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Abstract

By exploiting the regime shift in China's exchange rates in a natural experiment, we test for evidence of wealth-induced conspicuous consumption by Chinese foreign buyers in the private housing market in Singapore. The unpegging of China's currency in 2005 creates positive wealth effects that trigger Chinese foreign buyers' responses in the intensive margin to pay 3.42% more in housing prices relative to other foreign buyers. We find evidence of a higher propensity to purchase housing units with more visible features among Chinese foreign buyers after the policy shock relative to other foreign buyers. Chinee foreign buyers pay 11.0% premiums for high-floor units, 7.25% premiums for large units and 4.61% for luxury (more expensive) units after experiencing positive income shocks. We find that conspicuous consumption motives are augmented in high-income neighborhoods and neighborhoods with strong enclaves and social networks comprising residents from China. We show that conspicuous consumption motives are more significant for Chinese foreign buyers who are owner occupiers than for those who are investors. The results survive a slew of robustness and falsification tests, and we cannot reject the finding of wealth-induced conspicuous consumption by Chinese foreign buyers in Singapore's private housing market.

Keywords: Wealth Effect; Conspicuous Consumption; Foreign Buyers; Housing Transaction; Exchange Rate Regime

JEL codes: D31; F21; R30; F31

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1. Introduction

Wealth effects, or more specifically, positive income shocks, have a significant impact on the consumption behaviors of individuals (Case, Quigley and Shiller, 2006). However, when income is elastic, people do not simply consume more goods with increases in income; instead, they substitute their consumption of inferior and normal goods with that of luxury goods, as described by the Engel curve. While consumer theory builds on two interconnected concepts, housing wealth effects (Case, Quigley and Case, 2006) and changes in consumption elasticity (Feltovich et al. 2002; Charles, Hurst and Roussanov, 2009; Kaus, 2013; Lee and Mori, 2019), the empirical evidence, which in early studies is mostly reported in isolation, has failed to show the causal relationship between the two concepts. The literature also neglects the behavioral aspects of consumption, such as how income elasticity changes influence consumers' *signaling-by-consuming* motive, which is termed "*conspicuous consumption*" by Veblen (1965).

There is evidence that some individuals engage in conspicuous spending on visible goods to signal wealth and status (Feltovich et al. 2002; Charles et al., 2009; Heffetz, 2011). Housing is not just an important consumption commitment of households but also a positional good that represents a status symbol (Foye et al., 2018). Wei, Zhang Liu (2017) show that individuals are motivated to buy larger and more expensive houses to signal wealth and status and increase their competitiveness in finding marriage partners in China. The status good motive has also motivated many American families to live in larger and more expensive houses in the last five decades (Frank, 2008).

Do Chinese buyers who experience positive wealth effects increase their willingness to pay (WTP) for houses with "visible" attributes relative to other foreign buyers in the private housing market in Singapore? This paper aims to find empirical evidence to show how income elasticity shocks influence consumption behaviors and, more specifically, induce conspicuous consumption in housing purchases by foreigners in Singapore's private housing markets.

On July 21, 2005, the People's Bank of China (PBOC) announced a major reform to the exchange rate regime by unpegging Chinese yuan (or *renminbi*, RMB) from US dollars. The reform moving the RMB to a managed float system caused significant revaluation of the RMB. Using the regime shift in the RMB exchange rate as a policy experiment, we empirically investigate the influence of the wealth effect on the transaction outcomes of Chinese foreign buyers in Singapore's private housing market. In a difference-in-differences (DID) setting with the unit housing price as the dependent variable, we find significant price premiums of 3.42% in housing purchases by Chinese foreign buyers relative to

other foreign buyers after Chinese foreign buyers experienced positive income shocks in 2005. The unit housing price outcome shows incremental effects in an intensive margin, which are associated with the WTP by Chinese foreign buyers, rather than the quantum effects in the extensive margin associated with consuming more housing (buying multiple houses or a larger house) after experiencing wealth effects. We find evidence suggesting that price premiums are correlated with conspicuous motives, where Chinese foreign buyers show stronger preferences for housing units with more visible attributes, such as high-floor units, large units and luxury (more expensive) units, where the premiums paid by Chinese foreign buyers are estimated at 11.0%, 7.25% and 4.62%, respectively, for these units relative to the prices paid by other foreign buyers.

The results withstood a slew of robustness checks, which include using placebo time for the treatment shocks, controlling for the spatial-selection bias, and with counterfactual tests using other non-Chinese foreign buyers. We also test for heterogeneity in the outcome and find stronger conspicuous motives among Chinese foreign buyers who buy houses for owner occupation than among those who purchase for investment purposes. To show the signal attribute of housing goods, we do not just use "have" and "have not" a house in our identification; conditional on having purchased a house, we show that houses with either unique attributes or in limited supply, for example, high-floor units, large units or more expensive units (large and more expensive houses are also used as signals in Wei, Zhang and Liu, 2017) are more visible, and the signaling effects are enhanced in high-income neighborhoods and in neighborhoods with a large enclave of China's residents in Singapore.

We next subject our results to various falsification tests to rule out alternative explanations, such as nationality bias, ethnicity affinity, local information disadvantages, superstitious beliefs, immigration and safe haven motives. The results survive all the tests, and we find that the coexistence of wealth effects, WTP and a strong preference for housing with visible features by Chinese foreign buyers relative to other foreign buyers supports the claim that income elasticity shocks induce positive housing consumption, especially units with conspicuous features.

Our paper makes two contributions to the literature. First, we provide new micro-evidence to support the existence of wealth effects on housing consumption, which adds to the macro-evidence that shows cross-country variations in housing prices and consumption by Case, Quigley and Shiller (2006). There are other studies that show significant wealth effects associated with changes in housing and stock prices that increase consumption (Flavin and Yamashita, 2002; Davis and Heathcote, 2005; Campbell and Cocco, 2007; Cocco, 2004; Bostic et al., 2009). However, the early results are mixed with respect to the magnitude and the causal direction of the housing wealth effects, i.e., there are potential

endogeneity concerns. Some studies also challenge the identification issue of wealth effects in early empirical studies (Campbell and Cocco 2007; Attanasio et al., 2009; Cooper and Dynan, 2013). More recent studies use micro-evidence to test compositional effects in wealth changes on household consumption decisions (Leth-Petersen, 2010; Keys et al., 2014; Agarwal and Qian, 2017). We address potential endogeneity concerns by using the RMB reform as an exogenous policy shock in the DID setting and are able to disentangle differential housing purchase behaviors between Chinese foreign buyers who experience positive wealth effects and other foreign buyers who are not affected by RMB changes. Our research is related to the transmission of wealth shocks to international housing markets and indirectly adds evidence to the literature on financial liberalization and foreign capital flows (Bardhan and Kroll, 2007; Gerlowski et al., 1994).

Second, we contribute to the literature on conspicuous consumption by using ex post empirical evidence in housing markets rather than the survey-based data widely used in the early literature (Charles, Hurst and Roussanov, 2009; Heffetz, 2011; Kaus, 2013). In a more recent study, Lee and Mori (2016) use housing type to identify the income elasticity of households, and they find significant spatial and temporal variation in the consumption of luxury (conspicuous) goods in Singapore. Other studies find evidence of cross-sectional differences in consumption behaviors by race (Charles et al., 2009; Agarwal and Qian, 2014), age (Shukla, 2008), and gender (Segal and Podoshen, 2013), but linking consumption behavioral changes to income shocks is not obvious in early studies. As the income elasticities of consumers are usually not observed, it is difficult to show the effects of income shocks on conspicuous consumption. Some studies used various policy shocks; for example, Agarwal and Qian (2014) use the government's cash disbursements as income shocks to Singaporean citizens and find that such shocks have positive effects on consumption based on a unique dataset on credit and debit cards. In our study, we use the RMB appreciation after the reform to show how income shocks triggered positive WTP (intensive margin) among Chinese foreign buyers for housing with visible attributes and not the increases in consumption per se (extensive margin).

The paper is organized as follows. Section 2 introduces the background institutions of the exchange rate reforms in China and foreign buyers in Singapore's residential market. Section 3 describes the data and empirical design; Section 4 presents the empirical results on the wealth effect, WTP and motivations for conspicuous consumption. Section 5 provides further falsification tests on alternative explanations that examine nationality bias, information disadvantages, immigration and safe haven motives, and superstitious beliefs. Section 6 presents the conclusions.

2. Institutional Backgrounds

2.1. China's Exchange Rate Regime

Prior to 1979, China was a planned economy, where foreign trade was mostly controlled by a few state-owned foreign trade corporations. The official exchange rate played no significant role in international trade (Xu, 2000). The 1978 economic reform drove significant growth in foreign trade. The Chinese government liberalized the foreign exchange system over two periods, 1979-1984 and 1985-1993, which laid the foundation for the subsequent market-oriented exchange rate reforms in 1994 and 2005. The new exchange rate regimes play an instrumental role in helping China better manage foreign trade, macroeconomics, and the balance of payments (Mehran et al., 1996; Goldstein and Lardy, 2006; Ogawa and Sakane, 2006; Frankel and Wei, 2007; Frankel and Xie, 2010).

The first reform started in 1979, when the State Administration of Foreign Exchange (SAFE) established foreign exchange control functions, which were subsequently transferred to the PBOC in 1982. In the same year, the Chinese government implemented a foreign exchange retention system that allows local enterprises to retain a percentage of foreign exchange earnings. The local enterprises could redeem the retention quotas from the government at the official exchange rates and use the foreign exchange to import goods over and above the state import plans. However, the official exchange rates were significantly overvalued, which made exports by state-owned foreign trade unprofitable. The government introduced the internal settlement rate (ISR) with effects on January 1, 1981, and the ISR rate was fixed at 2.80 RMB to 1 US dollar. The ISR rate covered trade-related foreign exchange transactions, whereas the overvalued official exchange rate covered nontrade foreign exchange transactions, such as overseas Chinese remittances, tourism, foreign investments, foreign trade transportation, and insurance charges. However, differences in the official exchange rate and the ISR created arbitrage opportunities between the foreign trade and the nontrade sectors (Wu and Chen 1989, p. 71). There existed a black market for foreign exchange, which valued foreign exchanges at a substantial discount to the swap rate, causing disruption and leading to the subsequent termination of the foreign exchange swap business by the PBOC in December 1985.

China launched the second foreign exchange reform by setting up the first foreign exchange swap center in the Shenzhen Special Economic Zone (SEZ) in 1985. Foreign funded enterprises (FFEs) could freely negotiate and swap foreign exchange with domestic institutions in the SEZ. Unlike the 1979-1984 reform that focused on decentralizing foreign trade management functions to local governments, the 1985-1993 reform delegated greater autonomy in foreign trade to foreign trade

enterprises. With the retention quota system, the government continued to tax local exporters on their surrendered foreign exchange rate earnings at the overvalued official rates; then they used these earnings to cross-subsidize selected domestic importers. The dual rates between the official exchange rate and the swap market rate still coexist in China.

In the 1994 reform, China's government made a bold move in the transition from a fixed to a managed floating rates regime by unifying the dual exchange rates. The unified RMB rate was pegged at approximately 8.28 yuan per dollar as part of a tightly managed floating exchange rate policy. The government abolished the foreign exchange retention and submission systems, increasing the incentive for exporting enterprises to earn foreign exchange. In the same year, China set up China's Foreign Exchange Trade System, the first interbank currency market in Shanghai. Domestic enterprises could buy and sell foreign exchanges through designated foreign exchange banks. In March 1996, the SAFE experimented with a system that allows FFEs to purchase and sell foreign exchange through designated foreign exchange banks in four cities – Jiangsu, Shanghai, Shenzhen and Dalian; the system was subsequently extended nationwide in June 1996.

The occurrence of the Asian Financial Crisis (AFC) in 1997 seriously affected the export growth of China. The central bank faced intense pressure by domestic exporters who called for revaluation of the RMB. However, the central bank defied the calls and kept the RMB within a narrow range between 8.277 and 8.280 to 1 US dollar (USD) for three years from 1997 to 1999. The Chinese government's interventions controlling the level and variability of the RMB exchange rate caused the misalignment of RMB values.

After the AFC, China faced increasing pressure domestically and rising calls from the international community to move to a more flexible exchange range regime. On July 21, 2005, the PBOC published an article: "*Public Announcement of the People's Bank of China on Reforming the RMB Exchange Rate Regime*" that put in place a "managed floating" exchange rate regime based on market supply and demand with reference to a basket of currencies. The PBOC established a central parity mechanism to manage the RMB exchange rate fluctuation band according to the economic and financial situation (Das, 2019).

In the 2005 reform, the RMB was revalued at 8.110 against 1 USD, which is equivalent to a 2.1% appreciation from the previous managed rate of 8.280 to 1 USD (Spiegel, 2005). The RMB/USD rate fluctuation was controlled within a daily band of +/- 0.3% and a daily band of +/-1.5% against other foreign currencies traded in the interbank market (Euro, Hong Kong dollar, and Yen). The daily central

RMB/USD parity band gradually widened to +/- 0.5% in 2007, +/-1.0% in 2012, and then +/-2% in 2014. Based on a maximum daily central parity band of -0.3%, we could hypothetically expect the compound rate of appreciation of RMB against USD to accumulate up to 6.4% per month. Therefore, this study uses July 21, 2005, as the key treatment date to represent the wealth effects induced by the currency appreciation triggered by the currency reform.

The marketization process of China's RMB has been slow since the 2005 reform due to active interventions by the POBC, especially during the global financial crisis (GFC) period from 2007 to 2008. Following the crisis, China's current account surplus to GDP has reduced and stabilized, and the POBC announced two further reforms to the central parity system on June 19, 2010, and August 11, 2015, aimed at more closely linking the RMB exchange rate floats to market supply and demand with reference to a basket of currencies. The three reforms in 2005, 2010 and 2015 caused staggered appreciation in the RMB, and we include the two subsequent reforms in our robustness tests to capture potential staggered cumulative wealth shocks on foreign investment outflows.

Figure 1 (a) shows the CNY/USD exchange rate trends starting from January 1995. There was a clear regime switch in the exchange rate after the 2005 reform, as indicated by the black vertical line. During these periods, the coefficient of variance of the RMB/USD exchange rate is less volatile than that of the USD/SGD (US dollar to Singapore dollar) exchange rate.

There was no direct onshore trade between RMB and Singapore dollars (SGD) until late 2014.[1] In the two decades following 1994, the RMB/SGD exchange rate was calculated based on the central RMB/USD parity rates, which were managed within a very tight range between 8.70 (1994) and 8.11 (2015), and the SGD/USD exchange rates. On the assumption that the 2015 reform had not occurred, we compute the counterfactual RMB/SDG exchange rates and compare those rates with the real ones. Figure 1 (b) demonstrates the potential impact of the 2005 policy reform on the RMB/SGD exchange rate. We find a clear positive margin in the RMB appreciation (blue dashed line) relative to the counterfactual line after the 2015 regime shift.[2]

[1] Prior to the announcement, China Foreign Exchange Trading System (CFETS) had already launched direct yuan trading with major currencies including the US dollar, Russian ruble, euro, British sterling, Japanese yen, Australian dollar, New Zealand dollar, and Malaysian ringgit.

[2] On October 28, 2014, the POBC authorized the nation's interbank foreign exchange market to launch direct trading between the Chinese yuan and the Singapore dollar. We recalculate the differences between the real and the counterfactual exchange rates taking into consideration the 2014 change, but the impact is trivial (the result is not shown in the paper).

Figure 1(c) shows the purchasing power parity of RMB relative to USD and SGD[3], and we observe a significant increase in the purchasing power of RMB following the regime shift in the exchange rate system in 2005.

[Insert Figure 1 here]

2.2. Foreign Investments in Singapore's Private Residential Property Market

Singapore's housing market is characterized by a dual structure comprising a public housing market that provides affordable housing to only eligible Singaporean citizens and a laissez-faire private market. The private housing market, except for the landed market, is popular among foreign investors and expatriates working in Singapore. Foreigners are not allowed to buy or own landed property such as bungalows, semidetached or terrace houses, and vacant land without prior approval from the Singapore Land Authority (SLA), the custodian of state lands in Singapore. There are only limited cases where prior approvals from Singapore's Government are given to foreigners to buy landed houses for their own occupation. After August 2004, the government relaxed the rules by allowing foreigners to buy landed houses in a designated area in Sentosa Cove, which is a resort island to the south of the main island.

Condominiums and apartments are the two main types of non-landed private residential properties, and these are popular among foreign buyers. Condominiums are strata-titled developments with shared communal services and recreational amenities; there are no restrictions on the sale of condominiums to foreigners. Apartments are usually built on smaller land parcels, and prior to an amendment to the Residential Property Act on July 19, 2005, foreigners were not allowed to buy apartment units that are less than 6 levels in height.

The price dynamics of Singapore's private housing market are highly dependent on foreign liquidity (Liao et al., 2015). After a long recession in the private housing market in the start of the 2000s, a rebound in housing prices that occurred in 2004 drew a large influx of foreign liquidity, boosting the recovery of the private housing market, especially the high-end segment of the market. The relaxation of the rules to permit foreigners to buy landed houses in the Sentosa Cove area (see Figure 7a) that took effect in August 2004 also further fueled the upswing in private housing prices. However, private housing market activities took a sharp blip from the upward trend when the GFC hit in 2007. The

[3] OECD (2020), Purchasing power parities (PPP) (indicator). doi: 10.1787/1290ee5a-en (Accessed on 11 March 2020)

market followed a V-shaped recovery shortly after the GFC in 2009, and foreign investment continued to flow, causing a steep rebound in Singapore's private housing prices.

Figure 2(a) shows the temporal distribution in the transaction volume and market share of foreign buyers in Singapore's private housing market. The aftermath of the AFC in 1997 and 1998 accelerated the flow of foreign investment looking for a "safe haven" in Singapore's private residential market. There was a strong upward trend in the total transaction volume of foreign buyers after 2011, culminating in a peak in the foreign sale volume before the GFC in 2007. Private sales to foreigners rebounded again after the GFC and reached a new historical high in 2009 and 2010. In the peak years, foreign purchases constituted approximately 10% of the market share of private housing market transactions.

Foreign investments in private housing markets are highly sensitive to macroeconomic shocks, and abrupt drops in demand by foreigners were observed during crisis periods such as the AFC in 1997/1998, the severe acute respiratory syndrome (SARS) outbreak in 2003, and the GFC in 2007/2008. During the boom years, stopping the "tap" on foreign investments has always been the first direct response of many governments, including Singapore's, to halt the foreign demand flows that overheat the housing markets. Singapore's government has intervened aggressively by introducing a slew of cooling measures during the periods from 2011 to 2013, which include tightening on loan quantum, capping mortgage tenure, and imposing stamp duties such as the sellers' stamp duty and the additional buyer's stamp duty. The cooling measures aimed at curbing speculative activities in the market were applied more strictly to foreigners and nonindividuals. Foreigners are usually the first in line to be cut-off to protect local buyers against the unanticipated social and economic consequences caused by overheated markets.

Figure 2(b) shows the kernel density plots of price distributions of private housing purchases by foreign buyers (the blue dashed line) and Singaporean buyers (the darkened black line). The blue dashed line is shifted slightly to the right, which implies that foreign buyers pay higher prices per square meter than Singaporean buyers in the private housing markets.[4]

[Insert Figure 2 here]

[4] This paper will not touch upon the issues of the differences in prices pay by foreign and local buyers, which has been addressed in other papers like Chinco and Mayer (2016). Instead, we use the foreign private housing sale data to empirically test the conspicuous consumption behavior of foreign buyers.

Figure 3 shows the composition of the three largest groups of foreign buyers, which are Chinese, Indonesian and Malaysian (collectively known as the "Big 3"), based on (a) transaction volume and (b) market share in the private housing markets. The left-hand panel (a) shows the temporal changes in transaction volume by foreign buyers, and the sale volumes were sensitive to global shocks (1995-2009) and government interventions in the housing market (2010-2014). The trend in foreign sales shows a strong surge in buyers from mainland China in the local housing markets after 2005, and the sharpest rise was observed for the period from 2005 to 2011. The right-hand panel (b) shows that Chinese foreign buyers became the largest foreign investor group in Singapore's housing market, surpassing Indonesian buyers in their total transaction volume in 2008. We will empirically test in the subsequent sections whether the surge in China's buyers in the post-2005 period was correlated with the wealth effect created by the reform in the RMB exchange rate in mid-2005.

[Insert Figure 3 here]

Figure 4 links the nationality of buyers (left-hand column) to the nationality of sellers (the right-hand column) for the ten major foreign buyer groups (as indicated by different colors) in the private housing markets based on transaction volume, which is measured by the vertical dimension (height) of the column. The graph shows a high fraction of matched transactions with buyers and sellers of the same nationality, which implies that foreign buyers tend to trade with sellers of the same nationality. The results highlight a strong nationality bias in foreign transactions in the private housing market in Singapore. Based on this observation, we may expect the existence of significant social networks of foreign buyers/owners in the selected local submarkets, and the social network of foreign buyers may be one of the channels driving conspicuous consumption to be tested in our empirical tests.

[Insert Figure 4 here]

3. Data and Empirical Design

3.1. Data and Summary Statistics

We obtain empirical data mainly from two sources. The first dataset is on non-landed private residential property transactions published in caveats lodged in the Land Title Registry system administered by the SLA. The historical transaction data are collected from the Real Estate Information System. We collected a total of 372,367 non-landed private housing transaction records for the sample periods from 1995 to 2017, and the transacted properties are distributed across 37 administrative planning areas in Singapore. The property-level information includes project name, address, unit floor,

floor area (in square meters), transaction price (SGD), contract date, tenure, postal district, and planning region. Using ArcGIS, we derive other spatial variables based on straight-line distances to selected amenities, which include schools, hospitals, MRT stations and the central business district.

The second dataset is obtained from a proprietary source and contains personal details of 33,894 foreign buyers who have transacted in the non-landed private residential market in Singapore, covering period from 1995 to 2017. This dataset includes detailed information on buyers and sellers such as names, nationality (country) and personal identification number; transaction records such as contract date, transaction price, unit size and property type;[5] and transacted property location details, such as project name, unit number, street address, 6-digit postal code and planning district.

We merge the non-landed private residential property transaction dataset with the foreign buyer personal information dataset based on the transaction time, property address, transaction price and unit size. Based on a systematic process of data merging and sorting, we are able to identify and extract 18,719 matched transaction records by foreign buyers from the total of 370,822 private residential transactions in Singapore.

We group the full sample of matched transactions into three major groups based on the nationality of buyers, which include foreign buyers from mainland China, other major foreign buyers (Indonesian buyers, Malaysian buyers and others) and local Singaporean (SG) buyers, and plot the kernel density of selected property characteristics in Figure 6. The kernel density plots by (a) unit area and (b) transaction price show systematic differences in the skewness of unit area and per square meter transaction price for different buyer groups. Chinese foreign buyers tend to purchase smaller units and pay higher prices for the mid-range properties between S$10,000 and S$20,000 relative to other foreign buyers and local SG buyers. The two other panels in Figure 6 are the cumulative version of (c) the size and (d) the transaction price kernel density plots sorted by year of transaction and by property characteristics. We find significantly larger variations in yearly distributions in the transaction prices relative to the size. While the unit size of transacted properties remains relatively constant over time, the transaction prices vary significantly over the year.

[5] The original data contain residential properties, which include private non-landed properties (condominium, apartment) and public non-landed (executive condominium) and landed properties (semidetached house, terrace house) and other non-residential properties (factory, office, retail, shop house and warehouse). We only keep condominiums and apartments, which make up the largest share of the foreign transactions. Foreigners are restricted in buying executive condominiums and landed properties, and they are excluded in our empirical analyses.

By property location, we analyze the distribution of properties purchased by Chinese foreign buyers across Singapore by quarter and year, and Figure 5 shows only the temporal changes in the spatial distribution of Chinese buyers' property transactions for four different periods (1995Q3, 2000Q3, 2005Q3 and 2017Q3). We find that Chinese foreign buyers have a strong preference for residential properties located in the core central area (CCA) and the rest of the central area (RCA), especially in the first two panels in (a) 1995 and (b) 2000, and the spatial dispersion in Chinese foreign purchases increased in years (c) 2005 and (d) 2017, following the influx of more Chinese foreign buyers into the private residential property market in Singapore. The CCA and RCA are among the submarkets with the highest concentration of Chinese foreign houses in the four panels.

[Insert Figure 5 here]

3.2. Key Empirical Variables

Wei, Zhang and Liu (2017) show that housing is a status good that can signal wealth in the marriage market in China. To capture the signal effects, we use the logarithm value of unit price as the dependent variable to represent the buyers' WTP (intensive margin) rather than increasing their housing consumption, such as buying multiple houses (extensive margin). Instead of comparing "have" with "have not" houses in the control group, we define three dummies to explicitly measure the visible attributes of a housing unit in a development. We also examine how a house buyer can more effectively signal through his/her housing purchases in neighborhoods of different income levels and different ethnicity concentration levels (such as in an enclave of selected foreign nationality).

The first attribute dummy is for a high-floor unit (*Dhighfloor*), which has a value of 1 if a unit is in the top 20th percentile by floor height and by building; otherwise 0.[6] The second is a large-size unit dummy, (*Dlarge*), which has a value of 1 if a unit is either on the highest floor of the building (a penthouse unit) or in the top 20th percentile by unit size in a building. The third is a high-end/luxury unit dummy (*Dexpensive*), which has a value of 1 if the price per square meter of a unit is in the top 20th percentile in the price distribution sorted by building and by transition year. Based on the three attributes, the "visible" or "conspicuous" units constitute approximately 5.4% by floor height, 26.0% by unit size, and 20.5% by price range.

[6] In Singapore, every building is identified by a unique 6-digit postal code. For the dummy, we also use a dummy variable that is defined based on the top 10th percentile; and the results are not significantly different.

By buyer nationality, buyers from China and Indonesia are the two largest groups of foreign buyers in Singapore, constituting approximately 31.5% and 34.0% of the total 18,719 sample foreign buyers in the market.

We derive other variables for property attributes and sale types. To control for spatial heterogeneity in transaction activities and price dynamics, we include the localized log-real estate price indicators[7] for different neighborhoods (each is represented by a 500-meter x 500-meter raster). Table 1 shows the descriptive statistics of the key variables, including the mean statistics of housing transactions for Chinese foreign buyers, which are identified as the treatment group, and other foreign buyers, identified as the control group, and the differences. We find that except for the condominium type dummy, all the property attributes and sale types are significantly different between the two groups of buyers.

[Insert Table 1 here]

3.3. Empirical Design

We need the coexistence of the three factors—wealth effects, preference for goods with "signaling" features, and WTP for the "signaling effects"—to have sufficient evidence for the conspicuous consumption motive as argued by Veblen (1965) and Heffetz (2011). We adopt a three-prong strategy in our empirical design. The first step is to distinguish conspicuous consumption from wealth-induced "Engel" consumption, which is better represented by the absolute sale price, which is done by showing that people facing income shocks consume more housing goods at the expense of other inferior and normal goods. In our model, we use the log-unit price of housing to capture the intensive margin rather than the extensive margin in housing purchases between Chinese foreign buyers and other foreign buyers, controlling for housing attributes, localized price variations and fixed effects. The second is to show the "conspicuous" or the "signaling" effects beyond simply buying more expensive houses. The "signals" in housing consumption, in our study, come from a preference for housing units that have unique features, for example, top-floor units, which are the largest and most expensive (luxury) units and usually limited in supply in a selected development. The choice of a visible unit alone is not sufficient evidence to suggest conspicuous consumption, and we use RMB appreciation to test for income shocks on Chinese foreign buyers' WTP for these "signals" compared to other foreign buyers.

[7] The localized log-price indices data and the details of their calculation using spatially adjusted local weighted regression model can be found in Agarwal et al (2019).

In our DID strategy, we assign foreign buyers from China (or Chinese foreign buyers) in Singapore's housing market into a treatment group and other non-Chinese foreign buyers into a control group. The POBC decision to adopt a managed float RMB exchange rate regime on July 21, 2005 caused significant appreciation in RMB relative to other currencies, including SGD (see Figure 1b). We use the announcement of the RMB exchange rate reform on July 21, 2005 as a policy shock to test for wealth effects in Chinese foreign buyers' activities in the private housing market in Singapore. Figure 6 shows the parallel pre-trends followed by a structural break in the average unit prices of private housing purchases by the treatment group (Chinese foreign buyers) and the control group (other foreign buyers) before and after the 2005 policy shock. We cannot rule out that the RMB reform causes increases in the average unit prices paid by Chinese foreign buyers relative to those paid by other foreign buyers in Singapore's housing market.

[Insert Figure 6 here]

The first model tests the intensive margin in price variations between Chinese foreign buyers and other foreign buyers in response to wealth increases induced by the RMB exchange rate reform in 2015. The baseline regression model with the log-unit transaction price as the dependent variable is defined as follows:

$$lnunitprice_{i,t} = \alpha + \beta_1 Chinese_{i,t} + \beta_2 Chinese_{i,t} \times policy_{i,t} + \beta_3 policy_{i,t} + \sum_x \delta_x + \sum_r \delta_r + \sum_t \delta_t + \sum_{r,t} \pi_{r,t} + \varepsilon_i \quad (1)$$

where $Chinese_{i,t}$ is a treatment dummy that has a value of 1 if a foreign buyer is of Chinese citizen; otherwise 0 for a foreign buyer of other nationality; $policy_{i,t}$ denotes the RMB exchange rate regime shift, which equals 1 if a transaction occurs after July 21, 2005; and 0 otherwise; δ_x denotes a vector of housing characteristics including floor, unit area in square meters, building age, housing type dummy (condominium or apartment); buyer type (buyers with private address or public housing address), sale type (resale or new sale), and land tenure (99-year leases or freehold), and a localized housing price index to control for the exclusiveness of a neighborhood[8]; δ_t and δ_r denote the time and the regional fixed effects, respectively; and $\pi_{r,t}$ is the interaction of time and regional fixed effects. β_2 is the coefficient of interest in our study, where a positive and significant coefficient indicates price

[8] The spatially price adjusted local housing price indices are derived for a small standardized raster of 500 meters x 500 meters to capture relative prices at the local neighborhood level, which may capture the exclusiveness of a selected neighborhood. The details of the price index methodology can be found in Agarwal, Fan, McMillen and Sing (2019).

premiums in purchases by Chinese foreign buyers relative to other foreign buyers after the treatment shock following the RMB appreciation (i.e., wealth effects accrued to Chinese foreign buyers).

The second model is a binary choices model testing the preference of Chinese foreign buyers with respect to visible and luxury attributes in housing units relative to other foreign buyers using the following OLS regression model:

$$luxury_{i,t} = \alpha + \beta_1 Chinese_{i,t} + \beta_2 Chinese_{i,t} \times policy_{i,t} + \beta_3 policy_{i,t} + \sum_x \delta_x + \sum_r \delta_r + \sum_t \delta_t + \sum_{r,t} \pi_{r,t} + \varepsilon_i \quad (2)$$

where the binary dependent variable, $luxury_{i,t}$, is one of the three dummies that captures the unique and visible attributes of housing units of limited supply in a development. These variables are the high-floor unit dummy (*Dhighfloor*), the large unit dummy (*Dlarge*), and/or the luxury (expensive) unit dummy (*Dexpensive*) and are used as "signals" for only selected units in a development.

The third model tests the price premiums paid by Chinese foreign buyers relative to other foreign buyers with reference to the "signal" in selected housing attributes represented by the "$luxury_{i,t}$" dummy. If a unit price increase in the intensive margin is paid by Chinese foreign buyers, the triple "difference" term is correlated with the WTP for "signaling" in housing purchases. A positive coefficient reflects the increasing purchasing power of Chinese foreign buyers, who have a higher WTP to pay for housing units with unique attributes that can serve as a signal. The following regression is also used to test different channels driving conspicuous consumption motives:

$$lnunitprice_{i,t} = \alpha + \beta_1 Chinese_{i,t} + \beta_2 Chinese_{i,t} \times policy_{i,t} + \beta_3 Chinese_{i,t} \times policy_{i,t} \times luxury_{i,t} + \beta_4 Chinese_{i,t} \times luxury_{i,t} + \beta_5 policy_{i,t} + \sum_x \delta_x + \sum_r \delta_r + \sum_t \delta_t + \sum_{r,t} \pi_{r,t} + \varepsilon_i \quad (3)$$

The coefficient of the triple difference term (β_3) is positive and significant, implying conspicuous consumption by Chinese foreign buyers in Singapore's housing market after experiencing a positive income shock.

4. Empirical Results

4.1. Wealth Effects and Housing Consumption

We first test evidence of wealth effects on housing consumption using the DID model as in Equation (1), where we use Chinese foreign buyers as the treatment group relative to other foreign buyers in

Singapore's private housing market. Column (1) in Table 1 is the baseline model and shows that Chinese foreign buyers, on average, pay 0.63% more when they purchase private housing units relative to other foreign buyers after controlling for property- and spatial-related attributes. We also include the region, the time and the interaction of region and time as the fixed effects in the models. We find that overall, Chinese foreign buyers pay a higher purchase price than other foreign buyers. However, as the dependent variable is the log-unit housing price, the positive coefficient captures the intensive margin in price differences and does not imply that Chinese foreign buyers consume more housing goods relative to other foreign buyers in Singapore's housing markets. Why do Chinese foreign buyers pay more for comparable housing units? Unlike in Chinco and Mayer (2016), the results are unlikely to be correlated with information asymmetry because both the treatment group and the control group are foreign buyers in our tests.

We next test for wealth effects on the Chinese buyers by using the RMB appreciation in July 2005 as the treatment shock in the DID setting. Column (2) of Table 2 shows that the interactive term capturing the price premiums (intensive margin) paid by Chinese foreign buyers in their purchases in the post-treatment period (after the RMB exchange rate reform) is significantly positive, which implies that Chinese foreign buyers pay an average price premium of 3.42% in Singapore's housing market compared with other foreign buyers after experiencing a positive income shock (RMB appreciation).

[Insert Table 2 here]

RMB appreciation increases the purchasing power of Chinese foreign buyers, which is shown in their private housing purchasing behavior in Singapore. However, the positive coefficient captures the intensive margin in price changes in the model, and the results are not correlated with increases in housing quantum consumed by Chinese foreign buyers. Therefore, the results are unlikely to be driven by wealth effects, as argued by Case, Quigley and Shiller (2006). We cannot reject the hypothesis that the price premium is dependent on the increased WTP of Chinese foreign buyers after experiencing a positive income shock. One possible explanation for Chinese foreign buyers paying premiums is related to the "signaling" motive in housing consumption, i.e., the conspicuous consumption motive.

We conduct some robustness tests on the increased income elasticity (wealth effects) associated with the RMB exchange rate reform in China. As discussed in Section 2.1, China moved towards the managed float exchange regime 2005, but the reform was gradual, as the Chinese government still actively intervened in the exchange rate market to maintain a balance of payments in the capital account. Two more rounds of reforms were subsequently made on June 19, 2010, and August 11, 2015,

when the PBOC allowed more market-based adjustments to the RMB. In the robustness tests in Column (3) of Table 1, we add two different dummies to proxy the RMB reforms in 2010 and 2015 in the model and rerun the estimates. After controlling for the two additional treatment effects in the model, we find that the 2005 treatment effect is still significant and positive, and the two subsequent treatment effects in 2010 and 2015 are also significant and positive, but the magnitude of the two interactive coefficients are weaker in explaining Chinese foreign buyers' behaviors. The two subsequent RMB exchange rate reforms create incremental effects on the WTP of Chinese foreign buyers relative to other buyers in their private housing purchases in Singapore.

4.2. Willingness To Pay and Conspicuous Consumption Motives

We argue earlier that the price effects are in the intensive margin and are not correlated with more consumption in housing by Chinese foreign buyers relative to other foreign buyers. The price premiums show that the WTP of Chinese foreign buyers for housing could signal their wealth after experiencing positive income shocks. Based on the survey data of 1% of China's population, in which households were asked to report the purchase price or construction costs and construction area of their houses, Wei, Zhang and Liu (2017) use the variations in housing costs and housing area to proxy observable status signals in China's marriage market. However, we define the three dummies of the high-floor unit (*Dhighfloor*), large unit (*Dlarge*), and expensive unit (*Dexpensive*) from the *ex post* observable attributes of housing units in our data to represent visible attributes in the housing markets and use them to model signaling effects.

We first run the DID model as in Equation (2), with the three binary variables on housing quality as the dependent variables. The results in Table 3 show that Chinese foreign buyers, on average, have a lower propensity to pay for the more "conspicuous" units in Singapore's housing market relative to other foreign buyers. However, the DID coefficients, which are the interaction of the Chinese treatment group and the income shock (the post-2005 period), are significant and positive, indicating an increased propensity among Chinese foreign buyers to buy high-floor, large and more expensive units in the housing market after the income shock in 2005 relative to other foreign buyers. The demand by Chinese foreign buyers increases by 2.37% for high-floor units, 3.34% for larger units, and 5.91% in the more expensive segment of the housing markets. If signals are strong from the preference for "limited supply" and "luxury" housing units, we cannot rule out the effects of income shocks on the conspicuous consumption of Chinese foreign buyers.

[Insert Table 3 here]

The next piece of crucial evidence on conspicuous consumption is to show that Chinese foreign buyers pay for a "signaling" motive in their purchases in the housing market. We run the DID model as in Equation (3), with the unit price as the dependent variable, and include the triple DID term on the right-hand side of the model. The results in Table 4 show that the triple DID terms are significant in all three models, which implies that Chinese buyers have a positive WTP for the "conspicuous" attributes in housing purchases after experiencing positive income shocks in 2005. Chinese foreign buyers pay 11.0% premiums (in unit price) for high-floor units (Column 1), 7.25% premiums for larger units (Column 2) and 4.61% premiums for expensive units (Column 3) relative to other foreign buyers after they experience a positive income shock in 2005. The triple interaction term shows the coexistence of the three factors that represent a preference and WTP for unique and "conspicuous" features, as well as wealth effects, which imply that the hypothesis of conspicuous consumption by Chinese foreign buyers in the housing market is not rejected.

[Insert Table 4 here]

4.3. Enhanced Signaling via Social Networks and Socioeconomic Status

If, as predicted by the literature, individuals engage in conspicuous spending to signal their social status and wealth (Charles et al., 2009), Chinese foreign buyers should have stronger motives to signal "status" and wealth in a neighborhood with either a strong social network (Wong, 2013, 2014; Li, 2014; and Agarwal et al, 2019) or inhabited by other families with equal social status. We test the social network effects by introducing the triple interaction term ($Chinese_{i,t} \times policy_{i,t} \times social_{i,t}$) to Equations (2) and (3) as follows:

$$luxury_{i,t} = \alpha + \beta_1 Chinese_{i,t} + \beta_2 Chinese_{i,t} \times policy_{i,t} + \beta_3 Chinese_{i,t} \times policy_{i,t} \times social_{i,t} + \beta_4 policy_{i,t} + \sum_x \delta_x + \sum_r \delta_r + \sum_t \delta_t + \sum_{r,t} \pi_{r,t} + \varepsilon_i \quad (4)$$

$$lnunitprice_{i,t} = \alpha + \beta_1 Chinese_{i,t} + \beta_2 Chinese_{i,t} \times policy_{i,t} + \beta_3 Chinese_{i,t} \times policy_{i,t} \times social_{i,t} + \beta_4 policy_{i,t} + \sum_x \delta_x + \sum_r \delta_r + \sum_t \delta_t + \sum_{r,t} \pi_{r,t} + \varepsilon_i \quad (5)$$

where $social_{i,t}$ is a dummy that represents social network and socioeconomic status at the local level. We use the first 3-digits of the postal sector in Singapore as the location identifier, as the island is divided into 80 postal sectors, and compute the social network and social status indices at the postal sector level to create cross-sectoral variations. Based on the nationality of the foreign buyers, we

calculate the inverse-Shannon index[9] for each 3-digit sector, denoted as *cohesion*, to measure the "intensity" of the social network (or localized homogeneity) in a neighborhood (Forrest and Kearns, 2001; Badarinza and Ramadorai, 2018). For the social status measure, we use proprietary bank data[10] to calculate the average income (in 1,000 SGD) of households, denoted as *status*, to signal the economic class of residents for each postal sector. Based on the "cohesion" and "status" measures, two dummies, "*highcohesion*" and "*highstatus*", are defined for the 60th percentile of sectors showing a strong enclave of Chinese residents and a high-income neighborhood, respectively.

The results in Table 5 (Panel A) show that the conspicuous consumption motive is enhanced in a neighborhood with a strong network of residents sharing the same social and cultural background. Column (1) shows a positive and significant coefficient of the triple difference term (β_3), which implies that Chinese foreign buyers pay high premiums for houses in neighborhoods with an established network of residents from the same social and national background. Chinese foreign buyers show a high propensity to signal by buying housing units with conspicuous attributes, such as units on a high floor and more expensive units from developments in the neighborhood. However, in Singapore's non-landed housing market, developers usually build units differentiated by the number of rooms, and the size variation is small. Unlike Wei, Zhang and Liu (2017), "size" was not used as a visible signal by buyers in neighborhoods with a high concentration of buyers from China.

[Insert Table 5 here]

Panel B in Table 5 shows the WTP and preference for visible attributes in neighborhoods with higher socioeconomic status. We find a significant positive coefficient on the triple difference term (Column 1) supporting the enhanced signaling effect by Chinese foreign buyers when buying houses in areas with a greater number of high-income neighbors. We show the propensity of Chinese foreign buyers to buy high-floor units and more expensive units in high-income neighborhoods. As the size variation is usually small in non-landed developments in Singapore, the preference for large units as a signal is not significant among Chinese foreign buyers. The results are consistent with the conspicuous consumption motives of Chinese foreign buyers relative to other foreign buyers in these markets. The

[9] The Shannon equitability index is simply the Shannon diversity index divided by the maximum diversity. This normalizes the Shannon diversity index to a value between 0 and 1. Note that lower values indicate more diversity while higher values indicate less diversity.

[10] We would like to thank Sumit Agarwal and Wenlan Qian for sharing this database. This dataset was obtained from the leading bank in Singapore and comprises more than 4 million bank customers. The dataset contains information on individual incomes and the postal code of their homes.

signaling effects are enhanced in neighborhoods with a large enclave of Chinese residents and in high-income neighborhoods.

4.4. *Heterogeneity Tests: Owner Occupiers Versus Investors*

We conduct heterogeneity tests on the wealth effect among occupiers and investors. We differentiate between owner occupiers and investors based on two criteria, which are multiple purchases and sales by a given buyer (repeated transactions) within the sample period. We separate foreign buyers into two subsamples: owner occupiers and investors and rerun the triple DDD model as in Equation (2) separately using the two buyer subsamples. By comparing the two subsamples in Column (1) (owner occupiers) and Column (5) (investors) in Table 6, we find that the wealth effects on the price premium of Chinese buyers is only significant for occupiers (consumers) (Column 1) and nonsignificant for investors (Column 5). Occupiers are more inclined to signal status by purchasing luxury houses, and they pay significant premiums of 4.79% relative to non-Chinese owner occupiers after the policy shock. We control for variations in property and spatial attributes and for other unobserved variations using regional fixed effects, time fixed effects and the interaction of regional and time fixed effects in all the models. Investors who focus on their returns from property trading are unlikely to pay higher prices to signal status and wealth.

[Insert Table 6 here]

We also rerun Equation (3) using the two subsamples. The results in Table 6 show that the triple DID terms that proxy conspicuous consumption are significant in the owner occupiers' models (Panel A-Columns 2 to 4), but their effects are nonsignificant in the investors' models (Panel B – Columns 6 to 8). The results show that owners have stronger WTP for the ability to signal through the purchases of housing units with more differentiated attributes. They pay significant premiums for conspicuous motives relative to other foreign owner occupiers in Singapore's housing market. However, investors, who do not usually live in the properties, show no incentive to pay for the "signaling" effects in their housing purchases. As in Genesove and Mayer's paper (2001), which shows asymmetric loss behaviors between owner occupiers and investors, we also find asymmetric behaviors, where owner occupiers have stronger conspicuous motives in housing consumption compared to investors, who are more motivated by financial returns from their housing investments.

4.5. Robustness and Placebo Tests

The geographical distributions of Chinese foreign buyers in Figure 7 show that they have a strong location preference for houses located in the central region, which has a strong social enclave and network of Chinese foreign residents. The transactions by Chinese foreign buyers are likely to be nonrandomly distributed, and the inclusion of regional fixed effects may not address the nonrandom effects of housing purchases by buyers from China. We use two strategies to control for spatially based distributional bias in the regression results. First, we use a simple approach by pairing a transaction by a Chinese foreign buyer to an adjacent property transaction by another foreign buyer based on the floor and unit number of the property. The results in Column 1 of Table 7 show that the treatment effects remain significant, and Chinese foreign buyers pay 7.86% more than other foreign buyers after the RMB shocks; these results are stronger than the baseline result of 3.42% (Table 4), after controlling for potential selection bias in the Chinese samples. Second, we adopt the propensity score matching (PSM) approach to match Chinese foreign buyers' property with other foreign buyers' property, controlling for age, floor, area, lease, and location attributes in the model. Figure 8 shows the two different kernel density plots (at the planning region and building level) on the propensity scores between the two groups of foreign buyers before (blue colored lines) and after (black colored lines) the PSM. The distributions of the two samples (treatment and control) are relatively more homogenous after matching, and the DID results based on the PSM matched samples remain significant and consistent. The wealth effects on Chinese foreign buyers' housing purchases are still significant and also stronger, at 4.99% relative to the baseline effects of 3.42%.

[Insert Figures 7 and 8 and Table 7 here]

We conduct additional placebo tests on the validity of the treatment date by using three different time periods, which are 3 months (Column 3), 6 months (Column 4) and 5 years (Column 5) prior to the RMB policy implementation date. The results in Table 7 show no significant treatment effects in the pre-RMB reform date, which show that the implementation of the new RMB exchange rate policy strictly follows the announcement date, and no "leakage" of information was found in the study. We also run other counterfactual analyses by replacing the treatment group with a new one comprising other foreign buyers who are not affected by the RMB shock from Indonesia, Malaysia, and the United States of America, and the results show no significant response from these three groups of foreign buyers to the RMB policy shock (See Appendix 1). The results withstand all the robustness tests, the results of the DID models are mainly driven by the wealth effect created by the RMB appreciation, and only Chinese foreign buyers responded to the policy shocks by increasing their WTP for housing purchases in Singapore relative to other foreign buyers.

4.6. Falsification Tests on Alternative Channels

We next run tests on how conspicuous motives could be enhanced through social networks and socioeconomic status. We also conduct tests to rule out other non-wealth-related channels, which include spatial heterogeneity, nationality bias, information disadvantages, superstition, immigration policies and safe haven motives that could drive conspicuous consumption among China's buyers in Singapore.

We run falsification tests to rule out a nationality bias in sellers' selection as a possible explanation for the wealth effects and the conspicuous premiums paid by Chinese foreign buyers. Column (1) of Table 8 shows no significant effects on the propensity of Chinese foreign buyers to choose to trade with Chinese foreign sellers in the transactions, and the nationality bias of Chinese foreign buyers is independent of the wealth shock (nonsignificant interactive term). When we look at those repeated sale samples, we also do not find evidence of nationality bias among Chinese sellers in choosing to sell to other Chinese foreign buyers (Column 2). Therefore, the results showing that Chinese foreign buyers pay positive premiums for housing with "conspicuous" attributes are unlikely to be driven by nationality bias in the sellers' selection process.

[Insert Table 8 here]

In Singapore's multiracial society, many Malaysian and Indonesian residents with antecedent roots in China speak the common language, which is "Mandarin", though with local accent that may differ slightly from that in China. However, we further test whether ethnicity affinity could explain away the conspicuous consumption behaviors of Chinese foreign buyers (Li, 2014). We use only samples of Chinese Malaysian and Chinese Indonesian as the control group in our DID test, and our results in Column 3 (Table 8) show that the price premiums paid by the treatment group foreign buyer from mainland China are positive and significant, and the results imply that ethnicity affinity (a common spoken language) cannot explain away the wealth and conspicuous motives of Chinese foreign buyers in Singapore's housing market. Therefore, the currency-induced wealth effects that are reflected in price premiums in the transactions cannot be rejected.

Lack of local knowledge is another possible explanation for why foreign buyers pay higher prices relative to local buyers in housing markets (Chinco and Mayer, 2016). We do not observe information asymmetries between the foreign buyers in our samples consisting of only foreign buyers; however, we still need to disentangle the potential composition effects of Chinese foreign buyers with different local knowledge. We use Chinese foreign buyers with a Singapore permanent resident status as

identification to differentiate Chinese foreign buyers who have and those who have not already lived and worked in Singapore prior to the policy shock. The results in Column (4) of Table 8 show that Chinese foreign buyers who are Singapore permanent residents prior to housing purchases do not pay lower prices than other Chinese foreign buyers who bought their first house in Singapore after the treatment date.

We also test for local knowledge disadvantages by using only foreign buyers (both non-Chinese foreign buyers and China foreign buyers) who bought their first house in Singapore prior to the policy shock. Column (5) of Table 8 shows no significant difference in prices for housing purchases between non-Chinese foreigners and Chinese buyers with prior housing transaction experience after the RMB exchange rate regime shift. Therefore, our results are not dependent on local housing market knowledge, and the composition effects of Chinese foreign buyers are not correlated with wealth effects and the conspicuous consumption motives of the buyers.

Conspicuous consumption motives and superstitious beliefs are two highly correlated behaviors that influence buyers' decisions in the housing market. In a study on Chinese Singaporeans' housing buying behavior, He et al. (2019) show significant evidence of Chinese Singaporeans' preference for lucky numbers such as "8" (which sounds like "prosperous" in Mandarin) and dislike unlucky number such as "4" in the housing unit numbers. They show that Chinese Singaporeans pay significant premiums for units with addresses that end with the lucky number. However, the study could not rule out the hypothesis that conspicuous consumption motives could also drive the price premiums for lucky number units. This study tests whether superstitious motives are observed in Chinese foreign buyers relative to other foreign buyers and whether the preference for lucky numbers could explain away price premiums associated with income shocks and conspicuous consumption. Column (6) of Table 8 shows that the triple interaction terms of Chinese buyers, lucky/unlucky units and policy shocks are nonsignificant in the model, and the wealth-induced housing consumption effects of Chinese foreign buyers remain significant at 2.65% relative to other foreign buyers after the RMB policy shock. The results show that the treatment effects in our conspicuous consumption model are independent of the superstitious motives of Chinese foreign buyers.

4.7. Immigration and Safe Have Motives

The literature has shown that country-specific domestic political and economic risks cause the "flight of capital" out to the country to "safe havens" (Badarinza and Ramodorai, 2018), and foreign investors

also channel their capital to countries with immigration opportunities. However, information on foreign capital flows into local housing markets is opaque, and investments may be channeled through complex offshore special vehicles via tax havens such as Panama, which make the capital source almost untraceable. Thus, we need to rule out these two other confounders, as although they are not associated with the RMB exchange rate regime reform, they may possibly affect the treatment effects on Chinese foreign buyers.

For the immigration motives, we use the changes to the Global Investment Programme (GIP) in Singapore implemented on July 19, 2005[11], which allow a foreigner to invest at least SGD $2 million in setting up businesses and other investment vehicles, including residential properties, to be considered for permanent resident (PR) status. Up to 50% of the investment can be in private residential property, although still subject to the foreign ownership restrictions under the Residential Property Act, which exclude them from owning landed properties except in the Sentosa Cove area. However, the GIP aimed to attract foreign talent and investment immigrants, not limited to Chinese immigrants, to consider permanent residency in Singapore.

Using a dummy that sets the property investment threshold of SGD $1 million (50% of the GIP investment requirement), "Dvalue1million", as the dependent variable, we test the DID between Chinese foreign buyers and other foreign buyers for prices of their housing purchases on and after the RMB shocks on July 21, 2005.[12] Our empirical tests use the samples in the two distinct submarkets – suburban (Column 1) and city center (Column 2) (which has a high concentration of foreign residents from China), and those foreign buyers who have PR status prior to the purchases were excluded; the results in Table 9 show no significant treatment effects between Chinese foreign buyers and other foreign buyers. We can thus delink the wealth-induced conspicuous consumption premiums in housing purchases by Chinese foreign buyers from their immigration motives.

[Insert Table 9 here]

[11] Private residential property investment was disallowed from the GIP investment list in 1996 prior to the change in 2005 that reallowed private residential properties in the GIP investment list. The policy was reviewed again in 2012, when private property investment was again excluded from the investment list to curb excessive hot money that caused overheating in the private residential property market.

[12] The treatment date based on the RMB exchange rate reform on July 21, 2005, was just few days after the announcement of the changes to the GIP immigration policy in Singapore; we use the RMB reform date, which was after the GIP change.

For the safe haven identification, we match the names in our foreign transactions to the data from the "Panama Paper Leaks"[13] to identify if a foreign buyer uses an offshore special vehicle in a transaction, with a dummy "nominee" having a value of 1. The share of nominees identified in the Panama Paper database accounts for 6.6% of the total foreign transactions in our samples. In Column 3 of Table 9, we find that approximately 35% of Chinese foreign buyers invest in Singapore's housing market using Panama-based offshore special vehicles, but there is no significant change in the nominee arrangement before and after 2005. When we examine only Chinese foreign buyers in Column (4), we also find that Chinese foreign buyers that invest in Singapore's housing market via Panama nominees do not pay higher premiums after the RMB exchange rate reform. In Column (5), we exclude all foreign transactions linked to the Panama nominees from the samples and find that the treatment effects remain significant and positive, though the magnitude of the DID coefficient is smaller, at 2.17% compared to 3.42%, as shown in the baseline model in Table 2. The tests show that the "safe haven" effect does not explain the wealth-induced conspicuous consumption effects of Chinese foreign investors in our study.

5. Conclusion

The issues of housing wealth and using housing as a "signal" of status have been studied in the literature, but usually in isolation. Case, Quigley, and Shiller (2006) find evidence for wealth effects on consumption in a cross-country study using macro-data. Wei, Zhang and Liu (2017) show that housing is a status good that can be used to signal wealth in the marriage market in China. There is no conclusive evidence explicitly linking wealth effects and conspicuous consumption.

Evidence on conspicuous consumption motives is not *ex post* observable; the literature uses either survey-based data (Heffetz, 2011; Charles, Hurst and Roussanov, 2009; Kaus, 2013) or credit card data (Lee and Mori, 2019) to test for conspicuous consumption. These studies find significant cross-sectional variations in the consumption of luxury and visible goods (such as jewelry, clothing and cars) by race (Charles, Hurst and Roussanov, 2009; Kaus, 2013) and by housing type (Lee and Mori, 2019). However, consuming luxury and visible goods alone may not reveal a signaling intention, as argued by Wei, Zhang and Liu (2017), but simply show a preference for high-quality goods. Therefore, there

[13] The Panama Papers are an unprecedented leak of 11.5 m files from the database of the world's fourth biggest offshore law firm, Mossack Fonseca. The documents contain personal financial information about wealthy individuals and public officials that had previously been kept private. While offshore business entities are legal, reporters found that some of the Mossack Fonseca shell corporations were used for illegal purposes, including fraud, tax evasion, money laundering, and evading international sanctions (O'donovan et al., 2019).

is a need to differentiate conspicuous goods in Veblen's sense from the consumption of high-quality goods in Engel's sense.

Based on Engel's curve, households experiencing positive income elasticity shocks consume more high-quality goods on the extensive margin as a substitute for inferior goods when the supply of goods is abundant. However, "visible" attributes of goods are likely to be weaker if they are easily available and accessible to the public. People's WTP on the intensive margin reflects the ability to signal in goods with unique features and/or scarce in supply. For example, buying a posh car is correlated with positive income shocks in Engel's sense, but paying high prices for a unique car plate number for a posh car is more consistent with conspicuous consumption motives. The three key elements must coexist to support conspicuous consumption: positive income elasticity shocks (wealth effects), preference and WTP for goods that are unique and short in supply.

This paper uses micro evidence from Singapore's private housing market to show how wealth effects are correlated with conspicuous consumption behavior in the housing market by foreign buyers. We use the RMB exchange rate reform on July 21, 2005, as a policy experiment to test for the influence of the wealth effect on the conspicuous housing consumption behaviors of Chinese foreign buyers relative to other foreign buyers in Singapore's private housing market. Using a unit price in housing transactions as the dependent variable in our tests for price changes in the intensive margin in the DID setup, we find that positive wealth effects are associated with RMB appreciation after 2005, which increases WTP by 3.42% in housing purchases by Chinese foreign buyers relative to other foreign buyers in Singapore's private housing market.

Chinese foreign buyers experiencing positive income shocks are more likely to purchase luxury houses, defined by units on a high floor, large in size and more expensive in price during development, compared to other foreign buyers. Chinese foreign buyers pay 11% premiums for high-floor units (Column 1), 7.25% premiums for larger units (Column 2) and 4.61% premiums for expensive units (Column 3) relative to other foreign buyers after they experience a positive income shock in 2005. The triple interaction effects show the coexistence of the factors—WTP, premiums for unique and "conspicuous" features, and wealth effects—which are key elements supporting the conspicuous consumption motives of Chinese foreign buyers in the housing market. We subject the models to a slew of robustness tests including placebo tests on the pre-policy periods, counterfactual tests using other non-Chinese foreign investors, heterogeneity tests between owner occupiers and investors, and controls for spatial-based enclave selection bias; the results remain robust and consistent. We also show that conspicuous consumption signals are enhanced when Chinese foreign buyers purchase

houses in neighborhoods with a strong enclave of Chinese residents and in higher income neighborhoods in Singapore.

We run further tests aimed at falsifying other possible channels that explain the wealth effect and WTP by Chinese foreign buyers. We do not find evidence that WTP is linked to national bias or ethnicity affinity (transactions between people speaking the same language), local knowledge disadvantage, or superstitious beliefs. We show that the treatment effects are not triggered by immigration or the safe haven motives of Chinese foreign buyers. Our evidence that conspicuous consumption among Chinese foreign buyers is induced by positive income shocks is robust, thereby also providing a useful contribution to the tests for conspicuous consumption in the literature. We show that conspicuous consumption motives are supported by the coexistence of the preference and the WTP (intensive margin), rather than by increasing consumption (extensive margin), for goods with unique attributes (scarce in supply) by buyers who experience positive income elasticity (wealth) shocks.

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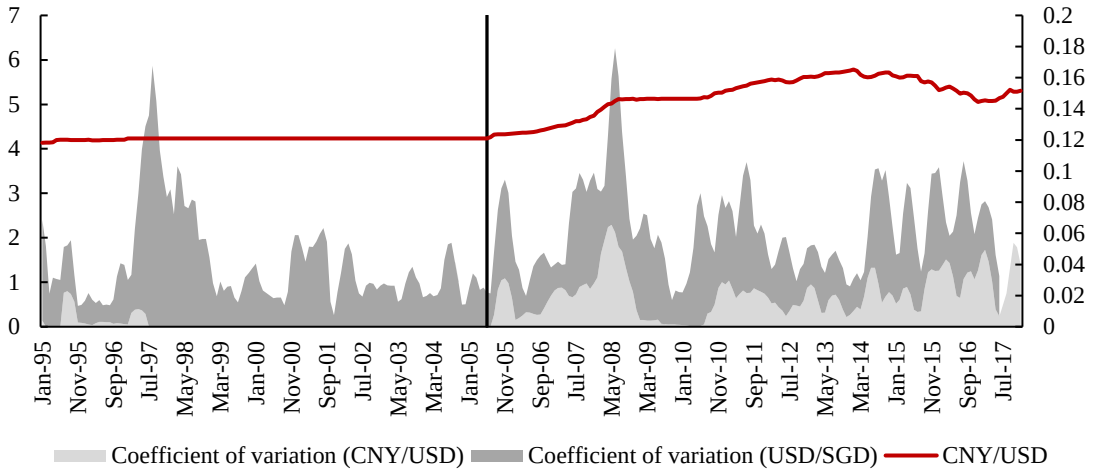
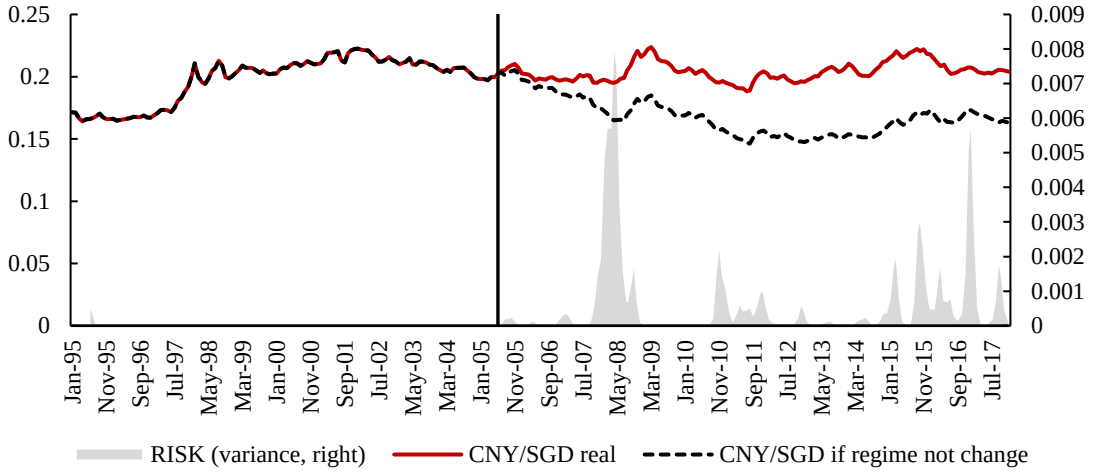
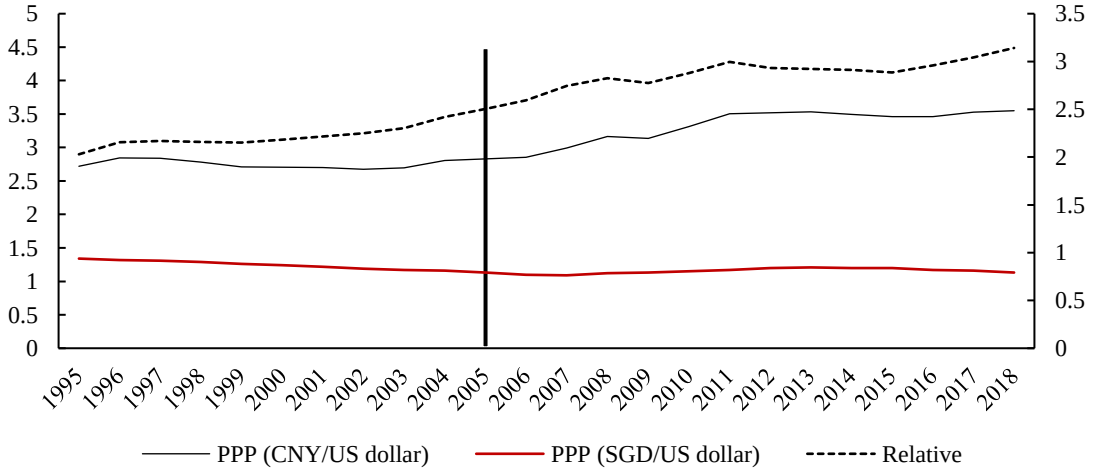


(a) CNY/USD exchange rate and variation



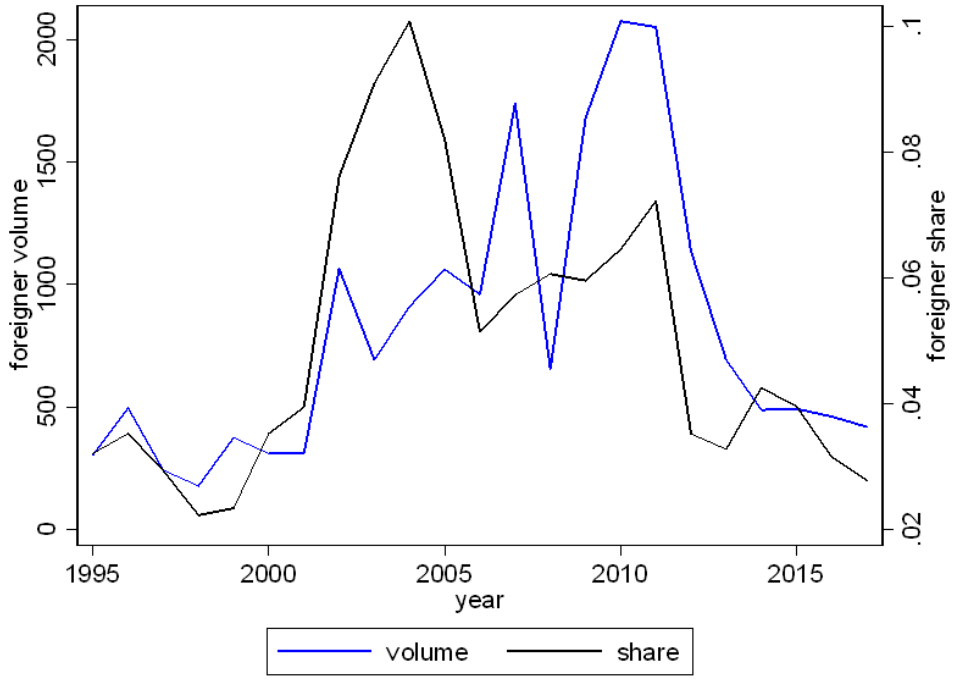
(b) counterfactual evidence with and without the regime shift in 2005



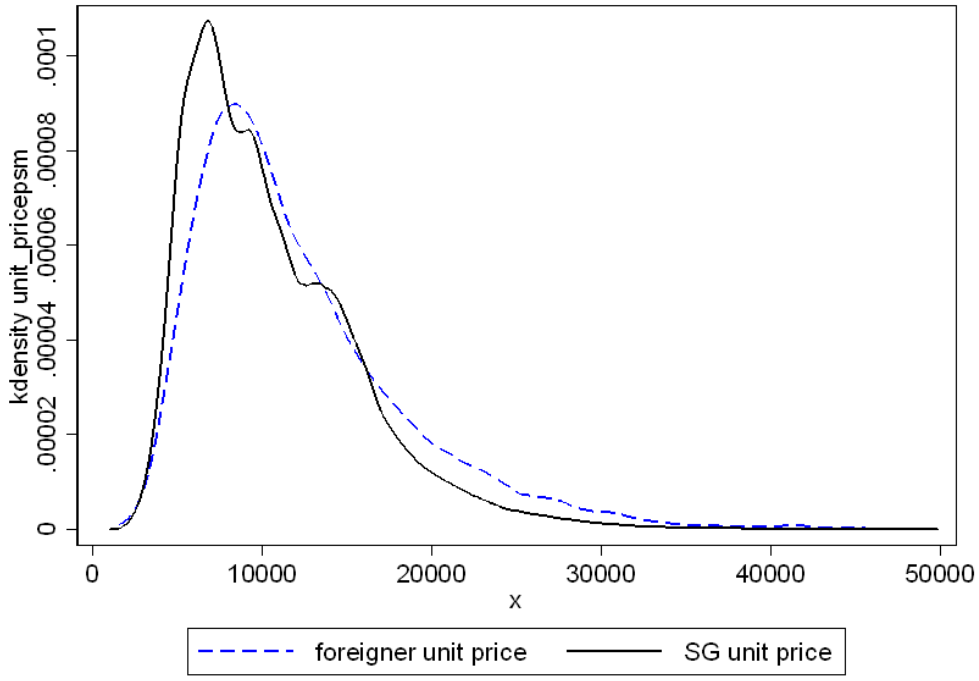
(c) CNY/SGD Purchasing Power Parities (PPPs)

Figure 1 Exchange rates, counterfactual Rates and Purchasing Power Parities (PPPs)

Note: Figure (a) exhibits the fluctuation of the CNY/SGD exchange rates. Figure (b) compares the real CNY/SGD exchange rates and the counterfactual rates if there is no regime shift. Figure (3) shows the trend of Purchasing Power Parities as a proxy for purchasing power of CNY relative to USD and SGD. Data is collected from the World Bank.



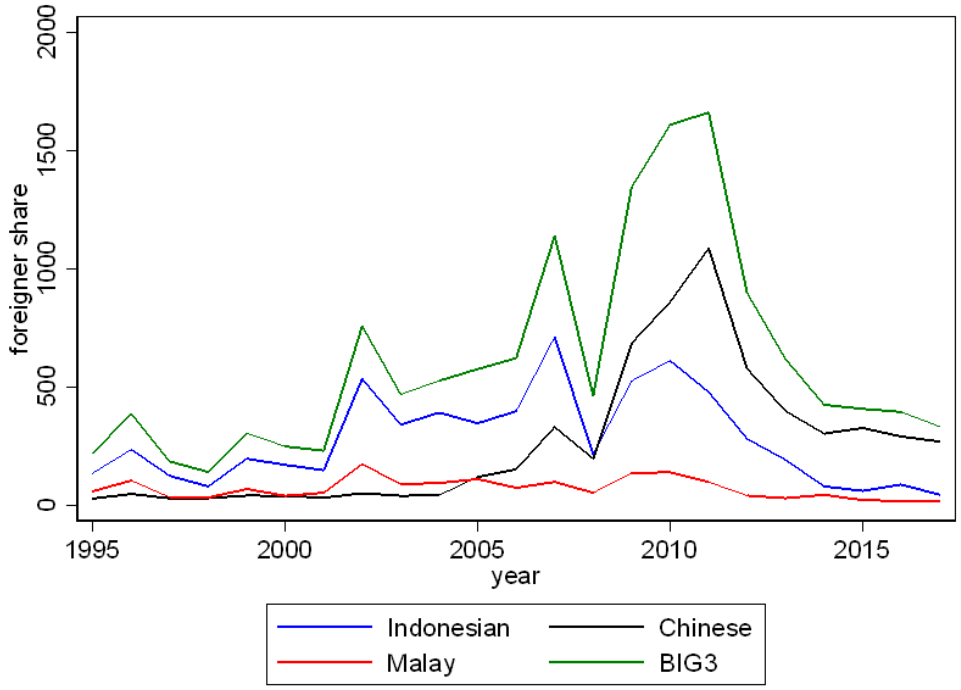
(a) transacted volume and share



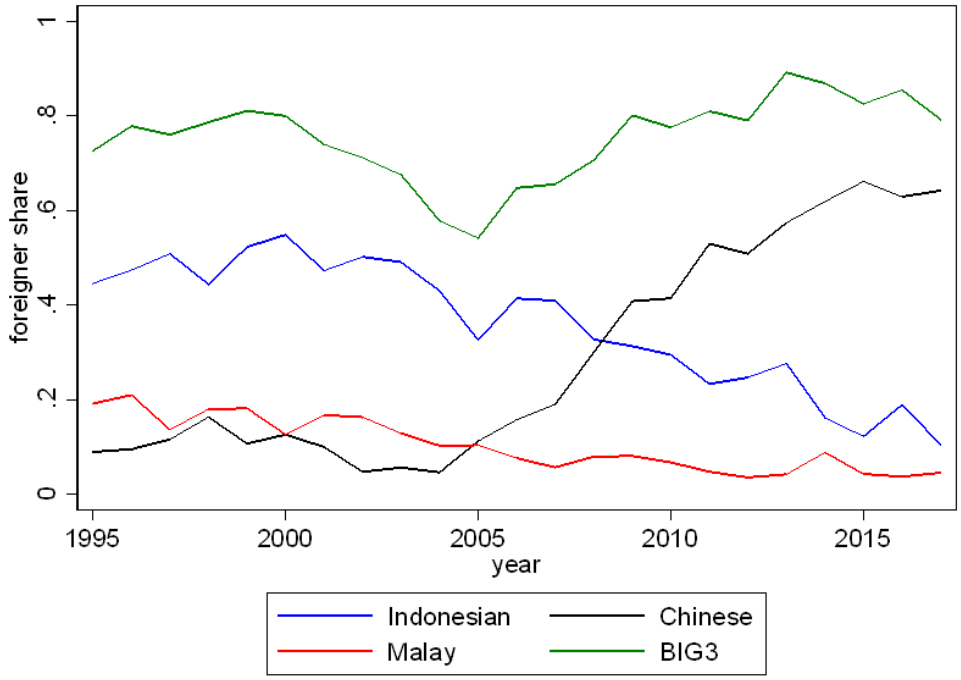
(b) kernel density of transacted price (per square meters)

Figure 2 Foreign Buyers across Years and Price Distributions

Note: Figure (a) shows the temporal distribution foreign buyers in Singapore's private housing market, in terms of transaction volumes of units and ratio of foreign transactions to total transactions (shown on the right hand side). Figure (b) compares the kernel density distribution of transacted unit price (per square meters) of foreign buyers and local Singaporean buyers.



(a) transacted volume in unit



(b) share to total foreign buyers

Figure 3 Major Foreign Buyers across Years

Note: Figure (a) demonstrates the distribution transaction volumes of major foreign buyers (Chinese buyers, Indonesian buyers, and Malaysian buyers, namely the "Big 3") over years. Figure (b) shows the ratio of the transactions across nationalities to total transactions over years.

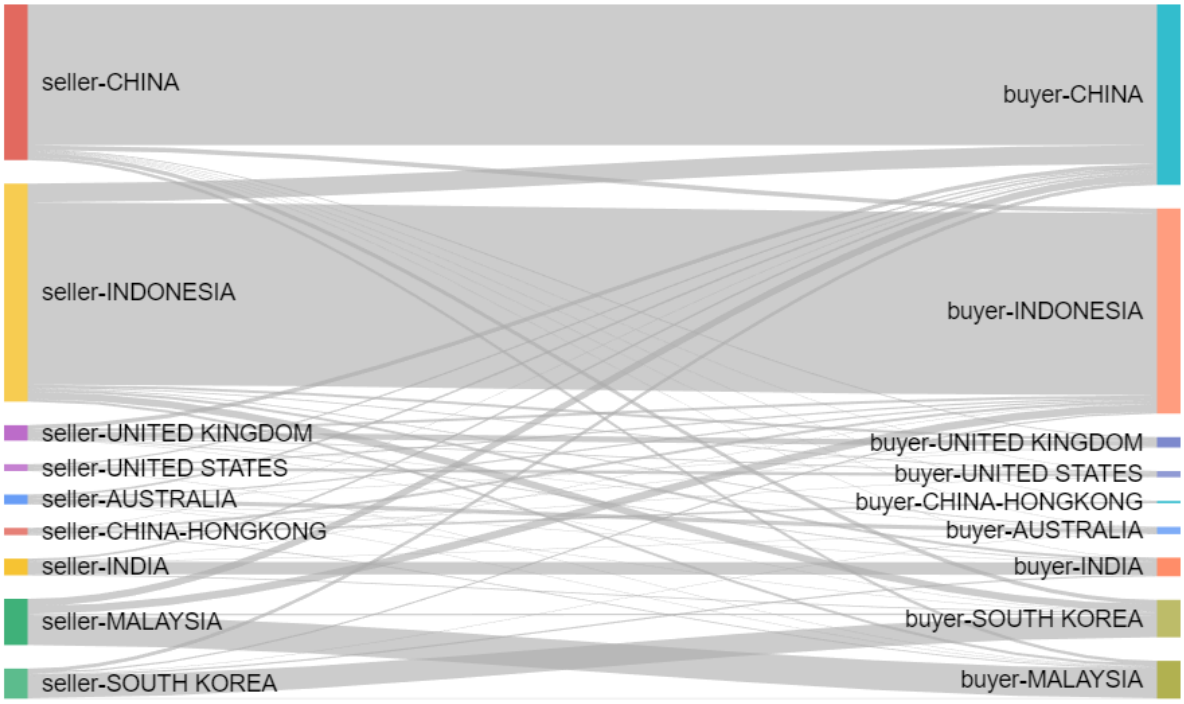
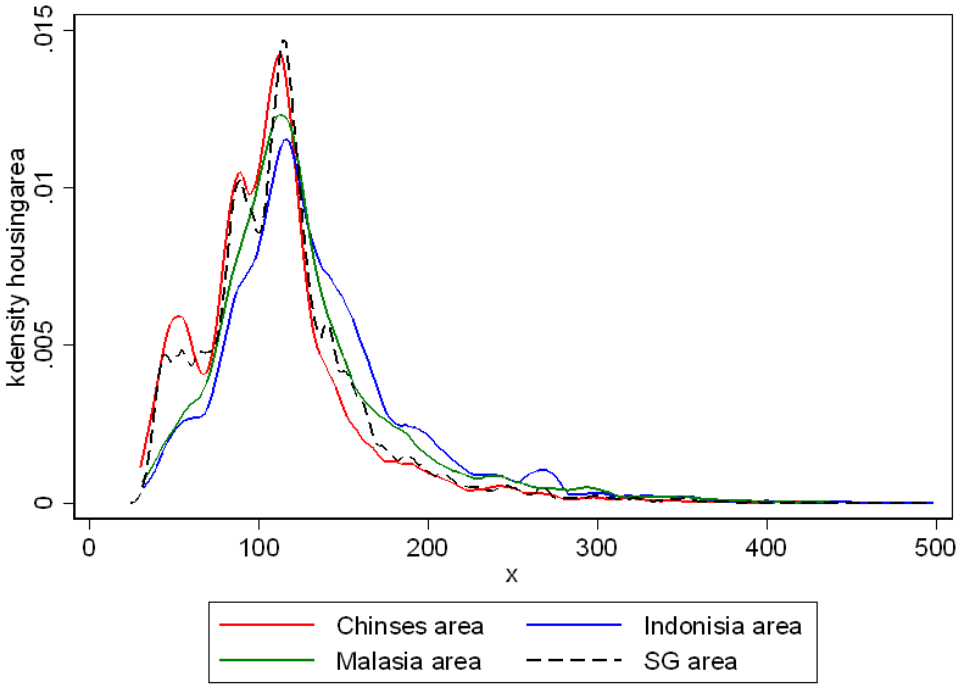
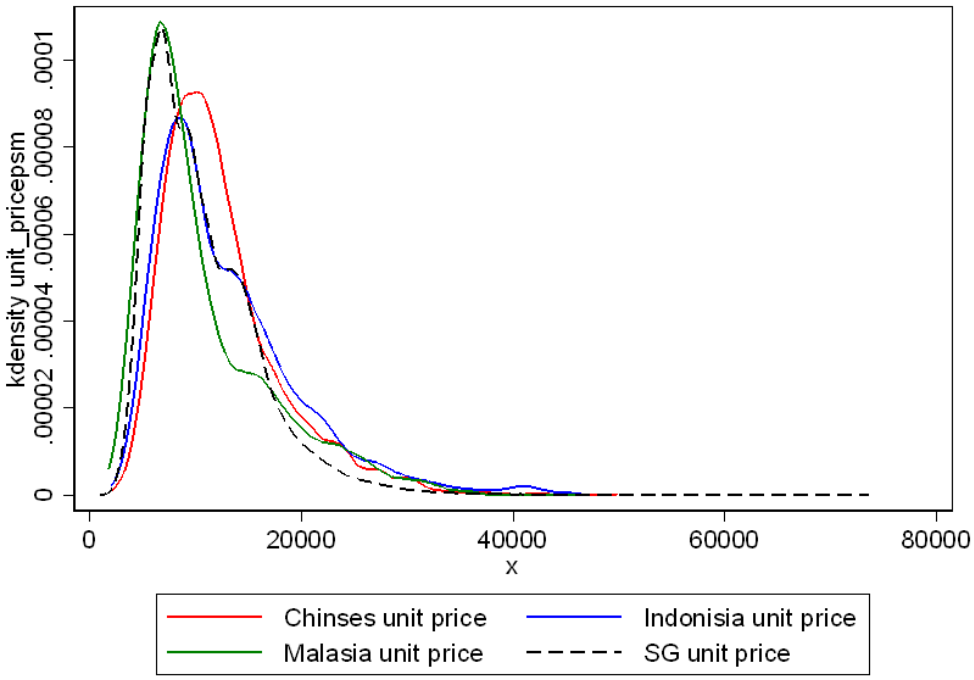


Figure 4 Transaction matching across major source country of foreigners

Note: This figure shows the nationality matching in housing transaction of ten major nationalities of foreign buyers. The left hand side is the nationality of sellers and the right hand side is the nationality of buyers.

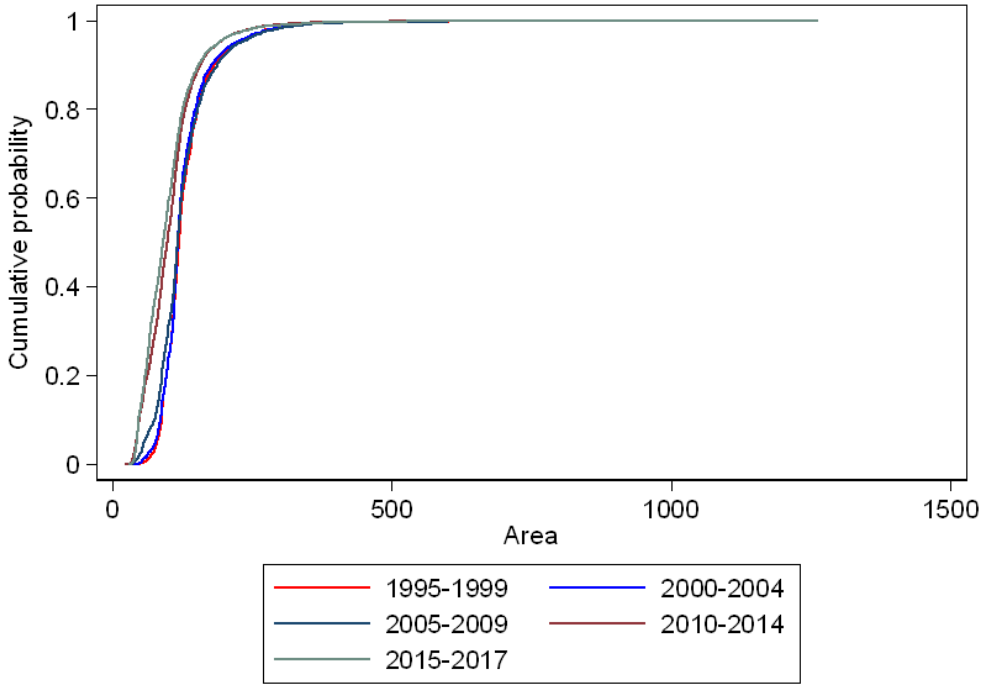


(a) Kernel distribution by unit area

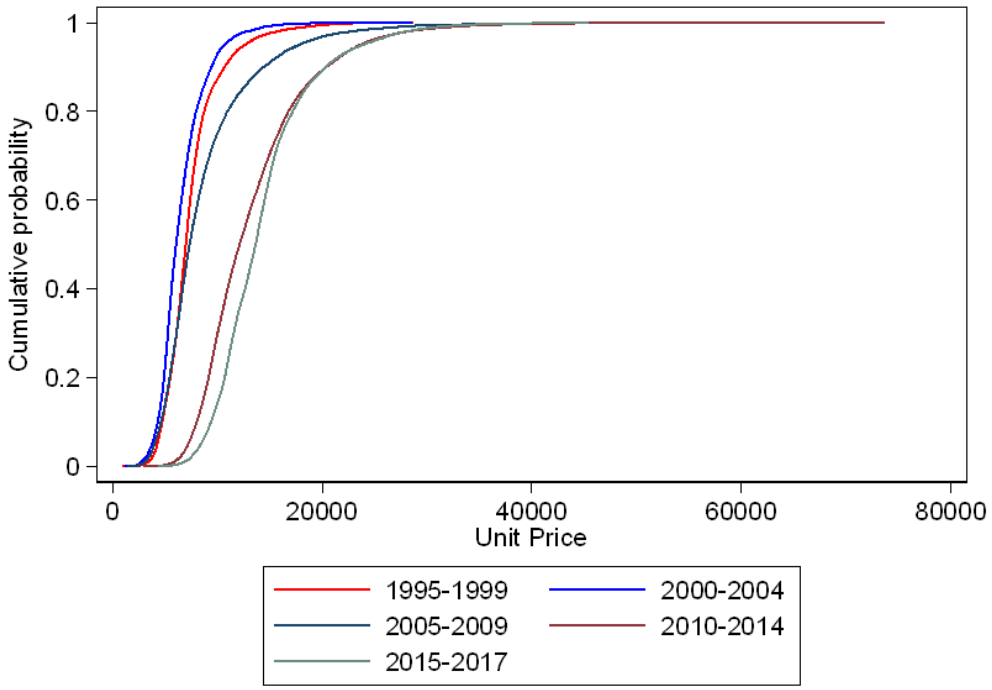


(b) Kernel distribution by transaction price

Figure 5 Distribution of Property Characteristics across Nationalities and by Years



(c) cumulative distribution of unit area by year



(d) cumulative distribution of unit prices by year

Figure 5 Distribution of Property Characteristics across Nationalities and by Years (Continued)

Note: Figure (a) shows the Kernel distribution of transacted areas across different nationalities (Chinese buyers, Indonesian buyers, Malaysian buyers, and Singaporean buyers), while Figure (b) shows the distribution of transacted unit prices across nationalities. Figure (c) and Figure (d) show the cumulative distribution of transacted areas and transacted unit prices across different years.

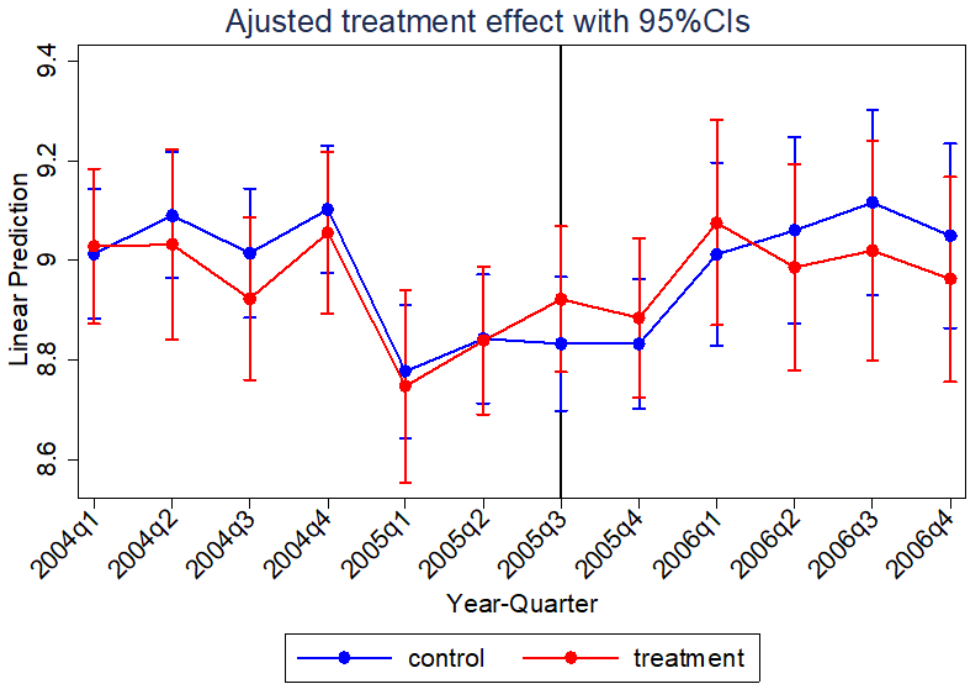
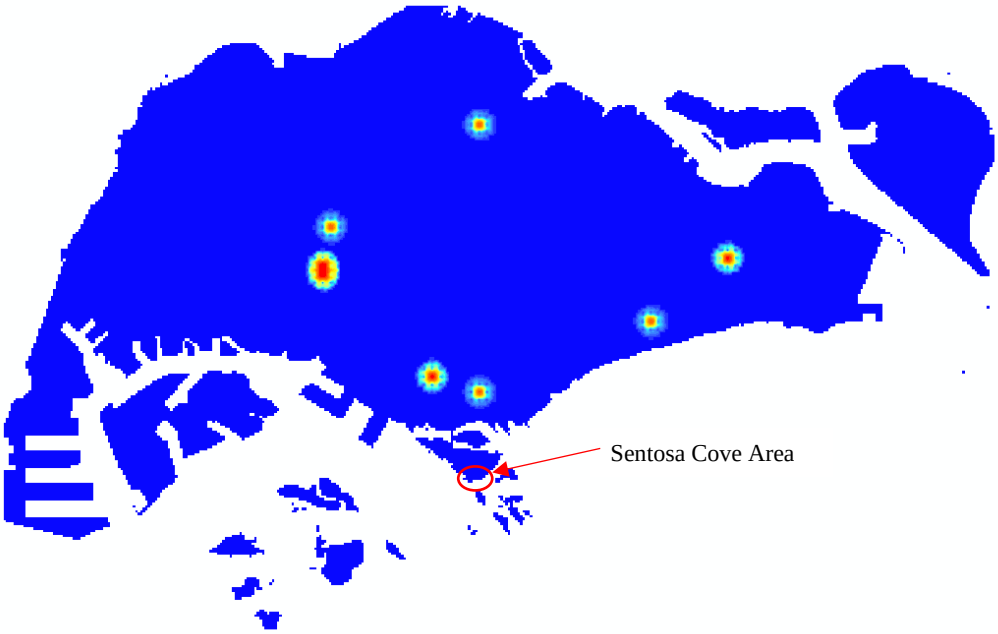
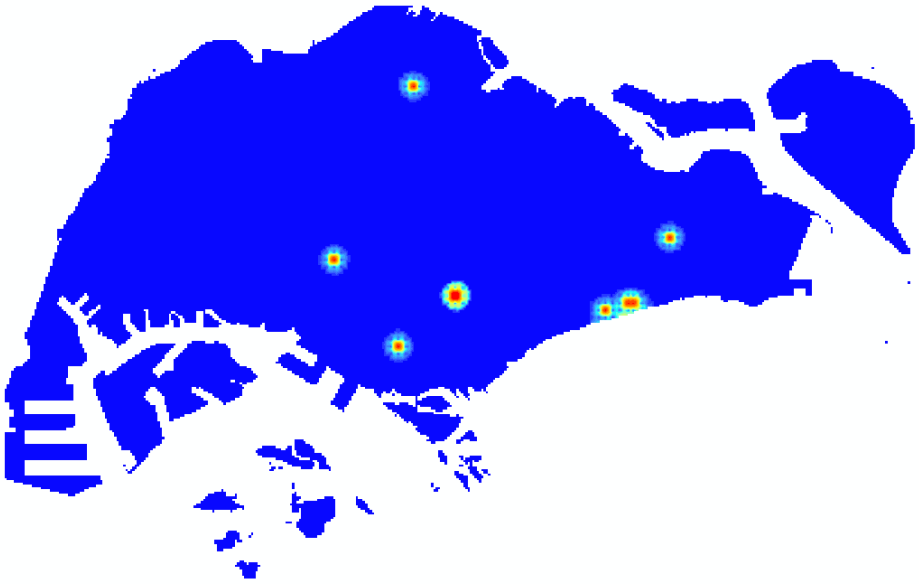


Figure 6 Pre-trend Parallel Test of Transaction Prices

Note: This figure demonstrates the parallel pre-trends followed by a structural break in the average unit prices of private housing purchases by the treatment group (Chinese foreign buyers) and the control group (other foreign buyers) before and after the 2005 policy shock. The y axis the linear prediction of the logarithm of transacted unit prices.

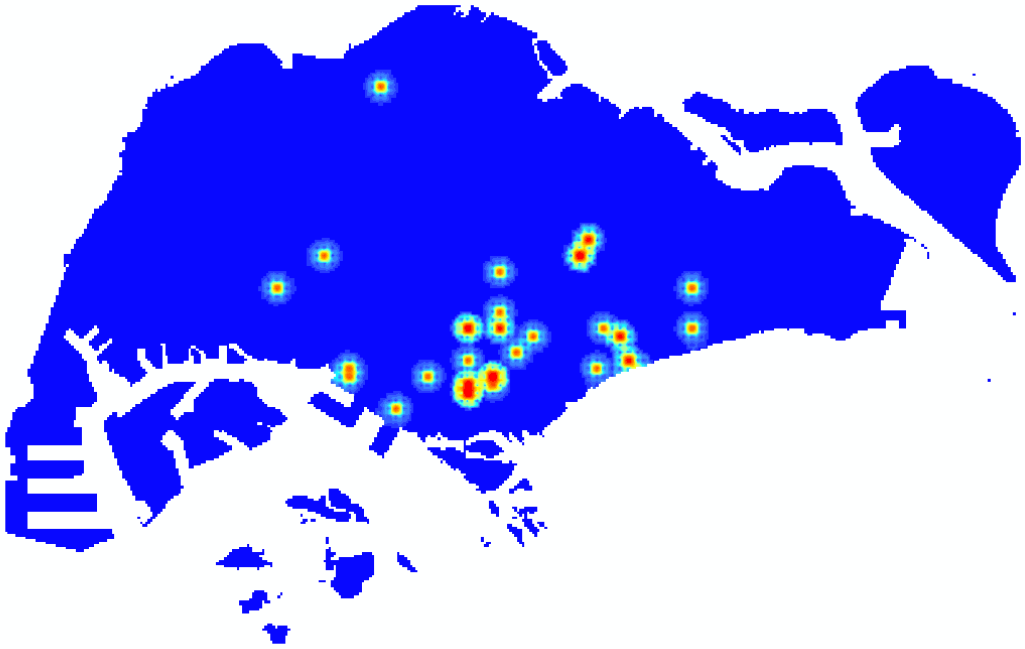


(a) Singapore Chinese transaction 1995Q3

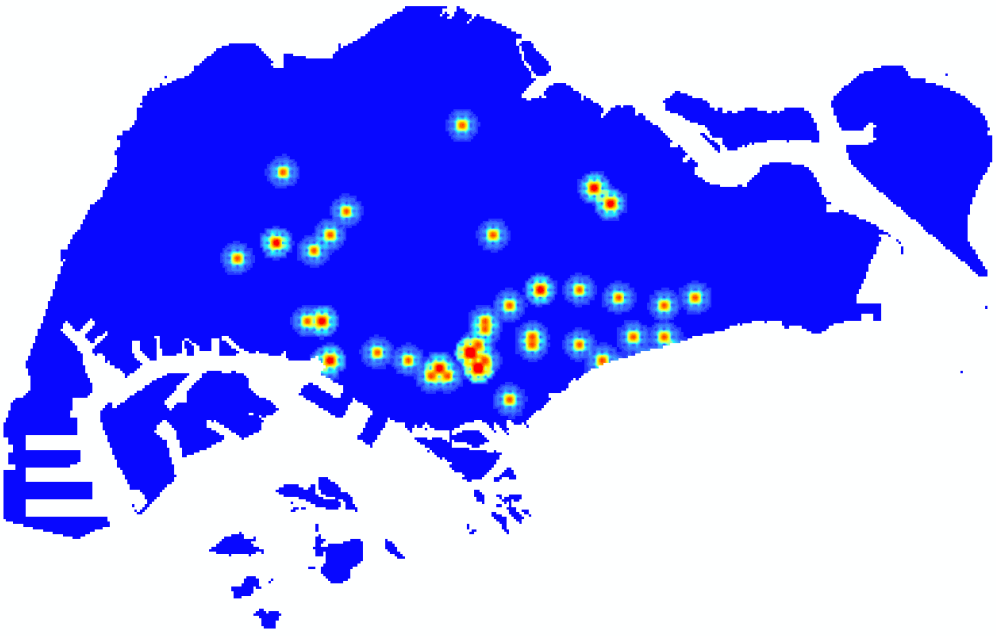


(b) Singapore Chinese transaction 2000Q3

Figure 7 Geographical Distributions of Chinese Buyers over Time



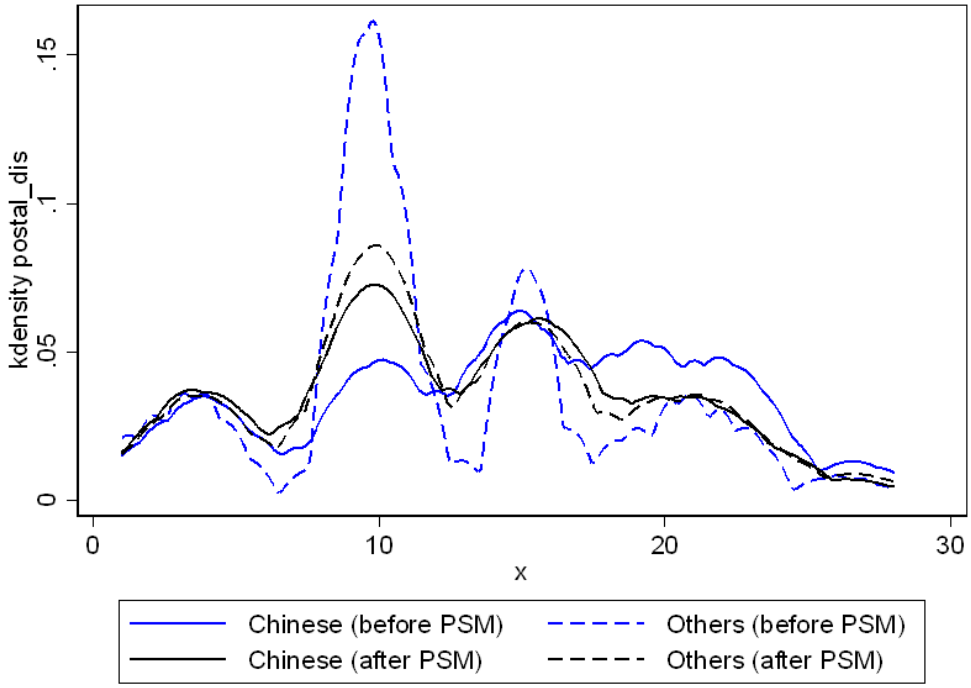
(c) Singapore Chinese transaction 2005Q3



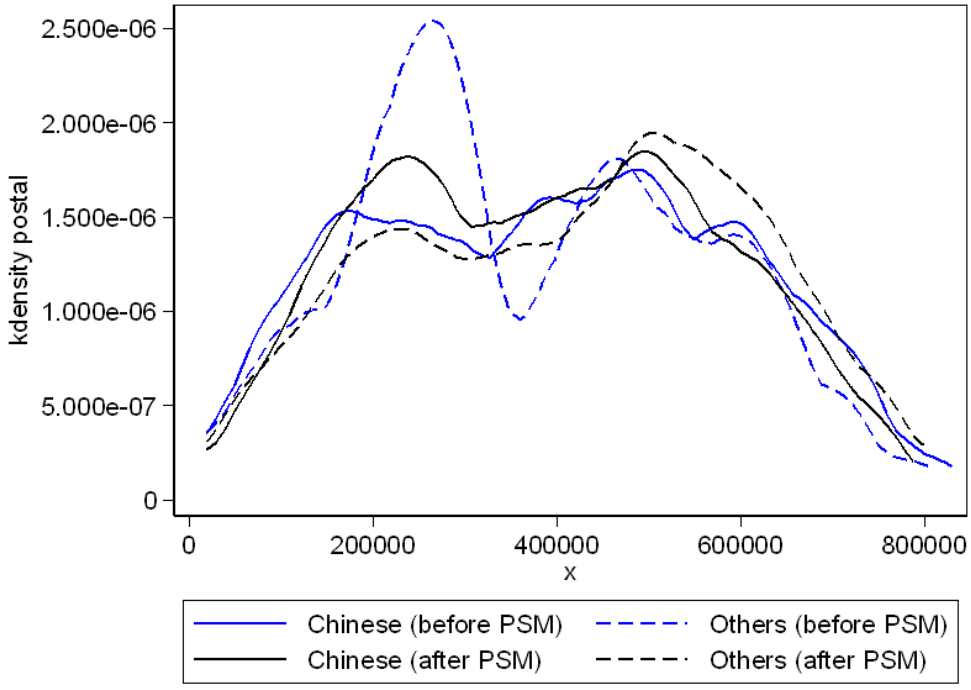
(d) Singapore Chinese transaction 2017Q3

Figure 7 Geographical Distributions of Chinese Buyers over Time (continued)

Note: This figure demonstrates the heatmap of the geographical distributions of properties transacted to Chinese buyers in Singapore over years. The color code ranges from blue, corresponding to low transaction volume, to red, corresponding to high transaction volume.



(a) distribution of location choice (postal districts identifiers)



(b) distribution of location choice (ZIP code identifiers)

Figure 8 Distribution of Location Choice before and after PSM

Note: Figures (a) exhibits the Kernel distribution of location choice before and after adopting PSM, using identifiers of postal districts as proxies. Figure (b) exhibits the Kernel distribution of location choice before and after adopting PSM, using identifiers of ZIP code as proxies.

Table 1 Descriptive Statistics of the Key Variables

Variable	Explanations	Total Foreign Buyers		Chinese foreign buyers	Other foreign buyers	Difference
		Mean	Std. Dev.	Mean	Mean	Mean
Number of observations		18719		5898	12821	
Dependent Variable						
unitprice	Unit price per square meters in Singapore dollar (S$ psm)	12177.250	6316.088	12492.22	12032.36	459.858***
Property Characteristics						
age	Building age	3.852	6.287	4.097	3.739	0.358***
floor	Floor height (by level) of a unit	10.566	8.881	10.203	10.733	-0.530***
Dcondo	A dummy for condominium type that has a value of 1 if a unit is a condominium; and otherwise 0	0.710	0.454	0.712	0.708	0.004
Dprivate	A dummy for a buyer currently living in a private house; and otherwise 0	0.726	0.446	0.600	0.784	-0.183***
Dresale	A dummy for sale type that has a value of 1, if it is a new sale (uncompleted project); and otherwise 0 for a unit from a resale project (completed unit)	0.434	0.496	0.491	0.407	0.084***
Dtenure99	A dummy of land tenure that has a value of 1, if a unit has a leasehold tenure of 99 years or less; and otherwise 9	0.064	0.246	0.055	0.069	-0.014***
housingarea	Unit floor area in square meter (sqm)	128.191	62.986	111.480	135.879	-24.399***
lnstdprice#	Logarithm of localized real estate price indices	9.378	0.438	9.431	9.354	0.077***
Visible Attributes of Housing Units						
Dhighfloor	A dummy on a high floor unit that has a value of 1, if a unit is in top 20% by height in a region, and higher than 25 stories; and otherwise 0	0.0636	0.244	0.056	0.067	-0.011***
Dlarge	A dummy for a large unit that has a value of 1 if a unit is either in the highest floor (penthouse) or in the top 20% by unit size in a building (based on the 6-digit postal code); and otherwise 0	0.215	0.411	0.145	0.247	-0.102***
Dexpensive	A dummy for a luxury / an expensive unit, if a unit is in the top 20% by price (most expensive) in a building (by the 6-digit postal code) and in a year; and otherwise 0	0.141	0.348	0.096	0.162	-0.066***
Buyer Nationalities						
Chinese	A dummy for a buyer of China nationality	0.315	0.465			
Indonesian	A dummy for a buyer of Indonesia nationality	0.340	0.474			
Malaysian	A dummy for a buyer of Malaysia nationality	0.086	0.281			
American	A dummy for a buyer of the United States of America nationality	0.015	0.120			

Notes: ** p<0.05, *p<0.1, *** p<0.01. # Refer to Agarwal et al (2019) for the details of the spatially adjusted real estate price indices.

Table 2 Wealth Effects on Housing Consumption by Foreign Buyers

VARIABLES	(1) lnunitprice	(2) lnunitprice	(3) lnunitprice
Chinese	0.00626*	-0.0221**	-0.0227**
	(0.00377)	(0.00894)	(0.00892)
policy		-0.0301	-0.0253
		(0.0316)	(0.0301)
Chinese × policy		0.0342***	0.0398***
		(0.00985)	(0.0113)
policy2010			-0.0679
			(0.0416)
Chinese × policy2010			0.0313***
			(0.0106)
policy2015			-0.0384
			(0.0464)
Chinese × policy2015			0.0348***
			(0.0134)
Observations	12,178	12,178	12,178
R-squared	0.900	0.900	0.900
Control variables	YES	YES	YES
Region FE	YES	YES	YES
Time FE	YES	YES	YES
Region*Time FE	YES	YES	YES

Note: This table reports wealth effect on the purchase price premium. The dependent variable is the logarithm of unit price per square meter. policy2010 denotes whether the transaction was made after June 19, 2010 while policy2015 denotes whether the transaction was made after August 11, 2015, where the PBOC allow more market-based adjustments to the RMB. Control variables include housing characteristics (including unit floor, floor area of the unit in square meters, age of the building, whether the project is condominium, whether the purchaser is private or HDB, whether the project is resale or new sale, and whether the project is 99-year leases) and the localized housing price estimated for standardized raster of 500m×500m. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.

Table 3 Preference for Visible Attributes of Housing Units

VARIABLES	(1) Dhighfloor	(2) Dlarge	(3) Dexpensive
Chinese	-0.0253**	-0.0452***	-0.0435***
	(0.0115)	(0.0171)	(0.0167)
policy	0.00733	-0.0246	0.0444
	(0.0348)	(0.0542)	(0.0481)
Chinese × policy	0.0237*	0.0334*	0.0591***
	(0.0128)	(0.0190)	(0.0187)
Observations	12,178	12,178	12,178
R-squared	0.566	0.525	0.365
Control Variables	YES	YES	YES
Region FE	YES	YES	YES
Time FE	YES	YES	YES
Region*Time FE	YES	YES	YES

Note: This table reports wealth effect on the purchase price premium. The dependent variables are proxies of luxury housing (dummy definitions of high floor unit (*Dhighfloor*), large unit (*Dlarge*), or expensive unit (*Dexpensive*)). Control variables include housing characteristics (including unit floor, floor area of the unit in square meters, age of the building, whether the project is condominium, whether the purchaser is private or HDB, whether the project is resale or new sale, and whether the project is 99-year leases) and the localized housing price estimated for standardized raster of 500m×500m. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.

Table 4: Willingness to Pay (WTP) for Conspicuous Motives in Housing Consumptions

VARIABLES	(1) lnunitprice	(2) lnunitprice	(3) lnunitprice
Chinese	-0.0198**	-0.00547	-0.00988
	(0.00904)	(0.00801)	(0.00939)
policy	-0.0306	-0.0432	-0.0369
	(0.0314)	(0.0314)	(0.0300)
Chinese × policy	0.0296***	0.0275***	0.0171*
	(0.00998)	(0.00906)	(0.0102)
Chinese × policy ×Dhighfloor	0.110**		
	(0.0530)		
Chinese × Dhighfloor	-0.0717		
	(0.0501)		
Chinese × policy × Dlarge		0.0725**	
		(0.0341)	
Chinese × Dlarge		-0.108***	
		(0.0323)	
Chinese × policy × Dexpensive			0.0461*
			(0.0242)
Chinese × Dexpensive			-0.0357
			(0.0222)
Observations	12,178	12,178	12,178
R-squared	0.900	0.901	0.916
Control Variables	YES	YES	YES
Region FE	YES	YES	YES
Time FE	YES	YES	YES
Region*Time FE	YES	YES	YES

Note: This table reports wealth effect on the purchase price and the direct and indirect wealth effect on the purchase price for Chinese buyers compared with other foreign buyers. The dependent variable is the logarithm of unit price per square meter. We include the interaction term with proxies of luxury housing (dummy definitions of high floor unit (*Dhighfloor*), large unit (*Dlarge*), or expensive unit (*Dexpensive*)). Control variables include housing characteristics (including unit floor, floor area of the unit in square meters, age of the building, whether the project is condominium, whether the purchaser is private or HDB, whether the project is resale or new sale, and whether the project is 99-year leases) and the localized housing price estimated for standardized raster of 500m×500m. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.

Table 5 Enhancements of Signalling Effects

VARIABLES	(1) lnunitprice	(2) Dhighfloor	(3) Dlarge	(4) Dexpensive
Panel A: Social cohesion				
Chinese	0.000181	-0.0322**	-0.0259	-0.0169
	(0.0123)	(0.0132)	(0.0264)	(0.0296)
policy	-0.0409	-0.0302	-0.0392	0.0536
	(0.0330)	(0.0313)	(0.0563)	(0.0512)
Chinese × policy	0.00948	0.0350**	0.0423	0.0230
	(0.0142)	(0.0160)	(0.0301)	(0.0334)
Chinese × policy × highcohesion	0.0456**	0.0404*	-0.0203	0.0689*
	(0.0197)	(0.0215)	(0.0408)	(0.0408)
Observations	11,556	11,556	11,556	11,556
R-squared	0.899	0.452	0.527	0.366
Control Variables	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
Region*Time FE	YES	YES	YES	YES
Panel B: Social status				
Chinese	-0.00145	-0.00465	-0.0376*	-0.00776
	(0.0101)	(0.0109)	(0.0199)	(0.0178)
policy	-0.0278	-0.0157	-0.0167	0.0884*
	(0.0316)	(0.0299)	(0.0550)	(0.0477)
Chinese × policy	0.0215*	0.000738	0.0179	0.0243
	(0.0111)	(0.0121)	(0.0218)	(0.0197)
Chinese × policy × highstatus	0.0501**	0.0425*	0.0377	0.111**
	(0.0242)	(0.0221)	(0.0448)	(0.0456)
Observations	12,178	12,178	12,178	12,178
R-squared	0.900	0.449	0.527	0.364
Control Variables	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
Region*Time FE	YES	YES	YES	YES

Note: This table reports the enhancement role of social cohesion and social status on wealth effect and Chinese buyers' housing purchase behaviors compared with other foreign buyers. The dependent variable in column (1) is the logarithm of unit price per square meter, while dependent variables in columns (2) to (4) are proxies of luxury housing (dummy definitions of high floor unit (*Dhighfloor*), large unit (*Dlarge*), or expensive unit (*Dexpensive*)). We include the interaction with social cohesion and social status proxies (*highcohesion* and *highstatus*), which as dummy variables defined for the 60^{th} percentile sectors with a strong enclave of Chinese residents and a high-income neighborhood, respectively. Control variables include housing characteristics (including unit floor, floor area of the unit in square meters, age of the building, whether the project is condominium, whether the purchaser is private or HDB, whether the project is resale or new sale, and whether the project is 99-year leases) and the localized housing price estimated for standardized raster of 500m×500m. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.

Table 6 Heterogeneity Tests on Willing to Pay between Owner Occupiers and Investors

	Panel A: Occupiers				*Panel B: Investors*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	lnunitprice	lnunitprice	lnunitprice	lnunitprice	lnunitprice	lnunitprice	lnunitprice	lnunitprice
Chinese	-0.0363**	-0.0299*	-0.00734	-0.0271	-0.0147	-0.0161	-0.0151	0.00372
	(0.016)	(0.016)	(0.014)	(0.017)	(0.016)	(0.017)	(0.018)	(0.018)
policy	-0.0537	-0.0512	-0.067	-0.0638	0.0113	0.0122	-0.00545	0.000734
	(0.047)	(0.048)	(0.046)	(0.048)	(0.049)	(0.049)	(0.050)	(0.041)
Chinese × policy	0.0479***	0.0406**	0.0397**	0.0330*	0.0255	0.0228	0.0314*	0.00833
	(0.018)	(0.018)	(0.016)	(0.019)	(0.018)	(0.018)	(0.019)	(0.019)
Chinese × policy × Dhighfloor		0.173*				0.0357		
		(0.094)				(0.054)		
Chinese × policy × Dlarge			0.131**				0.0139	
			(0.058)				(0.049)	
Chinese × policy × Dexpensive				0.0813*				0.0803*
				(0.042)				(0.043)
Observations	3,249	3,249	3,249	3,249	4,265	4,265	4,265	4,265
R-squared	0.901	0.901	0.903	0.912	0.892	0.892	0.892	0.908
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Region*Time FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table reports wealth effect on the purchase price of occupiers (Panel A) and investors (Panel B). The dependent variable is the logarithm of unit price per square meter. We include the interaction term with proxies of luxury housing (dummy definitions of high floor unit (*Dhighfloor*), large unit (*Dlarge*), or expensive unit (*Dexpensive*)). Control variables include housing characteristics (including unit floor, floor area of the unit in square meters, age of the building, whether the project is condominium, whether the purchaser is private or HDB, whether the project is resale or new sale, and whether the project is 99-year leases) and the localized housing price estimated for standardized raster of 500m×500m. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.

Table 7 Robustness Tests

	Panel A: Location Bias		*Panel B: Placebo Tests*		
	(1)	(2)	(3)	(4)	(5)
VARIABLES	lnunitprice	lnunitprice	lnunitprice	lnunitprice	lnunitprice
Chinese	-0.020	-0.040***	-0.026***	-0.021**	-0.002
	(0.025)	(0.013)	(0.009)	(0.009)	(0.012)
policy	-0.010	-0.128**			
	(0.121)	(0.061)			
Chinese × policy	0.077**	0.050***			
	(0.035)	(0.015)			
placebo3month			0.046**		
			(0.024)		
Chinese × placebo3month			0.053		
			(0.045)		
placebo6month				0.044	
				(0.030)	
Chinese × placebo6month				-0.013	
				(0.030)	
placebo2000					-0.115***
					(0.040)
Chinese × placebo2000					0.009
					(0.013)
Observations	538	3,109	4,856	4,856	12,178
R-squared	0.950	0.928	0.826	0.825	0.900
Control variables	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES
Region*Time FE	YES	YES	YES	YES	YES

Note: Panel A reports the placebo test on wealth effect prior to the implementation and across nationalities, while Panel B reports the robustness test on the bias form the supply side considering the selection of property locations and traders. The dependent variables are the logarithm of unit price per square meter. In column (1), we restrict our sample to adjacent property transactions in pairs based on the floor and unit number of the property. In column (2), we adopt Propensity Score Matching (PSM) to extract samples based on matched counterpart which are transacted to Chinese buyer and other foreign buyers, with similar characteristics in terms of age, floor, area, lease, and locations. The placebo event variable (*placebo3month*, *placebo6month* and *placebo2000*) denotes whether the transaction was made after the 3 or 6 months, or 5 years prior to the implication of the new exchange rate regime. Control variables include housing characteristics (including unit floor, floor area of the unit in square meters, age of the building, whether the project is condominium, whether the purchaser is private or HDB, whether the project is resale or new sale, and whether the project is 99-year leases) and the localized housing price estimated for standardized raster of 500m × 500m. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.

Table 8 Falsification Tests: Nationality Bias, Local Knowledge and Superstitious Beliefs

	Panel A: Nationality Bias			*Panel B: Local Knowledge*		*Panel C: Superstitious Belief*
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Chineseseller	NextChinesebuyer	lnunitprice	lnunitprice	lnunitprice	lnunitprice
Chinese	0.014	0.020	-0.031***			-0.016*
	(0.011)	(0.023)	(0.009)			(0.009)
policy	-0.003	-0.002	-0.162	-0.309**	-0.024	-0.030
	(0.003)	(0.014)	(0.066)	(0.145)	(0.032)	(0.032)
Chinese × policy	0.010	0.001	0.253**			0.026***
	(0.013)	(0.024)	(0.110)			(0.010)
ChineseSPR				0.016		
				(0.027)		
ChineseSPR × policy				-0.013		
				(0.026)		
ChineseExist					-0.021**	
					(0.009)	
ChineseExist × policy					0.001	
					(0.019)	
Chinese × Dluckyunit × policy						0.035
						(0.050)
Chinese × Dluckyunit						-0.031
						(0.047)
Chinese × Dunluckyunit × policy						0.064
						(0.044)
Chinese × Dunluckyunit						-0.051
						(0.042)
Observations	3,865	3,865	6,566	3,400	9,147	12,178
R-squared	0.225	0.153	0.912	0.920	0.898	0.900
Control variables	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Region*Time FE	YES	YES	YES	YES	YES	YES

Note: This table reports the robustness test on other possible explanations including information disadvantage, local knowledge, and superstitious belief. The dependent variables in column (1) and (2) are whether the seller's nationality is Chinese, and whether the current property will be sold to a Chinese buyer in the repeated transaction market. The dependent variable in columns (3) to (6) is the logarithm of unit price per square meter. *ChineseSPR* denotes Chinese buyers who are Singapore permeant residents. *ChineseExist* denotes Chinese buyers who have first appeared in Singapore housing transaction records prior to the policy shock. The dummy variable of a "lucky unit" and "unlucky unit" (*Dluckyunit* and *Dunluckyunit*) follows the definition of Agarwal et al. (2014). Control variables include housing characteristics (including unit floor, floor area of the unit in square meters, age of the building, whether the project is condominium, whether the purchaser is private or HDB, whether the project is resale or new sale, and whether the project is 99-year leases) and the localized housing price estimated for standardized raster of 500m × 500m. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.

Table 9 Other Channels: Immigration and Safe Haven Motives

	Panel A: Immigration Motives			*Panel B: Safe Haven Motives*		
	Non-PR Buyers	City Centre & Non-PR Buyers	Suburbs & Non-PR Buyers	All Foreign Buyers	Chinese Foreign Buyers	Foreign Buyers Not Linked to Panama Nominees
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	D1million	D1million	D1million	nominees	lnunitprice	lnunitprice
Chinese	-0.040*	0.011	-0.046*	0.037***		-0.021**
	(0.022)	(0.056)	(0.024)	(0.010)		(0.00902)
policy	0.047	0.029	0.093	-0.002	-0.315**	-0.030
	(0.066)	(0.120)	(0.081)	(0.002)	(0.145)	(0.032)
Chinese × policy	0.010	-0.035	0.012	0.005		0.035***
	(0.024)	(0.057)	(0.026)	(0.010)		(0.010)
nominees					-0.037	
					(0.058)	
nominees × policy					0.018	
					(0.059)	
Observations	10,472	3,049	7,396	12,178	3,400	12,014
R-squared	0.581	0.551	0.580	0.096	0.917	0.899
Control variables	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Region*Time FE	YES	YES	YES	YES	YES	YES

Note: Panel A reports the robustness test on immigration motivation of Chinese buyers compared with other foreign buyers. The dependent variable in columns (1) to (3) is a dummy whether the total purchase price is over S$1 million（*D1million*）. Panel B reports the robustness test on the potential safe heaven effect. The dependent variable in column (4) is whether the buyer has Panama Papers exposure; the dependent variables in columns (5) to (6) are the logarithm of unit price per square meter. *nominees* denotes whether the buyer is identified to be linked to Panama Nominees. Control variables include housing characteristics (including unit floor, floor area of the unit in square meters, age of the building, whether the project is condominium, whether the purchaser is private or HDB, whether the project is resale or new sale, and whether the project is 99-year leases) and the localized housing price estimated for standardized raster of 500m × 500m. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.

Appendix

Table A1 Counterfactual Tests with Non-Chinse Foreign Buyers

	(1)	(2)	(3)
VARIABLES	lnunitprice	lnunitprice	lnunitprice
Indonesian	0.020***		
	(0.006)		
policy	-0.010	-0.018	-0.013
	(0.033)	(0.033)	(0.033)
Indonesian × policy	-0.013		
	(0.008)		
Malaysian		-0.004	
		(0.008)	
Malaysian × policy		0.015	
		(0.012)	
American			0.000
			(0.017)
American × policy			-0.044*
			(0.027)
Observations	8,686	8,686	8,686
R-squared	0.896	0.896	0.896
Control variables	YES	YES	YES
Region FE	YES	YES	YES
Time FE	YES	YES	YES
Region*Time FE	YES	YES	YES

Note: This table reports the counterfactual tests across nationalities with non-chinse foreign buyers. The dependent variables are the logarithm of unit price per square meter. Control variables include housing characteristics (including unit floor, floor area of the unit in square meters, age of the building, whether the project is condominium, whether the purchaser is private or HDB, whether the project is resale or new sale, and whether the project is 99-year leases) and the localized housing price estimated for standardized raster of 500m × 500m. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.