A Tale of Two Cities: Mainland Chinese Buyers in the Hong Kong Housing Market

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Abstract

This paper examines the impact of mainland Chinese buyers in the Hong Kong housing market, using complete transaction records between 2001 and 2017. We find that mainland buyers pay an average price premium of 1.4% compared with locals. The premiums are estimated to be 3.5% for large-sized luxury units and 1.6% for homes in central locations. Using the Bartik instrumental variable estimation strategy, we show that such price premiums spill over to future housing transactions in close neighborhoods. The mechanisms that underlie the price premiums include a hedging effect, residential sorting, and information barriers, of which the hedging motive has the strongest impact. Mainland buyers' price premiums rise significantly when the Chinese currency depreciates or China's economic policy uncertainty increases. Our study sheds light on the impact and mechanism of the "China shock" on the global housing markets.

Keywords: Hong Kong housing market, price premiums, mainland buyers, hedging effect, residential sorting, information barriers
JEL Codes: R23, O18, F22

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1 Introduction

A burgeoning literature shows that global real estate markets are subject to the "China shock" in recent years (Gorback and Keys, 2020; Li et al., 2020; Pavlov and Somerville, 2020). Since 2010, mainland Chinese buyers have acquired international property totalling more than 430 billion US dollars (USD). In 2017, their purchase of international real estate reached a record high of USD 119.7 billion, ranking them first among all foreign buyers (Tan, 2018). The impact of the China shock on real estate markets has had rapid ramifications for other socioeconomic aspects, such as neighborhood quality and local employment (Li et al., 2020; Pavlov and Somerville, 2020). It is thus important to understand whether mainland buyers are truly the driving force for the rising housing prices in destination countries/regions, or just an easy target for blame. Moreover, we investigate the mechanisms through which mainland buyers impact local housing markets.

To answer these questions, we exploit the Hong Kong housing market as a laboratory to investigate the role of mainland Chinese buyers. Hong Kong is the primary destination for capital outflow from mainland China. China's Ministry of Commerce reports that Hong Kong received over 66% of China's foreign direct investment outflow in 2019. Given its close geographic proximity and cultural similarity to mainland China, Hong Kong has been a popular destination for mainlanders seeking to migrate or invest since its return to China in 1997 (Lau, 2013). Other global housing markets—such as Singapore, California, or Vancouver—have just started to gain popularity among Chinese buyers in recent years. Different from mainland China, Hong Kong features competitively low tax rates and a pegged exchange rate to the USD. In the real estate market specifically, relatively low transaction and holding costs, as well as no home purchase restriction (HPR), make the Hong Kong housing market an attractive destination for mainland buyers. The comovement between untamed housing prices and the high demand of mainland buyers triggers controversial public debate on the role of mainlanders in the Hong Kong housing market, which intensifies existing socioeconomic tensions between mainlanders and locals (Chu, 2012; Li, 2016; Shane, 2019).

Using comprehensive residential real estate transactions between 2001 and 2017 obtained

from the Hong Kong Land Registry, we first empirically quantify mainland buyers' price premiums relative to locals in the Hong Kong housing market. A unique feature of the data set is that it contains the official names of buyers and sellers for each housing transaction. Since buyers from mainland China and Hong Kong have distinctly different spellings of names for historical reasons, and these spellings rarely change with migration status, we are able to distinguish mainland buyers from locals. We identify 3.67% of the 687,598 housing transactions as being made by mainland buyers. Controlling for detailed housing characteristics, as well as time and location fixed effects at a granular level, our baseline results show that on average, mainland buyers pay price premiums of 1.4% compared with local buyers. Our heterogeneity analysis indicates that the price premiums are larger in higher-end market sectors, in more central locations, and during periods that experience larger demand by mainlanders.

Next, we investigate whether the price premiums paid by mainland buyers spill over to subsequent housing transactions in close neighborhoods. Specifically, we examine the impact of the presence of mainland buyers in a given building on subsequent transaction prices of housing units in the same building. Ordinary least squares (OLS) estimation can be biased, even when controlling for detailed temporal and location fixed effects, since unobserved *time-varying* factors—such as changing neighborhood quality—can be correlated simultaneously with the presence of mainlanders and housing prices. To address this endogeneity concern, we employ a Bartik instrumental variable (IV) estimation strategy (Bartik, 1991; Saiz, 2007; Saiz and Wachter, 2011; Sá, 2015). Using the predicted inflow of mainland buyers based on historical settlement patterns as the IV for the actual inflow of mainland buyers in each building, we find a significant spillover effect. In particular, if the 1-year-lagged number of mainland buyers increases by one, housing prices in the same building increase by 2.6% the next year. This result implies that although the current price premiums for mainland Chinese buyers are relatively small at 1.4%, their purchases play an important role in raising subsequent housing prices (Piazzesi and Schneider, 2009).

To further validate that this spillover effect arises from variations in mainland buyers' demand rather than other unobservables, we exploit the Buyer's Stamp Duty (BSD) policy introduced in

October 2012 as a quasi-natural experiment. This policy imposes an additional stamp duty tax for non-permanent resident (non-PR) homebuyers, which substantially increases mainland buyers' transaction cost by 15% of the total price.[1] It is expected to directly suppress housing demand from mainland buyers but leave local buyers unaffected. Combining this exogenous policy shock with the IV estimation, we find that buildings that attracted higher demand of mainland buyers in the prior period experience larger declines in housing prices after the BSD policy. This result offers corroborating evidence that the spillover effect on future housing transactions indeed comes from the demand of mainland buyers.

We then proceed to analyze the underlying reasons that mainland buyers pay price premiums in the Hong Kong housing market. Unlike those past studies which mainly focus on a single factor (Goetzmann et al., 2021), we compare multiple channels that influence mainland buyers' housing transactions simultaneously. We find supportive evidence for a hedging effect, residential sorting, and information barriers, among which the hedging motive has the largest impact on mainland buyers' price premiums. In particular, when the Chinese yuan (CNY) depreciates against the Hong Kong dollar (HKD) or when economic policy uncertainty in mainland China increases, mainland buyers seek diversification opportunities by purchasing residential real estate in Hong Kong. These results are robust after controlling for detailed institutional factors such as monetary supply, financing cost, and mainland China's HPR policies. These evidence further suggests that the wealth effect documented by Cvijanović and Spaenjers (2021) does not play a dominant role in our context, as mainlanders pay even higher premiums when their wealth shrinks due to CNY depreciation. Our horse-racing analysis shows that a one-standard-deviation increase in the HKD/CNY exchange rate can explain 75.6% of the average price disparity between mainland and local buyers.

To advance our understanding on why mainland buyers choose Hong Kong's residential real

[1]The Inland Revenue Department of Hong Kong states that the BSD is payable on all residential property transactions executed on or after October 27, 2012, except when the buyer is a Hong Kong permanent resident (PR) acquiring the property on his/her own behalf. According to the Hong Kong Immigration Department, a mainland Chinese citizen who has ordinarily resided in Hong Kong for a continuous period of not less than 7 years is eligible for permanent residency in Hong Kong.

estate as a hedging tool against currency risk and economic uncertainty in mainland China, we conduct a comparative analysis with the housing market of Singapore. Although Singapore and Hong Kong share various socio-demographic features, Hong Kong has the unique pegged exchange rate system and also enjoys relatively greater geographic proximity to mainland China. For these reasons, we expect that residential real estate in Hong Kong are more able to satisfy the hedging needs of mainland buyers than that in Singapore during our study period. Consistent with our expectations, our empirical results show that mainland buyers' overall price premiums and hedging related premiums are both higher in the Hong Kong housing market on average.

Literature uses the safe-haven effect to explain the inflow of foreign capital during crisis periods and documents that out-of-town investors display strong hedging motives by investing in cross-border real estate assets (Badarinza and Ramadorai, 2018). However, it remains unexplored the hedging activities of migrants, who have moved into the *host* countries/regions, to protect the assets in their *home* countries/regions against economic risks over there. As over 83% of the first-time mainland buyers in our sample are migrants who reside in Hong Kong, this unique setting enables us to provide novel evidence on the hedging motive of migrant buyers living in host countries/regions. Using the subsample of first-time property purchases, we find consistent evidence supporting the hedging motive that during period of greater currency risk or economic uncertainty, mainland buyers' price premium increases.

Our paper makes three main contributions. First, we add to the burgeoning literature on the China shock to global housing markets (Gorback and Keys, 2020; Li et al., 2020; Pavlov and Somerville, 2020). Using rich transaction-level data, we are among the first to study the impact of mainland Chinese buyers on the Hong Kong housing market, a primary destination of mainland China's capital outflow. We find that mainland buyers pay a housing price premium of only 1.4% on average. Even focusing on those housing segments favored by mainland buyers—luxury units or central locations—the price premiums do not exceed 4%. Nevertheless, the price premiums spill over to future housing transactions in close neighborhoods, for both mainland and local buyers. Overall, our results shed light on the ongoing public debate on the role of mainland buyers in the

Hong Kong housing market (Chu, 2012; Li, 2016; Shane, 2019).

Second, our study contributes to uncovering the major channels through which foreign/cross-border buyers affect housing prices in host countries/regions (Accetturo et al., 2014; Gonzalez and Ortega, 2013; Saiz and Wachter, 2011; Sá, 2015). To the best of our knowledge, we are the first to explicitly quantify and compare the contribution of each channel to explain the price premiums for foreign/cross-border homebuyers. Different from Cvijanović and Spaenjers (2021) which shows that a major channel lies in the wealth effect of out-of-town buyers who do not bargain enough to reach a fair market price, our results suggest that the wealth effect does not play a dominant role in our context. Among the channels we examine, we highlight that the mainland buyers' hedging motive against current risk and economic policy uncertainty in mainland China is a major driving force of their price premiums in the Hong Kong housing market.

Moreover, past literature mainly focuses on hedging using financial asset classes such as gold or securities (Baur and McDermott, 2010; Klingler and Lando, 2018; Ranaldo and Söderlind, 2010). An exception is Badarinza and Ramadorai (2018), which pioneers in presenting the correlation between London housing prices and variations in political risk in foreign buyers' countries of origin at the electoral ward level and link this to the safe-haven effect. However, their study lacks the information on individual buyers' countries of origin and hence could not conduct more granular analysis. Using rich transaction-level data with identity information on homebuyers, we establish a causal effect of mainland buyers' demand on future housing prices in Hong Kong. We also highlight the role of cross-border housing purchases in providing hedging functions during currency and economic fluctuations in the home country/region, which is more regular and carries a more general implication than the safe-haven effect as a conditional negative correlation in crisis periods (Baur and McDermott, 2010). Lastly, we also provide a cross-market analysis by comparing Hong Kong with the otherwise similar global city-state of Singapore. Our result reveals that the Hong Kong housing market—characterized by geographic proximity to the mainland and the pegged exchange rate to the USD—is a more attractive hedging asset for mainland Chinese buyers during the study period. This methodology is applicable to housing markets in other global cities.

The remainder of the paper is organized as follows. Section 2 introduces the institutional background. Section 3 describes our data. Section 4 develops hypotheses and lays out the empirical design. Section 5 presents the results and Section 6 discusses the channels. Section 7 concludes.

2 Institutional Background

The Hong Kong population is composed of a considerable number of mainland Chinese migrants (Lau, 2013). The Chinese government implements a permit-quota system to control the entry of mainland Chinese citizens into Hong Kong (Lam and Liu, 1998). Due to the geographic proximity, many Hong Kong residents have close family ties in mainland China. Mainland Chinese migrants coming to Hong Kong for family reunions via the "One-way Permit" (OWP) scheme constitute a major proportion of cross-border migration. This scheme allows up to 150 mainlanders to migrate into the city each day. A total of 950,000 mainlanders had migrated to the city through the scheme as of the end of 2016, and accounted for about 12.8% of Hong Kong's population (Ng and Ng, 2018).[2] In recent years, increasingly more wealthy and well-educated mainland Chinese migrate to Hong Kong via talent recruitment, local university education, and investment immigration schemes (HKID, 2020). These migrants add to a population of 7.4 million in a crowded city with a land area of just 1,100 square kilometers land area (425 square miles), 40% of which are country parks or nature reserves.

Residential property prices in Hong Kong have risen substantially over the last few years (Figure 1). Hong Kong has been ranked as the world's most expensive city to live in for the last 8 years (Carozzi et al., 2018). The disparity between housing price growth and household income growth in Hong Kong continues to widen. Apartments in the city cost 18.1 times the gross annual median income based on the 2016 Demographia survey, which is much higher than the 5.1 benchmark ratio for "severely unaffordable." Anecdotal reports point to limited housing supply and large capital flows from mainland Chinese buyers as the main driving factors, which anger

[2] In addition to the OWP, the Chinese government can issue an unlimited number of "Two-way Permits" (TWP) that allow holders to enter Hong Kong for the purpose of visiting families or doing business, but require that they return to China after a designated period.

local residents who cannot afford to get a foothold on the property ladder (Chu, 2012).

[— Insert Figure 1 about here —]

The Hong Kong government acknowledges the severity of the housing affordability issue and has implemented a series of cooling measures to rein in housing prices since 2010, as illustrated in Figure 1. Specifically, several major property tax policies introduced by the Hong Kong government from 2012 onward focus on suppressing demand from non-PR buyers.[3] In Hong Kong, all property buyers must pay an Ad Valorem Stamp Duty (AVD), which ranges from 1.5% to 8.5% based on property prices and purchase dates. In October 2012, the Hong Kong government imposed an additional 15% BSD on top of the AVD for all non-PR homebuyers, which substantially increased the housing acquisition cost and suppressed the demand of foreign buyers, the majority of whom are mainland buyers. The total stamp duty for non-PR buyers was further increased to 30% under the New Residential Stamp Duty (NRSD) policy introduced in November 2016.

The additional property taxes appear to be effective for curbing the demand of mainland Chinese homebuyers in the short term. Subsequent to the additional BSD imposed on non-PR homebuyers, the percentage of mainland buyers in the Hong Kong housing market dropped from 7.3% in 2011 to 3.1% in 2014, based on the complete housing transaction records from the Land Registry. Accordingly, the market indeed cooled down slightly in 2012 (Figure 1). However, the number of mainland buyers started to grow again in 2015.

Around 21,000 working professionals from mainland China obtained permanent residency in Hong Kong in 2019 and were exempted from the BSD (Liu, 2018). This number is likely to increase in future years as the Hong Kong government's visa program for mainland Chinese attracts more high-income young professionals. As stated by Chief Executive Carrie Lam in a July 2018 policy address, tighter restrictions may be imposed on non-local homebuyers to rein in property prices to prevent the property market from overheating.

[3] In addition to the policies that target non-PR buyers, other policies, such as the Special Stamp Duty (SSD) meant to curb short-term housing speculation, have also been implemented since 2010. However, these policies are applicable to all homebuyers including PRs and non-PRs, and therefore do not have differential impacts on mainland buyers.

3 Data

3.1 Sample Construction

The housing transaction data we use is the complete transaction records for the Hong Kong housing market. The data is obtained from the EPRC Limited, a data vendor that tracks property transactions registered with the Hong Kong Land Registry.[4] The data set contains comprehensive information on transaction details, such as transaction dates and sale prices, as well as housing characteristics: gross and net unit size, number of bedrooms and living rooms, building completion year, address, district, and housing type. We also match each transaction with the distances to various local amenities available at the time of the transaction: the Mass Transit Railway (MTR), bus stops, hospitals, schools, universities, and coastline. Our sample period ranges from 2001 to 2017.[5]

A unique merit of this data set is that it provides the full official names of both sellers and buyers in the romanized spelling of Chinese characters (Pinyin). Hong Kongese, mainland Chinese, and Taiwanese use distinctive spellings in Chinese Pinyin.[6] We are able to identify buyers' origins based on the distinctive spellings of their official names, because the spellings are determined by birthplace and usually remain unchanged after migration. We consider Hong Kong buyers to be local and others to be non-local. After removing transactions that involve company buyers, we find that non-local buyers constitute 5.95% of the remaining non-institutional buyers sample, and the majority of them (60%) are identified as mainland Chinese.

We cross-check name-based mainland buyers' identities (i.e., mainland migrants or out-of-town investors) with census statistics. According to the 5-year Hong Kong population census, the number of migrant homeowners from mainland China—defined as mainland-born residents who

[4]Detailed information can be found at www.eprc.com.hk.

[5]Although the EPRC data is available from 1992 onward, we do not use the data before 2001 because there were few transactions with mainlanders in the early years.

[6]We refer to the official Chinese romanization schemes published by government agencies in Hong Kong, mainland China, and Taiwan. For example, the Chinese character "曾" is spelled as "Zeng," "Tsang," and "Tseng" in mainland China, Hong Kong, and Taiwan, respectively. A full list of the spelling used in our classification is available upon request.

relocated to Hong Kong in the past 5 years and purchased housing—is about 6,600 from 2002 to 2006, 12,100 from 2007 to 2011, and 13,500 from 2012 to 2016. Our transaction data show that the number of first-time mainland buyers in the corresponding periods is 6,577, 16,494, and 15,840, respectively. This suggests that at least 83% of our identified first-time mainland buyers in Hong Kong are mainland migrants rather than out-of-town investors.

We apply the following criteria to construct the main sample. First, we only include resale transactions, since resale prices are negotiable between buyers and sellers. We exclude new sales from our main sample because new residential properties in Hong Kong are mainly sold through presales, whose prices are affected by unobserved selling strategies of developers (Li and Chau, 2019).[7] Second, we exclude non-arm's length contracts (e.g., deeds of gifts or name changes) and contracts that are not fully settled. Third, we exclude village houses in Hong Kong, which are likely subject to resale restriction policies.[8] Fourth, since we aim to study the effects of mainland buyers, we only include transactions by local and mainland buyers.[9] Given that a small proportion of mainland Chinese and Hong Kongese names are spelled the same, we exclude approximately 0.49% of transactions for which the buyer's origins cannot be identified. Further, transaction records with incomplete information on transaction dates, prices, or floor numbers are excluded. Lastly, we trim data on the top and bottom 1% of transaction prices, housing sizes, and building ages to exclude potential outliers. Our final working sample contains 687,598 transactions from 2001 to 2017, of which 3.67% are purchased by mainland Chinese buyers.[10]

[7]Developers can provide various price discounts for different settlement plans in presales; however, differentiated borrowing constraints between mainland and local buyers restrict the choice set of settlement plans and can lead to substantial differences in new sale transaction prices between the two groups. Unfortunately, there is a lack of data on settlement plans to rule out this impact. In addition, from the transaction records, over 50% of new units are sold within only 1.5 months, and around 80% complete sales within 1 year at the building level. Thus, there is a lack of sufficient variation in constructing a valid Bartik IV using the historical stock of mainland buyers and then estimating the effect of the 1-year-lagged share of mainland buyers on new sale prices.

[8]Appendix Table A1 reports the definitions of the different housing types in Hong Kong and Appendix Table A2 summarizes their distributions across regions.

[9]Including non-local individual buyers other than mainland Chinese does not affect our main findings of price premiums and spillover effects. Results are available upon request.

[10]The possibility of mainland buyers making hidden transactions through companies or local representatives is likely low, because purchases through companies do not bring tax benefits and proxy arrangements can induce large legal risks. The number of home purchases by mainlanders estimated from our name classification method closely matches government statistics, providing further validation for the full coverage of our data and the precision of our method. See: https://www.info.gov.hk/gia/general/202104/28/P2021042700613.htm.

3.2 Descriptive Statistics

Panel A of Table 1 presents summary statistics for the transaction-related variables in our final sample, and Panel B compares purchases made by mainland and local buyers.[11] We find that compared with local buyers, mainland buyers tend to purchase more expensive units in terms of total transaction prices and net unit prices per square foot (sq.ft.). On average, mainland buyers pay HKD 1.30 million more in terms of total price, which corresponds to about HKD 1,700 extra in terms of net unit price. Also, mainland buyers purchase larger and newer units, on higher floors, and with more bedrooms and living rooms than local buyers, consistent with anecdotal reports (Gopalan, 2018). These differences in housing features are statistically significant at the 1% level.

[— Insert Table 1 about here —]

Figure 2 presents the time trends for total transaction prices (in Panel 2a) and net unit prices (in Panel 2b) paid by local and mainland buyers. We find that mainland Chinese buyers consistently pay higher total transaction prices and net unit prices than local buyers. The premiums paid by mainland buyers are relatively low in the early years but increase after 2006.

[— Insert Figure 2 about here —]

Figure 3a presents the temporal comovement between the percentage of mainland buyers and average housing prices. Figure 3b shows the comovement between the percentage of mainland buyers and aggregate transaction numbers. From 2001 to 2010, average housing prices and aggregate transaction numbers generally increased with the rising share of mainland buyers. In 2011, the share of mainland buyers peaked at around 8%. It dropped significantly afterward to as low as 3.1% in 2014, possibly in response to the additional BSD imposed on non-PRs since 2012. Nevertheless, the share of mainland buyers gradually recovered from 2015. While the aggregate transaction numbers in Hong Kong plummeted twice in 2011 and 2013—possibly due to two waves of cooling measures introduced in 2010 and 2012—average housing prices continued to rise.

[— Insert Figure 3 about here —]

[11] Appendix Table A1 presents the definitions of variables.

4 Hypothesis Development and Empirical Design

4.1 Price Premium for Mainland Buyers

We start by quantifying the price premiums paid by mainland buyers relative to locals. Following the hedonic pricing theory (Rosen, 1974), we control for detailed property features and neighborhood characteristics, as well as temporal and location fixed effects at granular levels. We hypothesize that unexplained variations in transaction prices could be associated with buyers' origin, and that mainland buyers pay price premiums compared with locals due to hedging motives, residential sorting, and/or informational barriers, which will be detailed in Hypotheses 3.1–3.3.

Hypothesis 1 (Price Premium) *Mainland buyers pay higher prices than local buyers in the Hong Kong housing market, holding others constant.*

Our baseline regression is specified as below:

$$\log\left(Price_{it}\right) = \alpha_0 + \alpha_1 MB_{it} + X_{it}^{'}\alpha_X + \phi_t + \rho_i + \epsilon_{it}, \tag{1}$$

where $Price_{it}$ represents the pretax transaction price of unit i at date t. MB_{it} is a dummy variable equal to 1 if the transaction is by a mainland buyer. The coefficient α_1 estimates the price difference of mainland buyers compared with local ones. We follow He et al. (2020) and include a comprehensive set of categorical housing characteristic variables X_{it} to control for detailed housing features, such as the number of bedrooms and living rooms, bay-window indicator, bay-window size, net unit size, unit orientation dummies, and floor range dummies.[12] It is possible that after controlling for these observable features, mainland buyers' price premiums could still be affected by unobservable factors. Therefore, we use estate fixed effects, denoted as ρ_i, to further control for unobserved time-fixed property characteristics. ϕ_t denotes year times quarter fixed effects, which

[12]The number of bedrooms and living rooms are encoded as categories, with the missing values in an extra category. The bay-window indicator denotes whether bay-windows are included in the housing price. The bay-window size, net unit size, age of buildings, building completion years, and distances to amenities are encoded as 10 equally sized categories. Floor range dummies are formed by first classifying four building groups: VeryLowRise (on or less than 10 floors), LowRise (11 to 30 floors), MidRise (31 to 60 floors), and HighRise (61 floors or higher), and then encoding the floor groups for every 5 floors within each building group.

captures any time-varying factors at an aggregate level. Standard errors are clustered at district and year level.

4.2 Spillover Effect of Mainland Buyers on Future Transactions

A question commonly posed in the literature is whether a small proportion of homebuyers who paid price premiums (or discounts) can significantly affect the entire housing market in the future (Anenberg and Kung, 2014; Campbell et al., 2011; Harding et al., 2009; Piazzesi and Schneider, 2009). Our valuable institutional setting and rich data enable us to answer this question. Specifically, we investigate the effects of mainland buyers' housing transactions on the prices of subsequent housing transactions in close neighborhoods. Theoretically, Piazzesi and Schneider (2009) propose a search model to demonstrate how a small fraction of optimistic investors can have a large effect by pushing up housing prices without buying a large share of the housing stock. On the empirical side, Bhattacharya et al. (2021) document a strong negative spillover effect of "haunted" houses to their neighborhoods due to a demand-side shock, with prices dropping by as much as 10% for units in the same estate. Lin et al. (2009) and Campbell et al. (2011) find that foreclosures significantly lower subsequent housing prices in local neighborhoods. Along this line, we hypothesize that a larger proportion of mainland homebuyers will have a stronger positive spillover effect on subsequent housing transactions in close neighborhoods. We summarize the hypothesis as below:

Hypothesis 2.1 (Spillover Effect) *A higher share of mainland buyers at time t-1 leads to higher prices of subsequent transactions in the same neighborhood at time t.*

Given the high population density in Hong Kong, we define neighborhoods at building level rather than the broader district level in past studies (Saiz, 2007; Saiz and Wachter, 2011; Gonzalez and Ortega, 2013; Sá, 2015). To test Hypothesis 2.1, we specify the regression below:

$$\log(Price_{it}) = \beta_0 + \beta_1 ShareMB_{b,t-1} + X_{it}'\beta_X + \phi_t + \rho_i + \epsilon_{it}, \tag{2}$$

where $ShareMB_{b,t-1}$ indicates the share of mainland buyers in building b (the same building as unit i) in the 1-year period preceding transaction date t. We also use the total number of mainland buyers in building b during the period $t-1$ (denoted as $NumMB_{b,t-1}$) as an alternative measure. Other variables share the same definitions as in Equation (1). Standard errors are clustered at district and year level. The coefficient β_1 captures the effect of mainland buyers on subsequent housing transaction prices in the same building.

However, the OLS estimate of β_1 is likely biased, since the presence of mainland buyers in each building can be endogenous. For instance, the unobserved location preference may be simultaneously correlated with the presence of mainland buyers and housing prices. To address this concern, we use the Bartik IV estimation approach and generate a shift-share prediction of the number/share of mainland buyers in each building as an IV for the actual number/share of mainland buyers (Sá, 2015; Saiz and Wachter, 2011). Specifically, we use transactions from the start of sample period (year 2001) to year $t-2$ to calculate historical shares of mainlanders in each building and allocate mainland buyers in year $t-1$ to buildings, based on historical shares. $MBStock_{b,t-n,t-2}$ denotes the *cumulative* number (i.e., the stock) of mainland buyers in building b from 2001 to year $t-2$. $MBStock_{t-n,t-2}$ is the total stock of mainland buyers in Hong Kong from 2001 to year $t-2$. $MBFlow_{t-1}$ is the total number (i.e., the flow) of mainland buyers in Hong Kong in year $t-1$. The predicted number of mainland buyers in building b in the previous year ($PredictNumMB_{b,t-1}$) is calculated as:

$$PredictNumMB_{b,t-1} = \frac{MBStock_{b,t-n,t-2}}{MBStock_{t-n,t-2}} \times MBFlow_{t-1}. \tag{3}$$

$PredictNumMB_{b,t-1}$ is used as the IV for $NumMB_{b,t-1}$. We then divide $PredictNumMB_{b,t-1}$ by the total number of buyers in building b in year $t-1$ to obtain the predicted share of mainland buyers ($PredictShareMB_{b,t-1}$), and use $PredictShareMB_{b,t-1}$ as the IV for $ShareMB_{b,t-1}$. To ensure sufficiently long sample periods to calculate cumulative historical shares, we sidestep the years before 2011 and construct the IV estimation sample from 2011 to 2017. The first-stage IV estimation is

from the following Equation (4):

$$ShareMB_{b,t-1} = \kappa_0 + \kappa_1 PredictShareMB_{b,t-1} + X_{it}^{'}\kappa_X + \phi_t + \rho_i + \epsilon_{it}. \quad (4)$$

The Bartik shift-share prediction is a valid IV as it satisfies the assumptions of relevance, exogeneity, and exclusion restrictions. First, the IV is relevant because the prediction based on historical shares closely correlates with the actual shares of mainland buyers. Newly arrived mainland buyers are more likely to purchase in places where earlier migrants reside due to residential sorting (Saiz, 2007). In addition, we control for estate-level fixed effects, which capture the unobserved *time-invariant* preferences at a granular level. Furthermore, the predicted share—based on the historical one—is hypothetically constructed and unlikely to correlate with the unobserved *time-variant* preferences (Bartik, 1991). We also conduct robustness checks by using either historical records of inexperienced first-time buyers or fixing historical shares in the earliest year available. By doing so, we validate that our IV satisfies exogeneity and exclusion restriction assumptions.

To further validate that the estimated impact arises from the demand variations of mainland buyers rather than unobserved property heterogeneity, we exploit the BSD policy shock in October 2012 as a quasi-natural experiment. With no pre-announcement before the effective date,[13] the BSD imposed an extra 15% stamp duty for non-PR homebuyers, which substantially increased their transaction costs. The housing demand of mainland buyers is thus expected to be suppressed, and thus neighborhoods that previously attracted more demand from mainland buyers would experience larger reductions in housing prices after the exogenous policy shock. Accordingly, we propose the following hypothesis:

Hypothesis 2.2 (Quasi-natural Experiment with Demand-side Shock) *Neighborhoods with higher shares of mainland buyers at time* $t-1$ *have larger price reductions at time t under the BSD policy shock.*

We revise Equation (2) by introducing the BSD policy shock and apply the same IV strategy

[13]The BSD policy was announced by the Hong Kong government on the night before its effective date, which surprised the market. See: www.info.gov.hk/gia/general/201210/26/P201210260697.htm.

as discussed above:

$$\ln(Price_{it}) = \gamma_0 + \gamma_1 ShareMB_{b,t-1} + \gamma_2 BSD_t + \gamma_3 ShareMB_{b,t-1} \times BSD_t + X_{it}^{'}\gamma_X + \rho_i + \epsilon_{it}. \quad (5)$$

The dummy variable BSD_t equals 1 if the property is transacted after implementation of the BSD policy, and 0 otherwise. Definitions of other variables are the same as in Equation (2). The coefficient of the interaction term (γ_3) is of most interest, as it estimates the differential impact of the BSD policy on housing prices in neighborhoods with high ex ante mainland buyers' demand. We estimate the model using the sample of transactions within the 1-year and 2-year window around the BSD initiation date, respectively.

4.3 Mechanisms of Mainland Buyers' Price Premiums

Next we examine several potential mechanisms that underlie mainland buyers' price premiums. Previous literature mainly focuses on a single factor that affects price premiums in migrant buyers' housing purchases (Goetzmann et al., 2021). Common channels include the safe-haven effect (Badarinza and Ramadorai, 2018); wealth effect (Cvijanović and Spaenjers, 2021); residential sorting (Andersen, 2010); and information barriers (Ling et al., 2018). However, little work has been done to compare multiple channels. Moreover, understanding the mechanisms of mainland buyers' price premiums is crucial for policymakers seeking effective policy designs and for market participants in making rational decisions. Taking advantage of our rich data set, we aim to bridge this gap. Specifically, we standardize and compare multiple concurrent mechanisms to explain the price premiums for mainland buyers.

We start by examining the hedging motives of mainland buyers. By definition, hedging implies that investors aim to limit their risk exposure to one asset by retaining or increasing investment in other assets that are negatively correlated (or uncorrelated) on average. It is related to but different from the safe-haven effect, which refers to investments in assets that are only negatively correlated (or uncorrelated) during crisis periods (Baur and McDermott, 2010). Existing studies

mainly examine hedging behaviors or the safe-haven effect with respect to classical financial assets classes such as gold or securities (Baur and McDermott, 2010; Klingler and Lando, 2018; Ranaldo and Söderlind, 2010). Few studies have investigated hedging with real estate (Badarinza and Ramadorai, 2018).

Residential real estate in Hong Kong provides an attractive hedge against currency and economic risks in China-based assets. Since the HKD is pegged to the USD—commonly believed to be a safe currency—having HKD-denominated assets offers mainland buyers a hedging opportunity against currency risk for the CNY with exposure to the USD. Also, the Hong Kong housing market has generally followed a stable uptrend performance in past decades. Further, mainlanders prefer to keep their wealth close to home (Yoon, 2021). For these reasons, the Hong Kong housing market is expected to be an attractive destination for hedging-motivated home purchases in the context of the China shock (Gorback and Keys, 2020; Li et al., 2020; Pavlov and Somerville, 2020). Moreover, due to close socioeconomic and geographic connections between mainland China and Hong Kong, hedging motives may exist not only among mainland-based investors but also migrant buyers who live in Hong Kong. Recent migrants likely keep significant proportions of their household wealth in mainland China even after immigration.[14] We use the HKD/CNY exchange rate as a main measure of the hedging channel (Francis et al., 2008) and supplement it with the China Economic Policy Uncertainty (CEPU) Index (Baker et al., 2016; Huang and Luk, 2020). The hypothesis is summarized as follows:

Hypothesis 3.1 (Hedging Effect) *When the CNY is weaker against the HKD (or economic policy uncertainty in mainland China is higher) at time t-1, mainland buyers pay larger price premiums than locals at time t.*

Next, we investigate the mechanism of residential sorting, which posits that migrant buyers

[14]Important methods for mainland Chinese to immigrate to Hong Kong in the past decade include investment, education, employment, or talent acquisition (HKID, 2020). Migrants through the Capital Investment Scheme are mainly entrepreneurs, with their core businesses still present in mainland China. Migrants through education (Immigration Arrangements for Non-local Graduates) and employment/talent admission (Quality Migrant Admission Scheme or Admission Scheme for Mainland Talents and Professionals) are also unlikely to relocate all of their household assets to Hong Kong right after immigration, because their extended family members (e.g., parents) cannot migrate to Hong Kong with them in the short term due to immigration restrictions.

tend to have higher demand for properties in neighborhoods with a similar cultural background (Borjas, 2002; Card et al., 2008; Li et al., 2020). Housing theories indicate that migrants form ethnic housing enclaves, which help them to find an ethnic social network that supports them in the new country/region (Andersen, 2010). Empirically, migrants agglomerate in neighborhoods with a similar cultural background and pay price premiums for better social interactions in those neighborhoods (Fischer, 2012; Li, 2014). In the Hong Kong context, we use the lagged share of mainland buyers in a building in the previous year as the proxy measure for residential sorting at the neighborhood level. We formulate the hypothesis as follows:

Hypothesis 3.2 (Residential Sorting) *Mainland buyers pay larger price premiums at time t for homes in neighborhoods with more preceding mainland buyers at time t-1.*

Third, theories on information barriers suggest that mainland buyers have less local market information (Ling et al., 2018); higher searching costs (Lambson et al., 2004); and weaker local networks (Tu et al., 2017) than local buyers. As a consequence, they face greater frictions to reach optimal market prices. Empirical studies show that this kind of information barriers exist not only for out-of-town investors but also for migrant buyers. Recently arrived migrants in the host countries/regions tend to prefer agents and sellers with a similar cultural background due to language barriers (White and Hurdley, 2003) and pay positive price premiums in ethnicity-matching transactions (Agarwal et al., 2019). Also, migrant buyers may display irrational behavioral biases by anchoring to housing conditions in their home markets (Lambson et al., 2004) or have insufficient firsthand experience in observing local market conditions (Ihlanfeldt and Mayock, 2012). It is documented that it takes approximately one decade for migrants to fully overcome information barriers and equalize their price payments with locals (Fan et al., 2021). In the Hong Kong context, we use mainland buyers' prior transaction times in the local housing market as the measure of their market information barriers. Because of the complete records of property transactions over 17 years that include the names of buyers and sellers, we can identify multiple transactions conducted by an individual. The hypothesis is formulated below:

Hypothesis 3.3 (Information Barrier) *Mainland buyers with more prior transaction experiences in the Hong Kong housing market by time t-1 pay lower housing price premiums at time t.*

Putting Hypotheses 3.1–3.3 into a horse-racing framework to compare the impacts on mainland buyers' price premiums from each channel, we specify the following equation:

$$log(Price)_{it} = \delta_0 + MB_{it} \times Factor_{it}^{'}\delta_1 + \delta_2 MB_{it} + X_{it}^{'}\delta_X + \phi_t + \rho_i + \epsilon_{it}, \tag{6}$$

where $Factor_{it}$ is a set of standardized variables that measure the channels discussed above. We interact $Factor_{it}$ with the dummy of mainland buyers, MB_{it}, to capture the impact of each channel on housing price premiums for mainland buyers.[15] δ_1 is the interested vector of estimates. Other variables are the same as in Equation (1). We cluster standard errors by district and year.

5 Empirical Results

5.1 Price Premium for Mainland Buyers

Table 2 presents OLS estimates of mainland buyers' price premiums from Equation (1). Column (1) shows the results with controls for property physical features, estate fixed effects, and year-quarter fixed effects. Column (2) presents results using alternative estate times year-quarter fixed effects. In Column (3), we relax the estate fixed effects with district fixed effects but control for observed building-level features, such as building age, building completion years, swimming pool indicator, club house indicator, and distance to a train station (MTR), bus stop, hospital, school, university, and coastline. We find consistent patterns across all three models in which, on average, mainland homebuyers pay 1.4–2.0% higher prices than local buyers, holding others constant. All of the estimated price premiums are statistically significant at the 1% level. We consider Column (1) to be our baseline result, because some time-series measures (e.g., lagged

[15]Most of the channel measures are time-series indices. We therefore omit the term of $Factor_{it}$, as we have controlled for year and quarter fixed effects. All of these results are robust if we include $Factor_{it}$ in the model but omit the time fixed effects instead. Results are available upon request.

shares of mainland buyers) in our subsequent analyses may be absorbed by the estate times year-quarter fixed effects in Column (2), and the building-level controls in Column (3) are less effective in capturing unobserved features than using estate fixed effects.

[— Insert Table 2 about here —]

We further explore the heterogeneity in mainland buyers' price premiums and find that the premiums are larger in more central areas, for larger units, and during periods with more mainland buyers in the market, consistent with anecdotal evidence.[16] Panels A to C of Table 3 display the findings, respectively. On Hong Kong Island, where the city's central business district is located, mainland buyers pay 1.55% higher prices than local buyers. In the New Territories, which is a relatively suburban region of the city, mainland buyers only pay 1.07% higher prices than local buyers (Panel A). For large luxury units (> 80 sq.m.), we find that mainland buyers pay 3.52% more than local buyers. For ordinary units (40–80 sq.m.), the price premium is only 1.53%. Both the estimates and their difference are statistically significant at the 1% level. The price premium for mini units (< 40 sq.m.), however, is statistically insignificant (Panel B). Panel C shows that mainland buyers evidently pay higher prices than locals by 1.96% from 2007 to 2012, when the percentage of mainland buyers in the market is higher. Nevertheless, statistically insignificant and smaller price premiums are shown in the periods 2001-2006 and 2013-2017, respectively.

[— Insert Table 3 about here —]

Figure 4 plots the percentage of mainland buyers and their price premiums by year. Overall, the magnitudes of price premiums are positively correlated with the percentages of mainland buyers over time. In particular, mainland buyers' price premiums estimated by year are positive and

[16] Anecdotal reports show that mainland buyers prefer large units and central locations (Gopalan, 2018). Indeed, we find that the percentage of mainland buyers is higher on Hong Kong Island (4.16%) and in Kowloon (4.25%) than in the New Territories (3.25%). The first two regions are considered to be more central and thus have higher housing prices, whereas the New Territories is the peripheral region of the city. Regarding heterogeneity across unit sizes, we follow the industry standard and classify units into three size categories: mini units less than 40 sq.m. (430 sq.ft.), luxury units larger than 80 sq.m. (831 sq.ft.), and ordinary units whose sizes range between the first two categories. In our sample, the share of mainland buyers is 3% in mini units, 3.7% in ordinary units, and 6.3% in luxury units (Appendix Table A3), which confirms that mainland buyers prefer larger units.

statistically significant at the 5% level from 2007 to 2017. Price premiums generally increase from the start of the sample in 2001 until reaching a peak in 2010 and are highly correlated with the percentages of mainland buyers. After the government introduced the BSD in 2012, which targets non-PR buyers, both the magnitudes of price premiums and shares of mainland buyers reduced sharply till 2014, after which the trends started to revert.

[— Insert Figure 4 about here —]

5.2 Spillover Effect of Mainland Buyers on Future Transactions

5.2.1 Baseline Estimates

Panel A of Table 4 presents IV estimation results for Equation (2), as well as the corresponding OLS estimates. Columns (1)-(3) report results using the share of mainland buyers at building level in the previous year as the explanatory variable. Specifically, Column (1) reports first-stage IV estimation results, while Columns (2) and (3) report OLS and second-stage IV estimation results, respectively. Columns (4)-(6) replicate Columns (1)-(3) but use the number of mainland buyers at building level in the previous year as an alternative explanatory variable.

[— Insert Table 4 about here —]

We find strong first-stage results that validate our IV strategy. The predicted share/number of mainland buyers based on historical settlement patterns is highly correlated with the actual share/number of mainland buyers. Column (1) shows that if the predicted share of mainland buyers increases by 1 percentage point, the actual share will increase by 0.48 percentage points. Column (4) reveals that one more predicted mainland buyer is associated with a larger number of actual mainland buyers by 0.577. Both estimates are statistically significant at the 1% level. F-statistics are as large as 928.88 and 91.45, respectively, which eliminates the concern regarding weak instruments (Stock and Yogo, 2005).

The strong first-stage results enable us to proceed to second-stage IV estimations. Our second-stage IV estimate shows that a 1-percentage-point increase in the lagged share of mainland buyers

results in higher housing prices in the subsequent year by 0.19% (Column (3)). The estimate is statistically significant at the 1% level. Since the average transaction price in Hong Kong between 2011 and 2017 is HKD 4.78 million, this translates to an increase of HKD 9,082 (USD 1,158) per transaction. Compared with the IV estimate, the OLS estimate in Column (2) is biased downward, possibly driven by latent factors that affect both mainland buyers' home purchases and future home prices. For instance, some local market shocks—such as foreclosures and haunted houses—lower future housing prices in the neighborhoods (Bhattacharya et al., 2021; Campbell et al., 2011), while properties in those neighborhoods are more likely to be sold to less informed mainland buyers than locals.

Similar patterns are observed when using the lagged number of mainland buyers as an alternative explanatory variable. Columns (5) and (6) report the corresponding OLS and IV estimates, respectively. The IV estimate indicates that 1 additional mainland buyer in a building leads to significantly higher transaction prices by 2.56% in the same building in the next year, which is equivalent to a price increase of HKD 122,368 (USD 15,598) per transaction.[17]

To test the spillover effect of mainland buyers' housing purchases on subsequent housing purchases by local buyers, we further replicate the results in Panel A by focusing on the home purchases of locals only. Results are reported in Panel B of Table 4. The IV estimation results indicate that local buyers pay 0.18% higher prices in a building with a 1-percentage-point increase in the share of mainland buyers in the previous year (Column (3)). An additional mainland buyer in a building results in 2.50% higher prices paid by local homebuyers in the next year (Column (6)). Therefore, our results indicate that an influx of mainland buyers increases the future prices of housing transactions by local buyers in close neighborhoods.

Our findings survive a battery of robustness checks, including using the subsample of buildings with nonzero lagged mainland buyers (i.e., $NumMB_{b,t-1}>0$), recalculating the Bartik IV based on the shift-shares of first-time mainland homebuyers in each building, and constructing the Bartik IV based on fixed historical shares of mainland buyers in the base year (2010) before our sample

[17]Between 2011 and 2017, the average number of buyers in a building in a year is 12, so one mainland buyer in a building translates to an increase in the share of mainland buyers by around 1/12 = 8.3 percentage points.

period in the spillover analysis. Details are presented in Appendix B.

5.2.2 Validation with the BSD Policy Shock

To further validate that mainland buyers' spillover effect on future transactions is driven by their demand rather than unobserved property/neighborhood features, we exploit the October 2012 BSD policy shock discussed in Section 2 as a quasi-natural experiment. Following Equation (5), we interact the post-BSD dummy variable (BSD_t) with the lagged share of mainland buyers and apply IV estimation, as discussed in Section 4.2. Table 5 replicates Table 4, though with the first-stage results presented in Appendix Table A4. Using the transactions within a 1-year window around the effective date of the BSD, we find that the interaction term between $ShareMB_{b,t-1}$ and BSD_t is negative and statistically significant at the 1% level (Columns (1) and (2)). This indicates that buildings that previously attracted more mainland buyers have larger price decreases after the BSD, because the BSD has suppressed the demand of mainland buyers.[18] Our results remain robust if we use $NumMB_{b,t-1}$ as an alternative explanatory variable (Columns (3) and (4)) or use the transactions within a 2-year window around the effective date of the BSD (Appendix Table A6).

[— Insert Table 5 about here —]

In summary, we show that mainland buyers generate upward price momentum in the Hong Kong housing market due to the demand effect. Although mainland buyers account for only 3.7% of the entire buyer population and their own price premiums are less than 2% on average, there is a persistent spillover effect of their price premiums on subsequent transactions in the market.

6 Mechanism Analysis of Mainland Buyers' Price Premiums

In this section, we investigate three channels to explain the price premiums paid by mainland buyers: hedging motives, residential sorting, and information barriers. We then conduct a horse-

[18] An assumption behind the interpretation is that the purchase preferences of mainland buyers are not affected by introduction of the BSD policy. We conduct a balance test to compare the housing features of transactions made by mainland buyers in the [-1 year, 1 year] window around the BSD policy and find that the majority are not significantly different before and after the shock. Results are presented in Appendix Table A5.

racing test to compare contributions from the three channels.

6.1 Hedging Effect

As discussed in Section 4.3, we use the HKD/CNY exchange rate as our main measure of mainland buyers' hedging motive, following Francis et al. (2008). We expect the demand of mainland home-buyers to be higher—and thus their price premiums larger—when hedging motives are stronger (i.e., when the CNY depreciates against the HKD). We focus on the period from 2010 onward, as China introduced a wider floating currency policy thereafter.[19] Figure 5a plots the percentage of mainland buyers versus the HKD/CNY exchange rate over time. We find a positive correlation between the percentage of mainland buyers and the 1-month-lagged HKD/CNY exchange rate from 2010 to 2017, which indicates that the demand of mainland buyers is higher when the CNY is weaker than the HKD.

[— Insert Figure 5 about here —]

We estimate the effect of the lagged HKD/CNY exchange rate on the housing price premiums paid by mainland buyers based on Equation (6). As a benchmark for comparison, we first estimate the average price premium for mainland buyers in the sample period between 2010 and 2017 by including MB_{it} as the only explanatory variable. Results are reported in Column (1) of Panel A, Table 6. Mainland buyers pay price premiums of 2.5% on average, and the estimate is statistically significant at the 1% level. Column (2) presents the impact of exchange rate variation on mainland buyers' price premiums. With a 1-standard-deviation increase in the HKD/CNY exchange rate (around 326 basis points), mainland buyers' price premiums increase by 0.63 percentage point. The estimate is statistically significant at the 5% level.

[— Insert Table 6 about here —]

[19] Since 2006, the CNY exchange rate has been allowed to float in a narrow margin around a fixed base rate determined with reference to a basket of world currencies. On June 19, 2010, China further claimed that it would "proceed further with reform of the CNY exchange rate regime and increase the CNY exchange rate flexibility" (Xinhua Net, 2010).

Similar findings are presented using the CEPU index as an alternative measure of hedging motives (Baker et al., 2016; Huang and Luk, 2020).[20] The correlation between the percentage of mainland buyers in Hong Kong and the 1-month-lagged CEPU is positive (Figure 5b), consistent with the rationale that the demand of mainland buyers increases with more uncertainty in China's economic policy. We find that mainland buyers' price premiums increase with higher hedging motives, using the CEPU index as the alternative measure (Columns (3) and (4)). All estimates are statistically significant at conventional levels.

We further check the robustness of the hedging channel by controlling for additional institutional factors that may concurrently affect the price premiums for mainland buyers. First, we use the 1-month-lagged M2 growth rate in mainland China as a proxy for monetary supply (You and Solomon, 2015). Second, we use the 1-month-lagged mortgage lending rate difference between mainland China and Hong Kong to measure the difference in financing cost (Bhutta and Keys, 2016). Third, we use two dummy variables to denote the periods when the HPR was implemented nation wide in mainland China and when the HPR was implemented only in the four first-tier Chinese cities (Deng et al., 2021; Sun et al., 2017).[21] Results are reported in Column (5), and we find that the hedging channel remains strong and statistically significant.

In summary, we provide evidence that the hedging motives against currency depreciation and domestic economic uncertainty in mainland China increase the demand of mainland buyers in the

[20]The Economic Policy Uncertainty (EPU) index was initially introduced by Baker et al. (2016). It extracts information on regional economic policy uncertainty from newspapers by counting the frequency of related keywords in English. We use the EPU index specific to mainland China, which was constructed by Huang and Luk (2020) using the same methodology as Baker et al. (2016), but using local Chinese newspapers from mainland China.

[21]In April 2010, Beijing was the first city in mainland China to forbid home sales to any unqualified non-hukou residents, qualified non-hukou residents holding one or more units, and hukou residents holding more than two units (Sun et al., 2017). By October 2010, most of the first- and second- tier cities in mainland China had implemented HPR policies, although the strictness of the policies varied. As the market gradually cooled down, Hohhot was the first to abolish HPR policies in June 2014. Most of the other cities followed, and only the four first-tier cities (Beijing, Shanghai, Guangzhou, Shenzhen) retained their HPR policies by October 2014 (Reuters, 2014). From March 2017 onward, major cities in mainland China started to implement HPR policies again to cool overheated housing markets (Xinhua Net, 2017). We only control for the housing purchase restriction in mainland China, because the Hong Kong government mainly uses differential stamp duty policies to cool the overheated housing market and has no direct HPR polices for mainland Chinese buyers in the Hong Kong private housing market. HPR polices on mainland buyers are only applicable to public and government-subsidized housing, which accommodates only a small proportion of the local population. Public housing policies in Hong Kong are mostly stable in our study period and are therefore unlikely to have a significant impact on the time-varying price premiums for mainland buyers.

Hong Kong housing market during the study period. The larger demand further increases the price premiums they pay compared with locals. In other words, the price premiums can partially be viewed as the hedging cost of cross-border housing purchases.

6.2 Discussion

6.2.1 Comparing with the Singapore Housing Market

To understand why residential real estate in Hong Kong satisfies the hedging needs of mainland buyers, we turn to a socio-demographic analogy: Singapore. Unlike the HKD, which is pegged to the USD, the SGD does not provide a natural hedge for deprecation of the CNY against the USD. Also, Singapore, like other global housing markets that recently experienced the China shock (Li et al., 2020; Pavlov and Somerville, 2020), is not entirely comparable to Hong Kong in terms of geographic proximity or familiarity for mainland buyers. Therefore, because of safety and familiarity concerns, we expect stronger hedging motives and larger price premiums from mainland buyers in Hong Kong than in Singapore during the study period.

To test this hypothesis, we repeat our analysis of the hedging channel using a complete record of transactions in Singapore's private housing market.[22] Results are presented in Appendix Table A7. As expected, the price premiums paid by mainland buyers in Singapore (1.3%) are much smaller than those in Hong Kong (2.5%), and their variations associated with hedging motives are much weaker. These results highlight the importance of the Hong Kong housing market as a primary destination for mainland buyers seeking to hedge against their domestic economic uncertainty (Gorback and Keys, 2020).

[22]Housing transaction data for Singapore are constructed by combining transaction records between 2010 and 2017 from the Real Estate Information System (REALIS) with buyers' nationality information from a proprietary data source. Model specification and variable construction largely follow Equation (6). Due to data availability, there is minor deviation from Equation (6) in its control variables, which include net unit size, floor range dummies, purchaser indicator, tenure indicator, postal code fixed effects, and year-quarter fixed effects.

6.2.2 Subsample Analysis using Mainland Buyers' First Home Purchases

In this section, we analyze the hedging motives against the economic risks in home countries/regions for migrant buyers living in the host countries/regions. Past literature mainly examines the safe-haven effect of real estate for out-of-town investors during crisis periods (Badarinza and Ramadorai, 2018), and little attention is paid to the hedging behaviors of migrant buyers residing in the host country/region. Understanding these migrant buyers' hedging motives is especially important and relevant, as a considerable number of wealthy and well-educated mainlanders has migrated to and lived in Hong Kong in recent decades (HKID, 2020). Given the close socioeconomic and geographic connections between mainland China and Hong Kong, mainland migrants may still keep sizable proportions of their household wealth in mainland China and hence have strong incentives to hedge currency and economic risks in their China-based assets.

As over 83% of the first-time mainland buyers in our sample are mainland migrants residing in Hong Kong, according to the Hong Kong population censuses (as discussed in Section 3.1) and anecdotal reports (Lam, 2021), we utilize this unique setting to examine the hedging motives of migrant buyers living in host region/country. Since the HKD is pegged to the USD and mainlanders prefer to keep their wealth conveniently close to home (Yoon, 2021), mainland buyers' first home purchases in Hong Kong can be a combination of consumption good and hedging asset.

To test the hedging motives of the migrant buyers residing in Hong Kong, we re-estimate the baseline analysis using the subsample of first-time home purchases. The specification follows Equation (6), and the result is reported in Panel B of Table 6. Consistently, we observe a strong hedging effect among first-time mainland buyers, supporting the hedging motives for recent migrants living in Hong Kong.

We also provide further anecdotal evidence to corroborate this argument and highlight the importance of these migrant buyers residing in Hong Kong. For instance, during the COVID-19 pandemic when most out-of-town investors cannot travel to physically inspect properties or sign housing purchase contracts in Hong Kong, new Hongkongers—migrants from mainland China who have lived in Hong Kong for over 7 years and recently qualified for permanent residency—

still show strong demand in the housing market, especially for luxury homes (Lam, 2021). It is reported that they account for about 60% of housing transactions in the ultra-luxury housing segment (Li, 2021).

6.2.3 Ruling Out of the Wealth Effect

One potential confounding factor is the total wealth of mainland buyers, as wealthier buyers might bargain less (Cvijanović and Spaenjers, 2021). When the HKD/CNY exchange rate increases, the purchasing power of mainland buyers who hold China-based assets decreases. We expect the bargaining intensity of mainland buyers in their home purchase negotiations would increase due to the wealth effect, and their price premiums would fall. However, we find the opposite result, whereby mainland buyers pay higher price premiums when the CNY depreciates against the HKD, which rules out the wealth effect. Therefore, our empirical results suggest that in the context of the Hong Kong housing market, the hedging motives of mainland buyers dominate the wealth effect. In other words, the true effect of hedging motives can be even larger than our estimates if we consider unobserved changes in bargaining intensity.

6.3 Other Channels and Horse-racing Analysis

6.3.1 Residential Sorting

We also investigate the impact of residential sorting on the price premiums paid by mainland buyers. Mainland buyers are hypothesized to have higher demand for neighborhoods with a more similar cultural background and thus pay larger price premiums for properties in those neighborhoods (Card et al., 2008; Zhang and Zheng, 2015).

As expected, we find that mainland buyers have higher demand for housing units in neighborhoods with more previous buyers from mainland China. The results presented in Appendix C show that a 1-percentage-point increase in the lagged proportion of mainland buyers in a building is associated with a 1.23-percentage-point increase in mainland buyers in the subsequent year. Also, we find that due to the higher demand, mainland Chinese buyers pay larger price premiums

for those neighborhoods with more previous mainland Chinese buyers. A 1-standard-deviation increase in the lagged share of mainland buyers in the same building is associated with a 1.55-percentage-point increase in the price premiums paid by mainland buyers (Column (1) of Table 7). These estimates are statistically significant at the 1% level. In summary, our results validate the residential sorting channel that, at least in part, drives the price disparity.

[— Insert Table 7 about here —]

6.3.2 Information Barrier

Information barriers in the local housing market comprise the third channel hypothesized to explain the price premiums paid by mainland buyers. Information asymmetry is a key characteristic of real estate markets (Goetzmann et al., 2021), and non-local buyers find it more difficult to reach optimal market prices than locals due to a lack of market information and social networks, resulting in price premiums (Lambson et al., 2004; Ling et al., 2018; Tu et al., 2017). Even for migrants who live in the host society, it is challenging—and will take years—for them to overcome the information asymmetries arising from barriers such as language and social segregation (Agarwal et al., 2019; Fan et al., 2021; Li, 2014).

We find supportive evidence for the channel of information barriers faced by mainland buyers in the Hong Kong housing market. The results reported in Column (2) of Table 7 show that, compared with local buyers, first-time buyers from mainland China pay a 2.58% higher price. Mainland buyers with more experiences in the Hong Kong housing market pay lower price premiums, possibly due to an alleviation of the information barriers. Specifically, a 1-standard-deviation increase in mainland buyers' prior transaction times corresponds to a decrease in the price disparity between mainland and local buyers by 0.29 percentage points. These estimates are statistically significant at the 1% level.

6.3.3 Horse-racing Analysis

Lastly, to compare the relative contributions of each channel to the price premiums paid by mainland buyers, we put the standardized measures of every channel into a horse-racing framework, as captured by Equation (6). Column (3) in Table 7 presents the results.[23] All three channels—hedging effect, residential sorting, and information barriers—have the expected signs and are statistically significant at conventional levels. In particular, if the lagged HKD/CNY exchange rate increases by 1 standard deviation (or 326 basis points), the price premium paid by mainland Chinese buyers increases by 1.89 percentage points. This magnitude is the largest among the three channels investigated. Since the average price premium for mainland buyers in the study period is 2.50% (Column (1) in Panel A, Table 6), this translates to a 75.6% increase in the average price premium. Similar findings are observed if we use an alternative measure of the CEPU index. Further, in Column (4), we use the subsample of first-time buyers—among whom mainlanders are most likely migrants—and continue to find a large hedging effect.

7 Conclusion

Using comprehensive housing transaction records from 2001 to 2017 in the Hong Kong housing market, this study investigates the role of mainland Chinese buyers on Hong Kong's housing prices. We find that mainland buyers pay an average price premium of 1.39%—considerably lower than those reported in media reports—though such premiums are higher for homes with larger sizes and in more central locations. Despite their relatively low market share and moderate price premiums, the presence of mainland buyers raises future housing prices in close neighborhoods. To address endogeneity concerns and estimate the causal impact of mainland buyers on future housing prices, we adopt a Bartik IV estimation strategy (Campbell et al., 2011; Saiz and Wachter, 2011; Sá, 2015) and find that a 1-unit increase in the lagged number of mainlanders increases prices by 2.6% for transactions in the same building in the subsequent year. Our results remain robust under the

[23] Other institutional factors such as monetary supply, financing costs, and home purchase restrictions are also controlled for.

quasi-experimental BSD policy shock and survive a battery of robustness checks.

We further explore three channels—the hedging motive, residential sorting, and information barriers—to explain the price premiums paid by mainland buyers. Of these channels, the hedging motive, which positively correlates with currency risk and economic uncertainty in mainland China, has the largest impact. Our findings imply that during the study period, residential real estate in Hong Kong serves as an attractive hedging asset for mainland buyers—including migrant buyers living in Hong Kong—possibly because of the pegged exchange rate between the HKD and the USD and geographic proximity to mainland China.

Our study adds to the growing literature on the China shock to global housing markets, drawing inferences from the primary destination of mainland China's capital outflow, Hong Kong (Gorback and Keys, 2020; Li et al., 2020; Pavlov and Somerville, 2020). Our evidence shows that migrant buyers residing in the host country/region, as opposed to out-of-town investors (Badarinza and Ramadorai, 2018; Cvijanović and Spaenjers, 2021), also display strong hedging motives, which contributes to their price premiums in the Hong Kong housing market. We acknowledge the limitation on identifying exact type of the migrant buyers, and hence call for future studies to clearly distinguish these two types of buyers using quality data and to quantify the contributions of each channel underlying the price premiums.

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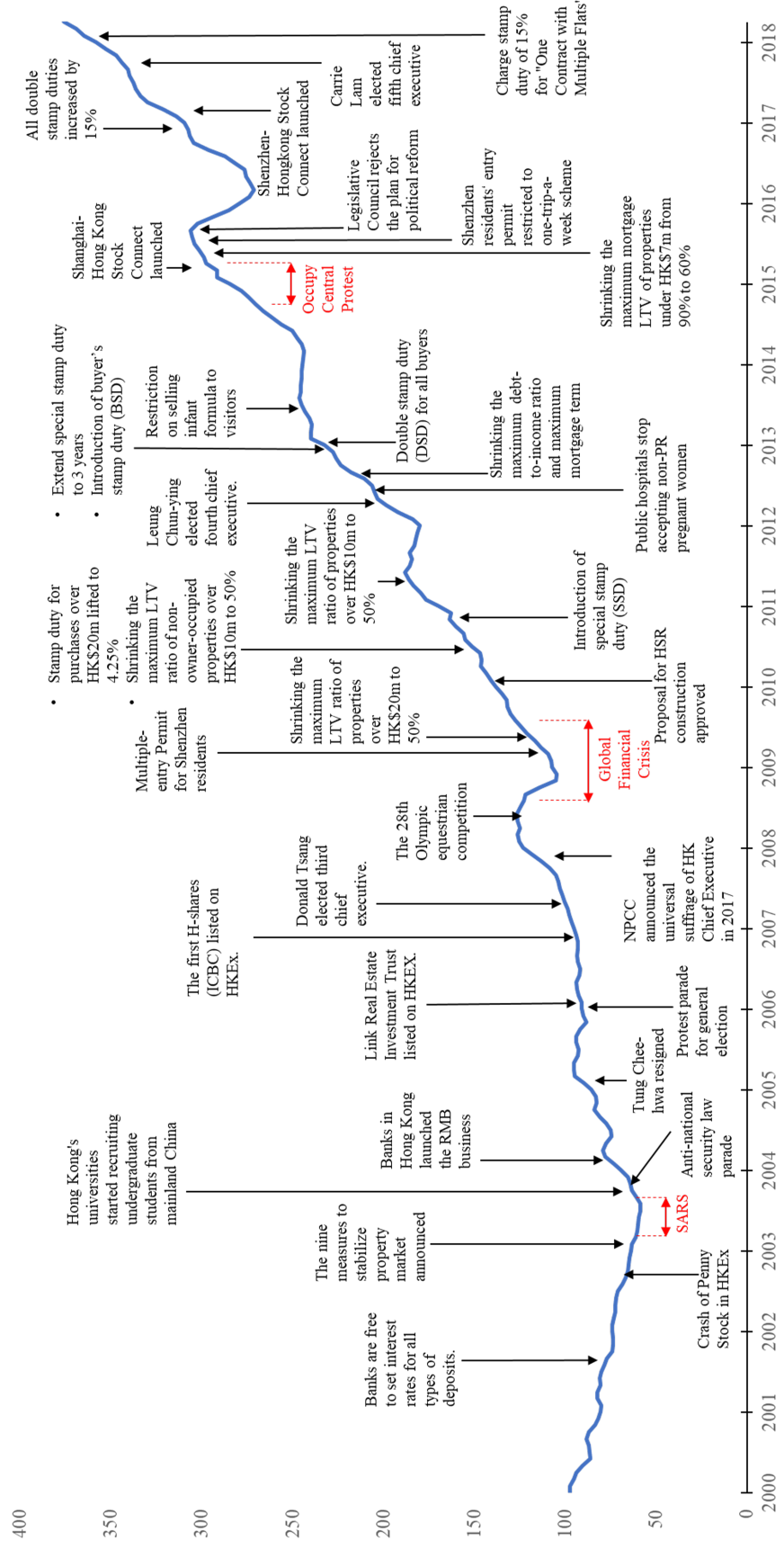
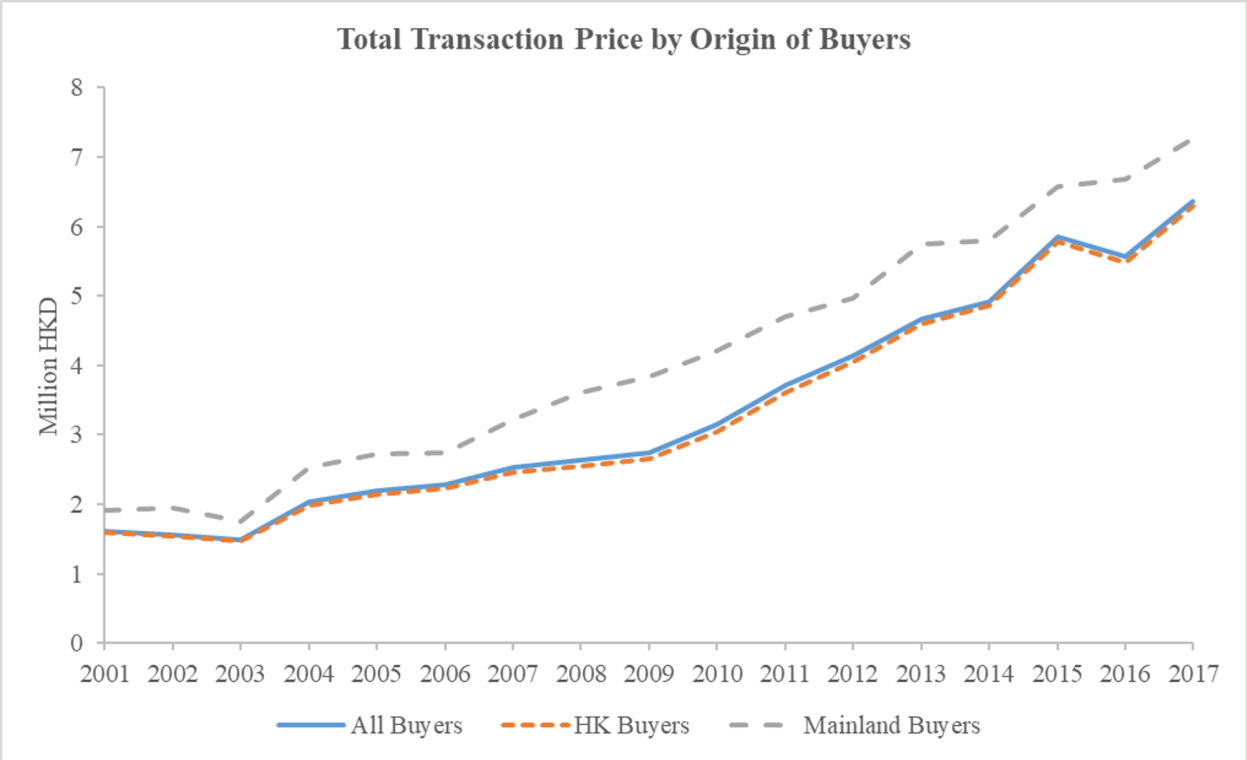
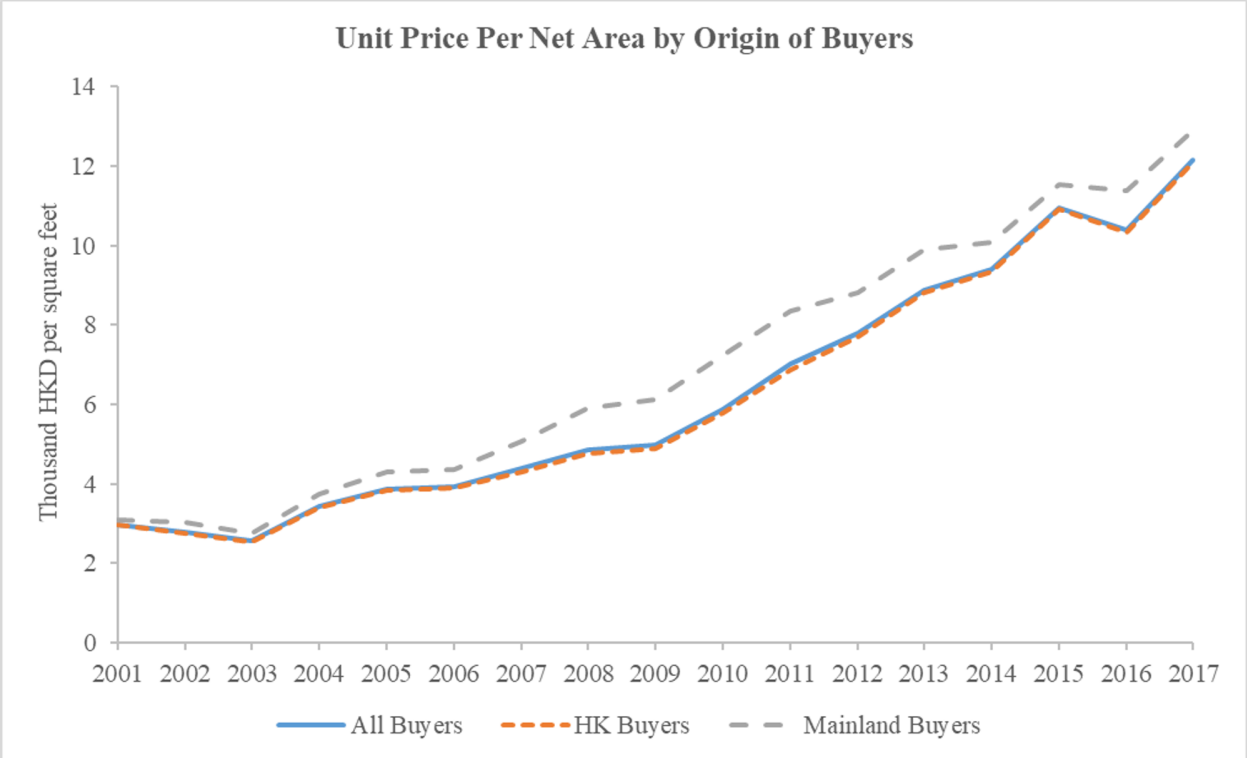


Figure 1: Socioeconomic Events and Housing Price in Hong Kong

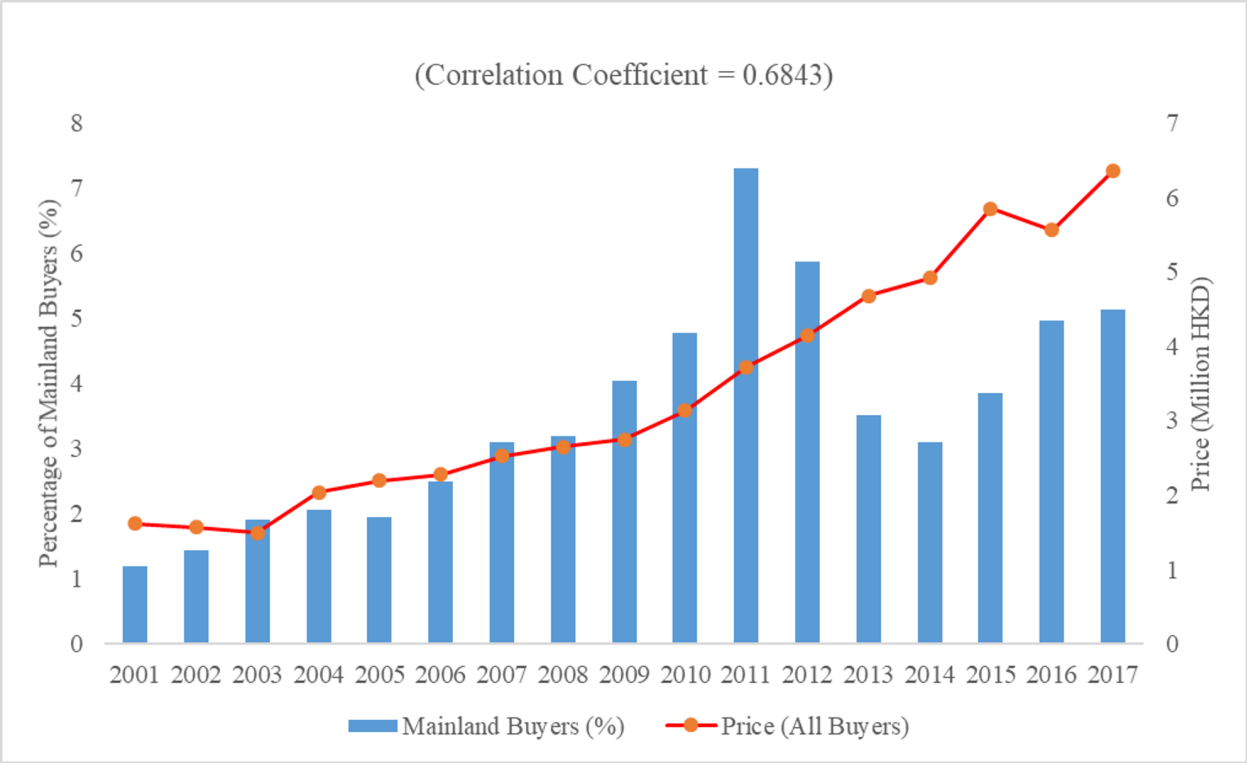


(a) Total Price

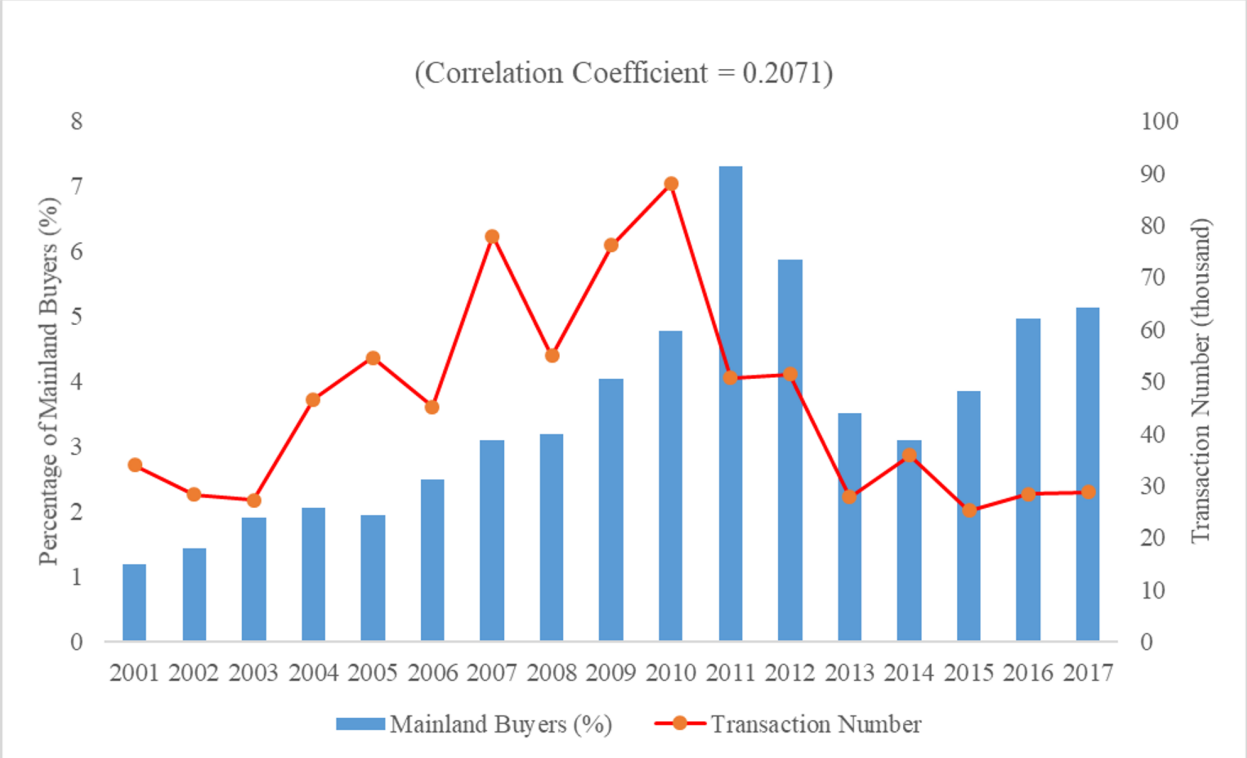


(b) Unit Price Per Square Foot

Figure 2: Housing Price in Hong Kong by Origin of Buyers



(a) Total Price



(b) Transaction Number

Figure 3: Hong Kong Housing Market and Percentage of Mainland Buyers by Year

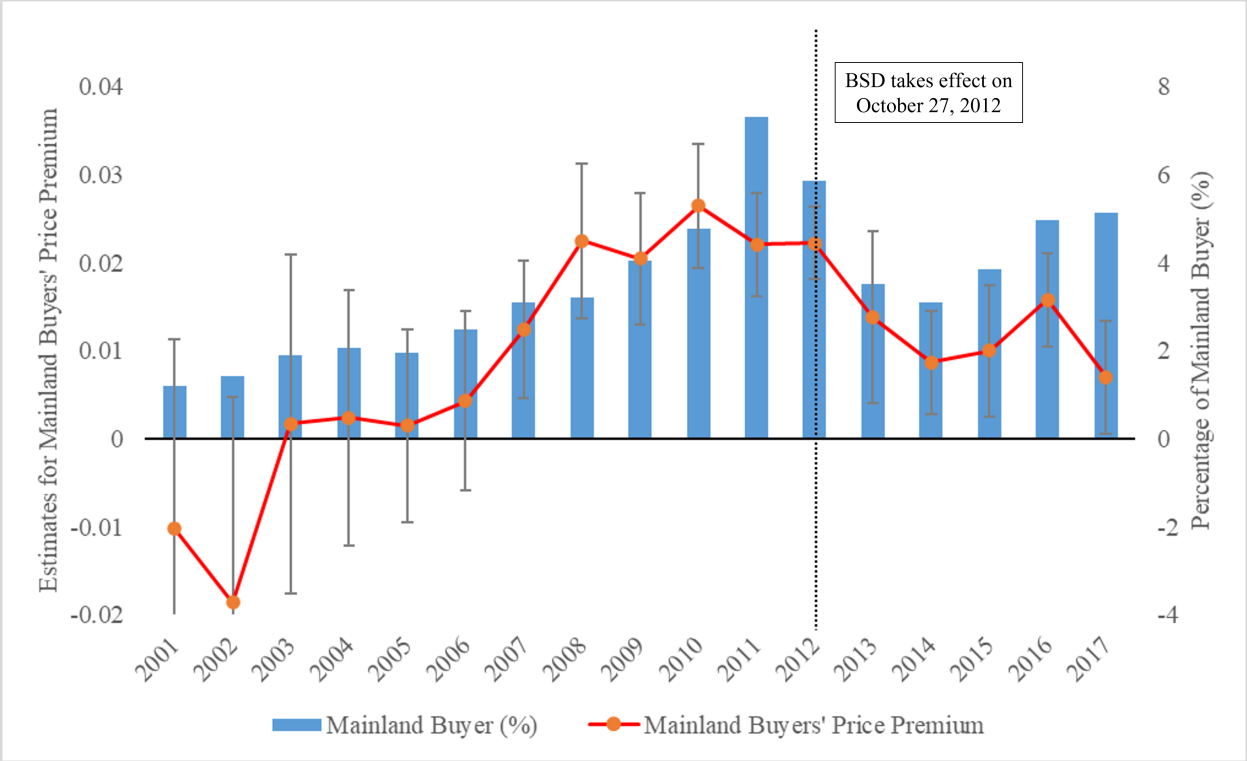
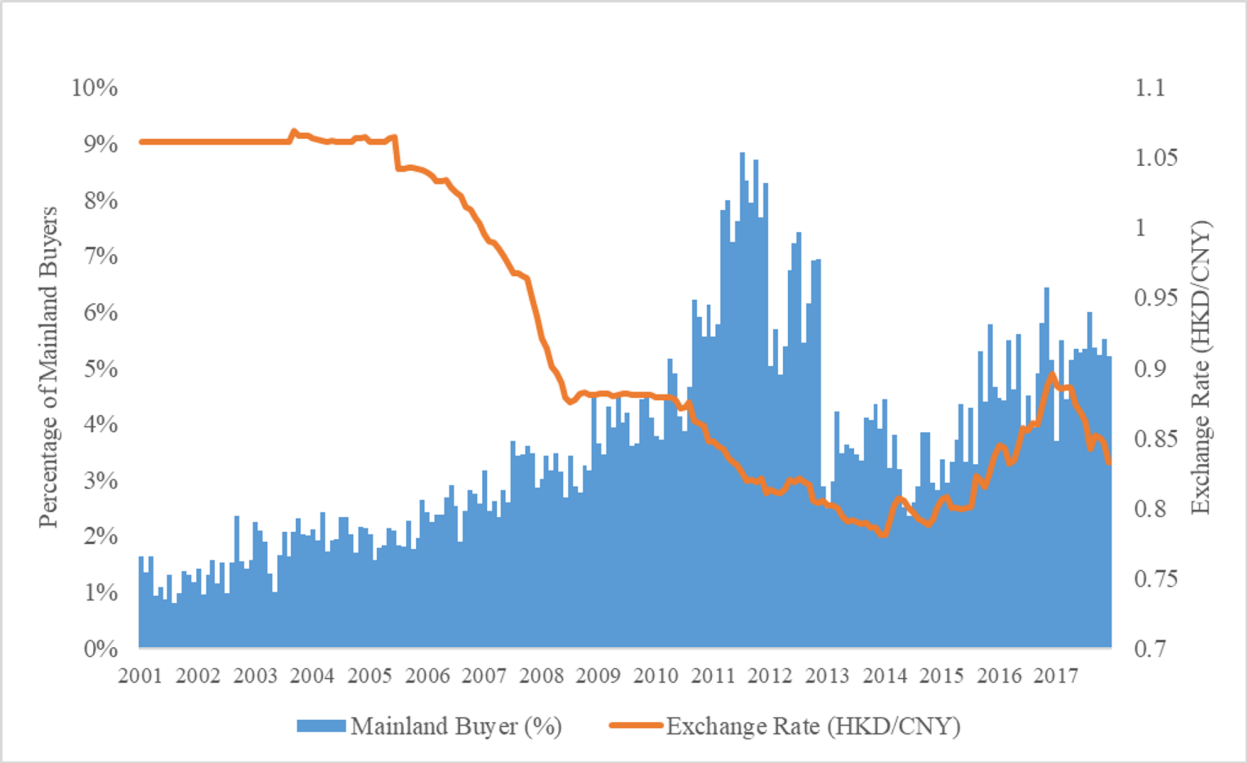
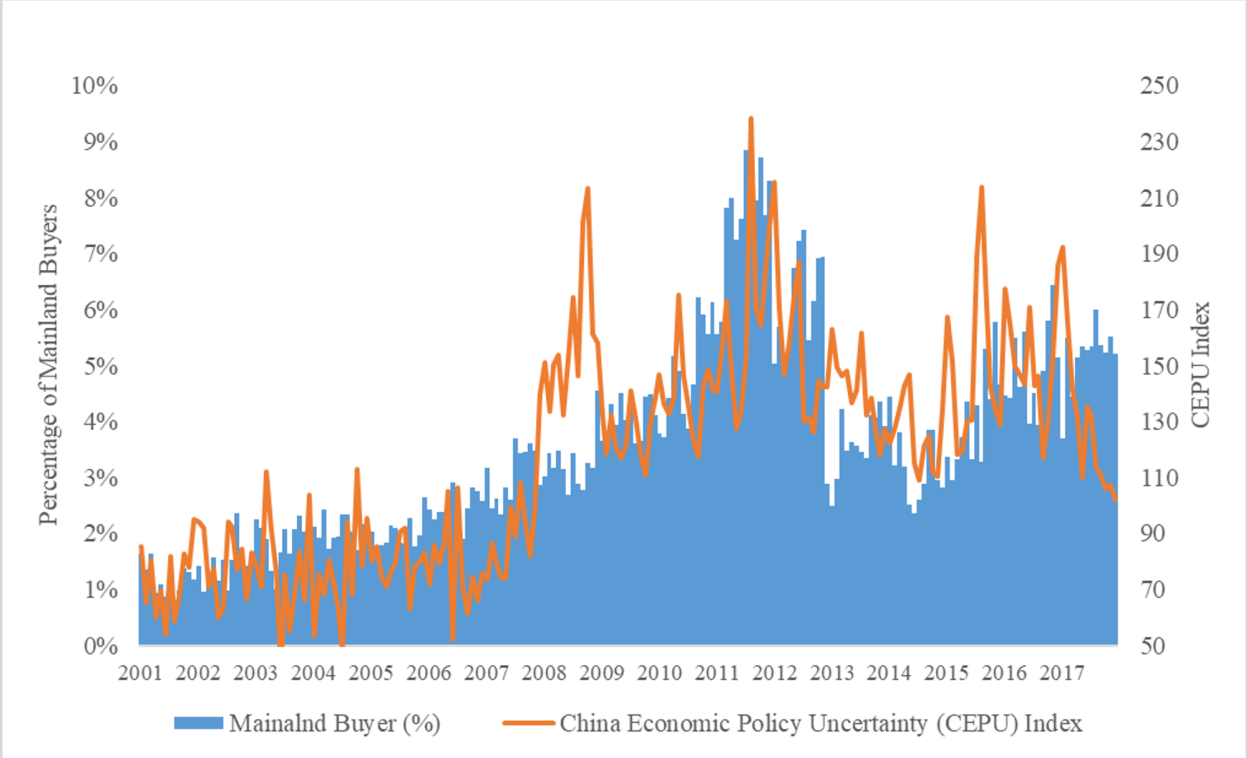


Figure 4: Mainland Buyers' Price Premium in the Hong Kong Housing Market by Year

Note: Standard errors are clustered by district and year. 95% confidence intervals are plotted with error bars.



(a) HKD/CNY Exchange Rate



(b) CEPU Index

Figure 5: Percentage of Mainland Buyers, HKD/CNY Exchange Rate and China Economic Policy Uncertainty (EPU) Index

Table 1: Summary Statistics

Panel A: Full Sample

	(1) N	(2) Mean	(3) Std. Dev.	(4) Min	(5) P(25)	(6) P(50)	(7) P(75)	(8) Max
mainland buyer	687,598	0.037	0.188	0	0	0	0	1
total price (million HKD)	687,598	3.173	2.543	0.539	1.480	2.438	4.000	21.990
unit price (thousand HKD p.s.f)	687,598	5.886	3.409	1.323	3.299	4.980	7.707	20.833
net unit area (hundred sq.ft.)	687,598	5.222	1.867	2.310	3.950	4.880	5.970	15.690
number of bedrooms	621,047	1.927	1.012	0	2	2	3	5
number of living rooms	625,381	1.532	0.777	0	1	2	2	7
floor	687,598	16.518	11.779	0	7	14	23	81
building age	687,598	18.143	10.164	2	10	17	25	47
bay-window size (sq.ft.)	687,598	16.282	16.020	0	0	16	30	250
construction year	687,598	1991	10.073	1956	1985	1991	1999	2015
to train station (km)	687,598	0.704	0.894	0.003	0.217	0.415	0.796	12.504
to bus stop (km)	687,598	0.349	0.337	0.008	0.162	0.284	0.440	7.637
to hospital (km)	687,598	1.602	1.336	0.038	0.747	1.257	2.008	10.589
to school (km)	687,598	0.143	0.201	0.000	0.066	0.104	0.159	2.526
to university (km)	687,598	3.433	2.762	0.024	1.299	2.676	4.894	21.394
to coastline (km)	687,598	1.356	1.587	0.000	0.318	0.754	1.689	8.227

Panel B: Compare Transactions by Mainland and Local Buyers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Local Buyer			Mainland Buyer			t-test	
	N	Mean	Std. Dev.	N	Mean	Std. Dev.	Diff. (2)-(5)	Std. Err.
total price (million HKD)	662,334	3.126	2.486	25,264	4.421	3.508	-1.295***	0.016
unit price (thousand HKD p.s.f)	662,334	5.824	3.368	25,264	7.527	4.020	-1.703***	0.004
net unit area (hundred sq. ft.)	662,334	5.208	1.854	25,264	5.567	2.160	-0.359***	0.012
number of bedrooms	597,317	1.925	1.011	23,730	1.970	1.033	-0.045***	0.007
number of living rooms	601,592	1.530	0.778	23,789	1.579	0.764	-0.049***	0.005
floor	662,334	16.465	11.715	25,264	17.906	13.259	-1.441***	0.076
building age	662,334	18.186	10.133	25,264	17.012	10.889	1.174***	0.065
bay-window size (sq. ft.)	662,334	16.192	16.013	25,264	18.633	16.021	-2.441***	0.103
construction year	662,334	1991	10.018	25,264	1993	11.151	-2.512***	0.065
to train station (km)	662,334	0.705	0.894	25,264	0.670	0.890	0.035***	0.006
to bus stop (km)	662,334	0.349	0.337	25,264	0.352	0.346	-0.003	0.002
to hospital (km)	662,334	1.602	1.331	25,264	1.601	1.454	0.001	0.009
to school (km)	662,334	0.144	0.202	25,264	0.137	0.182	0.007***	0.001
to university (km)	662,334	3.430	2.743	25,264	3.518	3.215	-0.088***	0.018
to coastline (km)	662,334	1.360	1.583	25,264	1.263	1.675	0.097***	0.010

Note: This table presents the summary statistics of our regression sample of resale housing transactions in Hong Kong from 2001 to 2017. Panel A summarizes the full sample of transactions. In Panel B, Columns (1) to (3) summarize transactions by local Hong Kong buyers. Columns (4) to (6) summarize transactions by mainland Chinese buyers. Columns (7) and (8) present t-test results for Columns (2) and (5). *** p<0.01, ** p<0.05, * p<0.1

Table 2: Price Premium for Mainland Buyers in the Hong Kong Housing Market

	(1) $\log(\text{price}_{it})$	(2) $\log(\text{price}_{it})$	(3) $\log(\text{price}_{it})$
MB_{it}	0.0139***	0.0156***	0.0200***
	(0.0015)	(0.0014)	(0.0021)
Property Features	Y	Y	Y
Estate Fixed Effects	Y	N	N
Year*Quarter Fixed Effects	Y	N	N
Estate*Year Quarter Fixed Effects	N	Y	N
Building-level Features	N	N	Y
District*Year Quarter Fixed Effects	N	N	Y
Observations	687,598	687,598	687,598
R-squared	0.957	0.978	0.932

Note: This table presents the estimated housing price premiums paid by mainland Chinese buyers in Hong Kong. The sample period is from 2001 to 2017. The dependent variable $\log(\text{price}_{it})$ is the price of unit i at time t in logarithmic form. MB_i is a dummy variable denoting mainland Chinese buyers. Unreported control variables for property features include number of bedrooms (in categories, with the missing values in an extra category), number of living rooms (in categories, with the missing values in an extra category), bay-window indicator (whether or not included in housing price), bay-window size (in 10 equally sized categories), net unit size (in 10 equally sized categories), direction facing dummies, and floor group dummies (each floor group is formed by first classifying buildings to four groups, which are VeryLowRise (on or less than 10 floors), LowRise (11 to 30 floors), MidRise (31 to 60 floors), and HighRise (61 floors or higher). Second, within each building group, we form floor groups for every 5 floors. For example, group VeryLowRise1 includes units on or below 5 floors in buildings belonging to VeryLowRise category.) Unreported control variables for building-level features include age of building (in 10 equally sized categories), building completion year (in 10 equally sized categories), swimming pool indicator, club house indicator, and distance to train station (MTR)/bus stop/hospital/school/university/coastline (each in 10 equally sized categories). In Column (1), we include controls for property features, estate fixed effects, and year-quarter fixed effects. Private single buildings are considered individual estates. In Column (2), we include controls for property features and estate times year quarter fixed effects. In Column (3), we include controls for property and building-level features, as well as district times year quarter fixed effects. Standard errors are clustered by district and year. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Price Premium for Mainland Buyers: Heterogeneity Analysis

Panel A. Heterogeneity across Regions			
	(1)	(2)	(3)
	Hong Kong Island	Kowloon	New Territories
	log($price_{it}$)	log($price_{it}$)	log($price_{it}$)
MB_{it}	0.0155***	0.0137***	0.0107***
	(0.0028)	(0.0030)	(0.0018)
Property Features	Y	Y	Y
Estate Fixed Effects	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y
Observations	139,412	165,431	382,755
R-squared	0.962	0.963	0.956
Panel B. Heterogeneity across Net Unit Sizes			
	(1)	(2)	(3)
	mini units	ordinary units	large units
	log($price_{it}$)	log($price_{it}$)	log($price_{it}$)
MB_{it}	0.0026	0.0153***	0.0352***
	(0.0017)	(0.0018)	(0.0044)
Property Features	Y	Y	Y
Estate Fixed Effects	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y
Observations	233,165	415,111	39,322
R-squared	0.953	0.954	0.902
Panel C. Heterogeneity across Periods			
	(1)	(2)	(3)
	2001-2006	2007-2012	2013-2017
	log($price_{it}$)	log($price_{it}$)	log($price_{it}$)
MB_{it}	-0.0048	0.0196***	0.0100***
	(0.0032)	(0.0016)	(0.0016)
Property Features	Y	Y	Y
Estate Fixed Effects	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y
Observations	201,881	350,118	135,599
R-squared	0.948	0.960	0.948

Note: This table presents heterogeneity analysis results for the housing price premiums paid by mainland Chinese buyers across regions (Panel A), net unit sizes (Panel B), and periods (Panel C). The dependent variable log($price_{it}$) is the price of unit i at time t in logarithmic form. MB_i is a dummy variable denoting mainland Chinese buyers. Unreported control variables for property features are the same as in Table 2. Standard errors are clustered by district and year. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Impact of Mainland Buyers on Future Transactions: OLS and IV Estimations

Panel A: All Homebuyers						
	(1) IV 1st Stage $\text{ShareMB}_{b,t-1}$	(2) OLS $\log(\text{price}_{it})$	(3) IV 2nd Stage $\log(\text{price}_{it})$	(4) IV 1st Stage $\text{NumMB}_{b,t-1}$	(5) OLS $\log(\text{price}_{it})$	(6) IV 2nd Stage $\log(\text{price}_{it})$
$\text{PredictShareMB}_{b,t-1}$	0.4822***					
	(0.0158)					
$\text{ShareMB}_{b,t-1}$		0.0599***	0.1913***			
		(0.0080)	(0.0264)			
$\text{PredictNumMB}_{b,t-1}$				0.5770***		
				(0.0603)		
$\text{NumMB}_{b,t-1}$					0.0078***	0.0256***
					(0.0009)	(0.0038)
Property Features	Y	Y	Y	Y	Y	Y
Estate Fixed Effects	Y	Y	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y	Y	Y
First-stage F-stats	928.38			91.45		
Observations	219,277	219,277	219,277	226,900	226,900	226,900
R-squared	0.309	0.948	0.948	0.545	0.948	0.948
Panel B: Local Homebuyers Only						
	(1) IV 1st Stage $\text{ShareMB}_{b,t-1}$	(2) OLS $\log(\text{price}_{it})$	(3) IV 2nd Stage $\log(\text{price}_{it})$	(4) IV 1st Stage $\text{NumMB}_{b,t-1}$	(5) OLS $\log(\text{price}_{it})$	(6) IV 2nd Stage $\log(\text{price}_{it})$
$\text{PredictShareMB}_{b,t-1}$	0.4816***					
	(0.0160)					
$\text{ShareMB}_{b,t-1}$		0.0549***	0.1828***			
		(0.0071)	(0.0253)			
$\text{PredictNumMB}_{b,t-1}$				0.5652***		
				(0.0579)		
$\text{NumMB}_{b,t-1}$					0.0071***	0.0250***
					(0.0009)	(0.0038)
Property Features	Y	Y	Y	Y	Y	Y
Estate Fixed Effects	Y	Y	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y	Y	Y
First-stage F-stats	909.72			95.24		
Observations	208,136	208,136	208,136	215,425	215,425	215,425
R-squared	0.297	0.948	0.948	0.528	0.948	0.948

Note: This table presents OLS and IV estimation results for the impact of lagged mainland Chinese buyers on subsequent housing prices in the same building in Hong Kong. Panel A includes transactions by all homebuyers from 2011 to 2017. Panel B includes transactions by local homebuyers from 2011 to 2017 only. We use Bartik shift-share predictions of mainland buyers as the instruments. Specifically, the predicted share of mainland buyers in the building in the previous year ($\text{PredictShareMB}_{b,t-1}$) is the instrument for the actual share of mainland buyers in the building in the previous year ($\text{ShareMB}_{b,t-1}$). The predicted number of mainland buyers in the building in the previous year ($\text{PredictNumMB}_{b,t-1}$) is the instrument for the actual number of mainland buyers in the building in the previous year ($\text{NumMB}_{b,t-1}$). Unreported control variables for property features are the same as in Table 2. Standard errors are clustered by district and year. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Impact of Mainland Buyers on Future Transactions: BSD Policy Shock

	(1) OLS log(price$_{it}$)	(2) IV 2nd Stage log(price$_{it}$)	(3) OLS log(price$_{it}$)	(4) IV 2nd Stage log(price$_{it}$)
ShareMB$_{b,t-1}$ * BSD$_t$	-0.0881***	-0.3499***		
	(0.0165)	(0.0385)		
ShareMB$_{b,t-1}$	0.0662***	0.3034***		
	(0.0133)	(0.0522)		
NumMB$_{b,t-1}$ * BSD$_t$			-0.0042***	-0.0095**
			(0.0011)	(0.0037)
NumMB$_{b,t-1}$			0.0036***	0.0143*
			(0.0010)	(0.0085)
BSD$_t$	0.0255***	0.0422***	0.0237***	0.0285***
	(0.0026)	(0.0035)	(0.0025)	(0.0040)
Property Features	Y	Y	Y	Y
Estate Fixed Effects	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y
First-stage F-stats		143.288		10.718
Observations	71,222	71,222	73,113	73,113
R-squared	0.956	0.955	0.956	0.954

Note: This table presents the estimated effect of curbing the housing demand of mainland buyers on housing prices in Hong Kong, using the BSD in October 2012 as the policy shock. The sample includes transactions in the [-1 year, +1 year] window around the effective date of BSD. The dependent variable log(price$_{it}$) is the price of unit i at time t in logarithmic form. BSD$_t$ is a dummy variable indicating transactions made after the BSD 2012 takes effect. ShareMB$_{b,t-1}$ is the share of mainland buyers in the building in the previous year. NumMB$_{b,t-1}$ is the number of mainland buyers in the building in the previous year. Columns (1) and (3) present OLS estimation results. Columns (2) and (4) present second-stage IV estimation results, using Bartik shift-share predictions of mainland buyers as the instruments. First-stage IV estimation results are reported in Appendix Table B2. Unreported control variables for property features are the same as in Table 2. Standard errors are clustered by district and year. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Channel of Hedging Effect

Panel A: All Homebuyers					
	(1) log($price_{it}$)	(2) log($price_{it}$)	(3) log($price_{it}$)	(4) log($price_{it}$)	(5) log($price_{it}$)
MB_{it}	0.0250***	0.0246***	0.0247***	0.0243***	0.0195**
	(0.0018)	(0.0017)	(0.0018)	(0.0017)	(0.0076)
MB_{it} * SD_HKD/CNY_{t-1}		0.0063**		0.0067**	0.0203***
		(0.0031)		(0.0031)	(0.0029)
MB_{it} * SD_CEPU_{t-1}			0.0034**	0.0039***	0.0027*
			(0.0014)	(0.0013)	(0.0014)
MB_{it} * $SD\_M2Growth_{t-1}$					0.0103***
					(0.0011)
MB_{it} * $SD\_LendDiff_{t-1}$					0.0259***
					(0.0030)
MB_{it} * HPR_Full_{t-1}					0.0037
					(0.0078)
MB_{it} * $HPR\_Partial_{t-1}$					0.0017
					(0.0090)
Property Features	Y	Y	Y	Y	Y
Estate Fixed Effects	Y	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y	Y
Observations	304,227	304,227	304,227	304,227	304,227
R-squared	0.953	0.953	0.953	0.953	0.953

Table 6: Channel of Hedging Effect (Continued)

Panel B: First-time Homebuyers Only					
	(1) $\log(\text{price}_{it})$	(2) $\log(\text{price}_{it})$	(3) $\log(\text{price}_{it})$	(4) $\log(\text{price}_{it})$	(5) $\log(\text{price}_{it})$
MB_{it}	0.0245***	0.0242***	0.0242***	0.0239***	0.0210***
	(0.0019)	(0.0018)	(0.0019)	(0.0018)	(0.0077)
MB_{it} * SD_HKD/CNY_{t-1}		0.0073**		0.0076**	0.0187***
		(0.0031)		(0.0030)	(0.0030)
MB_{it} * SD_CEPU_{t-1}			0.0036**	0.0041***	0.0016
			(0.0015)	(0.0014)	(0.0014)
MB_{it} * $SD\_M2Growth_{t-1}$					0.0103***
					(0.0012)
MB_{it} * $SD\_LendDiff_{t-1}$					0.0218***
					(0.0031)
MB_{it} * HPR_Full_{t-1}					0.0017
					(0.0077)
MB_{it} * $HPR\_Partial_{t-1}$					-0.0005
					(0.0092)
Property Features	Y	Y	Y	Y	Y
Estate Fixed Effects	Y	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y	Y
Observations	250,330	250,330	250,330	250,330	250,330
R-squared	0.953	0.953	0.953	0.953	0.953

Note: This table presents the estimated hedging effect on the price premiums paid by mainland Chinese buyers in the Hong Kong housing market. The sample period is from 2010 onward, when China started to implement a floating exchange rate policy, till 2017. Panel A includes transactions by all homebuyers in Hong Kong. Panel B includes transactions by first-time buyers in Hong Kong, of whom most of the mainland buyers are migrants. The dependent variable $\log(\text{price}_{it})$ is the price of unit i at time t in logarithmic form. MB_i is a dummy variable denoting mainland Chinese buyers. The independent variables of interest are the standardized 1-month-lagged HKD/CNY exchange rate (SD_HKD/CNY_{t-1}) and China's economic uncertainty index (SD_CEPU_{t-1}). $SD\_M2Growth_{t-1}$ is the standardized 1-month-lagged monthly M2 growth rate in mainland China. $SD\_LendDiff_{t-1}$ is the standardized 1-month-lagged difference in mortgage lending rate between mainland China and Hong Kong. HPR_Full_{t-1} and $HPR\_Partial_{t-1}$ are dummy variables denoting periods when home purchase restriction polices are in effect in the previous month nationwide in mainland China, or in the four first-tier Chinese cities (Bejing, Shanghai, Guangzhou, and Shenzhen) only, respectively. Single terms of the time-series measures (e.g., SD_HKD/CNY_{t-1}) are omitted, as we have included time fixed effects. Unreported control variables for property features are the same as in Table 2. Standard errors are clustered by district and year. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Horse-racing Analysis of Channels

	(1) All Buyers $\log(\text{price}_{it})$	(2) All Buyers $\log(\text{price}_{it})$	(3) All Buyers $\log(\text{price}_{it})$	(4) First-time Buyers $\log(\text{price}_{it})$
MB_{it}	0.0206***	0.0258***	0.0193**	0.0211***
	(0.0013)	(0.0018)	(0.0076)	(0.0076)
MB_{it} * SD_HKD/CNY_{t-1}			0.0189***	0.0171***
			(0.0028)	(0.0028)
MB_{it} * SD_CEPU_{t-1}			0.0031**	0.0020
			(0.0014)	(0.0014)
MB_{it} * $SD\_ShareMB_{b,t-1}$	0.0155***		0.0138***	0.0132***
	(0.0019)		(0.0018)	(0.0019)
MB_{it} * $SD\_Trans_{i,t-1}$		-0.0029***	-0.0018*	
		(0.0010)	(0.0010)	
Property Features	Y	Y	Y	Y
Estate Fixed Effects	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y
Observations	295,994	295,994	295,994	243,667
R-squared	0.954	0.953	0.954	0.954

Note: This table presents horse-racing analysis results for the impacts of different channels on the housing price premiums paid by mainland Chinese buyers. The sample period is from 2010 onward, when China started to implement a floating exchange rate policy, till 2017. The dependent variable $\log(\text{price}_{it})$ is the price of unit i at time t in logarithmic form. MB_i is a dummy variable denoting mainland Chinese buyers. SD_HKD/CNY_{t-1} denotes the standardized 1-month-lagged HKD/CNY exchange rate. SD_CEPU_{t-1} denotes the standardized 1-month-lagged China economic uncertainty index. $SD\_ShareMB_{b,t-1}$ denotes the standardized percentage of mainland Chinese buyers in building b in the previous year. SD_Trans_{t-1} equals the buyer's standardized prior transaction times in the Hong Kong housing market. Single terms of the time-series measures (e.g., SD_HKD/CNY_{t-1}) are omitted, as we have included time fixed effects. Columns (1) to (3) include transactions made by all homebuyers, and Column (4) includes transactions made by first-time homebuyers only. The coefficients of other institutional factors (MB_{it}*$SD\_M2Growth_{t-1}$, MB_{it}*$SD\_LendDiff_{t-1}$, MB_{it}*HPR_Full_{t-1}, and MB_{it}*$HPR\_Partial_{t-1}$) are unreported in Columns (3) and (4). Unreported control variables for property features are the same as in Table 2. Standard errors are clustered by district and year. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Internet Appendix A. Supplementary Tables

Table A1: Definition of Variables

Variable Name	Definition
Region	1 = Hong Kong Island; 2 = Kowloon; 3 = New Territories.
District	District codes assigned by the data vendor (EPRC Limited): 1 = Aberdeen/Ap Lei Chau; 2 = Causeway Bay; 3 = Central; 4 = Chai Wan; 5 = Happy Valley; 6 = Kennedy Town; 7 = Mid-level West; 8 = Mid-level Central; 9 = Mid-level East; 10 = North Point; 11 = North Point Hill; 12 = Peak; 13 = Pokfulam; 14 = Quarry Bay; 15 = Repulse Bay; 16 = Sai Ying Pun; 17 = Shau Kei Wan; 18 = Sheung Wan; 19 = Siu Sai Wan; 20 = Stanley; 21 = Tai Tam; 22 = Wan Chai; 23 = Wong Chuk Hang; 24 = Cheung Sha Wan; 25= Diamond Hill; 26 = Ho Man Tin; 27 = Hung Hom; 28 = Kai Tak; 29 = Kowloon Bay; 30 = Kowloon City; 31 = Kowloon Tong; 32 = Kwun Tong; 33 = Lai Chi Kok; 34 = Lam Tin; 35 = Mong Kok; 36 = Ngau Chi Wan; 37 = Ngau Tau Kok; 38 = San Po Kong; 39 = Sham Shui Po; 40 = Shek Kip Mei; 41 = Tai Kok Tsui; 42 = Tsim Sha Tsui; 43 = Tsz Wan Shan; 44 = Wang Tau Hom; 45 = Wong Tai Sin; 46 = Yau Ma Tei; 47 = Yau Tong; 48 = Fan Ling; 49 = Islands; 50 = Kwai Chung; 51 = Ma On Shan; 52 = Sai Kung; 53 = Sha Tin; 54 = Sheung Shui; 55 = Tai Po; 56 = Tseung Kwan O; 57 = Tsing Yi; 58 = Tsuen Wan; 59 = Tuen Mun; 60 = Yuen Long.
Building Type	1 = Private Estate; 2 = Private Single; 3= Government. A private estate building refers to an apartment building from an estate (project) that has multiple buildings. Buildings in the same estate usually share some common facilities, such as swimming pools or club houses. A private single building refers to an estate that only has a single apartment building, which normally has fewer facilities than multi-block estates. A government building refers to public housing initially constructed by the Hong Kong government, the units of which are permitted to be resold in the private market at market price if sellers pay back the full subsidies and land premiums to the Housing Authority. We exclude landed houses (i.e., Village Houses) in Hong Kong, which are mostly located in suburban areas of the New Territories region and are subject to restrictions on resales.
Total Price	Total pretax contract price, in million HKD.
Unit Price	Total pretax contract price divided by the net unit area, in thousand HKD.

Net Unit Area	Net sellable area of the unit, in hundred square feet.
Number of Bedrooms	Number of bedrooms in the unit.
Number of Living Rooms	Number of living rooms in the unit.
Floor	Floor level of the unit.
Building Age	Building age at the transaction time.
Bay-window Size	Total area of bay-windows in the unit.
Construction Year	Construction year of the building.
To Train Station	Distance to the nearest subway station, in kilometers.
To Bus Stop	Distance to the nearest bus stop, in kilometers.
To Hospital	Distance to the nearest public hospital, in kilometers.
To School	Distance to the nearest primary or middle school, in kilometers.
To University	Distance to the nearest university, in kilometers.
To Coastline	Distance to the coastline, in kilometers.
$\log(\text{price}_{it})$	Total price of unit i at time t, in logarithmic form.
MB_{it}	A dummy variable equal to one if the buyer of unit i at time t is mainland Chinese, zero otherwise.
$\text{ShareMB}_{b,t-1}$	Share of mainland Chinese buyers in building b over a one-year period before time t.
$\text{NumMB}_{b,t-1}$	Number of mainland Chinese buyers in building b over a one-year period before time t, in logarithmic form.
$\text{PredictShareMB}_{b,t-1}$	Predicted share of mainland Chinese buyers in building b over a one-year period before time t, using the Bartik shift-share method.
$\text{PredictNumMB}_{b,t-1}$	Predicted number of mainland Chinese buyers in building b over a one-year period before time t, using the Bartik shift-share method.
SD_HKD/CNY_{t-1}	One-month-lagged exchange rate from HKD to CNY, standardized with a mean of zero and standard deviation of one.
SD_CEPU_{t-1}	One-month-lagged China Economic Uncertainty Index, standardized with a mean of zero and standard deviation of one.
SD_M2Growth_{t-1}	One-month-lagged monthly M2 growth rate in mainland China, standardized with a mean of zero and standard deviation of one.

$SD\_LendDiff_{t-1}$	One-month-lagged difference in mortgage lending rate between mainland China and Hong Kong, standardized with a mean of zero and standard deviation of one. The mortgage lending rate in mainland China is the benchmark long-term loan prime rate (LPR) from the People's Bank of China. The mortgage lending rate in Hong Kong is the best lending rate from the Hong Kong Monetary Authority.
HPR_Full_{t-1}	A dummy variable equal to one if the nationwide home purchase restriction polices are in effect in mainland China in the previous month, and zero otherwise. The two periods of the nationwide home purchase restriction polices in mainland China are from April 2010 to June 2014 and from March 2017 onward.
$HPR\_Partial_{t-1}$	A dummy variable equal to one if home purchase restriction polices are only in effect in the four first-tier cities (Beijing, Shanghai, Guangzhou, and Shenzhen) in mainland China in the previous month, and zero otherwise. The period when home purchase restriction polices are only effective in the four first-tier cities is between July 2014 and February 2017.
$SD\_ShareMB_{b,t-1}$	Percentage of mainland Chinese buyers in building b over a one-year period before time t, standardized with a mean of zero and standard deviation of one.
$SD\_Trans_{i,t-1}$	A buyer's prior transaction times in the Hong Kong housing market, standardized with a mean of zero and standard deviation of one.
BSD_t	A dummy variable indicating transactions made after the BSD 2012 takes effect.

Table A2: Distribution of Residential Building Types in Hong Kong

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All		Hong Kong Island		Kowloon		New Territories	
	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.
Private Estate	468,176	68.09	71,936	51.60	98,520	59.55	297,720	77.78
Private Single	119,695	17.41	51,669	37.06	46,024	27.82	22,002	5.75
Government	99,727	14.50	15,807	11.34	20,887	12.63	63,033	16.47
Total	687,598	100	139,412	100	165,431	100	382,755	100

Note: This table summarizes the distribution of residential property transactions in Hong Kong by region and building type. A private estate contains multiple buildings that share common property management and facilities in the estate. A private single building is a stand-alone residential building that does not belong to a residential estate. A government building refers to the public housing initially constructed by the government. In Hong Kong, public housing units are permitted to be resold to any buyers in the private market at market price if sellers pay back the full subsidies and land premiums to the Housing Authority.

Table A3: Summary of Housing Features by Net Unit Size

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Mini Units 0 - 430 sq. ft.			Ordinary Units 430 - 831 sq. ft.			Luxury Units over 831 sq. ft.		
	N	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Mean	Std. Dev.
mainland buyer (Yes = 1)	233,165	0.033	0.177	415,111	0.037	0.188	39,322	0.063	0.243
total price (million HKD)	233,165	1.969	1.174	415,111	3.351	2.133	39,322	8.434	4.502
unit price (1,000 HKD p.s.f)	233,165	5.607	3.306	415,111	5.835	3.322	39,322	8.082	4.073
net unit area (100 sq. ft.)	233,165	3.542	0.500	415,111	5.675	1.038	39,322	10.392	1.579
number of bedrooms	202,205	1.347	0.906	383,945	2.157	0.924	34,897	2.751	0.931
number of living rooms	204,422	1.103	0.830	385,936	1.733	0.661	35,023	1.812	0.593
floor	233,165	14.560	9.627	415,111	17.688	12.515	39,322	15.782	13.616
building age	233,165	21.613	9.581	415,111	16.322	9.879	39,322	16.782	11.116
bay-window size (sq. ft.)	233,165	11.822	13.690	415,111	18.246	16.184	39,322	21.988	20.495
to train station (km)	233,165	0.531	0.632	415,111	0.781	0.980	39,322	0.913	1.085
to bus stop (km)	233,165	0.312	0.245	415,111	0.358	0.358	39,322	0.468	0.511
to hospital (km)	233,165	1.390	1.024	415,111	1.691	1.419	39,322	1.907	1.818
to school (km)	233,165	0.127	0.148	415,111	0.145	0.212	39,322	0.222	0.306
to university (km)	233,165	2.813	2.271	415,111	3.800	2.895	39,322	3.231	3.259
to coastline (km)	233,165	1.678	1.757	415,111	1.198	1.476	39,322	1.119	1.341

Note: This table presents summary statistics for our regression sample of housing resale transactions in Hong Kong from 2001 to 2017 by net unit size. Columns (1) to (3) summarize transactions for units below 430 sq.ft. Columns (4) to (6) summarize transactions for units between 430 and 831 sq.ft. Columns (7) to (9) summarize transactions for units over 831 sq.ft.

Table A4: BSD Policy Intensity Shock: First-stage IV Estimation Results

	(1) $ShareMB_{b,t-1}$	(2) $ShareMB_{b,t-1} * BSD_t$	(3) $NumMB_{b,t-1}$	(4) $NumMB_{b,t-1} * BSD_t$
$PredictShareMB_{b,t-1} * BSD_t$	-0.0689**	0.4963***		
	(0.0312)	(0.0215)		
$PredictShareMB_{b,t-1}$	0.4590***	-0.0024		
	(0.0282)	(0.0081)		
$PredictNumMB_{b,t-1} * BSD_t$			-0.1690***	0.4940***
			(0.0313)	(0.0247)
$PredictNumMB_{b,t-1}$			0.2056***	-0.0865***
			(0.0465)	(0.0223)
BSD_t	0.0058*	0.0192***	0.2262***	0.3017***
	(0.0032)	(0.0027)	(0.0492)	(0.0474)
Property Features	Y	Y	Y	Y
Estate Fixed Effects	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y
Observations	71,222	71,222	73,113	73,113
R-squared	0.415	0.431	0.586	0.534

Note: This table presents first-stage IV estimation results for the impact of curbing the housing demand of mainland buyers on housing prices in Hong Kong, using the BSD in October 2012 as the policy shock. The sample includes transactions in the [-1 year, +1 year] window around the effective date of the BSD. BSD_t is a dummy variable indicating transactions made after the BSD 2012 takes effect. $ShareMB_{b,t-1}$ is the share of mainland buyers in the building in the previous year. $NumMB_{b,t-1}$ is the number of mainland buyers in the building in the previous year. We use Bartik shift-share predictions of mainland buyers as the instruments. $PredictShareMB_{b,t-1}$ denotes the predicted share of mainland buyers in the building in the previous year. We use $PredictShareMB_{b,t-1}$ and $PredictShareMB_{b,t-1}$*BSD_{it} as the instruments for $ShareMB_{b,t-1}$ and $ShareMB_{b,t-1}$*BSD_{it}. $PredictNumMB_{b,t-1}$ denotes the predicted number of mainland buyers in the building in the previous year. We use $PredictNumMB_{b,t-1}$ and $PredictNumMB_{b,t-1}$*BSD_{it} as the instruments for $NumMB_{b,t-1}$ and $NumMB_{b,t-1}$*BSD_{it}. Unreported control variables for property features are the same as in Table 2. Standard errors are clustered by district and year. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A5: Balancing Test for Mainland Buyers' Transactions Before and After BSD

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1 Year before BSD			1 Year after BSD			t-test	
	N	Mean	Std. Dev.	N	Mean	Std. Dev.	(5) - (3)	Std. Err.
net unit area	5,765	5.386	1.934	1,212	5.574	2.022	0.188***	0.062
bedroom	5,665	1.94	1.009	1,182	1.948	1.062	0.008	0.033
living room	5,665	1.596	0.753	1,182	1.57	0.782	-0.026	0.024
floor	5,765	18.53	13.465	1,212	18.9	13.065	0.37	0.423
construction year	5,765	1995	10.539	1,212	1995	10.456	0.077	0.333
bay-window size	5,765	19.747	15.451	1,212	19.43	15.539	-0.317	0.489
to train station	5,765	0.69	0.913	1,212	0.712	0.881	0.022	0.029
to bus stop	5,765	0.351	0.35	1,212	0.377	0.369	0.026**	0.011
to hospital	5,765	1.625	1.508	1,212	1.687	1.537	0.062	0.048
to school	5,765	0.142	0.205	1,212	0.139	0.17	-0.003	0.006
to university	5,765	3.728	3.321	1,212	3.636	3.112	-0.092	0.104
to coastline	5,765	1.355	1.828	1,212	1.423	1.792	0.068	0.058

Note: The table reports the summary statistics for the housing features of transactions made by mainland buyers within the [-1 year, 1 year] window around the BSD. *** p<0.01, ** p<0.05, * p<0.1

Table A6: BSD Policy Intensity Shock: Robustness Check Using Samples in the 2-Year Window

Panel A: First-stage IV Estimation Results				
	(1)	(2)	(3)	(4)
	$\text{ShareMB}_{b,t-1}$	$\text{ShareMB}_{b,t-1} * \text{BSD}_t$	$\text{NumMB}_{b,t-1}$	$\text{NumMB}_{b,t-1} * \text{BSD}_t$
$\text{PredictShareMB}_{b,t-1} * \text{BSD}_t$	-0.0732***	0.4753***		
	(0.0271)	(0.0161)		
$\text{PredictShareMB}_{b,t-1}$	0.4361***	0.0194***		
	(0.0218)	(0.0064)		
$\text{PredictNumMB}_{b,t-1} * \text{BSD}_t$			-0.4857***	0.4598***
			(0.0705)	(0.0267)
$\text{PredictNumMB}_{b,t-1}$			0.4189***	-0.0272**
			(0.0424)	(0.0118)
BSD_t	0.0057*	0.0202***	0.6188***	0.3350***
	(0.0029)	(0.0027)	(0.1041)	(0.0538)
Property Features	Y	Y	Y	Y
Estate Fixed Effects	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y
Observations	154,917	154,917	158,881	158,881
R-squared	0.362	0.365	0.634	0.460
Panel B: OLS and Second-stage IV Estimation Results				
	(1)	(2)	(3)	(4)
	OLS	IV 2nd Stage	OLS	IV 2nd Stage
	$\log(\text{price}_{it})$	$\log(\text{price}_{it})$	$\log(\text{price}_{it})$	$\log(\text{price}_{it})$
$\text{ShareMB}_{b,t-1} * \text{BSD}_t$	-0.1683***	-0.6667***		
	(0.0194)	(0.0607)		
$\text{ShareMB}_{b,t-1}$	0.1198***	0.4789***		
	(0.0165)	(0.0581)		
$\text{NumMB}_{b,t-1} * \text{BSD}_t$			-0.0073***	-0.0069*
			(0.0013)	(0.0041)
$\text{NumMB}_{b,t-1}$			0.0056***	0.0177***
			(0.0008)	(0.0034)
BSD_t	0.0310***	0.0626***	0.0264***	0.0259***
	(0.0028)	(0.0052)	(0.0027)	(0.0045)
Property Features	Y	Y	Y	Y
Estate Fixed Effects	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y
First-stage F-stats		236.444		42.950
Observations	154,917	154,917	158,881	158,881
R-squared	0.954	0.954	0.954	0.953

Note: This table presents robustness check results for the effect of curbing the housing demand of mainland buyers on housing prices in Hong Kong, using the BSD in October 2012 as the policy shock. The sample period is extended to the [-2 years, +2 years] window around the effective date of the BSD. Panel A presents first-stage IV estimation results, using Bartik shift-share predictions of mainland buyers as the instruments. Panel B presents OLS and second-stage IV estimation results. The dependent variable $\log(\text{price}_{it})$ is the price of unit i at time t in logarithmic form. BSD_t is a dummy variable indicating transactions made after the BSD takes effect. $\text{ShareMB}_{b,t-1}$ is the share of mainland buyers in the building in the previous year. $\text{NumMB}_{b,t-1}$ is the number of mainland buyers in the building in the previous year. Unreported control variables for property features are the same as in Table 2. Standard errors are clustered by district and year. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A7: Comparative Analysis of Hedging Effect in the Singapore Housing Market

	(1) log(price$_{it}$)	(2) log(price$_{it}$)	(3) log(price$_{it}$)	(4) log(price$_{it}$)	(5) log(price$_{it}$)
MB$_{it}$	0.0132***	0.0131***	0.0131***	0.0131***	0.0192
	(0.0024)	(0.0024)	(0.0024)	(0.0024)	(0.0124)
MB$_{it}$ * SD_SGD/CNY$_{t-1}$		0.0020		0.0019	0.0047*
		(0.0019)		(0.0019)	(0.0024)
MB$_{it}$ * SD_CEPU$_{t-1}$			0.0006	0.0005	0.0004
			(0.0022)	(0.0022)	(0.0025)
MB$_{it}$ * SD_M2Growth$_{t-1}$					0.0022
					(0.0021)
MB$_{it}$ * SD_LendDiff$_{t-1}$					0.0003
					(0.0038)
MB$_{it}$ * HPR_Full$_{t-1}$					0.0008
					(0.0147)
MB$_{it}$ * HPR_Partial$_{t-1}$					-0.0084
					(0.0126)
Property Features	Y	Y	Y	Y	Y
Postal Code Fixed Effects	Y	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y	Y
Observations	87,756	87,756	87,756	87,756	87,756
R-squared	0.978	0.978	0.978	0.978	0.978

Note: This table presents the comparative analysis of the hedging effect on the price premiums for mainland Chinese homebuyers in Singapore, using resale transactions made by all homebuyers in the Singapore private housing market. The sample period is from 2010 onward, when China started to implement a floating exchange rate policy, till 2017. The dependent variable log(price$_{it}$) is the price of unit i at time t in logarithmic form. MB$_i$ is a dummy variable denoting mainland Chinese buyers. The independent variables of interest are the standardized 1-month-lagged SGD/CNY exchange rate (SD_SGD/CNY$_{t-1}$) and China's economic uncertainty index (SD_CEPU$_{t-1}$). SD_M2Growth$_{t-1}$ is the standardized 1-month-lagged monthly M2 growth rate in mainland China. SD_LendDiff$_{t-1}$ is the standardized 1-month-lagged difference in mortgage lending rate between mainland China and Singapore. HPR_Full$_{t-1}$ and HPR_Partial$_{t-1}$ are dummy variables denoting periods when home purchase restriction polices are in effect in the previous month nationwide in mainland China, or in the four first-tier Chinese cities (Bejing, Shanghai, Guangzhou, and Shenzhen) only, respectively. The single terms of the time-series measures (e.g., SD_HKD/CNY$_{t-1}$) are omitted, as we have included time fixed effects. Unreported control variables for property and building-level features are the same as in Table 2. Standard errors are clustered by district and year. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Internet Appendix B. Robustness Checks for the Impact of Mainland Buyers on Future Transactions

We conduct a set of robustness checks for our spillover analysis. To begin with, many buildings in Hong Kong may not have any mainland buyers, so both the actual and the predicted lagged number/share of mainland buyers in those buildings are zero. This potentially inflates the correlation in the first-stage IV estimation. Thus, we conduct a robustness check using the subsample of buildings with nonzero lagged mainland buyers (i.e., $NumMB_{b,t-1}>0$). Results are reported in Appendix Table B1. We obtain estimates similar to the original ones, which support the robustness of our findings.

In addition, a potential concern for the exclusion restrictions of the Bartik IV is that mainland buyers may be good at picking promising investments, so buildings with higher shares of mainland buyers in the previous year may have better price growth. We address this concern using two alternative methods to calculate the IV. First, we recalculate the Bartik IV only based on the shift-shares of first-time mainland homebuyers in each building, because transactions by first-time buyers carry less information compared with those made by sophisticated investors. Second, we follow Saiz (2007) to recalculate the Bartik IV based on the fixed historical shares of mainland buyers in the base year 2010, because historical shares in a much earlier year are less likely to correlate with unobservables in current housing prices.[24] Panels A and B in Table B2 report the results with these two alternative IVs, respectively, and the results remain qualitatively similar.

[24]In our main analysis, we do not use fixed historical shares in the base year to calculate the IV because buildings constructed later than the base year will not have the historical shares, resulting in a potential selection issue.

Table B1: Robustness Check for the Impact of Mainland Buyers on Future Transactions: Exclude Buildings Without Lagged Mainland Buyers

	(1) IV 1st Stage $\text{ShareMB}_{b,t-1}$	(2) OLS $\log(\text{price}_{it})$	(3) IV 2nd Stage $\log(\text{price}_{it})$	(4) IV 1st Stage $\text{NumMB}_{b,t-1}$	(5) OLS $\log(\text{price}_{it})$	(6) IV 2nd Stage $\log(\text{price}_{it})$
$\text{PredictShareMB}_{b,t-1}$	0.6877***					
	(0.0150)					
$\text{ShareMB}_{b,t-1}$		0.1036***	0.1216***			
		(0.0124)	(0.0197)			
$\text{PredictNumMB}_{b,t-1}$				0.4924***		
				(0.0654)		
$\text{NumMB}_{b,t-1}$					0.0076***	0.0232***
					(0.0010)	(0.0047)
Property Features	Y	Y	Y	Y	Y	Y
Estate Fixed Effects	Y	Y	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y	Y	Y
First-stage F-stats	38.01			56.67		
Observations	79,337	79,337	79,337	79,337	79,337	79,337
R-squared	0.684	0.960	0.959	0.529	0.960	0.959

Note: This table presents robustness checks for the impact of lagged mainland Chinese buyers on subsequent housing prices in the same building in Hong Kong. The sample includes transactions by all homebuyers from 2011 to 2017. We exclude buildings without any lagged mainland buyers in the previous year (i.e., $\text{NumMB}_{b,t-1} = 0$). We use Bartik shift-share predictions of mainland buyers as the instruments. Specifically, the predicted share of mainland buyers in the building in the previous year ($\text{PredictShareMB}_{b,t-1}$) is the instrument for the actual share of mainland buyers in the building in the previous year ($\text{ShareMB}_{b,t-1}$). The predicted number of mainland buyers in the building in the previous year ($\text{PredictNumMB}_{b,t-1}$) is the instrument for the actual number of mainland buyers in the building in the previous year ($\text{NumMB}_{b,t-1}$). Unreported control variables for property and building-level features are the same as in Table 2. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table B2: Robustness Check for the Impact of Mainland Buyers on Future Transactions: IV Estimations with Alternative Bartik Shift Share Calculations

Panel A: Shift Shares of First-time Buyers				
	(1) IV 1st Stage $\text{ShareMB}_{b,t-1}$	(2) IV 2nd Stage $\log(\text{price}_{it})$	(3) IV 1st Stage $\text{NumMB}_{b,t-1}$	(4) IV 2nd Stage $\log(\text{price}_{it})$
$\text{PredictShareMB}_{b,t-1}$	0.4519***			
	(0.0158)			
$\text{ShareMB}_{b,t-1}$		0.1979***		
		(0.0268)		
$\text{PredictNumMB}_{b,t-1}$			0.5766***	
			(0.0617)	
$\text{NumMB}_{b,t-1}$				0.0263***
				(0.0037)
Property Features	Y	Y	Y	Y
Estate Fixed Effects	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y
First-stage F-stats	819.19		87.41	
Observations	219,249	219,249	226,900	226,900
R-squared	0.300	0.948	0.542	0.948
Panel B: Fixed Historical Shares in the Base Year				
	(1) IV 1st Stage $\text{ShareMB}_{b,t-1}$	(2) IV 2nd Stage $\log(\text{price}_{it})$	(3) IV 1st Stage $\text{NumMB}_{b,t-1}$	(4) IV 2nd Stage $\log(\text{price}_{it})$
$\text{PredictShareMB}_{b,t-1}$	0.3877***			
	(0.0155)			
$\text{ShareMB}_{b,t-1}$		0.1420***		
		(0.0322)		
$\text{PredictNumMB}_{b,t-1}$			0.5494***	
			(0.0631)	
$\text{NumMB}_{b,t-1}$				0.0248***
				(0.0034)
Property Features	Y	Y	Y	Y
Estate Fixed Effects	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y
First-stage F-stats	625.89		75.83	
Observations	206,412	206,412	213,228	213,228
R-squared	0.279	0.948	0.545	0.948

Note: This table presents robustness check results for the impact of lagged mainland Chinese buyers on subsequent housing prices in the same building in Hong Kong. The sample includes transactions by all homebuyers from 2011 to 2017. We use alternative methods to calculate the Bartik shift-share predictions of mainland buyers as the instruments. In Panel A, we use the shift shares of first-time mainland buyers in each building in the previous year. In Panel B, we use the fixed historical shares of mainland buyers in each building in the base year 2010. Unreported control variables for property and building-level features are the same as in Table 2. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Internet Appendix C. The Impact of Residential Sorting on Mainland Buyers' Housing Demand

In this section, we investigate whether mainland Chinese buyers have higher demand for culturally similar neighborhoods—namely, places with more mainland residents. Since we find that many mainland Chinese buyers are migrant residents living in Hong Kong (see Section 3.1), the presence of mainland buyers in the previous year can serve as a proxy for mainland residents in the neighborhood. Specifically, our empirical specification is as follows:

$$MB_{it} = \zeta_0 + \zeta_1 N_{b,t-1} + X_{it}^{'}\zeta_X + \phi_t + \rho_i + \epsilon_{it}, \tag{C1}$$

where MB_{it} is a dummy variable equal to 1 if the buyer of unit i at date t is a mainland Chinese buyer and 0 otherwise. $N_{b,t-1}$ is the measure of 1-year-lagged mainland buyers in the same building. We use either the lagged proportion of mainland buyers or the lagged number of mainland buyers as $N_{i,t-1}$ in separate regressions. The coefficient ζ_1, therefore, indicates the effect of the previous presence of mainland buyers on the probability that the subsequent buyer is also from mainland China.

Appendix Table C1 presents Probit estimation results of Equation (C1), with margins at the means reported. We find that an increase in the lagged proportion of mainland buyers by 1 percentage point leads to a 0.045-percentage-point increase in the probability that the subsequent buyer in the same building is also from mainland China. Since mainland buyers constitute 3.67% of the homebuyers in our sample period, this translates to a 1.23% increase in mainland buyers at building level. Similarly, one additional mainland buyer in a building in the previous year increases the probability that the subsequent buyer is mainland Chinese by 2.7 percentage points. Both estimates are statistically significant at the 1% level. We also report the corresponding OLS estimation results in the same table for comparison (Greene, 2004) and continue to observe positive and statistically significant coefficients for the lagged proportion/number of mainland buyers.

Table C1: Residential Sorting Channel: Demand of Mainland Chinese Buyers

	(1) Probit MB_{it}	(2) Probit MB_{it}	(3) OLS MB_{it}	(4) OLS MB_{it}
$ShareMB_{b,t-1}$	0.0452***		0.0877***	
	(0.0030)		(0.0082)	
$NumMB_{b,t-1}$		0.0027***		0.0069***
		(0.0002)		(0.0008)
Property Features	Y	Y	Y	Y
Estate Fixed Effects	Y	Y	Y	Y
Year*Quarter Fixed Effects	Y	Y	Y	Y
Observations	660,327	680,044	660,327	680,044
(Pseudo) R-squared	0.061	0.061	0.023	0.023

Note: This table presents the estimated effects of lagged mainland Chinese buyers on attracting subsequent mainland Chinese buyers in the same building in Hong Kong. The dependent variable (MB_{it}) is a dummy variable indicating transactions by mainland buyers. In Columns (1) and (3), the independent variable is the share of mainland buyers in the building in the previous year ($ShareMB_{b,t-1}$). In Columns (2) and (4), the independent variable is the number of mainland buyers in the building in the previous year ($NumMB_{b,t-1}$). Columns (1) and (2) present Probit estimation results, with the margin at means reported. Columns (3) and (4) reports OLS estimation results. Unreported control variables for property and building-level features are the same as in Table 2. Standard errors are clustered by district and year. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1