Limits of Arbitrage and Term Structure of Idiosyncratic Risk in the Housing Market

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Abstract

Government regulations on housing flippers target their high capital gains but ignore their risk-sharing function: rational arbitrageurs reduce systematic risk borne by other participants while undertaking high idiosyncratic risk themselves. Regulations that tighten the limits of arbitrage in housing markets can adversely affect market efficiency by blocking this risk-sharing function. Using the comprehensive housing transaction records in Hong Kong from 1993 to 2021, we find although flippers obtain higher annual capital gain returns than long-term buyers by 8.76 percentage points, they undertake substantially higher idiosyncratic risk due to a unique downward term structure of idiosyncratic risk in real estate markets. Only experienced flippers, who have at least two prior trading experiences and constitute less than 20% of the flippers, outperform long-term buyers in terms of risk-adjusted returns. Following the enactment of an anti-speculation policy that decreases the share of flippers by 13.7 percentage points in one year, the systematic risk of the entire housing market increases by 22.3%.

Keywords: Limits of Arbitrage, Idiosyncratic Risk, Term Structure, Systematic Risk, Housing Flippers

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1. Introduction

The economic function of short-term investors (colloquially known as flippers) in the real estate market attracts substantial attention from the recent literature due to flippers' significant presence in various global markets (e.g., Chi et al., 2020; Fu et al., 2016; Leung & Tse, 2017). A substantial proportion of flippers attempt to profit from rational arbitraging (i.e., buy low and resell at market price or higher) in the housing market (Bayer et al., 2020), which improves market liquidity (Agarwal et al., 2023).

Although past literature highlights the excess return of flippers relative to long-term home buyers, important knowledge gaps exist regarding the risk of flipping housing investments. First, compared to other financial asset markets, arbitraging in real estate markets is much riskier due to factors like informational friction, liquidity constraints, and short-selling restrictions.[1] Notably, recent study reveals that, unlike other financial assets, the idiosyncratic risk of real estate capital gains has a unique downward term structure with holding periods (Giacoletti, 2021; Sagi, 2021), implying that the excess capital gains of short-term flippers are obtained at the cost of bearing high idiosyncratic risk. It remains unclear whether housing flippers outperform in terms of risk-adjusted returns.

Second, little is known about flippers' potential risk-sharing roles in real estate markets; that is, rational arbitrageurs may reduce market risk borne by other participants while undertaking high idiosyncratic risk themselves.[2] According to the limits of arbitrage theory (Gabaix et al., 2007; Shleifer & Vishny, 1997), macroprudential policies that curtail housing flippers, which originally aimed to lower demand and cool the market, may adversely increase the limits of arbitrage in the market, shut off flippers' risk-sharing function, and thus result in larger market risk. However, this plausibly unintended policy outcome has been overlooked and is rarely examined in literature.

In this paper, we bridge these knowledge gaps. We first evaluate flippers' performance from the perspective of risk-adjusted returns, in contrast to prior studies that focused on the unadjusted excess

[1] Anecdotally, the recent failure of Zillow's home-flipping business shows the substantial risk of flipping investments in real estate markets (Clark, 2021).

[2] More concretely, we define risk sharing as a shift from the systematic risk undertaken by all market participants to the idiosyncratic risk undertaken by flippers after they enter the market, rather than the redistribution of systematic risk among market participants. Meanwhile, our definition of risk sharing also implies that with a larger presence of flippers, both flippers and other long-term buyers benefit from lower systematic risk, consistent with the common definition of risk sharing in literature (e.g., Chari & Henry, 2004; Gomes & Michaelides, 2008).

capital gains achieved by flippers. In particular, we focus on the idiosyncratic risk of housing flippers, because idiosyncratic risk is the primary limit of arbitrage (Shleifer & Vishny, 1997; Pontiff, 2006; Cao & Han, 2016), and it is hard for specialized arbitrageurs to diversify idiosyncratic risk in housing markets (Gabaix et al., 2007). Further, we investigate the risk-sharing function of flippers and quantify their impacts on lowering systematic risk, using the implementation of an anti-speculation policy that increases the limits of arbitrage in the Hong Kong housing market as a policy shock. Specifically, the Special Stamp Duty (SSD) policy, introduced by the Hong Kong government on November 20, 2010, levies an additional stamp duty of 5-15% on home sales that are held for fewer than 2 years, which substantially increased the arbitraging costs of housing flippers and thus aggravate the limits of arbitrage in the housing market (Allen et al., 2021; Edmans et al., 2015; Gu et al., 2018).

Using the data of comprehensive secondhand housing transactions in Hong Kong between 1993 and 2021, we first show that flippers bear substantial idiosyncratic risk compared to long-term buyers due to the unique term structure of idiosyncratic risk in real estate capital gains, which is distinct from other financial assets. Specifically, the idiosyncratic risk of the annualized housing capital gain decreases with the holding period. If the holding period is extended by 1 year, the annualized idiosyncratic risk decreases by 0.61 percentage points on average, equivalent to a 6.56% decrease from the average idiosyncratic risk level. Moreover, the term structure of the idiosyncratic risk has a convex shape, with a sharp decrease in the idiosyncratic risk by around 1.86 percentage points after the first holding year. As a result, flippers, who resell the properties within 2 years after the purchases, undertake a substantially higher level of idiosyncratic risk than non-flippers, who hold for more than 2 years, by 8.65 percentage points. Novice flippers, who have fewer than two trading experiences in the local housing market, bear an even higher level of idiosyncratic risk than the experienced flippers by around 1.53 percentage points. These results show that the annualized idiosyncratic risk in real estate capital gains is unlike that of other liquid financial assets, which follows a random walk (Giacoletti, 2021; Sagi, 2021). In addition, since idiosyncratic risk constitutes a significant part of total risk in real estate capital gain (Eichholtz et al., 2021), while the systematic risk is unlikely correlated with holding periods, we find that the annualized total risk is also a function of the holding period.

We further investigate the risk-adjusted performances of flippers in the Hong Kong housing market and find a large proportion of flippers do not outperform non-flippers, which is different from the conclusions in prior studies that focus on unadjusted returns (e.g., Bayer et al., 2020; Chi et al., 2020; Zhang et al., 2023). On average, housing flippers achieve a higher unadjusted capital gain return than non-flippers in Hong Kong by 8.76 percentage points. However, after considering the higher risk of flippers, we find that among home investments with positive capital gain returns, the Sharpe ratio of investments made by flippers is surprisingly lower than that of non-flippers by 0.0836. Although this difference is small (equal to around 2% of the average Sharpe ratios), this result indicates that flippers are not obviously outperforming after considering the risk-return trade-offs. In addition, due to the lack of trading experience (Fan et al., 2023; Ling et al., 2018), novice flippers achieve a lower capital gain return than experienced flippers by 6.23 percentage points. In terms of Sharpe ratios, novice flippers perform even worse than all other types of home investors, including novice non-flippers who have similar levels of prior market trading experience.

Similar patterns are observed when we use appraisal ratios, namely the ratios of abnormal return to idiosyncratic risk, to measure homebuyers' risk-adjusted performances. Among the homebuyers who have achieved positive abnormal returns, only the experienced flippers, who constitute less than 20% of the flippers and account for no more than 5% of all homebuyers, outperform the long-term buyers in terms of appraisal ratios. In contrast, novice flippers, who constitute more than 80% of flippers, do not show an extraordinary asset-picking ability, with their appraisal ratio just merely comparable to that of novice long-term buyers and significantly lower than that of experienced long-term buyers. These findings also imply that flippers have various trading strategies (Agarwal et al., 2023; Bayer et al., 2020): Experienced flippers are more capable of arbitraging undervalued homes in the market, while novice flippers mainly earn capital gains from fast market growth but do not possess outstanding asset-picking and market timing skills.

Moreover, we find that after anti-speculation policies aggravate the limits of arbitrage and discourage flippers from entering the market, the high idiosyncratic risk originally undertaken by flippers is largely shifted to the systematic risk undertaken by long-term buyers, which demonstrates the risk-sharing role of flippers in the housing market. Specifically, since flippers provide price informativeness in the housing market (Agarwal et al., 2023; Deng et al., 2024; Fu et al., 2016; Hu et al., 2024), their exits from the market result in larger systematic risk borne by long-term buyers. In the year after the SSD took effect, systematic risk in implied capital gains, measured by the standard deviations of monthly return of the housing price index at the district level, increased by 5.02 percentage points, equal to a 22.3% increase from the average level. To strengthen causal inference, we compare districts that attracted more flippers before the policy took effect with those that attracted fewer flippers. We find that in the top 5 *ex-ante* hotspot districts for flipping transactions, there was a larger decrease in the share of flippers by 10.36 percentage points than in other districts in 1 year after the implementation of the SSD, together with a larger increase in systematic risk by 1.67 percentage points. In other words, a 1% market share of flippers can share around 0.72% of the average systematic risk. The patterns are also consistent in the top 10 *ex-ante* hotspot districts for flipping investments. These results imply that macroprudential policies targeting short-term speculations in housing markets may lead to substantial welfare losses for non-speculative home buyers.

To complete the analysis, we conduct additional studies on the mechanisms that shape the downward term structure of idiosyncratic risk in housing investments, which result in the high risk undertaken by flippers. Sagi (2021) suggests that the annualized idiosyncratic risk of real estate capital gain is decreasing with the holding period because the total idiosyncratic risk does not scale with the holding period. It is hypothesized that the idiosyncratic component of real estate capital gain is driven by the one-time shock at each transaction (i.e., purchase and reselling) time only, rather than by consecutive shocks over the holding period like in the stock market. With a larger shock to the idiosyncratic component of real estate capital gain at transaction time, a steeper term structure of annualized idiosyncratic risk is expected.

We explore two factors that influence the size of the shock, including information quality and market thinness. First, when poorer quality of information is available to evaluate the market price at the transaction time, the total idiosyncratic risk of housing capital gain is larger ceteris paribus, and its term structure is steeper. We provide both inter-market and intra-market evidence for this mechanism. Compared with the term structure of idiosyncratic risk in California's single-family housing market documented by Giacoletti (2021), we find that the term structure of idiosyncratic risk in Hong Kong's high-density apartment market has a flatter slope due to better information quality (i.e., easier to find comparable transactions). Within the Hong Kong market, we use the number of highly comparable apartment sales in the same building (or the same housing complex) during the holding period as the measurement of information quality at the transaction time (Li & Wan, 2021). We find that, given the same holding period, transactions with more comparable information will have a lower level of idiosyncratic risk and a flatter term structure. The magnitude of the impact is economically significant, as the number of comparable sales in the holding period can explain at least 62% of the associated variation in idiosyncratic risk.

The second mechanism that we explore is market thinness, as properties with fewer potential buyers and/or sellers can result in larger price dispersion and higher idiosyncratic risk. We use the introduction of the SSD as an identification for the changes in market thinness. This policy largely suppressed the supply in the market, as mainly flippers deferred their sales to avoid the additional tax (Agarwal et al., 2023; Chi et al., 2020). Meanwhile, it also impacts the demand, because flippers who still choose to resell within the lock-in period tend to transfer the costs to buyers and discourage potential buyers from accepting the deals (Zhang et al., 2023). We find that after the SSD policy takes effect, a very small group of investors continue to flip within the lock-in period, and their idiosyncratic risk substantially increases due to a thinner market. The impact is larger for flippers who are subject to a higher level of stamp duty, which further supports the mechanism of market thinness. While these two mechanisms are not mutually exclusive (i.e., properties with worse information quality are likely to be in a thinner market as well), they concurrently support the theoretical predictions in Pontiff (2006) and Sagi (2021) that market liquidity affects the level of idiosyncratic risk.

We conduct a battery of robustness checks for our results. First, we find strong positive autocorrelations of total idiosyncratic risk (i.e., not annualized) between sequential transactions of the same property. This result demonstrates that our measurement reliably captures the idiosyncratic risk at the asset level, rather than random noises incurred at each transaction. For annualized idiosyncratic risk, the autocorrelations are positive but much weaker, which supports that illiquid asset returns mainly receive idiosyncratic shocks at transaction time and do not scale with holding periods. Also, our results survive several alternative measurements of idiosyncratic risk, such as the standard deviations of abnormal returns at the district and year-month level, and the standard deviations of abnormal returns in logarithmic form (Peng & Thibodeau, 2017). Further, we use the resales of newly constructed apartment units to tease out the potential impact of unobserved renovations and capital improvements in flipping investments (Goetzmann & Spiegel, 1995). Last, we conduct subsample analyses of home investments purchased before the SSD policy took effect to address the potential policy impact on flippers' risk-adjusted performance, and our results remain robust.

This study contributes to three strands of literature. First, our study is part of the extensive literature investigating the impacts of limits of arbitrage on market efficiency, while we are among the first to extend the knowledge from stock markets to real estate markets. Past studies documented that in stock markets, limits of arbitrage are aggravated by trading constraints, information asymmetry and incomplete market participation, resulting in inefficient pricing (Allen et al., 2021; Edmans et al., 2015; Gomes et al., 2008; Gu et al., 2018). In real estate markets, limits of arbitrage are especially difficult to circumvent by specialized arbitrageurs due to the restrictions to diversification (Gabaix et al., 2007) and short selling (Ljungqvist & Qian, 2016). Using a quasi-natural experiment involving the introduction of the SSD, which is a trading constraint that limits the market participation of flippers, we reveal the impact of tightening limits of arbitrage on the systematic risk in housing markets. Our study suggests that such macroprudential policies introduced in the spirit of protecting long-term home buyers may adversely increase the market risk if the policies strengthen the limits of arbitrage.

Second, our study advances the emerging literature on flipping activities in real estate markets by evaluating their performances and trading behaviors in terms of risk-return trade-offs. Flipping transactions are prevalent in global housing markets due to high abnormal capital gain returns (LaCour-Little & Yang, 2021; Bayer et al., 2020; Zhang et al., 2023). Recent studies argue that experienced flippers, who act as middlemen, enhance market liquidity and reduce price volatility (Agarwal et al., 2023; Fu et al., 2016), while novice flippers, more likely speculators, amplify transaction volume and create momentum trading (Bayer et al., 2020; DeFusco et al., 2022). Previous research emphasizes deterring flippers, regardless of their roles and experience levels, from a regulatory perspective (Chi et al., 2020), while we offer new insights on evaluating flipping strategies from a rational investment standpoint. We show that novice flippers' speculative transactions are not justified in terms of risk-return trade-offs. Despite high capital returns, they face higher risk due to the unique term structure of risk in property markets, and their risk-adjusted performance ratios are no better than, or worse than, novice long-term investors. Thus, our results hold important implications for the decision making of investors in housing markets.

Third, our study adds to the growing literature on the term structure of idiosyncratic risk in real estate investment. Previous research, such as Flavin & Yamashita (2002) and Landvoigt et al. (2015), assumes that idiosyncratic risk of real estate capital gain follows a random walk, meaning total risk scales with the holding period, and annualized risk remains constant. However, Sagi (2021) challenges this assumption, proposing that idiosyncratic risk includes holding period-invariant shocks occurring only at transaction times, leading to a decline in annualized risk over longer holding periods. This novel theoretical model suggests that information quality and market thinness influence idiosyncratic risk, but empirical evidence remains limited. Giacoletti (2021) finds that static housing atypicality and suppressed housing demand due to lower credit supply increase annualized idiosyncratic risk. We provide new empirical support for this theory, using Hong Kong's unique urban and policy context. Instead of using cross-sectional atypicality, we measure the availability of comparable transaction data at resale time, confirming the impact of information quality. Additionally, using the introduction of transaction tax that severely affects the market liquidity of properties held by flippers (Agarwal et al., 2023; Zhang et al., 2023), we provide new supporting evidence for the channel of market thinness.

The remaining part of the paper is organized as follows. Section 2 introduces our measurements of idiosyncratic risk and the risk-adjusted performance of the home investors. Section 3 introduces our data and sample. Section 4 presents the empirical results on the term structure of idiosyncratic risk in the Hong Kong housing market, followed by the discussions on flippers' risk-adjusted performances in Section 5. Section 6 presents the analysis of flippers' risk-sharing function. Section 7 discusses the mechanisms for the term structure. Section 8 presents the results of robustness checks, and Section 9 concludes.

2. Measurement of Idiosyncratic Risk and Risk-adjusted Performance

The idiosyncratic component of house capital gain is the capital gain that is specific to each individual house resale, which is not explained by local market fluctuations and common physical characteristics across houses (Piazzesi et al., 2007). Compared to other financial assets, measuring the idiosyncratic capital gain of real estate is particularly challenging due to the heterogeneous features of real estate assets and the low liquidity of real estate markets. Some literature defines idiosyncratic risk in housing market as the standard deviation of hedonic pricing errors (e.g., Peng & Thibodeau (2017), Peng & Zhang (2021), and Simlai (2018)). Other studies, like Giacoletti (2021), use the local market index to compute the excess return over the market performance and then regress the excess return on hedonic features to obtain residuals for idiosyncratic risk calculation. In the study, we adopt both methods from these two strands of literature, with certain modifications that suit the institutional setting in the Hong Kong housing market.

2.1. Idiosyncratic Risk Using Method by Giacoletti (2021)

First, we follow the methodology in Giacoletti (2021) and use the matched property index returns during the holding period as the benchmarked market returns. We denote the corresponding abnormal return and idiosyncratic risk derived from this method as AR_G and $IdioRisk_G$, respectively. Specifically, for a home *i* purchased at time t and resold at time T, we denote its initial purchase price and the subsequent resale price as $P_{i,t}$ and $P_{i,T}$, respectively. During the holding period from t to T, the total market return (*TMR*) of all housing units comparable to unit *i* in Hong Kong is denoted as $TMR_{i,t,T}$. We obtain the total market returns using the local market indices of units in the same range of unit sizes, provided by the Rating and Valuation Department (RVD) of Hong Kong.[3] The RVD indices are derived using a hedonic approach based on the complete transactions in the market, with adjustments on property features over time (Chau et al., 2005), so they effectively capture the overall local market trends. If this home investment achieves the same capital gain appreciation as the overall market trend, the selling price should be equal to $P_{i,t} * (1 + TMR_{i,t,T})$. Accordingly, for this home investment, the total excess return (*TER*) beyond the market trend is written as below:

$$TER_{i,T} = \frac{P_{i,T} - P_{i,t} * (1 + TMR_{i,t,T})}{P_{i,t} * (1 + TMR_{i,t,T})}. \quad \text{--- (1)}$$

We transform the total excess capital gain returns into the logarithmic form and annualize it using the same rescaling method in Giacoletti (2021) and Sagi (2021). The total excess return in logarithmic form is scaled by $\sqrt{T - t}$, where $T - t$ equals the holding period in years. Accordingly, the annualized excess return beyond market trend in logarithmic form ($\log(ER_{i,T})$) is computed as:

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[3] The Hong Kong RVD residential property price index measures value changes by reference to the 'factor' of housing price divided by rateable value of the subject properties. The housing price is separated by class. The Class A index includes apartments with saleable areas under 40 m^2. The Class B index includes apartments with saleable areas between 40 m^2 and 69.9 m^2. The Class C index includes apartments with saleable areas between 70 m^2 and 99.9 m^2. The Class D index includes apartments with saleable areas between 100 m^2 and 159.9 m^2. The Class E index includes apartments with saleable areas above 160 m^2.

$$\log(ER_{i,T}) = \frac{\log(1+TER_{i,T})}{\sqrt{T-t}}. \qquad \text{--- (2)}$$

To further exclude the return components shared by common physical characteristics of the property, we follow Giacoletti (2021) and estimate the following regression equation:

$$\log(ER_{i,T}) = \beta X_{i,T} + \varphi_d + \omega_T + u_{i,T}, \qquad \text{--- (3)}$$

where $X_{i,T}$ is a set of information on physical property features, such as salable unit size, floor, building age, etc. φ_d and ω_T denotes the district and year-month fixed effects, respectively. The estimated residuals ($\hat{u}_{i,T}$) from Equation (3) represent the estimates of the idiosyncratic component of capital gains, namely the abnormal return in logarithmic form ($\log(AR_G)$):

$$\log(AR_{G,i,T}) = \hat{u}_{i,T}. \qquad \text{--- (4)}$$

Finally, we transform $\hat{u}_{i,T}$ from the logarithmic form back to the level, denoted the result as the level of abnormal return ($AR_{G,i,T}$):

$$AR_{G,i,T} = \exp(\hat{u}_{i,T}) - 1. \qquad \text{--- (5)}$$

The idiosyncratic risk of the capital gain return is computed as the standard deviation of the annualized abnormal returns ($AR_{G,i,T}$) among properties in the same district, purchased in the same year and month by investors at the same experience level ("experienced" or "novice"), and held for a similar period in length.[4] Investors are classified as experienced buyers if they have made at least two home purchases in Hong Kong before. Otherwise, they are considered novice buyers. For holding periods, we separate them into bins with incremental intervals of 6 months (i.e., 0-6 months, 7-12 months, etc.). Properties with holding periods in the same bins are deemed as having similar holding periods in length. With this approach, we obtain the level of idiosyncratic risk ($IdioRisk_G$). Notably, in some literature like Giacoletti (2021), the idiosyncratic risk is computed as the standard deviations of $\log(AR_{G,i,T})$, without transforming them back to the level. In this study, in order to achieve more interpretable regression coefficients, we follow the common practice in finance literature (e.g., Brown & Goetzmann, 1995) and use the standard deviations of abnormal returns in levels as our main results.

[4] Giacoletti (2021) has implemented two approaches to measure the risk in the idiosyncratic component of capital gains. The first approach assumes a random walk in the idiosyncratic abnormal capital gain with a zero mean, so the squared idiosyncratic capital gain should be equal to the variance of idiosyncratic capital gain ($Var(\hat{u}_{i,T}) \approx E[\hat{u}_{i,T}^2]$). We relax this assumption due to the time-variance term structure of the idiosyncratic risk and follow the second approach in Giacoletti (2021) to measure the idiosyncratic risk as the standard deviation of $\hat{u}_{i,T}$ among a certain groups of property investments.

We also use the standard deviations of $\log(AR_{G,i,T})$, denoted as $\log(IdioRisk_{G,i,T})$, in our additional robustness checks. `

We further measure the total returns and total risk of the property investments to complete the investment performance evaluation. To be comparable with the annualized abnormal return in logarithmic form, the annualized total return in logarithmic form ($\log(TR_{i,T})$) is computed as the log of the total capital gain scaled by the same factor ($\sqrt{T-t}$) introduced by Giacoletti (2021) and Sagi (2021):

$$\log(TR_{i,T}) = \frac{\log(P_{i,T}/P_{i,t})}{\sqrt{T-t}}. \qquad \text{--- (6)}$$

Then, we transform it back to the level of the annualized total return ($TR_{i,T}$). The total risk ($TotalRisk_{i,T}$) is computed as the standard deviation of the annualized total return among comparable properties in the same district, purchased in the same year and month by the same type of investors, and held for a similar period in length.

2.2. Idiosyncratic Risk Using Method by Peng & Thibodeau (2017)

The second approach we take to measure idiosyncratic risk follows the analysis in Peng & Thibodeau (2017), which is in the same spirit as a multifactor model that considers the market return and other hedonic property features as factors. To formally define the risk, we use the following log-linear model of annualized total capital gain return that includes the market return and housing features as the explanatory variables on the right-hand side:

$$\log(TR_{i,T}) = \beta_1 \log(MR_{i,t,T}) + \beta_2 X_{i,T} + \varphi_d + \omega_T + v_{i,T}. \quad \text{--- (7)}$$

$\log(TR_{i,T})$ denotes the annualized total capital gain return in logarithmic form of property *i* sold at time *T*, as derived in Equation (6). $\log(MR_{i,t,T})$ is the annualized local market return in logarithmic form during the holding period from *t* to *T*, written as below:

$$\log(MR_{i,t,T}) = \frac{\log(1+TMR_{i,t,T})}{\sqrt{T-t}}. \qquad \text{--- (8)}$$

Same as in the first method, we use the RVD price index that matches the unit size of property *i* to calculate the total market return over the holding period ($TMR_{i,t,T}$). $X_{i,T}$ is the same set of physical property features as in Equation (3). φ_d and ω_T are the district and year-month fixed effects, respectively. $v_{i,T}$ is the component of the capital gain return that cannot be explained by the market return and common property features.

We define the imputed residuals of Equation (7), $\hat{v}_{i,T}$, as the abnormal return of this property investment in logarithmic form. To differentiate it from the abnormal return that we estimate in the first method, we denote this abnormal return derived from the method by Peng & Thibodeau (2017) as log (AR_{PT}). We transform it back to the level and use the result as the abnormal return (AR_{PT}).

Last, we calculate the standard deviations of AR_{PT} among all properties located in the same district, purchased in the same month and by the same type of investors, and held for a similar period in length. The standard deviations are called the idiosyncratic risk of capital gain, denoted as $IdioRisk_{PT}$. Same as in the first method, we also calculate the standard deviations of log (AR_{PT}) as alternative measurements of idiosyncratic risk in the robustness checks, which are denoted log$(IdioRisk_{PT})$.

2.3. Risk-adjusted Performance Evaluation

Based on the methods widely adopted in the finance literature, we introduce two ratios to compare the risk-adjusted performance of flippers and other long-term investors in real estate markets. The first one is the Sharpe ratio, which measures the performance of an investment compared to a risk-free asset, after adjusting for the total risk of the investment (Sharpe, 1966). While this ratio was initially introduced for comparing mutual fund performance, it has also been adopted to measure the risk-adjusted performance of real estate assets (Fugazza et al., 2009; Lin & Liu, 2008; Shilling, 2003). This measurement seeks to characterize how well the return of a residential property that flippers (or non-flippers) invest in can compensate for the total risk they undertake. In our context of residential property investment, we define the Sharpe ratio as:

$$SharpeRatio = \frac{TR_{i,T} - Rf_{t,T}}{TotalRisk_{i,T}}. \qquad \text{---(9)}$$

Specifically, $Rf_{t,T}$ denotes annualized total risk-free return during the holding period from *t* to *T*. The total risk-free return is calculated as the annualized commutative return of the one-month deposit rate in Hong Kong during the holding period.[5]

The second risk-adjusted performance measurement we use is the appraisal ratio, defined as the abnormal return (Alpha) per unit of idiosyncratic risk (Brown & Goetzmann, 1995). This ratio is widely used to examine the skills of investors in terms of selecting assets that provide outperforming risked-adjusted abnormal returns beyond the benchmarks (e.g., Cederburg et al., 2020; Li et al., 2011). In our context, the appraisal ratio represents whether flippers are more informed than non-flippers to identify property investment opportunities that provide risk-adjusted abnormal returns. We calculate the appraisal ratios using the abnormal returns and idiosyncratic risk derived from the methods by Giacoletti (2021) and Peng & Thibodeau (2017), respectively. The formulas are as follows:

$$AppraisalRatio_G = \frac{AR_G}{IdioRisk_G} \qquad \text{---(10)}$$

$$AppraisalRatio_{PT} = \frac{AR_{PT}}{IdioRisk_{PT}} \qquad \text{---(11)}$$

3. Data and Sample

The housing transaction data we use in the study are obtained from the EPRC Limited, a data vendor that tracks the complete housing transactions lodged in the Hong Kong Land Registry.[6] Our sample period is from 1993 to 2021. The EPRC property transaction data provides information on transaction details, such as the transaction date, price, buyers' names, and sellers' names. It also contains a comprehensive list of property features, such as the property address, building construction year, floor level, salable floor area (i.e., net unit size), and the property type (e.g., residential, industrial, office, and retail properties).

We select our sample in the following steps. First, we only use the resales of residential properties that were initially purchased within our study period, enabling us to compute the capital gain returns during the holding periods. Second, we exclude resales with a holding period shorter than

[5] We use the annualized cumulative return of monthly deposit rate to match with the variations in the holding periods of property investments. We confirm that all results remain robust if we use the medium and long-term deposit rates (e.g., 6 months, 1 year, 2 years, etc.) that are best matched with the holding periods.
[6] See: http://www.eprc.com.hk.

one month, which are unlikely to be normal transactions at arm's length. Third, we drop the home buyers who purchase multiple housing units on the same day. Further, we only use the transactions of private apartment units and dropped village houses, because the village houses are subject to special transaction restrictions in Hong Kong. Last, same as in Fan et al. (2023), we only use the housing investments made in the secondary markets for our main analysis, because we aim to measure the investment-picking skills of investors without the influence of developers' unobserved selling strategies, but we use the new sale transactions in our robustness checks presented in Section 7. Our final regression sample consists of 635,038 home resales.

Table 1 presents summary statistics of the variables used in our analysis. The average transaction price equals 2.9 million Hong Kong dollars (HKD). The average size of the apartment unit equals 533 square feet (sq. ft.). The average building age in the purchase year and the average floor of the unit equal 12.8 and 16.1, respectively. The annualized capital gain return and the associated total risk are 15.41% and 11.34% on average, respectively. Using the method by Giacoletti (2021), the average abnormal return and idiosyncratic risk are computed as 0.69% and 9.32%, respectively. If using the method by Peng & Thibodeau (2017), the average abnormal return equals 0.63%, and the average idiosyncratic equals 9.27%. On average, home buyers hold the units for 5.3 years before resales. We define flippers as home buyers who hold the property for less than 2 years, and they constitute 24.7% of the home buyers in our sample. Panel B of Table 1 further compares the prices and property features of home purchases made by flippers and non-flippers. We find the flippers are more likely to invest in housing units with lower total prices and smaller unit areas than non-flippers. The target investment properties for flippers are likely to be older, on a lower floor and in a building with fewer total floors. They are also more likely to be in single-building estates and have fewer comparable units in the same building and estate.

[Insert Table 1 About Here]

Figure 1 plots the idiosyncratic risk of the housing capital gain returns as a function of holding periods. We calculate the average number of $IdioRisk_G$ and $IdioRisk_{PT}$ within bins of 6-month incremental holding periods (i.e., 0-6 months, 7-12 months, etc.), and plot the curves in Panel A and B, respectively. The term structure of idiosyncratic risk is decreasing in the holding period, with a steep decline for shorter holding periods and a slower decline as the holding period increases.

[Insert Figure 1 About Here]

We further classify the home investors based on their past trading experiences in the Hong Kong housing market. Buyers with at least two prior trading experiences are considered as experienced buyers, and the others are considered as novice buyers. Combined with the classification by holding periods, we find that on average, shares of experienced flippers, novice flippers, experienced non-flippers, and novice non-flippers are equal to 4.69%, 19.96%, 5.41%, and 69.94%, respectively. Figure 2 plots the changes in the shares of the four types of home buyers over years. It shows that the shares of the flippers in the market largely decreased after the introduction of the SSD policy, because the policy substantially increased the transaction cost of flippers who still resell within the 2-year lock-in period.

[Insert Figure 2 About Here]

Last, we compare the idiosyncratic risk of capital gains taken by the four types of housing investors, with the density plots of their idiosyncratic risk shown in Figure 3. Using either the method in Giacoletti (2021) or the method in Peng & Thibodeau (2017), we find consistent patterns that flippers bear higher level of idiosyncratic risk than non-flippers, and novice buyers further take higher risk than experienced buyers within the subgroups of flippers or non-flippers.

[Insert Figure 3 About Here]

4. Term Structure of Risk in Capital Gain Return

4.1. Idiosyncratic Risk

We start with analyzing the term structure of idiosyncratic risk for the capital gain returns in the Hong Kong housing market. Specifically, we use the following empirical model in reduced form:

$$IdioRisk_{i,T} = \beta_1 \tau_{i,T} + \beta_2 \tau_{i,T}^2 + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T}. \text{ --- (12)}$$

$IdioRisk_{i,T}$ denotes the idiosyncratic risk of the capital gain for home sales of property *i* at time *T*. As discussed in Section 2, we use the different methodologies in Giacoletti (2021) and Peng & Thibodeau (2017) to calculate this idiosyncratic component. The corresponding measurements, denoted as $IdioRisk_G$ and $IdioRisk_{PT}$, are used as the dependent variables in our empirical model, respectively.

IdioRisk$_G$ and *IdioRisk*$_{PT}$ are winsorized at the 1% level. The explanatory variable, $\tau_{i,T}$, denotes the holding period (in years) of the home seller when property *i* is sold at time *T*. Therefore, the coefficient β_1 denotes the impact of holding period on the idiosyncratic risk in capital gain return, which is expected to be negative. Same as Giacoletti (2021), we also include the squared term of the holding period ($\tau_{i,T}^2$) to capture the convex form of the term structure, so its coefficient (β_2) is expected to be positive. $X_{i,T}$ is the same set of controls for the housing features as in Equation (3). $MR_{i,t,T}$ is the level of annualized local market return. φ_d denotes the district fixed effects and ω_T denotes the year-month fixed effects. $\varepsilon_{i,T}$ is the error term. We double cluster the standard errors by district and year-month.

Panel A of Table 2 reports the regression results of Equation (12), using the idiosyncratic risk measured by the method in Giacoletti (2021) as the dependent variable. In column (1), we use the holding period in years as the explanatory variable. The result indicates that if the holding period increases by 1 year, the idiosyncratic risk of the annualized capital gain decreases by 0.61 percentage points on average. This estimate is statistically significant at the 1% level. Since the average level of idiosyncratic risk computed with this method (*IdioRisk*$_G$) is 9.3%, this transfers to a 6.56% decrease of the idiosyncratic risk from the average level. The magnitude of this average effect is relatively small, because the impact of holding period on idiosyncratic risk becomes smaller and the term structure curve becomes flatter in later years (see Figure 1).

[Insert Table 2 About Here]

In column (2), we add the squared term of the holding years in the regression. The magnitude for the negative coefficient of the holding years becomes much larger (-0.0194), and the coefficient of the squared term is positive (0.0008). Both estimates are statistically significant at the 1% level. This result confirms that the negative impact of holding period on idiosyncratic risk becomes smaller when the holding period is longer (i.e., the convexity of the term structure). Starting from the initial purchase time, the marginal impact of 1-year holding period on the idiosyncratic risk equals to around -1.86 percentage points (-0.0194+0.0008), which translates to a 20% decrease from the average level of idiosyncratic risk (9.3%).

To compare the average idiosyncratic risk taken by the short-term holders (flippers) and the long-term holders (non-flippers), we use a dummy variable ($Flipper_{i,T}$) to replace the holding years ($\tau_{i,T}$) as the explanatory variable in Equation (12). It equals to 1 if the home seller holds the property for less than 2 years. Otherwise, it equals zero. The corresponding regression results are reported in column (3) of Table 2, Panel A. We find that flippers take a higher level of idiosyncratic risk than non-flippers by 8.65 percentage points, and the estimate is statistically significant at the 1% level.

We further separate flippers (and non-flippers) by their prior trading experiences in the Hong Kong housing market and compare the level of idiosyncratic risk they take in their housing investments. Specifically, we use a set of dummy variables in Equation (12) to denote the home sellers who are experienced flippers, novice flippers, and experienced non-flippers, respectively. The base group includes the novice non-flippers. The corresponding regression results are reported in column (4). As expected, we find that experienced investors tend to choose residential properties with a lower idiosyncratic risk of capital gain. Investments of experienced non-flippers have lower idiosyncratic risk than that of novice non-flippers by 1.12 percentage points. The idiosyncratic risk taken by experienced and novice flippers is higher than those taken by novice non-flippers by 7.36 and 8.89 percentage points, respectively. The difference (1.53 percentage points) between the idiosyncratic risk taken by experienced and novice flippers is also statistically significant at the 1% level.

In Panel B of Table 2, we replicate the analysis using the idiosyncratic risk measures derived from the method by Peng & Thibodeau (2017). Our results are consistent with the ones presented in Panel A. With a longer holding period by 1 year, the idiosyncratic risk of capital gain taken by the home buyer is estimated to decrease by 0.60 percentage points on average in this method (column (1)). The marginal impact of a 1-year holding period on the idiosyncratic risk of capital gain in new home purchases is estimated to be -1.84 percentage points (columns (2)). Compared to non-flippers, the idiosyncratic risk of capital gain taken by flippers is higher by 8.56 percentage points (column (3)). The order of idiosyncratic risk level taken by the experienced and novice flippers/non-flippers is also consistent with the result obtained in Panel A, as shown in column (4).

In summary, our results confirm that the idiosyncratic risk component of capital gains in the Hong Kong housing market is a function of the holding periods and does not follow a random walk.

This result further implies that although flippers are known to achieve higher abnormal annual returns than non-flippers in many global housing markets (Agarwal et al., 2023; Bayer et al., 2020; Fu et al., 2016), their excess returns may be achieved at the cost of bearing higher risk. Therefore, analyzing the risk-adjusted performance of flippers versus non-flippers is important for understanding the actual benefits and costs of being a flipper.

4.2. Total Risk

We complete our analysis on the term structure of risk in capital gain returns in the Hong Kong housing market by extending from idiosyncratic risk to total risk. Past literature documents that idiosyncratic risk constitutes a major part of the total risk in real estate investments (e.g., Eichholtz et al., 2021), especially during earlier years in the holding period. This is consistent with the stylized facts shown in our summary statistics (see Table 1), where the average total risk is 11.34% and the average idiosyncratic risk is 9.3%. Given the term structure of idiosyncratic risk and its dominating share in total risk, it is reasonable to expect that the total risk in capital gain returns will also decrease with the holding period.

To empirically test this hypothesis, we modify Equation (12) by using the total risk as the outcome variable, and the model is specified as follows:

$$TotalRisk_{i,T} = \beta_1 \tau_{i,T} + \beta_2 \tau_{i,T}^2 + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T}. \quad \text{--- (13)}$$

Specifically, $TotalRisk_{i,T}$ denotes the total risk of the capital gain for home sales of property *i* at time T. $TotalRisk_{i,T}$ is winsorized at the 1% level. Definitions of other variables are the same as in Equation (12). The standard errors are double clustered by district and year-month.

Table 3 reports the estimation results of Equation (13). As expected, we find that the total risk in capital gain returns taken by residential property investors decreases by 0.65 percentage points with a longer holding period of 1 year on average (column (1)). This translates to a 5.73% decrease from the average total risk level (11.34%) of capital gains in the Hong Kong housing market. The magnitude also implies that the decline in total risk with holding periods most originates from the changes in idiosyncratic risk. The term structure of the total risk also follows a convex form, as shown by the results in column (2). The total risk taken by flippers is higher than that of non-flippers by 9.72 percentage points (column (3)), and the total risk taken by novice flippers is even higher than that taken by experienced flippers (column (4)). The patterns are closely tracking the ones we observed for idiosyncratic risk.

[Insert Table 3 About Here]

In summary, although flipping housing transactions may achieve high abnormal returns, their risk-adjusted performance ratios can be low. These empirical results on the term structure of total risk and idiosyncratic risk thus motivate our further analysis on flippers' Sharpe ratios and appraisal ratios.

5. Risk-adjusted Performance of Flippers

5.1. Total Return and Abnormal Return

In this section, we investigate the risk-adjusted performance of flippers. To compare with past studies like Bayer et al. (2020) and Fu et al. (2016), we start with the analysis on the actual annualized returns. We hypothesize that flippers will achieve higher annualized capital gain returns than non-flippers, similar to the findings in these past empirical works in other housing markets. Further, we hypothesize the returns of experienced flippers will be even higher than those of novice flippers. The reason is that experienced traders are expected to face lower market information asymmetry than novice traders (Fan et al., 2023). The real estate market is less efficient than the markets of other financial products in terms of price discovery due to its low liquidity, heterogeneity of properties, and high search cost (Gan, 2013; Wu & Deng, 2015). Experienced buyers are more likely to overcome market friction and achieve higher returns, because they may have observed the market for longer periods and have better access to market information, such as closer connections to local property agents (Ling et al., 2018). In the same spirit, we expect experienced non-flippers to achieve higher returns than novice non-flippers.

We use a standard hedonic approach (Rosen, 1974) to compare the returns achieved by flippers and non-flippers. The empirical models are formulated as follows:

$$Return_{i,T} = \beta_1 Flipper_{i,T} + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T}, \qquad \text{--- (14)}$$

$$Return_{i,T} = \beta_1 ExperiencedFlipper_{i,T} + \beta_2 NoviceFlipper_{i,T} + \beta_3 ExperiencedNonFlipper_{i,T} + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T}. \quad \text{--- (15)}$$

$Return_{i,T}$ denotes the annualized return of home sales for property *i* at time *T*. We use either the level of annualized total return or the level of annualized abnormal return as the outcome variables in separate regressions. $Return_{i,T}$ is winsorized at the 1% level. In Equation (14), $Flipper_{i,T}$ is a dummy variable equal to 1 if the home seller holds the property *i* for less than 2 years before reselling it at time *T*. Otherwise, $Flipper_{i,T}$ equals zero. Therefore, the coefficient β_1 represents the difference between the returns of flippers and non-flippers. In Equation (15), we further separate the home sellers into experienced flippers, novice flippers, experienced non-flippers, and novice non-flippers. We use a set of dummy variables to denote the first three groups of sellers and use novice non-flippers as the base group. $X_{i,T}$ represents the housing features. We also include the district fixed effects (φ_d) and year-month fixed effects (ω_T). Standard errors are double clustered district and year-month.

The corresponding regression results are reported in Table 4. In columns (1) and (2), we use the annualized total capital gain return as the outcome variable. The result in column (1) reveals that flippers achieve a higher total return than non-flippers by 8.76 percentage points in Hong Kong between 1993 and 2021, and the estimate is statistically significant at the 1% level.[7] Column (2) shows that novice flippers achieve higher returns than novice non-flippers by 7.53 percentage points. Experienced flippers achieve even higher returns than novice flippers by 6.23 percentage points, resulting in a total excess return of 13.76 percentage points than novice non-flippers. In contrast, experienced non-flippers only achieve a mild excess return than novice flippers by 0.66 percentage points. These estimates are also statistically significant at the 1% level.

In columns (3) and (4), we use the abnormal returns derived by the method in Giacoletti (2021) as the outcome variable. The patterns are consistent as those for the total returns. We find that flippers achieve a higher abnormal return than non-flippers by 7.89 percentage points. The abnormal returns of experienced flippers, novice flippers, and experienced non-flippers are higher than that of novice non-flippers by 12.36, 6.80, and 0.77 percentage points, respectively. In columns (5) and (6), we replicate the analyses using the abnormal returns derived by the method in Peng & Thibodeau (2017)

[7] This result is consistent with the excess total return (10.12 percentage points) of flippers in the Hong Kong housing market between 1992 and 2010, estimated by Agarwal et al. (2023).

as the outcome variable. The results are largely consistent with those reported in columns (3) and (4), indicating the robustness of our findings.

[Insert Table 4 About Here]

To conclude, our empirical findings are consistent with previous findings in other housing markets that flippers outperform non-flippers, if we only compare their annualized total or abnormal returns. Also, our results support our additional hypothesis that experienced home buyers achieve higher returns than novice home buyers.

5.2. Sharpe Ratio and Appraisal Ratio

While we find that flippers achieve higher annualized returns than non-flippers in the Hong Kong housing market, the term structure of the risk presented in Section 4 suggests that it is unclear whether flippers indeed overperform non-flippers in terms of risk-adjusted returns. In this section, we compare the Sharpe ratio and appraisal ratio between the housing investments made by flippers and non-flippers. Empirically, we modify Equations (14) and (15) as follows to conduct the regression analysis:

$$Ratio_{i,T} = \beta_1 Flipper_{i,T} + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T}, \quad \text{--- (16)}$$

$$Ratio_{i,T} = \beta_1 ExperienceFlipper_{i,T} + \beta_2 NoviceFlipper_{i,T} + \beta_3 ExperiencedNonFlipper_{i,T} + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T}. \quad \text{--- (17)}$$

Specifically, the outcome variable $Ratio_{i,T}$ denotes Sharpe ratio or appraisal ratio for the home sale of unit *i* at time *T*. $Ratio_{i,T}$ is winsorized at the 1% level. Definitions of other variables are the same as in Equations (14) and (15). We include home sales with positive total returns in the regressions for the Sharpe ratio and use home sales with positive abnormal returns in the regressions for the appraisal ratio. Standard errors are double clustered by district and year-month, as in our other models.

Table 5 reports the corresponding estimation results. In column (1), the dependent variable is the Sharpe ratio of the investments. We find that on average, the Sharpe ratio of the housing investments made by flippers is lower than that of non-flippers by 0.0836, and this estimate is statistically significant at the 1% level. However, this difference is very small in comparison to the mean (3.759) and standard deviation (5.830) of Sharpe ratios for all housing investments with positive capital gains in the market, which means that flippers' investments do not severely underperform those of non-flippers in terms of Sharpe ratio.[8] Nevertheless, unlike past studies that emphasize the substantially high total capital gain returns achieved by flippers, our study highlights the fact that those high total returns are at the cost of bearing higher total risk and there is no obvious premium in the Sharpe ratios for flippers.

[Insert Table 5 About Here]

In column (2), we further investigate the Sharpe ratios of investments made by the four groups of investors. We find that experienced non-flippers achieve the highest Sharpe ratio among the four types of investors, with a premium of 1.8622 over the base group (novice non-flippers). This translates to a higher Sharpe ratio by 49.5% and 81.5% from the mean (3.759) and median (2.285) Sharpe ratios of all housing investments with positive capital gains. The experienced flippers still outperform the novice flippers and achieve a higher Sharpe ratio by 0.8893, equivalent to 23.7% of the average level, but their Sharpe ratios are significantly lower than those of experienced non-flippers by 0.9729 (i.e., 1.8622 – 0.8893). Novice flippers have the worst Sharpe ratio performance among the four groups, with a lower ratio than novice non-flippers by 0.1857.

In columns (3) and (4), we report the regression results on the appraisal ratio of the investors, computed using the method by Giacoletti (2021). The corresponding results computed using the method by Peng & Thibodeau (2017) are reported in columns (5) and (6). Unlike the results for the Sharpe ratio, we find that after teasing out the market trends and the return components shared by common housing features, the abnormal return per unit of idiosyncratic risk for flippers is still higher than that for non-flippers by 0.1058 (column (3)) or 0.0725 (column (5)) on average. This translates to an increase in the average appraisal ratios of 9.3% or 6.2%, dependent on the choice of methods to compute the abnormal returns.

However, the high appraisal ratio of flippers on average is mostly driven by the performance of experienced flippers, who achieve a higher ratio than the base group (novice non-flippers) by 0.4201 as derived by our first method (column (4)). This difference translates to a 36.7% increase from the average appraisal ratios. In contrast, the appraisal ratio of novice flippers is significantly lower than

[8] In Internet Appendix Table IA1, we report the summary statistics of Sharpe ratios and appraisal ratios of all home investments, including those with positive or negative returns. Among all housing investments, the mean and standard deviation of the Sharpe ratio equal 1.537 and 6.894, respectively.

that of experienced non-flippers by 0.3059 (i.e., 0.3493 – 0.0434) and is only merely better than that of novice non-flippers by 0.0434 (column (4)). The difference between novice flippers and novice non-flippers is statistically significant but not economically prominent, as the magnitude only equals 3.8% of the average appraisal ratio. Also, if we use the method Peng & Thibodeau (2017), this performance difference between novice flippers and novice non-flippers further loses its statistical significance (column (6)).

In summary, these results indicate that only the experienced flippers, who have at least two prior trading experiences in the Hong Kong housing market and constitute less than 20% of the flipping trading numbers, can achieve higher appraisal ratios than all non-flippers. The appraisal ratio of novice flippers is just comparable to that of novice non-flippers and is severely worse than that of experienced long-term investors.[9]

The difference in appraisal ratio performance between experienced and novice flippers can be explained by their distinct trading strategies documented in past studies (Agarwal et al., 2023; Bayer et al., 2020). Experienced flippers with higher past trading volume are more likely to act as the middlemen in the market, who have the skills and expertise to purchase the undervalued properties below market price and can resell them above market price. The appraisal ratio, which is commonly used to evaluate an investor's asset-picking ability, directly captures this fundamental trading expertise of experienced flippers. In contrast, the novice flippers with less trading experience are mostly speculators who cannot purchase low and sell high but earn most of the returns from riding the fast market growth. Notably, using the method by Giacoletti (2021) or Peng & Thibodeau (2017), we have removed the market returns at the property-class level from the abnormal returns, so the remaining variations may come from the selection in smaller geographic scope (i.e., speculate in housing estates or districts with particularly fast price growth). The risk-adjusted return premium in this strategy, if any, will also be shared by other long-term investors in the same geographic areas, so the novice flippers do not necessarily have higher appraisal ratios than non-flippers.

[9] We confirm that the patterns are consistent across market cycles, with slightly larger differences in the risk-adjusted returns across investor types in the boom periods and smaller differences in the bust periods. These additional analysis results are available upon requests.

6. Risk-sharing Function of Flippers

In this section, we investigate the risk-sharing function of flippers in the housing market, using the introduction of the SSD policy in Hong Kong, which substantially reduced the shares of flippers in the market, as an identification. To tackle the rampant short-term speculations in the housing market, the Hong Kong government introduced the SSD on November 20, 2010, which levies an additional transaction tax equal to 5–15% of the total price for all residential properties resold within a 2-year holding period if the properties are purchased after November 20, 2010. The government suddenly announced this policy change just 1 day before the policy took effect (i.e., on November 19, 2010), which surprised the market. This policy was further tightened on October 27, 2012, with the lock-in period extended to 3 years and the tax rate increased to 10–20%. Appendix 2 reveals the changes in SSD rates due to the introduction of the policies.

We hypothesize that flippers, who undertake higher capital gain idiosyncratic risk in the housing market due to the term structure, provide liquidity and stabilize the market, thus lowering the systematic risk in capital returns (Fu et al., 2016). Therefore, when anti-speculation policies are introduced in the housing market, the exits of flippers are expected to result in larger systematic risk borne by the remaining market participants, namely the long-term buyers. In other words, the excess idiosyncratic risk originally undertaken by flippers is largely shifted to long-term buyers as an unintended outcome of the policy.

To start with, we estimate the changes in the shares of flippers and the systematic risk in implied capital gains at the district and month level after the SSD was introduced. We adopt the following empirical models:

$$ShareFlipNum_{d,t} = \beta_1 SSD_t + \beta_M Macro_t + \beta_{TN} TransNum_{d,t} + \varphi_d + \varepsilon_{d,t}. \quad \text{--- (18)}$$

$$SysRisk_{d,t} = \beta_2 SSD_t + \beta_M Macro_t + \beta_{TN} TransNum_{d,t} + \varphi_d + \varepsilon_{d,t}. \quad \text{--- (19)}$$

Specifically, in Equation (18), $ShareFlipNum_{d,t}$ refers to the share of flipping buyers in district *d* in month *t*. SSD_t is a dummy variable denoting whether the SSD policy is enacted in month *t*. Thus, the coefficient β_1 denotes the changes in the share of flippers after the SSD policy was introduced. To obtain a reliable estimate of β_1, the time fixed effects are omitted, but we control for a set of control variables in time series, including the macroeconomic control variables at the city level ($Macro_t$) like the quarterly GDP and monthly CPI, as well as the monthly transaction number in the district ($TransNum_{d,t}$). φ_d represents the district fixed effects and $\varepsilon_{d,t}$ is the error term. In Equation (19), the outcome variable is changed to the systematic risk of the implied capital gains in district *d* in month *t*, denoted as $SysRisk_{d,t}$. To measure the systematic risk, we first obtain the monthly housing price index of a district, using the actual transaction prices and adopting a hedonic model to account for the physical building features (Rosen, 1974). Then, we calculate the monthly capital gain return using the housing price index and consider the annualized standard deviation of the monthly return over a rolling 12-month window as the systematic risk. Other variables in Equation (19) are same as those in Equation (18), and the coefficient β_2 denotes the changes in systematic risk after the SSD policy was introduced. We use district-month observations in the [-1, +1] year window or the [-2, +2] years window in separate regression models, and the standard errors are clustered by district.

Table 6 reports the corresponding estimation results. In columns (1) and (2), the outcome variable is the share of flippers, while the regression sample includes district-month observations in the [-1, +1] year and the [-2, +2] year window, respectively. It reveals that in 1 year and 2 years after the enactment of the policy, the share of flippers at the district-month level decreased by 13.66 and 14.44 percentage points, respectively. In column (3), the outcome variable is changed to the systematic risk. We find that systematic risk increases by 5.02 percentage points in the year post-SSD, equivalent to a 22.3% increase from the average systematic risk level (22.50%). Similar patterns are observed if we extend to the [-2, +2] year window, as reported in column (4). These results support our hypothesis that the SSD policy resulted in the exits of flippers and increases in systematic risk.

[Insert Table 6 About Here]

To strengthen the causal inference of our results, we further exploit the variations in flippers' historical presences and compare the post-policy changes in systematic risk in districts that attracted more flippers with those that attracted fewer flippers. The assumption is that the SSD policy, which is the same policy applied for the entire city, will result in larger decreases of flippers in the historical speculation hotspots, but the policy is unlikely to correlate with variations of other latent variables across districts. Therefore, any additional changes in systematic changes in the historical speculation hotspots, relative to other districts, are caused by the larger decrease in flippers after the policy took effect. We adopt this identification strategy using the following empirical models, which are modified from Equations (18) and (19):

$$ShareFlipNum_{d,t} = \beta_1 Hotspot_d \times SSD_t + \beta_{TN} TransNum_{d,t} + \varphi_d + \omega_t + \varepsilon_{d,t}. \quad \text{--- (20)}$$

$$SysRisk_{d,t} = \beta_2 Hotspot_d \times SSD_t + \beta_{TN} TransNum_{d,t} + \varphi_d + \omega_t + \varepsilon_{d,t}. \quad \text{--- (21)}$$

$Hotspot_d$ is a dummy variable denoting the hotspot districts that attracted more flippers before the policy took effect. Specifically, we calculate the shares of flippers in the 2-year period before the SSD took effect and definite districts with the top 5 (or top 10) highest shares of flippers as the hotspots. The coefficient of the interaction term ($Hotspot_d \times SSD$) is our focus, which denotes the relative change in the hotspot districts compared to other districts. $Hotspot_d$, SSD_t, and the macroeconomic control variables at the city level ($Macro_t$) are omitted because we include district fixed effects (φ_d) and year-month fixed effects (ω_t). Definitions of other variables are same as in Equations (18)-(19).

Panel A of Table 7 presents the summary statistics for the shares of flippers before and after the policy change. It shows that decreases in shares of flippers are larger in the ex-ante speculation hotspots. In the top 5 hotspots, the share of flippers decreased by 25.76 percentage points in 2 years post-SSD, while the corresponding changes equaled 16.36 percentage points in other districts. If considering the top 10 hotspots and their counterparts, the changes equaled 24.40 and 15.58 percentage points, respectively. Panel B further quantifies this differential policy effect in curbing flippers using Equation (20). Column (1) shows that in the year post-SSD, there was a larger decrease in the shares of flippers in the top 5 hotspot districts by 10.36 percentage points, relative to other non-hotspot districts. Estimates are similar if we extend to 2 years post-SSD or focus on the top 10 hotspots, as reported in columns (2) to (4), respectively.

[Insert Table 7 About Here]

In Panel C, we report the estimation results from Equation (21), using the systematic risk in implied capital gains as the outcome variables. Column (1) reveals that the systematic risk in the top 5 hotspot districts increases by 1.67 percentage points, relative to other districts, in one year after the SSD took effect. The estimate is statistically significant at the 1% level. Considering the corresponding difference in the changes of the shares of flippers (10.36 percentage points, as in column (1) of Panel B), it implies that a 1-percentage-point increase in the share of flippers can share a systematic risk of

0.161 percentage points, equal to 0.72% of the average systematic risk level (22.50%). Columns (2) to (4) further show that the patterns are consistent if we extend to 2 years post-SSD or focus on the top 10 hotspots.

In summary, our study quantifies the risk-sharing function of short-term arbitrageurs in the housing markets. We provide novel evidence that anti-speculation policies targeting flippers can aggravate the limits of arbitrage and shut off this risk-sharing function, shifting substantial market risk to long-term home buyers, which has been largely overlooked in policymaking.

7. Additional Analysis: Mechanisms for the Term Structure of Idiosyncratic Risk

One of the key stylized facts documented in this study is that the idiosyncratic risk of annualized capital gain returns in the Hong Kong housing market has a term structure with a convex shape; that is, the idiosyncratic risk decreases with holding period and the decaying rate also decreases with holding period. This pattern of the high-density apartment market in Hong Kong complements the findings in the U.S. single-family house market documented by Giacoletti (2021) and contradicts with the random walk hypothesis in previous real estate literature (e.g., Flavin & Yamashita, 2002; Landvoigt et al., 2015). In this section, we study why the annualized idiosyncratic risk of capital gain of a given residential property decreases if the homeowner holds it for a longer period. In other words, we examine why short-term buyers bear larger annualized idiosyncratic risk than long-term buyers.

Using a structural model, Sagi (2020) provides a theoretical explanation for the term structure of idiosyncratic risk in real estate capital gains: due to search frictions and heterogeneous valuations among buyers, price dispersions are generated and realized when a transaction takes place. However, unlike other liquid financial assets that experience independent idiosyncratic shocks over time, such idiosyncratic shocks to property prices only occur at the transaction time and do not accumulate with longer holding periods. Accordingly, the annualized idiosyncratic risk becomes smaller with longer holding periods. Based on this theory, the idiosyncratic shock at the transaction time is expected to be larger when there is limited information for valuation, or when the market is thinner, resulting in steeper term structures. We examine these hypotheses in the Hong Kong housing market.

7.1. Comparable Transaction Information

The first mechanism we explore is the information quality available at transaction time. We hypothesize that, with less comparable transaction information, there are more heterogenous valuations and larger price dispersions in the market, which will raise the total idiosyncratic risk and steepen the term structure of annualized idiosyncratic risk.

We start with an inter-market analysis for this mechanism. Specifically, we compare the term structure of idiosyncratic risk in the Hong Kong housing market with that in the single-family housing market of California documented by Giacoletti (2021). Due to the high-density urban context with very similar physical features of units in the same building/estate, the apartment units in Hong Kong are expected to have more comparable transaction information for private valuations than the much more heterogeneous single-family houses in California (Li & Wan, 2021).[10] Therefore, we hypothesize that the term structure of idiosyncratic risk of single-family houses in California will have a steeper slope than that in Hong Kong.

To test this hypothesis, we use the EPRC data to replicate the analysis in Giacoletti (2021), following the same empirical specification.[11] The results are reported in Internet Appendix Table IA2. The coefficient of holding years equals to -0.0009 in the Hong Kong housing market, which is smaller in magnitude compared to the one reported in the single-family housing market of California (-0.0017). This pattern is consistent after adding the squared term of holding years in the regression, with a coefficient of -0.0038 for the holding year in Hong Kong and -0.0051 in California. Therefore, this cross-market analysis results provide support to the argument that information quality shapes the term structure of annualized idiosyncratic risk in the real estate market.

Further, we proceed to conduct an inter-market analysis for this mechanism. Giacoletti (2021) shows that the houses that are more atypical in the same ZIP codes will have higher idiosyncratic risk in their capital gain, because atypical properties have poorer information quality and are harder to be

[10] Most residential properties in Hong Kong are apartment units in a certain estate (i.e., housing complex). Units in the same estate share the common facilities and have very similar physical configurations.

[11] Unlike our empirical models that use the level of idiosyncratic risk as the outcome variable, the main objective of Table 4 in Giacoletti (2021) is to test the hypothesis of a random walk, so it uses the squared idiosyncratic capital gain ($\hat{u}_{i,T}^2$) as the outcome variable, which should be equal to the variance of idiosyncratic capital gain ($Var(\hat{u}_{i,T}) \approx E[\hat{u}_{i,T}^2]$) if the assumption of a random walk holds. To be comparable with the estimates, we follow the same empirical strategy in this additional test.

priced. Instead of considering the cross-sectional atypicality as static information quality, we hypothesize that the quality of market information available for a given property at transaction time can also be time-variant. More concretely, we assume that sellers and buyers mainly rely on comparable transactions made within the holding period to infer the capital gain of the property from its initial purchase date. Given the same holding period, properties with more comparable transactions within this holding period should have a lower level of idiosyncratic risk and a flatter term structure.

The high-density urban context of Hong Kong provides a unique institutional setting to test this hypothesis. Following Li & Wan (2021), we consider the sales of other units in the same building (or the same estate) as comparable transactions. Accordingly, we construct two variables, namely the total number of sales in the same building and in the same estate over the holding period, as the measurements for comparable information.[12]

We modify our Equation (12) as follows to empirically test our hypothesis of this mechanism:

$$IdioRisk_{i,T} = \gamma_1 Comparable_{i,t,T} + \gamma_2 Comparable_{i,t,T} \times \tau_{i,T} + \gamma_3 Comparable_{i,t,T} \times \tau_{i,T}^2 + \beta_1 \tau_{i,T} + \beta_2 \tau_{i,T}^2 + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T}. \quad \text{--- (22)}$$

$Comparable_{i,t,T}$ denotes the comparable transaction information for unit *i* accumulated from purchase time *t* to resale time *T*, which equals the total number of transactions in the same building (or estate) from *t* to *T* in the logarithmic form.[13] The coefficient γ_1 is expected to be negative, which will indicate the negative relationship between information quality and idiosyncratic risk. We further interact $Comparable_{i,t,T}$ with $\tau_{i,T}$ and $\tau_{i,T}^2$, and their coefficients (γ_2 and γ_3) are expected to be positive and negative, respectively, indicating a flatter term structure with more comparable information. Definitions of other variables are the same as in Equation (12). The standard errors are double clustered by district and year-month.

We report the corresponding estimation results in Table 8. In Panel A, the dependent variable is the idiosyncratic risk of the annualized capital gain computed by the method in Giacoletti (2021). In columns (1) to (3), the log-form number of sales in the same building is used to measure the available

[12] Some of the estates in Hong Kong may only have one building (i.e., the single-building estate), and the two measures will be equal in this case.
[13] We use log(sale number + 1) to account for the cases with zero sales during the holding period.

comparable information. We omit the squared term and all interactions in column (1) and find that among the home sales with the same length of holding periods, if the number of sales in the same building during the holding period increases by 10% (equivalent to around 9.2 transactions), the idiosyncratic risk will decrease by 0.249 percentage points. This estimate is statistically significant at the 1% level. Notably, after adding this measurement of comparable information, the coefficient of the holding period decreases from -0.0061 (in Panel A of Table 2) to -0.0023, implying that the availability of comparable transaction information in the same building can explain around 62.3% of the time-dependent variations in idiosyncratic risk.[14]

Further, column (2) reports the estimation results after the squared term of holding period is included, and column (3) reports the results from the full specification with all interactions. Across these specifications, the signs of the coefficients are consistent with our expectation, confirming that the size of the idiosyncratic shock is smaller, and the term structure becomes flatter when more comparable information is available.

[Insert Table 8 About Here]

In columns (4) to (6), we use the log-form number of sales in the same estate as the measurement of comparable information and obtain similar results. The explanatory power of sales in the same estate is lower than that of sales in the same building, because sales in the same building are likely to convey more comparable information than sales in the same estate but different buildings. A 10% increase (equivalent to around 64.1 transactions) in the number of sales in the same estate during the holding period will result in a lower idiosyncratic risk of capital gain by 0.131 percentage points (column (4)). The number of sales in the same estate can explain around 29.5% of the time-varying idiosyncratic risk, as the coefficient of the holding period changes to -0.0043. All these estimates are statistically significant at the 1% level.

Finally, we replicate the analyses using the idiosyncratic risk of the annualized capital gain computed by the method in Peng & Thibodeau (2017) as the outcome variable. The corresponding results are reported in Panel B of Table 8. We find consistent results in terms of both the magnitude of the effect and the level of statistical significance.

[14] This percentage is computed as (0.0061 – 0.0023) / 0.0061.

To conclude, our results provide supporting evidence for the mechanism of comparable information in determining the idiosyncratic risk of real estate capital gain. Notably, it advances the knowledge in Giacoletti (2021) by showing that information quality is not necessarily static.[15] Instead, the quality might be improved by accumulating information on comparable transactions during the holding period, which further shapes the term structure of idiosyncratic risk profile at the asset level.

7.2. Market Thinness

The second mechanism we propose relates to the market thinness. The total idiosyncratic risk of housing capital gain returns should be larger when the market is thinner and the pool of active buyers and sellers is smaller, resulting in a steeper term structure of the annualized idiosyncratic risk (Giacoletti, 2021). To examine the mechanism of market thinness in determining the high idiosyncratic risk taken by short-term home investors, we use the introduction of the SSD policy in Hong Kong as the shock. Our identification strategy assumes that the SSD policy provides a huge shock to the market thinness among flippers who still choose to resell within the lock-in period post the policy shock. There are two reasons for the validity of this assumption. First, although some short-term speculators will still choose to resell within the lock-in period, they will increase the listing prices and try to pass the additional stamp duty cost to potential buyers (Zhang et al., 2023). This discourages the potential buyers from accepting the deal and freezes the market liquidity from the demand side. Second, as documented in Agarwal et al. (2023), a significant proportion of short-term speculators will give up reselling within the lock-in periods, so the supply side is largely frozen as well.

Accordingly, it is hypothesized that after the introduction of the SSD, remaining flippers who choose to resell within the 2-year lock-in period will face a higher level of idiosyncratic risk in capital gain than that in the period before the SSD was introduced. Further, as Zhang et al. (2023) find that the lock-in effect on lowering transaction probability is stronger when the SSD tax rate is higher, we expect the increases in idiosyncratic risk are more prominent for properties held in 1 year (with the SSD rate of 10-15%) than those held between 1 to 2 years (with the SSD rate of 5%).

[15] In Internet Appendix Table IA3, we use the total number of units in a building (or housing complex) as a static proxy of information quality, which is in the same spirit as the cross-sectional atypicality measure in Giacoletti (2021). We confirm that the static proxy has a weaker explanatory power than our comparable information measures.

In Figure 4, we plot the term structure of idiosyncratic risk in home investments purchased in the [-2, +2] years window around the introduction of the SSD, which shows consistent patterns as we hypothesize. The line with square markers shows the term structure for home purchases made before the SSD took effect, while the line with diamond markers shows that after the SSD took effect. The idiosyncratic risk of capital gains in flipping transactions increases and the slope of the term structure steepens after the SSD took effect. Nevertheless, there is no obvious change for the majority of resales in the market that were held for more than 2 years, indicating the SSD policy has little impact on the idiosyncratic risk undertaken by other long-term buyers.

[Insert Figure 4 About Here]

We further adopt the following empirical model to formally test this hypothesis:

$$IdioRisk_{i,T} = \beta_1 Hold1Y_{i,T} + \beta_2 Hold1t2Y_{i,T} + \beta_3 Hold1Y_{i,T} \times SSD_{i,t} + \beta_4 Hold1t2_{i,T} \times SSD_{i,t} + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T}. \quad \text{--- (23)}$$

Specifically, the outcome variable is the idiosyncratic risk of capital gain for the home sale of unit *i* at selling time *T*. $Hold1Y_{i,T}$ and $Hold1t2Y_{i,T}$ are dummy variables denotes the home sales that have holding periods within 1 year and between 1 and 2 years, respectively. $SSD_{i,t}$ is a dummy variable denoting if the initial purchase date of the home sale is after the SSD policy took effect (i.e., on or after November 20, 2010). We interact $SSD_{i,t}$ with $Hold1Y_{i,T}$ and $Hold1t2Y_{i,T}$, and the coefficients of the interaction terms (β_3 and β_4) represent the changes in idiosyncratic risk for home resales in 1 years and 1-2 years due to the introduction of the SSD, respectively. The single term of $SSD_{i,t}$ is omitted in the model, as we have controlled for the time fixed effects (ω_T). Definitions of the other variables are the same as in our baseline Equation (12). Following Agarwal et al. (2023), we only include the home sales with initial purchase dates falling in the [-1, +1] year (or the [-2, +2] years) window around the SSD effective date in the regressions to remove the potential impacts of other confounding policies. The standard errors are double clustered by district and year-month.

[Insert Table 9 About Here]

The regression results are reported in Table 9. In columns (1) and (2), the outcome variables are the idiosyncratic risk measured by the method in Giacoletti (2021). Column (1) reports the results for home purchases made in the [-1, +1] year window around the SSD effective date, whereas column (2) reports the result for purchases made in the [-2, +2] years window. Consistent with our expectation, we find that after the SSD took effect, flips within 1 year will incur a higher level of idiosyncratic risk in capital gain by 10.91 to 17.39 percentage points. If flipping the property in 1 to 2 years, the idiosyncratic risk in capital gain will increase by 1.43 to 2.43 percentage points. Using the idiosyncratic risk measured by the method in Peng & Thibodeau (2017), our findings remain robust, as reported in columns (3) and (4).

Notably, although our regression results show that the idiosyncratic risk undertaken by the remaining flippers increased after the SSD took effect, the share of remaining flippers among home buyers in the market was very low (2.73% in one year and 2.37% in two years post-SSD). Meanwhile, the idiosyncratic risk undertaken by other buyers, who constitute the majority of the market share, is not largely influenced by the policy. Thus, we do not conclude that the SSD policy substantially raised the idiosyncratic risk among all market participants in the market. Instead, we emphasize that the policy shuts off the risk-sharing channel and increases the systematic risk as a cost for all market participants, as we presented in Section 6.

In summary, using the unique SSD policy shock as the identification, we provide evidence that market thinness is one mechanism that influencing the one-time shock to the total idiosyncratic risk at the transaction time. Concurrently with the mechanism of comparable market information, it shapes the term structure of the annualized idiosyncratic risk.

8. Robustness Analyses

In this section, we conduct a battery of robustness checks for our results. First, we check the consistency of our measurements in capturing the idiosyncratic risk at the asset level by testing the autocorrelations between sequential transactions of the same property. We expect that the realized idiosyncratic volatility in the preceding transaction proxies for the idiosyncratic volatility in the subsequent transaction (Hou and Loh, 2016), but the autocorrelation is expected to be strong in the full idiosyncratic volatility of each transaction and weak in their annualized terms, because the idiosyncratic risk of the illiquid asset does not scale with holding period (Sagi, 2021). The results reported in Appendix Table IA4 align with our expectation: We find that a one-percentage-point increase in the full idiosyncratic risk of the preceding transaction is associated with an over 0.4-

percentage-point increase in the full idiosyncratic risk of the subsequent transaction, but this coefficient is less than 0.03 percentage point for the annualized terms. This result also validates that our measurements are unlikely to be random noises, which should show little autocorrelations.

Second, to remove the potential skewness of risk in levels, some past literature (e.g., Peng & Thibodeau, 2017) use the standard deviations of the abnormal returns in logarithmic forms (i.e., $u_{i,T}$ in Equation (3) or $v_{i,T}$ in Equation (7)) as the idiosyncratic risk, instead of using the standard deviations of the abnormal return in levels. We use the levels of the risk in our main tests to achieve more interpretable magnitudes of regression coefficients, but we conducted robustness checks using these alternative measurements of risk in logarithmic forms. Specifically, we denote the annualized total risk in logarithmic forms as *log(TotalRisk)*. The annualized idiosyncratic risk in logarithmic forms computed by the method in Giacoletti (2021) and the method in Peng & Thibodeau (2017) are denoted as *log(IdioRisk$_G$)* log *(IdioRisk$_{PT}$)*. We replicate all our regression analyses on the term structures and mechanisms using these alternative measurements. The results are reported in Internet Appendix Tables IA5 to IA9, and all our findings remain robust.

Third, in our main analysis, we group homes by the district, purchase time, holding period, and investor experience to calculate the standard deviations of abnormal returns and derive the idiosyncratic risk, assuming the assets selected by the same types of investors and held for a similar period are comparable. As a robustness check, we relax this assumption and compute the idiosyncratic risk as the standard deviation of abnormal return among homes in the same district and purchased in the same year-month. Accordingly, we repeat all analyses using these alternative measures and find our results on term structures remain robust, as reported in Internet Appendix Table IA10.

Moreover, some past literature argues that idiosyncratic risk does not follow a random walk for short-term investors, because there are unobserved non-stochastic components like the upgrade and renovation expenses (e.g., Goetzmann & Spiegel, 1995). Giacoletti (2021) dispels this channel by controlling the renovation expenses and capital improvements. This information is not available in the EPRC data, but we use the subsample of first-hand property sales as a robustness check for the term structures, because most new apartment units sold in Hong Kong are fully furnished and it is unlikely that short-term investors spend additional costs on capital improvements in the new sales (Agarwal et al., 2023). The corresponding regression results are reported in Internet Appendix Table IA11. We find consistent patterns in the new sale market that the annualized idiosyncratic risk decreases with longer holding periods. It indicates that the term structure of idiosyncratic risk of the capital gains in the Hong Kong housing market is unlikely driven by additional capital investments of short-term investors, lending support to the robustness of our conclusion.

Last, the SSD policy not only influences the market liquidity and idiosyncratic risk taken by flippers, but also impacts the returns realized by flippers (Agarwal et al., 2023). Therefore, our main results on the risk-adjusted performance of flippers, which were estimated with the full sample in our study period, could potentially be biased by the policy effect. Accordingly, we conduct a robustness check using the subsample of home sales that were initially purchased before the introduction of the SSD policy. The corresponding results are reported in Internet Appendix Table IA12, and the patterns are generally consistent with those we find in the full sample.

9. Conclusion

When analyzing flipping activity and designing housing policies to restrict speculative flippers, we should consider not only the capital gains achieved in the flipping transactions but also the risk borne and shared by them. This study is among the first to evaluate housing flippers' performance from the perspective of risk-return trade-off and to quantify the risk-shifting to other housing market participants after the limits of arbitrage are aggravated by anti-speculation policies.

We show that flippers do generate higher capital gain returns, but they do not have superior risk-adjusted performance compared to long-term buyers, as flippers bear much higher idiosyncratic risk. Instead, only experienced flippers (constituting less than 20% of flippers) can generate good risk-adjusted performance. Using the unique urban and policy setting in Hong Kong, we show that low information quality and market thinness contribute to the high idiosyncratic risk in the housing market. Further, we estimate that a 1% market share of flippers can share around 0.72% of the market systematic risk, while the exits of flippers after the SSD policy largely shift the risk to long-term buyers. Thus, our study highlights the importance of considering the risk-sharing function of short-term housing speculators in policymaking.

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Appendix 1: Variable Definitions

Variable	Definition
Price	The transaction price before tax, in million Hong Kong dollars (HKD).
log (Price)	The transaction price before tax in logarithmic form.
TotalReturn	The annualized total capital gain return before tax.
log (TotalReturn)	The annualized total capital gain return before tax in logarithmic form.
Abnormal Return$_G$	The annualized abnormal capital gain return (alpha) before tax, measured by the method in Giacoletti (2021).
log (Abnormal Return$_G$*)*	The annualized abnormal capital gain return (alpha) before tax in logarithmic form, measured by the method in Giacoletti (2021).
Abnormal Return$_{PT}$	The annualized abnormal capital gain return (alpha) before tax, measured by the method in Peng & Thibodeau (2017).
log (Abnormal Return$_{PT}$*)*	The annualized abnormal capital gain return (alpha) before tax in logarithmic form, measured by the method in Peng & Thibodeau (2017).
TotalRisk	The total risk in the annualized total capital gain return before tax.
log (TotalRisk)	The total risk in the annualized total capital gain return before tax in logarithmic form.
IdioRisk$_G$	The idiosyncratic component of the risk in the annualized total capital gain return before tax, measured by the method in Giacoletti (2021). It is computed as the standard deviations of *Abnormal Return*$_G$ among comparable properties in the same district, purchased in the same year and month by same type of investors, and held for a similar period in length.
Next_IdioRisk$_G$	The measure of *IdioRisk*$_G$ for the subsequent transaction of the same property.
log (IdioRisk$_G$*)*	The idiosyncratic component of the risk in the annualized total capital gain return before tax in logarithmic form, measured by the method in Giacoletti (2021). It is computed as the standard deviations of *log* (*Abnormal Return*$_G$) among comparable properties in the same district, purchased in the same year and month by same type of investors, and held for a similar period in length.
IdioRisk$_{PT}$	The idiosyncratic component of the risk in the annualized total capital gain return before tax, measured by the method in Peng & Thibodeau (2017).
Next_IdioRisk$_{PT}$	The measure of *IdioRisk*$_{PT}$ for the subsequent transaction of the same property.

log (IdioRisk$_{PT}$)	The idiosyncratic component of the risk in the annualized total capital gain return before tax in logarithmic form, measured by the method in Peng & Thibodeau (2017). It is computed as the standard deviations of *log* (*Abnormal Return$_{PT}$*) among comparable properties in the same district, purchased in the same year and month by same type of investors, and held for a similar period in length.
Sharpe Ratio	The ratio of *TotalReturn* minus the annualized risk-free return to *TotalRisk*.
Appraisal Ratio$_G$	The ratio of *Abnormal Return$_G$* to *IdioRisk$_G$*.
Appraisal Ratio$_{PT}$	The ratio of *Abnormal Return$_{PT}$* to *IdioRisk$_{PT}$*.
Holding Year	The holding period of the housing investment in years.
Flipper	Home buyers who hold the property for less than 2 years.
Experienced Flipper	Home buyers who hold the property for less than 2 years and have at least two past home purchase experiences in Hong Kong before the time of purchase.
Novice Flipper	Home buyers who hold the property for less than 2 years and have fewer than two past home purchase experiences in Hong Kong before the time of purchase.
Experienced Non-flipper	Home buyers who hold the property for more than 2 years and have at least two past home purchase experiences in Hong Kong before the time of purchase.
Novice Non-flipper	Home buyers who hold the property for more than 2 years and have fewer than two past home purchase experiences in Hong Kong before the time of purchase.
Sales in Building	Number of other home sales in the same building during the holding period.
log (Sales in Building)	Number of other home sales in the same building during the holding period in logarithmic form.
Sales in Estate	Number of other home sales in the same estate (i.e., building complex) during the holding period.
log (Sales in Estate)	Number of other home sales in the same estate (i.e., building complex) during the holding period in logarithmic form.
Net Unit Size	Net sellable area of the unit in square feet.
Building Age	Age of the building at purchase time.
Unit Floor	The floor level of the unit.
Total Floor	Total number of floors in the building.

Single-building Estate	A dummy variable indicating that the estates consist of only one single building block.
Total Units in Building	Total number of apartment units in the building.
Total Units in Estate	Total number of apartment units in the estate.
Hold<1Yr	A dummy variable indicating home purchases that are held for less than 1 year before resales.
Hold1-2Yr	A dummy variable indicating home purchases that are held for 1 to 2 years before resales.
SSD	A dummy variable denoting observations after the introduction of the SSD on 20 November 2010.
Share of Flippers	Share of flippers among home buyers at the district and month level.
Systematic Risk	Systematic risk of the implied capital gains at the district and month level, measured as the annualized standard deviation of the monthly capital gain return in the housing price index over a rolling 12-month window. The monthly housing price index of a district is obtained using a hedonic model to account for the building features of the transacted units.
Top 5 Hotspots	Districts with the top 5 highest *ex-ante* shares of flipping buyers in the 2-year window before the SSD took effect.
Top 10 Hotspots	Districts with the top 10 highest *ex-ante* shares of flipping buyers in the 2-year window before the SSD took effect.
$Full\_IdioRisk_G$	The level of the idiosyncratic risk for the *non-annualized* total capital gain return in the Hong Kong residential property market, estimated using the method by Giacoletti (2021).
$Next\_Full\_IdioRisk_G$	The measure of $Full\_IdioRisk_G$ for the subsequent transaction of the same property.
$Full\_IdioRisk_{PT}$	The level of the idiosyncratic risk for the *non-annualized* total capital gain return in the Hong Kong residential property market, estimated using the method by Peng & Thibodeau (2017).
$Next\_Full\_IdioRisk_{PT}$	The measure of $Full\_IdioRisk_{PT}$ for the subsequent transaction of the same property.

Appendix 2: Special Stamp Duty Tax Rate in Hong Kong

This figure plots the special stamp duty rates for home sellers with respect to their initial purchase time and their holding periods under the SSD policy. The blue line indicates the SSD rate for homes purchased between 20 November 2010 and 26 October 2012, and the orange line indicates the SSD rate for units purchased after 27 October 2012.

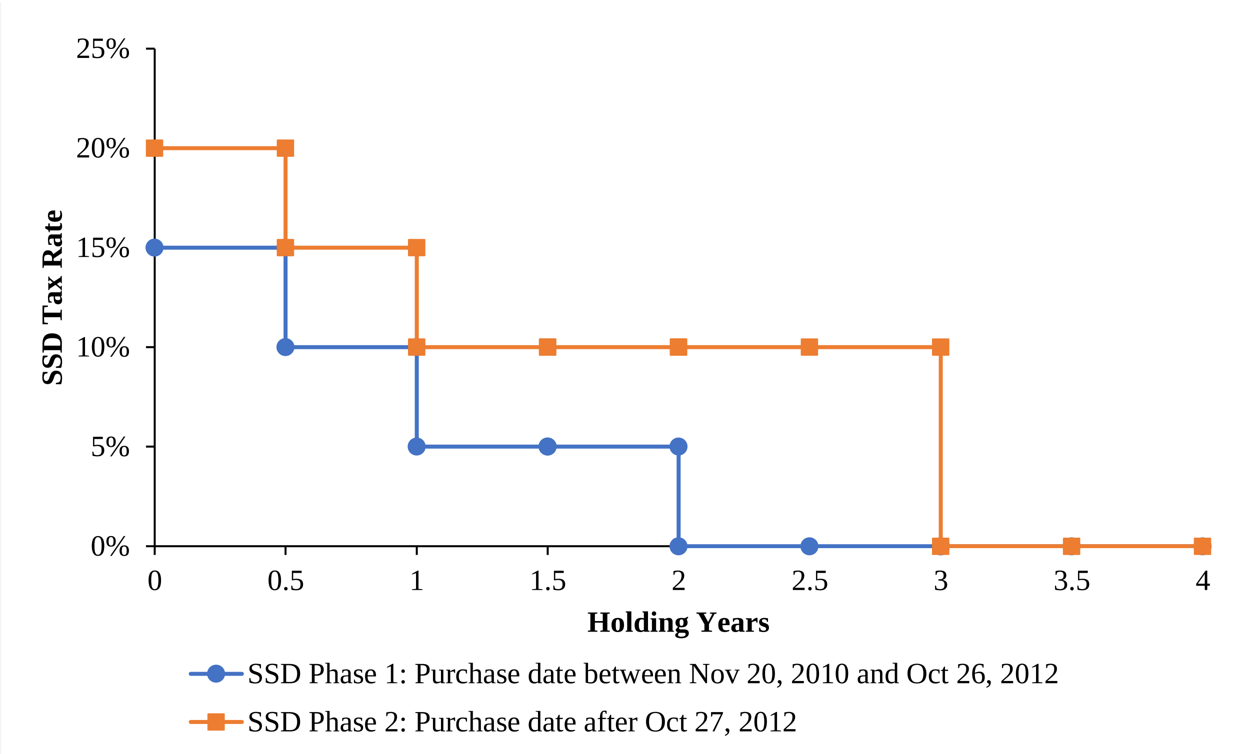
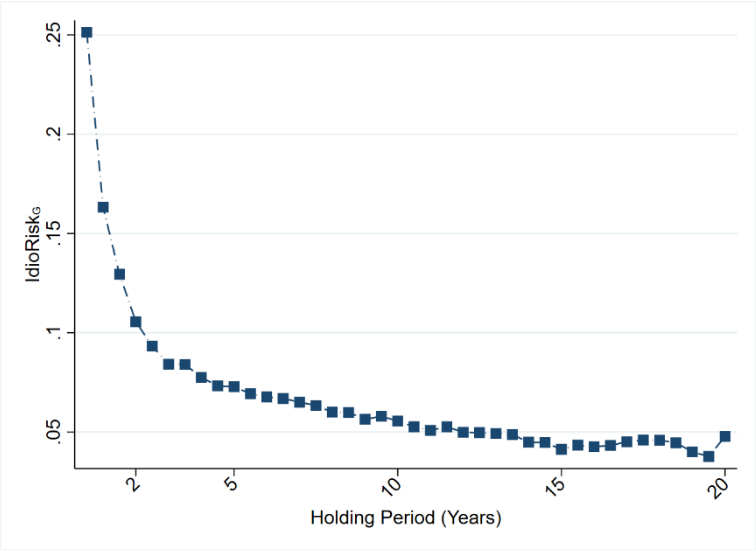


Figure 1: Idiosyncratic Risk of Capital Gain Returns and Holding Periods in the Residential Property Market

This figure plots the relationship between the idiosyncratic risk of annualized capital gain return and holding period (in years) in the Hong Kong residential property market. In Panel A, the idiosyncratic risk for the annualized capital gain return is estimated using the method by Giacoletti (2021). In Panel B, the idiosyncratic risk for the annualized capital gain return is estimated using the method by Peng & Thibodeau (2017).

Panel A. Idiosyncratic Risk Measured by Method in Giacoletti (2021)



Panel B. Idiosyncratic Risk Measured by Method in Peng & Thibodeau (2017)

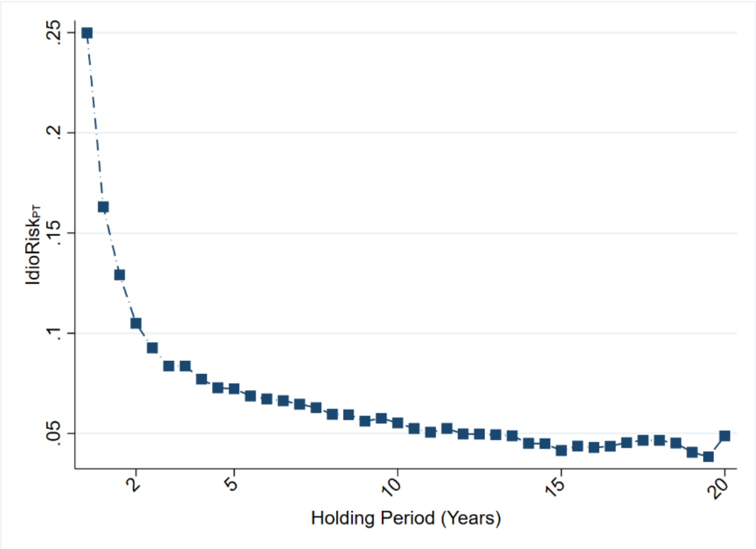


Figure 2: Shares of Buyer Types in the Residential Property Market

This figure plots the share of buyers by holding period and prior market transaction experience in the Hong Kong residential property market. *Flippers* are home buyers who hold the property for less than two years before resales, and *non-flippers* are the other home buyers who hold the property for at least 2 years before resales. *Experienced Flippers* (or *Experienced Non-flippers*) are flippers (or non-flippers) who have made at least two housing transactions in Hong Kong before. *Novice Flippers* (or *Novice Non-flippers*) are flippers (or non-flippers) who have made fewer than two housing transactions before. *SSD* refers to the Special Stamp Duty policy, which was introduced on 20 November 2010.

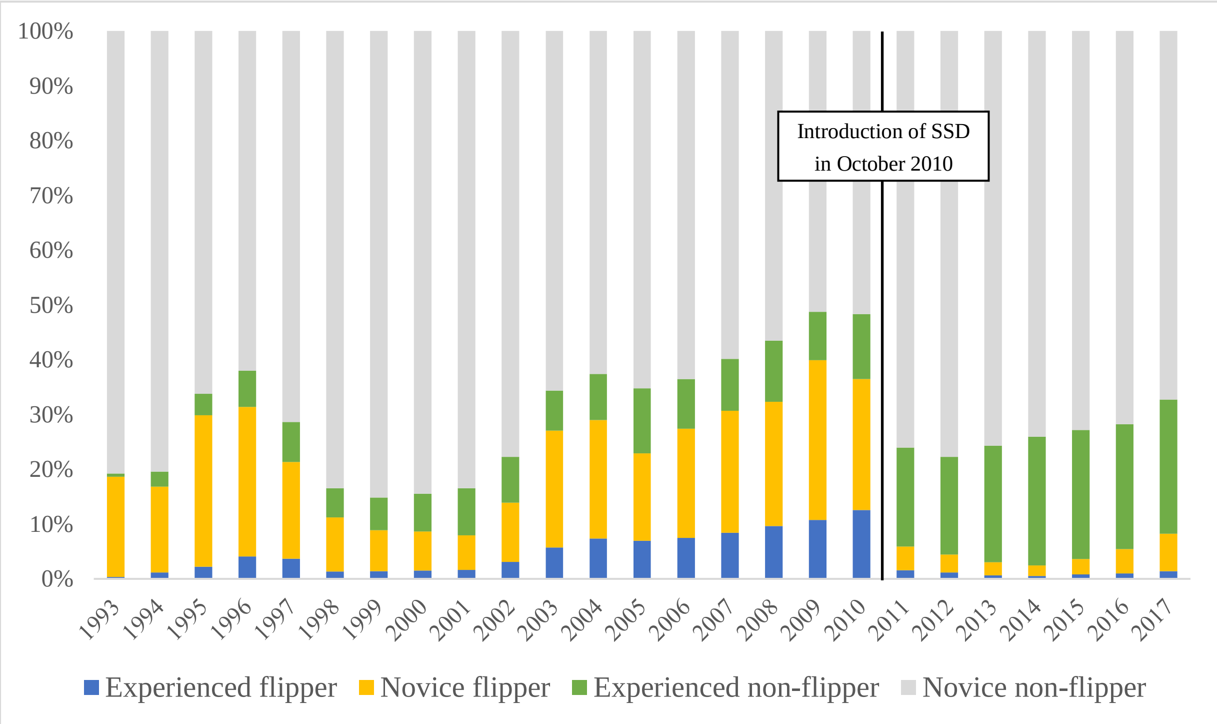
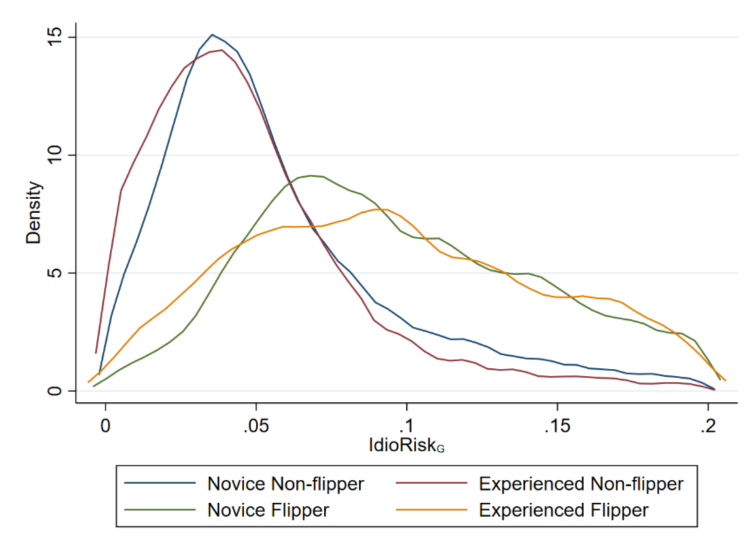


Figure 3: Distributions of Idiosyncratic Risk in Capital Gain Returns by Buyer Types

This figure plots the kernel-density distributions of the idiosyncratic risk in capital gain returns by buyer types in the Hong Kong residential property market. *Flippers* are home buyers who hold the property for less than two years before resales, and *non-flippers* are the other home buyers who hold the property for at least 2 years before resales. *Experienced Flippers* (or *Experienced Non-flippers*) are flippers (or non-flippers) who have made at least two housing transactions in Hong Kong before. *Novice Flippers* (or *Novice Non-flippers*) are flippers (or non-flippers) who have made fewer than two housing transactions before. In Panel A, the idiosyncratic risk for the annualized capital gain return is estimated using the method by Giacoletti (2021). In Panel B, the idiosyncratic risk for the annualized capital gain return is estimated using the method by Peng & Thibodeau (2017). Values over 0.2 on the x-axis are excluded from the plot.

Panel A: Idiosyncratic Risk Measured by Method in Giacoletti (2021)



Panel B: Idiosyncratic Risk Measured by Method in Peng & Thibodeau (2017)

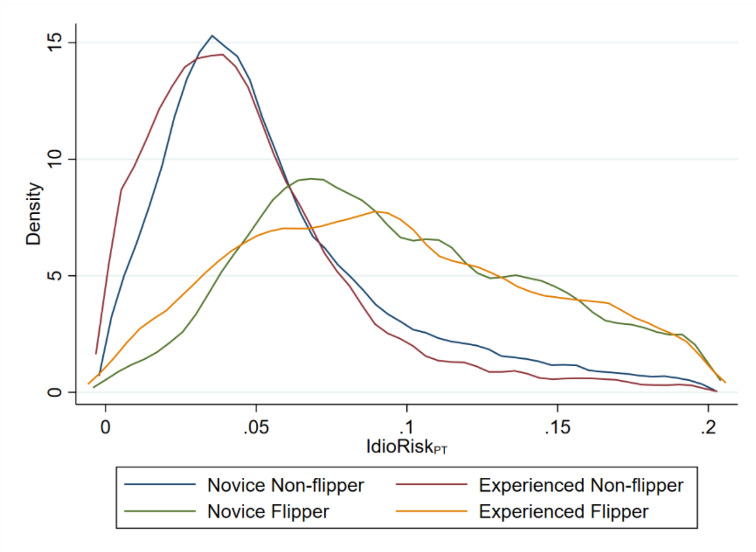
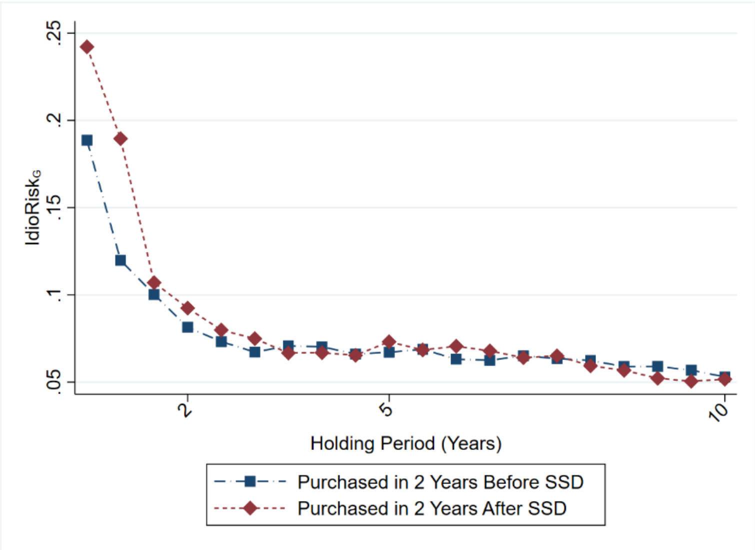


Figure 4: Term Structure of Idiosyncratic Risk Before and After the Introduction of Special Stamp Duty

This figure plots the term structure idiosyncratic risk of annualized capital gain return for home purchases made before and after the introduction of the SSD policy. In Panel A, the idiosyncratic risk for the annualized capital gain return is estimated using the method by Giacoletti (2021). In Panel B, the idiosyncratic risk for the annualized capital gain return is estimated using the method by Peng & Thibodeau (2017).

Panel A: Idiosyncratic Risk Measured by Method in Giacoletti (2021)



Panel B: Idiosyncratic Risk Measured by Method in Peng & Thibodeau (2017)

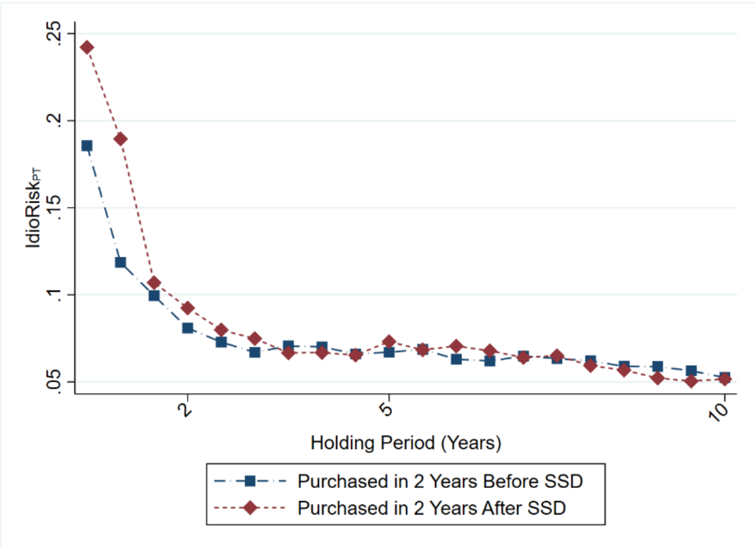


Table 1: Summary Statistics

This table presents the summary statistics of the key variables. Panel A provides the summary statistics of the variables used in regression analysis. Panel B presents the univariate test on physical features for homes purchased by flippers and non-flippers. Flippers refer to the homeowners who hold the property for less than two years before resales. Non-flippers are homeowners who hold the property for more than two years before sales. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

Panel A. Summary of Variables Used in Regressions

Variable	(1) N	(2) Mean	(3) Std. Dev.	(4) P25	(5) P50	(6) p75
Price	635,038	2.9084	2.9832	1.4200	2.1500	3.4200
log (Price)	635,038	0.8112	0.6792	0.3507	0.7655	1.2296
Net Unit Size	635,038	532.7763	234.4225	387	486	611
Building Age	635,038	12.8158	10.1693	4	11	19
Unit Floor	635,038	16.0780	11.6895	7	14	23
log (TotalReturn)	635,038	0.1218	0.2107	0.0028	0.1477	0.2609
log (Abnormal $Return_G$)	635,038	0.0002	0.1132	-0.0541	-0.0056	0.0444
log (Abnormal $Return_{PT}$)	635,038	-0.0002	0.1129	-0.0544	-0.0056	0.0438
log (TotalRisk)	635,038	0.0936	0.0932	0.0393	0.0654	0.1128
log ($IdioRisk_G$)	635,038	0.0884	0.0929	0.0352	0.0584	0.1057
log ($IdioRisk_{PT}$)	635,038	0.0880	0.0929	0.0349	0.0580	0.1052
TotalReturn	635,038	0.1541	0.2348	0.0028	0.1592	0.2981
Abnormal $Return_G$	635,038	0.0069	0.1210	-0.0527	-0.0056	0.0454
Abnormal $Return_{PT}$	635,038	0.0063	0.1204	-0.0530	-0.0056	0.0447
TotalRisk	635,038	0.1134	0.1352	0.0424	0.0739	0.1305
$IdioRisk_G$	635,038	0.0932	0.1156	0.0347	0.0578	0.1053
$IdioRisk_{PT}$	635,038	0.0927	0.1154	0.0344	0.0573	0.1048
Sharpe Ratio	477,333	3.7594	5.8302	0.9676	2.2850	4.2910
Appraisal $Ratio_G$	297,078	1.1433	1.1569	0.3330	0.8110	1.5539
Appraisal $Ratio_{PT}$	297,190	1.1670	1.2105	0.3358	0.8190	1.5683
Holding Year	635,038	5.2976	4.4468	2.0247	3.9644	7.6411
Flipper	635,038	0.2465	0.4310	0	0	0
Experienced Flipper	635,038	0.0469	0.2114	0	0	0
Novice Flipper	635,038	0.1996	0.3997	0	0	0
Experienced Non-flipper	635,038	0.0541	0.2263	0	0	0
Novice Non-flipper	635,038	0.6994	0.4585	0	1	1
Sales in Building	635,038	91.8887	102.7554	23	58	123
log (Sales in Building)	635,038	3.9268	1.2360	3.1781	4.0775	4.8203
Sales in Estate	635,038	640.8417	1023.1623	54	233	784
log (Sales in Estate)	635,038	5.2577	1.8156	4.0073	5.4553	6.6657

Panel B. Univariate Test on Physical Features of Units Purchased by Flippers and Non-flippers

	(1)	(2)	(3)	(4)	(5)	(6)
	Flippers (N=156,535)		Non-flippers (N=478,503)		t-test	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Diff in Mean	Std. Err.
Price	2.6343	2.8792	2.9981	3.0111	-0.3639***	0.0087
log (Price)	0.6891	0.6900	0.8512	0.6708	-0.1621***	0.0020
Net Unit Size	518.7952	246.9796	537.3500	229.9819	-18.5548***	0.6822
Building Age	14.6292	10.8473	12.2226	9.8654	2.4065***	0.0295
Unit Floor	14.9823	11.3115	16.4365	11.7885	-1.4542***	0.0340
Total Floor	29.1778	13.0507	30.8875	13.2327	-1.7097***	0.0384
Single-building Estate	0.3715	0.4832	0.2990	0.4578	0.0726***	0.0014
Total Units in Building	222.1265	136.4563	234.5024	135.8994	-12.3759***	0.3961
Total Units in Estate	1564.6530	1984.5643	1762.0130	2059.3442	-197.3606***	5.9433
Sales in Building	31.6317	47.1516	111.6009	108.2086	-79.9691***	0.2819
Sales in Estate	195.0397	332.7060	786.6791	1125.5362	-591.6394***	2.8852

Table 2: Term Structure of Idiosyncratic Risk for the Annualized Capital Gain Return in the Residential Property Market

This table presents the relationship between the idiosyncratic risk of annualized capital gain return and holding period (in years). In Panel A, the dependent variable $IdioRisk_G$ is the level of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Giacoletti (2021). In Panel B, the dependent variable $IdioRisk_{PT}$ is the level of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Peng & Thibodeau (2017). *Holding Year* is the property owner's holding period in years. *Flipper* is a dummy variable denoting whether the owner is a flipper (i.e., holding the property for less than two years). *Experienced Flipper* is a dummy denoting whether the owner is an experienced flipper who has made at least two housing transactions before. *Novice Flipper* is a dummy variable denoting whether the owner is a novice flipper who has made fewer than two housing transactions before. *Experienced Non-flipper* is a dummy variable denoting whether the owner is an experienced non-flipper (i.e., holding the property for more than two years) who has made at least two housing transactions before. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

Panel A. Idiosyncratic Risk Measured by Method in Giacoletti (2021)

	(1)	(2)	(3)	(4)
Dependent Variable:	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_G$
Holding Year	-0.0061***	-0.0194***		
	(0.0001)	(0.0003)		
Holding Year^2		0.0008***		
		(1.42E-05)		
Flipper			0.0865***	
			(0.0011)	
Experienced Flipper				0.0736***
				(0.0015)
Novice Flipper				0.0889***
				(0.0013)
Experienced Non-flipper				-0.0112***
				(0.0005)
Constant	0.0857***	0.1151***	0.0192***	0.0213***
	(0.0032)	(0.0032)	(0.0030)	(0.0030)
Base Group	N/A	N/A	Non-flipper	Novice Non-flipper
Property Features	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038
R-squared	0.1359	0.1699	0.1775	0.1786

Panel B. Idiosyncratic Risk Measured by Method in Peng & Thibodeau (2017)

	(1)	(2)	(3)	(4)
Dependent Variable:	$IdioRisk_{PT}$	$IdioRisk_{PT}$	$IdioRisk_{PT}$	$IdioRisk_{PT}$
Holding Year	-0.0060***	-0.0192***		
	(0.0001)	(0.0003)		
Holding Year^2		0.0008***		
		(1.42E-05)		
Flipper			0.0856***	
			(0.0011)	
Experienced Flipper				0.0723***
				(0.0015)
Novice Flipper				0.0882***
				(0.0013)
Experienced Non-flipper				-0.0112***
				(0.0005)
Constant	0.0846***	0.1137***	0.0192***	0.0214***
	(0.0032)	(0.0032)	(0.0030)	(0.0030)
Base Group	N/A	N/A	Non-flipper	Novice Non-flipper
Property Features	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038
R-squared	0.1364	0.1699	0.1778	0.1790

Table 3: Term Structure of Total Risk for the Annualized Capital Gain Return in the Residential Property Market

This table presents the relationship between the total risk of annualized capital gain return and holding period (in years). The dependent variable *TotalRisk* is the level of the total risk for the annualized capital gain return in the Hong Kong residential property market. *Holding Year* is the property owner's holding period in years. *Flipper* is a dummy variable denoting whether the owner is a flipper (i.e., holding the property for less than two years). *Experienced Flipper* is a dummy denoting whether the owner is an experienced flipper who has made at least two housing transactions before. *Novice Flipper* is a dummy variable denoting whether the owner is a novice flipper who has made fewer than two housing transactions before. *Experienced Non-flipper* is a dummy variable denoting whether the owner is an experienced non-flipper (i.e., holding the property for more than two years) who has made at least two housing transactions before. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

	(1)	(2)	(3)	(4)
Dependent Variable:	TotalRisk	TotalRisk	TotalRisk	TotalRisk
Holding Year	-0.0065***	-0.0215***		
	(0.0001)	(0.0003)		
Holding Year^2		0.0009***		
		(1.67E-05)		
Flipper			0.0972***	
			(0.0014)	
Experienced Flipper				0.0820***
				(0.0018)
Novice Flipper				0.1002***
				(0.0015)
Experienced Non-flipper				-0.0132***
				(0.0006)
Constant	0.0690***	0.1020***	-0.0021	0.0005
	(0.0039)	(0.0039)	(0.0035)	(0.0035)
Base Group	N/A	N/A	Non-flipper	Novice Non-flipper
Property Features	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038
R-squared	0.1480	0.1795	0.1899	0.1910

Table 4: Flippers' Total and Abnormal Capital Gain Returns in the Residential Property Market

This table presents the regression results on flippers' total and abnormal annualized capital gain returns. In columns (1) and (2), the dependent variable *TotalReturn* is the level of the annualized total capital gain return. In columns (3) and (4), the dependent variable *AbnormalReturn*$_G$ is the level of the annualized abnormal capital gain return, estimated using the method by Giacoletti (2021). In columns (5) and (6), the dependent variable *AbnormalReturn*$_{PT}$ is the level of the annualized abnormal capital gain return, estimated using the method by Peng & Thibodeau (2017). *Flipper* is a dummy variable denoting whether the owner is a flipper (i.e., holding the property for less than two years). *Experienced Flipper* is a dummy denoting whether the owner is an experienced flipper who has made at least two housing transactions before. *Novice Flipper* is a dummy variable denoting whether the owner is a novice flipper who has made fewer than two housing transactions before. *Experienced Non-flipper* is a dummy variable denoting whether the owner is an experienced non-flipper (i.e., holding the property for more than two years) who has made at least two housing transactions before. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	TotalReturn	TotalReturn	AbnormalReturn$_G$	AbnormalReturn$_G$	AbnormalReturn$_{PT}$	AbnormalReturn$_{PT}$
Flipper	0.0876***		0.0789***		0.0739***	
	(0.0014)		(0.0011)		(0.0011)	
Experienced Flipper		0.1376***		0.1236***		0.1165***
		(0.0022)		(0.0019)		(0.0019)
Novice Flipper		0.0753***		0.0680***		0.0635***
		(0.0013)		(0.0011)		(0.0011)
Experienced Non-flipper		0.0066***		0.0077***		0.0060***
		(0.0007)		(0.0006)		(0.0006)
Constant	-0.0563***	-0.0607***	-0.0452***	-0.0493***	-0.0457***	-0.0494***
	(0.0050)	(0.0050)	(0.0042)	(0.0042)	(0.0042)	(0.0042)
Base Group	Non-flipper	Novice Non-flipper	Non-flipper	Novice Non-flipper	Non-flipper	Novice Non-flipper
Property Features	YES	YES	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038	635,038	635,038
R-squared	0.6615	0.6641	0.1031	0.1110	0.1014	0.1086

Table 5: Flippers' Risk-adjusted Returns in the Residential Property Market

This table presents the regression results on flippers' risk-adjusted annualized capital gain returns. In columns (1) and (2), the dependent variable is the Sharpe ratio of the housing investment. In columns (3) and (4), the dependent variable is the appraisal ratio (i.e., the ratio of abnormal return to idiosyncratic risk) of the owner, calculated using the method by Giacoletti (2021). In columns (5) and (6), the dependent variable is the appraisal ratio of the owner, calculated using the method by Peng & Thibodeau (2017). Only residential property investments with positive Sharpe ratios are included in columns (1) and (2), and only the residential property investments with positive appraisal ratios are included in columns (3) to (6). *Flipper* is a dummy variable denoting whether the owner is a flipper (i.e., holding the property for less than two years). *Experienced Flipper* is a dummy denoting whether the owner is an experienced flipper who has made at least two housing transactions before. *Novice Flipper* is a dummy variable denoting whether the owner is a novice flipper who has made fewer than two housing transactions before. *Experienced Non-flipper* is a dummy variable denoting whether the owner is an experienced non-flipper (i.e., holding the property for more than two years) who has made at least two housing transactions before. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Total Return > 0		Abnormal Return$_G$ > 0		Abnormal Return$_{PT}$ > 0	
Dependent Variable:	Sharpe Ratio	Sharpe Ratio	Appraisal Ratio$_G$	Appraisal Ratio$_G$	Appraisal Ratio$_{PT}$	Appraisal Ratio$_{PT}$
Flipper	-0.0836***		0.1058***		0.0725***	
	(0.0246)		(0.0073)		(0.0076)	
Experienced Flipper		0.8893***		0.4201***		0.3902***
		(0.0380)		(0.0119)		(0.0124)
Novice Flipper		-0.1857***		0.0434***		0.0072
		(0.0260)		(0.0075)		(0.0079)
Experienced Non-flipper		1.8622***		0.3493***		0.3309***
		(0.0528)		(0.0131)		(0.0138)
Constant	1.9923***	1.5790***	1.0341***	0.9599***	1.0858***	1.0148***
	(0.1727)	(0.1723)	(0.0466)	(0.0465)	(0.0492)	(0.0490)
Base Group	Non-flipper	Novice Non-flipper	Non-flipper	Novice Non-flipper	Non-flipper	Novice Non-flipper
Property Features	YES	YES	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Observations	477,333	477,333	297,078	297,078	297,190	297,190
R-squared	0.1954	0.2022	0.0457	0.0553	0.0442	0.0526

Table 6: Impact of the Special Stamp Duty on the Systematic Risk

This table presents the regression results on the impact of the Special Stamp Duty (SSD) on the systematic risk of implied capital gains in the Hong Kong housing market. In columns (1) and (2), the dependent variable is the share of flippers among home buyers at the district and month level. In columns (3) and (4), the dependent variable is the systematic risk for implied housing capital gains in a district, measured by the standard deviation of monthly returns of the district's housing price index over the previous 12 months. The housing price index is obtained using a hedonic model of housing features. *SSD* is a dummy variable denoting the district-month observations after the introduction of the SSD on 20 November 2010. Columns (1) and (3) include observations within the [-1, +1] year around 20 November 2010. Columns (2) and (4) include observations within the [-2, +2] years around 20 November 2010. Unreported macroeconomic control variables include the quarterly GDP and monthly CPI in Hong Kong. Robust standard errors are reported in parentheses and are clustered by district. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

	(1)	(2)	(3)	(4)
	[-1, +1] year	[-2, +2] years	[-1, +1] year	[-2, +2] years
Dependent Variable:	Share of Flippers	Share of Flippers	Systematic Risk	Systematic Risk
SSD	-0.1366***	-0.1444***	0.0502***	0.0221*
	(0.0078)	(0.0070)	(0.0117)	(0.0131)
Constant	0.4285***	0.4785***	1.2880***	0.5118***
	(0.0854)	(0.0383)	(0.1574)	(0.1448)
Mean Dep. Var.	0.1032	0.1073	0.2250	0.2143
Macroeconomic Controls	YES	YES	YES	YES
Transaction Number	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	1,272	2,544	1,272	2,544
R-squared	0.7457	0.7344	0.8134	0.7158

Table 7: Heterogenous Impacts of the Special Stamp Duty on the Systematic Risk

This table presents the regression results on the heterogeneous impacts of the Special Stamp Duty (SSD) on the systematic risk of implied capital gains across districts in the Hong Kong housing market. Panel A reports the summary statistics for the share of flippers at the district-month level. The *top 5 hotspots* refer to the districts with the top 5 highest shares of flippers in the 2-year period before the SSD took effect, and the non-top 5 hotspots refer to the other districts. Similarly, the *top 10 hotspots* refer to the districts with the top 10 highest shares of flippers in the 2-year period before the SSD took effect, and the non-top 10 hotspots refer to the other districts. Panel B reports the heterogenous impacts of the SSD on the shares of flippers across districts. The dependent variable is the share of flippers among home buyers at the district and month level. Panel C reports the heterogenous impacts of the SSD on the systematic risk for implied housing capital gains across districts. The dependent variable is the standard deviation of monthly returns of the district's housing price index over the previous 12 months. The housing price index is obtained using a hedonic model of housing features. In both Panel A and B, *SSD* is a dummy variable denoting the district-month observations after the introduction of the SSD on 20 November 2010. Columns (1) and (3) include observations within the [-1, +1] year around 20 November 2010. columns (2) and (4) include observations within the [-2, +2] years around 20 November 2010. Unreported macroeconomic control variables include the quarterly GDP and monthly CPI in Hong Kong. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

Panel A: Summary Statistics for the Share of Flippers at the District-Month Level

	(1)	(2)	(3)	(4)	(5)
	Before: [-2, 0] years		After: [0, 2] years		Difference
	N	Mean	N	Mean	t-stat
Share of Flippers in Top 5 Hotspots	120	0.2915	120	0.0339	0.2576***
Share of Flippers in Non-top 5 Hotspots	1,152	0.1833	1,152	0.0197	0.1636***
Share of Flippers in Top 10 Hotspots	240	0.2766	240	0.0326	0.2440***
Share of Flippers in Non-top 10 Hotspots	1,032	0.1742	1032	0.0184	0.1558***

Panel B: Heterogeneous Impacts of the SSD on the Share of Flippers

	(1)	(2)	(3)	(4)
	[-1, +1] year	[-2, +2] years	[-1, +1] year	[-2, +2] years
Dependent Variable:	Share of Flippers	Share of Flippers	Share of Flippers	Share of Flippers
SSD × Top 5 Hotspots	-0.1036***	-0.0940***		
	(0.0068)	(0.0060)		
SSD × Top 10 Hotspots			-0.1053***	-0.0882***
			(0.0058)	(0.0047)
Constant	0.1081***	0.1117***	0.1132***	0.1156***
	(0.0014)	(0.0011)	(0.0014)	(0.0011)
Mean Dep. Var.	0.1032	0.1073	0.1032	0.1073
Macroeconomic Controls	YES	YES	YES	YES
Transaction Number	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	1,272	2,544	1,272	2,544
R-squared	0.7684	0.7590	0.7876	0.7685

Panel C: Heterogeneous Impacts of the SSD on the Systematic Risk

	(1)	(2)	(3)	(4)
	[-1, +1] year	[-2, +2] years	[-1, +1] year	[-2, +2] years
Dependent Variable:	Systematic Risk	Systematic Risk	Systematic Risk	Systematic Risk
SSD × Top 5 Hotspots	0.0167***	0.0174***		
	(0.0043)	(0.0063)		
SSD × Top 10 Hotspots			0.0114***	0.0171***
			(0.0040)	(0.0056)
Constant	0.2223***	0.2111***	0.2220***	0.2102***
	(0.0017)	(0.0016)	(0.0017)	(0.0016)
Mean Dep. Var.	0.2250	0.2143	0.2250	0.2143
Macroeconomic Controls	YES	YES	YES	YES
Transaction Number	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	1,272	2,544	1,272	2,544
R-squared	0.8554	0.7498	0.8554	0.7501

Table 8: Impact of Comparable Sales on the Term Structure of Idiosyncratic Risk

This table presents the regression results on the impact of comparable sales during holding periods on the term structure of idiosyncratic risk. In Panel A, the dependent variable $IdioRisk_G$ is the level of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Giacoletti (2021). In Panel B, the dependent variable $IdioRisk_{PT}$ is the level of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Peng & Thibodeau (2017). *log(Sales in Building)* is the logarithmic form of the number of other home sales in the same building during the holding period. *log(Sales in Estate)* is the logarithmic form of the number of other home sales in the same estate (i.e., housing complex) during the holding period. *Holding Year* is the property owner's holding period in years. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

Panel A. Idiosyncratic Risk Measured by Method in Giacoletti (2021)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_G$
Holding Year	-0.0023***	-0.0137***	-0.0536***	-0.0043***	-0.0166***	-0.0454***
	(0.0001)	(0.0002)	(0.0008)	(0.0001)	(0.0002)	(0.0006)
Holding Year^2		0.0006***	0.0026***		0.0007***	0.0021***
		(0.0000)	(0.0000)		(0.0000)	(0.0000)
log (Sales in Building)	-0.0249***	-0.0175***	-0.0349***			
	(0.0004)	(0.0004)	(0.0006)			
Holding Year × log (Sales in Building)			0.0092***			
			(0.0001)			
Holding Year^2 × log (Sales in Building)			-0.0005***			
			(0.0000)			
log (Sales in Estate)				-0.0131***	-0.0089***	-0.0220***
				(0.0002)	(0.0002)	(0.0003)
Holding Year × log (Sales in Estate)						0.0053***
						(0.0001)
Holding Year^2 × log (Sales in Estate)						-0.0003***
						(0.0000)
Constant	0.2279***	0.2085***	0.2528***	0.1263***	0.1390***	0.2082***
	(0.0043)	(0.0041)	(0.0042)	(0.0033)	(0.0033)	(0.0035)
Year-month FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038	635,038	635,038
R-squared	0.1650	0.1825	0.2082	0.1524	0.1770	0.1967

Panel B. Idiosyncratic Risk Measured by Method in Peng & Thibodeau (2017)

Dependent Variable:	(1) $IdioRisk_{PT}$	(2) $IdioRisk_{PT}$	(3) $IdioRisk_{PT}$	(4) $IdioRisk_{PT}$	(5) $IdioRisk_{PT}$	(6) $IdioRisk_{PT}$
Holding Year	-0.0023***	-0.0135***	-0.0531***	-0.0043***	-0.0164***	-0.0449***
	(0.0001)	(0.0002)	(0.0008)	(0.0001)	(0.0002)	(0.0006)
Holding Year^2		0.0006***	0.0026***		0.0007***	0.0021***
		(0.0000)	(0.0000)		(0.0000)	(0.0000)
log (Sales in Building)	-0.0247***	-0.0174***	-0.0346***			
	(0.0004)	(0.0004)	(0.0006)			
Holding Year × log (Sales in Building)			0.0091***			
			(0.0001)			
Holding Year^2 × log (Sales in Building)			-0.0005***			
			(0.0000)			
log (Sales in Estate)				-0.0130***	-0.0088***	-0.0218***
				(0.0002)	(0.0002)	(0.0003)
Holding Year × log (Sales in Estate)						0.0052***
						(0.0001)
Holding Year^2 × log (Sales in Estate)						-0.0003***
						(0.0000)
Constant	0.2256***	0.2064***	0.2503***	0.1248***	0.1375***	0.2061***
	(0.0043)	(0.0041)	(0.0042)	(0.0033)	(0.0033)	(0.0035)
Year-month FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038	635,038	635,038
R-squared	0.1651	0.1824	0.2077	0.1527	0.1769	0.1963

Table 9: Impact of Market Liquidity on the Term Structure of Idiosyncratic Risk

This table presents the regression results on the impact of market liquidity on the term structure of idiosyncratic risk, using the introduction of the Special Stamp Duty (SSD) on 20 November 2010 as the shock. In columns (1) and (2), the dependent variable $IdioRisk_G$ is the level of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Giacoletti (2021). In columns (3) and (4), the dependent variable $IdioRisk_{PT}$ is the level of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Peng & Thibodeau (2017). *Hold<1Yr* is a dummy variable indicating home purchases that are held for less than 1 year before resales. *Hold1-2Yr* is a dummy variable indicating home purchases that are held for 1 to 2 years before resales. *SSD* is a dummy variable denoting home purchases made after the introduction of the SSD on 20 November 2010. Columns (1) and (3) include the home purchases made within the [-1, +1] year around 20 November 2010. Columns (2) and (4) include the home purchases made within the [-2, +2] years around 20 November 2010. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

	(1)	(2)	(3)	(4)
	[-1, +1] year	[-2, +2] years	[-1, +1] year	[-2, +2] years
Dependent Variable:	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_{PT}$	$IdioRisk_{PT}$
Hold<1Yr	0.0595***	0.0588***	0.0589***	0.0581***
	(0.0063)	(0.0048)	(0.0062)	(0.0048)
Hold1-2Yr	0.0016	0.0096***	0.0018	0.0098***
	(0.0049)	(0.0035)	(0.0049)	(0.0035)
SSD × Hold<1Yr	0.1739***	0.1091***	0.1732***	0.1094***
	(0.0568)	(0.0373)	(0.0565)	(0.0371)
SSD × Hold1-2Yr	0.0243***	0.0143**	0.0241***	0.0142**
	(0.0088)	(0.0069)	(0.0087)	(0.0069)
Constant	0.1620***	0.1574***	0.1585***	0.1538***
	(0.0228)	(0.0149)	(0.0227)	(0.0148)
Base Group	Non-flipper	Non-flipper	Non-flipper	Non-flipper
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	54,740	101,810	54,740	101,810
R-squared	0.1514	0.1437	0.1477	0.1396

Internet Appendix A. Supplementary Tables

Table IA1: Additional Summary Statistics

This table reports the summary statistics of the risk-adjusted performance measures of the full sample.

	(1) N	(2) Mean	(3) Std. Dev.	(4) P25	(5) P50	(6) p75
Sharpe Ratio	635,038	1.5367	6.8936	-0.5122	1.3966	3.4512
Appraisal Ratio$_G$	635,038	-0.2445	1.9730	-1.0514	-0.0812	0.7337
Appraisal Ratio$_{PT}$	635,038	-0.2211	1.9595	-1.0472	-0.0805	0.7408

Table IA2: Cross-market Comparison on the Term Structure of Idiosyncratic Risk in the Housing Markets of Hong Kong and California

This table reports the cross-market comparison results on the term structure of idiosyncratic risk in the housing markets of Hong Kong and California. The outcome variable is the squared idiosyncratic capital gains (residuals $\hat{u}_{i,T}^2$ in Equation (3)). columns (1) and (2) include the EPRC data of resale housing transactions in Hong Kong between 1993 and 2021. Results in columns (3) and (4) are obtained from columns (2) and (3) of Table 4 in Giacoletti (2021), with all resales in California taking place over the period from April 1996 through December 2018. The location fixed effects are at the district level in columns (1) and (2) and are at the Zip Code level in columns (3) and (4). Robust standard errors are reported in parentheses and are double clustered by year-month and district (or Zip Code). ***, **, * indicate 1%, 5%, and 10% significance, respectively.

Dependent Variable:	(1) Hong Kong $\hat{u}_{i,T}^2$	(2) Hong Kong $\hat{u}_{i,T}^2$	(3) California $\hat{u}_{i,T}^2$	(4) California $\hat{u}_{i,T}^2$
Holding Year	-0.0009***	-0.0038***	-0.0017***	-0.0051***
	(2.21E-05)	(0.0001)	(0.0001)	(0.0003)
Holding Year^2		0.0002***		0.0003***
		(3.57E-06)		(1.62E-05)
Property Features	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	N/A	N/A
Zip Code FE	N/A	N/A	YES	YES
Observations	635,038	635,038	1,258,169	1,258,169
R-squared	0.054	0.065	0.099	0.108

Table IA3: Impact of Comparable Housing Stock on the Term Structure of Idiosyncratic Risk

This table presents the regression results on the impact of comparable housing stock during holding periods on the term structure of idiosyncratic risk. In Panel A, the dependent variable $IdioRisk_G$ is the level of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Giacoletti (2021). In Panel B, the dependent variable $IdioRisk_{PT}$ is the level of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Peng & Thibodeau (2017). *log(Units in Building)* is the logarithmic form of the total number of units in the same building during the holding period. *log(Units in Estate)* is the logarithmic form of total number of units in the same estate (i.e., housing complex) during the holding period. *Holding Year* is the property owner's holding period in years. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

Panel A. Idiosyncratic Risk Measured by Method in Giacoletti (2021)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_G$
Holding Year	-0.0061***	-0.0195***	-0.0331***	-0.0061***	-0.0195***	-0.0303***
	(0.0001)	(0.0003)	(0.0010)	(0.0001)	(0.0003)	(0.0008)
Holding Year^2		0.0008***	0.0014***		0.0008***	0.0012***
		(0.0000)	(0.0001)		(0.0000)	(0.0000)
log (Units in Building)	-0.0006**	-0.0011***	-0.0095***			
	(0.0003)	(0.0003)	(0.0008)			
Holding Year × log (Units in Building)			0.0026***			
			(0.0002)			
Holding Year^2 × log (Units in Building)			-0.0001***			
			(0.0000)			
log (Units in Estate)				-0.0010***	-0.0011***	-0.0064***
				(0.0001)	(0.0001)	(0.0004)
Holding Year × log (Units in Estate)						0.0016***
						(0.0001)
Holding Year^2 × log (Units in Estate)						-0.0001***
						(0.0000)
Constant	0.0895***	0.1221***	0.1650***	0.0891***	0.1192***	0.1540***
	(0.0037)	(0.0037)	(0.0051)	(0.0033)	(0.0033)	(0.0041)
Year-month FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038	635,038	635,038
R-squared	0.1359	0.1699	0.1708	0.1360	0.1700	0.1715

Panel B. Idiosyncratic Risk Measured by Method in Peng & Thibodeau (2017)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	$IdioRisk_{PT}$	$IdioRisk_{PT}$	$IdioRisk_{PT}$	$IdioRisk_{PT}$	$IdioRisk_{PT}$	$IdioRisk_{PT}$
Holding Year	-0.0060***	-0.0192***	-0.0329***	-0.0060***	-0.0193***	-0.0300***
	(0.0001)	(0.0003)	(0.0010)	(0.0001)	(0.0003)	(0.0008)
Holding Year^2		0.0008***	0.0014***		0.0008***	0.0012***
		(0.0000)	(0.0001)		(0.0000)	(0.0000)
log (Units in Building)	-0.0006**	-0.0011***	-0.0094***			
	(0.0003)	(0.0003)	(0.0008)			
Holding Year × log (Units in Building)			0.0026***			
			(0.0002)			
Holding Year^2 × log (Units in Building)			-0.0001***			
			(0.0000)			
log (Units in Estate)				-0.0010***	-0.0012***	-0.0064***
				(0.0001)	(0.0001)	(0.0004)
Holding Year × log (Units in Estate)						0.0016***
						(0.0001)
Holding Year^2 × log (Units in Estate)						-0.0001***
						(0.0000)
Constant	0.0885***	0.1208***	0.1635***	0.0880***	0.1179***	0.1525***
	(0.0037)	(0.0037)	(0.0051)	(0.0033)	(0.0033)	(0.0041)
Year-month FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038	635,038	635,038
R-squared	0.1364	0.1700	0.1708	0.1365	0.1700	0.1715

Table IA4: Autocorrelations of Idiosyncratic Risk Between Sequential Transactions

This table presents robustness check results on the autocorrelations of idiosyncratic risk between sequential transactions of the same property. *$Full\_IdioRisk_G$* is the level of the idiosyncratic risk for the non-annualized total capital gain return in the Hong Kong residential property market, estimated using the method by Giacoletti (2021), and *$IdioRisk_G$* is the corresponding idiosyncratic risk for the annualized capital gain return. *$Full\_IdioRisk_{PT}$* is the level of the idiosyncratic risk for the non-annualized total capital gain return in the Hong Kong residential property market, estimated using the method by Peng & Thibodeau (2017), and *$IdioRisk_{PT}$* is the corresponding idiosyncratic risk for the annualized capital gain return. *$Next\_Full\_IdioRisk_G$* (*$Next\_Full\_IdioRisk_{PT}$*, *$Next\_IdioRisk_G$*, or *$Next\_IdioRisk_{PT}$*) denotes the measure of *$Full\_IdioRisk_G$* (*$Full\_IdioRisk_{PT}$*, *$IdioRisk_G$*, or *$IdioRisk_{PT}$*) for the subsequent transaction of the same property. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

	(1)	(2)	(3)	(4)
Dependent Variable:	$Next\_Full\_IdioRisk_G$	$Next\_Full\_IdioRisk_{PT}$	$Next\_IdioRisk_G$	$Next\_IdioRisk_{PT}$
$Full\_IdioRisk_G$	0.4102***			
	(0.0928)			
$Full\_IdioRisk_{PT}$		0.4097***		
		(0.0925)		
$IdioRisk_G$			0.0279***	
			(0.0022)	
$IdioRisk_{PT}$				0.0282***
				(0.0022)
Constant	-0.2925	-0.3059	0.1071***	0.1068***
	(0.2543)	(0.2555)	(0.0051)	(0.0051)
Property Features	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	276,100	276,100	277,315	277,315
R-squared	0.0053	0.0052	0.0386	0.0389

Table IA5: Term Structure of Idiosyncratic Risk for the Annualized Capital Gain Return in the Residential Property Market – Robustness Check Using the Risk in Logarithmic Form

This table presents robustness check results on the relationship between the idiosyncratic risk of annualized capital gain return and holding period (in years). In Panel A, the dependent variable *log*($IdioRisk_G$) is the logarithmic form of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Giacoletti (2021). In Panel B, the dependent variable *log*($IdioRisk_{PT}$) is the logarithmic form of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Peng & Thibodeau (2017). *Holding Year* is the property owner's holding period in years. *Flipper* is a dummy variable denoting whether the owner is a flipper (i.e., holding the property for less than two years). *Experienced Flipper* is a dummy denoting whether the owner is an experienced flipper who has made at least two housing transactions before. *Novice Flipper* is a dummy variable denoting whether the owner is a novice flipper who has made fewer than two housing transactions before. *Experienced Non-flipper* is a dummy variable denoting whether the owner is an experienced non-flipper (i.e., holding the property for more than two years) who has made at least two housing transactions before. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

Panel A. Idiosyncratic Risk Measured by Method in Giacoletti (2021)

	(1)	(2)	(3)	(4)
Dependent Variable:	log ($IdioRisk_G$)	log ($IdioRisk_G$)	log ($IdioRisk_G$)	log ($IdioRisk_G$)
Holding Year	-0.0050***	-0.0147***		
	(0.0001)	(0.0002)		
Holding Year^2		0.0006***		
		(9.31E-06)		
Flipper			0.0653***	
			(0.0007)	
Experienced Flipper				0.0499***
				(0.0010)
Novice Flipper				0.0683***
				(0.0008)
Experienced Non-flipper				-0.0126***
				(0.0004)
Constant	0.0755***	0.0972***	0.0215***	0.0239***
	(0.0026)	(0.0026)	(0.0024)	(0.0024)
Base Group	N/A	N/A	Non-flipper	Novice Non-flipper
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038
R-squared	0.1397	0.1679	0.1716	0.1739

Panel B. Idiosyncratic Risk Measured by Method in Peng & Thibodeau (2017)

	(1)	(2)	(3)	(4)
Dependent Variable:	log ($IdioRisk_{PT}$)	log ($IdioRisk_{PT}$)	log ($IdioRisk_{PT}$)	log ($IdioRisk_{PT}$)
Holding Year	-0.0049***	-0.0147***		
	(0.0001)	(0.0002)		
Holding Year^2		0.0006***		
		(9.27E-06)		
Flipper			0.0651***	
			(0.0007)	
Experienced Flipper				0.0496***
				(0.0010)
Novice Flipper				0.0681***
				(0.0008)
Experienced Non-flipper				-0.0126***
				(0.0004)
Constant	0.0756***	0.0973***	0.0218***	0.0243***
	(0.0026)	(0.0026)	(0.0024)	(0.0024)
Base Group	N/A	N/A	Non-flipper	Novice Non-flipper
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038
R-squared	0.1395	0.1677	0.1712	0.1736

Table IA6: Term Structure of Total Risk for the Annualized Capital Gain Return in the Residential Property Market – Robustness Check Using the Risk in Logarithmic Form

This table presents robustness check results on the relationship between the total risk of annualized capital gain return and holding period (in years). The dependent variable *log(TotalRisk)* is the logarithmic form of the total risk for the annualized capital gain return in the Hong Kong residential property market. *Holding Year* is the property owner's holding period in years. *Flipper* is a dummy variable denoting whether the owner is a flipper (i.e., holding the property for less than two years). *Experienced Flipper* is a dummy denoting whether the owner is an experienced flipper who has made at least two housing transactions before. *Novice Flipper* is a dummy variable denoting whether the owner is a novice flipper who has made fewer than two housing transactions before. *Experienced Non-flipper* is a dummy variable denoting whether the owner is an experienced non-flipper (i.e., holding the property for more than two years) who has made at least two housing transactions before. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

	(1)	(2)	(3)	(4)
Dependent Variable:	log (TotalRisk)	log (TotalRisk)	log (TotalRisk)	log (TotalRisk)
Holding Year	-0.0046***	-0.0144***		
	(0.0001)	(0.0002)		
Holding Year^2		0.0006***		
		(9.20E-06)		
Flipper			0.0639***	
			(0.0007)	
Experienced Flipper				0.0479***
				(0.0011)
Novice Flipper				0.0671***
				(0.0008)
Experienced Non-flipper				-0.0132***
				(0.0005)
Constant	0.0678***	0.0894***	0.0170***	0.0196***
	(0.0027)	(0.0026)	(0.0025)	(0.0025)
Base Group	N/A	N/A	Non-flipper	Novice Non-flipper
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038
R-squared	0.1334	0.1612	0.1666	0.1691

Table IA7: Flippers' Total and Abnormal Capital Gain Returns in the Residential Property Market – Robustness Check Using the Return in Logarithmic Form

This table presents the robustness check results on flippers' total and abnormal annualized capital gain returns. In columns (1) and (2), the dependent variable *log(TotalReturn)* is the logarithmic form of the annualized total capital gain return. In columns (3) and (4), the dependent variable *log(AbnormalReturn$_G$)* is the logarithmic form of the annualized abnormal capital gain return, estimated using the method by Giacoletti (2021). In columns (5) and (6), the dependent variable *log(AbnormalReturn$_{PT}$)* is the logarithmic form of the annualized abnormal capital gain return, estimated using the method by Peng & Thibodeau (2017). *Flipper* is a dummy variable denoting whether the owner is a flipper (i.e., holding the property for less than two years). *Experienced Flipper* is a dummy denoting whether the owner is an experienced flipper who has made at least two housing transactions before. *Novice Flipper* is a dummy variable denoting whether the owner is a novice flipper who has made fewer than two housing transactions before. *Experienced Non-flipper* is a dummy variable denoting whether the owner is an experienced non-flipper (i.e., holding the property for more than two years) who has made at least two housing transactions before. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	log(TotalReturn)	log(TotalReturn)	log(AbnormalReturn$_G$)	log(AbnormalReturn$_G$)	log(AbnormalReturn$_{PT}$)	log(AbnormalReturn$_{PT}$)
Flipper	0.0703***		0.0705***		0.0660***	
	(0.0011)		(0.0011)		(0.0011)	
Experienced Flipper		0.1114***		0.1118***		0.1055***
		(0.0017)		(0.0016)		(0.0017)
Novice Flipper		0.0602***		0.0605***		0.0564***
		(0.0011)		(0.0010)		(0.0010)
Experienced Non-flipper		0.0056***		0.0085***		0.0066***
		(0.0006)		(0.0006)		(0.0005)
Constant	-0.0360***	-0.0395***	-0.0439***	-0.0478***	-0.0431***	-0.0466***
	(0.0041)	(0.0041)	(0.0040)	(0.0040)	(0.0040)	(0.0040)
Base Group	Non-flipper	Novice Non-flipper	Non-flipper	Novice Non-flipper	Non-flipper	Novice Non-flipper
Property Features	YES	YES	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038	635,038	635,038
R-squared	0.7071	0.7093	0.0916	0.0994	0.0913	0.0984

Table IA8: Impact of Comparable Sales on the Term Structure of Idiosyncratic Risk – Robustness Check Using the Risk in Logarithmic Form

This table presents the robustness check results on the impact of comparable sales during holding periods on the term structure of idiosyncratic risk. In Panel A, the dependent variable *log(IdioRisk$_G$)* is the logarithmic form of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Giacoletti (2021). In Panel B, the dependent variable *log(IdioRisk$_{PT}$)* is the logarithmic form of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Peng & Thibodeau (2017). *log(Sales in Building)* is the logarithmic form of the number of other home sales in the same building during the holding period. *log(Sales in Building)* is the logarithmic form of the number of other home sales in the same estate (i.e., housing complex) during the holding period. *Holding Year* is the property owner's holding period in years. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

Panel A. Idiosyncratic Risk Measured by Method in Giacoletti (2021)

	(1)	(2)	(3)	(4)
Dependent Variable:	log(IdioRisk$_G$)	log(IdioRisk$_G$)	log(IdioRisk$_G$)	log(IdioRisk$_G$)
Holding Year	-0.0108***	-0.0373***	-0.0127***	-0.0318***
	(0.0002)	(0.0005)	(0.0002)	(0.0004)
Holding Year^2	0.0004***	0.0018***	0.0005***	0.0015***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
log (Sales in Building)	-0.0121***	-0.0235***		
	(0.0002)	(0.0004)		
Holding Year × log (Sales in Building)		0.0061***		
		(0.0001)		
Holding Year^2 × log (Sales in Building)		-0.0003***		
		(0.0000)		
log (Sales in Estate)			-0.0062***	-0.0149***
			(0.0001)	(0.0002)
Holding Year × log (Sales in Estate)				0.0035***
				(0.0001)
Holding Year^2 × log (Sales in Estate)				-0.0002***
				(0.0000)
Constant	0.1607***	0.1900***	0.1133***	0.1592***
	(0.0030)	(0.0031)	(0.0026)	(0.0028)
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038
R-squared	0.1772	0.1946	0.1733	0.1867

Panel B. Idiosyncratic Risk Measured by Method in Peng & Thibodeau (2017)

	(1)	(2)	(3)	(4)
Dependent Variable:	log($IdioRisk_{PT}$)	log($IdioRisk_{PT}$)	log($IdioRisk_{PT}$)	log($IdioRisk_{PT}$)
Holding Year	-0.0108***	-0.0372***	-0.0127***	-0.0317***
	(0.0002)	(0.0005)	(0.0002)	(0.0004)
Holding Year^2	0.0004***	0.0018***	0.0005***	0.0014***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
log (Sales in Building)	-0.0120***	-0.0234***		
	(0.0002)	(0.0004)		
Holding Year × log (Sales in Building)		0.0060***		
		(0.0001)		
Holding Year^2 × log (Sales in Building)		-0.0003***		
		(0.0000)		
log (Sales in Estate)			-0.0062***	-0.0149***
			(0.0001)	(0.0002)
Holding Year × log (Sales in Estate)				0.0035***
				(0.0001)
Holding Year^2 × log (Sales in Estate)				-0.0002***
				(0.0000)
Constant	0.1605***	0.1896***	0.1134***	0.1591***
	(0.0030)	(0.0031)	(0.0026)	(0.0028)
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	635,038	635,038	635,038	635,038
R-squared	0.1768	0.1941	0.1730	0.1863

Table IA9: Impact of Market Liquidity on the Term Structure of Idiosyncratic Risk – Robustness Check Using the Risk in Logarithmic Form

This table presents the robustness check results on the impact of market liquidity on the term structure of idiosyncratic risk, using the introduction of the Special Stamp Duty (SSD) on 20 November 2010 as the shock. In columns (1) and (2), the dependent variable *log(IdioRisk$_G$)* is the logarithmic form of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Giacoletti (2021). In columns (3) and (4), the dependent variable *log(IdioRisk$_{PT}$)* is the logarithmic form of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Peng & Thibodeau (2017). *Hold<1Yr* is a dummy variable indicating home purchases that are held for less than 1 year before resales. *Hold1-2Yr* is a dummy variable indicating home purchases that are held for 1 to 2 years before resales. *SSD* is a dummy variable denoting home purchases made after the introduction of the SSD on 20 November 2010. columns (1) and (3) include the home purchases made within the [-1, +1] year around 20 November 2010. columns (2) and (4) include the home purchases made within the [-2, +2] years around 20 November 2010. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

	(1) [-1, +1] year log (IdioRisk$_G$)	(2) [-2, +2] years log (IdioRisk$_G$)	(3) [-1, +1] year log (IdioRisk$_{PT}$)	(4) [-2, +2] years log (IdioRisk$_{PT}$)
Hold<1Yr	0.0422***	0.0448***	0.0422***	0.0449***
	(0.0042)	(0.0035)	(0.0042)	(0.0035)
Hold1-2Yr	0.0016	0.0073***	0.0018	0.0075***
	(0.0039)	(0.0027)	(0.0039)	(0.0027)
SSD * Hold<1Yr	0.1599***	0.0966***	0.1605***	0.0974***
	(0.0437)	(0.0292)	(0.0436)	(0.0291)
SSD * Hold1-2Yr	0.0162**	0.0112*	0.0161**	0.0112*
	(0.0070)	(0.0059)	(0.0069)	(0.0059)
Constant	0.1264***	0.1309***	0.1267***	0.1310***
	(0.0199)	(0.0134)	(0.0199)	(0.0134)
Base Group	Non-flipper	Non-flipper	Non-flipper	Non-flipper
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	54,740	101,810	54,740	101,810
R-squared	0.1211	0.1192	0.1204	0.1186

Table IA10: Term Structure of Idiosyncratic Risk for the Annualized Capital Gain Return in the Residential Property Market – Robustness Check Using Standard Deviations by District and Purchase Time

This table presents robustness check results on the relationship between the idiosyncratic risk of annualized capital gain return and holding period (in years), with the idiosyncratic risk calculated as the standard deviations of abnormal returns of homes in the same district and purchased in the same year and month. In Panel A, the dependent variable $IdioRisk_G$ is the level of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Giacoletti (2021). In Panel B, the dependent variable $IdioRisk_{PT}$ is the level of the idiosyncratic risk for the annualized capital gain return in the Hong Kong residential property market, estimated using the method by Peng & Thibodeau (2017). *Holding Year* is the property owner's holding period in years. *Flipper* is a dummy variable denoting whether the owner is a flipper (i.e., holding the property for less than two years). *Experienced Flipper* is a dummy denoting whether the owner is an experienced flipper who has made at least two housing transactions before. *Novice Flipper* is a dummy variable denoting whether the owner is a novice flipper who has made fewer than two housing transactions before. *Experienced Non-flipper* is a dummy variable denoting whether the owner is an experienced non-flipper (i.e., holding the property for more than two years) who has made at least two housing transactions before. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

Panel A. Idiosyncratic Risk Measured by Method in Giacoletti (2021)

	(1)	(2)	(3)	(4)
Dependent Variable:	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_G$
Holding Year	-0.0005***	-0.0019***		
	(0.0002)	(0.0005)		
Holding Year^2		0.0001***		
		(0.0000)		
Flipper			0.0102***	
			(0.0021)	
Experienced Flipper				0.0075**
				(0.0035)
Novice Flipper				0.0109***
				(0.0022)
Experienced Non-flipper				-0.0004
				(0.0023)
Constant	0.2338***	0.2375***	0.2288***	0.2293***
	(0.0202)	(0.0200)	(0.0203)	(0.0203)
Base Group	N/A	N/A	Non-flipper	Novice Non-flipper
Property Features	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	792,352	792,352	792,352	792,352
R-squared	0.0854	0.0854	0.0855	0.0855

Panel B. Idiosyncratic Risk Measured by Method in Peng & Thibodeau (2017)

	(1)	(2)	(3)	(4)
Dependent Variable:	$IdioRisk_{PT}$	$IdioRisk_{PT}$	$IdioRisk_{PT}$	$IdioRisk_{PT}$
Holding Year	-0.0005***	-0.0019***		
	(0.0002)	(0.0005)		
Holding Year^2		0.0001***		
		(0.0000)		
Flipper			0.0102***	
			(0.0021)	
Experienced Flipper				0.0073**
				(0.0035)
Novice Flipper				0.0109***
				(0.0022)
Experienced Non-flipper				-0.0004
				(0.0022)
Constant	0.2319***	0.2355***	0.2269***	0.2274***
	(0.0201)	(0.0200)	(0.0202)	(0.0202)
Base Group	N/A	N/A	Non-flipper	Novice Non-flipper
Property Features	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	792,352	792,352	792,352	792,352
R-squared	0.0863	0.0863	0.0863	0.0863

Table IA11: Term Structure of Idiosyncratic Risk for the Annualized Capital Gain Return in the Residential Property Market – Robustness Checks using New Sale Units

This table presents robustness check results on the relationship between the idiosyncratic risk of annualized capital gain return and holding period (in years). The sample includes only the firsthand new sales in the Hong Kong housing market. In columns (1) and (2), the dependent variable $IdioRisk_G$ is the level of the idiosyncratic risk for the annualized capital gain return, estimated using the method by Giacoletti (2021). In columns (3) and (4), the dependent variable $IdioRisk_{PT}$ is the level of the idiosyncratic risk for the annualized capital gain return, estimated using the method by Peng & Thibodeau (2017). *Holding Year* is the property owner's holding period in years. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

	(1)	(2)	(3)	(4)
Dependent Variable:	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_{PT}$	$IdioRisk_{PT}$
Holding Year	-0.0032***	-0.0094***	-0.0031***	-0.0092***
	(0.0001)	(0.0007)	(0.0001)	(0.0007)
Holding Year^2		0.0003***		0.0003***
		(2.89E-05)		(2.82E-05)
Constant	0.0147*	0.0413***	0.0147*	0.0408***
	(0.0088)	(0.0096)	(0.0086)	(0.0094)
Property Features	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	137,588	137,588	137,588	137,588
R-squared	0.2952	0.3047	0.2890	0.2985

Table IA12: Flippers' Risk-adjusted Returns in the Residential Property Market – Robustness Checks Using Home Purchases Before the Introduction of the SSD Policy

This table presents the robustness check results on flippers' risk-adjusted annualized capital gain returns. The sample includes only the home investments that were initially purchased before the SSD policy took effect (i.e., before November 20, 2010). In columns (1) and (2), the dependent variable is the Sharpe ratio of the housing investment. In columns (3) and (4), the dependent variable is the appraisal ratio (i.e., the ratio of abnormal return to idiosyncratic risk) of the owner, calculated using the method by Giacoletti (2021). In columns (5) and (6), the dependent variable is the appraisal ratio of the owner, calculated using the method by Peng & Thibodeau (2017). Only residential property investments with positive Sharpe ratios are included in columns (1) and (2), and only residential property investments with positive appraisal ratios are included in columns (3) to (6). *Flipper* is a dummy variable denoting whether the owner is a flipper (i.e., holding the property for less than two years). *Experienced Flipper* is a dummy denoting whether the owner is an experienced flipper who has made at least two housing transactions before. *Novice Flipper* is a dummy variable denoting whether the owner is a novice flipper who has made fewer than two housing transactions before. *Experienced Non-flipper* is a dummy variable denoting whether the owner is an experienced non-flipper (i.e., holding the property for more than two years) who has made at least two housing transactions before. Robust standard errors are reported in parentheses and are clustered by district and year-month. ***, **, * indicate 1%, 5%, and 10% significance, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Total Return > 0		Abnormal Return$_{G}$ > 0		Abnormal Return$_{PT}$ > 0	
Dependent Variable:	Sharpe Ratio	Sharpe Ratio	Appraisal Ratio$_{G}$	Appraisal Ratio$_{G}$	Appraisal Ratio$_{PT}$	Appraisal Ratio$_{PT}$
Flipper	-0.1080***		0.0912***		0.0629***	
	(0.0237)		(0.0074)		(0.0078)	
Experienced Flipper		0.8184***		0.4002***		0.3721***
		(0.0374)		(0.0121)		(0.0127)
Novice Flipper		-0.2023***		0.0290***		-0.0005
		(0.0247)		(0.0076)		(0.0080)
Experienced Non-flipper		1.9196***		0.3355***		0.3277***
		(0.0678)		(0.0177)		(0.0188)
Constant	1.4586***	1.1499***	1.0396***	0.9755***	1.0811***	1.0187***
	(0.1777)	(0.1772)	(0.0494)	(0.0493)	(0.0524)	(0.0522)
Base Group	Non-flipper	Novice Non-flipper	Non-flipper	Novice Non-flipper	Non-flipper	Novice Non-flipper
Property Features	YES	YES	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Observations	402,798	402,798	251,793	251,793	251,814	251,814
R-squared	0.2116	0.2176	0.0469	0.0556	0.0462	0.0539