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

Quan Gan*
University of Sydney
Wayne Xinwei Wan
Monash University
Ke Xu
University of Hong Kong

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Motivation (1)

The failure of Zillow's home-flipping business

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Zillow's Shuttered Home-Flipping Business Lost $881 Million in 2021

Real-estate company says in a letter to shareholders that it is targeting revenue of $5 billion by 2025

By *Will Parker* Follow

Zillow, facing big losses, quits flipping houses and will lay off a quarter of its staff.

The real estate website had been relying on its algorithm that estimates home values to buy and resell homes. That part of its business lost about $420 million in three months.

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Motivation (2)

- **Government regulation focuses on capital gain and transaction cost.**
  - The economic function of short-term investors in the real estate market attracts substantial attention from the recent literature (e.g., Wong et al., 2022; Fu et al., 2016; Leung & Tse, 2017; Bayer et al., 2020; Agarwal et al., 2023).
  - Most government attempts to regulate flipping only emphasize the high capital gains by flippers.
  - Important knowledge gaps exist regarding the risk of flipping housing investments. It remains unclear whether housing flippers outperform in terms of risk-adjusted returns.

- **Little is known about flippers' potential risk-sharing roles in real estate market.**
  - According to the limits of arbitrage theory (Gabaix et al., 2007; Shleifer & Vishny, 1997), macroprudential policies that curtail housing flippers may adversely increase the limits of arbitrage in the market, shut off flippers' risk-sharing function, and thus result in larger market risk.

Research Question

- Evaluate flippers' performance from the perspective of risk-return trade-off, and in particular we focus on idiosyncratic risk

- Investigate the risk-sharing function of flippers and quantify their impacts on lowering systematic risk

Main findings

- We confirm a downward and convex term structure of idiosyncratic risk (risk versus holding time) in Hong Kong real estate market. Flippers bear substantial idiosyncratic risk compared to long-term buyers. Although flippers obtained higher annualized returns than long-term buyers by 8.76 percentage points on average, flippers are not obviously outperforming after considering the risk-return trade-offs.

- Only the experienced flippers, constituting less than 20% of the flippers, can generate high risk-adjusted returns.

- After anti-speculation policies, 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.

- Moreover, we provide new empirical evidence that information quality and market thinness explain the downward term structure of idiosyncratic risk.

- Implication: government regulations targeting flippers, emphasizing capital gain, and focusing on transaction cost, may adversely impact the efficiency of the housing market.

Contributions to literature

1. Our study extends literature investigating the impacts of limits of arbitrage on market efficiency in the housing market.

- This paper is among the first to extend the knowledge from stock markets to real estate 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.

2. It is among the first to evaluate the performance and trading behaviors of flippers in terms of risk-return trade-offs.

- This paper provides new insights on evaluating flipping strategies.
- Our results hold important implications for the decision-making of investors in housing markets.

3. Our paper contributes to the growing literature on the term structure of idiosyncratic risk (downward and convex slope of risk versus holding time) in real estate investment.

- Some follow the standard framework in financial economics and assume that idiosyncratic risk follow a random walk (e.g., Flavin & Yamashita, 2002; Landvoigt et al., 2015).
- Recent studies reject this hypothesis (Sagi 2021; Giacoletti 2021; Eichholtz et al., 2021).
- Our study contributes significantly to the mechanism and consequence of the downward-sloping term structure.

Definitions

- **Definitions of Experienced buyers or Novice buyers**
- Experienced: at least two home purchases experiences in Hong Kong before.
- Novice: fewer than two home purchased experiences in Hong Kong before.

- **Definitions of Flippers (Bayer et al., 2020)**
- Flipper: property buyer who hold the property for less than two years.

Measurement of Idiosyncratic Risk (1)

We adopt two strands of literature to measure the idiosyncratic risk.

1. **Idiosyncratic Risk using Method by Giacoletti (2021)**

1) **Compute the excess return over the market performance**

the total excess return (*TER*) beyond the market trend is written as below:

$$TER_{i,T} = \frac{P_{i,T} - P_{i,t} * \left(1 + TMR_{i,t,T}\right)}{P_{i,t} * \left(1 + TMR_{i,t,T}\right)}$$

- 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 $TMR_{i,t,T}$.

Measurement of Idiosyncratic Risk (1) (Continued)

2) Transform the total excess capital gain returns into the logarithmic form and annualize it

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

3) Regress the annualized excess return on hedonic features to obtain residuals for idiosyncratic risk calculation

$$\log\left(ER_{i,T}\right) = \beta X_{i,T} + \varphi_d + \omega_T + u_{i,T}$$

- $X_{i,T}$ 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.

$$\log\left(AR_{G,i,T}\right) = \hat{u}_{i,T} \qquad AR_{G,i,T} = \exp\left(\hat{u}_{i,T}\right) - 1$$

4) Compute the idiosyncratic risk ($IdioRisk_G$)

The standard deviation of the $AR_{G,i,T}$ 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.

Measurement of Idiosyncratic Risk (2)

2. Idiosyncratic Risk using Peng & Thibodeau (2017)

1) **Regress the log-form annualized total returns on market return and housing features**

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

- $\log(MR_{i,t,T})$ is the annualized local market return in logarithmic form during the holding period from *t* to *T*.

2) **Transform it back to the level of annualized abnormal return.** AR_{PT}

3) **Compute the idiosyncratic risk (**$IdioRisk_{PT}$**)**

The standard deviation of AR_{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.

Measurement of Total Risk

1) **Compute the annualized total return in logarithmic form**

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

2) **Transform it back to the level of annualized total return.** $TR_{i,T}$

3) **Compute the total risk (**$TotalRisk_{i.T}$**)**

The standard deviation of $TR_{i,T}$ 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.

Measurement of Risk-adjusted Performance

We adopt two ratios to compare the risk-adjusted performance of investors in real estate market.

1. **Sharpe ratio (Sharpe, 1966)**

$$SharpeRatio = \frac{TR_{i,T} - Rf_{t,T}}{TotalRisk_{i,T}}$$

- The total risk-free return is calculated as the annualized commutative return of 1-month deposit rate in Hong Kong during the holding period.

2. **Appraisal ratio (Brown & Goetzmann, 1995)**

$$AppraisalRatio_{G} = \frac{AR_{G}}{IdioRisk_{G}}$$

$$AppraisalRatio_{PT} = \frac{AR_{PT}}{IdioRisk_{PT}}$$

Data

Property transaction data (EPRC dataset)

- Sample period: 1993 to 2021
- Sample size: 635,038 home resales
- Information: transaction date, transaction price, buyers’ and sellers' names, property address, building age, floor level, salable floor area etc.

Selection criteria

- Only use the resales of properties that were initially purchased within our study period to compute the capital gain returns during the holding periods.
- Exclude resales holding shorter than one month.
- Drop the home buyers who purchase multiple housing units in the same day.
- Use the transactions of private apartment units.
- Use the transactions in the secondary markets.

Empirical Model (1): Examine the Term Structure of Idiosyncratic Risk

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

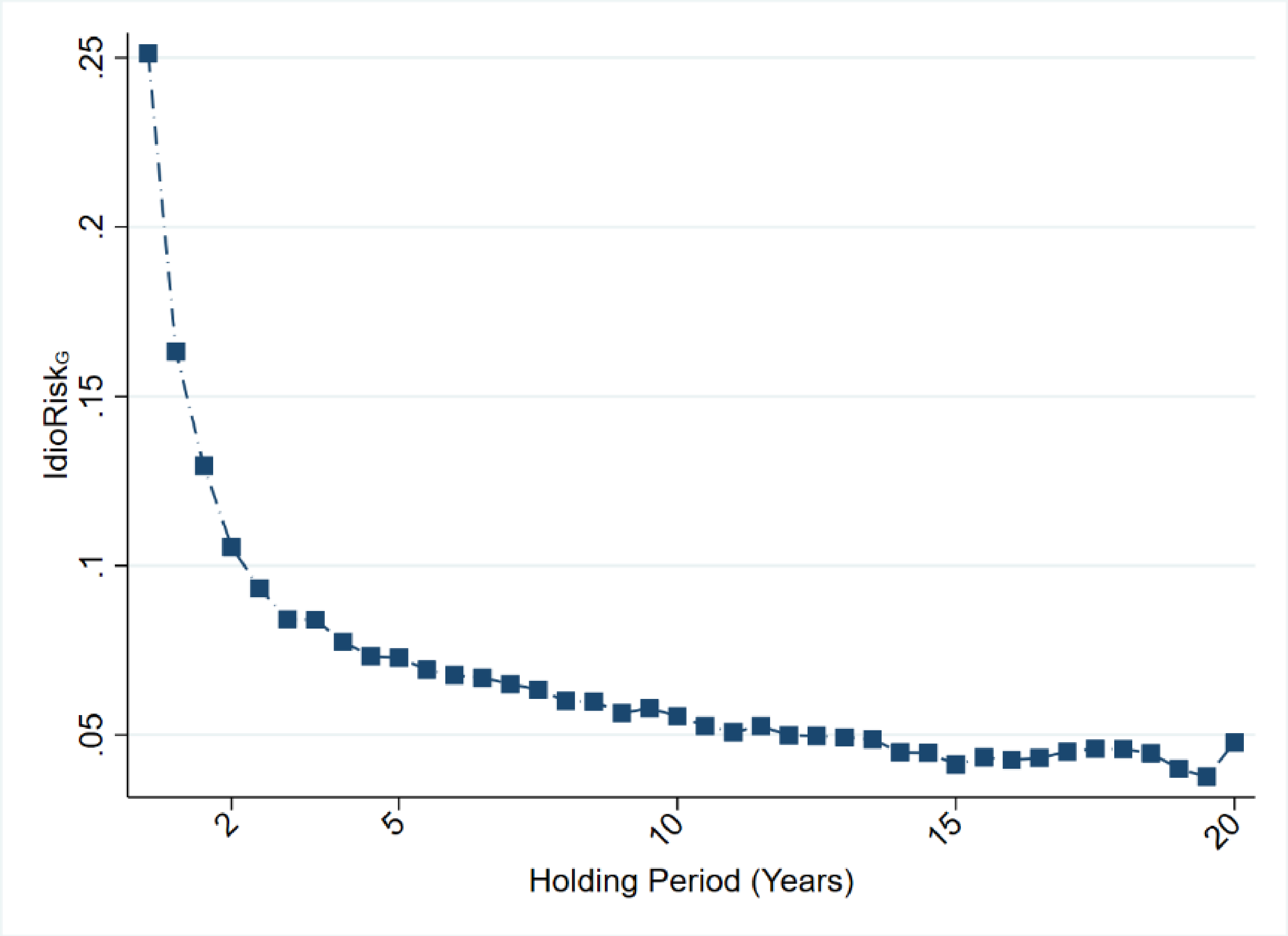
- $IdioRisk_{i,T}$ denotes the idiosyncratic risk of the capital gain for home sales of property *i* at time *T*. We use $IdioRisk_G$ and $IdioRisk_{PT}$ two methods separately.
- $\tau_{i,T}$, denotes the holding period (in years) of the home seller when property *i* is sold at time *T*.
- $X_{i,T}$ is the same set of controls for the housing features
- $MR_{i,t,T}$ 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.

Main Result (1)

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***		
		(0.0000)		
Flipper			0.0865***	
			(0.0011)	
Experienced Flipper				0.0736***
				(0.0015)
Novice Flipper				0.0889***
				(0.0013)
Experienced Non-flipper				-0.0112***
				(0.0005)
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

Idiosyncratic risk of the annualized capital gain decreases with the holding period.



- We calculate the average number of $IdioRisk_G$ within bins of 6-month incremental holding periods.

Main Result (1)

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***		
		(0.0000)		
Flipper			0.0856***	
			(0.0011)	
Experienced Flipper				0.0723***
				(0.0015)
Novice Flipper				0.0882***
				(0.0013)
Experienced Non-flipper				-0.0112***
				(0.0005)
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

Empirical Model (2): Examine the Term Structure of Total Risk

$$TotalRisk_{i,T} = \beta_1 \tau_{i,T} + \beta_2 \tau_{i,T}^2 + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T}$$

- $TotalRisk_{i,T}$ denotes the total risk of the capital gain for home sales of property *i* at time *T*.
- Definitions of other variables are the same as we mentioned before.
- The standard errors are double clustered by district and year-month.

Main Result (2)

	(1)	(2)	(3)	(4)
Dependent Variable:	TotalRisk	TotalRisk	TotalRisk	TotalRisk
Holding Year	-0.0065***	-0.0215***		
	(0.0001)	(0.0003)		
Holding Year2		0.0009***		
		(0.0000)		
Flipper			0.0972***	
			(0.0014)	
Experienced Flipper				0.0820***
				(0.0018)
Novice Flipper				0.1002***
				(0.0015)
Experienced Non-flipper				-0.0132***
				(0.0006)
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

Empirical Model (3): Investigate the investment performance

➢ **Who gets higher returns?**

- We use either the annualized total return or the annualized abnormal return as $Return_{i,T}$.

$$Return_{i,T} = \beta_1 Flipper_{i,T} + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T},$$

$$Return_{i,T} = \beta_1 ExperiencedFlipper_{i,T} + \beta_2 NoviceFlipper_{i,T} + \beta_3 ExperiencedNonFlipper_{i,T} + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T}$$

- We use either the level of annualized total return or the level of annualized abnormal return as $Return_{i,T}$
- Definitions of other variables are the same as we mentioned before.
- The standard errors are double clustered by district and year-month.

Main Result (3)

	(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)
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

Empirical Model (4): Investigate the investment performance

➢ **Who gets higher risk-adjusted returns?**

$$Ratio_{i,T} = \beta_1 Flipper_{i,T} + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T}$$

$$Ratio_{i,T} = \beta_1 ExperienceFlipper_{i,T} + \beta_2 NoviceFlipper_{i,T} + \beta_3 ExperiencedNonFlipper_{i,T} + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T}$$

- $Ratio_{i,T}$ denotes Sharpe ratio or appraisal ratio for the home sale of unit *I* at time *T*.
- We focus on cases with positive returns.
- Definitions of other variables are the same as we mentioned before.
- The standard errors are double clustered by district and year-month.

Main Result (4)

	(1)	(2)	(3)	(4)	(5)	(6)
	Total Return > 0		$AbnormalReturn_G$> 0		$AbnormalReturn_{PT}$> 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)
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

Empirical Model (5): Investigate the risk-sharing function of flippers

- **The introduction of the Special Stamp Duty (SSD)**

This policy levies an additional stamp duty of 5-15% on home sales that are held for fewer than 2 years (On November 20, 2010).

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*.

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.

Empirical Model (5): Investigate the risk-sharing function of flippers

➢ Estimate the changes in *the shares of flippers and the systematic risk* at the district-month level after SSD.

$$ShareFlipNum_{d,t} = \beta_1 SSD_t + \beta_M Macro_t + \beta_{TN} TransNum_{d,t} + \varphi_d + \varepsilon_{d,t}$$

$$SysRisk_{d,t} = \beta_2 SSD_t + \beta_M Macro_t + \beta_{TN} TransNum_{d,t} + \varphi_d + \varepsilon_{d,t}$$

- $ShareFlipNum_{d,t}$ refers to the share of flipping buyers in district *d* in month *t*.
- $SysRisk_{d,t}$ measures changed to the systematic risk of the implied capital gains in district d in month t,
- SSD_t is a dummy variable denoting whether the SSD policy is enacted in month *t*.
- 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

Main Result (5)

Dependent Variable:	(1) [-1, +1] year Share of Flippers	(2) [-2, +2] years Share of Flippers	(3) [-1, +1] year Systematic Risk	(4) [-2, +2] years Systematic Risk
SSD	-0.1366*** (0.0078)	-0.1444*** (0.0070)	0.0502*** (0.0117)	0.0221* (0.0131)
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

Empirical Model (6): Investigate the risk-sharing function of flippers…Continued…

- 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:

$$ShareFlipNum_{d,t} = \beta_1 Hotspot_d \times SSD_t + \beta_{TN} TransNum_{d,t} + \varphi_d + \omega_t + \varepsilon_{d,t}$$

$$SysRisk_{d,t} = \beta_2 Hotspot_d \times SSD_t + \beta_{TN} TransNum_{d,t} + \varphi_d + \omega_t + \varepsilon_{d,t}$$

- $Hotspot_d$ is a dummy variable denoting the hotspot districts that attracted more flippers before the policy took effect.
- 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.

Main Result (6)

Dependent Variable:	(1) [-1, +1] year Share of Flippers	(2) [-2, +2] years Share of Flippers	(3) [-1, +1] year Share of Flippers	(4) [-2, +2] years 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)
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

Dependent Variable:	(1) [-1, +1] year Systematic Risk	(2) [-2, +2] years Systematic Risk	(3) [-1, +1] year Systematic Risk	(4) [-2, +2] years 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)
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

Empirical Model (7): Mechanisms for the Term Structure of Idiosyncratic Risk

➢ **Comparable Transaction Information**

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

- The sales of other units in the same building (or the same estate) can be considered as comparable transactions of the unit (Li & Wan, 2021).
- $Comparable_{i,t,T}$ 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.
- Definitions of other variables are the same as we mentioned before.
- The standard errors are double clustered by district and year-month.

Main Result (7)

Dependent Variable:	(1) $IdioRisk_G$	(2) $IdioRisk_G$	(3) $IdioRisk_G$	(4) $IdioRisk_G$	(5) $IdioRisk_G$	(6) $IdioRisk_G$
Holding Year	-0.0023*** (0.0001)	-0.0137*** (0.0002)	-0.0536*** (0.0008)	-0.0043*** (0.0001)	-0.0166*** (0.0002)	-0.0454*** (0.0006)
Holding Year^2		0.0006*** (0.0000)	0.0026*** (0.0000)		0.0007*** (0.0000)	0.0021*** (0.0000)
log (Sales in Building)	-0.0249*** (0.0004)	-0.0175*** (0.0004)	-0.0349*** (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*** (0.0002)	-0.0089*** (0.0002)	-0.0220*** (0.0003)
Holding Year × log (Sales in Estate)						0.0053*** (0.0001)
Holding Year^2 × log (Sales in Estate)						-0.0003*** (0.0000)
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

Empirical Model (8): Mechanisms for the Term Structure of Idiosyncratic Risk

- **Market thinness**

Idiosyncratic risk of housing capital gain returns should be larger when the market is thinner and the set of active buyers matching with each individual seller is smaller (Giacoletti, 2021).

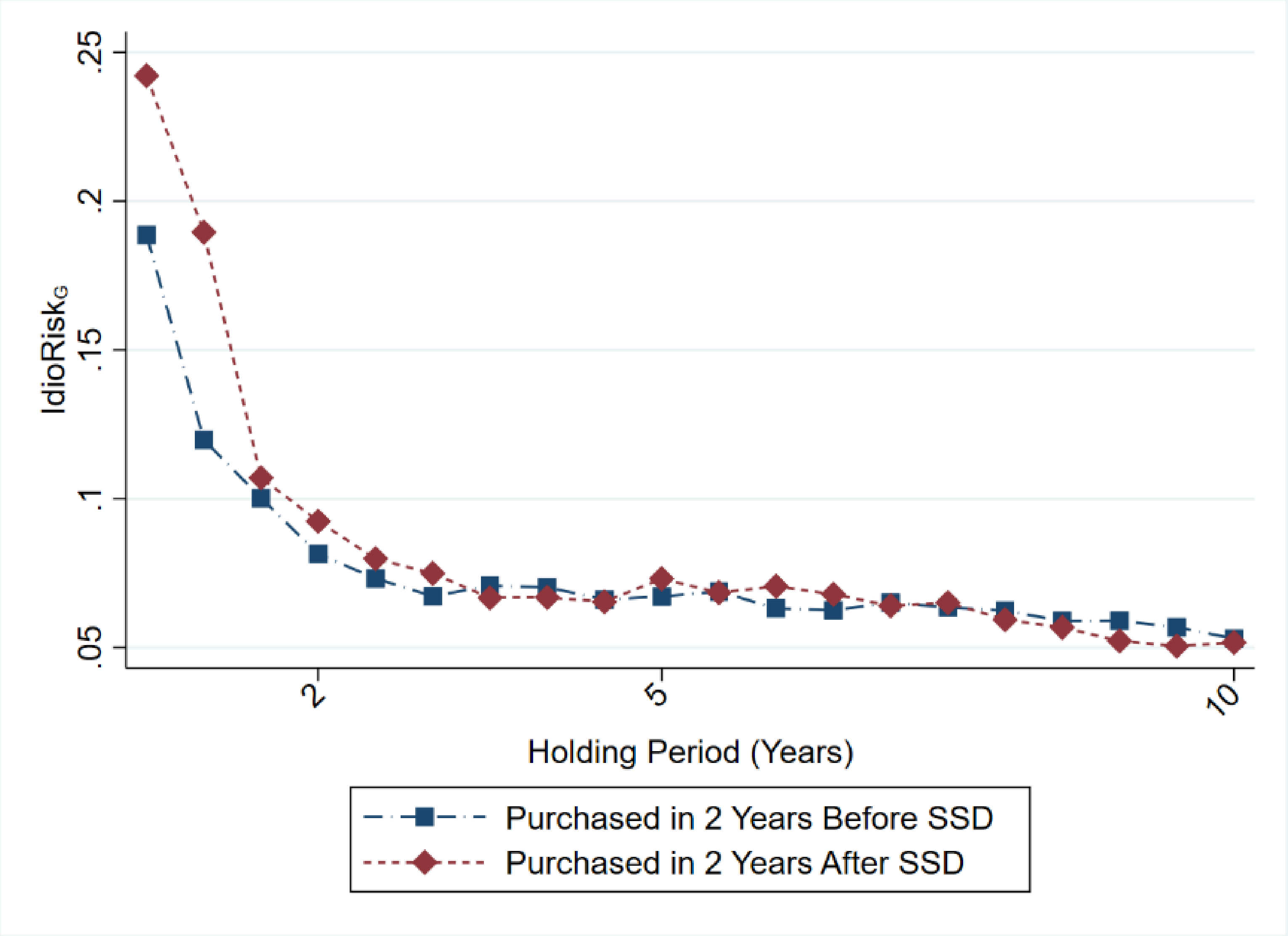
$$IdioRisk_{i,T} = \beta_1 Hold1Y_{i,T} + \beta_2 Hold1t2Y_{i,T} + \beta_3 Hold1Y_{i,T} \times SSD_{i,t} + \beta_4 Hold1t2_{i,T} \times SSD_{i,t} + \beta_X X_{i,T} + \beta_{MR} MR_{i,t,T} + \varphi_d + \omega_T + \varepsilon_{i,T}$$

- $Hold1Y_{i,T}$ 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.
- Definitions of other variables are the same as we mentioned before.
- The standard errors are double clustered by district and year-month.

Main Result (8)

	(1)	(2)	(3)	(4)
	[-1, +1] year	[-2, +2] years	[-1, +1] year	[-2, +2] years
	$IdioRisk_G$	$IdioRisk_G$	$IdioRisk_{PT}$	$IdioRisk_{PT}$
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)
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

Term Structure of Idiosyncratic Risk Before and After the Introduction of SSD



Robustness Checks

- Test the autocorrelations between sequential transactions of the same property to check the consistency of measurements in capturing the idiosyncratic risk.
- Use alternative measurements of risk in logarithmic forms to remove the potential skewness of risk.
- Relax our assumption about comparable transaction 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.
- Use first-hand property sales to mitigate the unobserved non-stochastic components like upgrade and renovation expenses.
- Use samples before SSD to address the potential policy impact on flippers' risk-adjusted performance.

Conclusions

- We confirm a downward and convex term structure of idiosyncratic risk (risk versus holding time) in Hong Kong real estate market. Flippers bear substantial idiosyncratic risk compared to long-term buyers. Although flippers obtained higher annualized returns than long-term buyers by 8.76 percentage points on average, flippers are not obviously outperforming after considering the risk-return trade-offs.

- Only the experienced flippers, constituting less than 20% of the flippers, can generate high risk-adjusted returns.

- After anti-speculation policies, 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.

- Moreover, we provide new empirical evidence that information quality and market thinness explain the downward term structure of idiosyncratic risk.

- Implication: government regulations targeting flippers, emphasizing capital gain, and focusing on transaction cost, may adversely impact the efficiency of the housing market.

Q&A

Thanks!

Appendix (1)

Summary Statistics (1)

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

Appendix (1) To be continued…

Summary Statistics (2)

Variable	(1) N	(2) Mean	(3) Std. Dev.	(4) P25	(5) P50	(6) p75
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

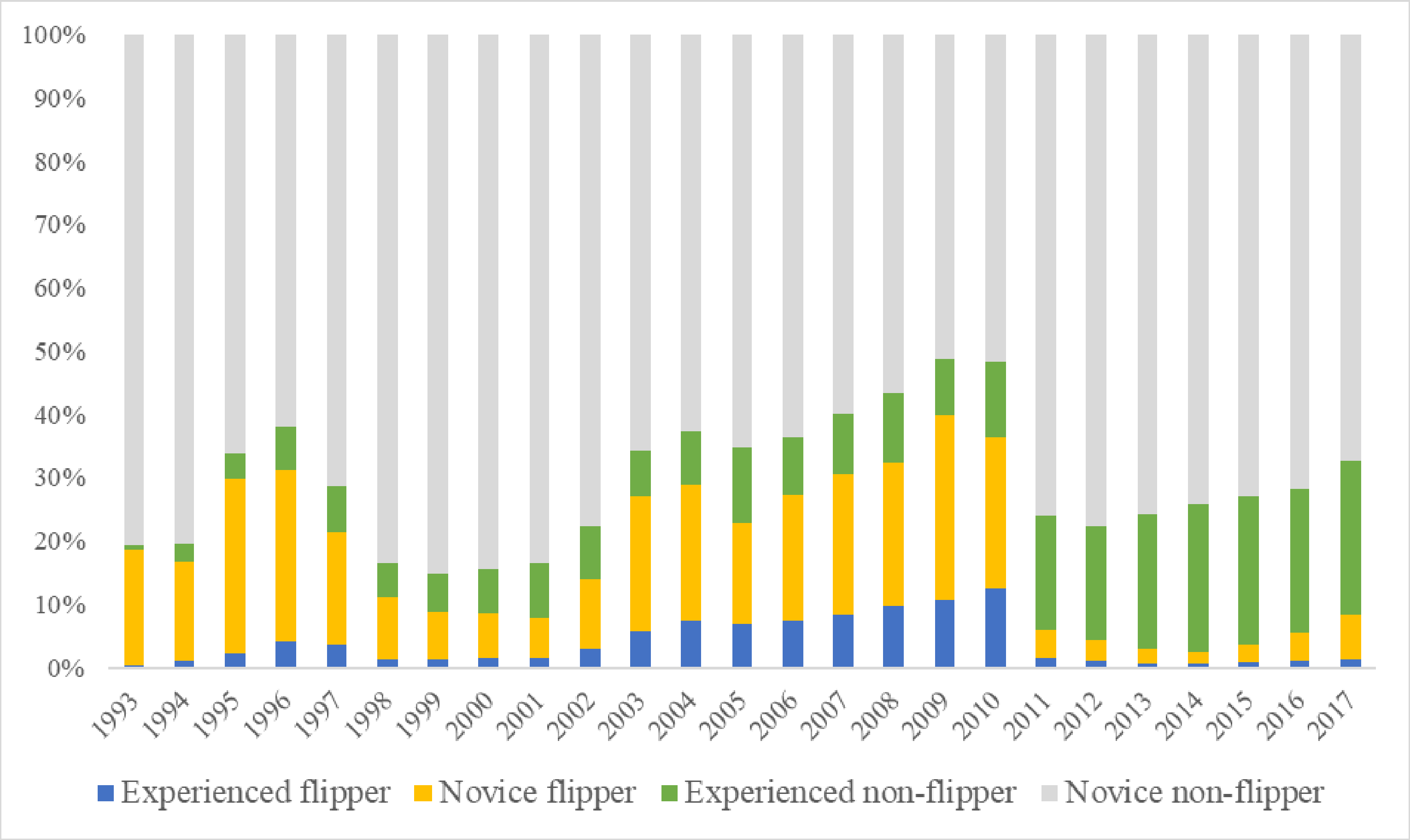
Appendix (2)

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

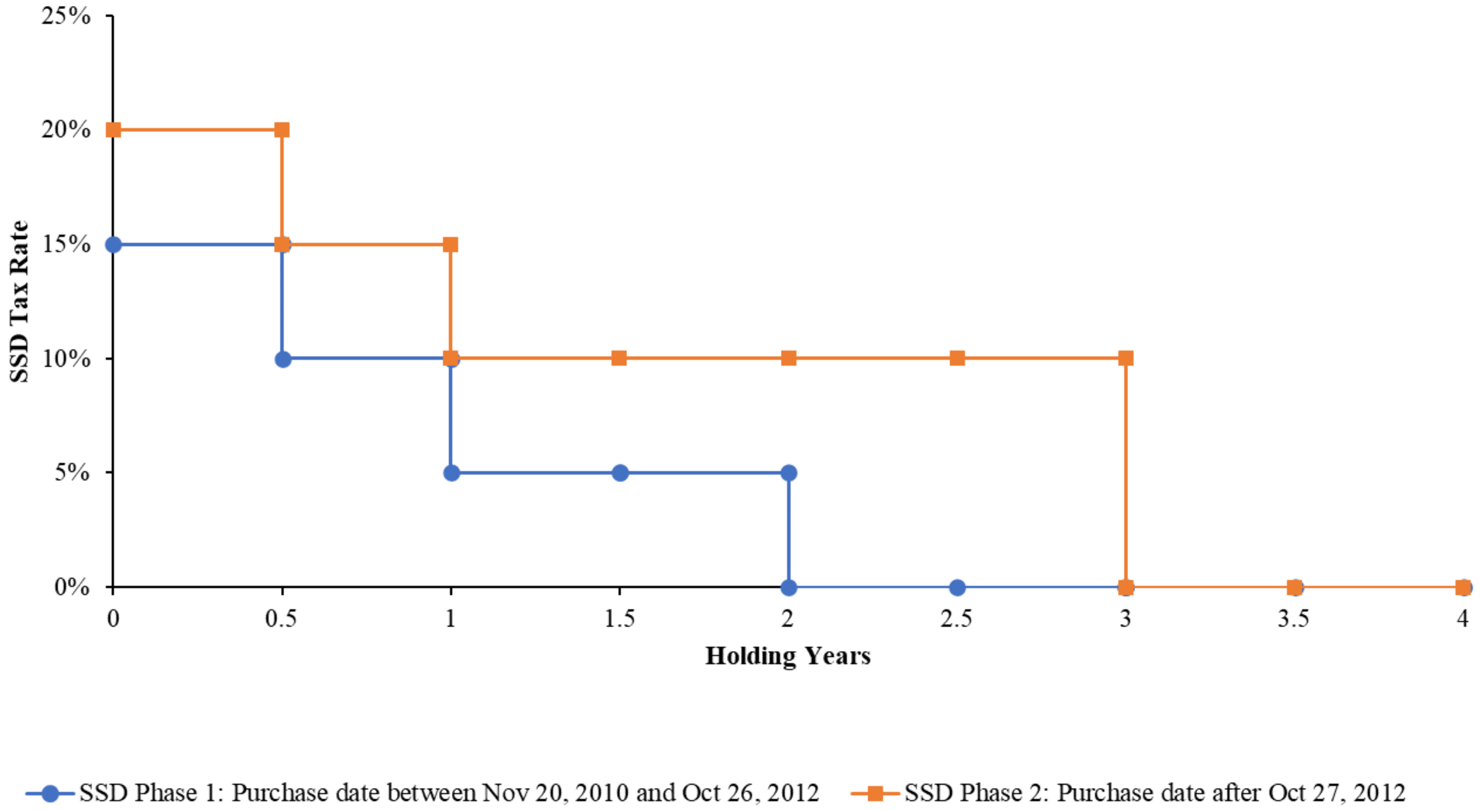
Appendix (3)

Shares of Buyer Types in the Residential Property Market



Appendix (4)

The introduction of the Special Stamp Duty (SSD)



Appendix (5)

The measurement of systematic risk

- 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.