A view from the top: Are top floor units good for consumption but bad for investment?

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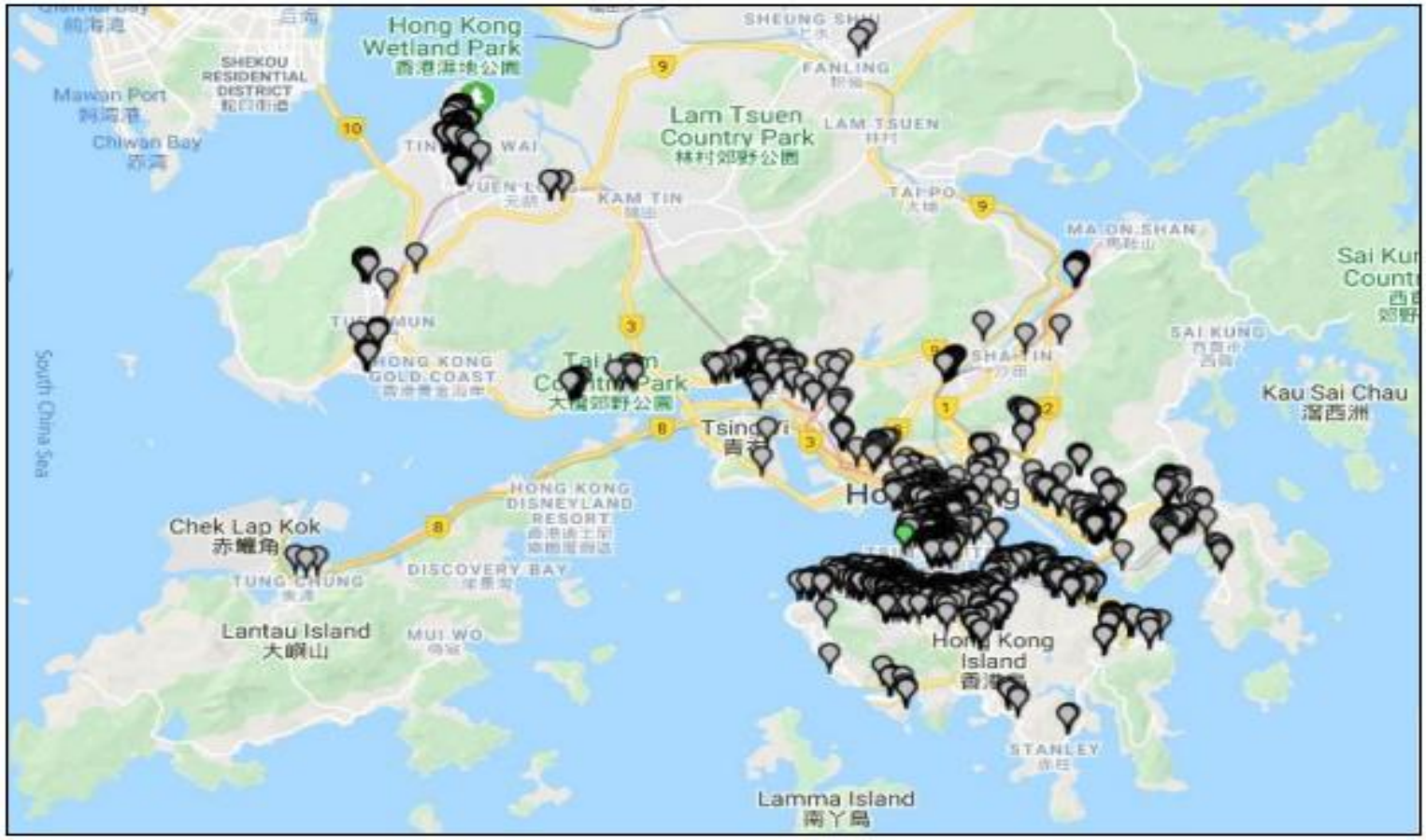
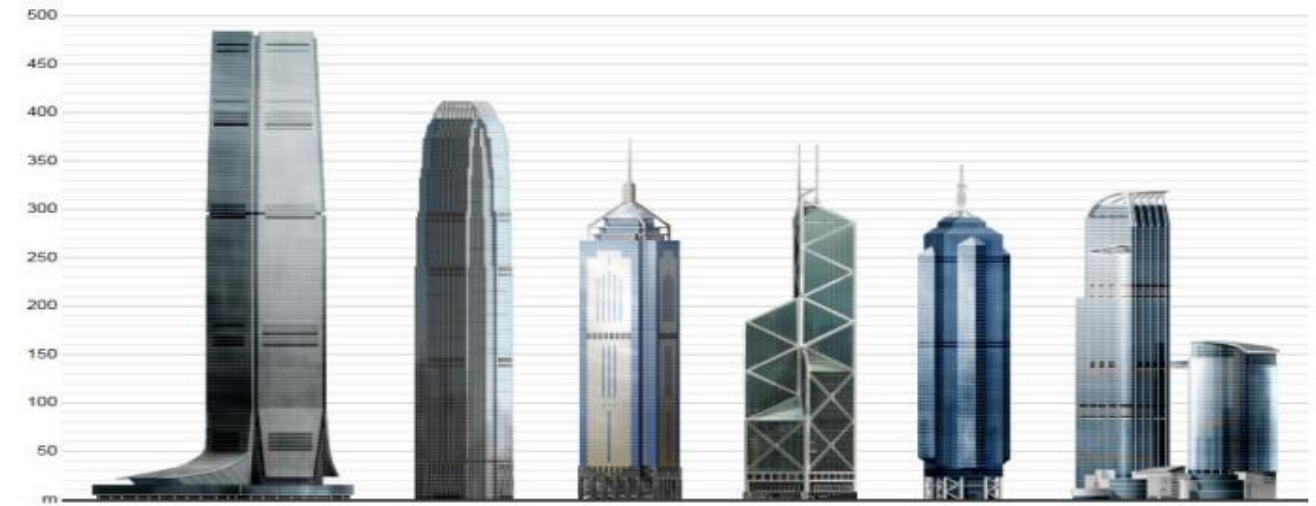
INTRODUCTION

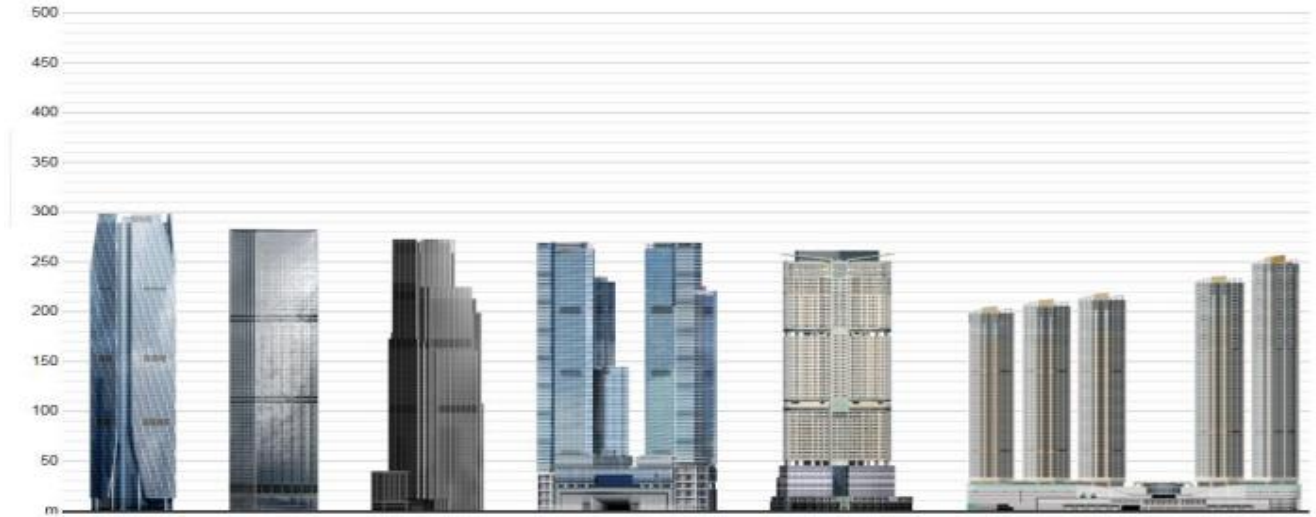
- High-rise buildings is the city icon of Hong Kong.
- Land area = 1,106km^2, Skyscrapers = 1,453



Source: http://skyscraperpage.com



Name	International Commerce Center	Two International Finance Centre	Central Plaza	Bank of China Tower	The Center	Nina Towers
Built	2010	2003	1992	1990	1998	2007
Floors	108	90	78	72	73	80
Use	Mixed use	Office	Office	Office	Office	Mixed use
Antenna Spire		412 m	374 m	367.4 m	346 m	
Roof	484 m	406.9 m	309 m	305 m	292 m	320.3 m



Name	One Island East Centre	Cheung Kong Center	Victoria Dockside	The Cullinan	The Masterpiece	The Sorrento
Built	2008	1999	2017	2009	2007	2003
Floors	67	63	66	68	64	74
Use	Office	Office	Mixed use	Mixed use	Mixed use	Residential
Antenna Spire	298.1 m					
Roof		282.9 m	273.4 m	269.9 m	256.9 m	256.3 m

Source: http://skyscraperpage.com

INTRODUCTION

- Benefits of staying at the top of buildings:
  - Better city views and air quality
  - Higher degree of privacy
  - A quiet environment

- While these buildings are eye-catching, formal analysis is rare.

- It takes an initial step and investigates the valuation of these properties.

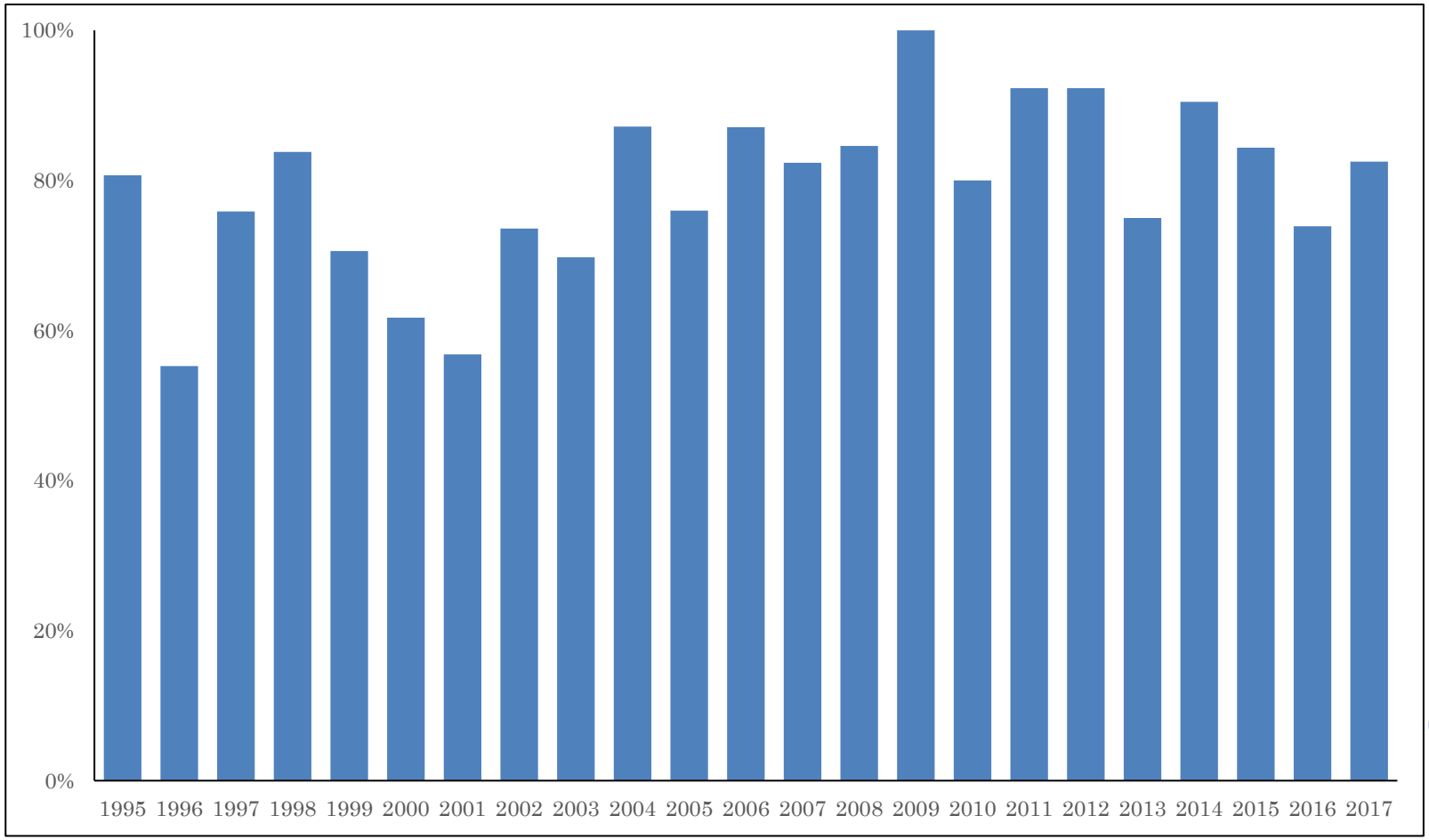
INTRODUCTION

- Our focus: Top floor units (TFU) at the top of residential buildings

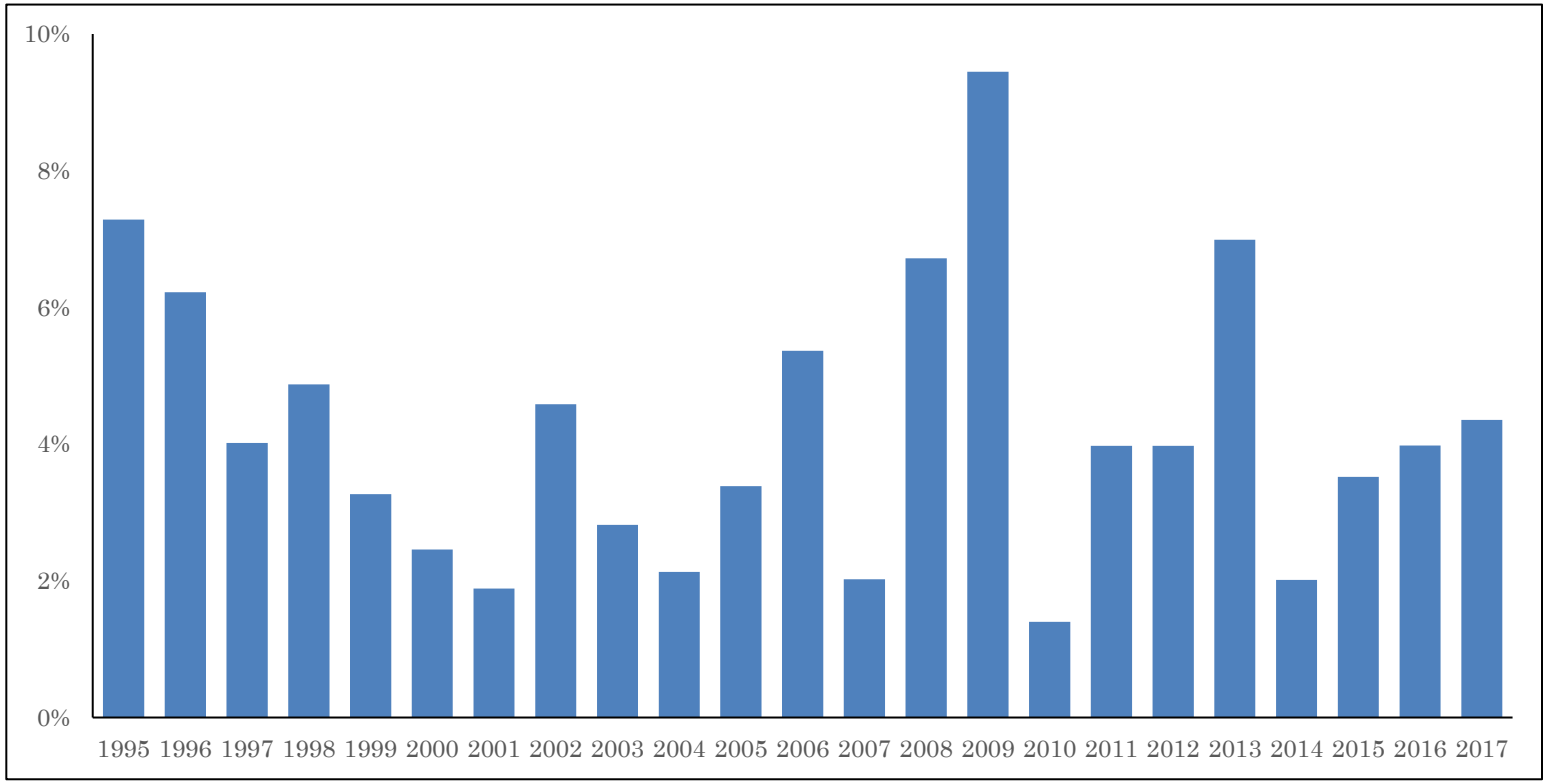
- Properties of TFU:
  - Accompanied by an accessible roof ➔ offering better living standards and prestige
  - Differentiated product ➔ driving the "peer group effect" or "relativity" in consumer behaviour (Van de Stadt et al., 1985; Cole et al., 1992; Carroll et al., 1997; Maurer and Meier, 2008)

- Our conjecture: TFU is traded at a premium

- Percentage of completed estates having TFU



- Ratio of completed TFU to the total completed housing units



FLOW OF THE PAPER

- Computation of top floor premium
- Inclusion of TFU in efficient frontier analysis
- Volatility of TFU market
- Performance of investing TFU versus standard housing units

Computation of top floor premium

- 32 large-scale residential estates
- ≈ 170,000 standard housing units, ≈ 3,000 TFU
- Data: EPRC (1993Q1 – 2017Q2)
- $Top\ Floor\ Premium$

$$= \frac{Actual\ transacted\ price\ of\ TFU - Predicted\ price\ of\ normal\ housing\ unit}{Actual\ transacted\ price\ of\ TFU}$$

COMPUTATION OF TOP FLOOR PREMIUM

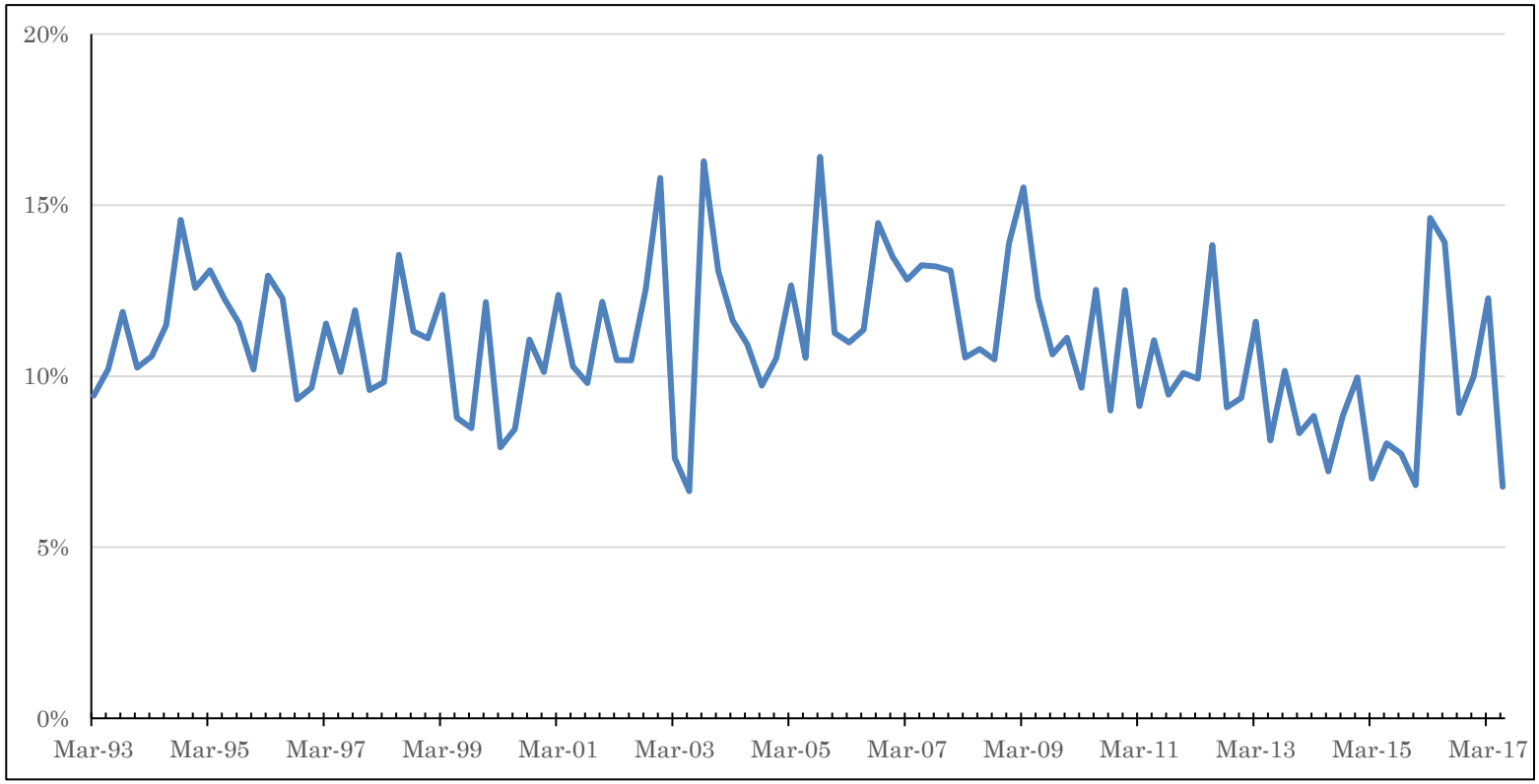
- Predicted price can be obtained from **hedonic pricing model**:

$$\ln(price) = \beta_0 + \beta_1\, floor + \beta_2 grossarea + \beta_3\, swp + \beta_4\, scale + \beta_5\, hk + \beta_6 kln + \beta_7\, cbd + \beta_8\, mtr + \beta_9\, market + \beta_{10}\, hospital + \beta_{11}\, library + \beta_{12}\, shk + \beta_{13}\, hen + \beta_{14}\, ck + \beta_{15} nwd + \beta_{16}\, sino + \varepsilon$$

- Adjusted R-square ≈ 90%

Computation of top floor premium

- Top floor premium: Fluctuates between 5% and 15%
- “Value of social status” inside TFU



TOP FLOOR PREMIUM AND MACROECONOMY

- Unit root test

Variable	Description	Level	First difference
TFP	Top floor premium	-3.9129 ***	-7.7072 ***
RHP	Real housing price (constant quality)	-0.1381	-5.6296 ***
RGDP	Real gross domestic product	-0.1246	-4.4974 ***
RHS	Real Hang Seng Index	-2.4375	-9.5141 ***
RTRADE	Real trade volume	-0.8763	-3.4530 **
TERM	10 year – 3 month Treasury yield spread	-3.4059 **	-7.7923 ***
TED	3 month LIBOR – 3 month Treasury yield spread	-2.6091	-10.1882 ***

Note: The optimum lag is determined by AIC criteria at a maximum lag of 4 quarters. *** and ** denotes 1% and 5% statistical significance respectively.

TOP FLOOR PREMIUM AND MACROECONOMY

- Granger causality

		TFP	ΔRHP	ΔRHS	ΔRGDP	ΔRTRADE	ΔTED	TERM
TFP	Granger causes							
ΔRHP		**		***		***		
ΔRHS			***					
ΔRGDP			***			***		
ΔRTRADE			***	***			**	
ΔTED		**				***		
TERM								

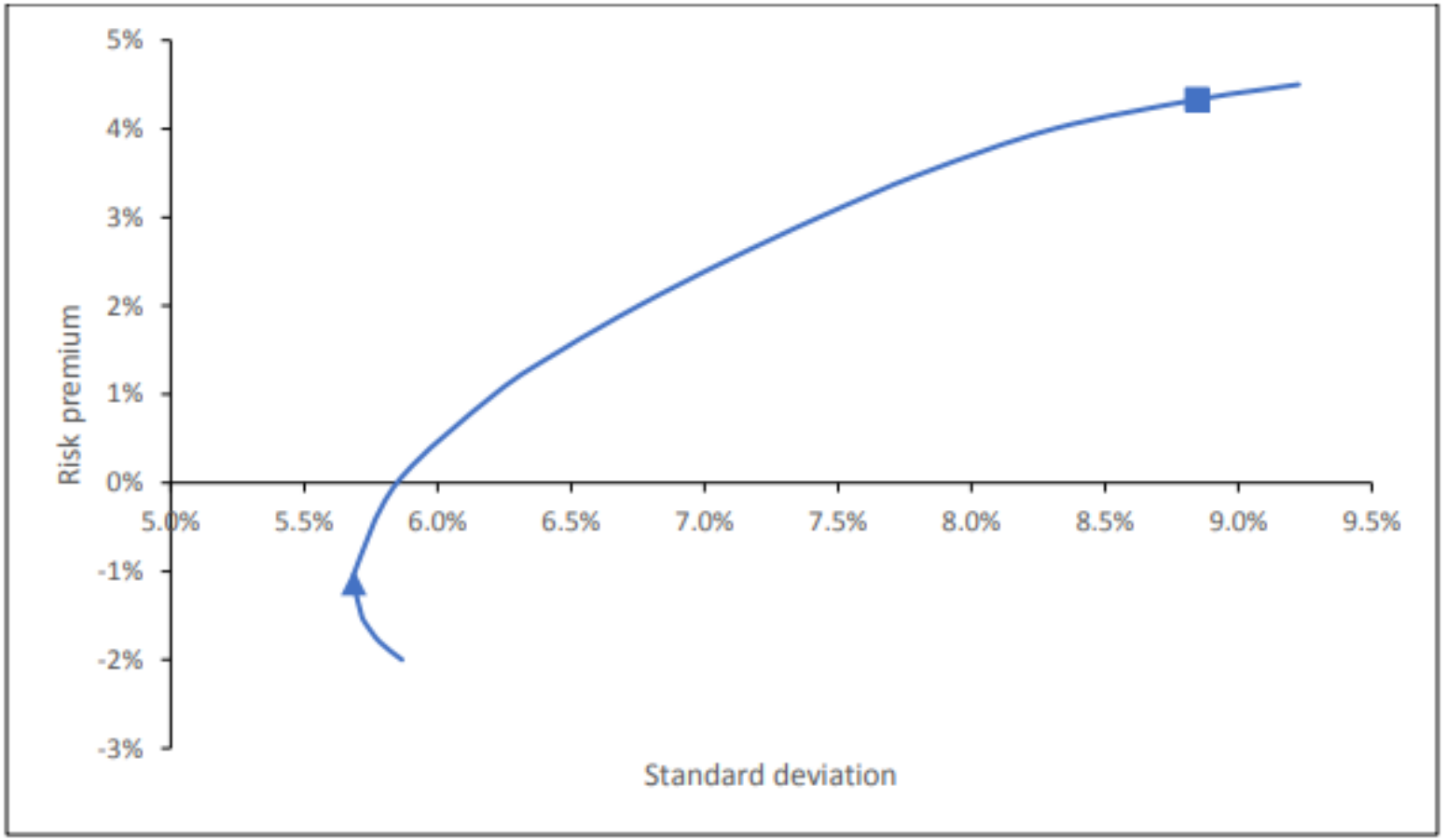
- The lag is chosen to be one. *** and ** denote 1% and 5% statistical significance respectively.

Efficient frontier

- Common investment vehicles in Hong Kong

Risk premium of:	Mean	Std.Dev.	Min	Max
Top-floor housing market	0.0254	0.1071	-0.1928	0.2498
Mass housing market	0.0412	0.1798	-0.4323	0.4155
Hang Seng Index	0.0682	0.2699	-0.5203	1.1204
S&P 500	0.0588	0.1647	-0.4308	0.5175
Gold	0.0369	0.1573	-0.2747	0.3948
British Pound	-0.0366	0.0862	-0.2986	0.1402
Japanese Yen	-0.0159	0.1141	-0.2798	0.2182

Efficient frontier



Note: ▲ = Minimum variance portfolio; ■ = Optimal tangency portfolio

Efficient frontier

	Minimum variance portfolio	Optimal tangency portfolio
Top-floor housing market	25.76%	23.54%
Mass housing market	0%	0%
Hang Seng Index	0%	0%
S&P 500	3.98%	41.47%
Gold	0%	34.99%
British Pound	26.65%	0%
Japanese Yen	43.61%	0%

VOLATILITY

- EGARCH

$$r_{i,t} = \beta_0 + \beta_1 r_{i,t-1} + \varepsilon_{i,t}, \qquad where\ \varepsilon_{i,t} \sim N(0, \sigma_{i,t}^2)$$

$$ln(\sigma_{i,t}^2) = \alpha_0 + \alpha_1 ln(\sigma_{i,t-1}^2) + \alpha_2 \frac{u_{i,t-1}}{\sqrt{\sigma_{i,t-1}^2}} + \alpha_3 \frac{|u_{i,t-1}|}{\sqrt{\sigma_{i,t-1}^2}} + \alpha_4 D_{1,t} + \alpha_5 D_{2,t}$$

$$for\ i = luxury\ market, mass\ market$$

where D_1 = 1 for 2010Q4 – 2012Q4 (only special stamp duty is imposed) and D_2 = 1 for 2013Q1 – 2017Q2 (special stamp duty and double stamp duty are imposed).

- Results of EGARCH model

Mean equation:

$$r_{i,t} = \beta_0 + \beta_1 r_{i,t-1} + \varepsilon_{i,t}$$

	Luxury market	Mass market
β_0	0.0159 ***	0.0031
β_1	0.6440 ***	0.3667 ***

Variance equation:

$$ln(\sigma_{i,t}^2) = \alpha_0 + \alpha_1 ln(\sigma_{i,t-1}^2) + \alpha_2 \frac{u_{i,t-1}}{\sqrt{\sigma_{i,t-1}^2}} + \alpha_3 \frac{|u_{i,t-1}|}{\sqrt{\sigma_{i,t-1}^2}} + \alpha_4 D_{1,t} + \alpha_5 D_{2,t}$$

	Luxury market	Mass market
α_0	-1.0133 *	-0.7938
α_1	0.8947 ***	0.9107 ***
α_2	0.2305 *	0.3400 ***
α_3	0.5338 ***	0.4240 **
α_4	-0.1027	-0.0078
α_5	-0.0715	0.0217

Note: ***, ** and * denote 1%, 5% and 10% significance level respectively.

PROFITABILITY

- Suppose one TFU was bought in period t_1 at the real price p_1, and was then resold in period t_2 at the real price p_2.

- Rate of return of trading TFU: $r_A = \frac{p_2 - p_1}{p_1}$

- The paper does a matching by collecting all non-TFU records that are traded at both t_1 and t_2. The real rate of return of each non-TFU transaction is computed. μ_A is then obtained by taking a simple average.

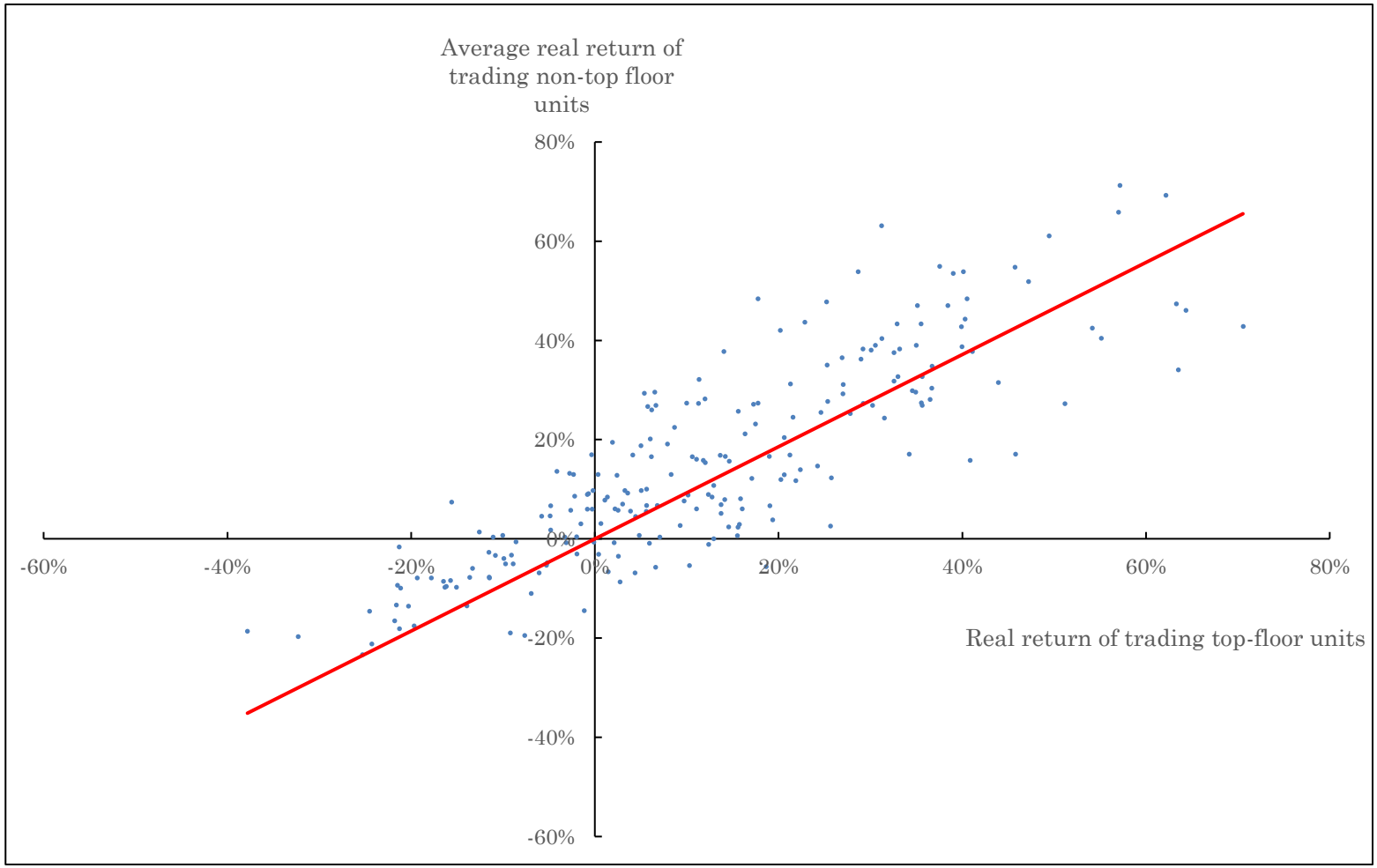
PROFITABILITY

- Comparison between r_A and μ_A:

  - **Liquidity preference theory (Keynes, 1936)**: Since the market of TFU is relatively illiquid than that of non-TFU, sellers need to sell the TFU at a lower price to attract buyers, thus producing a lower real rate of return (i.e. $r_A < \mu_A$).
  - **Theory of uniqueness (Snyder & Fromkin, 1980)**: excessive similarity to others will be negatively interpreted, and will result in greater seeking of differences to maintain one's separate identity. Therefore, the unique features of TFU allows sellers to achieve a higher real rate of return (i.e. $r_A > \mu_A$).

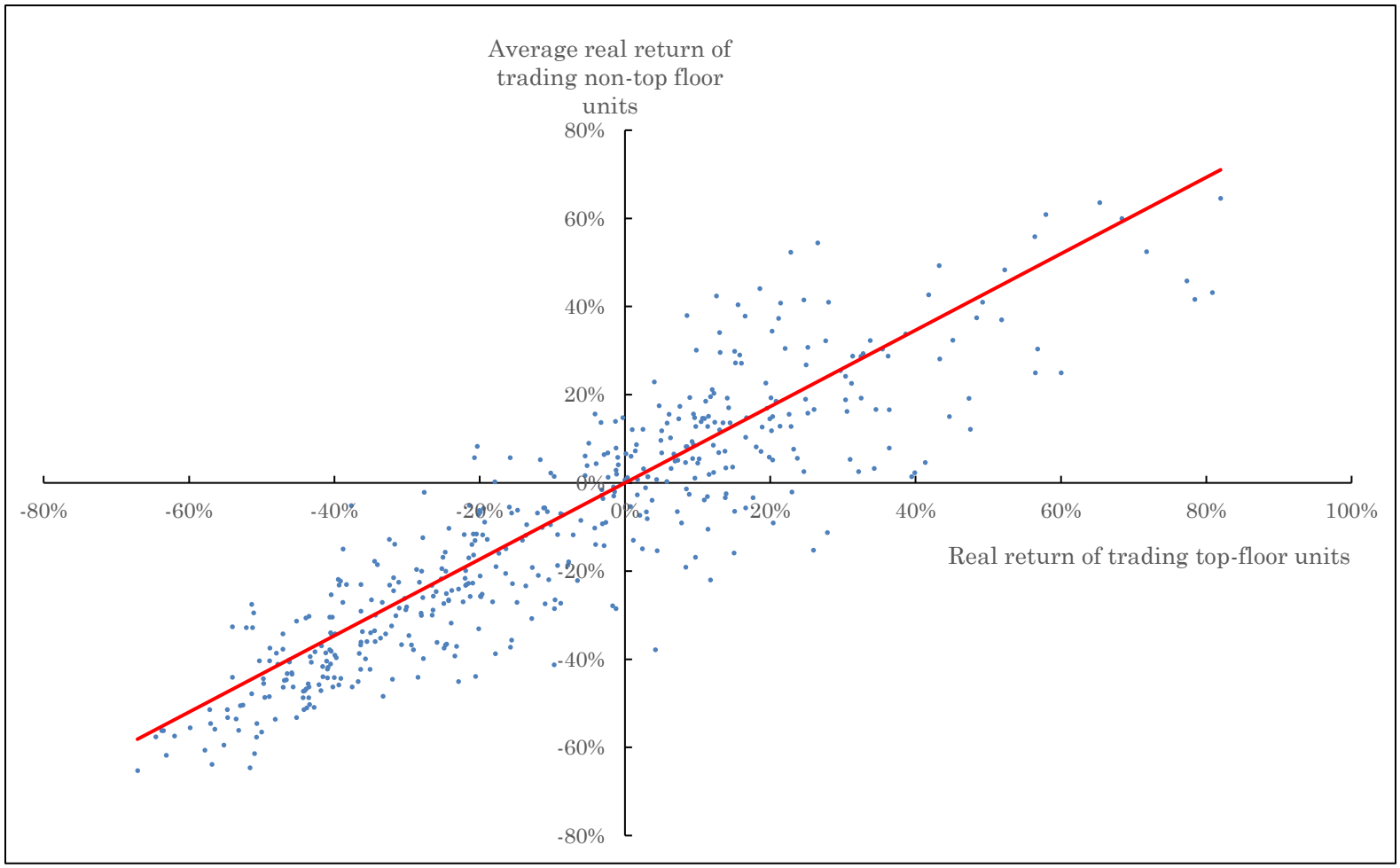
PROFITABILITY

- 1993Q1 – 1997Q4



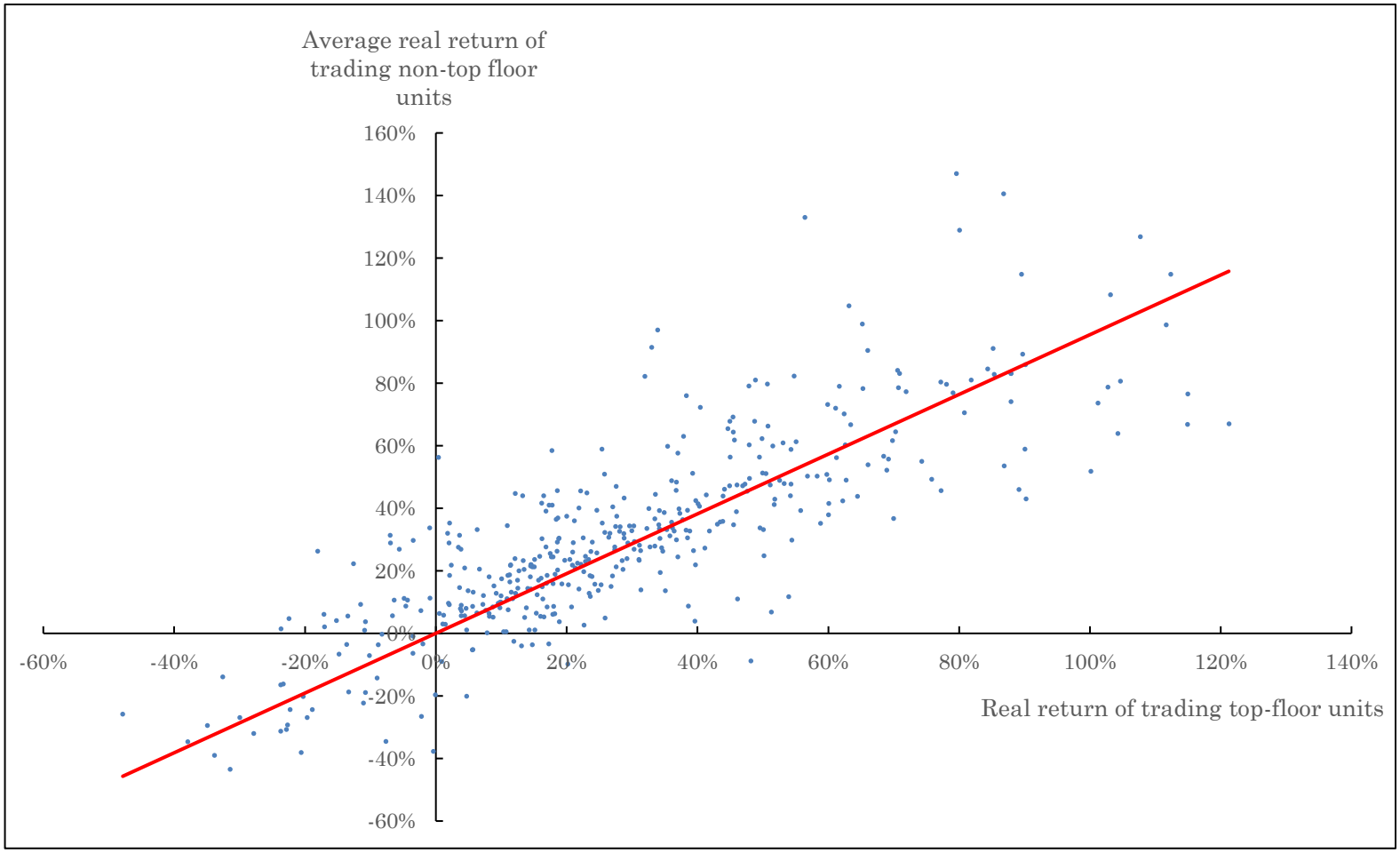
PROFITABILITY

- 1998Q1 – 2008Q2



PROFITABILITY

- 2008Q3 – 2017Q2



CONCLUSION

- Computation of top floor premium

  (Top floor premium is positive)
- Inclusion of TFU in efficient frontier analysis

  (TFU is an important asset in optimal tangency portfolio)
- Volatility of TFU market

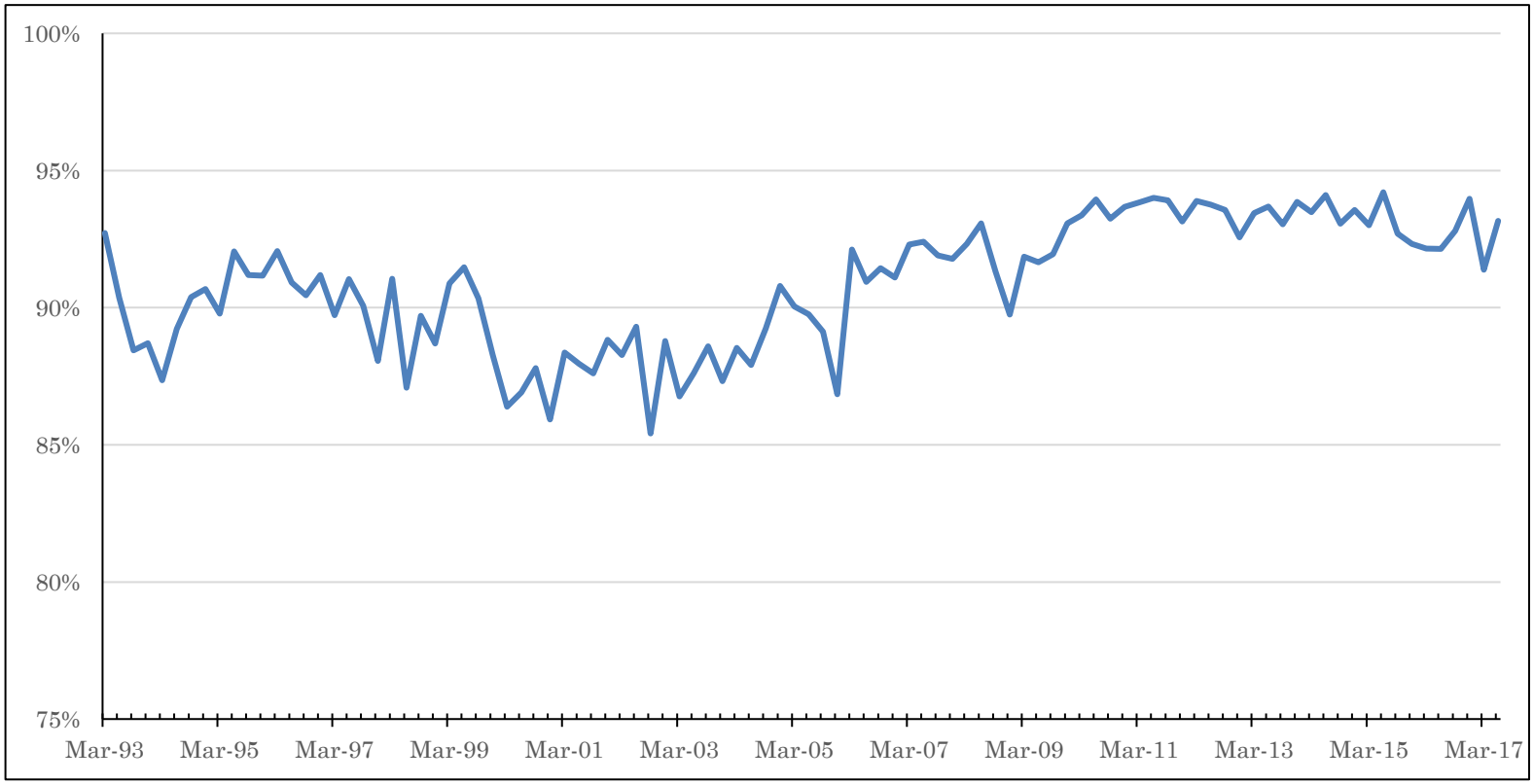
  (EGARCH ➔ Anti-leverage effect)
- Performance of investing TFU versus standard housing units

  (Liquidity preference theory vs. theory of uniqueness)

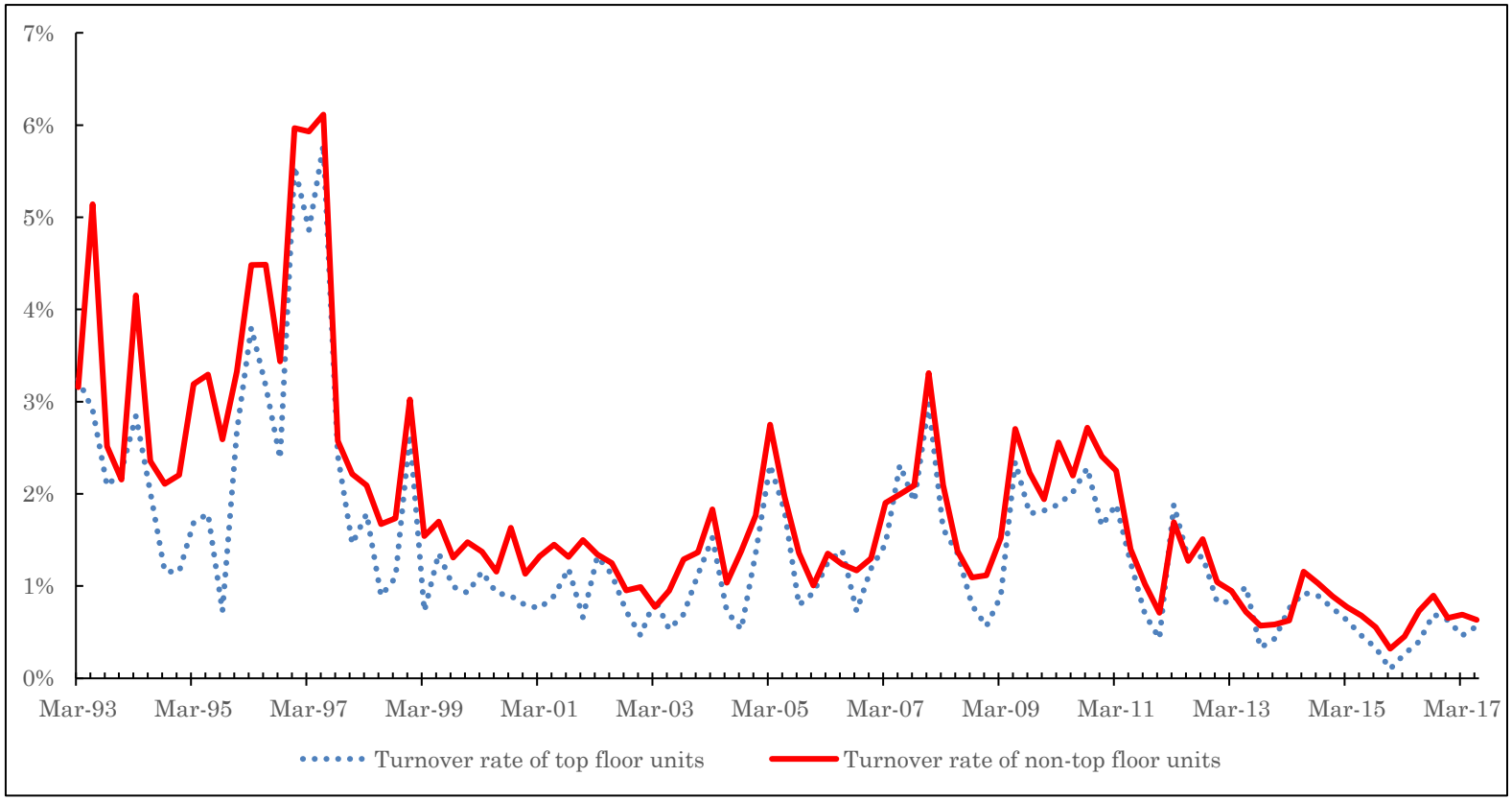
THANKS

APPENDIX

- Adjusted R-square of hedonic regression



- Turnover rate of TFU and non-TFU



- Summary statistics of variables in hedonic pricing model

Variable	Definition	Mean	Std.Dev.	Min	Max
ln(price)	Natural logarithm of transacted housing price	14.72	0.55	12.30	17.53
floor	Floor level of housing unit	15.25	9.19	1	45
grossarea	Gross area of housing unit (square feet)	662.23	174.92	311	1773
swp	Equals 1 if the estate has a swimming pool, 0 otherwise.	0.77	0.42	0	1
scale	Number of housing units in the estate	8122.81	4616.25	1120	15880
hk	Equals 1 if the estate locates at Hong Kong Island, 0 otherwise.	0.25	0.43	0	1
kln	Equals 1 if the estate locates at Kowloon, 0 otherwise.	0.27	0.44	0	1
cbd	Distance to central business district (kilometers)	18.24	11.03	5.8	39.3
mtr	Distance to the nearest subway station (kilometers)	1.00	0.86	0.08	4.9
market	Distance to mass transit station (kilometers)	1.32	0.73	0.17	2.8
hospital	Distance to public district general hospital (kilometers)	3.56	2.30	0.5	10.2
library	Distance to the public library (kilometers)	1.12	0.48	0.17	2.2
shk	Equals 1 if the estate is developed by Sun Hung Kai, 0 otherwise.	0.18	0.38	0	1
hen	Equals 1 if the estate is developed by Henderson Land, 0 otherwise.	0.11	0.31	0	1
ck	Equals 1 if the estate is developed by Cheung Kong, 0 otherwise.	0.38	0.49	0	1
nwd	Equals 1 if the estate is developed by New World Development, 0 otherwise.	0.23	0.42	0	1
sino	Equals 1 if the estate is developed by Sino, 0 otherwise.	0.04	0.21	0	1

- List of variables in time series analysis

Sampling period: 1993Q1 – 2017Q2

Variable	Definition	Source
TFP	Block trade premium	Author's calculation
RHP	Real housing price (constant quality)	Author's calculation
RGDP	Real gross domestic product	Census and Statistics Department
RHS	Real Hang Seng Index	Hong Kong Exchanges and Clearing Limited
RTRADE	Real trade volume	Census and Statistics Department
TERM	10 year – 3 month Treasury yield spread	U.S. Federal Reserve
TED	3 month LIBOR – 3 month Treasury yield spread	U.S. Federal Reserve

- Variance decomposition

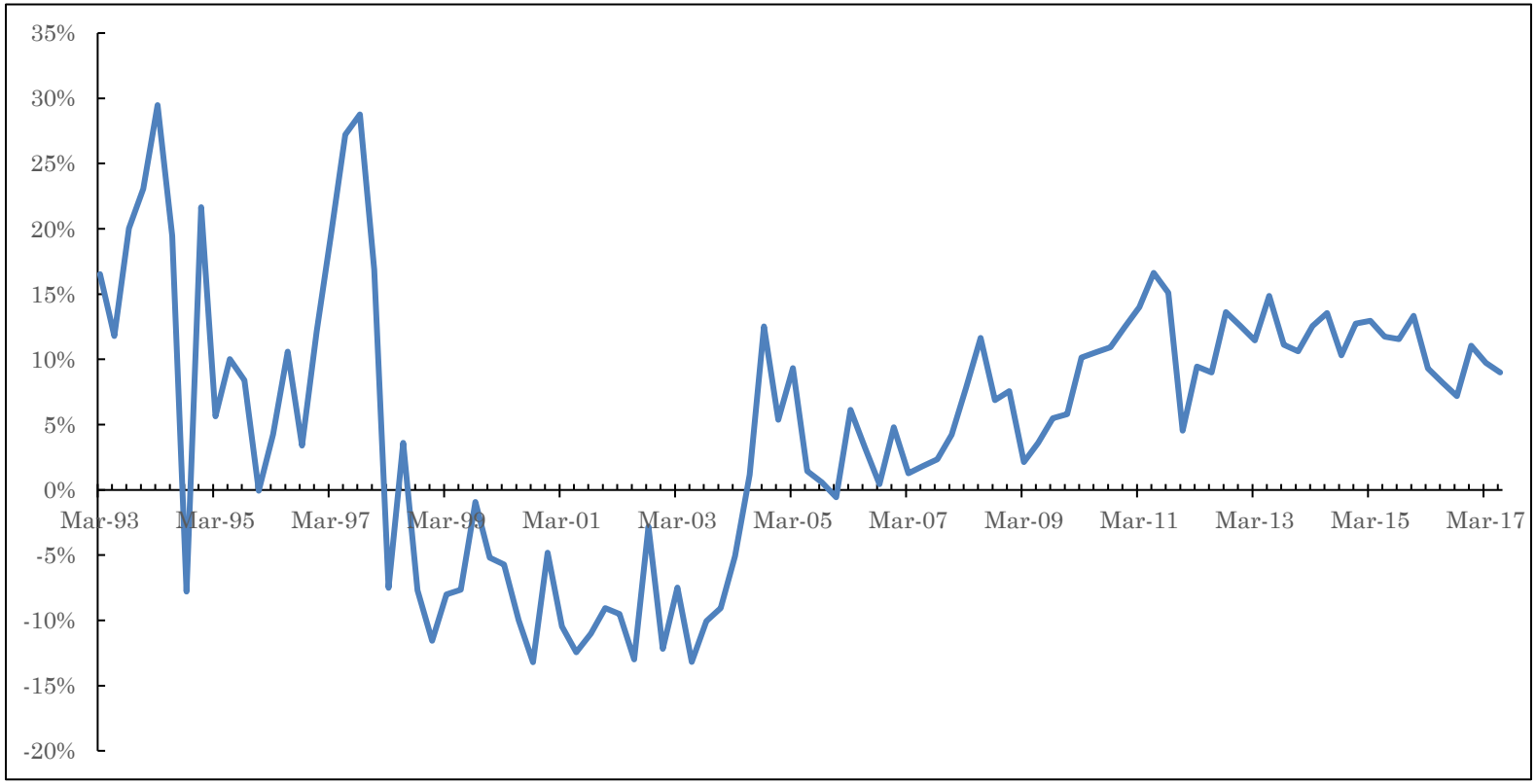
Quarters ahead	Explained by innovations in													
	TERM		ΔTED		ΔRTRADE		ΔRGDP		ΔRHS		ΔRHP		TFP	
	I	II	I	II	I	II	I	II	I	II	I	II	I	II
1	4.0	0.0	0.2	0.0	0.9	0.0	0.0	0.0	0.5	0.0	0.1	0.0	94.3	100.0
2	4.9	1.7	4.7	3.3	0.8	0.0	0.1	1.6	0.5	0.0	0.1	0.1	88.9	93.2
3	5.0	1.8	4.4	3.2	1.2	0.0	1.5	1.6	2.0	2.6	2.1	3.1	83.8	87.8
4	4.8	1.7	4.6	4.0	1.1	0.0	1.8	1.5	2.8	3.6	2.9	3.8	82.0	85.5
5	4.6	1.7	4.7	4.0	1.3	0.1	1.8	1.8	2.9	3.7	3.0	3.8	81.7	85.1
6	4.5	1.7	5.2	4.3	1.4	0.1	2.6	2.3	3.0	4.1	2.9	3.8	80.4	83.7
7	4.5	1.9	5.1	4.2	1.4	0.3	2.9	2.3	3.0	4.0	2.9	3.8	80.3	83.4
8	4.5	1.9	5.1	4.3	1.4	0.3	3.1	2.4	3.0	4.1	3.1	4.1	79.8	82.9

- Order I: TERM, ΔTED, ΔRTRADE, ΔRGDP, ΔRHS, ΔRHP, TFP
- Order II: TFP, ΔRHP, ΔRHS, ΔRGDP, ΔRTRADE, ΔTED, TERM

- Regression result

$Dependent\ variable: \frac{RHP_t}{RHP_{t-1}} - 1$	
$\frac{RHP_{t-1}}{RHP_{t-2}} - 1$	0.2191 **
TO_TOP_t	5.8858 ***
$TO\_NON\_TOP_t$	-2.8097
$\frac{RGDP_t}{RGDP_{t-1}} - 1$	0.1062
$\frac{RTRADE_t}{RTRADE_{t-1}} - 1$	0.1185
$TERM_t$	0.0115
$\Delta \mathrm{TED}_t$	-0.0666 ***
Constant	-0.0471 ***
Adjusted R-square	0.40

- Annualized return of TFU market



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Period	Top-floor transactions	Matched non-top floor transactions	Quadrant				Ratio	$r_A < \mu_A$	$r_A > \mu_A$	Ratio
			I	II	III	IV				
1993Q1 – 1997Q4	219	6,314	144	22	42	11	1 : 0.15 : 0.29 : 0.08	139	80	1.74 : 1
1998Q1 – 2008Q2	469	4,147	153	25	260	31	1 : 0.16 : 1.70 : 0.20	228	241	0.95 : 1
2008Q3 – 2017Q2	423	3,674	370	24	38	11	1 : 0.06 : 0.10 : 0.04	242	181	1.34 : 1