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How does investor sentiment predict the future real estate returns of residential property in Hong Kong?

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A B S T R A C T

Given the high volatility of housing prices in Hong Kong and the cycles of boom and bust, the traditional finance theory may not fully explain the market behavior. We observe that there exists a strong gap on explaining the actual interaction between the fundamental economic factors and the property price levels in Hong Kong, resulting in a wrong expectation about the property price levels and trends in various cycles in the past few decades. We therefore construct a proprietary new measure of investor sentiment for the Hong Kong property market to investigate whether sentiment affects residential property prices in Hong Kong. The results confirm that sentiment is negatively related to future returns of Hong Kong residential properties, with a lagged effect from 3 to 12 months. Consistent with the theoretical prediction by previous studies that sentiment should have stronger effect on more speculative assets (i.e. "hard to value" assets), we find that sentiment has a stronger effect on the prices of smaller units in Kowloon district than on larger units in all three Hong Kong districts (Hong Kong Island, Kowloon and New Territories). This study offers important implications for the Government and policy makers to consider timely measures trying to cool down the property market whenever the investor sentiment is persistently high for some period so as to avoid significant price corrections in the future.

Keywords:
Investor sentiment
Sentiment index
Behavioral finance
Real estate
Residential property
Boom and bust
Property bubbles

1. Introduction

The role of investor sentiment in the financial market has received more attention from academics during the last two decades, especially in the past 5 years where Robert Shiller (behavioral finance) and Richard Thaler (behavioral economics) were awarded the Nobel Prize in Economic Sciences in 2013 and 2017 respectively. The main theme of the investor sentiment studies is to determine 1) whether a level of high sentiment (optimism) in the current period leads to a low return (or vice versa) in the future, and 2) whether some asset classes are more sensitive to sentiment in terms of future returns or price changes, especially those assets that are "hard to value" (having high subjectivity on valuation) and that have "limits to arbitrage".

The "boom and bust" in the financial markets over the last two decades has provided space for behavioral finance to explain market behavior. For example, "noise traders" or "irrational investors" in the market may cause asset prices to deviate from their fundamental values, especially in the stock market. This deviation from fundamental value may be attributable to "investor sentiment". Nonetheless, the mispricing may not be easily corrected due to the "limits to arbitrage" and "hard to value" assets. As a result, there is a growing trend toward using investor sentiment to explain future returns and to detect bubbles, especially in the stock market where data are abundant, and transactions are more frequent as compared to the property market.

Residential property is an important asset class that is very significant in Hong Kong's economy. As of March 2017, Hong Kong has 2.745 million permanent residential flats for a total population of 7.38 million with 2.55 million domestic households (end-2016), with 56.0% (or 1.537 million units) belonging to private sector owners and the remaining 1.208 million units being various types of public housing built by the Government (Housing in Figures 2017, Census and Statistical Dept, HKSAR). Total outstanding bank loans to the residential mortgage market amounted to HKD1,137 billion as of March 2017, and this sum was 45.7% of the total GDP (HKD2,486 billion) in 2016. Housing prices have been extremely volatile in the past 20 years, with 5 times the difference between the trough and crest (May 2003 the lowest and Oct 2017 the highest). Despite warnings by economists, property researchers, Government and related organization (like Hong Kong Monetary Authority), property prices are still in upward trends in the past 10 years since the Global Financial Crisis in 2007 and with significant growth. For the 2001 to 2016 period, the Centa-City Index (CCI), a representative index for all Hong Kong properties increased from 43.8 in January 2001 to 141.17 in December 2016, a 222% increase, and now has reached its historical high level. However, the median household income growth was only 33.7% for the past 15 years (2001: HKD18,705 per month; 2016: HKD25,000 per month), a huge mismatch with the housing price growth. The Demographia
International Housing Affordability Survey ("DIHAS") published its 2017 annual report using the data as of 3Q 2016 to compare housing affordability globally. Hong Kong ranks first again, with a median income multiple of 18.1 years (19.0 years in the previous year's survey). Hong Kong has had the worst housing affordability index among all cities in the world for all seven years since it has been included in the DIHAS.

Previous studies show that residential property prices are affected by economic factors such as GDP growth, income levels, population growth, interest rates, supply and demand functions, etc. (Case & Shiller, 1990; Quigley, 1999). However, as can be seen in many regions including Hong Kong, the residential prices and price movements are not well explained by these economic factors, as there are considerable differences between "expected" rational prices and actual market transacted prices (Chan, Lee, & Woo, 2001; Wong, Hui, Seabrooke, & Raftery, 2005). The wider the gap between rational and actual prices, the larger the bubble described by academics (Shen, Hui, & Liu, 2005). The basic rationale is that the unexplained component of the property price is driven by "noise trader" activity (Barkham & Ward, 1999), and this is considered the "irrational" component of the price composition that is not related to the fundamental or rational factors. Noise traders may drive the market value of assets away from fundamental values for longer-than-expected periods. However, the investment market is growing increasingly complicated, and there may be a paradigm shift (both for the stock and the property markets) in which the original market mechanisms and fundamentals may need new explanations, or even some structural changes to the rules of the game (Cochrane, 1991). Therefore, using investor sentiment to study the future returns of residential property shall provide additional angle for us to look into this matter. Without a better understanding of the determinant components (both

fundamental and irrational) of property prices, and of the effects on the future property price movement based on those components, our financial and banking system is exposed to a very high risk that may ultimately have negative effects on the Hong Kong economy as a whole. This risk has already been seen in the negative effect to the economy in June 2003, when Hong Kong reached a peak of 106,000 households with negative equity in property assets.

This paper attempts to provide a better understanding of whether investor sentiment predicts the future returns of residential property in Hong Kong. We use a behavioral finance approach to investor psychology in constructing a new sentiment index of the Hong Kong residential property market that helps us to see how investor sentiment predicts the future returns in various categories of residential properties in Hong Kong.

We limit the regression models on the property market to 1) using monthly data only; 2) using the longest period of quality dataset we can obtain for various residential estates (from 1996 to 2012); 3) using the difference in returns for different classes of residential properties to test for sensitivity to sentiment; and 4) using different lagged periods, from 3 months to 15 months, to see the effect of sentiment on future returns in residential properties. These conditions on property market models are necessary because property does not sell like stocks and cannot be bought and resold within a very short period.

This paper has the following contributions: 1) construct a new customized investor sentiment index for the Hong Kong residential market that has a significant effect on the Hong Kong economy; 2) examine how investor sentiment affects future property prices; 3) investigate whether the effect of sentiment is greater on properties that are more speculative; and 4) alert the Government and policy makers to impose appropriate measures to cool down the property market when the index is high and persists for some period of time.

The rest of this paper is organized as follows: Section 2 provides the literature review; Section 3 develops the hypothesis and the model; Section 4 discusses the empirical studies and methodology; Section 5 conducts the discussion of the findings; and Section 6 concludes the paper with a summary of results and implications.

2. The research framework

2.1. Literature review

Classical finance theory holds that investors are rational, that asset prices are determined by fundamental factors and should be equal to "intrinsic values" and that the market is efficient (the efficient market hypothesis, or "EMH") (Fama, 1970). According to this school of thought, there is nothing in investor psychology (or investor sentiment) that can affect asset pricing, and thus the movement of future prices. Classical theory argues that even if some investors are irrational, their demands are eliminated by arbitrageurs and therefore mispricing is corrected (De Long, Shleifer, Summers, & Waldmann, 1990).

However, the explanation based on behavioral finance has become more popular since the early 1990s, as we have seen booms and busts in asset prices in the 1980s, especially in the U.S. (Black Monday in 1987) and in Japan (bubbles in 1989). Therefore, EMH has been subject to criticism (Malkiel, 2003). De Bondt (1993, pp. 1153–1183) mentions that "a general theory of booms and busts cannot be derived from institutional explanations that depend on time and place; however, it may be based on investor psychology." Hirshleifer (2001) also writes that "the purely rational approach is being subsumed by a broader approach based upon the psychology of investors."

Recent studies show that investor sentiment does affect asset price movement. Brown and Cliff (2005) posit that future returns of stocks are negatively related to sentiment. Excessive optimism causes market overreaction in the short run, whereas high current sentiment is followed by low cumulative returns in the long run. Lemmon and Portniaguina (2006) conclude that consumer confidence does predict future returns of small stocks as well as stocks with low institutional ownership (i.e., hard to value and limits to arbitrage). Stambaugh, Yu, and Yu (2012) conclude that the presence of market-wide sentiment is combined with the argument that overpricing should be more prevalent than underpricing, due to short-sale impediments.

A major study using a new approach on investor sentiment by Baker and Wurgler (2006), involves constructing a new sentiment index to investigate how investor sentiment affects the future stock returns on a cross-sectional basis in the U.S. To examine their hypothesis, these authors build a composite sentiment index that is based on the variation in the six representative sentiment proxies. They conclude that investor sentiment does have significant cross-sectional effects. Baker and Wurgler (2007) further analyze whether current level of investor sentiment predicts future returns and eventually correct mispricings.

Regardless of the potential importance of investor sentiment in property markets, there are limited studies that investigate the role of investor sentiment directly in the pricing and returns generation process for this asset class. One study by Lin, Rahman, and Yung (2009) comes close to investigating investor sentiment by examining the effect of investor sentiment on REIT returns in the U.S. Clayton, Ling, and Naranjo (2009) use both a direct survey and the creation of their own sentiment index (the "CLN index") to investigate the role of fundamentals and investor sentiment in the valuation of commercial real estate in the U.S. Marcato and Nanda (2016) use VAR model to analyze quarterly U.S. data and suggest that the sentiment in real estate conveys valuable information that can help predict changes in real estate returns.

Regarding the residential property market of Hong Kong and China, most studies are done using techniques based on econometrics as the main analytic tools. For example, Hui and Yue (2006) investigate whether there was a housing price bubble in Beijing, Shanghai and Hong Kong, using econometric methods to determine the rational prices. Hui and Yue (2006) also include a case study for Hong Kong between 1990 and 2003 to check the reliability of their analysis, because Hong Kong experienced a huge property bubble during the Asian financial crisis in 1997. Chan et al. (2001) conduct an empirical study to detect rational bubbles in the residential market of Hong Kong. Xiao and Liu (2010) analyze whether the rational bubble, in addition to fundamentals, can explain the price change of residential property in Hong Kong. Hui, Ng, and Lau (2011) investigate whether such housing price bubbles exist in two different residential markets (mass and luxury housing) in Hong Kong, and they give a detailed cross-sectional analysis using an econometric approach. Besides, Hui, Dong, Jia, and Lam (2017) create the buyer-seller sentiment and developer sentiment indexes and study their impact on housing returns for China.

In summary, most of these studies only indicate whether the bubbles are created and exist, based on the discrepancies between actual prices versus fundamental values, as determined by econometric methods. They do not explain why and how the mispricing happens, and what the causes are.

2.2. Hypotheses and model specification

Our theory and hypotheses are constructed with a logic flow based on the following assumptions:

- Investors can be divided into two categories: the rational investors (fundamentalists) and the noise trader/speculators (irrationals).
- Asset price is determined by two factors: the fundamental value (based on economic and fundamental factors) and the unexplained/ error term (unobserved/irrational component).
- The error term can arise due to the sentiment factor, or to the investor psychological effect.
- Real estate is an asset class that does not have arbitrage activity (being more illiquid and with no short selling activity) and it is hard to value (with a unique nature of each property and subjectivity on valuation) as compared to stock.
- Classical finance theory and the efficient market hypothesis cannot well explain the "booms and busts" of the real estate market, which implies the inadequacy of market analysis that is simply based on fundamental factors and rational investor assumptions.
- Even if there is mispricing in residential property, due to the limits to arbitrage, it is hard to eliminate mispricing quickly as happens in the stock market.
- Previous studies have shown that sentiment affects current price levels, and current high sentiment may push the current price to a much higher level, where future returns are expected to be low (and vice versa). This finding contrasts with the traditional view of market efficiency, which holds that future returns are unpredictable.

Based on the above assumptions, the following hypotheses will be tested:

H1. Investor sentiment negatively predicts the future returns of residential property in Hong Kong.

H2. In the cross-sectional analysis, the effect of investor sentiment on future return is stronger for certain types of properties, especially for smaller units (mass) in Kowloon district that are harder to value than other properties.

The basic regression model is formulated as follows: $Return\%_{i\,t,} = +c \quad \beta SentiE_{t-n} + \varepsilon_t$

where i = type of residential real estate, t = period (month) and n = lag period (months).

To investigate the sentiment effect on future returns, it is necessary to create a proprietary sentiment index ("SentiE") for the Hong Kong residential property market.

3. Creation of the sentiment index for residential property in Hong Kong

We compose the sentiment index for residential property in Hong Kong using principal component analysis ("PCA") to select a group of independent variables that may affect investor sentiment as indicated by previous academic studies and practical industry experience. The first step is to select suitable and relevant variables as proxies for investor sentiment that can be used as time-series conditioning variables.

PCA is mostly used as a tool in exploratory data analysis and for making predictive models, and is applied to reduce a large set of correlated variables to a small set of uncorrelated variables (i.e. principal components) that still contains most of the information in the large set. Since the first principal component accounts for as much of the variability in the data as possible, we therefore follow the Baker and Wurgler (2006) method to adopt PCA for our dataset and use the first principal component to create the proprietary sentiment index for Hong Kong residential property.

The procedure for composing the sentiment index is as follows:

1. Follow Baker and Wurgler (2006) process but modify it with proxies that are more appropriate for the Hong Kong property market. Baker and Wurgler ("BW") use six underlying proxies[1] for sentiment index construction based on the U.S. stock market. We modify this with the following set of basic proxies from the Hong Kong stock market that are more relevant and closely tied to property market: 1) Hang Seng Index (HSI), 2) Hang Seng Property Index (HSIP) and 3) Hang Seng Property Index Total Value (HSIPVal). As the local property market is highly correlated with the stock market, these three stock market indexes measure the overall stock market performance, the depth and width of the underlying property stocks behavior and shall be included in the index formation.
2. Add new proxies that represent the characteristics of Hong Konginvestor sentiment, especially those variables related to the residential property market in general. These new proxies come from five areas: stock market, property market, capital market, global market and Hong Kong representative property indices. We use a total of 13 proxies for sentiment at the beginning of the index creation.
3. To obtain a sentiment index that is free from economic influence, we first orthogonalize each of the 13 proxies separately by regressing them with the macroeconomic variables that capture variations in the business cycle of Hong Kong, namely 1) CPI growth, 2) retail sales growth, 3) changes in loans and advances to business, 4) changes in the Hong Kong effective exchange rate, 5) growth in

Table 1
Sentiment index category and symbol.

Category	No.	Symbol	Description	Variables	lag number (month)			
					t	t-1	t-3	t-6
Stock Market	1	HSI	Hang Seng Index					
	2	HSIProp	Hang Seng Property Index					
	3	HSIPVal	Hang Seng Property Index total value					

[1] Baker and Wurgler (2006) use the closed-end fund discount, the NYSE share turnover, the number and average of first-day returns on IPOs, the equity share in new issues and the dividend premium.

Property Market	4	HT1	Primary transaction (number)
	5	HT1$	Primary transaction (HK$ total)
	6	HT2	Secondary transaction (number)
	7	HT2$	Secondary transaction (HK$ total)
Capital Market	8	HOTM3	Hot Money M3
	9	NBLR	New bank loan to residential property
Global Market	10	PRCCCI	China Consumer Confidence Index
	11	USCCI	US Consumer Confidence Index
HK Property Index	12	HKUREIS	The University of Hong Kong Real Estate Index Series
	13	CCI	Centa-City Index

imports, 6) growth in exports and 7) GDP growth.

4. The residual terms of all of these proxies (after regressing with theseven macroeconomic factors) that are free from economic influence are then used for the principal component analysis in creating the sentiment index.
5. Last, we define the sentiment index ("SentiE") as the first principal component of the correlation matrix of the 13 proxies, where the lead or lag of each individual proxy has the highest correlation with the first-stage sentiment index and is significant (Table 1).

3.1. Explanation of the newly added proxies selected for the construction of sentiment index

i) Primary and secondary home transaction, dollars and volumes (HT1, HT2, HT1$, HT2$): Usually in Hong Kong when the overall sentiment is good, there are more primary residential projects being launched by developers and transaction volumes increase substantially as a result. At the same time, more secondary apartments are also released into the market, either by upgraders or by investors

Table 3
SentiE – total variance explained.

Table 2
Correlation matrix with first-stage sentiment index.

HSI	Pearson Correlation	.596**	.704**	.748**	.538**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
HSIProp	Pearson Correlation	.827**	.756**	.805**	.561**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
HSIPVal	Pearson Correlation	.754**	.750**	.459**	.808**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
HT1	Pearson Correlation	−0.018	0.023	0.092	0.094
	Sig. (2-tailed)	0.798	0.742	0.193	0.183
HT1$	Pearson Correlation	.155*	.182**	.182**	.232**
	Sig. (2-tailed)	0.027	0.009	0.001	0.009
HT2	Pearson Correlation	.479**	.565**	.643**	.709**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
HT2$	Pearson Correlation	.566**	.639**	.627**	.747**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
HOTM3	Pearson Correlation	.337**	.406**	.347**	.446**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
NBLR	Pearson Correlation	.489**	.588**	.536**	.688**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
PRCCCI	Pearson Correlation	.364**	.366**	.301**	.150*
	Sig. (2-tailed)	0.000	0.000	0.000	0.033
USCCI	Pearson Correlation	.216**	.274**	.354**	.333**
	Sig. (2-tailed)	0.002	0.000	0.000	0.000
HKUREIS	Pearson Correlation	.854**	.840**	.665**	.246**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
CCI	Pearson Correlation	.863**	.853**	.699**	.301**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

who may want to buy a larger and better apartment from the newly launched residential projects (or other better quality apartments in the secondary market) and who thus may need to sell their existing apartments in the secondary market.

ii) Hot money into Hong Kong (HOTM3): Unlike many other major regions in the world, Hong Kong has no foreign exchange control. "Hot money" comes to Hong Kong easily whenever investors or speculators think there are opportunities to make short-term profits, either in the stock market or in the property market.

Table 4

HP cycle summary – various lags on SentiE.

HP cycle component	Total variance explained	
	Senti	SentiE
lag3	47.925%	44.918%
lag6	43.288%	40.453%
lag1, 3, 6	49.511%	45.725%
lag1, 3, 6 (exclude HT1)*	53.567%	49.462%

A common way to estimate the hot money flow into the market is using the M3 money supply (i.e., the total money flow into the market, not just in the financial or housing market). This estimate is based on the assumption that a large portion of the money supply is contributed from the inflow of hot money due to the current low interest rate environment of Hong Kong that attracts new investments in the financial market (Guo & Huang, 2010). This study adopts the M3 as the hot money proxy.

iii) New bank loans approved for residential property (NBLR): It is commonly believed that an increase in the supply of credit will create more demand and thus increase the residential property price. This proxy should capture to a certain extent the sentiment of home buyers in the Hong Kong market.

iv) China and U.S. Consumer Confidence Indices (PRCCCI, USCCI): We would also like to see whether international investor sentiment levels might affect Hong Kong's sentiment level, as Hong Kong's economy and investment activities are influenced by the behavior of the international market to a certain extent. Therefore we include two consumer confidence indices from the two largest economic systems, i.e., the U.S. and China.

According to the Conference Board, U.S., "The Conference Board Consumer Confidence Index® (CCI) is a barometer of the health of the U.S. economy from

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.9355	49.4624	49.4624	5.9355	49.4624	49.4624
2	1.7087	14.2394	63.7018	1.7087	14.2394	63.7018
3	1.0829	9.0246	72.7264	1.0829	9.0246	72.7264
4	0.9837	8.1975	80.9238			
5	0.7492	6.2430	87.1668			
6	0.5742	4.7848	91.9516			
7	0.4559	3.7991	95.7508			
8	0.2617	2.1810	97.9318			
9	0.1728	1.4400	99.3718			
10	0.0433	0.3610	99.7328			
11	0.0243	0.2027	99.9356			
12	0.0077	0.0644	100			

Extraction Method: Principal Component Analysis.

the perspective of the consumer".[2] The China factor is no doubt a very important area that we cannot ignore when studying economic and investment activities of Hong Kong. The China Consumer Confidence Index (PRCCCI) is constructed by the National Bureau of Statistics of China, based on a monthly survey of consumers from 20 cities all over the country concerning their expectations about future economic trends and levels of satisfaction regarding their current economic situation.

v) The University of Hong Kong Real Estate Index Series (HKUREIS)and Centa-City Index (CCI): As property indices reflect overall market performance and are easy for general investors to understand, they may affect the sentiment level of investors to some degree. We therefore select the representative property indices of Hong Kong, one index constructed by academics and another index that is widely used by market practitioners.

The University of Hong Kong Real Estate Index Series (HKUREIS) is constructed using monthly transaction data based on the repeat sales methodology to maintain a constant level of index quality over time.[3]

[2] fidence Survey® Technical Note, February
The Conference Board, U.S., Consumer Con 2011. [3] Index Construction Method for the HKU-REIS, Version 1.28, Nov. 2006.

The Centa-City Index (CCI) is a monthly index constructed by Centaline (a leading Hong Kong property agency) based on all transaction records as registered with the Land Registry to reflect the monthly property price movement over time. Given the easy-to-understand format and the huge transaction database used in constructing

this index, the CCI is widely accepted and used by many industry practitioners as a key market benchmark of residential price movement.

4. Empirical studies and methodology

We hypothesize that high sentiment (optimism) leads to a period of market overvaluation on residential property, and thus the subsequent period's return will be low (and vice versa). To test our hypotheses in relation to the Hong Kong residential property market, we create a proprietary sentiment index.

4.1. Index creation methodology and procedures

The first step is to create the sentiment index using principal component analysis (PCA) based on the selected 13 independent variables as proxies of sentiment under five categories.

We create the sentiment index by using the first principal component of the above 13 variables and their lagged data of 1 month, 3 months and 6 months. We select those components having the higher significance levels on their correlation with the first-stage sentiment index for the same variables to be used for the index composition. However, as "trend" is included in those factors, we need to filter out the trending effect first, and use the detrended data to construct the sentiment index.

To obtain better detrended variables before we create the sentiment index, we use the Hodrick-Prescott Filter ("H-P filter")[3] to see whether the trend in each of the 13 raw factors can be separated out. The H-P filer is one of the most popular tools used in empirical studies for separating the trends and cycles of a time series (Giles, 2013).

Using H-P filter shall enable us to obtain a better and cleaner factor, without the trend factor for all of the 13 variables (all at I(0) – stationary and same order of integration) for regressing on a set of economic factors to be used as the index components for constructing the sentiment index.

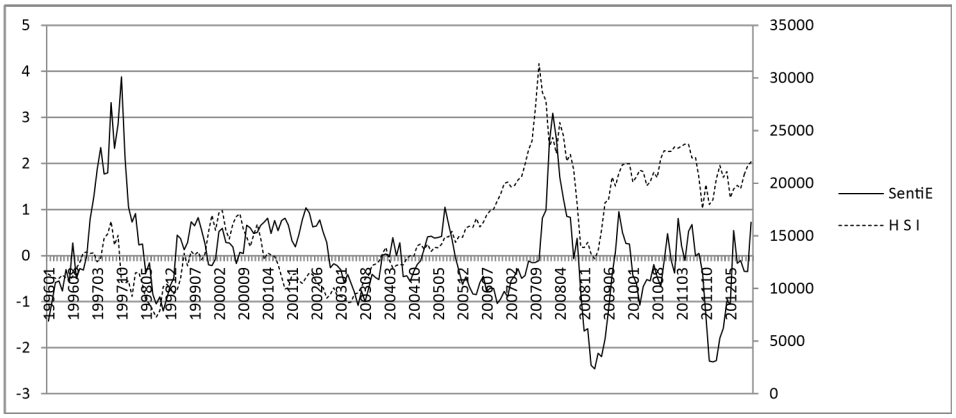
We then extract the first principal components of the 13 "detrended" variables and their lags using 1) 3-month lags, 2) 6-month lags and 3) 1, 3 and 6-month lags to form a sentiment index ("Senti"), using the variables of the same category with higher correlation with the firststage sentiment index. Also, all 13 independent variables are standardized as index components (i.e., mean = 0; SD = 1) before doing the principal component analysis.

In addition, the sentiment index is calculated without the effect of economic factors ("SentiE"). Each of the 13 variables is regressed ($Var_{i\,t,}$) on a set of economic factors, and we use the respective residuals (" "$e_{i\,t,}$) to re-do the principal component analysis for the construction of SentiE. The economic factors used as controlling variables are 1) CPI growth, 2) retail sales growth, 3) change in loans and advances to business, 4) change in the Hong Kong effective exchange rate, 5) growth in imports, 6) growth in exports and 7) GDP growth. As described in section 3, these economic factors represent and affect most sectors of the economy of Hong Kong.[5]

$$Var_{i\,t,} = \alpha + CPIgrowth_{i\,t,} + RetSgrowth_{i\,t,} + \triangle loanadv_{i\,t,}$$
$$+ \triangle EffExrate_{i\,t,} + \triangle Import_{i\,t,} + \triangle Export_{i\,t,} + GDPgrowth_{i\,t,} + e_{i\,t,}$$

where $e_{i\,t,} = Var_{i\,t,}$ *without economic effects*.

We see from the correlation matrix that in using lagged one month, lagged three months and lagged six months for SentiE analysis, the variable HT1 is not significant in its correlation with the first stage sentiment index. The other 12 variables remain the same for the period,



[3] Hodrick and Prescott, Postwar U.S. Business Cycles: An Empirical Investigation, Journal of Money, Credit and Banking, Vol. 29, No. 1, Feb. 1997. [5] Except for retail sales growth, growth in imports and growth in exports, in which three variables are measured for year-on-year change, the other four variables are measured for month-on-month change. All seven variables are stationary at I(0).

Fig. 1. Proprietary Sentiment Index (LHS: standard deviation) vs. Hang Seng Index (RHS: points) for Hong Kong Residential Market.

with strong correlation with both the first stage index of SentiE. Therefore, we decide to drop HT1 as an index component and use the remaining 12 variables to compose the sentiment index (Tables 2 and 3).

The first principal component explains 49.462% of the SentiE. The 12 variables as index components of the SentiE, including 1-month, 3month and 6-month lags, remain the same as the Senti, which implies that economic factors have a limited effect on the 12 variables that are used to construct the sentiment index. Again, HT1 is not significant in either case, and we drop it from the original 13 variables. The same set of 12 variables remains in both the Senti and SentiE, showing that the choice of the economic variables and the 12 variables is accurate (Table 4).

In summary, we use a sentiment index that is constructed using the cycle component of the 13 variables abstracted from H-P filter as index components and regress each of the components with the six economic factors to obtain another clean set of 13 variables as index components that are distilled from economic effects. Principal component analysis is used to construct the sentiment index, taking the first principal component of the 12 variables (dropping HT1 as insignificant) of various lagged periods that have the strongest correlation with the first stage sentiment index (Fig. 1).

The equations for SentiE (12 variables only) are as follows:

$$SentiE_t = 0.128HSI_{t-3} + 0.143HSIProp_{t-1} + 0.140HSIPVal_{t-1} + 0.059HT1\$_{t-3} + 0.138HT2_{t-3} + 0.142HT2\$_{t-3} + 0.078HOTM3_{t-3} + 0.133NBLR_{t-3} + 0.058PRCCCI_{t-1} + 0.059USCCI_{t-3} + 0.139HKUREIS_t + 0.141CCI_t$$

4.2. Sentiment effect on future returns (hypothesis 1)

We would like to investigate whether high (low) current sentiment is followed by low (high) future returns. In this study, the future returns (Return% $_{i,t}$) are defined as the monthly price changes between current month and last month, measured in percentage, i.e., [(Price $_t$/Price $_{t-1}$) −1] in percentage.[4]

H1. Investor sentiment negatively predicts the future returns of residential property in Hong Kong.

The sentiment index "SentiE" is used to do the cross-sectional analysis on the effects of sentiment on various residential estates in Hong Kong, including the effects on the following:

- representative residential estates (total 16)
- size: from class A to class E based on saleable area (defined by Rating and Valuation Department), with size ranges as follows:

  A: less than 40 m^2

  B: 40 m^2–69.9 m^2

  C: 70 m^2–99.9 m^2

  D: 100 m^2–159.9 m^2

  E: 160 m^2 or above

- location: three districts – Hong Kong Island, Kowloon and the New Territories.

4.2.1. Testing of hypothesis 1 (H1)

Using Sixteen representative residential estates in Hong Kong[5]: The 16 representative residential projects for this analysis are chosen based on the following criteria: 1) They have enough liquidity (i.e., transaction volume); 2) They have critical mass on their own (i.e., with adequate units in the development); and 3) They have been used by practitioners as benchmark estates for their districts.

First, we determine whether the monthly returns of these representative estates are correlated with the sentiment index, and then determine the optimal period for the lag time on sentiment that predicts the future returns.

$$Return\%_{i\,t,} = +c \quad \beta SentiE_{t-n} + \varepsilon_{i\,t,}$$

where i = each of the 16 residential estates, t = period (month), n = lag period (months). Return % is measured on a monthly basis[8]. We use the level of sentiment of the last period (i.e., lagged months = 3, 6, 9, 12, 15, 18, 24) and observe its effect on the following periods of study. In order to investigate the pattern on how sentiment may predict the future returns on different lagged sentiment periods, we extent the width of the study period to see how the lagged periods of 3, 6, 9, 12, 15, 18 and 24 months may affect the monthly returns for the subsequent periods concerning property. To correct for heteroskedasticity and autocorrelation that may affect the results of the analysis, we use the Newey-West HAC estimator (Newey & West, 1987, 1994) in Eviews to generate the robust standard errors and the adjusted p-values.

The results of the 16 residential estates are summarized as follows (we have bold and underlined the coefficient and adjusted p-value with largest values of each estate for easy observation of the pattern; also crossed out the insignificant ones) (Table 5):

[4] It is hard to obtain the reliable cap rates for residential properties in Hong Kong due to limitations in the quality and availability of the data for our analysis. We therefore use monthly price change percentage as the monthly return in this analysis, where monthly price change percentage captures most of the return on the property aside from the rental income (if any).

[5] The average monthly price dataset on the 16 residential estates are provided by DTZ research as a courtesy for academic research use only. [8] All of the time series data on monthly returns and SentiE are stationary.

As can be seen from the above summary table, the effect of

Table 5
16 residential estates versus sentiment index.[6]

No.	Residential Projects	SentiE months	3	6	9	12	15	18	24
1	Cavendish Heights	Coefficient of SentiE	−0.0119	−0.0137	−0.0127	−0.0129	−0.0129	−0.0096	−0.0015
		p-value	0.0016	0.0001	0.0000	0.0037	0.0488	0.0361	0.8051
		Adj R-squared	0.0829	0.1115	0.0919	0.1034	0.0732	0.0855	−0.0033
2	City Garden	Coefficient of SentiE	−0.0114	−0.0116	−0.0121	−0.0118	−0.0118	−0.0083	−0.0039
		p-value	0.0000	0.0000	0.0000	0.0002	0.0093	0.0272	0.3851
		Adj R-squared	0.1019	0.1050	0.1110	0.1153	0.0827	0.0864	0.0097
3	CityOne	Coefficient of SentiE	−0.0119	−0.0132	−0.0107	−0.0115	−0.0100	−0.0071	−0.0040
		p-value	0.0006	0.0000	0.0004	0.0000	0.0335	0.0410	0.3549
		Adj R-squared	0.0717	0.0884	0.0540	0.0693	0.0362	0.0377	0.0052
4	Dynasty Court	Coefficient of SentiE	−0.0148	−0.0165	−0.0145	−0.0139	−0.0180	−0.0103	−0.0014
		p-value	0.0013	0.0003	0.0000	0.0085	0.0049	0.0534	0.8207
		Adj R-squared	0.0915	0.1131	0.0836	0.0834	0.1030	0.0688	−0.0041
5	Heng Fa Chuen	Coefficient of SentiE	−0.0094	−0.0102	−0.0105	−0.0110	−0.0123	−0.0079	−0.0033
		p-value	0.0003	0.0000	0.0007	0.0010	0.0023	0.0239	0.4311
		Adj R-squared	0.0524	0.0625	0.0640	0.0776	0.0701	0.0596	0.0033
6	Hong Lok Yuen	Coefficient of SentiE	−0.0114	−0.0134	−0.0118	−0.0091	−0.0155	−0.0090	−0.0019
		p-value	0.0032	0.0002	0.0000	0.0195	0.0033	0.0416	0.6645
		Adj R-squared	0.0883	0.1213	0.0903	0.0565	0.1254	0.0856	−0.0021
7	Laguna City	Coefficient of SentiE	−0.0116	−0.0126	−0.0134	−0.0111	−0.0129	−0.0089	−0.0040
		p-value	0.0001	0.0000	0.0000	0.0002	0.0032	0.0180	0.2951
		Adj R-squared	0.0787	0.0931	0.1029	0.0763	0.0736	0.0730	0.0068
8	Mei Foo Sun Chuen	Coefficient of SentiE	−0.0111	−0.0115	−0.0122	−0.0097	−0.0118	−0.0077	−0.0032
		p-value	0.0007	0.0000	0.0000	0.0019	0.0280	0.0996	0.4130
		Adj R-squared	0.0720	0.0775	0.0839	0.0571	0.0614	0.0537	0.0022
9	Parkview	Coefficient of SentiE	−0.0141	−0.0159	−0.0156	−0.0137	−0.0165	−0.0129	−0.0031
		p-value	0.0102	0.0011	0.0000	0.0020	0.0059	0.0012	0.5690
		Adj R-squared	0.0912	0.1160	0.1075	0.0900	0.0949	0.1226	0.0004
10	Sceneway Garden	Coefficient of SentiE	−0.0117	−0.0121	−0.0136	−0.0109	−0.0137	−0.0087	−0.0037
		p-value	0.0000	0.0000	0.0000	0.0003	0.0012	0.0395	0.3826
		Adj R-squared	0.0801	0.0849	0.1042	0.0724	0.0831	0.0699	0.0047
11	South Horizon	Coefficient of SentiE	−0.0131	−0.0131	−0.0145	−0.0119	−0.0147	−0.0090	−0.0048
		p-value	0.0000	0.0000	0.0000	0.0007	0.0032	0.0114	0.2432
		Adj R-squared	0.0869	0.0861	0.1039	0.0747	0.0826	0.0635	0.0094
12	Taikoo Shing Others	Coefficient of SentiE	−0.0099	−0.0103	−0.0105	−0.0101	−0.0131	−0.0080	−0.0035
		p-value	0.0001	0.0000	0.0004	0.0015	0.0031	0.0443	0.3895

[6] We have used Newey-West HAC robust standard errors, p-value adjusted for heteroskedasticity and autocorrelation.

		Adj R-squared	0.0588	0.0646	0.0637	0.0651	0.0803	0.0618	0.0045
13	Taikoo Shing Seaviews	Coefficient of SentiE	−0.0114	−0.0122	−0.0126	−0.0107	−0.0136	−0.0079	−0.0032
		p-value	0.0000	0.0000	0.0000	0.0001	0.0033	0.0798	0.4905
		Adj R-squared	0.0869	0.0986	0.1021	0.0794	0.0934	0.0642	0.0032
14	Telford Garden	Coefficient of SentiE	−0.0097	−0.0103	−0.0105	−0.0093	−0.0121	−0.0069	−0.0031
		p-value	0.0002	0.0003	0.0000	0.0029	0.0020	0.0722	0.3850
		Adj R-squared	0.0823	0.0920	0.0922	0.0795	0.0986	0.0660	0.0052
15	Tsuen Wan Centre	Coefficient of SentiE	−0.0095	−0.0110	−0.0097	−0.0122	−0.0103	−0.0061	−0.0047
		p-value	0.0149	0.0022	0.0110	0.0007	0.0135	0.1025	0.3520
		Adj R-squared	0.0671	0.0906	0.0675	0.1185	0.0595	0.0416	0.0151
16	Whampoa Garden	Coefficient of SentiE	−0.0105	−0.0106	−0.0116	−0.0104	−0.0133	−0.0081	−0.0045
		p-value	0.0000	0.0000	0.0000	0.0011	0.0023	0.0603	0.2358
		Adj R-squared	0.0674	0.0681	0.0789	0.0686	0.0825	0.0621	0.0101

sentiment on monthly return is significant at the 1%–5% level[7] and is negatively correlated from lagged periods of 3 months and up to 15 months, and the coefficient of sentiment decreases significantly after lagged 15 months. At lagged 24 months the sentiment effect becomes insignificant on monthly returns for all 16 residential estates. We may intuitively think that sentiment has a relatively short-term effect on monthly returns, but in fact the affected period can be up to 15 months.

As the coefficients of the sentiment index do not have a significant difference in absolute values among the lagged periods from 3 months to 15 months for the 16 residential estates, investors may need to consider whether to transact more frequently or to hold properties for a longer period when taking account of the transaction costs, given an obvious change in sentiment. Please note that the sentiment index used here is standardized, and one standard deviation change results in a corresponding monthly return in percentage, which is the coefficient of the sentiment index on that particular residential estate.

With the above findings from the regression of sentiment index on the 16 residential estates, we can conclude the first hypothesis as follows:

H1. Investor sentiment negatively predicts the future returns of residential property in Hong Kong (p-values of SentiE are significant; signs of SentiE are all negative)

4.3. Sentiment effect on various classes of property (hypothesis 2)

Now we would like to see whether sentiment has different effects on different property classes, namely in terms of district (Hong Kong Island, Kowloon and the New Territories) and in terms of size (class A (small unit) to class E (large unit)). The hypothesis proposed is as follows:

H2. In the cross-sectional analysis, the effect of investor sentiment on future return is stronger for certain types of properties, especially for smaller units (mass) in Kowloon district that are harder to value than other properties.

4.3.1. Testing of hypothesis 2 (H2): using delta of monthly returns of classes

A to E The following regression equation is used to perform the test: $Return\%_{j\,k\,t,} - Return\%_{j**,k,t} = +c \qquad \beta SentiE_{t-n} + \varepsilon_{i\,t,}$

where j, j* = Hong Kong (HK), Kowloon (Kln), New Territories (NT), k, k* = class A, B, C, D, E, t = period (month), n = lag period (months). The lagged periods of 3, 6, 9 and 12 months are used for sentiment and the results are summarized as follows (next page).

We want to test whether the smaller units in Kowloon district are more exposed to sentiment (i.e "hard to value"). The major reasons for choosing this category to study are:

1. Kowloon district is a mature market with an excellent transportation network that is convenient for commuting to Hong Kong Island, the New Territories and any other places within Kowloon.
2. Kowloon has a diverse variety of residential properties in terms of grade, age, quality, size, sub-district, etc. that capture a wide range of owners and buyers.
3. Kowloon has a relatively stable and balanced supply of primary and secondary residential stocks, and smaller units have more transactions (higher liquidity) than larger ones due to the lump sum effect.
4. More importantly, Kowloon has gained a considerable number of new units in the last two decades that are new products in traditional old areas and are hard to value (i.e. very few direct and close comparable in terms of quality and features). These new projects are no longer priced in line with market fundamentals and expectations.

As a mature market, Kowloon has good liquidity and can attract more users and investors/speculators, who know that the depth of the market will enable them to easily get in and out, even in a down market. Nonetheless, the fact that the market is well-known does not mean that it is easy to value. Moreover, the "size" effect of larger and more expensive luxury units (i.e. the higher price limits the number of investors/speculators) and the "spillover" effect into smaller units, especially to the new smaller size luxury units (the B and C classes) may help to explain why the B and C classes in Kowloon are more sensitive to the sentiment effect. The liquidity and higher prices add to the "limits to arbitrage" argument of Baker and Wurgler, and thus further strengthen the argument relating to why smaller units in Kowloon are more exposed to sentiment.

[7] We have used Newey-West HAC robust standard errors, p-value adjusted for heteroskedasticity and autocorrelation.

The row on the left hand side of each table represents the first LHS items of the regression model, and the column on the top of each table represents the second LHS items of the regression model. Those boxes checked with "Y" represent that the delta (i.e. difference in returns) of the respective pair of row and column is significant at the 1%–5% level, and a "Y*" in the box represents that the delta is significant at the 10% level.

From the five tables below (also see the last summary table "SentiE (ALL)) we can see that there are more "Ys" on Kowloon B (8 Ys) and Kowloon C (8 Ys) units, implying that Kowloon B and C properties are more sensitive to sentiment, especially compared to the larger units (classes D and E) in Hong Kong and Kowloon districts, and the smaller units (classes A to C) in the New Territories (Table 6). With these findings we can postulate that.

H2. In the cross-sectional analysis, the effect of investor sentiment on future return is stronger for certain types of properties, especially for smaller units (mass) in Kowloon district that are harder to value than others.

5. Discussion on findings

There are consistent findings in all of the previous regression analysis that sentiment is significant, and is negatively correlated with future returns, with a lagged time from 3 months to 12 months in most cases. These are encouraging findings that further indicate that sentiment does play an important role in predicting the future returns of residential properties in Hong Kong. To gain a better understanding on the findings from all of the regression models, we would like to discuss the following in more detail:

i) Sentiment index and its applicability in the property sector ("time lag effect")
ii) A cross-sectional analysis of sentiment effect on classes A to E (delta of monthly price change % of classes A to E)
iii) The safety range of sentiment index movement

5.1. Sentiment index and its applicability in the property sector

When we look at the regression results from the 16 residential estates, we can see that sentiment effects on predicting the future returns are more obvious and significant from lagged 3 months to lagged 12 months. Unlike the stock market where investors can buy small lots of stocks, each with a small total quantum and with high liquidity in the market, residential property involves a much bigger lump sum in dollar terms per transaction in general. Investing in property also takes a much longer time, from identifying the property, negotiating with the vendor, doing the documentation, securing the bank financing and executing the sales and purchase agreement and the assignment. Therefore, the sentiment effect following a purchase can continue to predict the future returns for a longer period of up to 12 months. Also, information asymmetry on the property market is another key factor that prolongs the transaction process and may prolong the effect of market sentiment on future returns.

Similar findings can be seen from the sentiment effects on class A to E properties in Hong Kong, Kowloon and the New Territories. Most sentiment effects are obvious and significant from lagged 3 months–12 months for class A, B, C and D properties in Hong Kong and Kowloon, but with no significant effect in general for class E. However, for the New Territories, the sentiment effects are obvious and significant from lagged 6 months–12 months for classes A, B and C, and for classes D and E it is significant from lagged 3 months and up to 9 months only.

It is worthwhile to note that class E is not significant (or less sensitive) to sentiment effect on future returns in Hong Kong and Kowloon, but it is sensitive in the New Territories up to a lagged period of nine months. This situation in the New Territories recalls the "hard to value" and "limits to arbitrage" arguments concerning sentiment. Many of the large units (class E), especially for new developments, are built in new areas with limited available comparison between sales. Developers set the prices without really benchmarking to the fundamentals or market

Table 6
Delta of monthly returns of class A to E.[8]

SentiE3	HKA	HKB	HKC	HKD	HKE	KLNA	KLNB	KLNC	KLND	KLNE	NTA	NTB	NTC	NTD	NTE
KLNA						–						Y*	Y*		
KLNB					Y		–		Y		Y	Y	Y		
KLNC								–					Y		
KLND									–						
KLNE										–					
SentiE6	HKA	HKB	HKC	HKD	HKE	KLNA	KLNB	KLNC	KLND	KLNE	NTA	NTB	NTC	NTD	NTE
KLNA						–			Y	Y		Y	Y		
KLNB		Y		Y	Y		–		Y	Y	Y	Y	Y		
KLNC								–		Y					
KLND									–	Y					

[8] We have used Newey-West HAC robust standard errors, p-value adjusted for heteroskedasticity and autocorrelation. Y represents significant at 1% and 5% level; Y* represents significant at 10% level for the first 4 tables.

KLNE		Y*								–					
SentiE9	HKA	HKB	HKC	HKD	HKE	KLNA	KLNB	KLNC	KLND	KLNE	NTA	NTB	NTC	NTD	NTE
KLNA					Y*	–									
KLNB				Y	Y		–					Y	Y		
KLNC	Y*				Y			–	Y		Y*	Y	Y	Y*	
KLND					Y				–						
KLNE										–					
SentiE12	HKA	HKB	HKC	HKD	HKE	KLNA	KLNB	KLNC	KLND	KLNE	NTA	NTB	NTC	NTD	NTE
KLNA						–						Y	Y*		
KLNB							–		Y		Y*	Y	Y		
KLNC								–							
KLND									–						
KLNE										–					
SentiE(ALL)	HKA	HKB	HKC	HKD	HKE	KLNA	KLNB	KLNC	KLND	KLNE	NTA	NTB	NTC	NTD	NTE
KLNA					Y	–			Y	Y		Y	Y		
KLNB		Y		Y	Y		–		Y	Y	Y	Y	Y		
KLNC	Y				Y			–	Y	Y	Y	Y	Y	Y	
KLND					Y				–	Y					
KLNE		Y								–					

comps, and we have seen many large or "unique" units that are priced far above the average price for their surrounding areas in the New Territories. Sentiment definitely plays an important role in affecting the price levels on large units in the New Territories.

For Hong Kong and Kowloon, we may ask why sentiment does not have a significant effect on predicting the future returns on large units (class E). As mentioned previously, there is a "lump sum" effect on investing in residential property, i.e., the total quantum in terms of dollar value may affect the transaction volume of the properties, even though market sentiment may indicate that it is the right time to buy. Those buyers or investors who can afford a larger lump sum of property investments are less driven by sentiment, both in buying and selling, as they have holding power. Small investors and/or speculators are more easily affected by market sentiment, but due to their affordability limitations, they may not be able to invest in large units in a frequent and timely manner. Instead, they may prefer to go for smaller units (classes A to C) whenever there is a sentiment change.

5.2. Cross-sectional analysis on classes a to E on sentiment effect (delta of monthly returns of classes a to E)

For easy reference, the findings of the four lagged periods of sentiment (lagged 3, 6, 9 and 12 months)[9] are grouped as follows (Table 7):

There are some findings that are worth discussing in greater detail:

1) Kowloon B and C class units are more sensitive to sentiment as compared to other classes in other locations (this finding supports H2).
2) The larger units in Hong Kong and Kowloon, especially the class E units, are less sensitive to sentiment compared to the smaller units (classes A to C) in all three districts.
3) New Territories E class units are more exposed to sentiment effect than class A to C in the New Territories.

Regarding point 3, a reasonable explanation is that residential projects in the New Territories are more scattered compared to those in Hong Kong or Kowloon. Therefore, it is more difficult to compare the prices for large units (like class E) with neighboring units in the New Territories. Also new supply and stocks of units are comparatively less for class E units in the New Territories than for Hong Kong and Kowloon. Therefore, price judgment on class E units in the New Territories will be more difficult, resulting in greater sensitivity to sentiment.

For larger units in Hong Kong and Kowloon, which are more clustered in the city areas, there is more price history and more comparable units for sale. Therefore, there is less information asymmetry and similar information is shared among investors seeking comparable property units. This factor of density and comparability is one of the major reasons why larger units (especially class E) in Hong Kong and Kowloon are not sensitive to sentiment compared to those in the New Territories.

[9] The "Y" symbol in a box means that the t-statistic (Newey-West p-value) of sentiment index on monthly returns of the corresponding row minus those in the corresponding column are significant at the 1%, 5% or 10% levels.

The "spillover effect" may help to explain why Kowloon B and C class units are more sensitive to sentiment in general. Sentiment may affect the returns on larger units as well, but due to the size effect just mentioned, the majority of investors may flow to the smaller classes of units, where the investment lump sum is smaller for each transaction. Again, Kowloon B and C units come in greater supply and variety, with greater liquidity in both the primary and secondary markets, and with great convenience in terms of location ("limits to arbitrage"). These units are thus more easily driven by sentiment on current price change compared to other classes of units in other districts. In the property market, we can classify investors into long-term (on rental yield and capital gain) and short-term (mainly on capital gain), where long-term investors include (but are not limited to) end-users, and short-term investors include (but are not limited to) speculators. Speculators prefer to invest in residential units that are more liquid, have easy access to the transportation network, have an affordable dollar lump sum, and have a good cluster of facilities in the neighborhood. Moreover, the substantial quality change in property in the last two decades in terms of functionality, facilities, design, views, building quality, etc. where many of them were delivered in Kowloon also makes these newly developed projects "harder to value", implying they are more exposed

Table 7
Delta of monthly returns of class A to E (all).[10]

SentiE (All)	HKA	HKB	HKC	HKD	HKE	KLNA	KLNB	KLNC	KLND	KLNE	NTA	NTB	NTC	NTD	NTE
HKA	–			Y	Y				Y	Y		Y	Y	Y	
HKB		–		Y	Y					Y		Y	Y	Y	
HKC			–	Y					Y	Y			Y	Y	
HKD				–	Y					Y					
HKE					–										
KLNA					Y	–			Y	Y		Y	Y		
KLNB		Y		Y	Y		–		Y	Y	Y	Y	Y		
KLNC	Y				Y			–	Y	Y	Y	Y	Y	Y	
KLND					Y				–	Y					
KLNE		Y								–					
NTA					Y					Y	–	Y	Y		
NTB					Y					Y		–			
NTC										Y			–		
NTD					Y					Y				–	
NTE						Y			Y	Y	Y	Y	Y		–

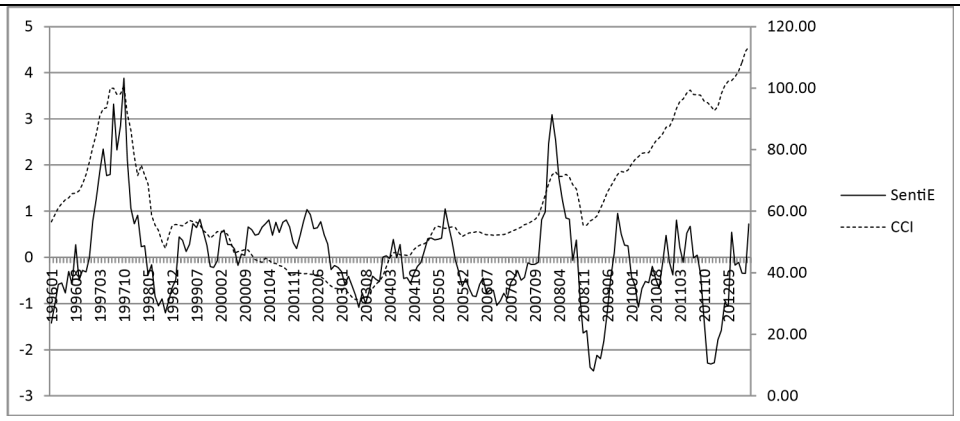


Fig. 2. Sentiment index versus CCI.

to sentiment.

In summary, this study's findings show that smaller units in the Kowloon district are more sensitive to sentiment, mainly due to the "size effect" and "spillover effect", than units of other classes and districts. In the New Territories, housing developments are more scattered and less price-comparable for large units, which results in more vulnerability to sentiment. For smaller units there is less "lump sum" effect in the New Territories, with more end-users and/or first-time buyers dominating the market, so returns on these investments are less sentiment driven. Hong Kong district has a more mature and traditionally longer-term end-user market. Property values in this district are therefore less exposed to sentiment, especially when compared to Kowloon district.

[10] We have used Newey-West HAC robust standard errors, p-value adjusted for heteroskedasticity and autocorrelation.

5.3. Safety movement range of sentiment index level

Another interesting observation can be made following chart which plots the sentiment index together with the Centa-City Index (CCI). We would like to see whether there is any obvious lead-lag relationship between the sentiment and the CCI indices. More importantly, we want to see whether there is any major pattern regarding the turning points of sentiment effect according to these two indices during the study period (Fig. 2).

As the sentiment index is standardized, it is apparent that the standard or safe movement range will be within one standard deviation. It can be seen from the chart that in most cases, every time the sentiment level goes beyond one standard deviation range (either up or down) and persists for more than one quarter, it results in a significant price change in the near future, signaling whether investors should buy or sell the property quickly. For example, when the sentiment level goes above one standard deviation from 1Q 2008 to 2Q 2008, it signals that a significant price change may occur soon, and we do see that CCI comes down considerably during Q3 and Q4 2008. However, when the sentiment level goes under one standard deviation between 3Q 2008 and 2Q 2009, this signals that it may be a good time to buy again, and the CCI does pick up starting in 4Q 2008. The sentiment level then moves in the safe range of one standard deviation until 4Q 2011. The 4Q 2011 to 1Q 2012 period may signal another good time to buy again. After that, the sentiment level goes back to the safe movement range (i.e., one standard deviation range), and we see that the prices keep trenching upward. We see a similar pattern of findings when we look at the 1Q 1997 to 4Q 1997 period, in which sentiment levels are abnormally high (almost four standard deviations at the peak) and are increasing rapidly, resulting in a big slump of property prices after the end of 4Q 1997.

We can also see a similar pattern of findings on the charts of the sentiment index in relation to the 16 residential estates and with class A to E units in all three districts. This is a very interesting finding that calls for additional tests (not explored in this paper) to further confirm the observations.

6. Conclusion

This paper has the following major findings.

- Sentiment negatively predicts future returns in 16 representative residential estates in Hong Kong for a prolonged lagged period from 3 months to 12 months.
- Sentiment has more effect on smaller units (class B and C), especially in the highly clustered Kowloon district, and sentiment does not have a significant effect on large units (class E) in Hong Kong and Kowloon.
- Sentiment has significant effect on larger units (class D and E) in the less clustered New Territories up to a lagged period of 9 months.
- From observing the sentiment index level chart, it can be postulated that whenever the sentiment level goes beyond one standard deviation (either up or down) and persists for at least one quarter, there may be a significant price adjustment (either up or down) in the near future.

In conclusion, with this study we make the following contributions. First, we construct and customize the first Hong Kong sentiment index for residential property to examine the Hong Kong residential market, which has never before been analyzed and measured. We also explain how investor sentiment can predict the future returns of Hong Kong residential property by using i) aggregate market prediction (for 16 residential estates) and ii) cross-sectional analysis (for class A to E units in three districts), a new dimension of analysis that is novel in this area of research. The findings will enable market practitioners such as investors, lenders, developers, end-users, Government and policymakers to gain a better understanding of the future price movements of residential property in Hong Kong based on the sentiment level and can better formulate strategies to meet their respective needs. Most importantly, the sentiment index can serve as a warning indicator to the Government and policymakers, especially when the index is consistently high for a period of time, we may look for appropriate measures to cool down the market, like how to control the new loan to residential sector, how to lower the transaction amount of primary homes (or the land price) as well as secondary sales and transaction amount via additional tax measures that are significant and controllable factors in the sentiment index equation.

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