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TOM: Why Isn't Price Enough?

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In an efficient market, differences in quality should be fully reflected in differences in price. This paper examines a highly active residential property market and verifies whether housing attributes can explain time on the market (TOM) in addition to prices. In contrast to the previous literature, only the price ratio and inflation factor are found to be critical in affecting TOM. An interpretation of the results is suggested, along with some directions for future research.

Keywords
TOM, price ratio, inflation factor, physical attribute, time aggregation

Introduction

The study of time on the market (TOM)[1] is not only interesting for practical purposes (such as pricing strategy for brokers and sellers), but also in academic research. A typical modern graduate microeconomics textbook will provide rigorous proof that a centralized market in which there is perfect information will instantaneously "clear," and that the difference in the market prices for the same type of goods produced by different firms should

[1] Throughout this paper, TOM is defined as the number of days between the listing date of the housing unit and the transaction date.

reflect differences in the quality of goods[2]. Therefore, the TOM for a centralized market with perfect information will be zero.

This theoretical prediction is in sharp contrast to the observed situation in the second-hand market for housing units. First, there are always vacant housing units and potential buyers in the market. The market is decentralized and does not "clear" all the time. TOM is typically non-zero. Second, some research papers suggest that the transaction price for the housing unit does not seem to reflect all the information about the unit. If it does, when the TOM variable is run against the transaction price, other variables (such as physical and locational attributes) should not contain any information and the corresponding coefficients should all be insignificantly different from zero. A voluminous literature clearly indicates that the opposite is true[3]. In a typical "TOM-regression," the TOM is on the left hand side and the listing and transaction prices with the physical and locational attributes are on the right-hand-side. While the exact functional forms and econometric strategies vary across papers, the literature implicitly assumes that the differences in transaction price are unable to capture the differences in attribute, and that the potential sellers somehow differentiate their products along the time dimension. This view of the housing market is supported by some recent theoretical work[4].

This paper re-examines the empirical determinants for TOM using a unique sample: the residential property market of Hong Kong during the 1990s. In particular, we will focus on estates on the most frequently traded list[5]. There are at least two justifications for this choice of sample. First, apartment units within this sample are very likely to be more homogeneous than the houses (many of them detached) studied in previous research[6]. Second, trading during the 1990s was very heavy in the residential market. According to the calculations of Leung, Cheng, and Leong (2002), the ratio of total number of transactions relative to the total stock of residential housing during the 1990s was typically above 10%, with 20% in the peak year of 1997[7]. Such unusual market liquidity should provide an accurate

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[2] For instance, see Mas-Colell, Whinston and Green (1995).

[3] The literature is too large to be surveyed here. See Anglin (1994, 1999), Anglin, Rutherford, and Springer (2001), and the references therein.

[4] For instance, see Haurin (1988), Taylor (1999).

[5] An "estate" in Hong Kong is similar to a "housing development" in the U.S. (i.e. a group of buildings built in the same neighbourhood at about the same time). Estates in Hong Kong can be very large. For instance, the "Taikoo Shing" estate has about 30 buildings, each with more than 20 floors. On each floor, there are several apartment units.

6 For instance, the several apartment units on the same floor have exactly the same height. The several hundred apartment units in the same building were of exactly the same age. Also, Haurin (1988) showed that the more typical a housing unit, the shorter the marketing time.

[7] The corresponding figure for the United States during the same period was less than 5%. Needless to say, there are great variations between cities.

estimate of the housing price, and hence significantly enhance the bargaining process between the buyers and sellers, as well as shorten the marketing time[8].

In fact, this paper found that the most important factors in explaining TOM are the ratio between the listing price and the selling price[9] and the inflation factor, whereas physical and locational attributes were found to be insignificant. This finding is in sharp contrast to those of the previous literature. The result was obtained by splitting our sample (which included more than 11,000 transactions) into 14 half-year sub-samples [10]. Interestingly, when the sub-samples were pooled together, as has been done in much of the previous literature, some physical and locational attributes became statistically significant. Some interpretations are proposed for these findings.

Needless to say, this paper builds on the many insights of the previous literature. However, due to the space limit, it can only refer interested readers to Chan (2002) for a literature review. Table 1 provides a selective summary. In sum, the current work differs from previous studies in several dimensions. It is based on a larger sample, and is able to examine the data as a series of cross-sectional regressions. This enables us to examine whether the coefficients of different variables fluctuate significantly over time and hence eliminate a potential bias due to mis-specifications. It also provides an indirect test for potential structural change in the Hong Kong housing market due to the 1997 handover or the Asian Financial Crisis. If there is a large structural change in the market, then we would expect the explanatory power of the model to fall sharply over time. This research also includes more macroeconomic variables such as candidate explanatory variables.

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[8] In addition, Hong Kong does not have a capital gains tax nor capital controls, but has an essentially flat and low tax rate, and maintained the same fixed exchange rate during the sample period. It may have attracted some foreign investors to participate in the market during this period, although the government does not have any formal record of this. For more details of the Hong Kong housing market, see Chow, et. al. (2002) and Leung, Lau, and Leong (2002).

[9] The terms "selling price" and "transaction price" will be used interchangeably.

[10] The section on methodology below provides justifications for this approach.

Table 1: Comparison with the Previous Literature

	Method	Period	Sample Size	Source	R square	R bar square
Kang & Grander (1989)	log linear	1982 - 1986	1877	Central Illinois	not reported	0.1
Lee & Chang (1996)	3 SLS	1990 - 1993	5347	Taiwan	0.625	not reported
Forgey, Rutherford, & Springer (1996)	log linear	1991 - 1993	3358	Texas	0.3	not reported
Ortalo-Magne & Merlo (2000)	hazard model	1995 - 1998	780	England	not applicable	not applicable
Anglin, Rutherford, & Springer (2001)	hazard model	1996 - 1997	3874	Texas	not applicable	not applicable
Huang & Palmquist (2001)	log linear	1974 - 1976	499	Washington	not reported	not reported
Our Model	Linear/ Hazard model	1993 - 1999	11612	Hong Kong	0.9016/ not applicable	0.9015/ not applicable

Table 2: Comparison of the Results

Table 2a: Physical characteristics

Physical Characteristics	Kang & Gardner (1989)	Lee & Chang (1996)	Forgey, Rutherford, & Springer (1996)	Ortalo-Magne & Merlo (2000)	Anglin, Rutherford, & Springer (2001)	Huang & Palmquist (2001)
Constant	3.219 *	-3.59 *	8.40 **	-6.217*	31.40 **	2.8484 **
(asking - transaction) / transaction	5.501 *					
asking price/transaction price		5.8 *				
asking price			4.59 E-3 **	0.450		0.0880 **
transaction price						
small price group		-0.037 *				
high price group		0.049 *				
degree of overpricing					1.3 **	
degree of overpricing -- sq					1.98 *	
highest offer received as a				6.607*		
proportion of asking price						

* Statistically significant at the 5% level, ** statistically significant at the 1% level

Table 2: Comparison of the Results (Cont'd)
Table 2a: Physical characteristics (Cont'd)

Physical Characteristics	Kang & Gardner (1989)	Lee & Chang (1996)	Forgey, Rutherford, & Springer (1996)	Ortalo-Magne & Merlo (2000)	Anglin, Rutherford, & Springer (2001)	Huang & Palmquist (2001)
small area group		-0.012				
large area group		0.085				
Area			2.93 E-2 *	0.152	0.34	
Area – sq			-8.45 E-4 **		0.01	
ln (deviation from the median area)	-0.008					
Age			1.82 E-2 **		-0.12	
Age – sq			-3.72 E-4 **		-0.00	
ln age	0.161 *					
Flat				0.094		
Terraced				0.098		
semi-detached				-0.067		
Garage				-0.060		
no garage					1.16 **	

* Statistically significant at the 5% level, ** statistically significant at the 1% level

Table 2b: Physical characteristics (Cont'd)

Physical Characteristics	Kang & Gardner (1989)	Lee & Chang (1996)	Forgey, Rutherford, & Springer (1996)	Ortalo-Magne & Merlo (2000)	Anglin, Rutherford, & Springer (2001)	Huang & Palmquist (2001)
bedrooms			6.75 E-2			
bedrooms -- sq			1.83 E-3			
2 bedroom				-0.075	-0.33 *	
3 bedroom				-0.117		
4 bedroom				-0.022	-0.07	
5 bedroom					-0.37 *	
bathrooms			-0.12	-0.058		
bathrooms -- sq			1.20 E-2			
stories					0.25 **	
fireplace			-6.67 E-2		-0.07	
heated area						-0.0005 **
pool			-5.49 E-2		-0.19 **	

* Statistically significant at the 5% level, ** statistically significant at the 1% level

Table 2: Comparison of the Results (Cont'd)
Table 2b: Seasonal and Macroeconomic Characteristics

Seasonal and Macroeconomic Characteristics	Kang & Gardner (1989)	Lee & Chang (1996)	Forgey, Rutherford, & Springer (1996)	Ortalo-Magne & Merlo (2000)	Anglin, Rutherford, & Springer (2001)	Huang & Palmquist (2001)
Winter			-0.33 **			
Spring			-0.2 **		0.08	-0.4359 **
Summer			-7.42 E-3		-0.51 *	-0.3280 **
Fall					-0.63 **	0.0944
interest rates trend			4.45 **			
mortgage interest rate					-4.24 **	
unemployment trend			-1.51 **			

* Statistically significant at the 5% level, ** statistically significant at the 1% level

Table 2c: Housing Market and Miscellaneous Factors

Housing Market and Miscellaneous Factors	Kang & Gardner (1989)	Lee & Chang (1996)	Forgey, Rutherford, & Springer (1996)	Ortalo-Magne & Merlo (2000)	Anglin, Rutherford, & Springer (2001)	Huang & Palmquist (2001)
broker size			-1.34 E-4 *			
inventory in housing market					1.07 **	
sales in a month					0.22 *	
market duration set with broker		0.057 *				
housing appliances listed				0.009		
no offer				0.832		
houses have a financial distress recently			0.33 **			
noise contour level						0.0530

* Statistically significant at the 5% level, ** statistically significant at the 1% level

The organization of this paper is as follows. The next section provides a description of the data used, followed by a discussion of the methodology.

The empirical findings and interpretations of these findings are presented in the next section, followed by a conclusion in the final section.

Data Description

The residential property data that is used in this paper was provided by the Economic Property Research Centre (EPRC)[11]. Houses for rental were excluded. The sampling period runs from January 1993 to December 1999. There are a total of 12,180 transactions, but only 11,612 transactions with complete records remain in the data set. These are further divided into 14 half-year sub-samples according to the transaction date.

We only focused on the most frequently traded list provided by the EPRC, comprising about forty estates[12]. There are some limitations to this sample. First, there is no individual household panel data set available in Hong Kong, and hence it is virtually impossible to detect the "seller motivations," which may be important for determining TOM[13]. Second, in Hong Kong, the number of bedrooms, bathrooms, etc. in a housing unit may be changed at any time without the need to report to the government[14]. Therefore, these potentially important variables are not included in the regression. Given these limitations, the explanatory variables that can be used are divided into four categories – price characteristics, physical characteristics, location characteristics, and macroeconomic factors. They are listed in Table 3.

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[11] In Hong Kong, all housing transactions need to be registered, and the EPRC simply compiles the data files from the Hong Kong Government. For more details about the EPRC, see Leung, Lau, and Leong (2002). Apart from the EPRC, this paper is also the source for some macroeconomic variables used in many government documents. Many real estate agent websites use information from the same paper regarding some of the physical characteristics of the housing units.

[12] There are several reasons for this. First, some estates are extremely luxurious relative to the others and may therefore distort the sample. Second, some estates are rarely subject to transactions, and this may affect the results artificially. More importantly, the government does not provide information on the age of the buildings, and so we are dependent on the websites of several real estate agents that only provide information on those more frequently traded. If we enlarge the sample to include other estates, then it would become impossible to identify the age of properties. See Chan (2002) for more details.

[13] For instance, see Glower, Haurin, and Hendershott (1998), who employed a small sample of survey data, and Anglin, Rutherford, and Springer (2001) for a much larger sample without survey data.

[14] Obviously, it could be dangerous to add bathrooms to an apartment without permission. However, it is easy to decrease the number of bathrooms and bedrooms.

[14] Implicitly, we have assumed that, on average, higher quality housing units will have a higher price per square foot.

Table 3: Factors Used in the Regression Model

	Factors Used in Regression	Symbol Used
	Price Factors	
1	High Price Group	HP
2	Low Price Group	LP
3	Nominal Price Ratio	P-Ratio
	Physical Characteristics	
4	Age	Age
5	Floor	Floor
6	Area	Area
	Locational Characteristics	
7	MTR	M500
8	LRT	L500
9	Bay	B500
10	Police Station	P500
11	Hong Kong Island	HK
12	Kowloon	KLN
	Macroeconomic Factors	
13	Gross Domestic Product	GDP
14	Growth rate of Loan	Loan Growth
15	Interest Rate	IR
16	Inflation Factor	Inflation

Price Factors

Factors 1 & 2: High/Low Price Group (HP/LP)

As the market can be segmented into different "classes" due to differences in "quality," we divided the housing units into three different groups, according to the real transaction price per square foot15. We used the medium price group as our control group in the regression, and treated the high price group (HP) and low price group (LP) as dummy variables in our regression.

[15] Implicitly, we have assumed that, on average, higher quality housing units will have a higher price per square foot.

Factor 3: Nominal Price Ratio (P-Ratio)

In each transaction, we divided the nominal listing price by nominal transaction price to get the nominal price ratio16. The literature (such as Kang and Gardner, 1989) shows that a positive coefficient can be expected.

Physical Characteristics

Factor 4: Age

This denotes the time between the transaction year and the year the households were allowed to move into the estate[17]. The age of some of the housing units is equal to 0 or even –1, which corresponds to advance sales before completion. When focusing on the secondhand market, we eliminated these transactions; they amounted to about 3.5% of our sample.

Factor 5: Floor

This data comes from the EPRC. Many estates in Hong Kong are at least 30 stories high, and some people may prefer upper floor units because they have better views and are less noisy. In our data set, some of the housing units are on the ground floor. These cases represent about 0.7% of our total data set and have been excluded for two reasons: they only occur in detached housing units, and the ground floor of a typical building is usually reserved for retail shops[18].

Factor 6: Area

The EPRC provides two types of area data: the gross area and the net area. The gross area is used for two reasons. Only a small portion of the units has information on the net area. More importantly, during the sampling period, there was neither official regulation nor professional consensus about how to measure the net area. Therefore, the "net area" reported by real estate developers is subject to personal bias and varies between developers. To

[16] We also included an inflation factor in the regression model to control for the effect of inflation. In any case, it seems that the inflation distortion is marginal because for most of the transactions, TOM is *less than 50 days*.

[17] In Hong Kong, especially during the early 1990s, the real estate market was prosperous, and newly-built houses or sales of pre-built houses were popular. They were also frequently traded in the second-hand real estate market. The information on "age" is not contained in the EPRC data files, and we have searched and verified this information on various real estate agent websites.

[18] Also, some of the units on the ground floor are a mixture of a residential unit and a retail store. In order to facilitate a focus on the residential market, these have been deleted from the sample.

avoid yet another potential source of measurement error in the sample, only the gross area was used. We proceeded with the acknowledgement of this limitation.

Locational Characteristics

Factors 7 & 8: MTR/LRT (M500 / L500)

There are three major railway systems in Hong Kong. The MTR is its subway system, with 44 stations, while the KCR is its railway system linking Hong Kong to China, with 13 stations. The Light Rail (LRT) serves only the northwestern portion of the New Territories.

Factors 7 and 8 measure the distance between the housing estates and the nearest railway station. Dummy variable "M500" takes the value of unity if there is a MTR Railway station within 500 meters of the house[19]. Similarly, dummy variable "L500" takes the value of unity if there is a Light Rail station within 500 meters of the house. A location near a railway system may be treated as a location convenience, but may also imply a noisy environment. We have not constructed another dummy variable "K500" for estates within 500 meters of KCR stations, as only 2% of the sample will take unity value for this dummy.

Factor 9: Bay (B500)

This factor measures the distance between the housing estate and the nearest bay or harbor. Being close to a bay or a harbor may imply a lower variation in temperature, proximity to water-view resort places[20], or a faster corrosion of furniture and appliances. A dummy variable "B500" was constructed to distinguish the effect of having a bay within 500 meters from the estate.

Factor 10: Police Station (P500)

Housing estates located near a police station may give residents a sense of security. A dummy variable "P500" is constructed, which equals 1, if the nearest police station is within 500 meters of the estate.

Factors 11 & 12: Hong Kong Island/Kowloon (HK/KLN)

[19] The distance "500 meters" is somewhat arbitrary, and we also considered a distance of 400 and 600 meters. The results are unchanged, and hence we focused on the case of "500 meters". See Chan (2002) for details.

[20] Estate developers typically build a private resort place within the estate so that residents can easily enjoy water views during their leisure time.

Geographically, Hong Kong can be divided into three parts: Hong Kong Island, Kowloon Peninsula, and the New Territories. The housing estates were divided up according to their locations. We used the New Territories as our control group in the regression and treated Hong Kong Island (HK) and Kowloon (KLN) as dummy variables.

Macroeconomic Factors[21]

Factor 13: Gross Domestic Product (GDP)

We collected the quarterly data for gross domestic product (GDP), measured at the constant market price for the year 1990. We used an intrapolation method to convert the quarterly GDP data into its monthly counterpart. This factor represents the general economic situation of Hong Kong for that period.

Factor 14: Growth Rate of Loan (Loan Growth)

As the real estate market may be subject to credit rationing[22], this variable was included to capture the loan market situation. It also reflects the expectations of the financial industry in relation to the real estate market[23]. As the series for real loans is statistically non-stationary[24], we used the growth rate, which is stationary, for regression.

Factor 15: Interest Rate (IR)

The interest rate is often regarded as the opportunity cost for real estate investment. A one-year Exchange Fund Note (henceforth EFN) is widely perceived as a risk-free investment, since it is essentially Hong Kong's version of the T-bill. The interest rate of the EFN during the sample period is non-stationary, and hence we have used the de-trended EFN rate for the regression.

Factor 16: Inflation factor (CPI Ratio)

This was calculated using the CPI(A) in the asking month divided by the CPI(A) in the transaction month.

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[21] All the data used in this section was collected from various government documents.
[22] See Leung, Lau, and Leong (2002), among others, for evidence.
[23] See Chen (2001) for more discussion on this.
[24] We divided the monthly data for loans to the construction sector by the corresponding consumer price index CPI (A) to obtain the real loan.

Dependent Variable – Time on the market (TOM)

The time on the market, TOM, is the number of days between the listing day and the transaction day[25]. The following tables provide more details.

Table 4a: Summary of Statistics

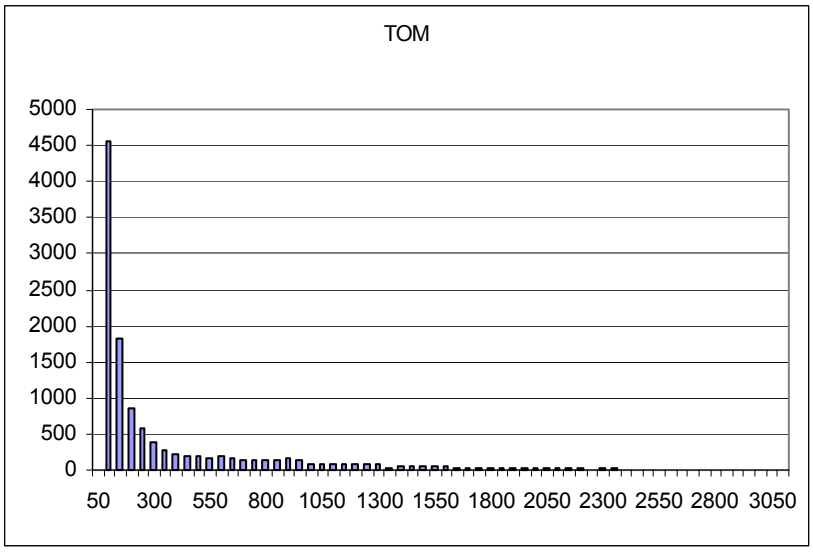
	Max.	Mean	Median	Min.	S.D.
TOM (day)	3002	301.67	81	1	460.73
P-Ratio	4.57	1.073	1.039	0.234	0.261
Age (year)	22	7.05	6	1	5.19
Area (sq. ft.)	2771	775.83	745	136	268.47
Floor	45	14.89	14	1	9.93
GDP	220.93	194.03	195	159.24	14.16
Loan Growth	0.522	0.012	0.009	-0.324	0.06
IR	0.326	0.001	-0.003	-0.271	0.09
Inflation	1.06	0.96	0.99	0.63	0.07

Table 4b: Summary of Statistics (dummy variables)

Variables	No. in all sample
M500	3338
L500	1474
B500	7631
P500	6671
HK	4257
KLN	2920
1993	1512
1994	1207
1995	1596
1996	2727
1997	2319
1998	1280
1999	971
Total Number of Transactions	11,612

[25] In our sample, some transaction records imply that the value of TOM is equal to 0. They constitute about 0.6% of our sample and were excluded from the analysis.

Figure 1: Distribution of TOM



Note:"50 days" means that the transaction was done between 0 to 50 days; "100 days" means that the transaction was done between 50 to 100 days, and hence forth.

Methodology

This paper uses a simple structure to capture the factors determining TOM. We will focus on the results from a duration model. We will also report results of Chan (2002) for comparison. Chan (2002) adopted the same data set as this paper, and she also split the sample on a half-yearly basis. Chan reached essentially the same conclusions using a simple OLS regression. She ran a simple cross-sectional regression for each period:

$$TOM = \beta 0 + \beta 1\, P + \beta 2\, L + \beta 3\, M + \varepsilon \qquad (1)$$

with P representing the price and the quantifiable physical characteristics of the house such as the gross area of the house, L representing locational factors such as railway network, and other public facilities (such as a police station), and M representing macroeconomic factors such as the gross domestic product. ε is the error term in the regression, with β_I I, I = 1, 2, ⋯ etc., being the vector of coefficients obtained for each period.

Notice that this formulation allows the coefficients of different variables β to vary over time[26]. This may occur, for instance, when there are some underlying changes in regulation (such as a legal minimum for the down payment as a share of the housing price) and/or political regime. The sampling period is from 1993 to 1999, and is indeed longer than most studies in the literature. There were important changes in the government regulations and macroeconomic situation for this period, including the handover of Hong Kong to China in 1997 and the "anti-speculation policies" introduced by the government in 1994 and 1997[27]. Time-varying coefficients may emerge. To control for these, the whole sample was split into 14 sub-samples, each of which is equal in length (half a year). The results from this procedure will be compared with results derived after pooling all of the data together[28]. To check the validity of the data, a log linear regression for TOM was also run, as suggested in some of the literature[29]:

$$\ln TOM = \beta 0 + \beta 1 \ln P + \beta 2 \ln L + \beta 3 \ln M + \varepsilon \qquad (2)$$

Chan (2002) also considered models with interacting terms, and found that the results are qualitatively the same.

However, there is a problem with this approach. The TOM variable, by definition, is non-negative. Also, the OLS approach presumes that the price ratio is independent of time on the market, which is clearly untrue. Following the literature, we employed a duration model to estimate the effect of different variables on time in the market[30]. Formally, we used the maximum likelihood method to estimate the following model for each period:

$$\ln TOM = \beta 0 + \beta 1 P + \beta 2 L + \beta 3 M + \varepsilon \qquad (3)$$

Interestingly, we found that the qualitative results for the two approaches are very similar, as we will show in the next section.

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[26] Time-varying parameter values are not uncommon in the real estate literature. For instance, these were documented in the hedonic pricing literature. See Leung, Cheng, and Leong (2002) for a discussion.

[27] See Law (2000) for an account of changes in Hong Kong housing policy during the 1990s.

[28] When a regression is run with all the data pooling together, six "year dummy" variables: "1993," "1994," "1995," "1996," "1997," and "1998" were also introduced.

[29] Only continuous variables such as age and price ratio are in log form, while dummy variables still enter the equation as "linear" terms.

[30] For an exposition of this, see, for instance, Retherford and Choe (1993).

Empirical Results

OLS Regression

As a benchmark, the results from a simple linear regression will be reported[31]. As there are a total of 14 sub-periods, it is possible that the estimated coefficients of the same variable appear positively significant for some periods and at the same time negatively significant in some other periods. Thus, it will be useful to see how often the coefficients of different variables were found to be significant. As summarized in Table 5, physical and locational characteristics are almost always insignificant. Apart from the inflation factor, macroeconomic factors (GDP, Loan growth, and the interest rate) are unstable in the sense that significant proportions of their corresponding coefficients are positively significant, while other significant proportions are negatively significant[32].

Table 5a: Values of the Coefficients of the Semi-Annual Line Regression

	Mean	Median	S.D.	Positively Significant at the 0.05 Level	Negatively Significant at the 0.05 Level	Insignificant
Constant	6163.19	5921.75	1779.89	100.00%	0.00%	0.00%
HP	-2.67	-2.73	4.87	0.00%	14.29%	**85.71%**
LP	1.98	2.58	18.63	7.14%	0.00%	**92.86%**
P-Ratio	62.38	-36.55	256.99	28.57%	**64.29%**	7.14%
Age	-0.39	0.03	1.1	14.29%	7.14%	**78.57%**
Floor	0.12	-0.01	0.48	0.00%	7.14%	**92.86%**
Area	0	0	0.02	7.14%	7.14%	**85.71%**
M500	1.62	1.05	6.32	14.29%	0.00%	**85.71%**
L500	5.52	1.53	15.58	0.00%	14.29%	**85.71%**
B500	-1.17	-0.3	5.14	0.00%	0.00%	**100.00%**
P500	5.24	-1.25	22.75	7.14%	0.00%	**92.86%**
HK	-0.25	-0.63	13.86	0.00%	7.14%	**92.86%**
KLN	-4.76	2.46	21.79	7.14%	0.00%	**92.86%**
GDP	-2.18	-1.37	6.72	28.57%	50.00%	21.43%
Loan Growth	1029.68	-42.92	4349.67	35.71%	21.43%	42.86%
IR	-104.61	-34.25	270.43	28.57%	50.00%	21.43%
Inflation	-5750.51	-5531.54	1282.36	0.00%	**100.00%**	0.00%

Note: We put the figures bold when they exceeded 51%.

31 To check for the robustness of our results, a log linear regression model was also run. The details of the log linear regression results can be found in Chan (2002). Suffice to say that the simple linear regression model can provide a higher explanatory power, since values for both R-square and R bar square are much higher. In addition, there are more significant point estimates in the simple linear regression model. Chan (2002) also ran regressions using interacting terms in both linear and log linear regression. Again, the major results remained unchanged.

32 In fact, based on the OLS regressions, Chan (2002) conducted further diagnoses and showed that in terms of explaining the difference in TOM across transactions, the inflation rate and price ratio are far more important than all the other variables combined.

Table 5b: Values of the Coefficients of the (Pooled) Linear Regression

Variables	Estimates	
Constant	6083.86	**
HP	-3.83	
LP	-0.04	
P-Ratio	266.14	**
Age	-0.37	
Floor	0.10	
Area	0.01	
M500	4.28	
L500	-13.41	**
B500	0.63	
P500	1.75	
HK	-1.93	
KLN	-7.93	*
GDP	1.16	**
Loan Growth	-1.06	
IR	-151.87	**
Inflation	-6216.44	**
1993	-384.51	**
1994	-383.31	**
1995	-437.91	**
1996	-393.58	**
1997	-346.86	**
1998	-310.26	**

*Significantly different from zero at the 95 percent level of confidence
**Significantly different from zero at the 99 percent level of confidence

The inflation factor is always negatively significant. Other things being equal, a higher inflation rate leads to a lower real transaction price; buyers are more willing to purchase, and the time on the market will be shortened.

Almost two-thirds of the coefficients of the price ratio variable are negatively significant, with only about one quarter matching the expected sign, which is positively significant. Chan (2002) further showed that the negative coefficients were typically concentrated in the period before the 1997 handover, while the positive coefficients typically appeared after the handover. This result is in contrast to many previous studies summarized in Table 2, and may be due to the fact that there are many housing market speculators who wait patiently for high-price buyers. It may take a long time for this kind of buyer to appear on the market, however. Thus, the lower price ratio (meaning that the transaction is high relative to the listing price) is associated with a higher TOM. However, the negative coefficients may also come from a mis-specification of the model. The OLS structure presumes

that the price ratio is exogenous to the TOM variable, which may not be true in practice. To investigate this possibility, it is necessary to address the problem with an alternative approach. Here, we follow the literature to adopt a duration model.

Before we switch to the results from duration models, however, there are two points worth mentioning. First, the explanatory power of the OLS model is high. According to Chan (2002), the adjusted R-square of almost all the cross-sectional OLS is above 0.90, although there is a tendency for it to decrease after 1998. It is somewhat surprising that such a simple structure can consistently produce a high adjusted R-square.

Second, when all the data was pooled together, some locational variables (L500, KLN) became statistically significant. The coefficient of the price ratio also became positive. The year dummies are all significant. These results are qualitatively the same as in the previous literature. In addition, some macroeconomic variables (GDP, the interest rate) also became significant. This suggests that the data-pooling procedure commonly adopted may have a non-trivial effect on the estimation results. It will be interesting to see if this also happens in the case of duration model results.

Duration Model

As in the case of OLS regression, the regressions were first run on a semi-annual basis. The results are summarized in Table 6, and are highly consistent with the results from OLS regressions reported in an earlier section. The physical and locational characteristics are almost always insignificant. Most macroeconomic variables (GDP, loan growth, and the interest rate) are often insignificant. The inflation factor is always negatively significant, as in the case of the OLS regression. Other things being equal, a higher inflation rate is typically associated with a shorter period of time on the market. The coefficients of the price ratio are now found to be positively significant in most periods, as the theory predicts. In addition, when the data from different years was pooled together, some locational variables were found to be significant (Age, Area, and KLN). The price ratio remained positively significant and the inflation rate remained negatively significant. The interest rate also became negatively significant. These results are more consistent with the findings from the previous literature.

Table 6a: Results from the Semi-Annual Duration Model

Variables	Positively Significant at the 0.05 Level	Negatively Significant at the 0.05 Level	Insignificant
Constant	**93%**	0%	7%
HP	0%	0%	**100%**
LP	0%	0%	**100%**
P-Ratio	**71%**	14%	14%
Age	0%	0%	**100%**
Floor	0%	0%	**100%**
Area	7%	0%	**93%**
M500	0%	0%	**100%**
L500	7%	0%	**93%**
B500	0%	0%	**100%**
P500	14%	0%	**86%**
HK	7%	7%	**86%**
KLN	0%	7%	**93%**
GDP	0%	14%	**86%**
Loan Growth	20%	0%	**80%**
IR	0%	29%	**71%**
Inflation	0%	**100%**	0%

Table 6b: Results from the (Pooled) Duration Model

Variables	Estimates	
Constant	22.05	**
HP	0.03	
LP	0.03	
P-Ratio	1.32	**
Age	-0.01	**
Floor	0.00	
Area	0.00	**
M500	0.06	
L500	-0.02	
B500	0.00	
P500	0.00	
HK	-0.05	
KLN	-0.11	**
GDP	0.00	
Loan Growth	-0.18	
IR	-0.53	**
Inflation	-17.91	**
1993	-1.44	**
1994	-1.31	**
1995	-1.63	**
1996	-1.38	**
1997	-1.18	**
1998	-1.24	**

**Significant at the 1% level; *Significant the 5% level.

Comparing the results of the OLS regression and the duration model, we found that there have been several changes. First, the unstable macroeconomic variables that were "unstable" in the OLS regression were found to be consistently insignificant. Second, the sign of the price ratio was changed from negatively significant (OLS) to positively significant (duration model), and made the results more in line with the theory. This suggests that the OLS method may in fact introduce serious bias in the regression.

Nonetheless, the major message seems to be robust to the change of the empirical procedure. First, most macroeconomic variables do not seem to be important in explaining TOM, although the inflation rate is always a negatively significant factor. This finding needs to be interpreted cautiously. Unlike the money growth rate, which is controlled by the government, the inflation rate is determined by the market, and thus depends on all other macroeconomic variables. Thus, a high explanatory power in the inflation factor can be interpreted as evidence that the TOM is strongly related to the general condition of the economy.

Second, physical and locational characteristics are typically insignificant, while the price ratio is typically important in the regression. This may suggest that prices actually reflect the heterogeneity of different houses so well that the additional contributions of physical and locational factors are negligible. Under this interpretation, the real estate market might be more efficient than has been usually perceived. Alternatively, this result may merely suggest that the housing units in the sample are "too homogenous," or because they are in the "most frequently traded list," so that the physical and locational factors become unimportant. More research needs to be carried out in the future to distinguish between these two possibilities.

Third, the choice of the sampling period seems to be very important. When we split the sample on a half-yearly basis, physical and locational attributes were always unimportant. However, when we pooled the data together, some of these attributes became significant. Also, the interest rate, which is either unstable or insignificant on a half-yearly basis, always became negatively significant in the pooled sample. In other words, the level of time aggregation matters [33]. This point may have been unintentionally overlooked in the previous literature, as a small sample size naturally precludes the possibility of splitting the sample into different sub-samples. The sample employed here is large enough to allow for both a series of cross-sectional regressions (half-yearly basis) and a pooled regression. The

[33] The time aggregation issue has long been recognized in economics. For instance, see Christiano and Eichenbaum (1987) and Christiano, Eichenbaum, and Marshall (1991). For a more general discussion of the aggregation issue, see Hanushek, Rivkin, and Taylor (1996).

results here seem to suggest that pooling the data into one large sample would lead to bias and misleading conclusions. The reasons behind this and the generality of these results still need to be explored.

Some institutional differences may play a role in the difference in results. For instance, previous studies based on United States data typically include factors such as the number of bedrooms and bathrooms. In Hong Kong, however, homeowners can remodel their homes at their convenience, and change the number of rooms without informing any government department. Obviously, the re-modeling decision may depend on the market situation, thus becoming a "missing" (and not redeemable) variable in the research[34]. Thus, in a sense, the housing market in Hong Kong is more "flexible" and hence more "efficient".

It is interesting to note, however, that the institutional explanation is likely to be inadequate. Once we pool all of the sub-samples together and re-run the "TOM-regression" with year dummies, as occurs typically in the literature, some physical and locational characteristics become significant at the 95% confidence level, as typically found in the literature (see Tables 5 and 6). The conclusions alter, depending on whether the half-year time aggregation or the full sample was used. Further research is required to determine to what extent this difference in results can be attributed to the time aggregation issue.

Conclusions

In this paper, with the advantage of a large data set and prolonged period of investigation, we modified the standard approach used to identify determinants of time on the market (TOM). By running regression on a half-yearly basis, we found that the "price factors" and the inflation factor are the major factors explaining TOM, while the physical and locational factors, as well as other macroeconomic variables, are typically insignificant. This is in sharp contrast to the previous literature. When all of the data was pooled together, as was done in previous research, some locational factors became statistically significant, as found in the previous literature. This paper also gives an account of the reasons for the change in the relationship between the TOM and the other factors.

Clearly, more research is needed to clarify several issues. First, the inflation factor may be a proxy for some deeper structural movement within the aggregate economy, and the TOM is in fact determined by these aggregate

[34] See Downing and Wallace (2002 a, b) for more elaborations on this point.

economy variables, rather than simply by the inflation factor. More efforts should be devoted to investigate the relationship between the real estate market and the aggregate economy.

Second, this research suggests that the level of time aggregation would indeed influence the results. Future research should further explore this issue and provide a clear guidance on the optimal level of time aggregation. Third, the price-ratio was found to be positively and significantly correlated to the TOM, as many search theoretic models would suggest. On the other hand, we found in this sample that the price-ratio and the inflation factor are the major determinants of TOM, as competitive models with a centralized market would predict. It seems that more efforts are needed to combine the insights of the two paradigms in order to provide a better characterization of the housing market[35].

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