Journal of Financial Management of Property and Construction
Volume 8, Number 3, pp129 - 137, December 2003
Printed in Great Britain

Price discovery function of forward contracts in the real estate market: an empirical test

K. W. CHAU and S.K. WONG
Department of Real Estate and Construction, The University of Hong Kong, Hong Kong

C. Y. YIU
Department of Building and Real Estate, The Hong Kong Polytechnic University, Hong Kong

Summary

- Studies on the pricing of financial forward contracts are abundant and massively outnumber those on the pricing of real forward contracts due to the scarcity of data in the real forward contracts market. In addition, most real forward contracts markets are thinly transacted and heterogeneous in nature.
- The property pre-sales market is a major real forward contract market in Hong Kong that has been actively transacted. The large volume of data in the Hong Kong property pre-sales market allows us to construct and test a forward contracts pricing model for properties.
- Despite the relative higher information cost in the real forward contracts compared to financial future contracts, we found that uncompleted properties in the pre-sales market are efficiently priced and accurately reflect the spot price level and the discount due to rental income forgone during the preoccupation period. We also found that the expected spot price derived from our forward pricing model tracks the *ex post* spot price closely.

Keywords: forward contracts, pre-sales, pricing model, price discovery, market efficiency

Introduction

Real estate markets are often said to be inefficient. On the side of informational friction (e.g. Berkovec and Goodman, 1996), the absence of centralized markets for the exchange of real estate means that buyers and sellers need to pay considerable search costs in the form of time and brokerage commissions. The informational friction is also aggravated by the heterogeneity and asymmetry of the quality of real estate, which raise the cost of quality search and contracting significantly. On the side of capital market imperfection, the indivisibility of real estate implies that capital constraints such as the down-payment requirement (Stein, 1995) do matter. Therefore, given that real estate markets are prone to inefficiency, it is tempting to ask whether arbitrage opportunities exist between the spot and real forward contracts markets.

From a finance perspective, pre-sales of real estate are forward contracts in the sense that contracting parties have agreed on the price, but the underlying asset, which is still under construction, will be delivered to the buyer after the completion of construction. A pre-sales contract is a form of real forward contract that differs from the highly standardized commodity or financial futures traded in a centralized market. Due to the heterogeneity and illiquidity of uncompleted real estate in most places, empirical studies on the pre-sales market are rare.

In Hong Kong, it is a common practice for developers to carry out pre-occupation sales (pre-sales) of new developments well before completion. Before the Asian Financial Crisis in late 1997, queuing overnight for developers' pre-sales was common in Hong Kong. Even the positions along a queue could be traded for a price. After first sales by developers, it was also usual for the uncompleted units to change hands several times prior to completion. The prevalence of pre-sales in Hong Kong over the past decade has therefore enabled the empirical analysis of real forward contracts.

The key objective of this paper is to test whether uncompleted properties in the pre-sales market (i.e. real forward contracts) are efficiently priced. Price discov-

-ery across the spot and (ie.real forward contracts) markets should prevent any riskless profit from being earned persistently through arbitrage between the markets. We propose a real forward contracts pricing model that combines the pricing model of futures with the hedonic pricing method to produce an equilibrium relationship between spot and forward contracts prices of non-standardized products. If uncompleted properties are efficiently priced, a stronger justification would be provided for the application of pricing models that rely on the efficient market hypothesis. In addition, we can uncover the spot price trends from the pre-sale prices. This means that we can construct a constant quality price index using the simple repeat sales model with pre-sales price data. Since uncompleted units are free from physical depreciation, the repeat sales indexes constructed from pre-sales price data are free from the singularity problem of building age and time. Furthermore, irrespective of whether the pre-sales market is efficient, the model described in this paper provides a means to measure the ex ante or expected future real estate price, which is useful for testing many asset pricing models.

The organization of this paper is as follows. Section 2 reviews the literature on futures pricing. Section 3 describes the background of the Hong Kong pre-sales market. Data and methodology are presented in Section 4, and the results are presented in Section 5. Finally, Section 6 is the conclusion.

Literature Review

There are basically two theoretical approaches to understanding whether futures are efficiently priced. One is to establish an equilibrium relationship between futures and current spot prices, such as the cost of carry model proposed by Kaldor (1939) and Working (1948). The model essentially posits that the difference between the futures and spot prices of a commodity is a function of risk-free interest rates, storage costs, and convenience yields. Then Peck (1976) and Stein (1992) further developed their rational expectation pricing model, and Garbade and Silber (1983) put forward their arbitrage model on futures price. The other approach is to model the relationship between futures and expected future spot prices, such as those performed by Cootner (1960) and Dusak (1973). This approach hypothesizes that the futures price of an asset would be an unbiased expectation of future spot price if the expected risk premium is zero. However, the empirical evidence of whether the expected risk premium is zero was mixed (Telser, 1958; Chang, 1985).

While the futures pricing models have been widely tested in the financial and commodity markets, similar studies in real estate markets were rare. One obvious reason is that a formal market for real estate futures does not exist. Shiller (1993) pointed out that the major problems in establishing a cash-settled market for real estate derivatives are illiquidity, heterogeneity in product quality, and the use of non-standardized contract terms. This poses a difficulty in measuring the underlying asset's price objectively for settlement. Although the problems of cash settlements can be reduced by physical delivery, the latter introduces other problems such as moral hazards. As a result, most studies advocated a real estate futures market based on property price indices (Miller, 1989; Gemmill, 1990; Baum, 1991; Case, et al, 1993; Shiller, 1993). They suggested that a futures market of real estate could benefit the spot market by hedging for risk and stabilizing spot prices. However, the demise of the first real estate futures market in London in 1991 undermined the interests of scholars and investors.

Although a formal futures market for real estate does not exist, real forward contracts of uncompleted properties are traded in the pre-sales market. Recognizing that pre-sales are real forward contracts, Shih (1992), Chang and Ward (1993), and Chang (1994) analyzed the pricing of uncompleted housing in Taiwan. Since the mechanisms of pre-sales systems are likely to differ across cities, the next section will explain the pre-sales market in Hong Kong first.

THE HONG KONG PRE-SALES MARKET

In Hong Kong, the private residential property price level has undergone a great change over the last decade. On average, nominal prices rose nearly 350% between 1989 and 1997, despite two small downturns in 1992 and 1994. Such a dramatic growth is primarily attributable to two factors. One is that the linked exchange system between the Hong Kong Dollar and the US Dollar resulted in very low (or even negative) real interest rates, leading to asset price inflation. The other factor is that the Sino-British Agreement restricted new land supply to no more than 50 hectare per year. The restricted land supply was not responsive enough to the strong demand from real income growth during the early period of economic reform in Mainland China. The rise in price levels continued until 1997, when the Asian Financial Crisis occurred. Since then, prices have undergone a significant downward adjustment, and reve-

-rted back to 1992 levels in 2001. Figure 1 shows the nominal price index of the residential market from 1989 through 2001.

It is a common practice for developers in Hong Kong to carry out pre-sales of new developments before their completion. The pre-sales arrangement is a means for developers to improve their liquidity and cash flow, but more importantly, it is a means to hedge against future price fluctuations. Pre-sales of real estate are real forward contracts in which the contracting parties have agreed on a price, but the assignment of the interest of real estate is executed at a certain period in the future. In general, the period is determined by the date at which the development is expected to be completed. Since the development has not yet been completed, no rental income (dividend) is receivable before the settlement of the contracts.

To developers, pre-sales help transfer financial risks to speculators at a price, and identify the market value of properties (Grossman, 1977; Malliaris, 1999). Unlike financial futures, there are usually several payment methods for pre-sales buyers. Discounts to spot prices are commonly provided if buyers choose to pay in full at the time when the real forward contracts are signed. Alternatively, buyers may choose to pay deposits first, and the balance will be payable until the assignment of real estate interests. However, it is plausible to assume that the different payment methods cost the same since developers have a strong incentive to adjust the rate of discount to elicit the former method of payment.

Notwithstanding the potential price discovery function of pre-sales, the Hong Kong Government believed that the sharp rise in property prices before 1997 had been attributable to speculative activities[1], especially in the pre-sales market. In 1994, the Government established a task force to look into the problem of speculation because there had been a public outcry to curb fierce speculation activities in the pre-sales market. The task force suggested that, among other things, the pre-sales market should be controlled because it attracted speculative activities. Several anti-speculation measures were implemented in June 1994 with an aim to stabilize property prices (Lands Department, 1999). They will be explained below.

First, sales restrictions were placed on developers. The permitted period of forward sales was shortened to no more than 9 months. Before the implementation of this measure, developers had generally been permitted to sell uncompleted developments up to 24 months before the anticipated date of completion (Lui, 1997). Renaud, et al (1997) regarded this measure as a hindrance to the cash flow of developers, and thus increased development risk. Furthermore, the permitted proportion of flats allocated for private internal sales[2] by developers was also reduced greatly from 50% to 10%. This not only hindered the use of internal sales to collect price information, but also suffocated the pre-sales channels through real estate agents. Real estate agents have played a significant role in the discovery of the market prices of properties and the dissemination of market information. The measures provided a big disincentive for speculators to enter the market and deterred their role in smoothing out price fluctuations.

Second, the initial deposit and forfeiture fee paid by buyers were centrally regulated. Prior to this regulation, the amount of initial deposit and forfeiture had simply been determined by the market and contractual terms. Less than 5% was the norm for the market. After the regulation, the initial deposit was fixed at 10% of the purchase price upon the signing of the preliminary sale and purchase agreement (PASP). The amount of forfeiture was set at 5% of the purchase price, which had to be paid if the purchaser failed to sign the sale and purchase agreement (ASP). The ASP was usually entered into within 14 days after the PASP. After the ASP has been signed, the contract would be binding on the part of both parties.

Third, some measures were imposed to increase the transaction cost of the pre-sales market. One was that any re-sales of ASPs were prohibited before the deed of assignment[3] had been executed. There had been no such prohibition of re-sales before. It was a significant disincentive to purchasers from taking part in aggressive short-term investment strategies in the primary housing market (Renaud, et al, 1997). Another measure was

[1] The argument of speculative activities is similar to the one claimed by Tse (1996): "...because of the linked exchange rate of Hong Kong dollar to the US currency, the positive impact of inflation on house prices is not offset by an equal negative impact of every inflationary increase in interest rates on property values. In the early 1990s, housing demand was only moderate (house rents only grew in line with inflation), but investment demand was extremely strong, reflecting the expectations that rapid inflation would continue and nominal interest rates will be on a decline. As a result, many people tend to borrow heavily to buy rental properties for investments."

[2] In contrast to sales in the open market, internal sales refer to the sales of properties to parties with special interests, such as real estate agents. Unlike open market sales where developers normally list a fixed set of prices, internal sales allow any method of price determination.

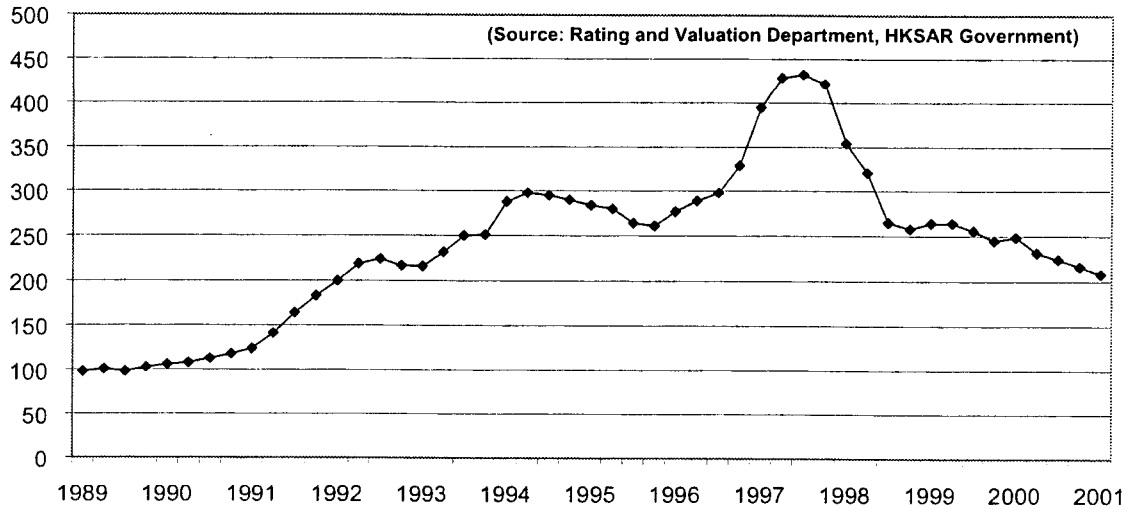

Figure 1: Hong Kong Private Residential Property Price Index (1989-2001)

an earlier levy of stamp duty for property transactions. Originally, the stamp duty would be levied only when the interests of real estate were assigned. This significantly increased the transaction cost of the sub-sales[4] of ASPs by 0.75% to 3.75% of the transacted price.

Not until the downturn of the property market in late 1997 did the Government consider relaxing the anti-speculation measures. In May and September of 1998, the Lands Department (1999) announced, among other things, the following relaxation measures:

- Suspension of the sub-sales restriction on uncompleted flats;
- Relaxation of the permitted period of forward sales from 9 months to no more than 15 months;
- Reduction of the initial deposit from 10% to 5%; and
- Increasing the proportion of flats allocated for private internal sales by developers from 10% to 20%.

These measures partly relaxed the constraints imposed in 1994. However, the most important constraint, which is the imposition of a stamp duty on ASPs, has not been relaxed. The transaction cost of the sub-sale of the ASP is still so high that this may deter investors from buying real forward contracts.

[3] The deed of assignment is a legal document signifying the transfer of the legal title of a property to the buyer after the completion of a building. This is usually the last stage of a property transaction.

[4] Sub-sales refer to subsequent sales of forward contracts before the completion of the unit.

Methodology and data

In order to test whether pre-sales are efficiently priced, a pricing model for real forward contracts is needed. We follow the cost of carry approach, which models the relationship between spot and futures prices. Under the "perfect market" assumptions[5], a typical pricing model for financial futures is:

$$F_{t,T} = S_t + (r_t - y_t)(T - t) \qquad (1)$$

where S_t is the natural logarithm of the spot price at time t; F_t,T is the natural logarithm of the forward contract price of the same asset at time t to be delivered at time T; r_t is the risk-free rate of interest, and y_t is the net continuously compounded dividend yield. In essence, the model suggests that the futures price equals the spot price plus a premium for the deferment of payment less the dividend income forgone. If the equality in Equation (1) does not hold, riskless profit can be earned by arbitrage between the futures and spot markets.

In principle, Equation (1) is also applicable to the pricing of real forward contracts (pre-sales contracts), except that the interpretation of y_t becomes the rental yield. Moreover, since deferred payment is not the norm in the pre-sales market of Hong Kong, the riskless interest rate should be excluded. Therefore, the pricing model for real forward contracts is:

$$F_{t,T} = S_t - y_t(T - t) \qquad (2)$$

Equation (2) implies that given a positive rental yield, the price of a real forward contract should be smaller than the spot price. The difference can be regarded as a discount in purchasing real forward contracts.

The remaining problem of Equation (2) is that it is logically impossible for the same underlying asset (i.e. property) to be traded simultaneously in the spot and pre-sales markets. This implies that the forward and spot prices of a property cannot co-exist. Fortunately, since the property market can be viewed as a joint market for the attributes of a property (Rosen, 1974), the spot price can be determined indirectly by their implicit prices, which can be estimated from the hedonic pricing model. Since the forward contract price is paid for a new property, the corresponding spot price should represent the price of a zero-age property. In this sense, the implied spot price refers to the price of a hypothetical existing property from which depreciation effects have been taken away.

The natural logarithm of the spot price can be expressed as the sum of a pricing function for property attributes, $g(X_t)$, and a time trend function for capturing general price changes, h(t). In other words, we can write the natural logarithm of spot price as:

$$S_t = g(\mathbf{X}_t) + h(t) \qquad (3)$$

where X_t is a vector of property attributes perceived to be attained after completion.

Then, by combining the real forward contracts pricing model in Equation (2) and the hedonic pricing model in Equation (3), the real forward contracts price for non-standardized products can be expressed as:

$$F_{t,T} = g(\mathbf{X}_t) + h(t) - y_t(T-t) \qquad (4)$$

The significance of Equation (4) is that the pre-sales market can be viewed as a joint forward contracts market for the attributes of a property.

Given the data for all variables (Xt ,t ,T, yt) and the functional forms of g(.) and h(.), the above real forward contracts pricing model can be tested. Alternatively, if a complete set of property attributes, X_t, is unavailable, a repeat sales variant of Equation (4) can be used. The repeat sales approach, proposed by Bailey, et al (1963), requires that there be repeated transactions (e.g. first sales and second sales) of the same uncompleted property[6]. Moreover, the implicit prices of property attributes at each pre-sales transaction must remain the same[7]. If these requirements can be fulfilled, we can eliminate g(Xt) in Equation (4) using the first and second sales data of the same property. This procedure will eliminate g(Xt) for each pair of transactions. We call this the Forward Contracts Repeat Sales (FCRS) model:

$$F_{t_2,T} - F_{t_1,T} = h(t_2) - h(t_1) - \left[y_{t_2}(T-t_2) - y_{t_1}(T-t_1)\right] \qquad (5)$$

where t_1 and t_2 indicate the time at which the first sales and the second sales occurred, respectively. Since the FCRS model involves repeated transactions of pre-sales only, the repeat sales method is free from the asset depreciation problem pointed out by Bailey, et al (1963).

To test whether real forward contracts are efficiently priced, the FCRS model has to be converted into a testable form. First, an error term, e_{t_2,t_1}, is added to cater for any stochastic effect. Second, $h(t_2)$ and $h(t_1)$ are assumed discrete and are replaced by a series of time dummy variables, D_t, and coefficients, α_t, where t ranges from period 0 to period M (i.e. the period covered by the sample). For a particular pair of transactions, D_t takes the value -1 when t is the time of first sales, 1 when t is the time of first sales, and 0 when there is no sales at time t. Note that D_0 has been normalized to zero. The coefficients, α_t, are interpreted as the cumulative spot returns implied (expected) from the forward contracts market. Finally, a coefficient, η, is attached to the discount of rental yield (i.e. the term in square brackets of Equation (5). The modified equation is shown in Equation (6), from which the coefficients can be estimated by the OLS method:

$$F_{t_2,\tau_2} - F_{t_1,\tau_1} = \sum_{t=1}^{M} \alpha_t D_t + \eta\left(y_{t_2}\tau_2 - y_{t_1}\tau_1\right) + \varepsilon_{t_2,t_1} \qquad (6)$$

where, for simplicity, T – t1 and T – t2 are replaced by $\tau 1$ and $\tau 2$, respectively.

---

[5] The assumptions include 1) no transaction costs, 2) no taxes, 3) a risk-free interest rate for borrowing and lending, and 4) no short-sale restrictions.

[6] Obviously, an uncompleted property will not stay the same as construction proceeds. What we mean by the *same* uncompleted property is that there is no change in the perceived quality of the property at the time of delivery. In other words, $\mathbf{X}_t = \mathbf{X}$ for all *t*.

[7] Technically speaking, no change in implicit prices implies that the functional form, *g*(.), does not change over time.

Two hypotheses can be formulated using the empirical model in Equation (6). If the pre-sales market is efficient, then 1) the implied (expected) cumulative spot returns, α_t, should equate the actual (ex post) cumulative spot returns in each period (see below for the description of the test), and 2) η should equate -1. This effectively means that pre-sales should be traded at a discount to spot transactions, where the discount is the rental income forgone for holding uncompleted properties.

The actual (ex post) cumulative spot returns can be computed by the repeat sales approach again using repeated transactions in the spot market:

$$S_{t_2} - S_{t_1} = \sum_{t=1}^{M} \beta_t D_t + v_{t_2 t_1} \qquad (7)$$

where S_t and D_t have the same meanings as before, βt are coefficients to be estimated, and $v_{t_2 t_1}$ is the error term. The coefficients, β_t, are interpreted as the cumulative ex post spot returns in the spot market.

To test the equality between α_t and β_t for the first hypothesis, we pool the pre-sales and spot data together and estimate the following equation by the OLS method:

$$P_{t_2} - P_{t_1} = \sum_{t=1}^{M} (\beta_t + \lambda_t L) D_t + \eta L\left(y_{t_2}\tau_2 - y_{t_1}\tau_1\right) + \omega_{t_2 t_1} \qquad (8)$$

where P_t is the natural logarithm of transaction prices (be they spot or pre-sales), L is a dummy variable which equals 1 for pre-sales data and 0 otherwise, $\lambda_t = \alpha_t - \beta_t$ is a coefficient to be estimated, ω_t is the error term, and other variables and coefficients have the same meanings as before. When L=1, Equation (8) is equivalent to the forward contracts model in Equation (6); when L=0, Equation (8) is equivalent to the spot model in Equation (7). We are interested in testing the null hypothesis that $\lambda_t = 0$, i.e. $\alpha_t = \beta_t$.

Since the FCRS model requires a sufficient number of repeat sales pairs for estimation, all property transactions in Hong Kong in the past 10 years (117 months) from July 1991 to March 2001 were taken into account. There were 3,062 pairs of repeated pre-sales transactions and about 270,000 pairs of repeated spot transactions.

Moreover, in this study, the *ex post* real rate of interest is taken as a proxy for the continuously compounded yield per unit time (y). The *ex post* real rate of interest is obtained by subtracting the inflation rate from the nominal interest rate. Inflation rates are derived from the consumer price index – Series A for non-luxury commodities; while nominal interest rates are derived from the Inter-bank offer rate for a 3-month period. The former is obtained from the Census and Statistics Department (various issues) and the latter is obtained from the Hong Kong Monetary Authority (various issues). Last, F_t,T and S_t are derived from the nominal transaction prices of pre-sales and normal sales, respectively, in Hong Kong Dollars. They are registered in the Government Land Registry and are obtained from a third party value-added data provider.

Results

Equations (6) and (7) were estimated by the OLS method. The adjusted R^2 values for the equations are 47% and 73%, respectively, which is reasonable in light of the geographical dispersion of the properties. All coefficients are statistically significant at the 1% level. The coefficients of the time dummy variables of the equations are presented in Figure 2 as price indices. The descriptive statistics of their monthly returns are shown in Table 1. Figure 2 shows that the trend of the expected spot price index reconciles in general with the *ex post* spot price index.

The first hypothesis that the two price indices are equal was tested using Equation (8). The results indicated that the coefficients λ_t are not significantly different from zero at the 5% level in almost all periods (i.e. 107 out of 116 coefficients)[8]. This implies that the ex post spot return (β_t) is not significantly different from the expected spot return (α_t) in each period. As a consequence, price discovery across the spot and real forward contracts markets cannot be rejected.

The second hypothesis deals with the coefficient (η) in Equation (6). The OLS estimate of η is -1.58 and is significantly different from zero ($p<0.01$). This reflects that real forward contracts are sold at a discount to spot contracts. Furthermore, the t-test was carried out to verify whether η is significantly different from -1. The results showed that η is not significantly different from -1 at the 5% level (in fact, $p>0.2$). This is consistent with the FCRS model in Equation (5), which postulates that the coefficient should be -1. Therefore, the hypothesis that real forward contracts are efficiently priced cannot be rejected.

Finally, it is noted from Figure 2 that the expected spot price overshot the *ex post* spot price in most periods. The reason is that the repeat sales model for the spot sample (but not for the pre-sales sample) fails to take asset depreciation into account, causing the *ex post* spot

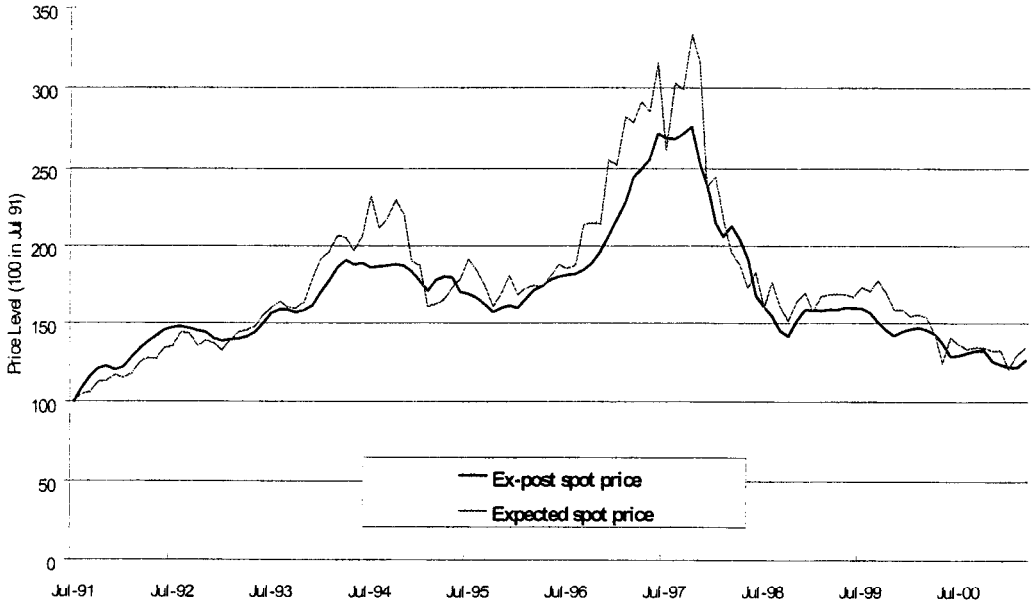

Figure 2: Pre-sales Price Indices

Table 1: Descriptive Statistics of the Monthly Returns

	Mean	Std. Dev.	Minimum	Maximum
Ex post Spot Return (β_t) in Equation (7)	0.20%	3.55%	-13.04%	7.86%
Expected Spot Return (α_t) in Equation (6)	0.25%	7.29%	-29.33%	17.63%

prices to be underestimated over time. Moreover, it is also observed that the overshooting tends to be more serious from 1994 to 1998. This abnormality agrees with the changes in pre-sales policy described in Section 3. When the anti-speculation measures on pre-sales were implemented during 1994-1998, pre-sales activities were deterred and the price discovery between the spot and pre-sales markets were restrained. Consequently, the price discovery function of real forward contracts was hindered.[9]

[8] The results are more or less the same after controlling for groupwise heteroskedasticity in the pooled sample.

[9] Obviously, the assertion warrants more vigorous tests in future research.

Conclusion

Futures and forward contracts of commodities have been traded in centralized markets for centuries. There have been intensive studies on the relationship between futures prices and spot prices. The roles of futures in hedging, risk transfer, and price determination are well established in these markets. However, a centralized market for real estate futures or forward contracts does not exist. Forward sales of real estate are usually not as popular as spot sales. Hence, investigation into the relationship between real forward contracts price and spot price is rare.

In this study, we constructed a Forward Contracts Repeat Sales model based on the premise of the repeat sales model and the cost of carry model. *Ex post* spot

prices as well as the expected spot prices implied by the real forward contracts market were estimated. Our key findings are that 1) the pre-sales of uncompleted properties are traded at a discount to the expected spot sales of completed properties, 2) price discovery across the spot and real forward contracts markets exists, and 3) the real forward contracts are efficiently priced.

Several implications can be drawn from this study. First, the Forward Contracts Repeat Sales model provides a transaction-based method to estimate the expected return of real estate investment, which is free from the asset depreciation problem inherent in the repeat sales model. Second, the findings will have policy implications on the pre-sales policy of the real estate market because the introduction of anti-speculative measures tends to hinder the price discovery function – the deviation between the expected and ex post spot prices was enlarged. Finally, the study opens up a wide research gap in the real forward contracts market. For example, research can be carried out to investigate whether the real forward contracts market stabilizes or de-stabilizes the spot market, and whether the spot and real forward contracts markets bear any lead-lag relationship.

Acknowledgements

We thank the two anonymous referees for their helpful comments. The work described in this paper was fully supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, China (Project No. PolyU 5119/03E)

References

Bailey M.J., Muth R.F. & Nourse H.O. (1963) A Regression Model for Real Estate Price Index Construction. *Journal of the American Statistical Association*, **58** (304), 933-942.

Baum A. (1991) Property Futures. *Journal of Property Valuation and Investment*, **9**(3), 227-232.

Berkovec J.A. & Goodman J.L. Jr. (1996) Turnover as a Measure of Demand for Existing Homes. *Real Estate Economics*, **24** (4), 421-440.

Case B. and Quigley J.M. (1991) The Dynamic of Real Estate Prices. *Review of Economics and Statistics*, **73** (1), 50-58.

Case K.E., Shiller R.J. & Weiss A.N. (1993) Index-based Futures and Options Markets in Real Estate. *Journal of Portfolio Management*, **19** (3), 83-92.

Census and Statistics Department (various issues) Consumer Price Index, *Monthly Digest of Statistics*, Hong Kong Government.

Chang L.O. & Ward C.W. (1993) Forward Pricing and the Housing Market: The Pre-Sales Housing System in Taiwan. *Journal of Property Research*, **10** (3), 217-227.

Chang E.C. (1985) Returns to Speculators and the Theory of Normal Backwardation. *Journal of Finance*, **40** (1), 193-208.

Chang L.C. (1994) A Study on the Relationship between the Pre-sales House and the existing House in Terms of the Forward Contract and the Spot – A Case in Taipei. *Journal of Housing*, **2**, 67-85 (in Chinese).

Cootner P.H. (1960) Returns to Speculators: Telser vs. Keynes. *Journal of Political Economy*, **68** (4), 396-404.

Dusak K. (1973) Futures Trading and Investor Returns: An Investigation of Commodity Market Risks Premiums. *Journal of Political Economy*, **81** (6), 1387-1405.

Garbade K.D. & Silber W.L. (1983) Price Movements and Price Discovery in Futures and Cash Markets. *Review of Economics and Statistics*, **65** (2), 289-297.

Gemmill G. (1990) Futures Trading and Finance in the Housing Market. *Journal of Property Finance*, **1** (2), 196-207.

Grossman S.J. (1977) The Existence of Futures Markets, Noisy Rational Expectations, and Informational Externalities. *Review of Economic Studies*, **44** (3), 431-449.

Hong Kong Monetary Authority (various issues) *Monthly Statistics Bulletin*, Hong Kong Government.

Kaldor N. (1939) Speculation and Economic Stability. *Review of Economic Studies*, **7** (1), 1-27.

Lands Department (1999) Lands Department Consent Scheme for Sale of Units in Uncompleted Private Residential Developments. *Legal Advisory Conveyancing Office Circular Memorandum No. 40A*, Hong Kong.

Lui F.L. (1997) The Housing Market and the Housing Policy of Hong Kong in 1996, in Cheng Y.S. (ed), *The Other Hong Kong Report*, The Chinese University Press, Hong Kong.

Malliaris A.G. (1999) *Foundations of Futures Markets*. Edward Elgar Publishing Co., UK.

Miller R. (1989) Property Price Futures and Options?. *Futures and Options World*.

Peck A.E. (1976) Futures Markets, Supply Response and Price Stability. *Quarterly Journal of Economics*, **90** (3), 407-423.

Renaud B., Pretorius F. & Pasadilla B. (1997) *Markets at Work: Dynamics of The Residential Real Estate Market in Hong Kong*. Hong Kong University Press, Hong Kong.

Rosen S. (1974) Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. *Journal of Political Economy*, **82** (1), 34-55.

Shih, K. (1992) Real Estate Pricing in a Forward Market. *Journal of Management and Science*, **9**, 31-37 (in Chinese).

Shiller R.J. (1993) *Macro Markets: Creating Institutions for Managing Society's Largest Economic Risks*. Oxford, UK.

Stein J.C. (1995) Prices and Trading Volume in the Housing Market: A Model with Down-Payment Effects. *Quarterly Journal of Economics*, **110** (2), 379-405.

Stein J.L. (1992) Cobwebs, Rational Expectations and Futures Markets, *Review of Economics and Statistics*, **74** (1), 127-134.

Tse R.Y.C. (1996) Relationship between Hong Kong House Prices and Mortgage Flows under Deposit-Rate Ceiling and Linked Exchange Rate. *Journal of Property Finance*, 7 (4), 54-63.

Telser L.G. (1958) Futures Trading and the Storage of Cotton and Wheat. *Journal of Political Economy*, **66** (3), 233-255.

Working H. (1948) Theory of the Inverse Carrying Charge in Futures Markets. *Journal of Farm Economics*, **30**, 1-28.

Volume 8 Number 3 December 2003
ISSN 1366-4387

Journal of Financial Management of Property and Construction

CONTENTS

RICS **FOUNDATION**