Temporal and Spatial Variations in Market Liquidity, Appraisal Smoothing and Price Discovery in Private and Public Real Estate Markets

by

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Summary

We examine two related hypotheses in this paper. Hypothesis One states that the degree of appraisal smoothing in the direct market depends on market liquidity, with smoothing highest in periods of low liquidity. When there are few transactions (i.e., low liquidity), a prudent appraiser will place more weight on past evidence. Other authors have advanced this hypothesis and, in our literature review, we present some indirect evidence that supports the hypothesis. Hypothesis Two states that price discovery between the indirect and direct real estate markets also depends on market liquidity. Liquidity in the indirect market is a necessary condition for price discovery between the two markets. Without it, there is no information to transmit between markets. Liquidity in the direct market increases the ability to absorb the information generated in the indirect market and to incorporate this information into the price.

Although the hypotheses are motivated by uncomplicated ideas, testing them is difficult. None of the liquidity measures commonly used (the bid ask spread, market capitalization or the liquidity ratio) is available for the direct real estate market. A proxy measure is needed. We turned to the finance literature for guidance. In this literature, various arguments lead to the conclusion that market liquidity is positively correlated with price volatility, price dispersion and trading volume. The studies suggest that trading volume would be the best measure, but we do not have this data. Instead, we use an endogenous measure of price volatility as our proxy for market liquidity. This measure is the GARCH variance for the appraisal returns series.

This measure has a basic requirement. It must vary through time in a systematic fashion. If it does not vary through time, we have a constant liquidity model. If it is not systematic, appraisers can not use the measure to assist their appraisals and we should observe a constant appraisal smoothing model. The evidence from equity markets suggests that the GARCH variance has both of these properties. Our preliminary evidence on the appraisal series shows that the GARCH variances for the United States, the United Kingdom, Singapore and Hong Kong are all time varying, systematic and strongly persistent. The persistence of the appraisal variances implies relatively long periods of high or low variance, punctuated by revision events. For the countries

in our study, the periods of high variance roughly correspond to bull markets, while the periods of low variance roughly correspond to bear markets. That is, the GARCH variance tends to follow market volume/liquidity.

A substantial portion of the paper is devoted to developing a general empirical model that considers the liquidity effects. The model is based on optimal theory and builds on the works of Quan and Quigley (1989, 1991) and Geltner (1989, 1991, 1993a, 1998). In the paper, we focus attention on the identification of the model. Our work indicates that the random walk model, which is the basis of most appraisal smoothing studies, is identified, but that simple extensions of this model may not be. Fortunately, constant smoothing models can be identified simply by adding relevant regressors; for example, by using a CAPM model to explain the required rate of return on direct real estate investments.

Despite our preliminary evidence, which suggested that the GARCH variances are time varying, our full model suggests that the variance of the appraisal returns is constant. We get this result for all four countries in our study. Thus, our data imply a constant appraisal smoothing constant. This refutes our first hypothesis. That is, we can not support liquidity based appraisal smoothing using our proxy for market liquidity. Following from this, because we can not substantiate time varying liquidity, we can not test our second hypothesis of liquidity based price discovery. Notwithstanding this result, we obtain some remarkable results for our constant appraisal smoothing model. These are summarized below.

We get a range of results for the constant appraisal smoothing version of our model. Consider the results related to the form of the pricing equation. First, we test and reject the random walk model as a description of pricing dynamics. Our estimates show that the returns equation should be based on an unrestricted autoregression of order one or two. The estimated coefficients reveal that each country has a different returns adjustment path. Furthermore, the adjustment speeds for the countries become alike as explanatory variables are added to the model. In our most complex model, the estimates of the persistence in returns for the United States, the United Kingdom and Singapore are: 0.781, 0.756 and 0.773, respectively. These figures suggest that it takes these markets about 3½ quarters to absorb new information and incorporate it into appraisals. Hong Kong alone is different, with persistence equal to 0.559. It takes the Hong Kong market about half a year to process new information. These results imply that, although these markets differ in many respects – including liquidity – these differences are not clearly reflected in the manner of adjustment.

Expanding the order of the autoregression of returns tends to reduce the value of the appraisal smoothing constant. For example, using the estimates from our pure autoregression model, we get conventional appraisal smoothing constants for the four countries of 0.867, 0.342, 0.883 and 0.607, while the "true" constants are smaller. They all lie between 0.422 and 0.490.

While this attenuation effect is of interest, it is overshadowed by the impact of explanatory variables on the smoothing coefficient. As we add explanatory variables to the model, we improve our understanding of the fundamental returns and the signal-to-noise ratio decreases. In the unrestricted pricing model, the drop in the signal-to-noise ratios produces small appraisal smoothing constants: 0.162 for the United States, 0.374 for the United Kingdom, 0.114 for Singapore and 0.026 for Hong Kong. This shows than when there is high quality information on the price path of a particular asset, there is no smoothing. This is the strongest finding in our study. Our results are supported by research in equity markets. A reduction in smoothing also was found in equity markets by Tauchen *et al.* (1996).

We use six explanatory variables to model the fundamental return to direct property. The estimates show that only three of these variables, the excess return to indirect real estate, the short rate and the real growth rate, have a broad effect on direct property returns. The results are sensitive to the country and the specification of the model. In the United States, the fundamental return to direct property depends primarily on the real growth rate and secondarily, on the short term interest rate. The estimates suggest that there may be a price discovery effect as well, but this effect is small and not robust with respect to changes in the specification of the model. The rate of return in the United Kingdom depends on the excess return indirect real estate – the price discovery effect. The evidence also reveals real growth and construction effects in our restricted pricing model. All of the coefficients for the U.K. are small in magnitude. This suggests a relatively constant fundamental return to real property investment. In Singapore and Hong Kong, the short term interest rate is the dominant determinant of the fundamental rate of return to direct property. In both countries, an increase in the short term rate leads to flight from the asset class and a commensurate fall in the return to direct property investment. Both countries also display a price discovery effect. However, in Singapore it is negative. This suggests that indirect real estate investment is a substitute for direct real estate investment in Singapore. The estimates for Singapore also include a negative real growth effect. We suggest that this may be due to chronic over building in the face of sustained growth, but this conjecture requires further research.

In conclusion, the most striking finding of this research is our support for appraisal smoothing in a reduced form model, but not in our structural model. This finding casts doubt on the appraisal smoothing story. It suggests that the conventional model has power because it inadequately specifies the signal generating process. This conclusion should not be overstated, however, for two reasons. First, in the literature, one of the original motivations for smoothing models was to desmooth appraisal series. Our findings do not invalidate the use of conventional appraisal smoothing models for this purpose. They continue to provide a convenient means of reverse filtering the data. Second, our results are sensitive to the specification of the fundamental return generating model. While we have developed a structural model of the appraisal process, we have used a reduced form specification for our return generating equation. This needs to be improved. We believe the next step in research should be to examine a structural model of asset pricing and returns.