Three essays on real estate finance
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Chapter 1

Introduction

Real estate, being either residential real estate or commercial real estate, is an important component of the overall investment portfolio for each individual household. It also appears on the balance sheet of many corporations, institutional investors and alike. The high market value weight of the real estate asset class in the overall market portfolio makes the national wealth significantly exposed to the real estate market besides stock market and bond market. As a consequence, any fluctuation in the real estate market will have major repercussions on the overall economy, which has also been evidenced by the recent financial turmoil stemming from the real estate market.

This thesis consists of three chapters in the field of real estate finance. The first chapter tackles the functional form assumption within the popular hedonic regression framework and its consequence on the house price index construction. The second chapter addresses the correlation among housing transactions along both the spatial and temporal dimension and its consequences for the prediction of house prices. The third chapter considers the impact of including real estate assets in the market portfolio and how this affects the market risk premium of real estate investment trusts (REITs). Overall, this thesis contributes to the existing literature on understanding the importance of these issues and establishing the validity of taking them into consideration in empirical real estate research.

Chapter 2 (“Semi-parametric Estimation of House Price Indices”) builds upon the popular hedonic house price index construction approach of Kain and Quigley (1970) where log(transaction price) is taken to be linearly related to various housing attributes and coefficients are interpreted as the implicit attribute prices accordingly. Despite its popularity, such log-linear functional form poses a problem. As Rosen (1974) pointed out, there is no theoretical justification for such a relation to be assumed in empirical
applications. Moreover, as shown in Mason and Quigley (1996), it is futile to deduce the precise hedonic specification from the economic theory, and the appropriate functional form in a hedonic regression depends on the data used in practice. To tackle the functional form issue related to the empirical application of hedonic model, Halvorsen and Pollakowski (1981) estimated the functional form of hedonic regression using Box-Cox transformation (Box and Cox, 1964). Nonparametric models have also been adopted to allow more flexibility in the traditional log-linear hedonic regression. See, for example, Pace (1993), Bao and Wan (2004), Martins-Filho and Bin (2005), and Henderson et al. (2007), to name just a few.

In this chapter, we apply the semi-parametric approach to address the hedonic functional form issue and examine its implication on the house price index construction. We apply cubic splines in approximating the unknown functional form, and address the index revision problem by estimating the semi-parametric model on an annual basis. In addition, our index construction is based on the identification of the representative house for each year whose value is predicted according to the semi-parametric model. A Laspeyres chained index is then constructed based on the changes of values of the representative house. We show that the semi-parametric model produces a better fit than the log-linear hedonic model. Moreover, we find consistent divergence between the indices produced by both models. Overall, our results are in line with the previous literature, and we conclude that hedonic equation with less stringent functional form is to be preferred in the empirical house price index construction.

Chapter 3 (“Spatial and Temporal Dependence in House Price Prediction”) considers the correlation among housing transactions along both the temporal and spatial dimension and its consequence in house price prediction. Empirical applications of the popular hedonic model often overlook the correlations among housing transactions which leads to inefficient as well as erroneous inference of the parameter estimates. Recognizing this fact, various authors have put emphasis on the model comparison between the default hedonic pricing model and models that account for spatially correlated errors, for example Can (1990, 1992), Basu and Thibodeau (1998), Dubin et al. (1999), and Case et al. (2004). These studies either use a small sample of housing transactions or do not explore the
temporal structure in the housing market in making out-of-sample predictions since only early transactions carry pricing information relevant to pricing later transactions and not vice versa.

This chapter builds upon papers by Pace et al. (1998), Pace et al. (2000) and Bourassa et al. (2007). We employ the Spatial and Temporal Autoregressive Model as developed in Pace et al. (1998) and Pace et al. (2000), which assumes the OLS hedonic errors to follow an autoregressive process and models the spatial and temporal dependence in the hedonic errors through spatial and temporal weighting matrices. In making out-of-sample predictions, Bourassa et al. (2007) did not recognize the temporal structure in housing transactions. Moreover, they only used the estimated structural parameters from both the OLS model and the spatial model, and did not exploit the information contained in the spatial weighting matrix. We improve upon Bourassa et al. (2007) in that, for each house in the out-of-sample, we first look for its spatial and temporal neighbors, then combine this information with structural parameter estimates to make out-of-sample predictions. In our empirical analysis we control for time variation of structural parameters through performing the analysis on an annual basis. Further, we control for spatial neighborhood effects or spatial heterogeneity using experience-based submarkets defined by real estate professionals as advocated by Bourassa et al. (2003). We show that, overall, integrating both the spatial and temporal dependence among housing transactions in empirical analysis contributes to a better prediction outcome of future house prices.

Chapter 4 (“The Composition of Market Proxy in REITs Risk Premium Estimation”) includes real estate assets into the market portfolio and investigates its impact on the estimation of the risk premium of REITs. Of course, this is a relevant issue to a much broader range of assets, but we limit our analysis to REIT in this chapter due to its increasing popularity among investors looking for either diversification or exposure to the real estate market. By definition, the riskiness of an asset is measured by the risk premium that compensates its undiversifiable market risk exposure. In practice, both academics and practitioners seem complacent to use equity indices for approximating the market portfolio in the estimation of the asset market risk premium, such as S&P 500, and CRSP indices. Using equity indices as market proxies, however, leaves part of the market risk to remain
diversifiable as the investment set also includes other assets besides equity. It follows naturally to ask if using a more diversified market portfolio would matter for the estimation of the market risk premium.

In this chapter, we construct a market portfolio in the spirit of Roll (1977) that consists of equity, fixed income securities, and real estate. We test if the REITs risk premium estimated using an equity index as market proxy is robust to alternative broader specifications of the market portfolio. In doing so, we do not attempt to find the true market portfolio that is exhaustive in terms of inclusion of assets, but rather identify a more diversified market portfolio relative to the popular market proxy using equity indices. Our results show that REIT betas are significantly increased as a broader market proxy is used. The market risk premium estimation of REITs is sensitive to both the structural break in the REIT market and market portfolio composition, Moreover, adding real estate in the market portfolio accounts for a significant portion of the bias in the estimated REITs market risk premium. Our results stand after using a survivor-bias free sample of REITs.