



# How integrated are real estate markets with the world market? Evidence from case-wise bootstrap analysis<sup>☆</sup>



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## ABSTRACT

We investigate the extent by which real estate markets are integrated with the world market. We apply a case-wise bootstrap analysis – a method that is robust to non-normality and increased volatility that characterises financial markets, especially during periods of distress. We also take into account the effect of the global financial crisis. Our investigation is conducted in relation to five most important and highly internationalised real estate markets, namely, the US, UK, Japan, Australia and the United Arab Emirates (UAE). We find that the first four markets are integrated with the world market – with Japan, the US, and the UK being the most integrated, but the last one is not. Our results also show that the US real estate market crisis affected the five markets differently. It made the UAE, Australia and the US real estate markets more integrated internationally but resulted in the Japanese market becoming less globally integrated. In the case of the UK, the crisis did not affect at all its level of integration with the world market.

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## 1. Introduction

The issue of integration of real estate markets with the world market is one that has both theoretical and practical significance. If real estate markets are found to be significantly integrated with the world market, then the relevant model to use in the pricing of real estate investments would be an international asset pricing model since world systematic risk should be priced. This also implies that there is international contagion risk – that is, international events can spill over into domestic real estate markets. These have very significant implications for investors and policymakers particularly so that real estate markets are very fundamentally important to the economies of countries. The recent global financial crisis is a glaring testimony to this important role of real estate markets. If investors misprice real estate investments, then this can have negative consequences on other sectors of the economy and can also spill over internationally.

In this paper, we provide fresh robust evidence on the integration of real estate markets with the world market. Specifically, we examine the extent of integration of the real estate markets of the US, the UK, Japan, Australia and the UAE with the world. We apply an international capital asset pricing model (ICAPM) which we estimate through the use of a case-wise bootstrap analysis – a method that is robust to non-normality and increased volatility that characterises the financial markets especially during periods of distress. We take into account the global financial crisis (GFC) in our analysis.

Over the last decade, real estate markets in different countries have experienced rapid globalisation and internationalisation primarily aided by the development of real estate securities instruments which have allowed investors worldwide to participate in these markets (Bardhan and Kroll, 2007; Eicholtz and Nils, 2009; Hobbs et al., 2007). Thus, it may be expected that real estate markets will now be integrated with the world market. However, real estate is a commodity that is not physically tradeable internationally, and this can hinder the integration of real estate markets with the world market. But with the advent of securitisation of real estate markets, which has gathered significant pace over the last decade (Bond and Patel, 2003; Liow, 2007; Liow and Webb, 2005), this would have overcome the underlying limitation. Notwithstanding this, there is evidence that prices in one real estate market do not respond significantly to movement in the prices of other real estate markets (Bardhan et al., 2007). Thus, it appears that a priori, there is no clarity as to whether or not real estate markets are integrated with the world market.

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As mentioned, we also examine the impact of the GFC on the integration between national real estate markets. A priori, it is difficult to say whether as a reaction to the US market debacle, real estate markets would keep to themselves or would be more connected with the world. On one hand, one would expect that real estate markets would keep to themselves in order not to be contaminated with what was happening in the US. Investors would tend to focus on their own market rather than on overseas markets. On the other hand, real estate markets might be tempted to open up more to welcome overseas investors who are fleeing from other markets. Investors also might be on the lookout in other markets for bargains. Hence, real estate markets would be more connected to the world.

At present, there are only very few studies which have examined the issue of global integration of real estate markets. Liow (2007) investigated the applicability of the international capital asset pricing model (ICAPM) in relation to the securitised real estate markets of Australia, Japan, the UK and Europe. This study used the world stock market and world real estate market as proxies for the world market. It estimated conditional and time varying betas and found the average betas of the markets to be less than one. The results of the study showed that the world real estate market has a positive effect on the real estate markets of Asia-Pacific, Hong Kong, Singapore and Malaysia, and a negative effect on the real estate markets of Europe and the UK. It also concluded that the world real estate market, as compared to the world stock market, was a better proxy for the world market. Ling and Naranjo (2002) also studied securitised real estate markets while Goetzmann and Wachter (2001) examined direct real estate markets. The findings of their investigations also showed that real estate markets are significantly affected by the world market. Given the limited number of studies, there is therefore scope for further studies on this issue.

Our study differs with the few previous studies on the integration of real estate markets with the world market in several ways. Firstly, we make use of a different estimation methodology – case-wise bootstrapping, that provides a number of advantages. As previously mentioned, this method performs better than the standard methods particularly when the data are non-normal and heteroscedastic which is the case during the financial crisis. Secondly, we also utilise a more updated and longer data set for the countries covered in the study as compared to those used in previous investigations. Thirdly, we examine the impact of the US sub-prime crisis on the level of integration of the US, UK, Japanese, Australian and UAE real estate markets with the world market. The impact of the recent crisis in the US real estate market on the global market risk for real estate markets is certainly an essential issue for investors given the magnitude of the crisis and the worldwide impact it had made. To our knowledge, this is the first study to take into account the effect of the Global Financial Crisis (GFC) on the world beta of real estate markets. Previous studies such as the one by Liow (2007) only examined the impact of the Asian economic crisis.

Our findings show that all five markets are integrated with the world market – with the US and UK markets being the most internationally integrated real estate markets and UAE being the least. Our results also demonstrate that the US sub-prime crisis has a different effect on the real estate markets. We find that the US real estate market crisis made the US and UAE real estate markets to be more integrated internationally but resulted in the Japanese market becoming less globally integrated. On the other hand, the crisis did not affect the extent of integration of the Australian and UK markets with the world market, whether it is with the world stock market or the world real estate market. These results imply that global market risk should be priced in real estate investments, and that international shocks such as the US sub-prime crisis have a differential impact on different real estate markets.

The rest of the paper is organised in the following way. The next section discusses methodology while Section 3 presents the empirical findings. The summary and conclusions are provided in Section 4.

## 2. Methodology

### 2.1. Model specification and estimation

In this paper, we investigate the extent of integration of real estate markets with the world market. We then determine the effect of the US real estate market crisis on this integration. In order to achieve these objectives, we estimate the beta for each real estate market in the context of an international capital asset pricing model (ICAPM). We use beta as a proxy for the extent of integration of each real estate market with the world market.

The method that we apply to estimate the ICAPM is a case-wise bootstrap approach that is suggested by Hatemi-J and Hacker (2005). This method is shown by the authors via simulation experiments to perform accurately when the financial markets are under distress and the standard assumptions of normal distribution and constant variance are not satisfied by the data. Since the underlying data is not normally distributed and the volatility is time-varying the standard methods based on the asymptotic distributions are not reliable. Thus, using the case-wise bootstrap approach is necessary in order to obtain correct inference.<sup>2</sup> Calculations are implemented by using a statistical software component that is produced by Hacker and Hatemi-J (2009), which is available online. We make use of the following regression for calculating the international beta in the presence of a potential break:

$$R_{it} = \alpha_{i0} + \alpha_{i1}D_{it} + \beta_{i0}R_{mt} + \beta_{i1}D_{it}R_{mt} + \varepsilon_{it}. \quad (1)$$

The denotations are defined as the following:

$R_{it}$  is the return of the real estate market  $i$  ( $i = 1, \dots, 5$ ) at time  $t$ .  $R_{mt}$  is the world market return.  $D_{it}$  is a dummy variable with value zero for the period before the crisis and one for the period after the crisis for each market. The stochastic error term  $\varepsilon_{it}$  does not have to follow a normal distribution process with constant variance because the case-wise bootstrap method is robust to the non-existence of these statistical assumptions. If the estimated coefficient  $\beta_{i1}$  is statically significant it means that there is a shift in the world market risk for country  $i$  due to the crisis.

We also define the following matrix denotation to describe the case-wise bootstrap method that is used to estimate and test the statistical significance of the coefficients  $\alpha_{i0}$ ,  $\alpha_{i1}$ ,  $\beta_{i0}$  and  $\beta_{i1}$  in model (1):

$$Y = BX + \varepsilon \quad (2)$$

where

$$Y = \begin{bmatrix} R_{i1} \\ R_{i2} \\ \vdots \\ R_{iT} \end{bmatrix} \text{ a } (T \times 1) \text{ vector, } X = \begin{bmatrix} 1 & R_{m1} & D_1 & D_1R_{m1} \\ 1 & R_{m2} & D_2 & D_2R_{m2} \\ \vdots & \vdots & \vdots & \vdots \\ 1 & R_{mT} & D_T & D_TR_{mT} \end{bmatrix} \text{ a } (T \times 4) \text{ matrix,}$$

$$B = [\alpha_{i0} \quad \alpha_{i1} \quad \beta_{i0} \quad \beta_{i1}] \text{ a } (4 \times 1) \text{ vector, and } \varepsilon = \begin{bmatrix} \varepsilon_{i1} \\ \varepsilon_{i2} \\ \vdots \\ \varepsilon_{iT} \end{bmatrix} \text{ a } (T \times 1) \text{ vector.}$$

<sup>2</sup> The diagnostic test results for normality and conditional heteroscedasticity that are presented in Tables 1a, 1b, 1c reveal that the data is not normally distributed and heteroscedasticity prevails.

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