Journal of *Risk and Financial Management*

MDPI

Article

An Extended Fama-French Multi-Factor Model in Direct Real Estate Investing

Chung-Yim Yiu [1,*], Chuyi Xiong [2] and Ka-Shing Cheung [1]

1 Department of Property, The University of Auckland Business School, Auckland 1010, New Zealand
2 Three Gorges Finance Co., Ltd., Beijing 100197, China
* Correspondence: edward.yiu@auckland.ac.nz

Abstract: Understanding risk-adjusted returns in real estate investment are crucial, but little is known about the risk-adjusted returns for direct real estate. This paper examines risk-adjusted total returns by developing an extended capital asset pricing model (CAPM) to investigate whether direct real estate returns compensate for their risk levels. Based on a panel dataset of the residential property transaction in 62 Territorial Authorities of New Zealand from 2002Q1 to 2018Q4, a direct real estate portfolio performance in the single-factor CAPM model is compared with the national housing markets stock markets and REITs markets in New Zealand before the pandemic. The results demonstrate that the direct real estate returns outperform the market returns with a significant positive alpha and beta smaller than one but positive. The alpha is further evaluated by the five-factor CAPM model, which includes the factors of liquidity risk, value risk, time risk, credit-rating risk, and currency risk. The assessment shows that most of the excess return (alpha) can be attributed to direct real estate market risks.

Keywords: direct real estate; total housing returns; CAPM; Fama-French five-factor model; New Zealand

Citation: Yiu, Chung-Yim, Chuyi Xiong, and Ka-Shing Cheung. 2022. An Extended Fama-French Multi-Factor Model in Direct Real Estate Investing. *Journal of Risk and Financial Management* 15: 390. https://doi.org/10.3390/jrfm15090390

Academic Editor: Riza Demirer

Received: 1 August 2022
Accepted: 29 August 2022
Published: 2 September 2022

1. Introduction

Is there an excess risk-adjusted return in direct real estate investments? At the end of 2019, when most investment markets plummeted in the pandemic outbreak, housing prices rose in many countries. The United States Case-Shiller's National Home Price Index and China's 70 Major Cities New Home Price Index have uninterruptedly risen since November 2019, with their respective annual growth rates reaching 8.4% and 4.0% in October 2020. In terms of risk-return ratios, real estate investments outperform many other investment vehicles. In hindsight, if direct real estate, especially residential properties, had been included in an investment portfolio during the early pandemic, the portfolio's investment returns might have made a real difference. Chong et al. (2009, p. 183) also found that "a higher allocation towards real estate will reduce portfolio risk in periods of high-interest rate volatility". This paper uses New Zealand as a case to compare the risk-return relationships between a direct housing portfolio and other investment vehicles. During the pandemic, New Zealand has been one of the countries with the most substantial house price growth. In December 2020, the REINZ house price index of New Zealand showed a 19.2% year-on-year increase, regardless of the rental yield. Even before the pandemic, the average price return of housing investment in New Zealand achieved 7.93% from 2002 to 2018, compared to 3.42% for REITs, 4.85% for bonds, and 9.59% for stocks. In the meantime, the risk level of residential property investment, as measured by the standard deviation of the price swings, was only 8.57%, compared to 11.85% in REITs and 13.23% in stocks (Table 1).

Table 1. Annual price returns and standard deviations of various investment vehicles in New Zealand, 2002–2018.

Annual Returns (%)	Stocks	REITs	Bonds	Houses
Mean	9.59	3.42	4.85	7.93
Std. Dev.	12.84	11.85	1.33	7.14

Notes: The annual price returns of stocks, REITs, and houses are calculated by the year-on-year change of the NZX50 index and the REINZ house price index of New Zealand. The annual return of bonds is calculated by the average of 10-year secondary market government bond yields (RBNZ).

Figure 1 shows the time series of investment vehicles' price returns, including stocks, REITs, bonds, and houses. Housing returns clearly show fewer occurrences of negative returns and are of lower volatility than stocks and REITs.

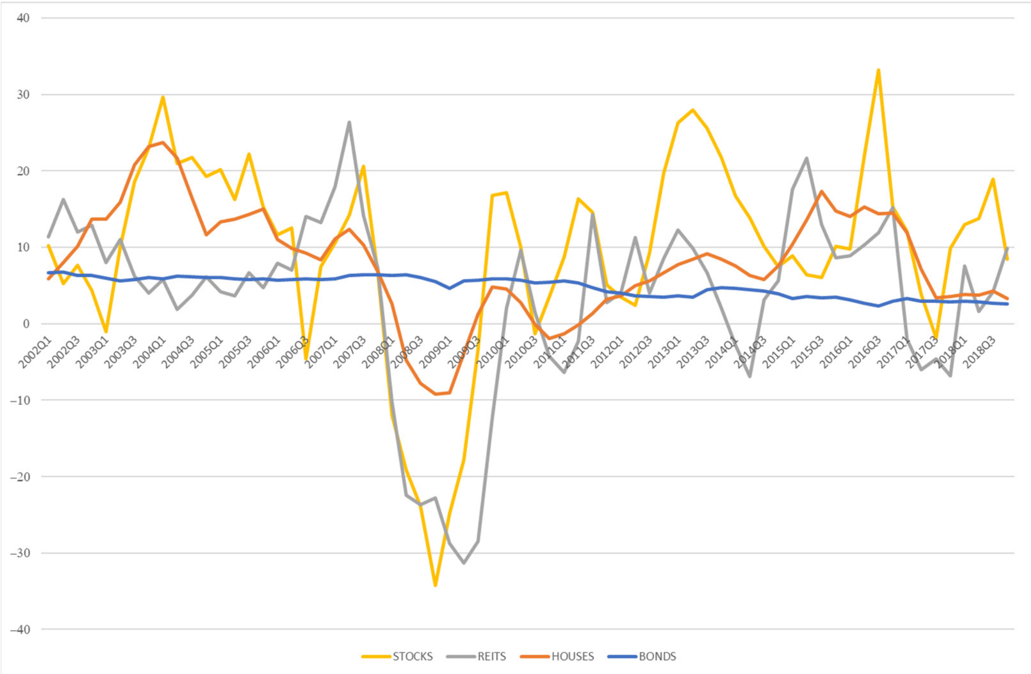

Figure 1. The Annual Price Returns of Stocks, REITs, Bonds and Houses in New Zealand, 2002–2018.

Comparing the risk-return performance of 21 forms of investment from 1989 to 2011 in New Zealand, Watson (2012) also found that direct real estate investment (i.e., farmland and residential property) earned the highest average return in excess of the risk-free rate, as indicated by the Sharp ratio, a standard metric of risk-adjusted return. The study further explained that such excess return per unit of risk is associated with liquidity risk and portfolio risk. A portfolio of property assets is expensive to acquire because the indivisibility and trading of properties also incur considerable transaction costs such as agency fees and search costs. Furthermore, the idiosyncratic risk associated with owning an individual property (non-uniformity) and owning properties within one specific region (spatial risk) also accounts for the excess returns of direct real estate. However, the study did not provide any empirical evidence of these omitted risks when national housing returns were analysed. This paper aims to empirically study the impacts of various types of risk on direct real estate excess returns.

Traditionally, direct real estate is seldom considered in portfolio management. This is due to its 'lumpiness', illiquidity, and high transaction costs (Liao and Mei 1999). CAPM analyses on the REITs market do not represent direct real estate performance, as the movement of REITs returns is found essentially to follow stock markets (Glascock et al. 2000; Niskanen and Falkenbach 2010). However, with the recent PropTech (and FinTech) advancement, investors can trade houses online via instant buyers platforms or invest in crowdfunded e-REIT markets (Montgomery et al. 2018). The former reduces transaction costs and improves liquidity, while the latter reduces lumpiness and facilitates diversification by including direct real estate in portfolios. According to a performance report of an e-REIT company, its returns continued to increase steadily, whereas the stock market and public REITs markets plunged by 48% and 37%, respectively. With the advancement of PropTech, risk-return analysis of direct real estate has become essential in portfolio management.

Financial analyses, such as Markowitz's (1952) portfolio theory and Sharpe's (1964) CAPM model, emphasize the risk-return relationship. Fama and French (1995) developed a Fama-French model to explain size risk and value risk. Fama and French (2015) further advanced a five-factor Fama-French model to explain profitability and investment risks. With the development of real estate investment trusts (REITs) markets, risk-return analysis is commonly applied in indirect (or securitized) real estate investment. Yet there have been very few risk-return analyses on direct real estate.

Some studies argued that risk-adjusted direct real estate returns should be analysed by considering liquidity risk, owner-occupied housing, segmented market structures, and leverage ratio. However, most of these studies do not provide empirical evidence (Liu et al. 1990). Almost all previous empirical studies considered price return instead of total return, and some were taking stock return as the market return (Cannon et al. 2006; Domian et al. 2015) or the national housing return as the market (Case et al. 2011; Huang 2021).

While the importance of a stable and continuous rental yield is well recognized in both direct real estate (i.e., residential property purchases) and indirect real estate (i.e., REITs markets), relatively few studies compare the returns of these two markets in a unified framework. To better understand the risk-return relationship of direct real estate assets in a diversified portfolio, this study attempts to examine the risk-return performance of a spatial portfolio of direct real estate markets of 65 Territorial Authorities (TAs) in New Zealand by using both the CAPM model (Sharpe 1964) and Fama-French model (Fama and French 2015). By comparing the returns amongst the national housing market, stock market, and the REITs market, both market risk, and institutional risk factors are considered. Specifically, we would like to answer this question: can the excessive returns be attributable to **market risk and institutional risk**? This study aims to identify the relationships between housing returns, market returns, and asset risk factors. Three proxies of market return are considered, *viz*. (1) the New Zealand National House Price Index, (2) the New Zealand Stock Price Index, and (3) the New Zealand REITs Price Index. Both price returns and total returns will be studied. The size risk (liquidity risk), value risk, time risk, default risk, and currency risk are further controlled in a Fama-French analysis.

New Zealand is used as the case because the country has experienced one of the most substantial growths in housing prices over the past decade. Are the returns from its direct real estate commensurate with the risk levels? The Economist (2019) declares that New Zealand houses are vastly overvalued, and house markets entrench into the bubble territory "on an unsustainable path". That also affects the affordability of homeownership (Cheung and Wong 2019). In the fourth quarter of 2018, houses in New Zealand were overvalued by 57% relative to incomes and 113% relative to rents. New Zealand's house prices have more than trebled since 1990, while British and American house prices have less than doubled. Some have even warned that New Zealand's house prices are the most vulnerable to correction (Kennedy 2019). During the outbreak of COVID-19, the year-on-year growth of house prices in New Zealand was one of the highest in the world. With the outbreak of COVID-19, asset markets are experiencing an unprecedented spike of risk and uncertainty worldwide; how does the risk factor into the urban housing markets (Cheung et al. 2021)?

This paper is organized as follows. Section 2 is a literature review. Section 3 outlines the research design and data, and Section 4 discusses empirical results. Section 5 concludes.

2. Literature Review

The Capital Asset Pricing Model (CAPM), which Sharpe (1964) and Lintner (1965) introduced based on the earlier work of Markowitz (1952) and Tobin (1958), is widely used in financial markets for relating the expected rate of return of a security to expected risk (Wu et al. 2017; Panwar 2016). The seminal papers developed by Fama and French (1992, 1993, 1995, 2015) add non-market factors to address size risk, value risk, profitability risk, and investment risk. In order to predict risk-return, many studies have applied the multifactor model to the stock market (Taneja 2010; Hu et al. 2019; Sehgal and Balakrishnan 2013; Santhi and Gurunathan 2014; Alves 2013). As CAPM and the Fama-French models offer investors a new insight into investment under conditions of certainty in the stock market, more studies are extending the implications of these two models (Paliienko et al. 2020; Sehrawat et al. 2020).

Ling and Naranjo (1999) applied a multifactor asset pricing model to test whether indirect real estate such as REITs integrates with stocks. Subsequently, an extensive body of research in literature has applied CAPM and the Fama-French model to REITs to explore the explanation for REITs' risk-return relationship and illustrate the diversification benefit of REITs in portfolio management (Chun et al. 2004). Peterson and Hsieh (1997) showed that the three stock market factors and two bond market factors could explain REITs' risk premium. Jackson (2020) also demonstrated a positive relationship between REITs' risk and market capitalization.

Many studies evidence the efficiency of CAPM and the Fama-French model for explaining the risk-return of REITs (Yusof and bin Mohd Nawawi 2012; Coşkun et al. 2017), but not in direct real estate. Even if the studies applied CAPM analysis to direct real estate, most of them focused on the commercial real estate market and measured its risk and return using aggregate data at an index level or appraised property values (Brueggeman et al. 1984; Peng 2016). Some literature compares the risk and returns between REITs and the commercial real estate market (Ross and Zisler 1991; Neil Myer and Webb 1993). Wong and Cheung (2017) found that the magnitude of discounts/premiums of high-end commercial properties hinges on the tradeoff between asset specificity and search. However, the literature on the risk and return of residential real estate is very slender.

Some theoretical studies have raised concerns about various types of risk impacts on direct real estate investment returns. Domian et al. (2015, p. 594) extended the cross-sectional CAPM model by adding liquidity risk and leverage risk to estimate the risk and return for residential real estate. They found that residential real estate underperformed the bond and stock markets after considering liquidity and leverage, probably because their sample included the post-subprime mortgage crisis period. Furthermore, the assumed "12-month marketing period for a typical residential transaction, and a Time-on-Market (TOM) risk premium of 44 percent" was rather arbitrary.

Besides comparing to the stock markets, another strand of studies compares individual housing returns to national housing returns. Case et al. (2011), for example, applied CAPM-based models on MSA-level housing returns to compare with the national housing return. They found strong support for a positive risk-return relationship in housing. Similarly, Huang (2021) used a Fama-French model on MSA-level housing return to compare with the national housing return and showed credit and liquidity risk effects. However, in the previous studies, all the housing returns considered are only price returns, not total returns. One of the significant differences between direct real estate investments and stocks or bonds is the stable and continuous rental income stream from the real estate assets. That is also one of the characteristics of investing in REITs. Therefore, this paper does not only compare housing returns with national housing and stock returns but also with the REITs market.

Recent studies of residential real estate risk and return focus on total returns and trading momentum. Chambers et al. (2019) included rental yield in constructing real estate total returns and found that long-term real estate investment would be less profitable and rather risky. Jordà et al. (2019) also considered housing rental yield to study the total returns of various asset classes. Deng et al. (2022) estimated 'real estate risk' with and without short-term trading based on return predictability, return volatility, and price dispersion. They show that as short-term investors exit the market, market returns are less predictable and less volatile, while prices are less dispersed cross-sectionally.

This study attempts to apply CAPM and Fama-French models on both housing price return and total return to identify the effects of rental yield and risk factors on the excess returns of direct investment on residential real estate. The models are well-established in both financial and indirect real estate markets, providing a sound methodology for our study.

3. Research Design

3.1. Data

Table 2 summarises the variables with their sources, descriptions, and units of measurement. First, our sample contains 62 Territory Authorities (TAs) with data period from 2002Q1 to 2018Q4 (68 quarters) to avoid the COVID shock. These data form a panel dataset of 5,184 observations. The housing price return is defined as the annual price return and is derived from the year-on-year changes of the house price indices of the individual Territory Authorities (CoreLogic 2020). The total housing return is the sum of the annual price return and the rental yield (MBIE 2020). The rental yields are derived by taking a weighted average of the rent-to-price ratio of each meshblock and aggregating them to the Territory Authority levels, as shown in the Appendix A. Three proxies are used for market returns, viz. (a) New Zealand housing market total returns; (b) stock market returns from NZX50; and (c) New Zealand REITs returns (Datastream 2020). The first market return measures the average of the price returns of housing investment of all TAs—national housing return, which shares a similar institutional arrangement of the housing market of each TA. The second one refers to the returns of the stock market NZX50, which is the most commonly used metric in the literature but is not real estate specific. The price and total returns of New Zealand REITs (NZ_REITs) are also employed, reflecting the performance of the New Zealand real estate markets, with similar market risk factors, but different institutional risk factors. We have also derived five risk factors in the analysis, namely (1) liquidity risk (SMB), (2) value risk (HML), time risk (SML) (RBNZ 2020), default risk (GMB) (S&P 2020), and currency risk (CUR) (Datastream 2020). Detailed definitions of them are shown in Table 2.

Table 2. Descriptions and Sources of the Variables.

Variable	Descriptions	Units	Sources
$R_{i,t}$	Price return of housing in New Zealand (Estimated by a hedonic pricing analysis on the transactions in Territory Authority *i* at time *t*)	% p.a.	See Appendix A
$\overline{R}_t$	National Price return of housing in New Zealand (average of all Territory Authorities at time *t*)	% p.a.	Average of $R_{i,t}$
$T_{i,t}$	Total return of housing in New Zealand (Sum of price return and rental yield in Territory Authority *i* at time *t*)	% p.a.	See Appendix A
$R_{f,t}$	Risk-free rates (i.e., 10-year government bond yield rate from the Reserve Bank of New Zealand)	% p.a.	RBNZ
$R_{m,t}$	Market price return in year-on-year % change of the proxied index (Proxy 1: New Zealand Housing Price Return, $\overline{R}_t$) (Proxy 2: New Zealand Stock Index, NZX 50) (Proxy 3: S&P New Zealand All REITs Return Index, NZ_REITs)	% p.a.	NZ_HTR = $\overline{R}_t$ NZX 50—S&P (Datastream); NZ_REITs—S&P (Datastream)
$T_{m,t}$	Market total return in year-on-year % change of the S&P New Zealand All REITs Total Return Index, NZ_REITs_TR)	% p.a.	NZ_REITs—S&P (Datastream)

Table 2. *Cont.*

Variable	Descriptions	Units	Sources
SMB_t	Liquidity risk (Small Minus Big): Smallest 1/3 Price Index—Biggest 1/3 Price Index	NA	CV—CoreLogic (2020), P (See Appendix A)
HML_t	Value risk (High Minus Low): Highest 1/3 CV/P—Lowest 1/3 CV/P	NA	
SML_t	Time risk (Short-term Minus Long-term): 2-year yield minus the 10-year yield of government bonds	% p.a.	Govt Bond Yield (RBNZ 2020)
GMB_t	Default risk (Good-grade Minus Bad-grade): AA yield—BBB yield of corporate bond	% p.a.	S&P NZL AA & BBB Investment Grade Corporate B.D. Index (Datastream)
CUR_t	Currency risk: NZD exchange rate against USD	NA	Datastream

Notes: RBNZ stands for Reserve Bank of New Zealand. (RBNZ 2020).

Table 3 shows the summary statistics of the variables used. The average price and total returns of housing investment in New Zealand from 2001 to 2018 are about 9.7% and 14.2% per annum, higher than the market returns in the stock exchange (11.3%) and New Zealand REITs market (3.4%). The risk-free rate is about 5%, even higher than that of REITs in New Zealand. The "liquidity risk (SMB)" and "value risk (HML)" are about -2.4% and −1.2% on average, whereas the time risk (SML) and the credit-rating risk (GMB) are about −0.6% and −0.8% on average. The exchange rate from New Zealand dollars to United States dollars is, on average, about 1.0 to 0.7.

Table 3. Summary Statistics of the Panel Variables.

Variables	Mean	Std. Dev.	Minimum	Maximum
$R_{i,t}$	9.71	13.04	−372.40	124.20
$T_{i,t}$	14.17	13.01	−32.45	129.19
$\overline{R}_t$	14.17	8.38	−1.60	34.01
$R_{f,t}$	4.94	1.33	2.29	6.77
$R_{m,t}$ (NZX50)	11.24	13.13	−33.01	30.60
$R_{m,t}$ (NZ_REITS)	3.42	11.76	−31.32	26.33
$T_{m,t}$ (NZ_REITS_TR)	11.04	12.53	−25.04	35.14
SMB_t	−2.39	6.93	−18.72	12.85
HML_t	−1.18	5.47	−11.45	10.13
SML_t	−0.64	0.78	−2.02	0.92
GMB_t	−0.83	0.57	−2.70	0.53
CUR_t	0.69	0.11	0.41	0.86
TA	62 (Territorial Authorities of New Zealand)			
Quarters	68 (2002Q1–2018Q4)			

3.2. Model Setup

Consider Jensen's (1968) single-factor CAPM model as the baseline panel model (Model 1), as shown in Equation (1):

$$R_{i,t} - R_{f,t} = \alpha_{1,P} + \beta_{1,P}\left(R_{m,t} - R_{f,t}\right) + \varepsilon_{1,i,t} \quad (1)$$

where $R_{i,t}$ is the price return of housing investment in each Territory Authority (TA) i at time t, which is calculated by the annual return $G_{i,t}$ of the hedonic house price indices (details in the Appendix A). $R_{f,t}$ is the risk-free rate at time t proxied by the ten-year government bond yield from the Reserve Bank of New Zealand. $R_{m,t}$ is the market price return at time t. The total return model is similar to Equation (1) by replacing $R_{i,t}$ with total return $T_{i,t}$, and $R_{m,t}$ with the total market return $T_{m,t}$.

Housing market risks include not only financial risks but also spatial-temporal risks. Spatial-temporally, different TAs will have different risk-return relationships due to various spatial and temporal reasons, such as ease of resale (liquidity risk, SMB_t, Small Minus

Big), the predictive power of appraisal information (value risk, HML_t, High Minus Low), institutional costs, etc. Temporally, different periods will also have different risk-return associations due to various macroeconomic reasons, such as the time cost risk (SML_t, Short-term Minus Long-term), the required compensations for default risk (GMB_t, Good-grade Minus Bad-grade) and currency risk (CUR_t), etc. Thus, to further control other relevant temporal-risk and spatial-temporal-risk factors, we modify the baseline model to an extended Fama-French Five-Factor Model (Model 2, Equation (2)). Mathematically:

$$R_{i,t} - R_{f,t} = \alpha_{2,P} + \beta_{2,P}\left(R_{m,t} - R_{f,t}\right) + \gamma_{1,P}SMB_t + \gamma_{2,P}HML_t + \gamma_{3,P}SML_t + \gamma_{4,P}GMB_t + \gamma_{5,P}CUR_t + \varepsilon_{2,i,t} \quad (2)$$

In the housing markets, SMB_t is proxied by subtracting the average return of the smallest one-third of TAs in housing transaction amount from the average return of the largest one-third of TAs in housing transaction amount (Equation (3)). SMB_t represents the liquidity risk as the transaction amount represents market activeness. Instead of using the book-to-value ratio used in stock market analysis, HML_t of the housing market is proxied by the appraisal-to-value ratio, which is the difference between the average return of the lowest one-third of TAs of housing appraised Capital Value to Market Price (CVTP) ratio and the average return of the highest one-third of TAs of housing CVTP ratio (Equation (4)) (Appendix A). HML_t can be considered as an appraisal risk:

$$SMB_t = \frac{\sum_{i=s}^{S} R_{i,t}}{S-s} - \frac{\sum_{i=b}^{B} R_{i,t}}{B-b} \quad (3)$$

$$HML_t = \frac{\sum_{i=h}^{H} R_{i,t}}{H-h} - \frac{\sum_{i=l}^{L} R_{i,t}}{L-l} \quad (4)$$

where $s,\ s+1,\ \ldots, S$ and $b,\ b+1,\ \ldots,\ B$ are the smallest and the largest one-third of TAs in housing transaction amounts at time t; whereas $h,\ h+1,\ldots,H$ and $l,\ l+1,\ \ldots,\ L$ are the highest and the lowest one-third TAs in housing CV/P ratios at time t.

$$SML_t = y^g_{2y,t} - y^g_{10y,t} \quad (5)$$

Equation (5) represents the time cost risk, which is proxied by the difference between short-term and long-term market required returns, SML_t (i.e., Short-term Minus Long-term). SML_t is calculated by subtracting the long-term risk-free 10-year New Zealand government bond yields $y^g_{10y,t}$ from the 2-year New Zealand government bond yields $y^g_{2y,t}$ at time t.

$$GMB_t = y^c_{aa,t} - y^c_{bbb,t} \quad (6)$$

Equation (6) shows GMB_t (Good-grade Minus Bad-grade) that represents the default risk (3rd-party credit-rating risk). The risk is proxied by the difference of market required returns between good grade and bad grade corporate bonds, where $y^c_{aa,t}$ and $y^c_{bbb,t}$ are the AA-grade and BBB-grade corporate bond yields at time t, respectively. The currency risk factor CUR_t is also included in the model because of an argument that foreign funds influence house prices in New Zealand. Currency risk is proxied by the annual growth rate of the exchange rate between NZD and USD.

4. Empirical Results and Discussion

Table 4 presents the results of a panel data analysis of single-factor CAPM panel models on three different market risk proxies: NZ_HCR, NZX50, and NZ_REITs. The cross-sectional effect on each TA is fixed (fixed effects, F.E.). Jensen's alpha α_i in these models exhibits a significantly positive excess return, increasing from 3.7 to 9.2 from the national housing to the stock and the REITs markets. This reflects the fact that New Zealand's housing price returns outperform the market price returns of NZ_HCR, NZX50, and NZ_REITs in the period when the risk factors of residential direct real estate markets are not considered. However, if the total return is considered, the excess return of housing investment is almost 40% more than that measured by the price return model. All the beta (β) estimates are positive and far less than one, decreasing from 0.78 to 0.11 of the four market return proxies. The relatively larger beta of Model 1a and the smaller betas of other Models imply that the housing returns correlate strongly with the national housing market returns but correlate weakly with the stock or REITs' market returns in the same direction. This implies that direct real estate can be a good candidate for portfolio diversification. The result also raises the question of the linkages between the real estate market and the REITs market (Gounopoulos et al. 2019).

Table 4. Results of the Single-factor CAPM Models.

	Model 1a	**Model 2a**	**Model 3a**	**Model 4a**
Dep. Var	R_m(NZ_HCR)	R_m(NZX50)	R_m(NZ_REIT)	T_m(NZ_REIT_TR)
α_i	3.695 (18.21) ***	6.618 (28.35) ***	9.166 (49.00) ***	12.710 (51.36) ***
β_i	0.777 (39.35) ***	0.301 (17.77) ***	0.124 (6.12) ***	0.110 (5.83) ***
F.E.	Yes	Yes	Yes	Yes
Adj R-sq	0.36	0.14	0.07	0.07
Observations	72 × 62	68 × 62	68 × 62	68 × 62

Notes: *** represents estimate is significant at the 1% level. The figures in parentheses are the t-statistics. Models 1a, 2a, 3a, and 4a are for the four proxies of market returns, viz. NZ_HCR, NZX50, NZ_REIT, and NZ_REIT_TR, respectively.

Figure 2 shows the scatterplot of betas versus average price returns of 12 City-TAs in New Zealand, illustrating their beta-return relationships. The beta-return correlations in city-TA are primarily positive, which confirms the Security Market Line (Tang and Shum 2003). The small magnitudes of the betas reflect the diversification benefits of including direct real estate investment in the portfolio with NZX50 stocks. We further test the five-factor models to determine the risk factors that can explain the returns.

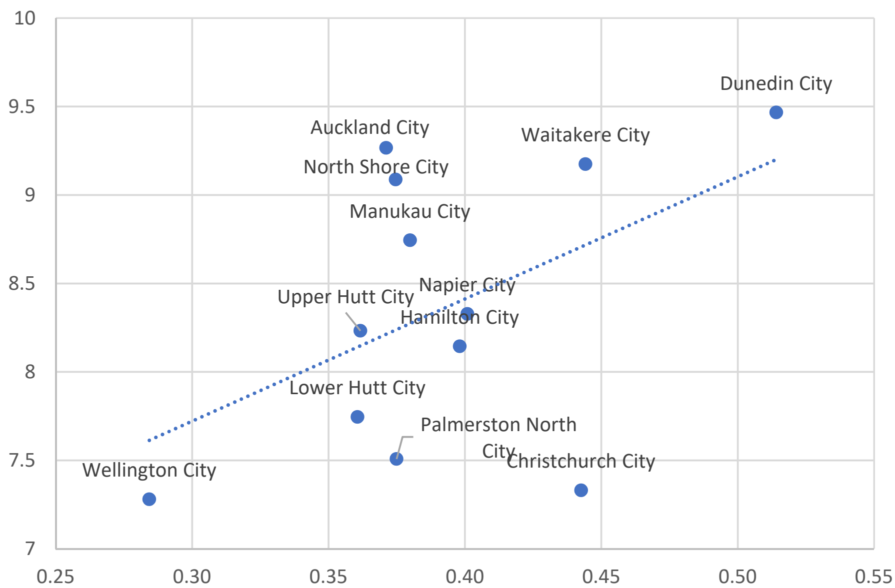

Figure 2. Beta-return relationships of the 12 City-TAs of New Zealand. Notes: This beta-return scatterplot is based on the single-factor CAPM model taking NZX50 as the market returns on the 12 City-TAs of New Zealand (excluding three outliers—Invercargill City, Porirua City, and Nelson City). The vertical axis represents the betas β_T estimated in Model 1b of the TA, and the horizontal axis represents the average total return $\overline{R}_t$ of the TA housing market. The best fit line $\overline{R}_t = 6.91\beta_T + 5.65$ achieves an R-squared of 0.25.

Table 5 presents the results of the five-factor models. First, all the alphas α_i are substantially reduced compared to those in the single-factor model. The result indicates that the excess returns in the housing markets can partially be explained by other risk factors, regardless of which market returns are considered. However, when total return is considered, the magnitude of the excess return is almost 70% more than that in the price return model. It reflects that most of the five risk factors cannot explain most of the excess return in rental yield. Second, the similar magnitude of betas β_i in all models reflect the independence of these specific risk factors from the market risk.

Table 5. Results of the Five-factor Fama-French Models.

	Model 1b	**Model 2b**	**Model 3b**	**Model 4b**
Dep. Var	R_m(NZ_HCR)	R_m(NZX50)	R_m(NZ_REIT)	T_m(NZ_REIT_TR)
α_i	2.673 (7.64) ***	4.038 (10.69) ***	4.950 (12.10) ***	8.359 (17.38) ***
β_i	0.813 (31.21) ***	0.308 (18.92) ***	0.185 (8.57) ***	0.148 (7.35) ***
SMB_t	−0.007 (−0.15)	−0.206 (−4.25) ***	−0.336 (−6.65) ***	−0.315 (−6.26) ***
HML_t	−0.013 (−0.25)	−0.017 (−0.29)	−0.042 (−0.68)	−0.009 (−0.16)
SML_t	−0.780 (−2.80) ***	3.28 (11.78) ***	1.986 (6.61) ***	2.201 (7.37) ***
GMB_t	−0.489 (−1.41)	−4.759 (−13.41) ***	−5.098 (−13.34) ***	−5.191 (−13.70) ***
CUR_t	−0.027 (−1.72) *	−0.057 (−3.36) ***	−0.021 (−1.20)	−0.015 (−0.85)
F.E.	Yes	Yes	Yes	Yes
Adj R-sq	0.36	0.24	0.18	0.18
Obs.	65 × 62	65 × 62	65 × 62	65 × 62

***, * represents estimate is significant at the 1% and 10% level. The figures in parentheses are the t-statistics. Models 1b, 2b, 3b, and 4b are for the four proxies of market returns, viz. NZ_HCR, NZX50, NZ_REIT, and NZ_REIT_TR, respectively.

4.1. The Two Spatial-Temporal-Risk Factors

For the liquidity risk factor SMB, all the coefficients in the models are significantly negative, confirming the liquidity risk hypothesis, i.e., TAs with more transactions obtained lower excess returns than those with fewer transactions. For the price information risk factors HML, all the coefficients are insignificant, indicating that appraisal value in relation to price does not affect performance. The insignificant HML measure implies no evidence that the appraised values (i.e., capital values) can predict the actual transaction prices.

4.2. The Three Temporal-Risk Factors

The time cost risk factors SML are all significantly positive, implying that a more extensive yield spread requires a higher housing return to compensate for the more expensive time cost. Similarly, the default risk factors GMB of all Models are negative and significant, except Model 1b. This indicates that housing investment returns will be under pressure when market participants are willing to pay a higher premium for a better credit-rating investment vehicle. It probably reflects investors' risk-averse attitude to direct real estate investment when the default risk is high and is probably caused by the high debt ratio in the housing markets. Thus, the default risk, being an institutional risk factor, is only significant when comparing two different markets. Furthermore, the negative sign of the currency risk factor CUR indicates that a stronger New Zealand dollar results in a lower return on housing investment. This risk can be interpreted as a currency return in compensation for a lower housing return. These results agree with the foreign buyer hypothesis (DoL 2008).

5. Conclusions

This paper aims to conduct the single-factor CAPM models and the five-factor Fama-French models on the housing prices and total returns of the 62 Territorial Authorities of New Zealand from 2002Q1 to 2018Q4 to investigate whether the returns compensate for the risk levels. The study period excludes the two recent shocks: the pandemic and the enactment of the Overseas Investment Amendment Act that, since October 2018, has banned non-resident foreigners from buying existing houses. This paper makes two contributions. First, the results show the risk-return differences when price returns and total returns are used. Second, the comparisons with the national housing market, stock market, and the REITs market show the effects of market risk and institutional risk.

The results show that the housing returns outperform the investment market returns, with a large positive alpha and a smaller than one positive beta regardless of the market benchmarks—i.e., the national housing returns, the stock returns, or the New Zealand REITs returns and REITs total returns. The five-factor models can explain the large excess returns (alphas), including the liquidity risk, value risk, time risk, default risk, and currency risk. However, comparing the excess returns (measured by Jensen's alpha) between price return and total return shows a substantial underestimation of the excess returns of residential direct real estate investment. It reflects the contribution of housing rental incomes to the excess returns.

Several results are highlighted. First, the liquidity risk test confirms that a premium is required to compensate for the illiquidity. A practical contribution of this finding is the financial viability of introducing PropTech to the sale of real estate, as it enhances liquidity and reduces the transaction costs of the real estate market. Second, the results do not support the value risk hypothesis, as the results show no evidence that appraised capital values can predict price return or total returns. In other words, the results do not find any returns due to the HML house value categories. Third, the time cost hypothesis is confirmed, which agrees with the theory of interest that a lower long-term interest rate will cause higher house prices. Fourth, the default risk hypothesis is also confirmed, reflecting the vulnerability of the heavy financial distress in housing markets. Fifth, the results also support the currency risk hypothesis that a stronger NZD causes a lower total return on housing investment in New Zealand. It agrees with the foreign buyer hypothesis.

This paper attempts to compare the risk-return relationships of direct housing investment in New Zealand with other investment market returns. After controlling the risk factors, the excess price returns of the housing markets can largely be explained. The remaining excess returns require further studies to demonstrate, especially the excess rental yields. The recent global upsurge of housing prices during the pandemic has aroused investors' interests and policymakers' concerns. For example, the Finance Minister of New Zealand is questioning the roles of the central banks' mortgage policies on hikes during the COVID-19 period. Is the mortgage policy intervention specific to housing markets that empower the markets to outperform other investment vehicles, even when many of these investment vehicles faced unprecedented plummets in the wake of the lockdowns? This institutional risk factor is unique in the residential direct real estate market during the pandemic.

In the past, direct real estate was not included in portfolio management analysis as it was considered lumpy, indivisible, illiquid, and subject to high transaction costs. With the recent advancement in PropTech and FinTech (Moro-Visconti et al. 2020; Chen et al. 2019), online investment in direct real estate has become more feasible and popular. Unfortunately, there have been very few risk-return analyses of direct real estate markets. This paper opens a new agenda for future research on the role of PropTech in risk reduction and liquidity enhancement of direct real estate investment. For example, the digital tokenization of the lumpy and illiquid single real estate assets allows investors to participate in the ownership of a broader universe of assets and build more diversified portfolios (Baum 2020). The use of PropTech, such as virtual reality, also shortens the marketing time of property (Xiong et al. 2022). In London, the International Property Securities Exchange (IPSX) was the first regulated securities exchange dedicated to the initial public offering and secondary market trading of companies owning single and multiple institutional-grade real estate assets. While PropTech promises a triumphant response to the potential of disruptive change, the law, market knowledge, and academic research seem to be unable to keep pace with this technological advancement. There is an apparent shortage of research to guide investment in this market. Many classical financial investment models, such as the Capital Asset Pricing Model (CAPM), the Fama-French Five-Factor asset pricing model, consumption beta (CCAPM), and intertemporal CAPM (ICAPM) essentially overlook direct real estate assets, owing mainly to their lumpy and illiquid nature.

Author Contributions: Conceptualization, C.-Y.Y. and K.-S.C.; methodology, C.-Y.Y., C.X., and K.-S.C.; validation, K.-S.C.; formal analysis, C.-Y.Y., C.X., and K.-S.C.; data curation, K.-S.C.; writing—original draft preparation, C.-Y.Y. and C.X.; writing—review and editing, K.-S.C.; supervision, C.-Y.Y.; project administration, C.-Y.Y. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: The data that support the findings of this study are partly available from CoreLogic and Datastream, and partially available openly from the following institutional websites. Restrictions apply to the availability of CoreLogic data and Datastream data, which were used under a license: Rental Returns: estimated from the MBIE's (2020) rental data (https://www.tenancy.govt.nz/about-tenancy-services/data-and-statistics/rental-bond-data/) and the CoreLogic's Transaction Data; Stock Index Returns: obtained from Datastream subscribed from the University of Auckland Library. Government bond yields: Reserve Bank of New Zealand RBNZ (2020) (https://www.rbnz.govt.nz/statistics/b2). Corporate bond yields: S&P's (2020) S&P Global.com (https://www.spglobal.com/spdji/en/indices/fixed-income/sp-new-zealand-aa-investment-grade-corporate-bond-index/#overview, https://www.spglobal.com/spdji/en/indices/equity/sp-nzx-real-estate-select/#overview).

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

The Hedonic Pricing Model used to estimate the House Price Indices, PI_t of Territory Authorities is:

$$In\left(P_{i,j,t}\right) = \alpha_1 + \sum_{i=2}^{I} \beta_i L_i + \sum_{j=1}^{J} \gamma_j X_j + \sum_{t=2}^{T} \delta_t D_t + \varepsilon_{i,j,t} \tag{A1}$$

$$PI_t = e^{D_t} \tag{A2}$$

$$G_t = D_t - D_{t-12} \tag{A3}$$

where $P_{i,j,t}$ is the transaction price of house j at Territory Authority i at time t. L_i, X_j and D_t are the variables representing Territory Authority, house characteristics, and months of the transactions, respectively. PI_t refers to the estimated price index, G_t is the annual price return of housing investment at time t.

The House Rental Yields of Territory Authorities is defined as:

$$Y_{i,t} = \frac{r_{i,t}}{P_{i,t}} \tag{A4}$$

where $Y_{i,t}$ is the rental yield at Territory Authority i at time t, $r_{i,t}$ and $P_{i,t}$ are the average transacted house rents and prices at Territory Authority i at time t, respectively. The average house rents are based on the actual rents of the renter-occupied properties (MBIE 2020).

Total House Transaction Amount of Territory Authority is defined as:

$$A_{i,t} = \sum_{j=1}^{J} P_{i,j,t} \tag{A5}$$

where $A_{i,t}$ is the total house transaction amount at Territory Authority i at time t.

Appraised House Capital Value to Market Price Ratio of Territory Authority is defined as:

$$CVTP_{i,j,t} = \frac{V_{i,j,t}}{P_{i,j,t}} \tag{A6}$$

where $CVTP_{i,j,t}$ is the appraised house capital value to market price ratio of house j at Territory Authority i at time t. $V_{i,j,t}$ is the appraised house capital value of house j at Territory Authority i at time t.

References

Alves, Paulo. 2013. The Fama French Model or the capital asset pricing model: International evidence. *The International Journal of Business and Finance Research* 7: 79–89.

Baum, Andrew. 2020. Tokenisation—The Future of Real Estate Investment? The University of Oxford Research. Available online: https://www.sbs.ox.ac.uk/sites/default/files/2020-01/tokenisation.pdf (accessed on 2 July 2021).

Brueggeman, William, Andrew Chen, and Thomas Thibodeau. 1984. Real estate investment funds: Performance and portfolio considerations. *Real Estate Economics* 12: 333–54. [CrossRef]

Cannon, Susanne, Norman Miller, and Gurupdesh Pandher. 2006. Risk and Return in the U.S. Housing Market: A Cross-Sectional Asset-Pricing Approach. *Real Estate Economics* 34: 519–52. [CrossRef]

Case, Karl, John Cotter, and Stuart Gabriel. 2011. Housing Risk and Return: Evidence from a Housing Asset-Pricing Model. *Journal of Portfolio Management* 37: 89–109. [CrossRef]

Chambers, David, Christophe Spaenjers, and Eva Steiner. 2019. The rate of return on real estate: Long-run micro-level evidence. In *HEC Paris Research Paper*. No. FIN-2019-1342. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3407236# (accessed on 2 July 2021).

Chen, Mark, Qinxi Wu, and Baozhong Yang. 2019. How Valuable Is FinTech Innovation? *The Review of Financial Studies* 32: 2062–106. [CrossRef]

Cheung, Ka Shing, and Siu Kei Wong. 2019. Entry and exit affordability of shared equity homeownership: An international comparison. *International Journal of Housing Markets and Analysis* 13: 737–52. [CrossRef]

Cheung, Ka Shing, Chung Yim Yiu, and Chuyi Xiong. 2021. Housing market in the time of pandemic: A price gradient analysis from the COVID-19 epicentre in China. *Journal of Risk and Financial Management* 14: 108. [CrossRef]

Chong, James, Joëlle Miffre, and Simon Stevenson. 2009. Conditional Correlations and Real Estate Investment Trusts. *Journal of Real Estate Portfolio Management* 15: 173–84. [CrossRef]

Chun, Gregory, Jarjisu Sa-Aadu, and James Shilling. 2004. The role of real estate in an institutional investor's portfolio revisited. *The Journal of Real Estate Finance and Economics* 29: 295–320. [CrossRef]

CoreLogic. 2020. Property Data & Analytics, Residential Real Estate, CoreLogic, New Zealand. Available online: https://www.corelogic.co.nz/industries/residential-real-estate/property-data-analytics (accessed on 2 July 2020).

Coşkun, Yener, Sevtap Selcuk-Kestel, and Bilgi Yilmaz. 2017. Diversification benefit and return performance of REITs using CAPM and Fama-French: Evidence from Turkey. *Borsa Istanbul Review* 17: 199–215. [CrossRef]

Datastream. 2020. Databases on Historical Financial and Economic Information. Available online: https://www.library.auckland.ac.nz/subject-guides/bus/infosources/datastream_faqs.htm (accessed on 2 July 2021).

Deng, Kuang Kuang, Siu Kei Wong, Ka Shing Cheung, and Kwok Sang Tse. 2022. Do real estate investors trade on momentum? *The North American Journal of Economics and Finance* 62: 101746. [CrossRef]

DoL. 2008. Housing Markets and Migration: Evidence from New Zealand: Economic Impacts of Immigration Working Paper Series, Department of Labour, New Zealand Government. Available online: https://www.lgnz.co.nz/assets/Housing-2030-Library-Resources/a18e59989e/housing-markets-and-immigration-evidence-from-nz_compressed.pdf?fbclid=IwAR2U5J12kzAjY8gNBA-Kn7Xl8bl4t4FDzCzi3KQcCz0-2ZWLny5r21ShoI8 (accessed on 2 July 2021).

Domian, Dale, Rob Wolf, and Hsiao Fen Yang. 2015. An assessment of the risk and return of residential real estate. *Managerial Finance* 41: 591–99. [CrossRef]

Fama, Eugene, and Kenneth French. 1992. The cross-section of expected stock returns. *Journal of Finance* 47: 427–65. [CrossRef]

Fama, Eugene, and Kenneth French. 1993. Common risk factors in the returns on stocks and bonds. *Journal of Finance Economics* 33: 3–56. [CrossRef]

Fama, Eugene, and Kenneth French. 1995. Size and book-to-market factors in earnings and returns. *The Journal of Finance* 50: 131–55. [CrossRef]

Fama, Eugene, and Kenneth French. 2015. A five-factor asset pricing model. *Journal of Financial Economics* 116: 1–22. [CrossRef]

Glascock, John, Chiuling Lu, and Raymond So. 2000. Further Evidence on the Integration of REIT, Bond and Stock Returns. *Journal of Real Estate Finance and Economics* 20: 1–9.

Gounopoulos, Dimitrios, Kyriaki Kosmidou, Dimitrios Kousenidis, and Victoria Patsika. 2019. The investigation of the dynamic linkages between real estate market and stock market in Greece. *The European Journal of Finance* 25: 647–69. [CrossRef]

Hu, Grace Xing, Can Chen, Yuan Shao, and Jiang Wang. 2019. Fama–French in China: Size and value factors in Chinese stock returns. *International Review of Finance* 19: 3–44. [CrossRef]

Huang, MeiChi. 2021. Regime switches and permanent changes in impacts of housing risk factors on MSA-level housing returns. *Journal of Finance Research* 26: 310–42. [CrossRef]

Jackson, Leonard. 2020. An application of the Fama–French three-factor model to lodging REITs: A 20-year analysis. *Tourism and Hospitality Research* 20: 31–40. [CrossRef]

Jensen, Michael. 1968. The performance of mutual funds in the period 1945–1964. *The Journal of Finance* 23: 389–416. [CrossRef]

Jordà, Òscar, Katharina Knoll, Dmitry Kuvshinov, Moritz Schularick, and Alan Taylor. 2019. The rate of return on everything, 1870–2015. *The Quarterly Journal of Economics* 134: 1225–98. [CrossRef]

Kennedy, Simon. 2019. Canada and New Zealand Show Signs of Housing Bubble. *Bloomberg Economics*. July 13. Available online: https://www.bloomberg.com/news/articles/2019-07-12/canada-new-zealand-show-signs-of-housing-bubble-says-study (accessed on 1 August 2022).

Liao, Hsien Hsing, and Jianping Mei. 1999. Institutional Factors and Real Estate Returns-A Cross Country Study. *International Real Estate Review* 2: 21–34. [CrossRef]

Ling, David, and Andy Naranjo. 1999. The integration of commercial real estate markets and stock markets. *Real Estate Economics* 27: 483–515. [CrossRef]

Lintner, John. 1965. The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The Review of Economics and Statistics* 51: 224–24. [CrossRef]

Liu, Crocker, Terry Grissom, and David Hartzell. 1990. The impact of market imperfections on real estate returns and optimal investor portfolios. *Real Estate Economics* 18: 453–78. [CrossRef]

Markowitz, Harry. 1952. Portfolio selection. *Journal of Finance* 7: 77–99.

MBIE. 2020. Rental Bond Data, Tenancy Services, New Zealand Government, New Zealand. Available online: https://www.tenancy.govt.nz/about-tenancy-services/data-and-statistics/rental-bond-data/ (accessed on 2 July 2021).

Montgomery, Nicolle, Graham Squires, and Iqbal Syed. 2018. Disruptive potential of real estate crowdfunding in the real estate project finance industry. *Property Management* 36: 597–619. [CrossRef]

Moro-Visconti, Roberto, Salvador Cruz Rambaud, and Joaquin López Pascual. 2020. Sustainability in FinTechs: An Explanation through Business Model Scalability and Market Valuation. *Sustainability* 12: 10316. [CrossRef]

Neil Myer, F., and J. Webb. 1993. Return properties of equity REITs, common stocks, and commercial real estate: A comparison. *Journal of Real Estate Research* 8: 87–106. [CrossRef]

Niskanen, J., and H. Falkenbach. 2010. REITs and Correlations with Other Asset Classes: A European Perspective. *Journal of Real Estate Portfolio Management* 16: 227–39. [CrossRef]

Paliienko, Oleksandr, Svitlana Naumenkova, and Svitlana Mishchenko. 2020. An empirical investigation of the Fama-French five-factor model. *Investment Management and Financial Innovations* 17: 143–55. [CrossRef]

Panwar, Vikrant. 2016. Testing the validity of capital asset pricing model (CAPM) in the Indian stock market. *Indian Journal of Research in Capital Markets* 3: 49–56.

Peng, Liang. 2016. The risk and return of commercial real estate: A property level analysis. *Real Estate Economics* 44: 555–83. [CrossRef]

Peterson, James, and Cheng Ho Hsieh. 1997. Do common risk factors in the returns on stocks and bonds explain returns on REITs? *Real Estate Economics* 25: 321–45. [CrossRef]

RBNZ. 2020. Secondary Market Government Bond Yields, Wholesale Interest Rates, Reserve Bank of New Zealand, New Zealand. Available online: https://www.rbnz.govt.nz/statistics/b2 (accessed on 2 July 2021).

Ross, Stephen, and Randall Zisler. 1991. Risk and return in real estate. *The Journal of Real Estate Finance and Economics* 4: 175–90. [CrossRef]

Santhi, N. S., and K. Balanaga Gurunathan. 2014. Fama-French three factors model in the Indian mutual fund market. *Asian Journal of Economics and Empirical Research* 1: 1–5.

Sehgal, Sanjay, and A. Balakrishnan. 2013. Robustness of Fama-French three-factor model: Further evidence for the Indian stock market. *Vision* 17: 119–27. [CrossRef]

Sehrawat, Neeraj, Amit Kumar, Narander Kumar Nigam, Kirtivardhan Singh, and Khushi Goyal. 2020. Test of capital market integration using Fama-French three-factor model: Empirical evidence from India. *Investment Management and Financial Innovations* 17: 113–27. [CrossRef]

Sharpe, William. 1964. Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance* 19: 425–42.

Taneja, Yash Pal. 2010. Revisiting Fama-French three-factor model in Indian stock market. *Vision* 14: 267–74. [CrossRef]

Tang, Gordon, and Wai Shum. 2003. The conditional relationship between beta and returns: Recent evidence from international stock markets. *International Business Review* 12: 109–26. [CrossRef]

The Economist. 2019. Global House Price Index. *The Economist*. June 27. Available online: https://www.economist.com/graphic-detail/2019/06/27/global-house-price-index?date=2000-03&index=income&places=NZL&places=AUS (accessed on 2 July 2021).

Tobin, James. 1958. Liquidity preference as behaviour towards risk. *The Review of Economic Studies* 25: 65–86. [CrossRef]

Watson, Elizabeth. 2012. Asset returns and the investment choice of New Zealanders. *Reserve Bank of New Zealand* 75: 26–34.

Wong, Siu Kei, and Ka Shing Cheung. 2017. Renewing a Lease at a Discount or Premium? *Journal of Real Estate Research* 39: 215–34. [CrossRef]

Wu, Mengyun, Muhammad Imran, Yanhua Feng, Linrong Zhang, and Muhammad Abbas. 2017. Review and validity of capital asset pricing model: Evidence from Pakistan stock exchange. *International Research in Economics and Finance* 1: 21. [CrossRef]

Xiong, Chuyi, Ka Shing Cheung, DeborahSusan Levy, and Michael Allen. 2022. The effect of virtual reality on the marketing of residential property. *Housing Studies*, 1–24. [CrossRef]

Yusof, Aida Yuzi, and Abdul Halim bin Mohd Nawawi. 2012. Does Malaysian REITs outperform the equity market? Paper presented at the 2012 International Conference on Statistics in Science, Business and Engineering (ICSSBE), Langkawi, Malaysia, September 10–12; pp. 1–5.