Chapter 2

Related Theories and Literature Reviews

The problem of real estate sector stock determination and its predictability is a very controversial issue in the international economics literature. In particular, the empirical specification of non-linear models for real estate sector stock has been largely motivated by non-linear solutions presented for such variables in a number of theoretical models. Study the economic theory model and learn the econometrics theory models are very important to catch the flood of international economic progress.

2.1 The economic theories

There are basically three economic growth theories reviewed in this part, which are the portfolio and consumption decisions and the macro equilibrium.

2.1.1 The portfolio and consumption decisions

At the start of t, they have S (t) shares in a market portfolio and B (t) bonds. P (t) is the price per share of the shares in the market portfolio. Each bond has a value of $1.00 at the start of t and it pays (1 + r) dollars at the end of t. The portfolio decision of the jth investor at the start of t is the allocation of wealth or net worth, W (j,t), between shares and bonds. Investor j holds S (j,t) shares and B(j,t) bonds so that

$$W(j,t) = S(j,t)\,P(t) + B(j,t). \qquad (2.1)$$

The fraction of net worth invested in shares, called the *equity ratio* here, is

$$az(j,t) = \frac{S(j,t)\ P(t)}{W(j,t)}. \qquad (2.2)$$

B(j,t) is negative when the investor borrows and invests S(j,t) > W(j,t) in shares, but when we aggregate over all investors the sum of the B(j,t) is B(t), the outstanding number and value of bonds.

$$dz(j,t) = \frac{[k(t) - r]}{v(t\text{-}1)\,[1 - \delta(j)]} \quad . \qquad (2.3)$$

The additional variables here are k(t), v(t) and δ(j) with k(t) > r and 0 ≤ δ(j) < 1. k(t) is the expected return on the market portfolio or the yield at which it is selling, and v(t) is the variance in the return on the market portfolio. 1 - δ(j) is the risk aversion of the jth investor, and it is assumed to be constant over time. The behaviour represented by Eq. (3) is quite reasonable, apart from the assumption that the variables on the right hand side are constant from one period to the next. The desired equity ratio increases with k(t) - r, the premium in the share's *expected* return over the interest rate, and it decreases as the portfolio's risk and the investor's aversion to risk, v(t) and 1-δ(j) rise.

An investor who maximizes the expected utility of future consumption under a HARA utility function with constant relative risk aversion, consumes the fraction of W(j,t) given by the expression:

$$cz(j,t) = \frac{r\,\delta(j)^2 - \delta(j)\,[r + \gamma(t) + \beta(j)] + \beta(j)}{[1 - \delta(j)]^2}, \tag{2.4}$$

with $\gamma(t) = \dfrac{[k(t) - r]^2}{2\,v(t-1)}$. In this expression β(j) is the rate at which future utility is discounted by investor j. We have little to go by for the value of β(j), and if it is believed that β(j) = r for all investors, cz(j,t) reduces to

$$cz(j,t) = r - \frac{\delta(j)\;\gamma(t)}{[1 - \delta(j)]^2}. \tag{2.5}$$

Eqs (4) and (5) state that the fraction of net worth consumed increases with the interest rate and the excess return on the share, and it falls as risk and risk aversion rise. Since $0 \leq \delta\,(j) < 1$, we can see that cz(j,t) also increases with $\beta(j)$.

When the desired equity ratio falls (rises) as net worth rises (rises), the investor has increasing (decreasing) relative risk aversion. We capture increasing relative risk aversion by modifying Eq. (3) as follows:

$$dk(j,t) = \frac{[k(t)\ -\ r]}{v(t-1)\,[1-\delta(j)]}\left[\frac{WLR(t-1)}{W(j,t)}\right]^{\Psi} = dz(j,t)\left[\frac{WLR(t-1)}{W(j,t)}\right]^{\Psi}. \qquad (2.6)$$

Here, $0 < \Psi < 1$ and WLR(t) is a long-run value of W(j,t). It captures the fact that dk(j,t) for any current level of net worth rises with the general prosperity of society.

The consumption behaviour of an investor who does not reduce consumption towards zero as net worth goes to zero may be captured by the expression:

$$CK(j,t) = \lambda\, cz(j,t)\, WLR(t) + (1 - \lambda)\, cz(j,t)\, W(j,t) \qquad (2.7)$$

$$= cz(j,t)[\lambda WLR(t) + (1-\lambda)W(j,t)].$$

With cz(j,t) given by Eq. (5) and $0 < \lambda < 1$.

2.1.2 The macro equilibrium

All investors in aggregate must hold the outstanding amounts of the bond and the share. That is

$$P(t)\, S(t) = P(t)\, \Sigma_j\, S(j,t), \tag{2.8}$$

And

$$B(t) = \Sigma_j\, B(j,t). \tag{2.9}$$

In addition each neoclassical investor must have az(j,t) = dz(j,t) and in aggregate we must have

$$az(t) = \frac{\sum_j az(j,t)\, W(j,t)}{W(t)} = dz(t) = \frac{\sum_j dz(j,t)\, W(j,t)}{W(t)} \tag{2.10}$$

The price of a share portfolio at the start of period t is

$$P(t) = \frac{eD(t, t-1)}{[k(t) - eg(t, t-1)]} \quad . \tag{2.11}$$

Here eD(t, t-1) is the expected value of the dividend in t, arrived at on the basis of information available at the end of t-1, that is, before P is determined. Similarly, eg(t,t-1) is the expected value of the dividend's growth rate over all time subsequent to t, on the basis of the information available at the end of t-1. Hence, given P(t), we know k(t) and vice versa, and they are inversely related.

The requirement that the actual and desired equity ratio be equal on the micro level, that is az(j,t) = dz(j,t) is easily satisfied. The actual P is observed and the k is inferred by the investor on the basis of her estimates of D and g.

On the macro level the outcome of the sale and purchase of shares and bonds is different and more subtle, but no less effective in a closed system. At the start of t, the number of shares S, and the amount of bonds B are given, so that net worth W=SP+B changes only with P=eD/ (k-eg). Furthermore, eD and eg are given for each investor, so that P and k are mutually determined by the inverse relation in Eq. (11). The actual equity ratio, az = SP/SP + B, is zero when P and with it W are zero, and it rises from zero asymptotically towards one as P and W rise to infinity.

The desired equity ratio dz is infinite at W = 0, and it falls asymptotically towards zero as W rises towards infinity.

The dividend expectation subsequent to t on the basis of information available at the end of t-1 can be represented by the expected value of the price at the start of t + 1. In that case

$$P(t) = \frac{e\,D(t,t+1) + e\,P(t+1, t-1)}{1 + h(t)} \tag{2.12}$$

Share price are ex post realized values. They give rise to the realized holding period return during t:

$$hr(t) = \frac{P(t+1) - P(t) + D(t)}{P(t)}\,. \tag{2.13}$$

The ability to observe hr(t) has led to the assumption that expectations are on average realized, in which case averages over many periods can be used as estimates of expected return for various empirical purposes, including the testing of the CAPM.

2.2 The econometric theories

2.2.1 Linear and Nonlinear method models

The time-series literature has traditionally concentrated on linear methods and models, partly no doubt for both mathematical and practical convenience. Despite their simplicity, linear methods often work well and may well provide an adequate approximation for the task at hand, even when attention is restricted to univariate methods. Linear methods also provide a useful yardstick as a basis for comparison with the results from more searching alternative analyses. However, there is no reason why real life generating processes should all be linear, and so the use of non-linear models seems potentially promising. Many observed time series exhibit features which cannot be explained by a linear model. Non-linear models have, as yet, been used rather little for serious forecasting but there is increasing interest in such models and they have exciting potential. This study also see linear model as one of the special nonlinear autoregressive time series models.

Consider the discrete-time univariate stochastic process $\{X_t\}_{t\in T}$. Suppose Xt is generated by the map:

$$X_{t+s} = f(X_t, X_{t-d}, \ldots X_{t-(m-1)d}; \theta) + \varepsilon_{t+s}$$

With $\{X_t\}_{t \in T}$ white noise, ε_{t+s} independent w.r.t. Xt+s, and with f a generic function from R^m to R. This class of models is frequently referenced in the literature with the acronym NLAR(m), which stands for Nonlinear Auto Regressive of order m.

In this function, we have implicitely defined the embedding dimension m, the time delay d and the forecasting steps s. The vector θ indicates a generic vector of parameters governing the shape of f, which we would estimate on the basis of some empirical evidence (i.e., an observation time series $\{ x_1, x_2, ..., x_N \}$).

(1) Autoregressive-linear model (AR-linear Model)

The basic linear model is AR (m) model and also this model can be written in equation:

$$y_{t+s} = \phi + \phi_0 y_t + \phi_1 y_{1-d} + ... + \phi_m y_{t-(m-1)d} + \varepsilon_{t+s} \qquad (2.14)$$

The equation (2.1) is represented the AR (m) model and y_t is time series data at time t, ϕ is parameter and coefficient of y_t in the model. In addition, ε is error term of this equation:

(2) Self-Exciting Threshold Autoregressive Model (SETAR Model)

The general Self-Exciting Threshold Autoregressive Model or SETAR model can be written in equation:

$$y_{t+s} = \begin{cases} \phi_1 + \phi_{10} y_t + \phi_{11} y_{t-d} + \ldots + \phi_{1L} y_{t-(L-1)d} + \varepsilon_{t+s} & Zt \le th \\ \phi_2 + \phi_{20} y_t + \phi_{21} y_{t-d} + \ldots + \phi_{2H} y_{t-(H-1)d} + \varepsilon_{t+s} & Zt > th \end{cases} \quad (2.15)$$

The equation (2.2) is represented the SETAR models and y_t is time series data at time t, ϕ is the parameter and coefficient of equation. In addition, ε is error term of this equation and Z_t is a threshold variable in the model. The L is represented lower regime of model and H is represented the higher regime of the model.

(3) Logistic Smooth Transition Autoregressive Model (LSTAR model)

The general Logistic Smooth Transition Autoregressive Model or LSTAR model can be written in equation:

$$\begin{aligned} y_{t+s} &= (\phi_1 + \phi_{10} y_t + \phi_{11} y_{t-d} + \ldots + \phi_{1L} y_{t-(L-1)d})(1 - G(z_t, \gamma, th)) + \\ &(\phi_2 + \phi_{20} y_t + \phi_{21} y_{t-d} + \ldots + \phi_{2H} y_{t-(H-1)d}) G(z_t, \gamma, th) + \varepsilon_{t+s} \end{aligned} \quad (2.16)$$

The equation (2.3) is represented the LSTAR model and y_t is the time series data at time t, ϕ is the parameter and coefficient of equation. In addition, ε is error term of this equation and Z_t is a threshold variable in the model. The L is represented lower regime of model and H is represented the higher regime of the model. Moreover, G is the logistic function and ϕ, γ th are the parameters to be computed.

(4) Neural Network Models (NNT Model)

From the neural network model was used for estimation in this research can be explained by equation:

$$y_{t+s} = \beta_0 + \sum_{j=1}^{D} \beta_j g(\gamma_{0j} + \sum_{i=1}^{m} \gamma_{ij} y_{t-(i-1)d}) \qquad (2.17)$$

The equation (2.4) is represented the NNT model and y_t is time series data at time t, the β_0 is parameter of equation. In a hidden units and activation function g.

(5) Additive Autoregressive Model (AAR Model)

The generalized non-parametric additive model (Generalized Additive Model) or AAR model can be written in equation:

$$y_{t+s} = \mu + \sum_{i=1}^{m} s_i(y_{t-(i-1)d}) \qquad (2.18)$$

The equation (2.5) is represented the generalized non-parametric additive model and y_t is time series data at time t. S_i are smooth functions represented by penalized cubic regression.

2.2.2 Copulas Theory

Copula is a function that connects multi-dimensional distribution function with one-dimensional marginal distribution function. Copulas is emergence not only bring risk analysis and multivariate time series analysis to a new stage, but also promote the financial risk measurement method to a new breakthrough which measuring the risk of non-ellipsoidal shape distribution. At meanwhile, it can accurately describe the correlation of multi-variable distribution. The use of copulas therefore splits a complicated problem (finding a multivariate distribution) into two simpler tasks. The first task is to model the univariate marginal distributions and the second task is finding a copula that summarizes the dependence structure between them.

(1) The Sklar's theorem

Sklar's theorem implies that a joint distribution can be factored into two marginal distributions of the components and a copula describes the dependence between the components. With Sklar's theorem, one can first estimate suitable marginal distributions of the components of a multivariate system by any possible method, then link them together through an appropriate copula to form a joint distribution.

Suppose the marginal distribution function of a multi-dimensional distribution function H is that $F_1(x_1),...,F_n(x_n)$, then there exists a Copula function that satisfies:

$$H(x_1,...x_n) = C(F_1(x_1),...F_n(x_n)) \tag{2.19}$$

If $F_1(x_1),...,F_n(x_n)$ is continuous, then the Copula function is uniquely determined, and vice versa. From this theorem, it can be inference that we can easily calculate the joint distribution of financial time series when we identified the marginal distribution a number of financial time series and selected a suitable Copula function, which is also the advantage of Copula functions in practical application.

(2) The empirical copula

Empirical copula as introduced by Deheuvels [1979]. Let $X^t = (X_1^t,...X_N^t) \in R^N$ be an i.i.d. sequence with distribution F and margins F*n*. We assume that F is continuous so that the copula associated to F is unique.

If δ_u stand for the Dirac measure with $U \in R^N$, we define $\hat{\mu} = \frac{1}{T}\sum_{t=1}^{T}\delta_{X^t}$ the empirical measure associated with a sample of X, and $\hat{F}(x_1,...,x_N) = \hat{\mu}(\Pi_{n=1}^N]-\infty, x_n])$ its empirical function. We note $\{x_1^{(t)},...,x_N^{(t)}\}$ be the order statistic and $\{\gamma_1^t,...,\gamma_N^t\}$ the rank statistic of the sample which are linked by the relationship $x_n^{(\gamma_n^t)} = x_n^t$. It is possible to introduce the empirical copula of the sample as any copula $\hat{C}$ of the empirical distribution $\hat{F}$. But the problem is that $\hat{C}$ is not unique, that's why DEHEUVELS[1981] proposes the following way to cope with the problem.

Any copula $\hat{C} \in C$ defined on the lattice

$$L = \{(\frac{t_1}{T},...,\frac{t_N}{T}); 1 \le n \le N, t_n = 0,...,T\} \quad (2.20)$$

By $$\hat{C}(\frac{t_1}{T},...,\frac{t_N}{T}) = \frac{1}{T}\sum_{t=1}^{T}\prod_{n=1}^{N} 1_{[Y_n^t \le t_n]} \qquad (2.21)$$

is an empirical copula.

Introduce the notation $\hat{C}_{(T)}$ in to define the order of the copula, that is the dimension of the sample used to construct it. DEHEUVELS [1979, 1981] obtain then the following conclusions:

1. The empirical measure $\hat{\mu}$ (or the empirical distribution function $\hat{F}$) is uniquely and reciprocally defined by both

   (a) the empirical measures of each coordinate $\hat{F}_n$.

   (b) the value of an empirical copula $\hat{C}$ on the set L.

2. The empirical copula $\hat{C}$ defined on L is in distribution independent of the margins of F.

3. If $\hat{C}_{(T)}$ is any empirical copula of order T, then $\hat{C}_{(T0)} \to C$ with the topology of C (uniform convergence for example).

We could now define the analog of the Radom-Nikodym density for the empirical copula $\hat{C}$

$$\hat{c}(\frac{t_1}{T},...,\frac{t_n}{T},...,\frac{t_N}{T}) = \sum_{i_1=1}^{2}...\sum(-1)^{i_1+...+i_N}\hat{C}(\frac{t_1-i_1+1}{T},...,\frac{t_n-i_n+1}{T},...,\frac{t_N-i_N+1}{T}) \qquad (2.22)$$

$\hat{c}$ is called the empirical copula frequency(NELSEN[1998]). The relationship between empirical copula distribution and frequency are:

$$\hat{C}\left(\frac{t_1}{T},\ldots.,\frac{t_n}{T},\ldots,\frac{t_N}{T}\right)=\sum_{i_1=1}^{t_q}\cdots\sum_{i_N=1}^{t_N}\hat{c}\left(\frac{i_1}{T},\ldots,\frac{i_n}{T},\ldots,\frac{i_N}{T}\right) \tag{2.23}$$

Note that empirical copulas permits to define the sample version of dependence measures.

(3) Rank correlation

Rank correlation reflects the monotonic dependence between variables, so it remains unchanged under the non-linear monotone transformation that has good statistical properties, and should be superior to a traditional linear correlation. The most representative rank correlation coefficients are Kendall.tau and Spearman.rho.

(i) Kendall.tau

Suppose $(x_1, y_1),(x_2, y_2)$ are i.i.d vector, $x_1, x_2 \in x$, $y_1, y_2 \in y$, let

$$\tau = p\{(x_1 - x_2)(y_1 - y_2) > 0\} - p\{(x_1 - x_2)(y_1 - y_2) < 0\} \tag{2.24}$$

Then, τ measures the degree of consist change in x and y. It can be proved:

$$\tau = 2P\{(x_1 - x_2)(y_1 - y_2) > 0\} - 1 \quad (2.25)$$

It can be seen that the τ is between [-1, 1], suppose the copula function of (x_1,y_1) is C (u, v), then Schwettzer and Wolff (1998) proved that the function τ is given by copula:

$$\tau = 4\iint_0^1 C(u,v)dC(u,v) - 1 \quad (2.26)$$

(ii) Spearmam.rho

Let (x, y) have the joint distribution H(x, y). Their corresponding marginal distribution is F_x and F_y, $x_0 \in x$, $y_0 \in y$ and $(x,y) \sim F(x)G(y)$, that is,x_0, y_0 are independent. Assume (x,y) and (x_0, y_0) are also independent, let

$$\rho = 3[P\{(x - x_0)(y - y_0) > 0\} - p\{(x - x_0)(y - y_0) < 0\}] \quad (2.27)$$

When the Copula function C (u, v) is given, where u=F(x), v=G (y), Schwettzer and Wolff (1998) proved that ρ is given by the corresponding Copula function:

$$\rho = 12\iint_{0}^{1} C(u,v)dC(u,v) - 3 \tag{2.28}$$

(4) Pearson's correlation coefficient

Pearson's correlation coefficient between two variables is defined as the covariance of the two variables divided by the product of their standard deviations.

For a population:

Pearson's correlation coefficient when applied to a population is commonly represented by the Greek letter ρ (rho) and may be referred to as the population correlation coefficient or the population Pearson correlation coefficient. The formula for ρ is:

$$\rho_{X,Y} = \frac{\mathrm{cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{E[(X-\mu x)(Y-\mu y)]}{\sigma_X \sigma_Y} \tag{2.29}$$

For a sample:

Pearson's correlation coefficient when applied to a sample is commonly represented by the letter r and may be referred to as the sample correlation coefficient or the sample Pearson correlation coefficient. We can obtain a formula for r by substituting estimates of the covariances and variances based on a sample into the formula above. That formula for r is:

$$\gamma = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}} \tag{2.30}$$

An equivalent expression gives the correlation coefficient as the mean of the products of the standard scores. Based on a sample of paired data (Xi, Yi), the sample Pearson correlation coefficient is

$$\gamma = \frac{1}{n-1}\sum_{i=1}^{n}\left(\frac{X_i - \bar{X}}{s_X}\right)\left(\frac{Y_i - \bar{Y}}{s_Y}\right) \tag{2.31}$$

Where $\frac{X_i - \bar{X}}{s_X}$, $\bar{X}$ and s_X are the standard score, sample mean, and sample standard deviation, respectively.

The absolute value of both the sample and population Pearson correlation coefficients are less than or equal to 1. Correlations equal to 1 or -1 correspond to data points lying exactly on a line (in the case of the sample correlation), or to a bivariate distribution entirely supported on a line (in the case of the population correlation). The Pearson correlation coefficient is symmetric: corr(X,Y) = corr(Y,X).

A key mathematical property of the Pearson correlation coefficient is that it is invariant (up to a sign) to separate changes in location and scale in the two variables. That is, we may transform X to a + bX and transform Y to c + dY, where a, b, c, and d are constants, without changing the correlation coefficient (this fact holds for both the population and sample Pearson correlation coefficients). Note that more general linear transformations do change the correlation: see a later section for an application of this.

The Pearson correlation can be expressed in terms of uncentered moments. Since $\mu_X = E(X), \sigma_X^2 = E[(X - E(X))^2] = E(X^2) - E^2(X)$ and likewise for Y, and since

$$E[(X - E(X))(Y - E(Y))] = E(XY) - E(X)E(Y) \qquad (2.32)$$

The correlation can also be written as

$$\rho_{X,Y} = \frac{E(XY) - E(X)E(Y)}{\sqrt{E(X^2) - (E(X))^2}\sqrt{E(Y^2) - (E(Y))^2}} \quad (2.33)$$

Alternative formulae for the sample Pearson correlation coefficient are also available:

$$\gamma_{xy} = \frac{\sum x_i y_i - n\bar{x}\bar{y}}{(n-1)s_x s} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n\sum x_i^2 - (\sum x_i)^2}\sqrt{n\sum y_i^2 - (\sum y_i)^2}} \quad (2.34)$$

The above formula suggests a convenient single-pass algorithm for calculating sample correlations, but, depending on the numbers involved, it can sometimes be numerically unstable.

(5) Dependence Measures

The general properties of dependence measures can be explained by the 4 items properties shown below (Embrechts, Lindskog and McNeil (2003))

1. $\delta(X,Y) = \delta(Y,X)$

2. $-1 \le \delta(X,Y) \le 1$

3. $\delta(X,Y)=1$ If X and Y are comonotonic; as well as $\delta(X,Y)=-1$ if X and Y are comontonic.

4. If T is exactly monotonic, then

$$\delta(T(X),Y)=\{\delta(X,Y), T=increasing \quad \text{Or} \quad -\delta(X,Y), T=decreasing\}$$

Normally, the Pearson linear correlation fits only the first two properties but the rank correlation measures Spearman's rho and Kendall's tau fits all of the 4 properties. Therefore, the copulas uses the Spearman's rho and Kendall's tau to calculate the dependence measures between X and Y which are random variables.

2.3 Literature reviews

2.3.1 Foreign literature reviews

In modern finance theory, from the abroad literature, most of economists studied the relationship between stock market and real estate prices by empirical studies, which focus primarily on the relationship and interaction mechanism between the real estate prices and the stock prices.

Early in 1984, Ibbotson and Siegel in "Real Estate Economics" magazine published a paper that is "real estate returns: comparison with other investments", which analyzed the correlation between U.S. real estate prices and S & P 500 stock index, and showed that the correlation coefficient was only -0.06.

Jorion and Schwartz (1986) conclude that segmentation influences asset pricing. Liu et al., (1990) also follow a similar framework in an attempt to clarify the issue further, exploring whether the commercial non-farm real estate market is integrated with, or segmented from, the stock market.

The result of this study is their evidence provides support for the hypothesis that segmentation does exist, albeit based upon indirect barriers such as the cost, amount and quality of information on real estate, as opposed to any legal constraints.

Perron (1989) concludes that business cycles are in fact transitory fluctuations around a more or less stable trend path, thereby resulting in non-linear phenomena. In similar fashion, he argues that a non-linear relationship may exist within European countries. Furthermore, he notes that in the majority of the prior empirical studies addressing the issue of equilibrium, most of the models fail to take into consideration the asymmetric properties of the adjustment process in both the real estate market and the stock market.

Gyourko and Keim (1992) report totally contradictory findings, with their results providing evidence to suggest that the stock market contains important information on real estate fundamentals and that S&P 500 returns have significant explanatory power in terms of predicting equity ‘real estate investment trust’ (REIT) returns. Furthermore, Meyer and Webb (1993) also note that the returns on equity REITs appear to be very similar to the returns on common stocks, thereby suggesting a certain degree of integration between the two markets.

Wilson et al., (1996) explore the relationship between the stock and real estate markets by comparing the results of the non-linear model with those obtained through the use of the conventional Engle and Granger (1987) Cointegration tests.

The result of this study is that the non-linear model supports the notion that the markets are fractionally integrated, the Cointegration results also provide contradictory support for the view that the stock and real estate markets are segmented.

Okunev and Wilson (1997) used monthly U.S. time series data and Co-integration model to test the relationship between real estate prices and stock prices.

The results showed that there is no link between real estate prices and stock prices.

Quan and Titman (1997) examine the relationship between real estate stock portfolio returns and standard appraisal-based index returns. Using a cross-sectional regression analysis of real estate price indices and stock price data on seventeen countries.

The result of this study is that indicate a significantly positive relationship between both real estate valuations and stock returns. Liu et al., (1990) find further evidence of market segmentation between the real estate market and the stock market, with their results gaining additional support from the findings of Geltner (1990), who reported discernible differences between the noise component of stock and real estate returns, and thereby concluded that the two markets are probably segmented.

Enders and Granger (1998) and Enders and Siklos (2001) propose the use of the asymmetric ‘threshold auto-regressive (TAR) model and the ‘momentum-threshold auto-regressive (M-TAR) Cointegration tests, indicating that the application of nonlinear models using macroeconomic variables is likely to become the mainstream methodology.

The result of this study is that these models are equipped to provide the requisite empirical evidence favorable to the elucidation of long-run relationships through the use of error correction mechanisms or by permitting asymmetric adjustment.

Quan and Titman (1999) test 14 years real estate price change in 17 different countries, and the rate of return of stock relationship in short period. The result of this study is indicate that in 16 countries, the relationship between housing price change and stock short run return rate is not significant. But if we switch to the long period, the correlation relationships will become more and stronger.

Wilson and Okunev (1999) used nonlinear methods to examine the relationship between the stock market and the real estate market in U.S., UK and Australia.

The results showed that there was no correlation in U.S. and British, while there existed as correlation in Australian.

Arnaud Costinot and Thierry Roncalli（2000）this paper show that the dependence between financial markets with copulas**.** In financial economics, the classical tool is the Pearson (or linear correlation) to compare the dependence structure.

The results showed that this coefficient does not give precise information on the dependence structure. Instead, we propose a conceptual framework based on copulas. Two applications are proposed. The first one concerns the study of extreme dependence between international equity markets. The second one concerns the analysis of the East Asian crisis.

Caner and Hansen (2001) suggest the use of the M-TAR specification. As compared to the conventional Cointegration approaches, M-TAR produces more convincing evidence, essentially because it has sufficient flexibility that enables it to capture non-linear adjustment patterns.

The result of this study is that to ascertain whether there is indeed any significant relationship between the real estate and stock markets in European countries using a non-linear model. We aim to facilitate the forecasting of future performance between one market and the other, thereby providing important and significant insights for investors and speculators.

Awartani and Corradi (2005) show that the use of squared returns as a proxy for volatility ensures the correct ranking of predictive models in terms of a quadratic loss function. Therefore, when the true underlying volatility process is not observed, this study uses squared returns as a proxy for latent volatility. The empirical analysis comprises two steps: The first step involves obtaining an overview of the predictive ability of the various models by computing their out-of-sample mean squared errors (MSE) and mean absolute errors (MAE). Since these two summary statistics do not provide a statistical test of the difference between the two models. The DM-test which has been advocated by Diebold and Mariano (1995) is thus used to further examine the relative out-of sample predictive ability of various GARCH models.

The result of this study is precisely determining the relationship between the stock market and the real estate market remains somewhat contentious; and indeed, regardless of whether this relationship is examined over the short-term or the long-term, it remains unsettled as to whether the two markets are segmented or integrated.

2.3.2 Chinese literature reviews

China stock market developed later than foreign countries. Along with China's rapid economic growths, the stock market gradually gets improved and perfected. The importance and sensitivity of the stock price and real estate price had attracted a large number of scholars and public's attentions. Most of the studies on the relationship between real estate prices and the national economy were theoretical research. But the empirical researches were rare.

Liu et al., (1990) suggest that the securitized real estate indices, such as REITs, behave very much like common stocks, exhibiting non-linear behavior; they also note that equity REITs are integrated with the stock market.

The result of this study is that the research focus is clearly shifting towards the possibility of non-linearity in both stock price and real estate price data; and indeed, based upon their use of non-linear models. Liu and Mei (1992) claim that the real estate and stock markets are indeed integrated, with the latter of these two studies using rescaled range analysis – developed within the fractal geometry literature – to test for non-linear trends in the returns series for different asset classes.

Xu (1999) and Lee etal. (2001) this study shows that estimate volatility for stock markets in China. Xu (1999) modeled volatility for daily spot returns of Shanghai composite stock index from May 21, 1992 to July 14, 1995 and tested the in-sample goodness-of-fit of various competing models.

The result of this study is that the GARCH model is superior to that of either EGARCH or GJR-GARCH models, indicating that there is almost no so-called leverage effect in the Shanghai stock market since volatility is mainly caused by governmental policy on stock markets under the present financial system. They provided strong evidence of time-varying volatility and indicated volatility is highly persistent and predictable. This study chooses an adaptive volatility model for the China stock market by examining the relative out-of-sample predictive ability of the GARCH-N and GARCH-SGED models on daily Shanghai and Shenzhen stock return data. Particularly, the forecast horizon is extended to include 1-, 2-, 5-, 10- and 20-day forecasts.

Wang (2002) shows Grey–Fuzzy, Yao & Chi (2004) shows Grey–Taguchi, Hsu (2003) shows Grey–Markov, Hsu (2003) shows Grey–Fourier, and Tseng, Yu, & Tzeng (2001) shows Grey–depersonalized Data.

The results of these studies are researchers developed various hybrid grey forecasting model, the mathematics becomes more and more complicated which deviates from the original idea of simplicity of Grey theory.

Wei and Zhang（2004） this study shows that dependence analysis of finance markets Copula-GARCH model. As a new methodology that measures dependence， Copula technique can be also used widely in studying the characteristics of financial markets，portfolio aggregation and risk analysis etc. Conditional dependence of index returns series in Shanghai stock market is analyzed using the Copula-GARCH model combined the T-GARCH model with a Copula function.

The empirical results show that different index returns series have different marginal distribution. There are strong positive correlations between these series. We found that the conditional dependence between these series is time varying，and that the variety trend is very likeness.

Pan and Zhou（2005） this study shows that dependence structure between China's real estate and financial market. From real estate's supply, demand and dependence structure between real estate and financial policy of this three aspects to analysis relationship between real estate and financial market. And show that them have high correlation.

Sheng Songcheng, Li Anding and Liu Huina (2005) analyzed the fluctuation relationship between Shanghai real estate price index and Shanghai Composite index by correlation coefficient methods.

The result revealed that the degree of correlation between those two indexes was very weak.

Zhang,Lii and Huang (2007) used Co-integration models to examine the relationship between the stock market and real estate market. They found that those markets were related in Taiwan from 1986 to 2001. Furthermore，Li (2008) the papers first do some research on the relationship between the price index for real estate and Shanghai Composite Index from 1998 to 2007 in quarter. It uses the recent stage of the different development phase to do Co-integration test by the monthly data of the price index for real estate and Shanghai Composite Index. It works out the long-term balance between them. Finally, it established the error correction model on the basis of the balanced mechanism.

The results indicated that, in recent years the long-term equilibrium price between the price index for real estate and Shanghai Composite Index has been formed, and the wealth effect is strong than substitution effects and the effects of extrusion. But in short term, they are deviated, which is consistent with the reality. Therefore, the effectiveness of China's market regulation and policy should be established on the basis of taking into account both the stock market and the real estate market.

Chen (2008); Chen, Chen, & Chen (2008) previously proposed NGBM together with Nash equilibrium concept, which is called NNGBM, is used to forecast stock market indices.

The result of this study shows that many methods to forecast the general behavior trend of stock prices by macroeconomic model, time series method and neural network so on.

Hu and Chen（2009） show that the Relevancy of Real Estate and Financial Section in Chinese A-Stock-Market.

The result of this study is that based on the Co-integration analysis，the opening and closing price in capital markets for real estate sector and the financial sector closely interact each other. In spite of the real estate section often having the leading role，the price response often lags behind，and real estate sections have more impact on the financial section， but not a decisive role. This study systematically discusses the relevancy of real estate sector in stock market. The general fluctuation of financial sector and price tendency of real estate sections are deduced in the long run， and its relevancy is indicated.

Li and Jia（2010）this paper empirically analysis on the relationships between Shanghai composite index and real estate index by the way of using unit root test，Co-integration test and Granger test with the latest data，the research of which finally shows no existence of co-integration and Granger causality relationship.

Li and Feng（2010）analysis correlation relationship between the China's stock market and real estate market. This paper chooses the seasonal data of the real estate price index from 1998 to 2009, through the Engle-Granger two-step c-integration to analysis found there two effects one is wealth and another one is substitution when we establish VAK mode, and use Engle-Granger test to analysis interaction relationship between them.

The result of this study is that there is an Engle-Granger causality relationship between the share price and real estate price, and the effect of substitution powerful than wealth.

Liu Qiongfang and Zhang Zongyi (2011) the paper applies the Copulas theory to investigate the dependence structure between real estate and finance industries. Based on AIC and BIC minimum theories, the Gumbel Copula function shows that a correlation between these two markets exists in only upper tail for single parameter Copulas. However, the BB3 Copula has a higher correlation in the lower tail than the upper tail for a variety of parameters used in the Copula function. The GPD model needs to estimate the threshold values in order to exactly fit the margin distribution of Copula function. In addition, creating an investment portfolio of two different stocks won’t necessary help reduce investment risk.

The summary of the literature reviews are as following table 2.1 and 2.2

Table 2.1 Summary of foreign literature reviews

Authors	Methodology/variables	Results
Ibbotson and Siegel (1984)	U.S. real estate prices and S & P 500 stock index	The correlation coefficient between U.S. real estate prices and S & P 500 stock index was only -0.06.
Jorion and Schwartz (1986)		Evidence provides support for the hypothesis that segmentation does exist.
Perron (1989)		Business cycles are in fact transitory fluctuations around a more or less stable trend path, thereby resulting in non-linear phenomena.
Ambrose, Ancel and Griffths (1992)		Real estate market and stock market have the Cointegration structure in USA.
Gyourko and Keim (1992)		The stock market contains important information on real estate fundamentals.
Meyer and Webb (1993)		Returns on equity REITs appear to be very similar to the returns on common stocks.
Wilson et al., (1996)	Stock and real estate markets/non-linear model	Non-linear model supports the notion that the markets are fractionally integrated, the Cointegration results also provide contradictory support for the view that the stock and real estate markets are segmented.
Okunev and Wilson (1997)	U.S. time series data and co-integration test	There is no link between real estate prices and stock prices.
Quan and Titman (1997)	Real estate stock portfolio returns and standard appraisal-based index returns.	There is a significantly positive relationship between real estate valuations and stock returns.

Source: From summarized

Table 2.1 (Continues)

Authors	Methodology/variables	Results
DanielC.Quan and SheridanTitman (1998)	Test 14 years real estate price change in 17 different countries and rate of return of stock	The relationship between housing price change and stock short run return rate in long period
Wilson and Okunev (1999)	The stock and property markets in the US, the UK and Australia.	There was no correlation in U.S. and British, while there existed as correlation in Australian.
Arnaud Costinot and Thierry Roncall（2000）	Copula	The results showed that this coefficient does not give precise information on the dependence structure, Instead, we propose a conceptual framework based on copulas
Caner and Hansen (2001)	M-TAR	There is a significant relationship between the real estate and stock markets in European countries using a non-linear model.
Nan-KuangS Chen (2001)	Granger Test，the system of credit	The relationships between real estate market and stock price are increase and change in the same pace for each other
RaymondY.C.Tse (2001)	Impulse response function and VAR model	The unexpected real estate prices change has a direct impact on the stock price changes
Okunev, Wilson and Zurbrueg (2002)		There is a relationship between stock market and real estate sector index. And fit by the nonlinear dynamic models.
Awartani and Corradi (2005)	Mean squared errors (MSE) and mean absolute errors (MAE)	There is the relationship between the stock market and the real estate market remains somewhat contentious

Source: From summarized

Table 2.2 Summary of Chinese literature reviews

Authors	Methodology/variables	Results
Xu (1999) and Lee etal. (2001)	GARCH model	No so-called leverage effect in the Shanghai stock market since volatility is mainly caused by governmental policy on stock markets under the present financial system
Sheng Songcheng, Li Anding and Liu Huina (2005)	Shanghai real estate price index and Shanghai Composite index	The correlation between Shanghai real estate price index and Shanghai Composite index is very weak.
Pan and Zhou（2005）	Real estate supply，demand and financial policy	China real estate and financial market have high correlation
Chen et al. (2008)	NGBM model	The modified model improved nonlinear adjustable parameter n.
Li (2008)	Co-integration Test	There is a long-term equilibrium price between the price index for real estate and Shanghai Composite Index.
Hu and Che（2009）	Co-integration Test, the opening and closing price	Financial sector and price tendency of real estate sections are relevant in the long run
Li and Feng（2010）	VAK mode and Granger Test	There is an Engle-Granger causality relationship between the share price and real estate price.
Li and Jia（2010）	Co-integration Test and Granger Test	There is no existence of co-integration and Granger causality relationship between Shanghai composite index and real estate index.
Liu Qiongfang and Zhang Zongyi (2011)	Copula	The BB3 Copula has a higher correlation in the lower tail than the upper tail for a variety of parameters used in the Copula function.

Source: From summarized