行政院國家科學委員會專題研究計畫　成果報告

靜態及動態資本訂價模型：理論與實證研究

計畫類別：個別型計畫
計畫編號：NSC93-2416-H-009-024-
執行期間：93 年 08 月 01 日至 94 年 07 月 31 日
執行單位：國立交通大學財務金融研究所

計畫主持人：李正福

計畫參與人員：張馨文、陳孟雅、施冠宇、蘇文淇

報告類型：精簡報告
報告附件：出席國際會議研究心得報告及發表論文
處理方式：本計畫可公開查詢

中　華　民　國 94 年 10 月 20 日

行政院國家科學委員會補助專題研究計畫 - 成果報告

計劃名稱：靜態及動態資本訂價模型：理論與實證研究 A Static and Dynamic International CAPM

計畫類別：☑ 個別型計畫　　□ 整合型計畫

計畫編號：NSC－93－2416－H－009－024

執行期間：93 年 8 月 1 日至 94 年 7 月 31 日

計畫主持人：李正福

共同主持人：

計畫參與人員：張馨文、陳孟雅、施冠宇、蘇文淇

成果報告類型(依經費核定清單規定繳交)：☑精簡報告　□完整報告

本成果報告包括以下應繳交之附件：

□赴國外出差或研習心得報告一份

□赴大陸地區出差或研習心得報告一份

☑出席國際學術會議心得報告及發表之論文各一份

□國際合作研究計畫國外研究報告書一份

處理方式：除產學合作研究計畫、提升產業技術及人才培育研究計畫、列管計畫及下列情形者外，得立即公開查詢

□涉及專利或其他智慧財產權，□一年□二年後可公開查詢

執行單位：國立交通大學財務金融研究所

中　華　民　國　94　年　10　月　20　日

I.中英文摘要及關鍵詞(keywords)

（一）計畫中文摘要。

計畫名稱：靜態及動態資本訂價模型: 理論與實證研究
關鍵詞：靜態資本訂價模型、動態資本訂價模型、函數型態、供應效能

在此計畫中，首先根據 Chaudhury & Lee (1997) 和 Nieh & Lee (2001) 的文獻，利用日本、南韓、台灣、香港、泰國及新加坡等地區之個別股票及指數的報酬率來研究靜態國際資本訂價模型的函數形式關係。從此實證之結果，我們分析市場有效性及市場間之整合關係。而由此實證結果，我們也估計與比較各國股票之資金成本。

其次，根據 Chang & Hung (2000) 和 Chang et al. (2002)，我們估計動態國際資本訂價模型，實證結果加以詳細分析並與靜態模型比較。

最後，我們希望導引出考慮到供需效果的資本訂價模型。截至目前為止，大多數國際資產訂價模型都假設國際資產市場的運作均具有如同美國股票市場一樣的效率。然而，我們有充分的理由相信證券市場其實常常是處於不平衡狀態中。某些市場限制常使得價格無法有效反應供需相等下的價格，導致市場結清情況無法應用。因此，我們將利用二次式的成本函數來導出證券供給面之調整過程；證券需求面則利用投資者財富效用函數(負指數之效用函數)導出。另外，因為交易量及匯率兩個變數分別代表跨期變動及貨幣避險，所以我們也將此二變數引進至計畫中的模型。當標準化的聯立方程式系統建立後，一些實際應用(如供應效能)即可被檢驗與測試。

(二) 計畫英文摘要。

Title: A Static and Dynamic International CAPM
Keywords: Static international CAPM, Dynamic International CAPM,
Functional Form, Supply Effect

In this project, we'll first investigate the functional form relationship of static international CAPM by using rates of return of individual stocks and stock indices of Japan, South Korea, Taiwan, Hong Kong, Thailand, and Singapore in accordance with our previous research papers of Chaudhury & Lee (1997) and Nieh & Lee (2001). Implications of market efficiency and market integration will be analyzed in details. In addition, cost and equity capital in terms of this generalized international CAPM will be estimated and compared.

Secondly, we will estimate dynamic international CAPM in accordance with the model developed by Chang & Hung (2000) and Chang et al. (2002). Implications of empirical results in terms of this dynamic model will be analyzed in details and compared with those obtained from static international

CAPM.

Finally, we will try to develop an international asset pricing model in the absence of direct information on the quantity of securities demanded and supplied. So far, most of the international asset pricing models assume that the international equity markets are as efficient as the stock market of the United States. However, there are reasons to believe that the international equity markets are sometimes in a situation of disequilibrium. Some restrictions prevent the price from changing efficiently to equate the demand and supply, and thus the market clearing condition cannot be employed. We'll derive an endogenous supply side to the model under the assumption of quadratic costs of adjustment. On the other hand, the demand side for the securities is derived from a negative exponential function for the investor's utility of wealth. We will incorporate the variables of trading volume and exchange rate into the model since each of them represents intertemporal change and currency hedging factor respectively. After we construct a standard structure form of a simultaneous equation system, some implications of the model, such as the existence of supply effect, will be examined and tested.

II. 報告內容

A Dynamic CAPM with Supply Effect Theory and Empirical Results

Abstract

Black (1976) has derived a dynamic CAPM in terms of demand and supply relationship. In this study, we first theoretically extend the simultaneous CAPM to be able to test the existence of supply effect in asset pricing determination process. Then we use data of Price per share, Earning per share, and Dividend per share to test the existence of supply effect in terms of both international index data and US equity data. In this study, we find the supply effect is important in both international and US domestic markets.

A. Introduction

Black (1976) initiates the modification of the static CAPM by explicitly allowing for the supply effect of risky securities to generate the dynamic pattern. He modifies the static model by explicitly allowing for the supply effect of risky securities. The demand side for the risky securities is derived from a negative exponential function for the investor's utility of wealth as the traditional static CAPM. He suggests that the static CAPM is unnecessarily restrictive in its neglect of the supply side and that the dynamic generalization of static CAPM can provide grist for many empirical tests, particularly with regards to intertemporal aspects and the role of the supply side. Assuming there is a quadratic cost structure of retiring or issuing security and assuming the demand for security may deviate from supply due to anticipated and unanticipated random shocks, he concludes that if the supply of a risky asset is responsive to its price, large price changes will be spread over time in a specific way predicted by the dynamic capital asset pricing model. One important implication in Black's model is that the efficient market hypothesis holds only if the supply of securities is fixed and independent of current prices.

In short, Black's dynamic generalization model of static wealth-based CAPM adopts an endogenous supply side of risky securities. This model provides a way to connect static and dynamic model as one equates the quantity demanded and supplied of the risky securities. Lee and Gweon (1985) extend Black's framework to allow time varying dividends and then tests the existence of supply effect in the situation of market equilibrium. The result rejects the null hypothesis of no supply effect in U.S. domestic stock market. The rejection seems to imply a violation of efficient market hypothesis in the U.S. stock market.

It is worthy noting that some recent studies also relate return on portfolio to trading volume, for example, the studies by Campbell, Grossman and Wang (1993) and Lo and Wang (2000). Surveying the relationship between aggregate stock market trading volume and the serial correlation of daily stock returns, Campbell, Grossman and Wang (1993) suggest that a stock price decline on a high-volume day is more likely than a stock price decline to be associated with an increase in the expected stock market on a low-volume day. They propose an explanation that trading volume occurs when random shifts in the stock demand of non-informational traders are accommodated by the risk-averse market makers. The study of Lo and Wang (2000) is another example in the intertemporal setting. They derive ICAPM by defining preference over wealth, instead of consumption, by introducing three state variables into the exponential terms of investor's preference. This state-dependent utility function allows one to capture the dynamic nature of the investment problem without explicitly solving a dynamic optimization problem. Thus, the marginal utility of wealth depends not only on the dividend of the portfolio, but also on future state variables. This dependence introduces dynamic hedging motives in the investors' portfolio choices. That is, this dependence induces investors to care about future market conditions when choosing their portfolio. In equilibrium, this model also implies that an investor's utility depends not only on his wealth, but also on the stock payoffs directly. This "market spirit," in their terminology, affects investor's demand for the stocks. In other words, even the investor holds no stocks his utility fluctuates with payoff of the stocks. It is notable that one can identify the hedging portfolio using volume data in their model setting.

Both Black's and Lo and Wang's models use quantity information, outstanding shares and trading volume respectively, as a channel to connect the decisions in two different periods, unlike consumption-based CAPM which uses consumption or macroeconomic information. For example, Black, Lee and Gweon all derive the dynamic generalization models from the wealth-based CAPM by adopting an endogenous supply schedule of risky securities. Thus, the information of quantities demanded and supplied now can play a role in determining the asset price. The difference of utilizing quantity information is that it provides the wealth-based model another way to investigate ICAPM.

In Section B, a simultaneous equation system will be constructed through a standard structure form of multi-period equation to represent the dynamic relationship between supply and demand for capital assets. The hypotheses implied by the model will be also constructed in this section. Section C describes two sets of data used in this paper. The first one is the stock market indices from sixteen countries in the world, including G7 and the other nine counties from both developed and emerging markets. The second set is ten portfolios generated from the companies listing in the S&P500 of the U.S.'s stock market. The empirical finding for the hypotheses and tests constructed in previous section are then presented in this section. In section D, we present summary and concluding remarks.

B. Derivation of Simultaneous Equations System

1. Development of Multiperiod Equilibrium Asset Pricing Model

In this section, based on framework of Black (1976), a multiperiod equilibrium asset pricing model will be derived. Black (1976) modifies the static wealth-based CAPM by explicitly allowing for the supply effect of risky securities. The demand for securities is based on well-known model of James Tobin and Harry Markowitz. However, Black further assumes a quadratic cost function of changing short-term capital structure under long-run optimality condition. He also assumes the demand for security may deviate from supply due to anticipated and unanticipated random shocks. On the other hand, Lee and Gweon (1986) modify and extend Black's framework to allow time varying dividends and then test the existence of supply effect. In Lee and Gweon's model, two major different assumptions from Black's model are: (1) the model derived here allows the time-varying dividends, unlike Black's assumption of being constant, and (2) there is only one random, unanticipated shock in the supply side instead of two shocks, anticipated and unanticipated shocks, as in Black's model.

2. The Demand for Capital Assets

The demand equation for the assets is derived under the standard assumptions of the CAPM[1]. An investor's objective is to maximize the expected utility function. A negative exponential function for the investor's utility of wealth is assumed:

(1) $$U = a - h \times e^{\{-bW_{t+1}\}}$$

where the terminal wealth $W_{t+1} = W_t(1 + R_t)$, W_t is initial wealth and R_t is the rate of return on the portfolio. The parameters, a, b and h, are assumed to be

[1] The basic assumptions are: 1) a single period moving horizon for all investors, 2) no transactions costs or taxes on individuals, 3) the existence of a riskfree asset with rate of return, r*, 4) evaluation of the uncertain returns from investments in term of expected return and variance of end of period wealth, and 5) unlimited short sales or borrowing of the risk-free asset.

constants.

The dollar returns on N marketable risky securities can be represented by:

(2) $X_{j,\,t+1} = P_{j,\,t+1} - P_{j,\,t} + D_{j,\,t+1}$, $j = 1, \ldots, N$

where $P_{j,\,t+1}$ = (random) price of security j at time t+1

$P_{j,\,t}$ = price of security j at time t

$D_{j,\,t+1}$ = (random) dividend or coupon on security at time t+1, and

these three variables are assumed to be jointly normal distributed.

After taking expectation to equation (2) at time t, the expected returns for each security, $x_{j,\,t+1}$, can be rewritten as:

(3) $x_{j,\,t+1} = E_t X_{j,\,t+1} = E_t P_{j,\,t+1} - P_{j,\,t} + E_t D_{j,\,t+1}$, $j = 1, \ldots, n$

where $E_t P_{j,\,t+1} = E(P_{j,\,t+1} \mid \Omega_t)$,

$E_t D_{j,t+1} = E(D_{j,\,t+1} \mid \Omega_t)$, and

$E_t X_{j,t+1} = E(X_{j,t+1} \mid \Omega_t)$, Ω_t is given information available at time t.

Then, a typical investor's expected value of end-of-period wealth is

(4) $w_{t+1} = W_t + r^* (W_t - q_{t+1}' P_{t+1}) + q_{t+1}' x_{t+1}$

where $P_t = (P_{1,\,t}, P_{2,\,t}, P_{3,\,t}, \ldots, P_{N,\,t})'$,

$x_{t+1} = (x_{1,t+1}, x_{2,t+1}, x_{3,t+1}, \ldots, x_{N,\,t+1})' = E_t P_{t+1} - P_t + E_t D_{t+1}$,

$q_{t+1} = (q_{1,t+1}, q_{2,t+1}, q_{3,t+1}, \ldots, q_{N,\,t+1})'$,

$q_{j,t+1}$ = number of units of security j after reconstruction of his portfolio, and

r^* = risk-free rate.

The second term on the RHS of equation (4) is the return on the risk-free investment and the last term is the return on the portfolio of risky securities. The variance of W_{t+1} can be written as:

(5) $V(W_{t+1}) = E\,(W_{t+1} - w_{t+1})\,(W_{t+1} - w_{t+1})' = q_{t+1}'\, S\, q_{,t+1}$

where $S = E\,(X_{t+1} - x_{t+1})\,(X_{t+1} - x_{t+1})'$

= the covariance matrix of returns of risky securities.

Maximization of the expected utility of W_{t+1} is equivalent to:

(6) $$Max. \quad w_{t+1} - \frac{b}{2} V(W_{t+1}).$$

By substituting equation (4) and (5), equation (6) can be rewritten as:

(7) $$Max. \quad (1+r^*) W_t + q_{t+1}' (x_{t+1} - r^* P_t) - (b/2)\, q_{t+1}' S\, q_{t+1}.$$

Differentiating equation (7), one can solve the optimal portfolio as:

(8) $$q_{t+1} = b^{-1} S^{-1} (x_{t+1} - r^* P_t).$$

Under the assumption of homogeneous expectation, or, by assuming that all the investors have the same probability belief about future return, the aggregate demand for risky securities can be summed as:

(9) $$Q_{t+1} = \sum_{k=1}^{m} q_{t+1}^{k} = cS^{-1}\left[E_t P_{t+1} - (1+r^*)P_t + E_t D_{t+1}\right]$$

where $c = \Sigma\, (b^k)^{-1}$.

In the standard CAPM the supply of securities is fixed, say Q^*. Then, equation (9) can be rearranged as $P_t = (1 / r^*)\,(x_{t+1} - c^{-1} S\, Q^*)$, where c^{-1} is the market price of risk. In fact, this equation is similar to the Lintner's well-known equation.

3. Supply of Securities

An endogenous supply side to the model is derived in this section. Some hypotheses are made here. The main one is the market imperfection. For examples, the existence of taxes will make firm to borrow more since the interest expense is tax-deductible. The penalties for changing contractual payment or the direct and indirect bankruptcy costs are material in magnitude, so the value of the firm would be reduced if firms borrow more. Another imperfection is the prohibition of short sales of some securities[2]. The costs generated by market imperfections reduce the value of a firm, and thus, firm has incentive to

---

[2] The reasons why taxes and penalties affect capital structure are first proposed by Modigliani and Miller (1958), and then, Miller (1963, 1977). The another market imperfection, prohibition on short sales of securities, can generate "shadow risk premiums", and thus, provide a further incentive for firms to reduce the cost of capital by diversifying their securities.

minimize these costs. Three more related assumptions are made here. First, firm cannot issue risky-free security; second, these adjustment costs of capital structure are quadratic; and third, the firm is not seeking to raise new funds from the market.

It is assumed that there exists a solution to the optimal capital structure and that the firm has to determine the optimal level of additional investment. The one-period objective of the firm is to achieve the minimum cost of capital vector with adjustment costs involved in changing the quantity vector, $Q_{i,\,t+1}$:

(10) $$\mathit{Min.}\quad E_t D_{i,t+1} Q_{i,\,t+1} + (1/2)\,(\Delta Q_{i,t+1}{}'\, A_i\, \Delta Q_{i,\,t+1})$$
$$\text{subject to}\quad P_{i,t}\, \Delta Q_{i,\,t+1} = 0$$

where A_i is an $n_i \times n_i$ positive define matrix of coefficients measuring the assumed quadratic costs of adjustment. If the costs are high enough, firms tend to stop seeking raise new funds or retire old securities. The solution to problem (10) is

(11) $$\Delta Q_{i,\,t+1} = A_i^{-1}\,(\lambda_i P_{i,\,t} - E_t D_{i,\,t+1})$$

where λ_i is the scalar Lagrangian multiplier.

Aggregating equation (11) over N firms, the supply function is given by

(12) $$\Delta Q_{t+1} = A^{-1}\,(B\, P_t - E_t D_{t+1})$$

where $$A^{-1} = \begin{bmatrix} A_1^{-1} & & & \\ & A_2^{-1} & & \\ & & \ddots & \\ & & & A_N^{-1} \end{bmatrix},\quad B = \begin{bmatrix} \lambda_1 I & & & \\ & \lambda_2 I & & \\ & & \ddots & \\ & & & \lambda_N I \end{bmatrix},\ \text{and}\quad Q = \begin{bmatrix} Q_1 \\ Q_2 \\ \vdots \\ Q_N \end{bmatrix}$$

Equation (12) implies that a lower price for a security will increase the amount retired of that security. In other words, the amount of each security newly issued is positively related to its own price and is negatively related to its required return and the prices of other securities.

4. Multiperiod Equilibrium

The aggregate demand for risky securities presented by equation (9) can be seemed as a difference equation. The prices of risky securities are determined in the multiperiod agenda. It is also clear that the aggregate supply schedule has similar structure. As a result, the model can be summarized by the following equations:

(13) $\quad Q_{t+1} = cS^{-1} (E_t P_{t+1} - (1+ r^*) P_t + E_t D_{t+1})$

(14) $\quad \Delta Q_{t+1} = A^{-1} (B P_t - E_t D_{t+1})$.

Differencing equation (13), and comparing the result with equation (14), a new equation relating supply and demand for securities as:

(15) $\quad cS^{-1}[E_t P_{t+1} - E_{t-1} P_t - (1+r^*)(P_t - E_{t-1} P_{t-1}) + E_t D_{t+1} - E_{t-1} D_t] = A^{-1}(B P_t - E_t D_{t+1}) + V_t,$

where V_t is included to take into account the possible discrepancies in the system. Here, V_t is assumed to be random disturbance with zero expectation value and non-autocorrelation.

Obviously, equation (15) is a second-order system of stochastic difference equation in P_t, and conditional expectations $E_{t-1}P_t$ and $E_{t-1}D_t$. Using the property of $E_{t-1}[E_t P_{t+1}] = E_{t-1}P_{t+1},$ the following equation can be obtain by taking the conditional expectation at time t-1 on equation (15):

(16) $$- [(1+ r^*)cS^{-1} + A^{-1}B] (P_t - E_{t-1}P_t) + cS^{-1}(E_t P_{t+1} - E_{t-1} P_{t+1}) + (cS^{-1} + A^{-1}) (E_t D_{t+1} - E_{t-1} D_{t+1}) = V_t$$

Equation (16) shows that prediction errors in prices (first term of RHS) due to unexpected disturbance are a function of expectation adjustments in price (second term of RHS) and dividends (third term of RHS) two periods ahead. This equation can be seemed as a generalized capital asset pricing model.

One important implication of the model is that the supply side effect can be examined by assuming the adjustment costs are large enough to keep the firms from seeking to raise new funds or to retire old securities. In other words, the assumption of high enough adjustment costs would cause the inverse of matrix A in equation (16) to vanish. The model is, therefore, reduced to the following certain equivalent relationship:

(17) $$P_t - E_{t-1}P_t = (1+ r^*)^{-1}(E_tP_{t+1} - E_{t-1}P_{t+1}) + (1+r^*)^{-1}(E_t D_{t+1} - E_{t-1} D_{t+1}) + U_t$$

where $U_t = -c^{-1}SV_t$. Equation (17) suggests that current forecast error in price is determined by the sum of the values of the expectation adjustments in its own next-period price and dividend discounted at the rate of 1+r*.

5. Derivation of Simultaneous Equations System

From equation (17), if price series follow a random walk process, then, the price series can be represented as $P_t = P_{t-1} + a_t$, where a_t is a white noise. It follows that $E_{t-1}P_t = P_{t-1}$, $E_tP_{t+1}=P_t$ and $E_{t-1}P_{t+1}=P_{t-1}$. According the results in Appendix A1, the assumption that price follows a random walk process seems to be reasonable for both data sets. As a result, equation (17) becomes

(18) $$- (r^*cS^{-1} + A^{-1}B)\,(P_t - P_{t-1}) + (cS^{-1} + A^{-1})\,(E_t D_{t+1} - E_{t-1} D_{t+1}) = V_t.$$

One can rewrite equation (18) as

(19) $$G\, p_t + H\, d_t = V_t$$

where $G = - (r^*cS^{-1} + A^{-1}B)$

$H = (cS^{-1}+A^{-1})$

$d_t = E_t D_{t+1} - E_{t-1} D_{t+1}$

$p_t = P_t - P_{t-1}$

If matrix G is assumed to be nonsingular, the reduced-form of the model may be written:

(20) $$p_t = \Pi\, d_t + U_t,$$

where Π is a n by n matrix of the reduced form coefficients and U_t is a column vector of n reduced form disturbances. Or

(21) $$\Pi = - G^{-1} H, \text{ and } U_t = G^{-1} V_t.$$

Without a priori knowledge of the system, all equations of the model would look alike statistically in which each equation is a linear combination of all endogenous (p_t) variables and all exogenous variables (d_t). No equation contains any single variable which does not appear in any other equation.

Thus, in estimating this model, it is necessary to assume that the expectation adjustments in dividends, d_t, is exogenous in the model, i.e., d_t is not influenced by p_t. However, before examining this assumption, it is also necessary to model the dividend processes since the data used are in expectation terms and are not observable beforehand. Appendix A2 shows how to model the dividend processes for both data sets.

The results of this assumption are discussed in Appendix A3. From the Granger causality analysis, one can see that this assumption seems to be evidenced for most of the portfolios selected from S&P 500 or the country indices analyzed in this paper. Finally, the model can be estimated by the reduce form. The prices of value-weighted portfolio or the country indices series (p_t) are endogenous. In contrast, the series of expectation adjustments in dividend (d_t) will be treated as exogenous variable.

6. Test of Supply Effect

Since the simultaneous equation system as in equation (19) is exactly identified, it can be estimated by the reduced-form as equation (20). A proof of identification problem is shown in Appendix B. That is, equation (20), $p_t = \Pi\, d_t + U_t$, can be used to test the supply effect. For example, in the case of two portfolios, the coefficient matrix G and H in equation (19) can be written as[3]

(22)
$$G = \begin{bmatrix} g_{11} & g_{12} \\ g_{21} & g_{22} \end{bmatrix} = \begin{bmatrix} -(r*cs_{11} + a_1 b_1) & -r*cs_{12} \\ -r*cs_{21} & -(r*cs_{22} + a_2 b_2) \end{bmatrix}$$

$$H = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} = \begin{bmatrix} cs_{11} + a_1 & cs_{12} \\ cs_{21} & cs_{22} + a_2 \end{bmatrix}$$

Since $\Pi = -G^{-1}H$ in equation (21), Π can be calculated as

[3] s_{ij} is the *i*th row and *j*th column of the variance-covariance matrix of return. a_i and b_i are the supply adjustment cost of firm *i* and overall cost of capital of firm *i* respectively.

(23) $$-G^{-1}H = \begin{bmatrix} r*cs_{11}+a_1b_1 & r*cs_{12} \\ r*cs_{21} & r*cs_{22}+a_2b_2 \end{bmatrix}^{-1} \begin{bmatrix} cs_{11}+a_1 & cs_{12} \\ cs_{21} & cs_{22}+a_1 \end{bmatrix}$$

$$= \frac{1}{|G|} \begin{bmatrix} r*cs_{22}+a_2b_2 & -r*cs_{12} \\ -r*cs_{21} & r*cs_{11}+a_1b_1 \end{bmatrix} \begin{bmatrix} cs_{11}+a_1 & cs_{12} \\ cs_{21} & cs_{22}+a_1 \end{bmatrix}$$

$$= \frac{1}{|G|} \begin{bmatrix} (r*cs_{22}+a_2b_2)(cs_{11}+a_1) - r*cs_{12}cs_{21} & (r*cs_{22}+a_2b_2)cs_{12} - r*cs_{12}(cs_{22}+a_1) \\ -r*cs_{21}(cs_{11}+a_1) + (r*cs_{11}+a_1b_a)cs_{21} & -r*cs_{21}cs_{12} + (r*cs_{11}+a_1b_1)(cs_{22}+a_1) \end{bmatrix}$$

$$= \begin{bmatrix} \pi_{11} & \pi_{12} \\ \pi_{21} & \pi_{22} \end{bmatrix}$$

From equation (23), if there is a high enough quadratic cost of adjustment, or if $a_1 = a_2 = 0$, then with $s_{12} = s_{21}$, the matrix would become a scalar matrix in which diagonal elements are equal to r^*c^2 (s_{11} s_{22} - s_{12}^2), and the off-diagonal elements are all zero. In other words, if there is high enough cost of adjustment, firm tends to stop seeking to raise new funds or to retire old securities. Mathematically, this will be represented in a way that all off-diagonal elements are all zero and all diagonal elements are equal to each other in matrix Π. In general, this can be extended into the case of more portfolios. For example, in the case of N portfolios, equation (20) becomes

(24) $$\begin{bmatrix} p_{1t} \\ p_{2t} \\ \vdots \\ p_{Nt} \end{bmatrix} = \begin{bmatrix} \pi_{11} & \pi_{12} & \cdots & \pi_{1N} \\ \pi_{21} & \pi_{22} & \cdots & \pi_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ \pi_{N1} & \pi_{N2} & \cdots & \pi_{NN} \end{bmatrix} \begin{bmatrix} d_{1t} \\ d_{2t} \\ \vdots \\ d_{Nt} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \\ \vdots \\ u_{Nt} \end{bmatrix}.$$

Equation (24) shows that if an investor expects a change in the prediction of the next dividend due to the additional information, such as change in earnings, during the current period, then the price of the security changes. Regarding the international equity markets, if one believes that_global financial market is perfectly integrated, that is, if one believes the way in which the expectation errors in dividends are built in the current price is the same for all securities, then, the price changes would be influenced by only its own dividend expectation errors. Otherwise, say if the supply of securities is flexible, then the change in price would be influenced by the expectation adjustment in dividends of all other countries as well as that in its own dividend.

Therefore, two hypotheses related to supply effect are to be tested about the parameters in the reduced form system shown in equation (20).

Hypothesis 1: All the off-diagonal elements in the coefficient matrix Π are zero if the supply effect does not exist.

Hypothesis 2: All the diagonal elements in the coefficients matrix Π are equal in the magnitude if the supply effect does not exist.

These two hypotheses should be satisfied jointly. That is, if the supply effect does not exist, price changes of a security (index) should be a function of its own dividend expectation adjustments and the coefficients should be all equal across securities. In the model described in equation (18), if investor expects a change in the prediction of the next dividend due to the additional information during the current period, then the price of the security changes.

Under the assumption of the integration of the global financial market or the efficiency in the domestic stock market, the way in which the expectation errors in dividends are built in the current price is the same for all securities. This would happen if supply of securities is fixed and the price changes would be influenced by only its own dividend expectation errors. If the supply of securities is flexible, then the change in price would be influenced by the expectation adjustment in dividends of all other securities as well as that in its own dividend.

C Data and Empirical Results

In this Section, two different types of market are analyzed. First is the international equity market and the other is the U.S. domestic stock market. Most details of the model, the methodologies and the hypotheses for empirical tests have already discussed in Section B. However, before testing the hypotheses, some other details of the related tests that are needed to support the assumptions used in the model are also briefly discussed in this section. The first part of this section discusses the international asset pricing and second part, the domestic asset pricing in the U.S. stock market.

1 International Equity Markets – Country Indices

In this part, the existence of supply effect in the international equity markets will be tested. In other words, candidate explaining why the simple one-period static CAPM does not perform well is if supply effect exists in the global equity markets. The reason can also imply that a dynamic CAPM may be a better choice in international asset pricing model.

1.1 Data and Descriptive Statistics

The data used here comes from two different sources. One is the Global Financial Data in the Indexes and Databases of Rutgers Libraries and the second sets come from MSCI (Morgan Stanley Capital International, Inc.) equity indices. Most of the time the first data sets are used in all analyses, however, the second sets are sometimes used for comparison, for example, two sets are used in the Granger-causality test. The monthly data set consists of index, dividend yield, price earnings ratio and capitalization for each equity market. There are eighteen indices used, including G7, nine emerging markets, one world index and one other world index excluding the U. S. The list of all indices used is shown in Appendix C. For all countries, indices, dividends and earnings are all converted into U.S. dollar denominations. The exchange rate data also comes from Global Financial Data. These monthly series start from February 1988 to March 2004.

In Table 1.1, the first four moments of monthly returns of national indexes is reported. The emerging markets tend to be more volatile than developed markets though they may yield opportunity of higher return. The average of monthly variance of return in emerging markets is 0.166 while the average of monthly variance of return in developed countries is 0.042. Consider the coexistence of the low global correlation and high volatility in developing countries, the information from global markets are less sensitive to the investors in the domestic market but local news causes larger impact on equity prices.

1.2 Dynamic CAPM with Supply Side Effect

Recall the previous analysis, the structure form equations are exactly identified and the series of expectation adjustments in dividend, $d_{t,}$ are exogenous variables. Now, the reduce form equations can be used to test the supply effect. That is, equation (24) needs to be examined by the following hypotheses:

Hypothesis 1: All the off-diagonal elements in the coefficient matrix Π are zero if the supply effect does not exist.

Hypothesis 2: All the diagonal elements in the coefficients matrix Π are equal in the magnitude if the supply effect does not exist.

These two hypotheses should be satisfied jointly. That is, if the supply effect does not exist, price changes of each country's index would be a function of its own dividend expectation adjustments and the coefficients should be equal across all countries.

The estimated results of the simultaneous equations system are summarized in Table 1.2. The report here is from the estimates of seemingly unrelated regression (SUR) method.[4] Under the assumption that the global equity market consists of these sixteen counties, the estimations of diagonal elements vary across countries and some of the off-diagonal elements are

[4] The estimates are similar to the results of full information maximum likelihood (FIML) method.

significant from zero. The results from G7 and the rest of the countries are also reported in Table 1.2-1 and Table 1.2-2. The elements in these two matrices are similar to the elements in matrix Π. However, simply observing the elements in matrix Π directly can not justify or reject the null hypotheses derived for testing the supply effect. Two tests should be done separately to check whether these two hypotheses can be both satisfied. For the first hypothesis, the test of supply effect on off-diagonal elements, the following regression is run for each country: $p_{i,t} = \beta_i d_{i,t} + \Sigma_{j \neq i} \beta_j d_{j,t} + \varepsilon_{i,t}$, $i, j = 1, \ldots, 16$. The null hypothesis then can be written as: H_0: $\beta_j = 0$, j=1, …, 16, j ≠i. The results are reported in Table 1.3. Two test statistics are reported. The first one is an F distribution with 15 and 172 degrees of freedom, and the second one is a chi-squared distribution with 15 degrees of freedom. Most countries have larger values of F-statistic and chi-squared statistic than the critic values. Thus, the null hypothesis is rejected at different levels of significance in most countries.

For the second test, the following null hypothesis needs to be tested:

H_0: $\pi_{i,i} = \pi_{j,j}$ for all i, j=1, …, 16

Under the above fifteen restrictions, the Wald test statistic has a chi-square distribution with 15 degrees of freedom. The statistic is 165.03, which corresponds to a p-value of 0.000. One can reject the null hypothesis at any conventional levels of significance. In other words, the diagonal elements are obviously not similar to each other in magnitude. From these two tests, the two concerned hypotheses cannot be satisfied jointly, or, the non-existence of supply will be rejected. Thus, the empirical results suggest the existence of supply effect in international equity markets.

2 United States Equity Markets – S&P500

This part examines the hypotheses derived from Section B for the U.S. domestic stock market. Similar to the first part of this section, the focus is discussion of the existence of supply effect when market is assumed in equilibrium. If the supply effect exists, this may imply that the U.S. stock market is not efficient. In other words, if the supply of risky assets is responsive to its price, large price changes, due to the change in expectation of future dividend, will be spread over time.

2.1 Data and Descriptive Statistics

Three hundred companies were selected from the S&P500 list and grouped into ten portfolios with equal numbers of thirty companies by their payout ratios. The data are obtained from the COMTUSTAT North America industrial quarterly data. The data starts from the first quarter of 1981 to the last quarter of 2002. The companies selected here should satisfy the following criteria. First, the company should appear or has appeared in S&P500 list during the period. Second, there are a complete data available, including price, dividend, earnings per share and shares outstanding, during the 88 quarters (22 years). The number of the company increases, though not much, if one allows those companies once listed in S&P500 but not in the current list. Some companies no longer exist, for example, are merged by others, or are excluded. The second criterion eliminates some of the current companies since they are new established. Some other firms are eliminated from the list because their report earnings or were trivial or even negative and dividend were trivial.[5] 314 firms left after these adjustments. Finally, excluding those seven companies with highest and lowest average payout ratio, the rest are grouped into ten portfolios by the payout ratio. Each portfolio contains 30 companies. Figure 1 shows the comparison of S&P500 index and the value-weighted price of the market portfolio composed by the 300 firms selected. The path pattern is similar to each other before the 3rd quarter of 1999. That is, some volatile stocks are not included in the market portfolio with 300 firms.

In order to group these 300 firms, the payout ratio for each firm in each

[5] The payout ratios here are computed each year and then average out over the entire 22 years. Thus, sometimes a big negative number will affect the average heavily.

year is determined by dividing the sum of four quarters' dividends by the sum of four quarters' earnings, then, the yearly ratios are further averaged over the 22-year period. The first 30 firms with highest payout ratio comprises portfolio one, and so on, then, the price, dividend and earnings of each portfolio are computed by value-weighted of the 30 firms that are belonged to the same category. All the data of the market portfolio are derived from the value-weighted data of 10 portfolios. Some summary statistics of these 10 portfolios are described in Table 2.1 From Table 2.1 and Figure 2 to Figure 4, it appears to exist an inverse relationship between return and payout ratio, payout ratio and beta. However, the positive relationship between return and beta is not so clear.[6] The average size of each portfolio does not seem to relate to the other three factors. There are a lot of literatures regarding the relationships among the values of these factors; however, it is not a topic in this dissertation, though these figures show evidences consistent with some of the findings. The emphasis here is that each portfolio seems to be well characterized by their dividend payout ratio.

Table 2.2 shows the first four moments of quarterly returns of the market portfolio and ten portfolios. The coefficients of skewness, kurtosis, and Jarque-Bera statistics show that one can not reject the hypothesis that log return in most portfolios is normal.[7] The fact shows that the kurtosis statistics for most sample portfolios are close to three, which seems to imply no serious problem of heavier tails. Additionally, Jarque-Bera coefficients illustrate that the hypotheses of Gaussian distribution for most portfolios are not rejected. It seems to be unnecessary to consider the problem of heteroskedasticity in estimating domestic stock market if the quarterly data are used.

---

[6] For example, Fama and French (1992) say their results seem to contradict the evidence that the slope of the line relating expected return and beta is positive. Black (1993) argues the low-beta may continue to do better than CAPM says they should.

[7] It should be noted that failing to reject normality does not confirm it. This test is only a test of symmetry and mesokurtosis.

2.2 Dynamic CAPM with Supply Side Effect

If one believes that the stock market is efficient, that is, if one believes the way in which the expectation errors in dividends are built in the current price is the same for all securities, then, the price changes would be influenced by only its own dividend expectation errors. Otherwise, say, if the supply of securities is flexible, then the change in price would be influenced by the expectation adjustment in dividends of other portfolios as well as that in its own dividend. Thus, two hypotheses related to supply effect are to be tested and should be satisfied jointly in order to examine whether there exists a supply effect.

The estimated results of the simultaneous equations system are summarized in Table 2.3. The results are similar to each other by either using FIML or SUR approach. The report here is from the estimates of SUR method. If one assumes that stock market consists of ten portfolios used in this study, the supply effect seems to exist, but not significantly. The estimations of diagonal elements seem to vary across portfolios and most of the off-diagonal elements are significant from zero. Again, the null hypotheses can be tested by the tests mentioned in the previous section. The results of the test on off-diagonal elements are reported in Table 2.4. The null hypothesis is rejected at 5% level in six out of ten portfolios, but only two are rejected at 1% level. This evidence seems to be insufficient to reject the null hypothesis.

For the second one, the following null hypothesis needs to be tested. H_0: $\pi_{i,i} = \pi_{j,j}$ for all i, j=1, …, 10. Under the above nine restriction, the Wald test statistic has a chi-square distribution with nine degrees of freedom. The statistic is 18.858, which is greater than 16.92 at a significant level of 5%. Since the statistic corresponds to a p-value of 0.0265, one can reject the null hypothesis at 5% though it cannot reject H_0 at a significant level of 1%. In other words, the diagonal elements are not similar to each other in magnitude. In conclusion, the empirical results are sufficient to reject two null hypotheses of non-existence of supply effect in the U.S. stock market.

D. Summary and Concluding Remarks

In summary, the paper attempts to examine the asset pricing model which incorporates firm's decision concerning the supply of risky securities into the CAPM. This model focuses on a firm's capital decision by explicitly introducing the firm's supply of risky securities into the static CAPM and allows supply of risky securities to be a function of security price. And thus, the expected returns are endogenously determined by both demand and supply decisions within the model. In other words, the supply effect may be one possible factor that can invalidate the implication of the traditional CAPM.

The objectives are to investigate the existence of supply effect in both international equity markets and U.S. stock markets. The test results show that two null hypotheses of non-existence of supply effect do not seem to be satisfied jointly in both data sets. In other words, this evidence seems to be sufficient to support the existence of supply effect, and thus, imply a violation of the assumption in the one period static CAPM, or imply a dynamic asset pricing model may be a better choice in both international equity markets and U.S. domestic stock markets.

However, some limitations should be mentioned. First, there is no discussion for the role of the exchange rate in the international pricing setting. In the analysis of international equity market, all the variables, such as index, dividends and earnings, are directly converted from local currency into U.S. dollars denominations. This is true only when the investors and firms are aware of the exact concurrent value of the local currency and able to buy or sell at this value as they are making decisions. In other words, it is true only when the foreign exchange markets in all countries are efficient. However, the structure of foreign exchange markets varies across the countries. Even in the same country, the structure changes over time. There exist huge differences in foreign exchange market before and after the deregulation of capital flow. To modify this, one needs to be very cautious on the changes of market structure in those emerging markets since the data period analyzed covers the time when the foreign exchange markets change dramatically there.

The other problem is that the second alternative uses dollar returns instead of rate of return. This differs from the first alternative model or the traditional static CAPM. This limitation makes it difficult to compare the second alternative with the first model or with the static one. One way to modify this drawback is to normalize the dollar return to the conventional return measure by dividing it by the share price or index. However, this may lead to a nonlinearity problem among the variables in the derived demand and supply functions and complicates the relationship between price and quantity information. Some may question the second alternative for the assumption of an exogenous interest rate. A constant riskfree rate is indeed unrealistic, but this simplifies the analysis. The main reason why the interest rate is treated as constant is that changes in the interest rate are not important for the issue of supply effect.

Another problem could arise as one tries to apply this model into an international pricing model. The developed model is based on the decision of an individual firm and on the prices and dividends of individual security; however, there are structure differences among countries' equity markets. Whether this theoretical model can extend to country indices needs some deeper investigations. For examples, firms were strictly restricted to buy back securities issued by themselves in some countries not long ago. The difficulty in issuing new funds or retiring old securities varies across countries, thus the costs of adjustment are in different scale for the firms located in the different countries.

Nonetheless, the lift of restriction on fixed supply of risky security in the second alternative is an interesting and encouraging modification of the static CAPM. Fixed supply is one of the most restrictive assumptions underlying the CAPM. Change in supply of securities is related to investment decisions, capital structure, and dividend policy. Once the restriction disappears, the quantity supplied of risky securities starts to play a role in asset pricing.

Reference

Adler, M., and B. Dumas (1983), "International Portfolio Selection and Corporation Finance: A Synthesis," *Journal of Finance* 38, 925-984.

Bekaert, G., C. R. Harvey, and Ng, A. (2003), "Market Integration and Contagion," *NBER Working paper* 9510 (EFA 2002 Berlin Meetings Presented Paper)

Black, Stanley W. (1976), "Rational Response to Shocks in a Dynamic model of Capital Asset Pricing," *American Economic Review* 66, 767-779.

Black, F., M. Jensen, and M. Scholes (1972), "The Capital Asset Pricing Model: Some Empirical Tests," in Jensen, M. (ed.), *Studies in the Theory of Capital Markets*, Praeger, New York, 79-121.

Breeden, D.T. (1979), "An Intertemporal Asset Pricing Model with Stochastic Consumption and Investment Opportunities," *Journal of Financial Economics* 7, 265-196.

Brennan, M. J., A. W. Wang, and Xia, Y. (2004), "Estimation and Test of a Simple Model of Intertemporal Capital Asset Pricing," *Journal of Finance* 59, 1743-1775.

Campbell, John Y. (2000), "Assets Pricing at the Millennium," *Journal of Finance* 55, 1515-1567.

Campbell, Lo, and MacKinlay (1997), *The Econometrics of Financial Markets*, Princeton University Press.

Campbell, John Y., Sanford J. Grossman and Jiang Wang (1993), "Trading Volume and Serial Correlation in Stock Returns," *Quarterly Journal of Economics* 108, 905-939.

Campbell, Harvey R., "Predictable Risk and Returns in Emerging Markets (1995)," Review of Financial Study, and NBER 4621.

Cochrane, John H. (2001), *Asset Pricing*, Princeton University Press.

Cox, John C., Jonathan E. Ingersoll, Jr., and Stephen A. Ross (1985), "An Intertemporal General Equilibrium Model of Asset Prices," *Econometrica* 53, 363-384.

De Santis G., and B. Gerard (1997), "International Asset Pricing and Portfolio Diversification with Time-Varying Risk," *Journal of Finance* 52, 1881-1912.

De Santis G., and B. Gerard (1998), "How Big is the Premium for Currency Risk" *Journal of Financial Economics* 49, 375-412.

Dumas, B., and B. Solnik (1995), "The World Price of Foreign Exchange Risk," *Journal of Financial Economics* 50, 445-479.

Fama, E., and K. R. French (1992), "The Cross-section of Expected Stock Return," *Journal of Finance* 47, 427-465.

Fama, E., and K. R. French (1993), "Common Risk Factors in the Return on Bonds and Stocks," *Journal of Financial Economics* 33, 3-56.

Fama, E., and K. R. French (1996), "Multifactor Explanations of Asset Pricing Anomalies," *Journal of Finance* 51, 55-84.

Fama, E., and K. R. French (1998), "Value versus Growth: The International Evidence," *Journal of Finance* 53, 1975-1999.

Fama, E., and K. R. French (2000), "Disappearing Dividends: Changing Firm Characteristics or Lower Propensity to Pay?" *Journal of Financial Economics* 60, 3-43.

Ferson, W. E., and C. R. Harvey (1991), "The Variation of Economic Risk Premiums," *The Journal of Political Economy* 99, 385-415.

Ferson, W. E., and C. R. Harvey (1999), "Conditioning Variables and the Cross Section of Stock Returns," *The Journal of Finance* 54, 1325 – 1360.

Granger, C. W. J (1969), "Investigating Causal Relations by Econometric Models and Cross-spectral Methods*," Econometrica*, vol. 37

Grinols, Earl L. (1984), "Production and Risk Leveling in the Intertemporal Capital Asset Pricing Model." *The Journal of Finance*, Vol. 39, Issue 5, 1571-1595.

Grossman, Sanford J., and Zhongquan Zhou (1996), "Equilibrium Analysis of Portfolio Insurance," *Journal of Finance* 51, 1379-1403.

Gweon, Seong Cheol (1985), "Rational Expectation, Supple Effect, and Stock Price Adjustment Process: A Simultaneous Equations System Approach," Ph.D Dissertation, Univ. of Illinois.

Hansen, Lar Peter (1982), "Large Sample Properties of Generalized Method of Moments Estimators," *Econometrica* 50, 1029-1054.

Harvey, C.R. (1991), "The World Price of Covariance Risk," *Journal of Finance* 46, 111-158.

Hamilton, James D. (1994), "Time Series Analysis," Princeton University Press.

Lee, Cheng-few, and Seong Cheol Gweon (1986), "Rational Expectation, Supply Effect and Stock Price Adjustment," paper presented at *Econometrica Society annual meeting* 1986.

Lee, Cheng-few, and Chunchi Wu, and Mohamed Djarraya (1987), "A Further Empirical Investigation of the Dividend Adjustment Process," *Journal of Econometrics* 35, 267-285.

Lintner, J. (1965), "The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics* 47, 13-37

Lo, Andrew W., and Jiang Wang (2000), "Trading Volume: Definition, Data Analysis, and Implications of Portfolio Theory," *Review of Financial Studies* 13, 257-300.

Markowitz, H. (1959), *Portfolio Selection: Efficient Diversification of Investments*, John Wiley, New York.

Mehra, Rajnish, and Prescott Edward (1985), "The Equity Premium: A Puzzle," *Journal of Monetary Economics* 15, 145-161.

Merton, Robert C. (1973), "An Intertemporal Capital Assets Pricing Model," *Econometrica*, 41, 867-887.

Mossin, J. (1966), "Equilibrium in a Capital Asset Market," *Econometrica* 35, 768-783.

Ross, Stephen A. (1976), "The Arbitrage Theory of Capital Asset Pricing," *Journal of Economic Theory* 13, 341-360.

Sharpe, W. (1964), "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *Journal of Finance* 19, 425-442.

Solnik, Richard E. (1974), "An Equilibrium Model of the International Capital Market," *Journal of Economic Theory* 8, 500-524.

Stulz, R. (1981), "A Model of International Asset Pricing," *Journal of Financial Economics* 9, 383-406.

Wang, Q. K. (2003), "Asset Pricing with conditional Information: A New Test," The Journal of Finance 58, 161 – 196.

Table 1.1

Summary Statistics of Monthly Return

Country	Mean (Monthly)	Std. Dev. (Monthly)	Skewness	Kurtosis	Jarque-Bera
WI	0.0051	0.0425	-0.3499	3.3425	4.7547
WI excl.US	0.0032	0.0484	-0.1327	3.2027	0.8738
CD	0.0064	0.0510	-0.6210	4.7660	36.515**
FR	0.0083	0.0556	-0.1130	3.1032	0.4831
GM	0.0074	0.0645	-0.3523	4.9452	33.528**
IT	0.0054	0.0700	0.2333	3.1085	1.7985
JP	-0.00036	0.0690	0.3745	3.5108	6.4386*
UK	0.0056	0.0474	0.2142	3.0592	1.4647
US	0.0083	0.0426	-0.3903	3.3795	5.9019

Country	Mean (Monthly)	Std. Dev. (Monthly)	Skewness	Kurtosis	Jarque-Bera
AG	0.0248	0.1762	1.9069	10.984	613.29**
BZ	0.0243	0.1716	0.4387	6.6138	108.33**
HK	0.0102	0.0819	0.0819	4.7521	26.490**
KO	0.0084	0.1210	1.2450	8.6968	302.79**
MA	0.0084	0.0969	0.5779	7.4591	166.22**
MX	0.0179	0.0979	-0.4652	4.0340	15.155**
SG	0.0072	0.0746	-0.0235	4.8485	26.784**
TW	0.0092	0.1192	0.4763	4.0947	16.495**
TL	0.0074	0.1223	0.2184	4.5271	19.763**

1. The monthly returns from Feb. 1988 to March 2004 for international markets.
2. * and ** denote statistical significance at the 5% and 1%, respectively.

Table 1.2

Coefficients for matrix Π (all sixteen markets)

P_CD	P_FR	P_GM	P_IT	P_JP	P_UK	P_US	P_TW	P_TH	P_SG	P_MX	P_MA	P_KO	P_HK	P_BZ	P_AG
0.416	0.626	0.750	0.232	0.608	0.233	0.282	0.130	0.066	1.003	1.130	0.126	0.035	3.080	0.564	1.221
(0.087)	(0.137)	(0.183)	(0.055)	(0.481)	(0.095)	(0.108)	(0.095)	(0.089)	(0.388)	(0.317)	(0.061)	(0.035)	(1.049)	(0.209)	(0.392)
[4.786]	[4.570]	[4.106]	[4.210]	[1.264]	[2.460]	[2.623]	[1.376]	[0.743]	[2.583]	[3.560]	[2.056]	[1.010]	[2.935]	[2.698]	[3.114]
0.003	0.038	0.015	-0.008	0.067	-0.015	0.001	-0.036	-0.027	-0.170	-0.144	-0.030	0.012	-0.067	-0.020	-0.110
(0.021)	(0.034)	(0.045)	(0.014)	(0.119)	(0.023)	(0.027)	(0.023)	(0.022)	(0.096)	(0.078)	(0.015)	(0.009)	(0.259)	(0.052)	(0.097)
[0.145]	[1.121]	[0.342]	[-0.585]	[0.567]	[-0.650]	[0.024]	[-1.522]	[-1.247]	[-1.771]	[-1.845]	[-1.968]	[1.347]	[-0.260]	[-0.390]	[-1.137]
-15.03	40.376	43.677	8.090	-6.208	9.340	-28.52	-8.987	2.107	-79.09	-78.51	2.538	-4.437	-75.61	13.109	-54.23
(19.51)	(30.78)	(41.05)	(12.39)	(108.1)	(21.27)	(24.16)	(21.23)	(20.04)	(87.20)	(71.29)	(13.76)	(7.84)	(235.7)	(46.91)	(88.09)
[-0.771]	[1.312]	[1.064]	[0.653]	[-0.057]	[0.439]	[-1.181]	[-0.423]	[0.105]	[-0.907]	[-1.101]	[0.184]	[-0.566]	[-0.321]	[0.279]	[-0.616]
0.043	0.029	0.062	0.099	-0.030	0.022	0.014	0.000	0.014	0.155	0.275	-0.024	0.002	0.455	0.043	0.272
(0.043)	(0.069)	(0.091)	(0.028)	(0.241)	(0.047)	(0.054)	(0.047)	(0.045)	(0.194)	(0.159)	(0.031)	(0.017)	(0.525)	(0.104)	(0.196)
[0.980]	[0.427]	[0.683]	[3.585]	[-0.124]	[0.473]	[0.265]	[-0.002]	[0.321]	[0.799]	[1.730]	[-0.789]	[0.115]	[0.867]	[0.413]	[1.390]
0.058	0.087	0.073	0.020	0.801	0.069	0.083	0.035	0.012	0.173	0.203	-0.003	0.023	0.466	0.086	0.080
(0.015)	(0.024)	(0.032)	(0.010)	(0.084)	(0.017)	(0.019)	(0.016)	(0.016)	(0.068)	(0.055)	(0.011)	(0.006)	(0.183)	(0.036)	(0.068)
[3.842]	[3.641]	[2.300]	[2.101]	[9.537]	[4.205]	[4.396]	[2.132]	[0.746]	[2.558]	[3.668]	[-0.242]	[3.777]	[2.546]	[2.366]	[1.173]
-22.313	29.783	13.186	-7.778	99.863	127.70	-23.812	-43.206	-14.772	28.205	-23.034	20.639	-15.315	-23.313	-58.263	-72.967
(24.88)	(39.25)	(52.36)	(15.80)	(137.9)	(27.13)	(30.82)	(27.08)	(25.56)	(111.2)	(9.09)	(17.55)	(10.00)	(30.06)	(59.83)	(112.4)
[-0.897]	[0.759]	[0.252]	[-0.492]	[0.724]	[4.707]	[-0.773]	[-1.595]	[-0.578]	[0.254]	[-2.533]	[1.176]	[-1.532]	[-0.776]	[-0.974]	[-0.649]
-29.480	-54.442	-56.122	-17.049	-61.119	-29.977	-23.036	-22.029	35.898	-80.345	-74.468	-25.152	-0.222	-18.695	-22.574	-82.626
(12.70)	(20.04)	(26.73)	(8.07)	(70.42)	(13.85)	(15.73)	(13.82)	(13.05)	(56.77)	(46.42)	(89.61)	(51.02)	(15.35)	(30.54)	(57.35)
[-2.287]	[-2.717]	[-2.100]	[-2.114]	[-0.868]	[-2.165]	[-1.464]	[-0.159]	[0.275]	[-1.415]	[-1.604]	[-0.281]	[-0.004]	[-1.218]	[-0.739]	[-1.441]
-0.041	0.000	0.026	0.028	-0.070	-0.008	-0.038	0.030	-0.068	-0.280	-0.080	0.017	-0.030	-0.957	0.105	-0.407
(0.065)	(0.102)	(0.136)	(0.041)	(0.359)	(0.071)	(0.080)	(0.071)	(0.067)	(0.290)	(0.237)	(0.046)	(0.026)	(0.783)	(0.156)	(0.293)
[-0.634]	[-0.004]	[0.188]	[0.684]	[-0.194]	[-0.120]	[-0.479]	[0.426]	[-1.025]	[-0.965]	[-0.338]	[0.361]	[-1.138]	[-1.222]	[0.677]	[-1.390]
-0.026	-0.050	-0.020	-0.035	0.021	-0.056	-0.068	0.017	0.031	0.099	-0.176	0.074	-0.001	-0.011	-0.022	-0.190
(0.032)	(0.050)	(0.067)	(0.020)	(0.177)	(0.035)	(0.040)	(0.035)	(0.033)	(0.143)	(0.117)	(0.023)	(0.013)	(0.386)	(0.077)	(0.144)
[-0.820]	[-0.987]	[-0.295]	[-1.722]	[0.117]	[-1.608]	[-1.727]	[0.494]	[0.943]	[0.692]	[-1.508]	[3.280]	[-0.059]	[-0.028]	[-0.284]	[-1.315]
0.025	0.039	0.017	0.008	0.028	0.031	0.039	0.029	0.023	0.222	0.050	0.018	0.008	0.479	0.048	0.078
(0.015)	(0.024)	(0.032)	(0.010)	(0.084)	(0.017)	(0.019)	(0.017)	(0.016)	(0.068)	(0.056)	(0.011)	(0.006)	(0.184)	(0.037)	(0.069)
[1.613]	[1.623]	[0.516]	[0.854]	[0.334]	[1.867]	[2.082]	[1.737]	[1.465]	[3.264]	[0.906]	[1.666]	[1.257]	[2.606]	[1.325]	[1.134]
0.011	0.024	0.034	0.003	-0.037	0.017	0.022	0.011	0.012	0.085	0.184	0.002	0.006	0.286	0.053	0.080
(0.009)	(0.015)	(0.020)	(0.006)	(0.052)	(0.010)	(0.012)	(0.010)	(0.010)	(0.042)	(0.034)	(0.007)	(0.004)	(0.114)	(0.023)	(0.043)
[1.189]	[1.644]	[1.736]	[0.423]	[-0.705]	[1.672]	[1.887]	[1.033]	[1.212]	[2.018]	[5.341]	[0.248]	[1.492]	[2.518]	[2.323]	[1.886]
0.019	-0.110	-0.064	-0.026	0.304	0.048	-0.019	-0.073	0.011	0.018	-0.060	0.057	0.009	-0.160	-0.160	-0.344
(0.070)	(0.111)	(0.148)	(0.045)	(0.389)	(0.077)	(0.087)	(0.076)	(0.072)	(0.314)	(0.257)	(0.050)	(0.028)	(0.848)	(0.169)	(0.317)
[0.276]	[-0.992]	[-0.431]	[-0.590]	[0.780]	[0.628]	[-0.224]	[-0.958]	[0.150]	[0.059]	[-0.234]	[1.160]	[0.333]	[-0.189]	[-0.947]	[-1.085]
0.103	0.071	-0.077	0.037	1.007	0.070	0.176	-0.005	0.029	0.449	0.077	-0.045	0.158	-0.726	-0.071	0.102
(0.082)	(0.129)	(0.172)	(0.052)	(0.453)	(0.089)	(0.101)	(0.089)	(0.084)	(0.365)	(0.299)	(0.058)	(0.033)	(0.987)	(0.196)	(0.369)
[1.262]	[0.548]	[-0.446]	[0.706]	[2.225]	[0.782]	[1.740]	[-0.060]	[0.345]	[1.230]	[0.257]	[-0.789]	[4.818]	[-0.736]	[-0.362]	[0.278]
-0.012	-0.013	-0.008	-0.006	-0.013	-0.007	-0.009	0.003	-0.001	-0.021	-0.006	-0.001	-0.002	-0.006	-0.012	-0.008
(0.004)	(0.007)	(0.009)	(0.003)	(0.024)	(0.005)	(0.005)	(0.005)	(0.004)	(0.019)	(0.016)	(0.003)	(0.002)	(0.053)	(0.010)	(0.020)
[-2.844]	[-1.921]	[-0.891]	[-2.158]	[-0.540]	[-1.549]	[-1.736]	[0.568]	[-0.113]	[-1.083]	[-0.359]	[-0.331]	[-1.209]	[-0.112]	[-1.123]	[-0.386]
0.009	0.017	0.023	0.005	-0.012	0.012	0.016	0.008	-0.003	0.012	0.050	0.004	0.000	0.017	0.053	0.060
(0.005)	(0.007)	(0.010)	(0.003)	(0.025)	(0.005)	(0.006)	(0.005)	(0.005)	(0.020)	(0.017)	(0.003)	(0.002)	(0.055)	(0.011)	(0.021)
[1.878]	[2.337]	[2.424]	[1.855]	[-0.490]	[2.328]	[2.907]	[1.568]	[-0.557]	[0.605]	[2.989]	[1.226]	[-0.068]	[0.306]	[4.801]	[2.902]
0.007	0.008	0.008	0.001	-0.001	0.008	0.008	0.001	0.005	0.000	0.049	0.002	0.000	0.061	0.009	0.094
(0.005)	(0.007)	(0.010)	(0.003)	(0.026)	(0.005)	(0.006)	(0.005)	(0.005)	(0.021)	(0.017)	(0.003)	(0.002)	(0.056)	(0.011)	(0.021)
[1.466]	[1.056]	[0.857]	[0.356]	[-0.025]	[1.614]	[1.326]	[0.255]	[1.012]	[-0.004]	[2.879]	[0.604]	[-0.017]	[1.081]	[0.776]	[4.464]
0.3148	0.31	0.2111	0.2741	0.4313	0.3406	0.2775	0.1241	0.0701	0.2148	0.3767	0.1479	0.2679	0.1888	0.2435	0.2639
5.2676	5.151	3.0692	4.3299	8.6948	5.9235	4.4049	1.6245	0.8642	3.1376	6.9313	1.9898	4.196	2.6688	3.69	4.1112

Table 1.2-1

Coefficients for matrix Π (G7 countries)

	CD	FR	GM	IT	JP	UK	US
:anada (CD)	0.4285	0.6293	0.7653	0.2302	0.5960	0.2415	0.2877
	(0.0887)	(0.1387)	(0.1815)	(0.0553)	(0.4722)	(0.0964)	(0.1114)
	[4.83222]	[4.53805]	[4.21660]	[4.16284]	[1.26211]	[2.50434]	[2.58267]
France (FR)	0.0092	0.0479	0.0224	-0.0069	0.0659	-0.0132	0.0037
	(0.0211)	(0.0331)	(0.0433)	(0.0132)	(0.1126)	(0.0230)	(0.0265)
	[0.43450]	[1.45043]	[0.51768]	[-0.52404]	[0.58564]	[-0.57310]	[0.14092]
ierman (GM)	-22.2372	27.6389	29.0424	5.7762	-17.3229	1.3207	-42.1272
	(19.7482)	(30.8842)	(40.4215)	(12.3171)	(105.1662)	(21.4773)	(24.8064)
	[-1.12604]	[0.89492]	[0.71849]	[0.46895]	[-0.16472]	[0.06149]	[-1.69824]
Italy (IT)	0.0522	0.0371	0.0799	0.1043	0.0342	0.0318	0.0330
	(0.0432)	(0.0676)	(0.0884)	(0.0269)	(0.2300)	(0.0470)	(0.0543)
	[1.20922]	[0.54894]	[0.90383]	[3.87215]	[0.14853]	[0.67670]	[0.60883]
Japan (JP)	0.0738	0.1040	0.0864	0.0245	0.8312	0.0836	0.0996
	(0.0149)	(0.0234)	(0.0306)	(0.0093)	(0.0796)	(0.0163)	(0.0188)
	[4.93698]	[4.45014]	[2.82459]	[2.63259]	[10.4454]	[5.14208]	[5.30466]
U. K. (UK)	-40.7615	-0.8139	-16.2433	-16.6896	112.3044	112.3671	-44.9229
	(24.8303)	(38.8320)	(50.8237)	(15.4869)	(132.2300)	(27.0043)	(31.1901)
	[-1.64160]	[-0.02096]	[-0.31960]	[-1.07766]	[0.84931]	[4.16109]	[-1.44029]
U. S. (US)	-31.2190	-56.8336	-57.4718	-15.7037	-71.5680	-30.7517	-26.3700
	(12.8501)	(20.0963)	(26.3022)	(8.0147)	(68.4315)	(13.9752)	(16.1415)
	[-2.42947]	[-2.82807]	[-2.18506]	[-1.95935]	[-1.04583]	[-2.20045]	[-1.63368]
R-squared	0.2294	0.2373	0.1605	0.2122	0.4095	0.2622	0.1641
F-statistic	8.9794	9.3872	5.7685	8.1274	20.9187	10.7183	5.9233

umbers in () are standard deviations, in [ ] are the t-value.

Table 1.2-2

Coefficients for matrix Π (Nine emerging markets)

	TW	TH	SG	MX	MA	KO	HK	BZ	AG
Taiwan	0.0279	-0.0686	-0.3535	-0.1396	0.0040	-0.0258	-1.1395	0.0761	-0.5048
(TW)	(0.0709)	(0.0652)	(0.2943)	(0.2548)	(0.0454)	(0.0265)	(0.7956)	(0.1573)	(0.2966)
	[0.39388]	[-1.05234]	[-1.20100]	[-0.54785]	[0.08857]	[-0.97462]	[-1.43238]	[0.48390]	[-1.70195]
Thailand	0.0167	0.0263	0.1122	-0.1344	0.0660	0.0068	0.1445	0.0008	-0.1593
(TH)	(0.0344)	(0.0316)	(0.1428)	(0.1236)	(0.0220)	(0.0129)	(0.3859)	(0.0763)	(0.1439)
	[0.48456]	[0.83246]	[0.78605]	[-1.08725]	[2.99283]	[0.53054]	[0.37457]	[0.01022]	[-1.10720]
Singapore	0.0315	0.0215	0.2163	0.0524	0.0142	0.0120	0.4915	0.0519	0.0574
(SG)	(0.0162)	(0.0149)	(0.0674)	(0.0584)	(0.0104)	(0.0061)	(0.1822)	(0.0360)	(0.0679)
	[1.93909]	[1.44098]	[3.20829]	[0.89816]	[1.36499]	[1.98318]	[2.69713]	[1.43966]	[0.84543]
Mexico	0.0133	0.0129	0.0923	0.1955	0.0025	0.0049	0.2794	0.0503	0.0864
(MX)	(0.0102)	(0.0094)	(0.0425)	(0.0368)	(0.0066)	(0.0038)	(0.1149)	(0.0227)	(0.0428)
	[1.30151]	[1.37317]	[2.17164]	[5.31170]	[0.37451]	[1.26819]	[2.43220]	[2.21608]	[2.01656]
Malaysia	-0.0668	0.0227	0.1107	-0.0168	0.0664	0.0106	-0.0391	-0.1358	-0.3029
(MA)	(0.0760)	(0.0699)	(0.3154)	(0.2731)	(0.0487)	(0.0284)	(0.8526)	(0.1686)	(0.3179)
	[-0.87856]	[0.32527]	[0.35080]	[-0.06150]	[1.36417]	[0.37456]	[-0.04584]	[-0.80543]	[-0.95281]
S. Korea	0.0040	0.0302	0.5954	0.2211	-0.0516	0.1724	-0.3149	-0.0105	0.2073
(KO)	(0.0891)	(0.0819)	(0.3696)	(0.3200)	(0.0571)	(0.0333)	(0.9991)	(0.1976)	(0.3725)
	[0.04516]	[0.36871]	[1.61091]	[0.69078]	[-0.90507]	[5.17701]	[-0.31514]	[-0.05290]	[0.55646]
HongKong	0.0008	-0.0011	-0.0262	-0.0176	-0.0003	-0.0033	-0.0287	-0.0161	-0.0124
(HK)	(0.0047)	(0.0043)	(0.0196)	(0.0170)	(0.0030)	(0.0018)	(0.0530)	(0.0105)	(0.0198)
	[0.16463]	[-0.25388]	[-1.33665]	[-1.03852]	[-0.10295]	[-1.88424]	[-0.54139]	[-1.53139]	[-0.62961]
Brazil	0.0091	-0.0020	0.0176	0.0621	0.0034	0.0005	0.0380	0.0558	0.0686
(BZ)	(0.0049)	(0.0045)	(0.0205)	(0.0177)	(0.0032)	(0.0018)	(0.0554)	(0.0110)	(0.0206)
	[1.84521]	[-0.43841]	[0.85699]	[3.50359]	[1.08063]	[0.28347]	[0.68631]	[5.09912]	[3.32283]
Argentina	0.0026	0.0050	0.0092	0.0585	0.0024	0.0012	0.0950	0.0154	0.1004
(AG)	(0.0050)	(0.0046)	(0.0209)	(0.0181)	(0.0032)	(0.0019)	(0.0565)	(0.0112)	(0.0211)
	[0.51493]	[1.08871]	[0.44123]	[3.23312]	[0.74046]	[0.65121]	[1.68184]	[1.37500]	[4.76894]
R-squared	0.057384	0.050263	0.137001	0.231799	0.104100	0.191448	0.108119	0.179049	0.194793
F-statistic	1.362139	1.184153	3.552016	6.751474	2.599893	5.297943	2.712414	4.879985	5.412899

Numbers in () are standard deviations, in [ ] are the t-value.

Table 1.3

Test of Supply Effect on off-Diagonal Elements of Matrix Π

	R^2	F- statistic	p-value	Chi-square	p-value
Canada	0.3147	3.5055	0.0000	52.5819	0.0000
France	0.3099	4.6845	0.0000	70.2686	0.0000
German	0.2111	2.8549	0.0005	42.8236	0.0002
Italy	0.2741	2.9733	0.0003	44.6004	0.0001
Japan	0.4313	0.7193	0.7628	10.7894	0.7674
U.K.	0.3406	3.9361	0.0000	59.0413	0.0000
U.S.	0.2775	4.5400	0.0000	68.1001	0.0000
Taiwan	0.1241	1.6266	0.0711	24.3984	0.0586
Thailand	0.0701	0.7411	0.7401	11.1171	0.7442
Singapore	0.2148	2.1309	0.0106	31.9634	0.0065
Mexico	0.3767	4.7873	0.0000	71.8099	0.0000
Malaysia	0.1479	1.6984	0.0550	25.4755	0.0439
S. Korea	0.2679	2.1020	0.0118	31.5305	0.0075
Hongkong	0.1888	2.6836	0.0011	40.2540	0.0004
Brazil	0.2435	1.9174	0.0244	28.7613	0.0173
Argentina	0.2639	2.6210	0.0014	39.3155	0.0006

Note: 1. $p_{i,t} = \beta_i' d_{i,t} + \Sigma_{j \neq i} \beta_j' d_{j,t} + \varepsilon'_{i,t}$, i, j = 1, …,16.

Null Hypothesis: all $\beta_j = 0$, j=1,…, 16, j ≠i

2. The first one is an F distribution with 15 and 172 degrees of freedom, and the second one is a chi-squared distribution with 15 degrees of freedom.

Table 2.1

Characteristics of Ten Portfolios

Portfolio	Return	Payout	Size (000)	Beta (M)
1	0.0351	0.7831	193,051	0.7028
2	0.0316	0.7372	358,168	0.8878
3	0.0381	0.5700	332,240	0.8776
4	0.0343	0.5522	141,496	1.0541
5	0.0410	0.5025	475,874	1.1481
6	0.0362	0.4578	267,429	1.0545
7	0.0431	0.3944	196,265	1.1850
8	0.0336	0.3593	243,459	1.0092
9	0.0382	0.2907	211,769	0.9487
10	0.0454	0.1381	284,600	1.1007

1. The first 30 firms with highest payout ratio comprises portfolio one, and so on.
2. The payout ratio for each firm in each year is found by dividing the sum of four quarters' dividends by the sum of four quarters' earnings, then, the yearly ratios are further averaged over the 22-year period.
3. The price, dividend and earnings of each portfolio are computed by value-weighted of the 30 firms included in the same category.

Table 2.2

Summary Statistics of Quarterly Return

Country	Mean (quarterly)	Std. Dev. (quarterly)	Skewness	Kurtosis	Jarque-Bera
Market portfolio	0.0364	0.0710	-0.4604	3.9742	6.5142*
Portfolio 1	0.0351	0.0683	-0.5612	3.8010	6.8925*
Portfolio 2	0.0316	0.0766	-1.1123	5.5480	41.470**
Portfolio 3	0.0381	0.0768	-0.3302	2.8459	1.6672*
Portfolio 4	0.0343	0.0853	-0.1320	3.3064	0.5928
Portfolio 5.	0.0410	0.0876	-0.4370	3.8062	5.1251
Portfolio 6.	0.0362	0.0837	-0.2638	3.6861	2.7153
Portfolio 7	0.0431	0.0919	-0.1902	3.3274	0.9132
Portfolio 8	0.0336	0.0906	0.2798	3.3290	1.5276
Portfolio 9	0.0382	0.0791	-0.2949	3.8571	3.9236
Portfolio 10	0.0454	0.0985	-0.0154	2.8371	0.0996

1. Quarterly returns from 1981:Q1to 2002:Q4 are calculated.

2. * and ** denote statistical significance at the 5% and 1%, respectively.

Table 2 3

Coefficients for matrix Π' (10 portfolios)

	P_P1	P_P2	P_P3	P_P4	P_P5	P_P6	P_P7	P_P8	P_P9	P_P10
P1	15.57183	-12.60844	13.15747	-8.58455	8.62495	-2.486287	10.48123	1.959701	-1.274653	-13.4239
	-23.5688	-24.513	-22.2507	-22.3461	-25.6377	-26.1305	-24.906	-24.181	-16.358	-29.1236
	[0.6607]	[-0.5144]	[0.5913]	[-0.3842]	[0.3364]	[-0.0952]	[0.4208]	[0.0810]	[-0.0779]	[-0.4609]
P2	-16.67868	-18.7728	-24.73303	-12.19542	-18.61126	5.326864	-16.99283	-5.675232	-1.795597	13.98581
	-14.2287	-14.7988	-13.433	-13.4906	-15.4778	-15.7753	-15.036	-14.5984	-9.8755	-17.5823
	[-1.1722]	[-1.2685]	[-1.8412]	[-0.9040]	[-1.2025]	[0.3377]	[-1.1301]	[-0.3888]	[-0.1818]	[0.7955]
P3	140.7762	117.8989	180.973	128.0238	161.9093	44.47442	115.7946	103.2686	74.30349	74.72393
	-73.6813	-76.6333	-69.5607	-69.8588	-80.1493	-81.69	-77.8617	-75.5953	-51.1387	-91.047
	[1.9106]	[1.5385]	[2.6017]	[1.8326]	[2.0201]	[0.5444]	[1.4872]	[1.3661]	[1.4530]	[0.8207]
P4	-79.569	-82.9826	-16.2607	-71.5316	-38.36708	-29.88297	-43.8957	-20.7400	-10.4372	-2.02316
	-64.5317	-67.1171	-60.9228	-61.1839	-70.1966	-71.5459	-68.193	-66.208	-44.7884	-79.741
	[-1.2330]	[-1.2364]	[-0.2669]	[-1.1691]	[-0.5466]	[-0.4177]	[-0.6437]	[-0.3133]	[-0.2330]	[-0.0254]
P5	25.63953	29.0526	54.39686	6.087413	31.12653	7.582502	30.88937	19.3122	17.58315	-0.01716
	-25.521	-26.5435	-24.0937	-24.197	-27.7613	-28.2949	-26.9689	-26.1839	-17.7129	-31.5359
	[1.0047]	[1.0945]	[2.2577]	[0.2516]	[1.1212]	[0.2680]	[1.1454]	[0.7376]	[0.9927]	[-0.0005]
P6	-12.46593	-8.734942	-45.85208	-25.53128	-17.06422	-18.11443	-23.51969	-1.723033	-4.492465	-31.53814
	-12.1881	-12.6764	-11.5065	-11.5558	-13.2581	-13.5129	-12.8796	-12.5047	-8.45921	-15.0607
	[-1.0228]	[-0.6891]	[-3.9849]	[-2.2094]	[-1.2871]	[-1.3405]	[-1.8261]	[-0.1378]	[-0.5311]	[-2.0941]
P7	-84.5262	-35.03964	-114.7987	-19.48548	-97.9274	4.402397	-57.69584	-58.88397	-68.04914	3.566607
	-56.1062	-58.354	-52.9685	-53.1955	-61.0314	-62.2046	-59.2894	-57.5636	-38.9406	-69.3296
	[-1.5065]	[-0.6005]	[-2.1673]	[-0.3663]	[-1.6045]	[0.0708]	[-0.9731]	[-1.0229]	[-1.7475]	[0.0514]
P8	-5.497057	-4.463256	-31.77293	29.38345	-8.488357	0.394223	-21.59846	-45.72339	19.80597	-107.4715
	-62.0465	-64.5323	-58.5765	-58.8276	-67.4932	-68.7905	-65.5667	-63.6582	-43.0635	-76.67
	[-0.0886]	[-0.0692]	[-0.5424]	[0.4995]	[-0.1258]	[0.0057]	[-0.3294]	[-0.7183]	[0.4599]	[-1.4017]
P9	20.70817	28.77904	15.61156	23.14069	25.93932	35.08121	23.73591	15.46799	18.15523	25.27915
	-15.5463	-16.1691	-14.6768	-14.7398	-16.911	-17.236	-16.4283	-15.9501	-10.7899	-19.2103
	[1.3320]	[1.7799]	[1.0637]	[1.5700]	[1.5339]	[2.0353]	[1.4448]	[0.9698]	[1.6826]	[1.3159]
P10	-14.64016	-51.1797	-49.51991	-64.67943	-23.53575	67.38674	7.053653	-30.23067	-15.54273	36.60222
	-112.584	-117.094	-106.288	-106.743	-122.467	-124.821	-118.971	-115.508	-78.1391	-139.118
	[-0.1300]	[-0.4371]	[-0.4659]	[-0.6059]	[-0.1922]	[0.5399]	[0.0593]	[-0.2617]	[-0.1989]	[0.2631]
R^2	0.083841	0.096546	0.283079	0.134377	0.088212	0.075947	0.091492	0.027763	0.065971	0.138979
F-st	0.772786	0.902404	3.334318	1.310894	0.816966	0.694038	0.850408	0.241141	0.596435	1.363029

Standard errors in ( ) & t-statistics in [ ]

Table 2.4

Test of Supply Effect on off-Diagonal Elements of Matrix Π

	R^2	F- statistic	p-value	Chi-square	p-value
Portfolio 1	0.1518	1.7392	0.0872	17.392	0.0661
Portfolio 2	0.1308	1.4261	0.1852	14.261	0.1614
Portfolio 3	0.4095	5.4896	0.0000	53.896	0.0000
Portfolio 4	0.1535	1.9240	0.0607	17.316	0.0440
Portfolio 5	0.1706	1.9511	0.0509	19.511	0.0342
Portfolio 6	0.2009	1.2094	0.2988	12.094	0.2788
Portfolio 7	0.2021	1.8161	0.0718	18.161	0.0523
Portfolio 8	0.1849	1.9599	0.0497	19.599	0.0333
Portfolio 9	0.1561	1.8730	0.0622	18.730	0.0438
Portfolio 10	0.3041	3.5331	0.0007	35.331	0.0001

Note: 1. $p_{i,t} = \beta_i' d_{i,t} + \Sigma_{j\neq i}\, \beta_j' d_{j,t} + \varepsilon'_{i,t}, \quad i, j = 1, \ldots, 10.$

Hypothesis: all $\beta_j = 0$, $j=1,\ldots, 10$, $j \neq i$

2. The first one is an F distribution with 9 and 76 degrees of freedom, and the second one is a chi-squared distribution with 9 degrees of freedom.

Figure 1

Comparison of S&P500 and Market portfolio

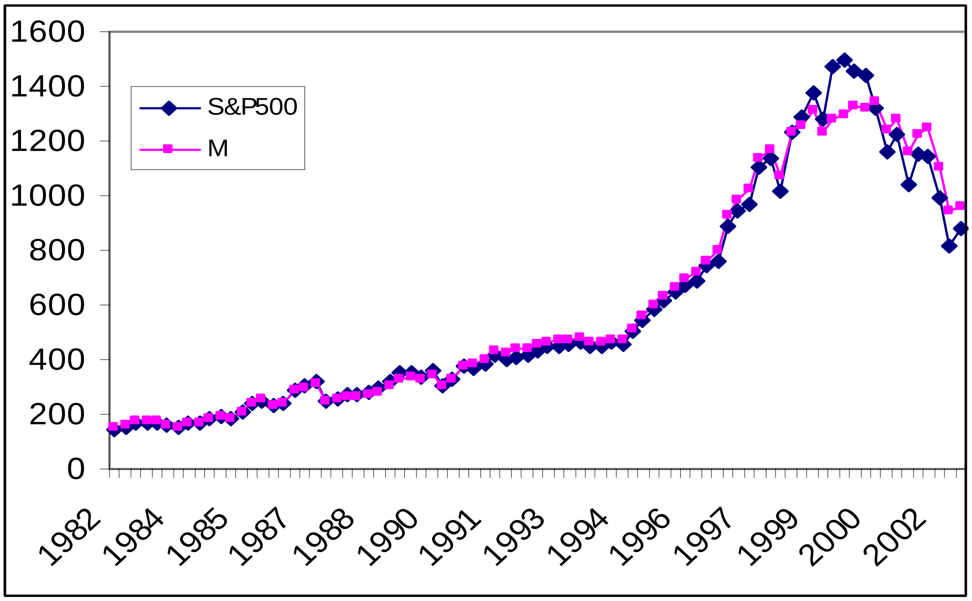
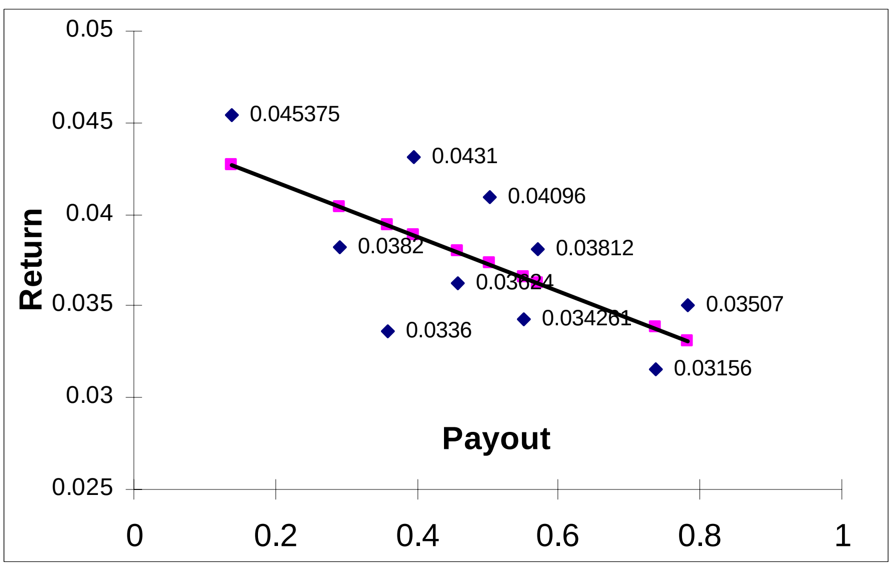


Figure 2

Return and Payout



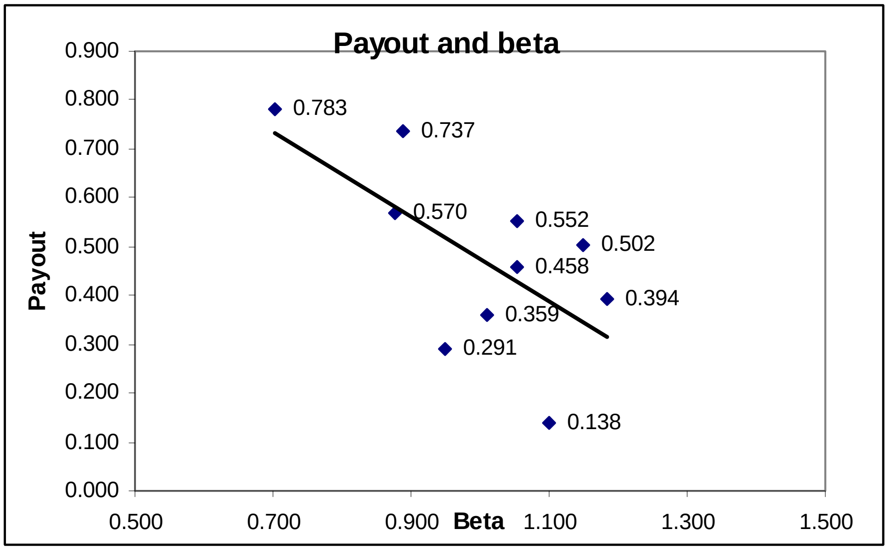
Return = 0.04478 – 0.01490×Payout $(R^2 = 0.4412)$

(0.0030) (0.0059)

[14.71]** [-2.62]*

Figure 3

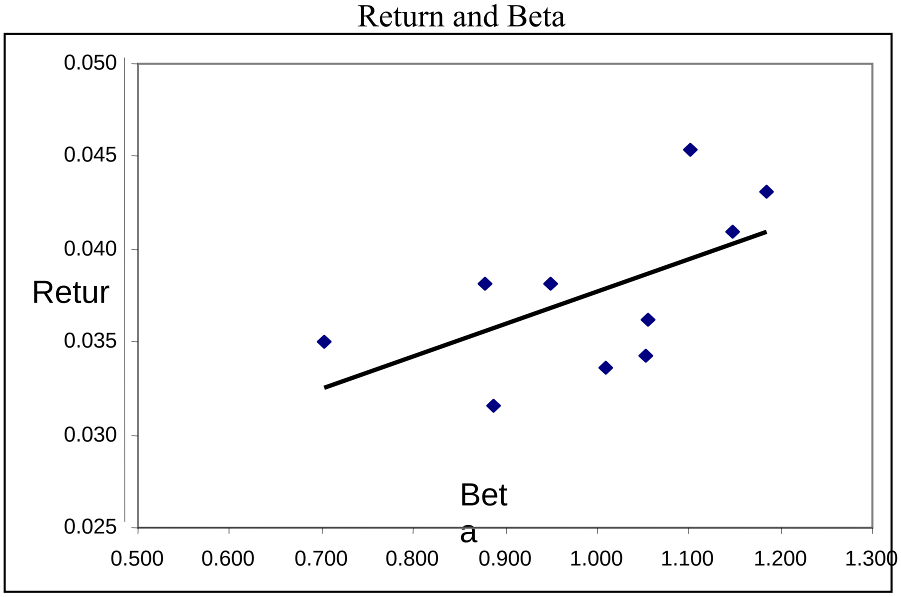
Payout and Beta



Payout = 1.3444 – 0.8683×Beta (R^2 =0.4147)
(0.3672) (0.3648)
[3.662]** -2.381]*

Figures 4

Return and Beta



Return = 0.0202 + 0.0175×Beta (R^2 =0.3359)
(0.0088) (0.0087)
[2.300] [-2.012]

Appendix A

A1 Modeling the Price Process

In Section B, equation (18) is derived from equation (17) under the assumption that all countries' index series follow a random walk process. Thus, before further discussion, we should test the order of integration of these price series. Two widely used unit root tests are the Dickey-Fuller (DF) and the augmented Dickey-Fuller (ADF) tests. The former can be represented as: $P_t = \mu + \gamma P_{t-1} + \varepsilon_t$, and the latter can be written as: $\Delta P_t = \mu + \gamma P_{t-1} + \delta_1 \Delta P_{t-1} + \delta_2 \Delta P_{t-2} + \ldots + \delta_p \Delta P_{t-p} + \varepsilon_t$. The results of the tests for each index are summarized in Table A.1 It seems that one cannot reject the hypothesis that the index follows a random walk process. In the ADF test the null hypothesis of unit root in level can not be rejected for all indices whereas the null hypothesis of unit root in the first difference is rejected. This result is consistent with most which conclude that the financial price series follow a random walk process.

Similarly, in the U.S. stock markets, the Phillips-Perron test is used to check the whether the value-weighted price of market portfolio follows a random walk process. The results of the tests for each index are summarized in Table A.2. It seems that one cannot reject the hypothesis that all indices follow a random walk process since, for example, the null hypothesis of unit root in level cannot be rejected for all indices but are all rejected if one assumes there is a unit root in the first order difference of the price for each portfolio. This result is consistent with most studies concluding the financial price series follow a random walk process.

A2 Modeling the Dividend Processes

I Granger-Causality among Price, Dividend and Earnings

The second question comes from the second term in equation (18), the expectation adjustments in dividends between one and two periods ahead. Thus, one needs to find an appropriate dividend behavioral model to construct the forecast value of dividends. One country's history of earning seems to be a good candidate to forecast future dividends. Before constructing the dividend behavior model, the relationship among price, dividend and earning should first be examined. The Granger causality test is helpful in this regard. For example, if price does not cause dividend in the Granger's sense, past and current prices can be left out of consideration to form the conditional expectations of dividend. Or, if there is a causal relationship between price and dividend, then past and current prices should be included in the information set.

The test for the Granger causality follows directly from Granger (1969). This test approach to the question of whether x causes y is to see how much of the current y can be explained by past values of y and then to see whether the adding lagged values of x can improve the explanation of y, or in other word, whether the coefficients on the lagged x's are statistically significant.

The results of pair-wise Granger causality tests for the market portfolio, world index, are summarized in Table A.3. If the lag terms are chosen as 12 periods ahead, at 5 % significant level, the null hypothesis, which assumes earnings doesn't Granger cause dividend, is rejected, but one can not reject all the other directions at 5% significant level. At 1% significant level, it seems to have a Granger causality relationship between earning and dividend. These implications are even stronger if 4 period lags are included. The hypotheses assuming that earnings does not Granger cause dividend and that earnings does not Granger cause dividend are both rejected at 5% level and 1% level respectively. Thus, it is reasonable to incorporate earnings data as one forecast the future dividend.

In the U.S. stock markets, the results are summarized in Table A.4. If the lag terms are chosen as 2 quarters ahead, at 5 % significant level, the null hypothesis of that dividend doesn't Granger cause earnings is rejected and at 1% significant level, there seems to have a Granger causality relationship between earning and price. These implications are even stronger if 4 quarters lag is included. If only one lag is allowed, the hypothesis that earnings does not Granger cause dividend and that earnings does not Granger cause dividend can be rejected at 1% level and 5% level respectively. This is also true for the direction of earnings to price and price to earnings if lag is one quarter but not true if 2 quarters lag allowed. Thus, incorporating earnings data into dividend behavior model seems to be reasonable again.

II Modeling the Dividend Processes

There are three dividend behavior models introduced here. First one is the partial adjustment model, which can be represented as:

(A-1) $$D_t - D_{t-1} = a + r\gamma E_t - \gamma D_{t-1} + u_t .$$

The second one is adaptive expectation model:

(A-2) $$D_t - D_{t-1} = r\delta E_t - \delta D_{t-1} + u_t - (1-\delta)u_{t-1}$$

where D, E are dividends and earnings, and r is the target payout ratio. In (A-1), γ is the speed of adjustment and the intercept term, *a*, measures the management's reluctance to cut dividends. In equation (A-2) δ is the expectation coefficient. If δ is greater than zero, current expectation of earning can be improved from the previous expectation of earnings by the same proportion.

The third one is the process proposed by Campbell, Grossman and Wang (1993)[8]. In this model, each share pays dividend of D_t in period t. The model can be summarized as:

(A-3) $$D_t - D_{t-1} = (\alpha_D - 1)(D_{t-1} - \overline{D}) + S_{t-1} + \varepsilon_{D,t} .$$

In equation (A-3), if one uses earning series multiplies by target payout-ratio as

---

[8] In Campbell, Grossman and Wang (1993), $D_t = \overline{D} + \tilde{D}_t$, $\tilde{D}_t = \alpha_D \tilde{D}_{t-1} + u_{D,t}$, $0 \le \alpha_D \le 1$. where $\overline{D} > 0$ is the mean dividend, $\tilde{D}_t$ is the zero-mean stochastic component of the dividend and the innovation $u_{D,t}$ is i.i.d. with normal distribution $u_{D,t} \sim N(0, \sigma_u^2)$. $u_{D,t}$ is further assumed to contain a signal, S_t, which all investors receive at time t about the future dividend shock, i.e., $u_{D,t+1} = S_t + \varepsilon_{D,t+1}$. where $E[u_{D,t+1} \mid S_t] = S_t$, $S_t \sim N(0, \sigma_s^2)$, $\varepsilon_{D,t} \sim N(0, \sigma_\varepsilon^2)$ are joint i.i.d. normal.

the signal in (A-3), the third specification is similar to the previous two specifications. In fact, one can use the following generalized model to check the performance of different specification. This generalized is modified from the original form derived by Lee, Wu and Diarraya (1987).

(A-4) $$D_t - D_{t-1} = c_0 + c_1 t + c_2 D_{t-1} + c_3 D_{t-2} + c_4 E_t + c_5 E_{t-1} + u_{,t}.$$

The results for the world index under different specifications are summarized in <u>Table A.5</u>. It appears that the adaptive expectation model in equation (A-2) describes dividend behavior better than others. This result is also consistent with the implication of Granger-causality test that earnings help predict the future values of dividends.

To find out an appropriate dividend behavior specification in the U.S. stock market, one can estimate the generalized model described as in equation (A-4): $D_t - D_{t-1} = c_0 + c_1 t + c_2 D_{t-1} + c_3 D_{t-2} + c_4 E_t + c_5 E_{t-1} + u_{,t}$ The results are summarized in <u>Table A.6</u>. Under these different specifications, it seems that the adaptive expectation model describes dividend behavior better than others. This result is also consistent with the implication of Granger-causality test. That is, earnings help predict the future values of dividends.

A3 Structure Form vs. Reduced Form

Now, the equation (18) can be written as equation (19): G p_t + H d_t = V_t, where G = -(r^*cS^{-1} + $A^{-1}B$), H = ($cS^{-1}+A^{-1}$), $p_t = P_t - P_{t-1}$ and $d_t = E_t D_{t+1} - E_{t-1} D_{t+1}$, which can be forecasted and calculated from the past observations of earnings and dividend by the adaptive expectation model established in previous part.

Recall the analysis in Section B showing that if the structure form of the simultaneous equation system represented as equation (19) is exactly identified, then, if the matrix G is also assumed to be nonsingular, this system can be estimated by the reduced form described as (20): $p_t = \Pi\, d_t + U_t$, where $\Pi = -G^{-1}H$, a n×n matrix of the reduced form coefficients and $U_t = G^{-1}V_t$, a column vector of n reduced form disturbances. Without a prior knowledge of the system, all equations of the model would look statistically similar in which each equation is a linear combination of all endogenous (p_t) variables and all exogenous variables (d_t). No equation contains any single variable which does not appear in any other equation.

The identification problem is proved in Appendix B. That is, there is one-to-one correspondence between structure parameters and reduced form parameters. One question is still remains, how can one assure that and d_t is exogenous in this model, or, in other words, d_t is not influenced by p_t?

Again, the relationship between p_t and d_t for every individual country needs to be checked by, again, Granger-causality test. In international equity market, the results are summarized in Table A.7.[9] The assumption that the index series in first order difference, p_t, are endogenous variables and the series of expectation adjustments in dividend, d_t, are exogenous variables seem to be evidenced for world index and most countries. Especially, if index and dividend are measured in U.S. dollars, the causality relationship is even weaker. For further analysis, the price of value-weighted portfolio, p_t, or the country indices series here, will be treated as endogenous. In contrast, the series of expectation adjustments in dividend (d_t) will be treated as an exogenous variable.

In the U.S. stock markets, the relationship between p_t and d_t for every portfolio is checked by Granger-causality test. The results are summarized in Table A.8. The assumption that p_t is endogenous and the series of expectation adjustments in dividend, d_t, is exogenous variable seems to be evidenced for market portfolio and most of the individual portfolios, except portfolio 5 and 8 if 4 period-lag are chosen. Therefore, treating the adjustment in price series, p_t, as endogenous seems reasonable. In contrast, d_t will be treated as exogenous variable in the later analysis.

[9] Table 5.10-1 shows the similar results, if the MSCI country indices are used.

Table A.1

Unit root tests for P_t

	$P_t = \mu + \gamma P_{t-1} + \varepsilon_t$		Unit root test (ADF)	
	Estimated c_2 (Std. Error)	R^2	Level	1st Difference
World Index	0.9884 (0.0098),	0.9820	0.63	-13.74**
W.I. ex. U.S.	0.9688 (0.0174)	0.9434	0.13	-14.03**
Argentina	0.9643 (0.0177)	0.9411	-0.70	-13.08**
Brazil	0.9738 (0.0160)	0.9520	-0.65	-12.49**
Canada	0.9816 (0.0156)	0.9550	-0.69	-11.80**
France	0.9815 (0.0121)	0.9725	0.34	-14.06**
Germany	0.9829 (0.0119)	0.9736	0.12	-14.53**
Hong Kong	0.9754 (0.0146)	0.9599	-1.68	-13.87**
Italy	0.9824 (0.0136)	0.9656	0.24	-15.42**
Japan	0.9711 (0.0185)	0.9368	-1.02	-14.32**
Malaysia	0.9757 (0.0145)	0.9603	-0.64	-7.01**
Mexico	0.9749 (0.0159)	0.9531	-0.26	-13.39**
Singapore	0.9625 (0.0173)	0.9432	0.02	-14.08**
S. Korea	0.9735 (0.0170)	0.9463	-0.67	-12.61**
Taiwan	0.9295 (0.0263)	0.8706	-0.54	-12.49**
Thailand	0.9854 (0.0124)	0.9715	-0.49	-12.79**
U.K.	0.9875 (0.0094)	0.9835	0.53	-13.76**
U.S.	0.9925 (0.0076)	0.9892	0.82	-14.10**

* 5% significant level; ** 1% significant level

Table A.2

Unit root tests for P_t

	$P_t = \mu + \gamma P_{t-1} + \varepsilon_t$		Phillips-Perron test	
	Estimated c_2 (Std. Error)	Adj. R^2	Level	1st Difference
Market portfolio	1.0060 (0.0159)	0.9788	-0.52	-8.48**
S&P500	0.9864 (0.0164)	0.9769	-0.90	-959**
Portfolio 1	0.9883 (0.0172)	0.9746	-0.56	-8.67**
Portfolio 2	0.9877 (0.0146)	0.9815	-0.97	-9.42**
Portfolio 3	0.9913 (0.0149)	0.9809	-0.51	-13.90**
Portfolio 4	0.9935 (0.0143)	0.9825	-0.61	-7.66**
Portfolio 5	0.9933 (0.0158)	0.9787	-0.43	-9.34**
Portfolio 6	0.9950 (0.0150)	0.9808	-0.32	-8.66**
Portfolio 7	0.9892 (0.0155)	0.9793	-0.64	-9.08**
Portfolio 8	0.9879 (0.0166)	0.9762	-0.74	-9.37**
Portfolio 9	0.9939 (0.0116)	0.9884	-0.74	-7.04**
Portfolio 10	0.9889 (0.0182)	0.9716	-0.69	-9.07**

Note:

1. * 5% significant level; ** 1% significant level
2. The process assumed to be random walk without drift.
3. The null hypothesis of zero intercept terms, μ, can not be rejected at 5%, 1% level for all portfolio.

Table A.3

Pair-wise Granger Causality Tests for price, dividend and earning

World index

Pairwise Granger Causality Tests
(Lags: 12)

Null Hypothesis:	F-Statistic	Probability
Dividend does not Granger Cause price	1.35092	0.19477
Price does not Granger Cause Dividend	0.69352	0.75618
Earning does not Granger Cause Price	1.33565	0.20311
Price does not Granger Cause Earning	1.47867	0.13700
Earning does not Granger Cause Dividend	2.03228	0.02452*
Dividend does not Granger Cause Earning	1.69183	0.07290

* 5% significant level, ** 1% significant level

(Lags: 4)

Null Hypothesis:	F-Statistic	Probability
Dividend does not Granger Cause price	0.93018	0.44761
Price does not Granger Cause Dividend	0.34339	0.84838
Earning does not Granger Cause Price	1.69242	0.15356
Price does not Granger Cause Earning	0.19778	0.93929
Earning does not Granger Cause Dividend	4.43140	0.00192**
Dividend does not Granger Cause Earning	3.02656	0.01900*

* 5% significant level, ** 1% significant level

Note: the Granger-causality tests are estimated though the equation:

$$y_t = \sum_{i}^{T} m_i y_{t-i} + \sum_{j}^{T} n_j x_{t-j} + u_t, T = 4,12 \ \ respectively$$

Table A.4

Pair-wise Granger Causality Tests for price, dividend and earning

Market portfolio

(Lags: 1)

Null Hypothesis:	F-Statistic	Probability
Dividend does not Granger Cause price	0.03196	0.85855
Price does not Granger Cause Dividend	2.92599	0.09085
Earning does not Granger Cause Price	9.05601	0.00346**
Price does not Granger Cause Earning	4.01856	0.04822*
Earning does not Granger Cause Dividend	6.96700	0.00990**
Dividend does not Granger Cause Earning	5.32593	0.02347*

(Lags:2)

Null Hypothesis:	F-Statistic	Probability
Dividend does not Granger Cause price	1.61040	0.20614
Price does not Granger Cause Dividend	1.50288	0.22863
Earning does not Granger Cause Price	9.08435	0.00028**
Price does not Granger Cause Earning	3.01529	0.05457
Earning does not Granger Cause Dividend	2.08141	0.13138
Dividend does not Granger Cause Earning	3.53847	0.03363*

(Lags:4)

Null Hypothesis:	F-Statistic	Probability
Dividend does not Granger Cause price	0.95676	0.43633
Price does not Granger Cause Dividend	2.14044	0.08406
Earning does not Granger Cause Price	8.11535	1.7E-05**
Price does not Granger Cause Earning	5.22449	0.00091**
Earning does not Granger Cause Dividend	2.76083	0.03367*
Dividend does not Granger Cause Earning	7.64023	3.2E-05**

* 5% significant level, ** 1% significant level

Note: the Granger-causality tests are estimated though the equation:

$$y_t = \sum_{i}^{T} m_i y_{t-i} + \sum_{j}^{T} n_j x_{t-j} + u_t, T = 1,2,4 \textit{respectively}$$

Table A.5

Dividends Behavior Models (Market Portfolio: World Index)

Dependent Variable	Constant	Trend	Dividend (t-1)	Dividend (t-2)	Earnings (t)	Earnings (t-1)	Adj. R^2	F-Statistic
$D_t - D_{t-1}$	0.5779**	0.0015**	-0.514**	0.3245**	0.1093**	-0.097**	0.2776	15.83**
	(0.1540)	(0.0004)	(0.0720)	(0.0699)	(0.0325)	(0.0330)		
	[3.7513]	[3.6796]	[-7.1392]	[4.6403]	[3.3649]	[-2.943]		
	0.1431*		-0.444**	0.3912**	0.1102**	-0.099**	0.2435	1653**
	(0.0670)		(0.0672)	(0.0677)	(0.0340)	(0.0341)		
	[2.1361]		[-6.609]	[5.7815]	[3.2407]	[-2.906]		
	0.5801**	0.0015**	-0.545**	0.3443**	0.0175*		0.2409	16.31**
	(0.1554)	(0.0004)	(0.0769)	(0.0705)	(0.0070)			
	[3.7323]	[3.6135]	[-7.091]	[4.8841]	[2.4995]			
	0.8264**	0.0022**	-0.273**		0.1265**	-0.110**	0.1912	12.46**
	(0.1704)	(0.0005)	(0.0562)		(0.0316)	(0.0326)		
	[4.8487]	[4.8603]	[-4.870]		[4.0023]	[-3.3797]		
	0.8493**	0.0023**	-0.293**		0.0230**		0.1433	11.82**
	(0.1800)	(0.0005)	(0.0588)		(0.0079)			
	[4.7176]	[4.7412]	[-4.994]		[2.9033]			
		-0.0000	-0.452**	0.4303**	0.0128*		0.1909	2.065**
		(0.0002)	(0.0677)	(0.0703)	(0.0060)			(D-W)
		[-0.447]	[-6.670]	[6.1249]	[2.1297]			
		0.0000	-0.034**		0.0179*		0.0143	2.794
		(0.0001)	(0.0115)		(0.0054)			(D-W)
		[-0.373]	[-2.963]		[3.3052]			
	0.1365		-0.475**	0.4126**	0.0167*		0.2056	17.65**
	(0.0719)		(0.0708)	(0.0695)	(0.0064)			
	[1.8973]		[-6.706]	[5.9327]	[2.5990]			
	0.1983*		-0.092**		0.0237**		0.0478	5.87
	(0.0795)		(0.0280)		(0.0067)			
	[2.4950]		[-3.296]		[3.5392]			

Note:

1. Numbers in () are standard deviations, in [ ] are the t-value.

2. * denotes significant at 5% level, ** denotes significant at 1% level.

Partial adjustment model:

$$D_t - D_{t-1} = a + r\gamma E_t - \gamma D_{t-1} + u_t \cdot$$

Adaptive expectation model:

$$D_t - D_{t-1} = r\delta E_t - \delta D_{t-1} + u_t - (1-\delta)u_{t-1}$$

Model modified from Campbell, Grossman and Wang (1993):

$$D_t - D_{t-1} = (\alpha_D - 1)(D_{t-1} - \overline{D}) + rE_{t-1} + u_{D,t} \cdot$$

Generalized model:

$$D_t - D_{t-1} = c_0 + c_1 t + c_2 D_{t-1} + c_3 D_{t-2} + c_4 E_t + c_5 E_{t-1} + u_t \cdot$$

Table A.6

Dividends Behavior Models (Market Portfolio)

Dependent Variable	Constant	Trend	Dividend (t-1)	Dividend (t-2)	Earnings (t)	Earnings (t-1)	Adj. R^2	F-Statistic
$D_t - D_{t-1}$								
	0.2720**	0.0094**	-0.7560**	0.4920**	-0.0108	0.0429*	0.3818	11.50**
Specification	(0.0903)	(0.0034)	(0.1014)	(0.1000)	(0.0178)	(0.0179)		
1	[3.0120]	[2.7690]	[-7.4514]	[4.9214]	[-0.6068]	[2.3887]		
	0.0724*		-0.6471**	0.5798**	-0.0106	0.0406*	0.3309	11.51**
2	(0.0566)		(0.0973)	(0.0986)	(0.0185)	(0.0186)		
	[1.2790]		[-6.6506]	[5.8793]	[-0.5712]	[2.1771]		
	0.2422*	0.0090*	-0.6659**	0.4493**	0.0167		0.3459	12.23**
3	(0.0920)	(0.0035)	(0.0969)	(0.1012)	(0.0140)			
	[2.6226]	[2.589]	[-6.8730]	[4.4411]	[1.1948]			
	0.2749**	0.0094**	-0.7432**	0.4695**		0.0358*	0.3866	14.40**
4	(0.0898)	(0.0034)	(0.0989)	(0.0925)		(0.0136)		
	[3.0602]	[2.7771]	[-7.5172]	[5.0755]		[2.6272]		
	0.4068**	0.0142**	-0.4166*		0.0224	0.0268	0.2016	6.43**
5	(0.0967)	(0.0035)	(0.0848)		(0.0187)	(0.0196)		
	[4.2083]	[4.008]	[-4.915]		[1.1997]	[1.3440]		
	0.3800**	0.0137**	-0.3775**		0.0383**		0.1939	7.89**
6	(0.0950)	(0.0035)	(0.0800)		(0.0145)			
	[3.9980]	[3.8682]	[-4.7196]		[2.6450]			
		0.0015	-0.5869**	0.5395**	0.0069		0.2738	2.568
7		(0.0021)	(0.1028)	(0.1069)	(0.0152)			(D-W)
		[0.7087]	[-5.7065]	[5.0454]	[0.4548]			
	0.0754		-0.6348**	0.5578**		0.0334*	0.3364	15.37**
8	(0.0561)		(0.0945)	(0.0904)		(0.0142)		
	[1.3440]		[-6.7189]	[6.1721]		[2.3804]		

Note:

1. Numbers in () are standard deviations, in [ ] are the t-value.
2. * denotes significant at 5% level, ** denotes significant at 1% level.

Partial adjustment model:

$$D_t - D_{t-1} = a + r\gamma E_t - \gamma D_{t-1} + u_t \cdot$$

Adaptive expectation model:

$$D_t - D_{t-1} = r\delta E_t - \delta D_{t-1} + u_t - (1-\delta)u_{t-1}$$

Model modified from Campbell, Grossman and Wang (1993):

$$D_t - D_{t-1} = (\alpha_D - 1)(D_{t-1} - \overline{D}) + rE_{t-1} + u_{D,t} \cdot$$

Generalized model:

$$D_t - D_{t-1} = c_0 + c_1 t + c_2 D_{t-1} + c_3 D_{t-2} + c_4 E_t + c_5 E_{t-1} + u_t \,.$$

Table A.7

Granger Causality Tests for p_t and d_t

	p ➔ d	d ➔ p
World Index	0.96	1.16
W.I. excl. U.S.	1.14	1.55

Individual Index

	p ➔ d	d ➔ p	p ➔ d (in U.S. Dollar)	d ➔ p (in $ Dollar)
Canada	2.01*	1.01	1.06	1.37
France	2.63**	1.99*	1.40	1.73
Italy	4.98**	1.16	3.87**	1.06
Japan	2.14*	0.99	1.44	0.54
Germany	2.95**	2.76**	2.94**	2.46**
U.K.	2.11*	1.55	0.95	0.84
U.S.	4.99**	2.44**	4.99**	2.44**
Argentina	1.63	1.44	1.35	0.42
Brazil	11.97**	13.95**	1.66	2.41*
Hong Kong	1.69	2.16*	1.69	2.17*
Malaysia	0.90	0.69	1.14	0.42
Mexico	2.11*	2.60**	1.57	1.24
Singapore	1.57	1.70	1.57	1.89*
S. Korea	1.55	1.23	1.60	1.56
Taiwan	0.75	1.14	1.00	1.20
Thailand	1.48	0.69	2.15*	0.61

Note: 1. * 5% significant level; ** 1% significant level

2. The numbers shown are F-statistics

3. $p_t = P_t - P_{t-1}$, $d_t = E_t D_{t+1} - E_{t-1} D_{t+1}$

4. The test results of using MSCI data are reported in Table 4'. Most indices show the similar pattern.

Table A.8

Granger Causality Tests for p_t and d_t

	Lag = 4		Lag = 2	
	p ➔ d	d ➔ p	p ➔ d	d ➔ p
Market portfolio	1.55	1.84	3.05	0.37
S&P500	2.10	1.71	2.38	0.26

Individual Portfolio

	Lag = 4		Lag = 2	
	p ➔ d	d ➔ p	p ➔ d	d ➔ p
Portfolio 1	1.82	1.62	1.86	1.65
Portfolio 2	0.81	1.42	0.31	0.85
Portfolio 3	1.16	1.10	4.77*	2.08
Portfolio 4	3.31*	5.98**	5.59**	5.05**
Portfolio 5	3.83**	2.09	2.58	1.05
Portfolio 6	0.09	1.59	0.17	0.95
Portfolio 7	0.40	1.28	0.36	0.28
Portfolio 8	1.93	0.57	1.34	1.92
Portfolio 9	4.76**	3.58*	3.51*	4.80**
Portfolio 10	3.56*	0.29	1.11	0.19

Note:

1. * 5% significant level; ** 1% significant level
2. The numbers shown are F-statistics
3. $p_t = P_t - P_{t-1}$, $d_t = E_t D_{t+1} - E_{t-1} D_{t+1}$

Appendix B. Identification of the Simultaneous Equation System

Note that given G is nonsingular, $\Pi = -G^{-1} H$ in equation (21) can be written as

(A-1) $\qquad AW = 0$

$$\text{where } A = [G \quad H] = \begin{pmatrix} g_{11} & g_{12} & \ldots\ldots & g_{1n} & h_{11} & h_{12} & \ldots\ldots & h_{1n} \\ g_{21} & g_{22} & \ldots\ldots & g_{1n} & h_{21} & h_{22} & \ldots\ldots & h_{2n} \\ . & & & & & . & & \\ . & & & & & . & & \\ g_{n1} & g_{n2} & \ldots\ldots & g_{nn} & h_{n1} & h_{n2} & \ldots\ldots & h_{nn} \end{pmatrix},$$

$$W = [\Pi \quad I_n]' = \begin{pmatrix} \pi_{11} & \pi_{12} & \ldots\ldots & \pi_{1n} & 1 & 0 & \ldots\ldots & 0 \\ \pi_{21} & \pi_{22} & \ldots\ldots & \pi_{1n} & 0 & 1 & \ldots\ldots & 0 \\ . & & & & & . & & \\ . & & & & & . & & \\ \pi_{n1} & \pi_{n2} & \ldots\ldots & \pi_{nn} & 0 & 0 & \ldots\ldots & 1 \end{pmatrix}$$

That is, A is the matrix of all structure coefficients in the model with dimension of n times 2n and W is a 2n times n matrix. The first equation in (A. 1) can be expressed as

(A-2) $\qquad A_1W = 0,$

where A_1 is the first row of A, i.e., $A_1= [g_{11}\ g_{12}\ldots.g_{1n}\ h_{11}\ h_{12}\ldots..h_{1n}]$.

Since the elements of Π can be consistently estimated and I_n is the identity matrix, equation (A. 2) contains 2n unknowns in terms of π's. Thus, there should be n restrictions on the parameters to solve equation (A. 2) uniquely. First, one can try to impose normalization rule by setting g_{11} equal to 1 to reduce one restriction. As a result, there are at least n-1 independent restrictions needed in order to solve (A. 2).

It can be illustrated that the system represented by equation (4.2.2) is exactly identified with three endogenous and three exogenous variables. It is entirely similar to those cases of more variables. For example, if n=3, equation (19) can be expressed in the form

$$\text{(A-3)} \qquad -\begin{pmatrix} r^*cs_{11} + a_1 b_1 & r^*cs_{12} & r^*cs_{13} \\ r^*cs_{21} & r^*cs_{22} + a_2 b_2 & r^*cs_{23} \\ r^*cs_{31} & r^*cs_{32} & r^*cs_{33} + a_3 b_3 \end{pmatrix} \begin{pmatrix} p_{1t} \\ p_{2t} \\ p_{3t} \end{pmatrix}$$

$$+ \begin{pmatrix} cs_{11} + a_1 & cs_{12} & cs_{13} \\ cs_{21} & cs_{22} + a_2 & cs_{23} \\ cs_{31} & cs_{32} & cs_{33} + a_3 \end{pmatrix} \begin{pmatrix} d_{1t} \\ d_{2t} \\ d_{3t} \end{pmatrix} = \begin{pmatrix} v_{1t} \\ v_{2t} \\ v_{3t} \end{pmatrix}$$

where r^* = scalar of riskfree rate

s_{ij} = elements of variance-covariance matrix of return,

a_i = inverse of the supply adjustment cost of firm i,

b_i = overall cost of capital of firm i.

For Example, in the case of n=3, equation (19) can be written as

$$\text{(A-4)} \qquad -\begin{pmatrix} g_{11} & g_{12} & g_{13} \\ g_{21} & g_{22} & g_{23} \\ g_{31} & g_{32} & g_{33} \end{pmatrix} \begin{pmatrix} p_{1t} \\ p_{2t} \\ p_{3t} \end{pmatrix} + \begin{pmatrix} h_{11} & h_{12} & h_{13} \\ h_{21} & h_{22} & h_{23} \\ h_{31} & h_{32} & h_{33} \end{pmatrix} \begin{pmatrix} d_{1t} \\ d_{2t} \\ d_{3t} \end{pmatrix} = \begin{pmatrix} v_{1t} \\ v_{2t} \\ v_{3t} \end{pmatrix}$$

Comparing (A. 3) with (A. 4), the prior restrictions on the first equation take the form, $g_{12}= -r^*h_{12}$ and $g_{13}= -r^*h_{13}$, and so on.

Thus, one can put the restriction matrix for the first equation as this form:

$$\text{(A-5)} \qquad \Phi = \begin{pmatrix} 0 & 1 & 0 & 0 & r^* & 0 \\ 0 & 0 & 1 & 0 & 0 & r^* \end{pmatrix}',$$

Then, the relations from equation (A.2) in the parameters of the first equation give

$$\text{(A-6)} \qquad [g_{11}\ \ g_{12}\ \ g_{13}\ \ h_{11}\ \ h_{12}\ \ h_{13}] \begin{pmatrix} \pi_{11} & \pi_{12} & \pi_{13} & 0 & 0 \\ \pi_{21} & \pi_{22} & \pi_{13} & 1 & 0 \\ \pi_{31} & \pi_{32} & \pi_{33} & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & r^* & 0 \\ 0 & 0 & 1 & 0 & r^* \end{pmatrix} = [0\ \ 0\ \ 0\ \ 0\ \ 0\ \ 0]$$

That is, extending (A. 6), we have

$$\begin{aligned} &g_{11}\pi_{11} + g_{12}\pi_{21} + g_{13}\pi_{31} + h_{11} = 0, \\ &g_{11}\pi_{12} + g_{12}\pi_{22} + g_{13}\pi_{32} + h_{12} = 0, \\ \text{(A-7)} \qquad &g_{11}\pi_{13} + g_{12}\pi_{23} + g_{13}\pi_{33} + h_{13} = 0, \\ &g_{12} + r^*\, h_{12} = 0, \text{ and} \\ &g_{13} + r^*\, h_{13} = 0. \end{aligned}$$

The last two (n-1 = 3-1 = 2) equations in (A.7) give the value h_{12} and h_{13} and the normalization condition, $g_{11} = 1$, allow us to solve equation (A.2) in terms of π's uniquely. That is, in the case n=3, the first equation represented by (A.2), $A_1W = 0$, can be finally rewritten as (A. 7). Since there are three unknowns, g_{12}, g_{13} and h_{11}, left for the first three equations in (A.7), the first equation A_1 is exactly identified. Similarly, it can be shown that the second and the third equations are also exactly identified.

Appendix C. Country Index List

WI	World index: FT-Actuaries World $ Index (w/GFD extension)
AG	Argentina: Buenos Aires SE General Index (IVBNG)
BZ	Brazil: Brazil Bolsa de Valores de Sao Paulo (Bovespa) (_BVSPD)
CD	Canada: Canada S&P/TSX 300 Composite Index (_GSPTSED)
FR	France: Paris CAC-40 Index (_FCHID)
GM	German: Germany Deutscher Aktienindex (DAX) (_GDAXD)
IT	Italy: Banca Commerciale Italiana General Index (_BCIID)
HK	Hong King: Hong Kong Hang Seng Composite Index (_HSID)
JP	Japan: Japan Nikkei 225 Stock Average (_N225D)
MA	Malaysia: Malaysia KLSE Composite (_KLSED)
MX	Mexico: Mexico SE Indice de Precios y Cotizaciones (IPC) (_MXXD)
SG	Singapore: Singapore Straits-Times Index (_STID)
KO	South Korea: Korea SE Stock Price Index (KOSPI) (_KS11D)
TW	Taiwan: Taiwan SE Capitalization Weighted Index (_TWIID)
TL	Thailand: Thailand SET General Index (_SETID)
UK	United Kingdom: UK Financial Times-SE 100 Index (_FTSED)
US	United States: S&P 500 Composite (_SPXD)
WIXUS	World index excluding U.S.

III. 計畫成果自評

With the results of this research project, we'll submit a paper to top quality journals in either economics or finance for publication.

出席國際學術會議心得報告

I have gone to the U.S. on June 10 and 11, 2005 to jointly in charge of the 13th Annual Conference on Pacific Basin Finance, Economics, and Accounting at Rutgers University. The 13th Conference on Pacific Basin Finance, Economics, and Accounting was held at Rutgers University on June 10-11, 2005. The result was both exciting and outstanding. This conference has become one of the most prestigious academic conferences in finance and accounting nationally and internationally. See the attached program for the details of the two-day event.

The seventeen-member executive committee coordinated the program are as follows: James R. Barth, Auburn University, USA; Ren Raw Chen, Rutgers University , USA; Chin-chen Chien, National Cheng-Kung University, Taiwan; J. Jay Choi, Temple University, USA; Yasuo Hoshino, University of Tsukuba, Japan; Frank C. Jen, SUNY at Buffalo, USA; John C. Lee, JP Morgan Chase & Company, USA; Alice C. Lee, San Francisco State University , USA; Picheng Lee, Pace University, USA; William T. Lin, Tamkang University, Taiwan; Martin Markowitz, Rutgers University, USA; Oded Palmon, Rutgers University, USA; James H. Scott, Prudential Investments, USA; Khee Giap Tan, Nangyang Technological University, Singapore; Emilio Venezian, Rutgers University, USA; Gili Yen, Chaoyang University of Technology, Taiwan; Gillian Yeo, Nanyang Technological University, Singapore.

The detailed program is as follows:

Friday, June 10, 2005

8.00 a.m. – 9.00 a.m. Registration and Continental Breakfast

9:00 a.m. – 9: 10 a.m. Welcome, Auditorium, Livingston Student Center
Speaker: Cheng Few Lee

9:10 a.m. – 9:20 a.m. Opening Remarks, Auditorium, Livingston Student Center
Speaker: Provost Steve Diner

9:20 a.m. – 9:30 a.m. Opening Remarks, Auditorium, Livingston Student Center
Speaker: Dean H. Tuckman,

9:30 a.m. – 10:10 a.m. Keynote Speech I, Auditorium, Livingston Student Center
Speaker: Robert F. Engle

10:10 a.m. – 10:40 a.m. Keynote Speech II, Auditorium, Livingston Student Center
Speaker: Thomas M.F. Yeh

10:40 a.m. – 11:10 a.m. Keynote Speech III, Auditorium, Livingston Student Center
Speaker: George Kaufman

1:10 a.m. – 11:25 a.m. Coffee break

Concurrent Sessions: 11.25 a.m. – 1:00 p.m.

Session I: Microstructure (Room JHL107C)
Session II: Futures Markets (Room JHL 107B)
Session III: Corporate Governance (Room JHL 106)
Session IV: MBS and Credit Derivatives- the recent development (Room JHL 003)
Session V: Imputation Systems: Dividends and Capital Structure (Room JHL 006)
Session VI: Monetary Policy (Room JHL 005)

1:00 p.m. – 1:40 p.m. Lunch

1:40p.m. – 2:20 p.m. Keynote Speech IV, Auditorium, Livingston Student Center
Speaker: Martin J. Gruber

Concurrent Sessions: 2.30 p.m. – 4:00 p.m

Session VII: Foreign Exchange Markets (Room JHL 107C)
Session VIII: Options Markets (Room JHL 107B)
Session IX: Valuation and Risk Management (Room JHL 106)
Session X: Empirical Finance (Room JHL 003)
Session XI: Credit Risk Management (Room JHL 006)
Session XII: Economic Indicators and Stock Market of US and Japan (Room JHL 005)

4:00 p.m. – 4:15 p.m. Coffee

Concurrent Sessions: 4:30 p.m. – 6:00 p.m

Session XIII: Impacts of Outsourcing on U.S. Economy (Room JHL 107C)
Session XIV: Corporate Finance (A) (Room JHL 107B)
Session XV: Global Trends in Hedge Funds (Room JHL 106)
Session XVI: IPO (Room JHL 003B)
Session XVII: Returns Predictability (Room JHL 006)
Session XVIII: International Finance and Emerging markets (Room JHL 005)

6:30 p.m. – 8:00 p.m. Dinner at Hayett Regency (Garden State Ballroom)

Saturday, June 11, 2005

8:00 a.m. – 9:00a.m. Registration and Continental Breakfast

9:00 a.m. – 9:40 a.m. Keynote Speech V, Auditorium, Livingston Student Center
Speaker: Wayne Ferson

9:40 a.m. – 10:20 a.m. Keynote Speech VI, Auditorium, Livingston Student Center
Speaker: Kose John

10:20 a.m. – 10:35 a.m. Coffee break

10:35 a.m. – 12:00pm International Management Education
Auditorium, Livingston Student Center

12:00p.m. – 1:20p.m. Lunch

Concurrent Sessions: 1:30p.m. – 3:00 p.m.

Session XIX: Corporate Finance (B) (Room JHL 107C)
Session XX: Interest Rate Models (Room JHL 102)
Session XXI: Financial Accounting (Room JHL 106)
Session XXII: Credit Risk Management (Room JHL 103
Session XXIII: International Accounting (Room JHL 006)
Session XXIV: Asian Financial Market (Room 005)

3:00 p.m. – 3:30 p.m.   Coffee break

Concurrent Sessions: 3:30p.m. – 5:00 p.m.

Session XXV: Credit Risk (Room JHL 107C)
Session XXVI: Banking Management and Monetary Policy (Room JHL 102)
Session XXVII: Asian Stock Market and Corporate Finance (Room JHL 106)
Session XXVIII: Financial Econometrics (Room JHL 103)
Session XXIX: International Corporate Governance   (Room JHL 006)
Session XXX: Executive Compensation (Room JHL 005)