



Behavioral: Some Challenges to Market Efficiency

A&D Ch. 4

Efficient Markets Hypothesis

- Core idea: ***Prices of securities in financial markets fully reflect all available information in the markets.***
- 3 versions of market efficiency
 - **Weak form:** prices reflect all the information contained in historical returns.
 - **Semi-strong form:** prices reflect all publicly available information, including past earnings and earning forecasts, everything in the publicly released financial statements (past and most recent), everything relevant appearing in the business press, and anything else considered relevant.
 - **Strong form:** prices even reflect information that is not publicly available, such as insiders' information.

Anomalies

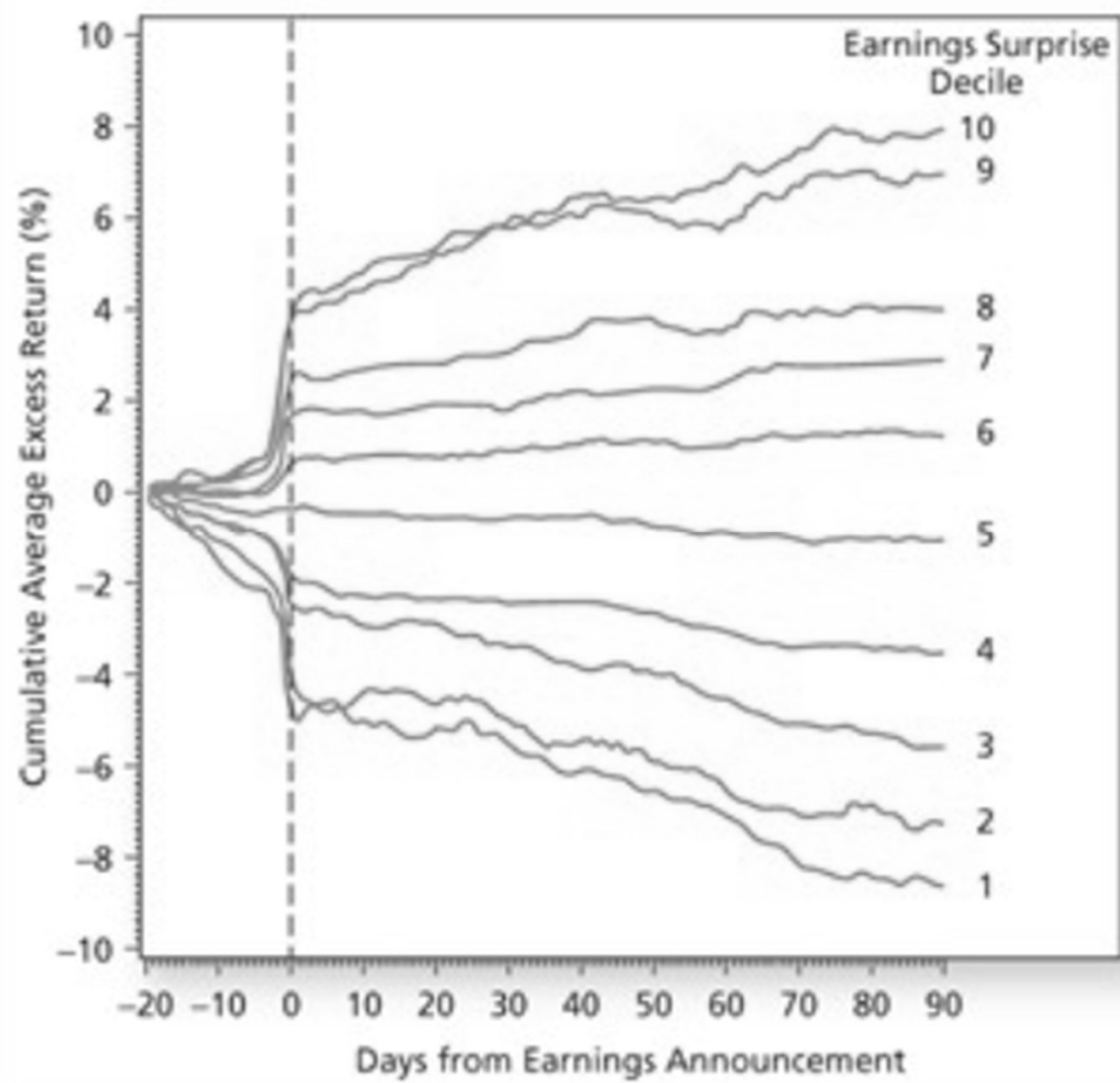
- [Siegel&Thaler] An empirical result qualifies as an ***anomaly*** if it is difficult to “rationalize” or if implausible assumptions are necessary to explain it within the paradigm.
- [A&D] **Anomalies** are empirical results that appear, until adequately explained, to run counter to market efficiency.
- [A&D] Since all tests of market efficiency require the use of an asset pricing model, efficiency tests are by their nature joint hypothesis tests (market efficiency and a risk-adjustment technique). Rejection implies either inefficiency or an inappropriate risk-adjustment method (or perhaps both).

Key Anomaly 1: Lagged Reactions to Earning Announcements

- Market efficiency tests based on earning announcements typically used the *event study* methodology.
- An event study
 - looks at a large number of similar events for a comprehensive sample of firms
 - work in terms of event-time rather than calendar-time
 - calculate excess returns (or residuals) on days leading up to the event, on the day of the event, and on days after the event
 - average these residuals over all events in the sample
 - accumulate these residuals to arrive at cumulative average residuals (CARs).
- Note: excess returns are returns above what needs to be earned in compensation for risk.

Key Anomaly 1: Lagged Reactions to Earning Announcements

- An important event that all firms regularly experience is an earnings announcement.
- According to a study by Richard Rendleman, Chales Jones and Henry Latane, which examines daily return data around the quarterly earnings announcement of about 1,000 firms during 1972 – 1980.
- Their prodedure was to divide earnings announcements into 10 deciles, ranging from extremely positive surprises (in decile 10) to extremely negative surprises (in decile 1).
- Surprises are defined to be announced earnings minus expected earnings (scaled by volatility or standard error).



Key Anomaly 1: Lagged Reactions to Earning Announcements

- The previous figure shows that on the day of the announcement, the market reacts correspondingly.
- However, the tendency there to be a continued drift in prices, especially after unexpected very good or unexpected very bad earning announcements.
- The latter is inconsistent with market efficiency, since it appeared that the drift was sufficiently large, so that a speculative profit would remain.

Key Anomaly 2: Small-firm effect

- The **small-firm effect** is the tendency for firms with low levels of market capitalization to earn excess returns after accounting for market risk.
- Using U.S. data, for example, a portfolio – long the smallest firms and short the largest firms – was able to earn 1.52% per month during 1931 – 1975.
- Deepening the mystery, further research indicated that much of the small-firm effect was concentrated in January, implying that the effect was largely a *January effect*.
- Even if a tax-related reason is compelling, the question remains why arbitrageurs did not eliminate the decline in prices at year-end.
- However, the stability of the small-firm effect has been questioned. It has declined dramatically in the last 20 years or so.

Key Anomaly 3: Value Vs Growth

- **Value stocks** are defined to be stocks with prices that are low relative to earnings, cash flows, and book value.
- **Growth stocks** are stocks with prices that are high relative to earnings, cash flows and book value, at least in part because the market anticipates high future growth.
- **Value investing** is the tendency to overweight value stocks (relative to growth stocks) in one's portfolio.

Key Anomaly 3: Value Vs Growth

- A study by Sanjoy Basu focused on P/E ratios.
- Sampling an average of 500 stocks per year over 1956 – 1969, he grouped them into quintiles on the basis of P/E ratios.
- Hypothetical portfolios were formed at the beginning of the year and then held for 12 months.
- Results are as shown in the following table.
- It is apparent that high P/E firms had lower returns than did low P/E firms.
- Market risk did not account for this as low P/E portfolio were actually less risky than were high P/E portfolios – at least in the sense of CAPM.

Performance Measure/ Summary Statistic	CAPM defined with	P/E Portfolios ¹						Market Portfolios ¹	
		<i>A</i>	<i>A</i> [*]	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>S</i>	<i>F</i>
Median P/E ratio and inter-quartile range ²	—	35.8 (41.8)	30.5 (21.0)	19.1 (6.7)	15.0 (3.2)	12.8 (2.6)	9.8 (2.9)	15.1 (9.6)	
Average annual rate of return (r_p) ³	—	0.0934	0.0955	0.0928	0.1165	0.1355	0.1630	0.1211	0.1174
Average annual excess return (r'_p) ⁴	r_f	0.0565	0.0585	0.0558	0.0796	0.0985	0.1260	0.0841	0.0804
	r_z	0.0194	0.0214	0.0187	0.0425	0.0613	0.0889	0.0470	0.0433
Systematic risk ($\hat{\beta}_p$)	r_f	1.1121	1.0579	1.0387	0.9678	0.9401	0.9866	1.0085	1.0000
	r_z	1.1463	1.0919	1.0224	0.9485	0.9575	1.0413	1.0225	1.0000

Key Anomaly 3: Value Vs Growth

- A related anomaly is based on the book-to-market price (B/P or B/M) ratio.
- A study by Lakonishok, Shleifer, and Vishny shows that firms with high book-to-market ratios tend to outperform firms with low book-to-market ratios, after adjusting for risk.
- Results are as shown in the following table.
- The highest book-to-market decile (decile 10) earned on average 17.3%, while the lowest book-to-market decile (decile 1) earned 11.0%.
- Over five-year intervals, the gap was even greater; 19.8% vs. 9.3%.

	Glamour									Value
	1	2	3	4	5	6	7	8	9	10
Panel A: B/M										
R_1	0.110	0.117	0.135	0.123	0.131	0.154	0.154	0.170	0.183	0.173
R_2	0.079	0.107	0.140	0.145	0.153	0.156	0.169	0.164	0.182	0.188
R_3	0.107	0.132	0.155	0.167	0.165	0.172	0.191	0.207	0.196	0.204
R_4	0.081	0.133	0.136	0.160	0.170	0.169	0.188	0.204	0.213	0.207
R_5	0.088	0.137	0.163	0.175	0.171	0.176	0.216	0.201	0.206	0.215
AR	0.093	0.125	0.146	0.154	0.158	0.166	0.184	0.189	0.196	0.198
CR_5	0.560	0.802	0.973	1.045	1.082	1.152	1.320	1.375	1.449	1.462

Key Anomaly 3: Value Vs Growth

- A study has shown that the previous results are consistent over different markets and time periods.
- A study by Fama and French applied various value investing approaches over different markets – for example, U.S., Japan, U.K., France, Germany etc.
- In all 15 cases value stocks outperformed growth (or glamour) stocks, where value/glamour portfolios were formed within each country by forming portfolios from the top/bottom 30% of stocks for each year on the basis of beginning-of-year B/P, E/P, and CF/P.

Table III

Annual Dollar Returns in Excess of U.S. T-Bill Rate for Market, Value, and Growth Portfolios: 1975–1995

Value and growth portfolios are formed on book-to-market equity (B/M), earnings/price (E/P), cashflow/price (C/P), and dividend/price (D/P), as described in Table II. We denote value (high) and growth (low) portfolios by a leading H or L; the difference between them is H – L. The first row for each country is the average annual return. The second is the standard deviation of the annual returns (in parentheses) or the *t*-statistic testing whether H – L is different from zero [in brackets].

	Market	HB/M	LB/M	H-LB/M	HE/P	LE/P	H-LE/P	HC/P	LC/P	H-LC/P	HD/P	LD/P	H-LD/P
U.S.	9.57 (14.64)	14.55 (16.92)	7.75 (15.79)	6.79 [2.17]	14.09 (18.10)	7.38 (15.23)	6.71 [2.28]	13.74 (16.73)	7.08 (15.99)	6.66 [2.08]	11.75 (13.89)	8.01 (17.04)	3.73 [1.22]
Japan	11.88 (28.67)	16.91 (27.74)	7.06 (30.49)	9.85 [3.49]	14.14 (26.10)	6.67 (27.62)	7.47 [4.00]	14.95 (31.59)	5.66 (29.22)	9.29 [3.03]	16.81 (35.01)	7.27 (27.51)	9.54 [2.53]
U.K.	15.33 (28.62)	17.87 (30.03)	13.25 (27.94)	4.62 [1.08]	17.46 (32.32)	14.81 (27.00)	2.65 [0.83]	18.41 (35.11)	14.51 (26.55)	3.89 [0.85]	15.89 (32.18)	12.99 (26.32)	2.90 [0.72]
France	11.26 (32.35)	17.10 (36.60)	9.46 (30.88)	7.64 [2.08]	15.68 (37.05)	8.70 (32.35)	6.98 [2.16]	16.17 (36.92)	9.30 (31.26)	6.86 [2.29]	15.12 (30.06)	6.25 (33.16)	8.88 [2.48]
Germany	9.88 (31.36)	12.77 (30.35)	10.01 (32.75)	2.75 [0.92]	11.13 (24.62)	10.58 (34.82)	0.55 [0.14]	13.28 (29.05)	5.14 (26.94)	8.13 [2.62]	9.99 (24.88)	10.42 (34.42)	-0.43 [-0.10]
Italy	8.11 (43.77)	5.45 (35.53)	11.44 (50.65)	-5.99 [-0.91]	7.62 (42.36)	12.99 (54.68)	-5.37 [-0.84]	11.05 (43.52)	0.37 (38.42)	10.69 [1.73]	10.07 (38.28)	12.68 (56.66)	-2.61 [-0.33]
Netherlands	13.30 (18.81)	15.77 (33.07)	13.47 (21.01)	2.30 [0.44]	14.37 (21.07)	9.26 (20.48)	5.11 [1.04]	11.66 (33.02)	11.84 (23.26)	-0.19 [-0.03]	13.47 (21.38)	13.05 (30.81)	0.41 [0.07]
Belgium	12.62 (25.88)	14.90 (28.62)	10.51 (27.63)	4.39 [1.99]	15.12 (30.47)	12.90 (27.88)	2.22 [0.78]	16.46 (28.84)	12.03 (25.57)	4.44 [1.27]	15.16 (26.47)	12.26 (29.26)	2.91 [1.29]
Switzerland	11.07 (27.21)	13.84 (30.00)	10.34 (28.57)	3.49 [0.80]	12.59 (31.44)	11.04 (28.81)	1.54 [0.36]	12.32 (36.58)	9.78 (27.82)	2.53 [0.41]	12.62 (31.00)	10.44 (27.83)	2.18 [0.63]
Sweden	12.44 (24.91)	20.61 (38.31)	12.59 (26.26)	8.02 [1.16]	20.61 (42.43)	12.42 (24.76)	8.19 [1.03]	17.08 (30.56)	12.50 (23.58)	4.58 [0.90]	16.15 (29.55)	11.32 (25.13)	4.83 [1.05]
Australia	8.92 (26.31)	17.62 (31.03)	5.30 (27.32)	12.32 [2.41]	15.64 (28.19)	5.97 (28.89)	9.67 [1.71]	18.32 (29.08)	4.03 (27.46)	14.29 [2.85]	14.62 (28.43)	6.83 (28.57)	7.79 [1.65]
Hong Kong	22.52 (41.96)	26.51 (48.68)	19.35 (40.21)	7.16 [1.35]	27.04 (44.83)	22.05 (40.81)	4.99 [0.82]	29.33 (46.24)	20.24 (42.72)	9.09 [1.37]	23.66 (38.76)	23.30 (42.05)	0.35 [0.09]
Singapore	13.31 (27.29)	21.63 (36.89)	11.96 (27.71)	9.67 [2.36]	15.21 (29.55)	13.12 (34.68)	2.09 [0.65]	13.42 (26.24)	8.03 (28.92)	5.39 [1.49]	10.64 (22.01)	13.10 (33.93)	-2.46 [-0.45]

Key Anomaly 4: Momentum Vs Reversal

- Weak-form efficiency says that returns should not be predictable by conditioning merely on lagged returns.
- However, ...
- **Momentum** exists when returns are positively correlated with past returns
- **Reversal** exists when returns are positively correlated with past returns.
- For short-term interval (one-month), there is reliable reversal.
- For medium-term interval (about 3 – 12 months), there is well-documented momentum.
- For long-term intervals (about 3 – 5 years), reversal is typical.

Key Anomaly 4: Momentum Vs Reversal

- Werner De Bondt and Richard Thaler formed portfolios of “winners” and “losers” based on past performance relative to benchmark.
- Winners are the top 50 stocks in terms of performance net of the market over the formation period. Losers are the bottom 50.
- Then these winner and loser portfolios were tracked going forward.
- If the markets are efficient, there should be no difference between the post-formation excess returns of winners and losers.
- The following figure shows results based on 5-year formation periods and future returns being tracked 5 years forward.
- From the figure, past losers substantially outperform past winners.
 - Much of the difference is generated by the strong performance of losers rather than the weak performance of past winners.
 - Much of the return boost/drop occurs in the month of January.

Average of 46 Yearly Replications
 Starting Every January Between 1933 and 1978
 Length of Formation Period: Five Years

image 11

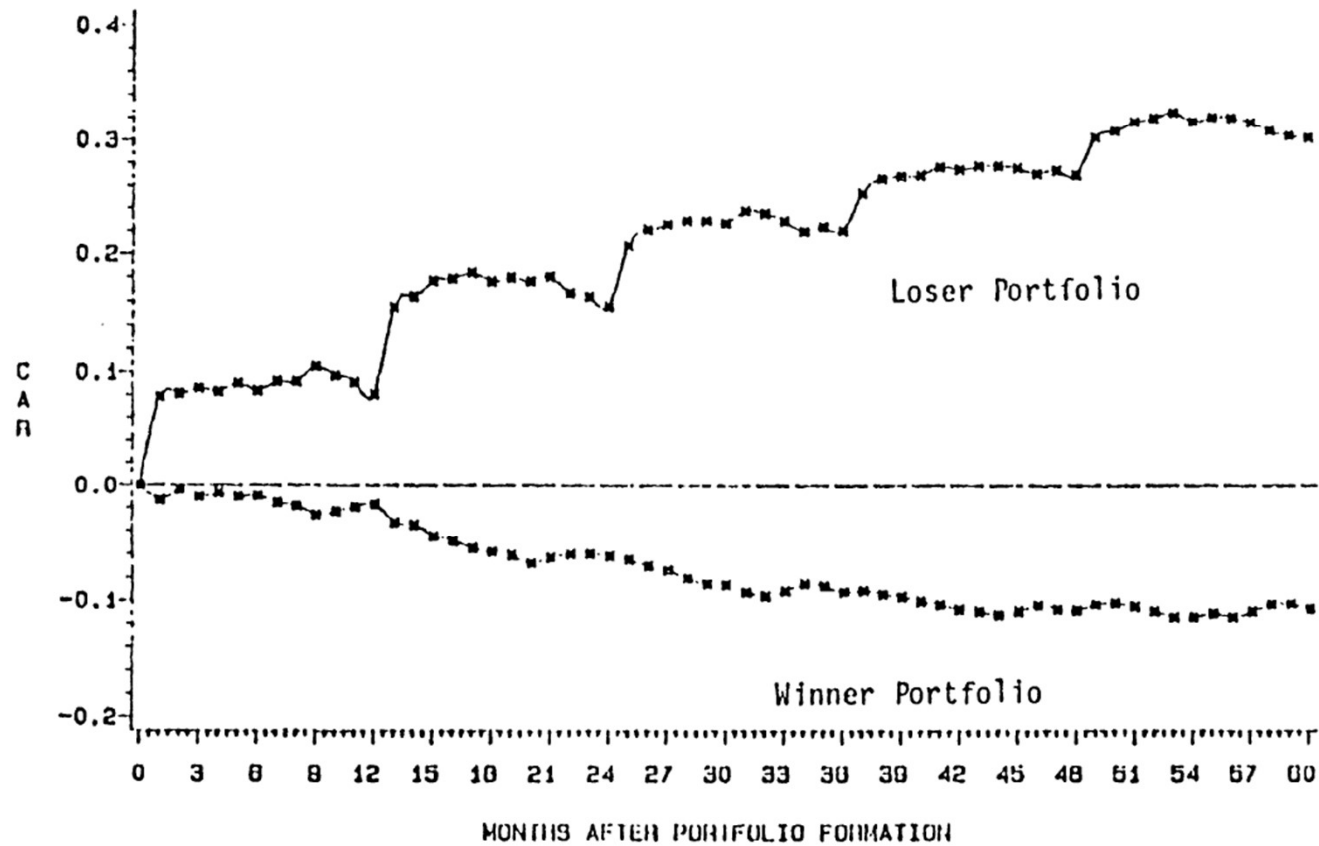


Figure 3. Cumulative Average Residuals for Winner and Loser Portfolios of 35 Stocks (1-60 months into the test period)

Key Anomaly 4: Momentum Vs Reversal

- Several years later, momentum was documented by Jegadeesh and Titman. Their approach is similar to that of De Bondt and Thaler, but their return intervals were shorter.
- The results of their study are as shown in the following table.
- They found, for example, that a long-short zero-cost portfolio formed on the basis of returns over the previous six months earned an average excess return of 0.95% per month over the next six months.
- While transaction costs lead to some erosion of momentum profitability, they remain reliable for institutional investors.

	<i>J</i>	Panel A					Panel B				
		<i>K</i> =	3	6	9	12	<i>K</i> =	3	6	9	12
3	Sell		0.0108 (2.16)	0.0091 (1.87)	0.0092 (1.92)	0.0087 (1.87)		0.0083 (1.67)	0.0079 (1.64)	0.0084 (1.77)	0.0083 (1.79)
3	Buy		0.0140 (3.57)	0.0149 (3.78)	0.0152 (3.83)	0.0156 (3.89)		0.0156 (3.95)	0.0158 (3.98)	0.0158 (3.96)	0.0160 (3.98)
3	Buy-sell		0.0032 (1.10)	0.0058 (2.29)	0.0061 (2.69)	0.0069 (3.53)		0.0073 (2.61)	0.0078 (3.16)	0.0074 (3.36)	0.0077 (4.00)
6	Sell		0.0087 (1.67)	0.0079 (1.56)	0.0072 (1.48)	0.0080 (1.66)		0.0066 (1.28)	0.0068 (1.35)	0.0067 (1.38)	0.0076 (1.58)
6	Buy		0.0171 (4.28)	0.0174 (4.33)	0.0174 (4.31)	0.0166 (4.13)		0.0179 (4.47)	0.0178 (4.41)	0.0175 (4.32)	0.0166 (4.13)
6	Buy-sell		0.0084 (2.44)	0.0095 (3.07)	0.0102 (3.76)	0.0086 (3.36)		0.0114 (3.37)	0.0110 (3.61)	0.0108 (4.01)	0.0090 (3.54)
9	Sell		0.0077 (1.47)	0.0065 (1.29)	0.0071 (1.43)	0.0082 (1.66)		0.0058 (1.13)	0.0058 (1.15)	0.0066 (1.34)	0.0078 (1.59)
9	Buy		0.0186 (4.56)	0.0186 (4.53)	0.0176 (4.30)	0.0164 (4.03)		0.0193 (4.72)	0.0188 (4.56)	0.0176 (4.30)	0.0164 (4.04)
9	Buy-sell		0.0109 (3.03)	0.0121 (3.78)	0.0105 (3.47)	0.0082 (2.89)		0.0135 (3.85)	0.0130 (4.09)	0.0109 (3.67)	0.0085 (3.04)
12	Sell		0.0060 (1.17)	0.0065 (1.29)	0.0075 (1.48)	0.0087 (1.74)		0.0048 (0.93)	0.0058 (1.15)	0.0070 (1.40)	0.0085 (1.71)
12	Buy		0.0192 (4.63)	0.0179 (4.36)	0.0168 (4.10)	0.0155 (3.81)		0.0196 (4.73)	0.0179 (4.36)	0.0167 (4.09)	0.0154 (3.79)
12	Buy-sell		0.0131 (3.74)	0.0114 (3.40)	0.0093 (2.95)	0.0068 (2.25)		0.0149 (4.28)	0.0121 (3.65)	0.0096 (3.09)	0.0069 (2.31)

Key Anomaly 4: Momentum Vs Reversal

- Other research found that momentum existed not just at the level of the firm, but also at the level of the industry.
- Also, there is a relationship between post-earnings announcement drift and momentum.
- Momentum has been found to be robust internationally.
- Similarly, long-term reversals have been documented in a number of markets outside the U.S.

Key Anomaly 5: Excessive Volatility

- According to Robert Shiller, The anomaly represented by the notion of excess volatility seems to be much more troubling for efficient market theory than some other financial anomalies.
- Since price in the market reflects all available information, while optimal forecast of each individual person may involve with errors. We can state that

$$E(P_t^*) = P_t$$

where P_t^* is optimal forecast from discounted cashflows and P_t is market price.

- The efficient market hypothesis, then, can be stated as:

$$P_t^* = P_t + u_t$$

- Market price should be less variable than the optimal forecast. However, ...

Figure 1

Real Stock Prices and Present Values of Subsequent Real Dividends

(annual data)

