



Capital Expenditure and Research & Development versus Stock Price

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April 23, 2003



Agenda

- Literature review on Investment Decisions
- Methodology
- Paper 1 – “Corporate capital expenditure decisions and the market value of the firm”
- Paper 2 – “Corporate research and development expenditures and share value”
- Recent research
- Current paper

Literature on Investment Decisions

Year	Research Topic	Authors
1976	<i>Agency problem.</i> Managers undertake negative NPV projects that benefit themselves when they have small ownership shares.	Jensen, Meckling
1985	Abnormal return on stock price that correlates positively with unexpected change in capital expenditure.	McConnell & Muscarella
1986	<i>Agency problem.</i> Managers overinvest with free cash flow to enlarge firm size for more power and advancement opportunities.	Jensen
1989	<i>Managerial myopic behavior.</i> Shareholders use earnings to evaluate performance due to insufficient information, and managers forego marginal positive NPV projects to maintain high earnings.	Stein
1990	Abnormal return on stock price that correlates positively with unexpected change in research and development expenditure.	Chan, Martin, Kensinger
1992	<i>Stock market / shareholder myopic behavior.</i> Shareholders use earnings to evaluate performance due to insufficient information, and share price increase when capex decreased (earning increase) and vice versa.	Porter
2000	Return on stock price that has no correlation unexpected change in capital budget expenditure.	Huson, Morck, Smith, Yu

Market Myopia

■ Pollak (1989); Stein (1988)

- investors cannot see beyond current earnings
- L/T payoff investments (e.g. R&D) will affect S/T earnings and will depress stock prices
 - More attractive takeover target
 - Management avoids L/T investments
 - Remove the threat of takeover and management will invest for the L/T

■ Meulbroek et al. (1990)

- Offers evidence against Market Myopia
- R&D spending decreased after passing anti-takeover amendments to corporate charters.



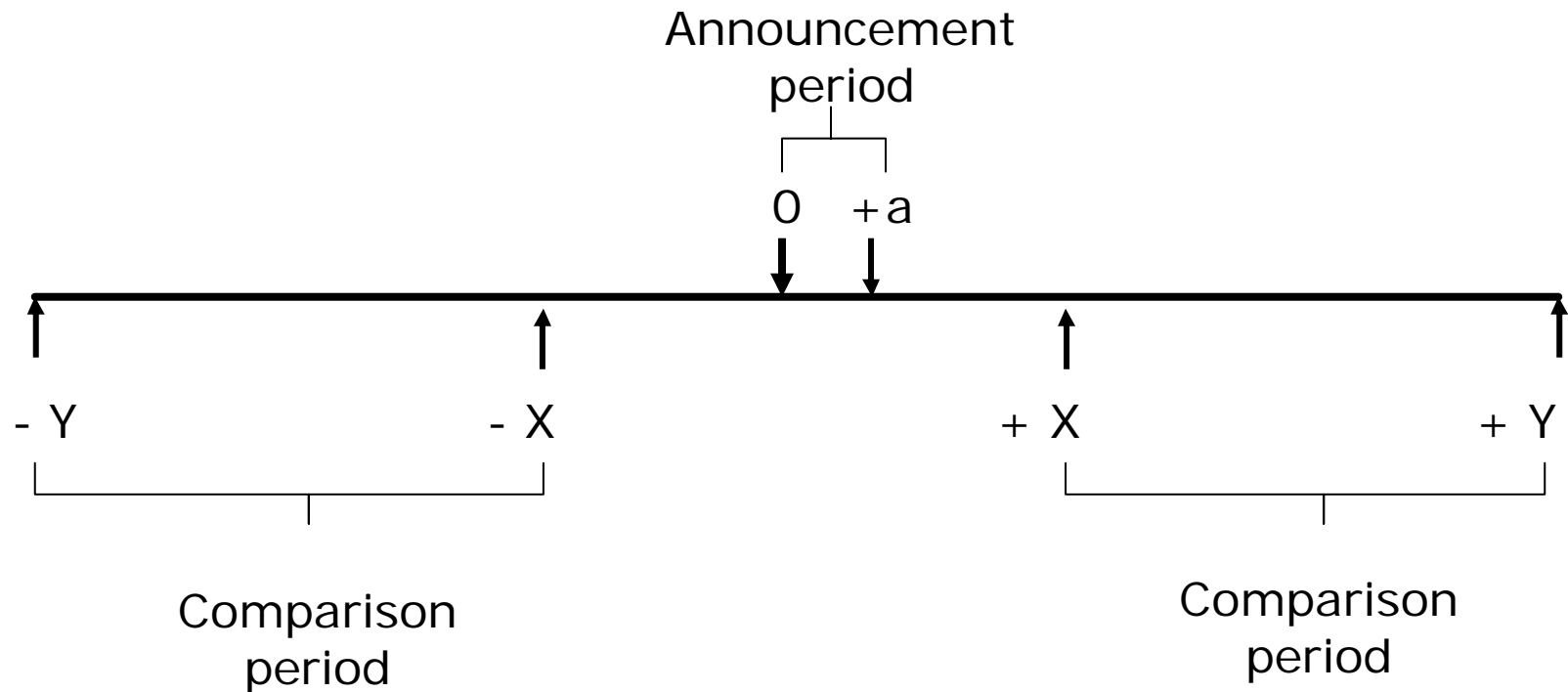
Managerial Myopia

■ Jensen (1986)

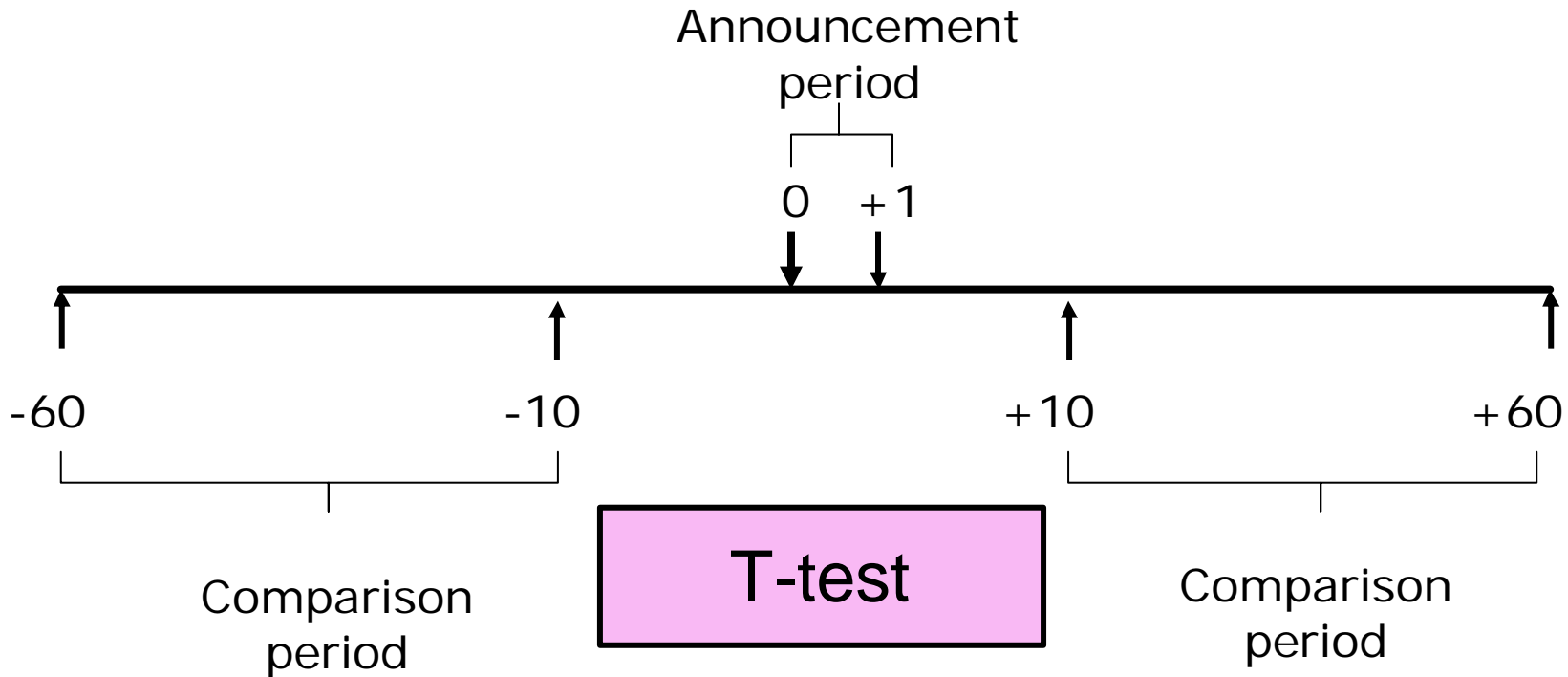
- Managers hold little stock in company + compensated based on S/T objective e.g. accounting earnings
- Managers avoid L/T investments due to self interest

Methodology

- Event studies – the measurement of an abnormal stock return



Methodology



Ho – Mean return on announcement period = Mean return on comparison period

Ha – Mean return on announcement period ¹ Mean return on comparison period



Paper One

Corporate capital expenditure decisions and the market value of the firm

- John J. McConnell
- Chris J. Muscarella
- Journal of Financial Economics 14 (1985) 399-422

Research question

- Given the information contained in the announcement, does the market respond in a way that an unexpected increase in Capex would lead to an increase in the market value of the firm and vice versa?

↑ Capex => ↑ Firm value ?

Background

■ Traditional valuation theory

- Developed by Miller and Modigliani (1961)
- The market value of the firm is equal to the discounted value of future earnings expected to be generated by assets already in place, plus the discounted net present value of investment opportunities that are expected to be available to the firm in the future.

$$\text{Market Value} = \text{NPV (existing assets)} + \text{NPV (new investment)}$$

Background

- Market value maximization hypothesis
 - suggested by Fama and Miller (1972)
 - assumes that managers seek to maximize the market value of the firm in making investment decisions
 - Rate of return $>$ market required return
 - an announcement of an unexpected increase in capital expenditures should have a positive impact on the market value of the firm and vice versa.

↑ Capex => ↑ NPV (new investment) => ↑ Firm value



Data collection

- Stock prices of 658 listed corporations over the period of 1975 through 1981
- Samples of firms which made public announcement about their capital expenditure plans
 - Only company-wide capital expenditure plans are included
 - Announcement about specific projects are excluded
 - Capital expenditures announcement which include funds for the purpose of acquisitions and tender offers are excluded
 - Announcements of capital expenditure plans by corporate subsidiaries or corporate divisions

What are we trying to measure?

$$E[I(t)] = I(t-1)$$

$E[I(t)]$ - the expected dollar amount of capital expenditures announced in period t

$I(t-1)$ - the original planned dollar amount of capital expenditures previously announced in period t-1

The model

- If $I(t) > I(t-1)$
 - unexpected increase from a previous announcement

- If $I(t) < I(t-1)$
 - unexpected decrease from a previous announcement

Distribution of announcements

Category	Industrial firm sample	Public utilities sample
1. Increase in Capex in comparison with previous year's budget	354	72
2. Increase in Capex in comparison with current year's budget previously announced	73	11
3. Decrease in Capex in comparison with previous year's budget	87	18
4. Decrease in Capex in comparison with current year's budget previously announced	33	10
Total	547	111

Hypothesis

- According to traditional valuation theory, the stock prices of companies will respond differently to capital expenditure announcements depending upon whether the **firm's investment opportunity rate of return is greater than the current market required rate of return**

- Industrial company –
 - rate of return > market required rate of return
- Public utility company – permitted to earn only the marginal 'cost of capital' on invested funds,
 - rate of return = market required rate of return

Distribution of announcement (by intended use of Capex)

Intended Use of Capex	Industrial firm sample		Public utility sample	
	Number	%	Number	%
Unspecified	202	36.9%	83	74.8%
General plant & equipment	155	28.3%	14	12.6%
Research & Development	8	1.5%	0	0
Exploration & development	93	17%	6	5.4%
General plant & equipment and R&D	5	0.9%	0	0
General plant & equipment and Exploration & development	64	11.7%	8	7.2%
Retail stores	20	3.7%	0	0
Total	547	100%	111	100%

Results - 658 capital expenditure announcements

	Industrial firm sample		Public utilities sample	
Category	Number	Statistical significance	Number	Statistical significance
1. Increase in Capex in comparison with previous year's budget	354	0.01	72	Insignificant
2. Increase in Capex in comparison with current year's budget previously announced	73	0.05	11	Insignificant
3. Decrease in Capex in comparison with previous year's budget	87	0.01	18	Insignificant
4. Decrease in Capex in comparison with current year's budget previously announced	33	0.05	10	Insignificant
Total	547		111	



But ...

- 36.2% of the industrial firm sample and 49.5% of the public utility firm sample released other firm-specific information on the same day as the announcement of the capital budget
- There is still possibility the results are due to other information that announced together with the unexpected capex increase / decrease

Results - 405 capital expenditure announcements which contain no other firm specific information

	Industrial firm sample		Public utilities sample	
Category	Number	Statistical significance	Number	Statistical significance
1. Increase in Capex in comparison with previous year's budget	216	0.01	34	Insignificant
2. Increase in Capex in comparison with current year's budget previously announced	57	0.05	5	Insignificant
3. Decrease in Capex in comparison with previous year's budget	53	0.01	11	Insignificant
4. Decrease in Capex in comparison with current year's budget previously announced	23	0.10	6	0.1
Total	349		56	

Stock returns for 547 industrial firms (by intended use of Capex)

	Budget increase		Budget decrease	
<u>Intended Use</u>	Number			%
Unspecified	138			0.01
General plant & equipment	123	0.0	32	0.01
Research & Development	8	Insignificant	0	Insignificant
Exploration & development	84	-ve	9	+ve
General plant & equipment and R&D	5	Insignificant	0	Insignificant
General plant & equipment and Exploration & development	55	0.01	9	0.05
Retail stores	14	Insignificant	6	0
Total	427		120	

Due to
'overinvesting' in oil
and gas exploration
and refining
companies

Conclusion

- Reaction of common stock prices to capex announcement is generally consistent with the market value maximization hypothesis and a traditional model of corporate valuation:
 - For industrial firms, announcement of increases in planned capex are associated with statistically significant increase in the market value of common stock and vice versa
 - For public utility firms, neither announcements of increases nor decreases in planned capex are associated with statistically significant changes in the market value of common stock and vice versa



Paper Two

Corporate research and development expenditures and share value

- Su Han Chan, John D. Martin, and
- John W. Kensinger
- Journal of Financial Economics 26 (1990) 255-276



Literature Review

- Market, on average, does value R&D investments positively: McConnell & Muscarella (1985), Jarrell et al. (1985), Woolridge (1988)
- However, the above researches do not explain the reason for some cases with negative share response to increase in R&D expenditure



Research Questions

- What is the relationship between announcement in R&D expenditure and share value
- What is the possibility that market responds negatively to R&D investments when short-term earnings decreased?
- Are there any factors that systematically explain positive stock movement in some cases but negative in other cases?

Data Collection


- Starts with 167 announcements between June 1979 to June 1985 taken from:
 - Center for Research in Security Prices (CRSP).
 - Dow Jones New Retrieval Service database , Wall Street Journal, and Barron's.
- After elimination → 95 **different** announcements of **specific** plans to increase **current year company-sponsored R&D expenditures** from the previous fiscal year
- Out of 95 announcements, 79 used for regression due to some missing information on regression variables.

Descriptive Stats of Regression Sample (79 Firms)

Variable	Mean	Sd	Min	Max
Net sales (\$M) (previous year)	4,349	12,072	68	103,143
Total assets (\$M) (previous year)	3,201	6,875	56	56,577
Announced R&D exp (\$M)	158	166	3	1,040
Δ R&D exp (\$M)	23	20	1	86
Δ R&D exp as % of previous	21.6%	10.8%	7.2%	66.7%
Δ R&D exp as % of net sales	1.2%	1.0%	0.1%	6.3%
(x) Firm R&D intensity (R&D exp / Net sales)	6.3%	3.7%	0.7%	17.2%
(y) Industry R&D intensity	4.4%	1.7%	0.4%	8.3%
RDINT (x/y)	1.5	0.8	0.3	4.1

Distribution of 79 Firms by Size

Sales	# of firms	Relative frequency
\$10 to \$100 mil	2	2.5%
\$100 mil to \$1 bil	23	29.1%
\$1 bil to \$10 bil	51	64.6%
> \$10 bil	3	3.8%



Relationship Between Share Value and Announcement in R&D Exp.

- Assessing Abnormal Stock Performance
- Event-study methodology: evaluate market and risk adjusted residual returns

Empirical Results: Avg. Abnormal Stock Performance

- Relatively large price adjustment on Day 0 and Day 1 after at 1% significance level
 - Day 0 AAR = 0.85% ($t = 4.99$)
 - Day 1 AAR = 0.56% ($t = 3.12$)
 - Day 0+1 CAR = 1.38% ($t = 5.74$)
- Mean abnormal return:
 - Before: Day -30 to -1 = -0.01%
 - After: Day 2 to 12 = 0.04%

On avg., announced plan to increase R&D exp are associated with stock price increases

What is the Effect of Concurrent Events?

- Concurrent Events e.g. announcement of cap-ex plans, earnings or earnings forecasts
- Repeated stats analysis using announcements from each of the subsets
- Concurrent Event has no significant effect on the results

Increase in R&D expenditures are, on avg., associated with increase in the wealth of existing shareholders

Distribution of Sample

Type of announcement		Full data set	Regression data set
I.	Pure R&D: (a) Corp-wide	47	41
	(b) Project-specific	8	0
II.	R&D + earnings forecast	7	7
III.	R&D + reported earnings	3	3
IV.	R&D + increase other cap-ex	30	29
<u>Total:</u>		95	79

Does reported earnings per share influence investors view on R&D?

- Myopic market should react negatively to R&D exp increases, especially with decrease in EPS
- Comparison of mean 2-day cumulative average abnormal return (CAR) for 62 firms with increase in EPS and 33 with decrease in EPS → no significant difference.

Market takes a long-term view of R&D investments and rewards firms that pursue aggressive R&D strategy even in face of earnings declines



Does level of technology of the firm affect investors' view on R&D?

- Segmented firms into Hi and Low tech groups
- On average, stock price response is +ve for the hi-tech group but –ve for low-tech group
- t-statistic for a test of the difference between the two sample means is highly significant

Stock market values increased R&D exp more for firms in hi-tech industries than for low-tech industries

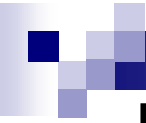
Distribution of 95 Announcements

Industry Type (based on Business Week's annual R&D Scoreboard)	Full data set	Regression data set
High-tech: Pharmaceuticals, Electronics, Info processing, etc.	63	55
Low-tech: Aircraft / defense, Automotive, Building mat, etc.	32	24
<u>Total:</u>	95	79

What other factors may affect investors' view on R&D expenditure

- Cross-sectional analysis of CAR
- Multiple regression models to test influence of:
 1. Intensity of firm's R&D effort relative to industry norm
 2. Level of technology in the industry
 3. The size of the announced increase in R&D in relation to the firm's sales
 4. Industry concentration
 5. Firm's market power

Outspending the industry norm tends to increase stock price for hi-tech firms but neutral on low-tech firms




Managerial Discretion and Possibility of Limited Dependent Variable Bias

- Original sample includes only firms which management chose to announce increase in R&D expenditure
- Is it possible that announcement is made only when managers expect a positive response from investors?

Managerial Discretion and Possibility of Limited Dependent Variable Bias (con't)

- Procedure suggested by Maddala (1983) and used by Eckbo et al. (1990) to assess potential bias in cross-sectional results
- Select 2nd sample of firms that increased R&D exp but did not announce from Business Week 'R&D Scoreboard' and COMPUSTAT with corresponding SIC industry code as original

Results are not materially affected by the potential bias from managements' decision on weather to announce additional R&D exp.



Summary & Conclusion

- Announcements of new planned increase in firm-sponsored R&D = +ve impact on stock price
- Response to R&D announcement tends to be +ve even for firms with simultaneous announcements of earnings decline
- US equity market is not myopic; investors look beyond the S/T earnings impact of major strategic investments when valuing a firm's stock



Summary & Conclusion (con't)

- Increase R&D has significant +ve stock-price response for hi-tech firms but significant –ve response for low-tech firms.
- Higher R&D intensity than industry avg. = larger stock-price increases for hi-tech firms announcing R&D increase, but neutral for low-tech firms
- Results are robust to any sample selection bias resulting from managers' discretion over whether to announce R&D spending plans



A Study of Cross Sectional Variation in the Stock Market's Reaction to Corporate Investment Decisions

- Mark Huson
- Randall Morck
- Gary Smith
- Wayne Yu
- China Accounting and Finance Review, 2, 4, (2000), 71-88



Research Questions

- Does stock price change when unexpected capital budget announcements were made?
- How does agency problem and quality of management affect the stock price changes?



Data Collection

- Sources
 - Dow Jones News Retrieval Service
 - Wall Street Journal
- 1984 to 1993
- 143 data points collected
 - 96 increase, 46 decrease

Methodology

- Cumulative Average Abnormal Returns (CAR)
 - Return on stock
 - Return on CRSP value weighted index
- Profitability Index (“PI”)
 - $E(NPV) = CAR \times V_E$
 - Normalize for size of project using firm’s capital budget as base



Methodology

- Variables used to test agency problem
 - Insider ownership
 - Measure the separation of ownership from control, or proxy for agency problem
 - Firm size
 - More difficult for insider to own a large stake in a larger firm
 - Past capital expenditure levels
 - Average capex / net PP&E over last 3 years
 - Past growth in capital expenditure levels
 - Average fractional change in capex over last 3 years

Methodology

- Variables used to test quality of management
 - Average q
 - Measure of the firm's intangible assets
 - Research and development spending
 - Second proxy for intangible assets
 - Advertising spending
 - Third proxy for intangible assets
 - Cash flow
 - Total cash flow normalized by BV of total assets

Summary & Conclusions

- Market reaction to change in capital budgets
 - Increase capex – share price falls
 - Decrease capex – share price rises
 - Both statistically insignificant
 - Normalize for project size – same results

**Change to share price on announcement
period statistically insignificant**

Summary & Conclusions

■ Myopic behavior

- Management myopic behavior (Stein)
 - Share price increases when capex increases
- Market myopic behavior (Porter)
 - Share price decreases when capex increases

No evidence of management and market myopia behavior

Summary & Conclusions

- Agency problem
 - Insider ownership and square of insider ownership
 - Higher abnormal return if management owns between 4.9% and 71.3% of firm

Agency problem do exist

Summary & Conclusions

- Free cash flow utilization problem
 - High cash flow
 - Lack of positive NPV projects
 - Invest in value-decreasing projects
- High cash flow firms with low q ratios - insignificant

High cash flow firms do not invest its excess cash inefficiently



Share value and capital investment decisions in an extended negative return market

- Lawrence Lai
- Thomas Wu
- Gordon Yen



Research Questions

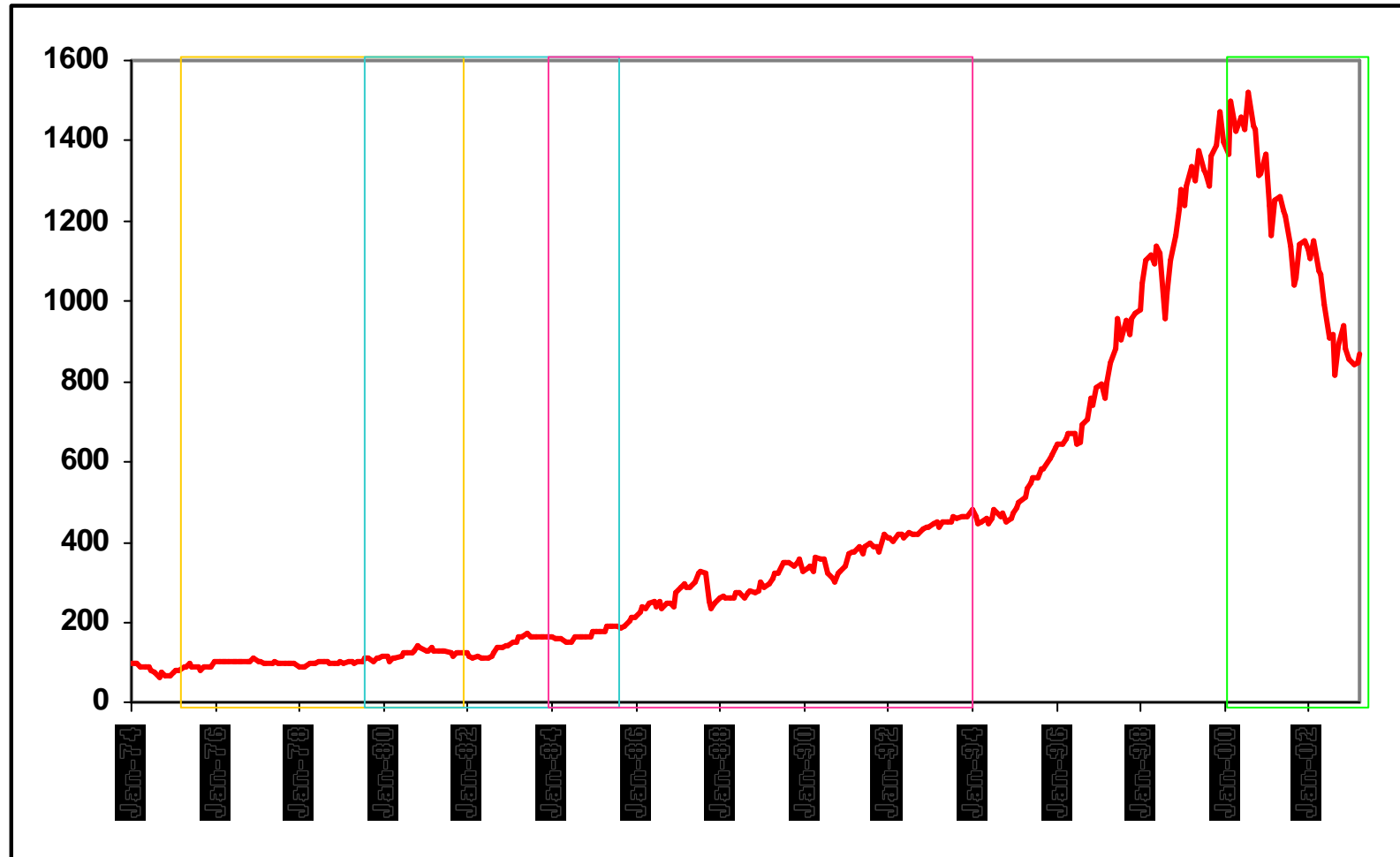
- Does share prices react differently to unexpected change in capital budgets in an extended negative return economic environment?
- Does quality of management affects the share price reaction?



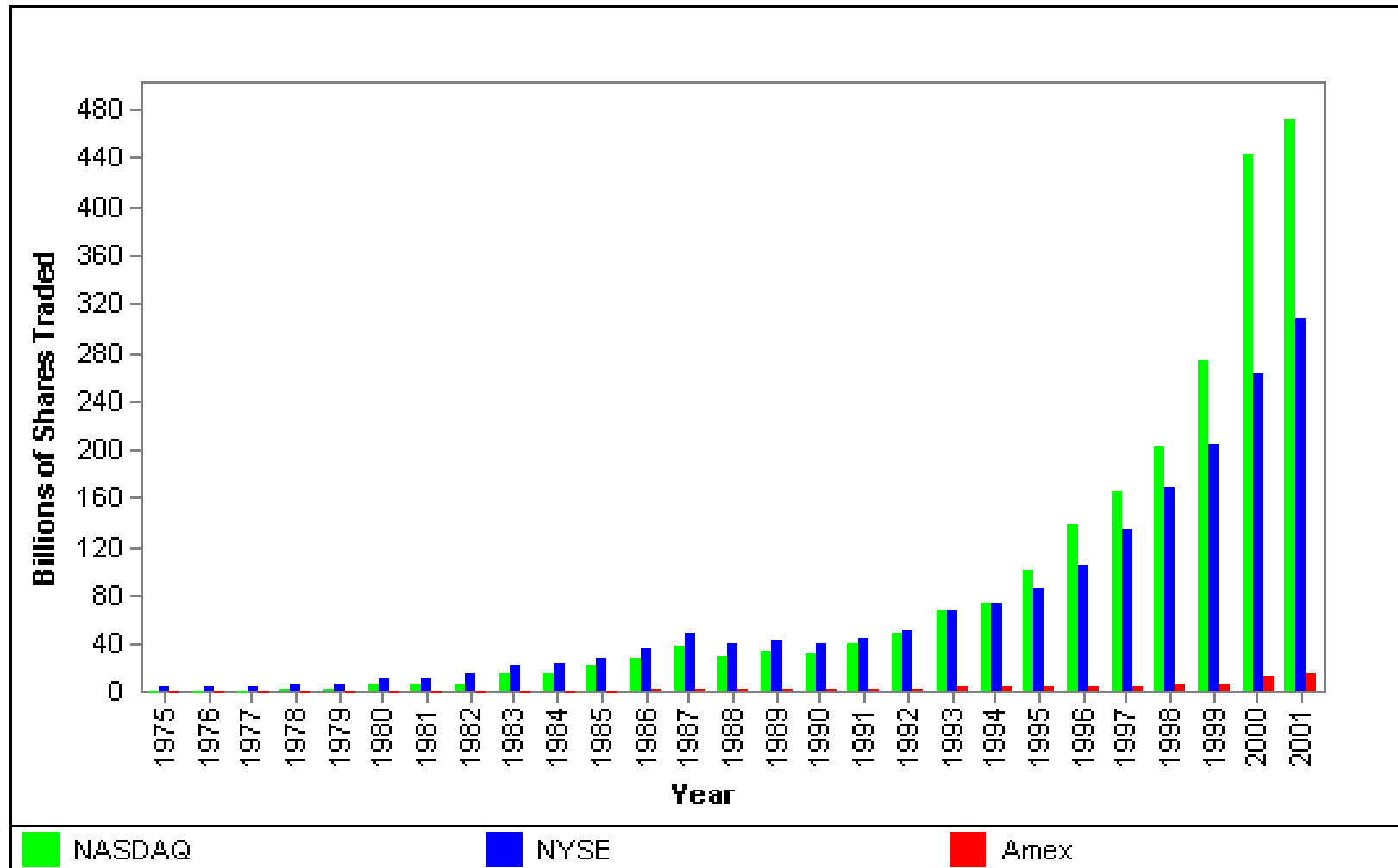
Data Collection

- Source
 - Dow Jones News Service (online)
 - Wall Street Journal (online)
- Jan 2000 to Feb 2003 (38 months)
- Capital expenditure and Research and development
- Expected returns based on beta from Reuter's MultexInvestor Service
- Price to book ratio, ROE, ROA from Reuter's MultexInvestor Service
- Includes Nasdaq listed companies

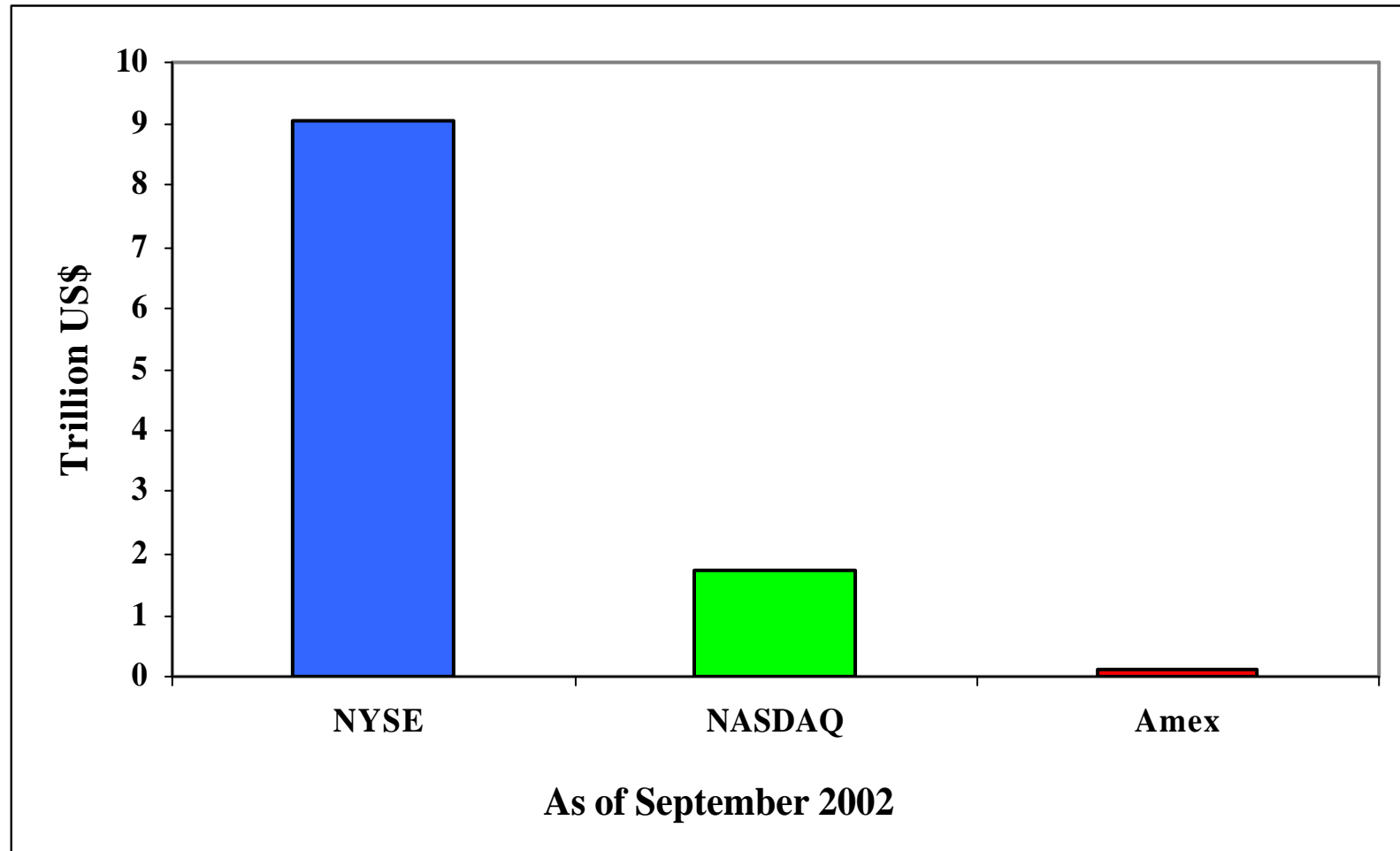
US Stock Market Level



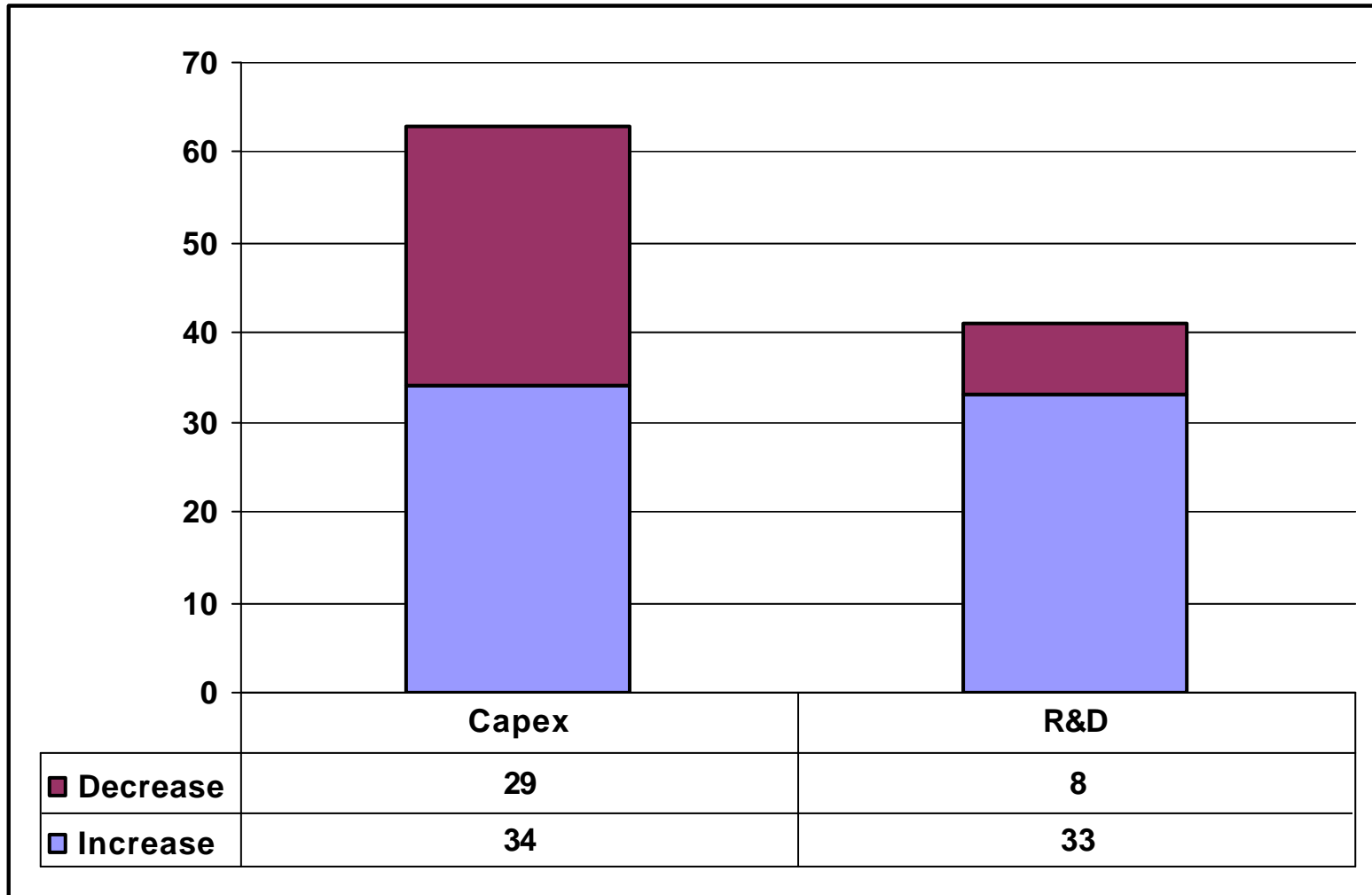
Share Volume Of Exchanges



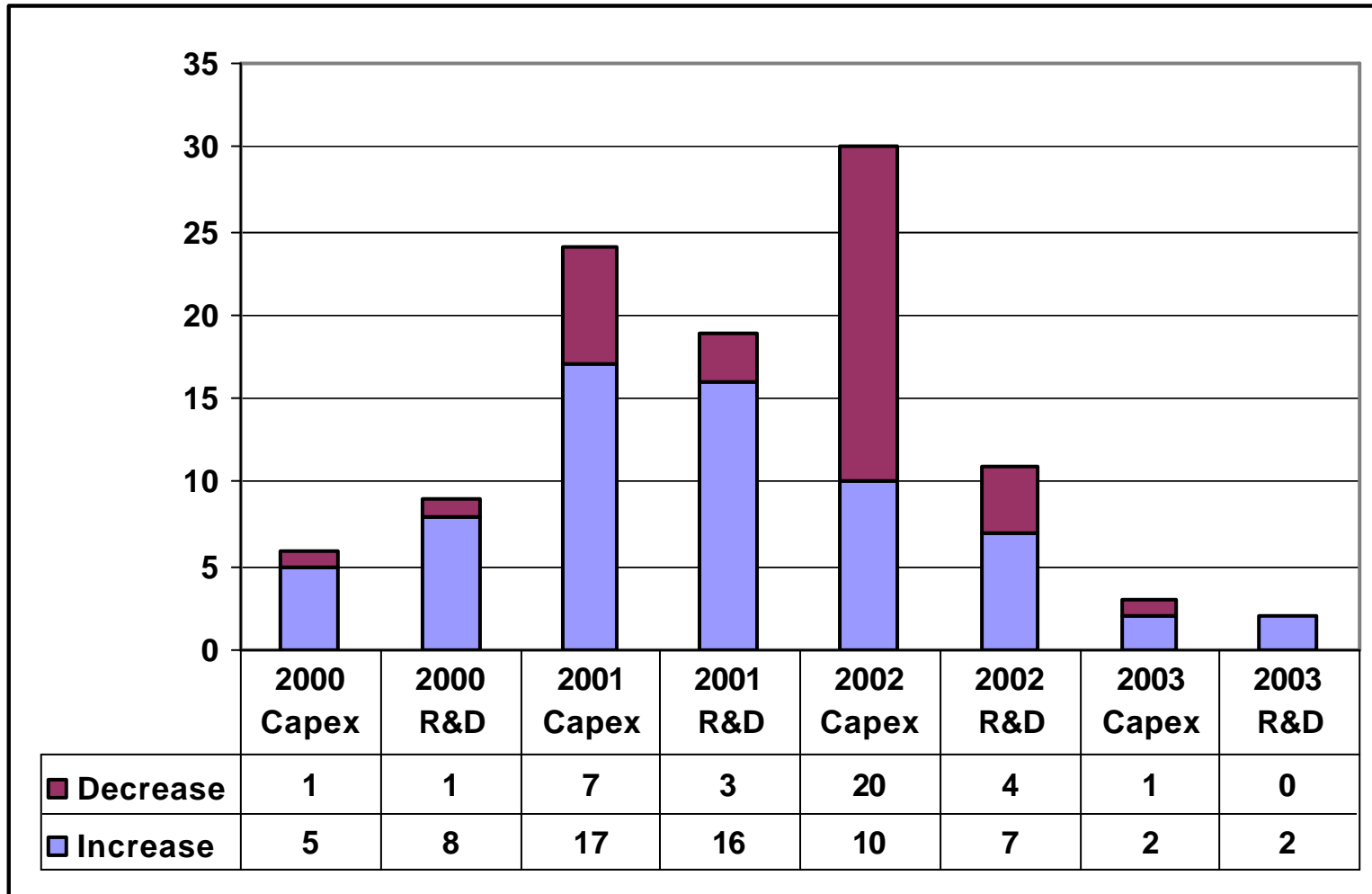
Market Value of Exchanges



Data Sample – 104 Data Points



Data Sample



Results of T-test

- How does share price react to unexpected change in capital budgets?

	Capital Budget	
	Increase	Decrease
Mean Abnormal Return	-0.012 (t= -1.136)	0.020 ^b (t=2.333)

b=significant at 5%

Decrease capital budget ? positive abnormal returns

Results of T-test

- Is there any difference between capex and R&D announcements?

	Capital Budget			
	Increase		Decrease	
	Capex	R&D	Capex	R&D
Mean Abnormal Return	-0.015 (t= -1.843)	-0.009 (t= -0.449)	0.020 (t=1.868)	0.022 (t=1.672)

No difference between capex and R&D announcements

Results of T-test

- Is there any difference between high tech and low tech industries?

	Capital Budget			
	Increase		Decrease	
	Hi Tech	Low Tech	Hi Tech	Low Tech
Mean Abnormal Return	-0.012 (t= -0.661)	-0.013 (t= -1.427)	0.024 (t=1.847)	0.016 (t=1.422)

No difference between high tech and low tech industries

Results of Regression

- Does quality of management affect abnormal returns?

		Capital Budget	
		Increase	Decrease
Price to book ratio	Coefficient	0.0001 (t=0.269)	-0.001 (t= -0.661)
Return on asset	Coefficient	0.006 (t=0.503)	-0.017 (t= -0.136)
Return on equity	Coefficient	0.009 (t=0.381)	0.017 (t=0.344)
R ²		0.008	0.037

Quality of management has no effect on abnormal returns

Conclusions

- During periods of continual recessive economic conditions:
 - Significant abnormal return on stock prices when capital budget decrease
 - Quality of management no significant effect on abnormal returns
 - Caveats – price to book ratios, ROA and ROE on abnormal basis without standardization for industry differences



New Questions Raised

- In recessive and uncertain economic periods
 - Market and managerial myopic behavior do not exist?
 - Investors lower their selectivity and ability to differentiate?
- Investors' threshold for pain tolerance is not symmetric to the utility they received during times of financial gains
 - Are the risk return non-linear under certain conditions or circumstances?

Comparison Of Findings

	Corporate Capital Expenditure Decisions And the Market Value of Firm	Corporate research and development expenditures and share value	A Study of Cross Sectional Variation in the Stock Market's Reaction to Corporate Investment Decisions	Current Paper
Authors	McConnell, Muscarella	Chan, Martin, Kensinger	Huson, Morch, Smith, Yu	Lai, Wu, Yen
Year of Publication	1985	1990	2000	TBD
Period Under Study	1975 to 1981	June 1979 to June 1985	1984 to 1993	Jan 2000 to Feb 2003
Market Returns	11.2% annual return	21.4% annual return	18.3% annual return	(13.4%) annual return
Source of Data	Wall Street Journal Index and Predicasts F&S Index	WSJ, DJNW, Barron's	Dow Jones News Retrieval Service and WSJ	WSJ, Dow Jones News Services
Sample Size	658	95	143	104
Selection Criteria	NYSE / AMEX listed companies only	NYSE / AMEX listed companies only	NYSE / AMEX listed companies only	NYSE / AMEX listed and Nasdaq companies
Findings:	Significant positive relationship between change in capex and excess stock returns.	Positive response on share price when R&D increased despite concurrent news of earnings decrease. Increase significant for firms in high tech sector. No market myopic behavior.	Negative relationship between capital budget change and share price, but statistically insignificant. No market and managerial myopic behavior. Agency problem does exist. Firms do not invest excess cash flow inefficiently.	Significant abnormal return on stock prices when capital budget decreased. Quality of management no effects on abnormal returns.