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Industry Specific Effects in Investment Performance and Valuation of Firms

Marginal q in a Stock Market Bubble

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Abstract

A necessary criterion for a performance measure in corporate governance is the degree to which it mirrors how well the management succeeds in maximizing firm value. Such a performance measure is marginal *q* which links changes in firm value to the investments decided by the management. Empirical studies of investment and performance based on marginal *q* have demonstrated the usefulness of this measure. Most research however, has mainly focused on long-term performance. This paper takes a short-term perspective and, based on the marginal *q*-theory, considers how market values change in the extreme stock price cycle of a stock market bubble. We find an anomaly in form of a new industry specific effect that, in addition to investment, explains changes in firm value.

JEL classification: G14; G31; G34; L21
Keywords: Marginal q; Investment; Stock bubbles; Different industries

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1. Introduction

A central topic in corporate governance is how to align the interests of the management with the interests of the shareholders. In a corporation with dispersed ownership most of the shareholders are primarily interested in how well the management succeeds in maximizing the value of the firm. A maximization of firm value means that the value of the equity will be maximized. This in turn means that the part of personal wealth that the shareholders hold in the stock will be maximized.

From this perspective a performance measure used in corporate governance should mirror how well management succeeds in maximizing firm value. One measure that has this property is Tobin's *q*. Market value of the firm is in the nominator, and the cost of repurchasing the assets is in the denominator. The denominator normalizes the expression in a manner that makes it possible to compare different firms.

However, Tobin's *q* is an average measure that shows per unit capital how much firm value that is generated. An analysis of efficient allocation of resources has to be of a marginal character. A marginal q, which makes marginal analysis possible, has been developed by Mueller and Reardon (1993) and has been used in a number of empirical studies with good results. Marginal *q* shows how firm value changes in response to an investment. Firm value is maximized when marginal *q* is equal to one. A marginal q less than one indicates that the last investments´ returns are less than the cost of capital, i.e. overinvestment from the point of view of the shareholders.

One assumption that has to be fulfilled in the use of *q*-measures in empirical analyses is that capital markets are efficient. However, research by, amongst others, Shiller (1981, 2000) has cast doubt on the efficiency of capital markets, at least in the short run. Booms and recessions can be the result of bubbles. If that is the case, the calculated *q* will differ between booms and recessions because of biased estimates of future cash flows. It is not the efficient use of resources solely that determines the value of the *q*.

Assuming that such a bubble effect was evident in the Swedish stock market during the period 1998 to 2002, the purpose of this paper is to study whether some industries exhibit more of a bubble-like behavior of stock prices and market values than others. We propose that the stock prices during a bubble can be explained not only by fundamentals (investments), but also by an industry specific effect. This effect is due to asymmetric information related to new and knowledge intense industries[1].

The paper is organized as follows. Earlier research is reviewed in the next section. The net present value rule and the theory of marginal *q* are discussed in the third section. The fourth section presents the hypotheses used in the empirical analysis. Data, variables and statistical methods are described in the fifth section. The results of our empirical analysis are presented in the sixth section. The paper ends with a summary.

[1] The term "new" industry will be used in the paper as an analogy to high-tech and knowledge intense industries, formally defined as firms belonging to the Biotechnology, IT and Telecommunication industries.

2. Earlier Studies

The neoclassical investment theory, as formulated by amongst others Modigliani and Miller (1958), states that in order to maximize shareholder wealth, firms shall invest up to the point where their cost of capital equals the marginal returns on investment. Another way to express this is that a firm shall invest as long as the net present values of investments are positive. However, firms invest today to produce tomorrow's output and consequently in the calculation of the profitability of an investment it is necessary to estimate the future cash flows the investment will generate. Thus, Grunfeld (1960) proposed that the firm's market value could be used as an estimation of profitability of future sales. If the capital market is efficient the market valuation of equity and debt should be unbiased estimates of all investments made by the firm. To account for this, recent studies of investment have used Tobin's q (Tobin, 1969) as performance measure. Tobin's q is the ratio of a firm's market value to the replacement cost of its current capital stock.

However, there are problems in the interpretations of Tobin's q in investment performance studies. Tobin's q gives an average value of how successful investments are. A low value could be a result of past mistakes. A more accurate measure of investment performance would look at how well recent investments have succeeded. When measuring the returns on a firm's recent investment, the main difficulty is to access the future cash flows that the investment generates. Assuming that the market is efficient, Mueller and Reardon (1993) circumvent this problem and present a performance measure, marginal q, which is essentially a marginal Tobin's q[2]. The market efficiency assumption implies that the market makes an unbiased estimation of the firm's future cash flows. The marginal q measures the ratio of the change in a firm's market value to the cost of the change in total assets (i.e. the investment) that caused it. Using this methodology, Mueller and Reardon (1993) show that many large firms invest in projects with much lower returns than their shareholders' opportunity costs. The upshot is that managers frequently make investments that do not promote the interests of shareholders and lenders. By using a marginal analysis it is possible to trace this type of managerial discretion and find out why corporate governance problems of this kind occur.

A growing body of literature continues to accumulate knowledge of the usefulness of marginal q in analyses of investment and corporate governance issues. Using the Mueller and Reardon (1993) method, Gugler, Mueller and Yurtoglu (2002b) present evidence for the relationship between institutional differences, such as legal systems, ownership structures and their relationship to investment performance. A dataset of more than 19 000 companies in 61 countries across the world is used. The advantages of using a marginal q instead of Tobin's q in studies of investment in firms and corporate governance issues have been further demonstrated in Gugler and Yortuglu (2003) and Gugler, Mueller and Yurtoglu (2004)

Even if marginal q opens up improved methods for empirical research about investment and corporate governance, it has a weakness that it shares with all other performance measures. It assumes an efficient capital market. The capital market is assumed to provide unbiased estimates of future cash flows in the pricing of securities.

A growing body of research within the field behavioral finance has cast doubt on the presumption that the capital market always provides unbiased estimates (see e.g. .Shiller (1981, 2000 and 2002) and Shleifer (2000)). Special attention has been devoted to the stock

[2] A theoretical proof of the advantages of using a marginal q was first presented by Hahashi (1982).

market bubble that built up in the late 1990s and burst in the second quarter of 2000, the start of a nearly three-year uninterrupted decline in stock prices (see e.g. Evans, 2003, and Sheeran and Spain, 2004). An explanation of the stock market bubble is that industries based on new technologies such as internet, telecom and biotechnology gave promises of a new economic era with unprecedented growth in productivity and profits. Unrealistic expectations of increases in productivity, profits and growth built up. This was a new industry phenomenon which primarily affected the stock prices of the new industry firms.

This paper will, by using the marginal q measure, address the issue of differences in investment performance and valuation of new and old industries.

3. The Net Present Value Rule and Marginal q

In standard textbooks in corporate finance, such as Brealey and Myers (1991), the net present value rule is introduced as the criterion to be used when a firm evaluates investments. The criterion requires for each project a comparison between the negative cash flow of the investment (I) and the present value (PV) of future cash flows (CF_t) generates ($PV = \sum_{t=1}^{n} CF_t \frac{1}{(1+r)^t}$). The difference between PV and I is called net present value (NPV). The rule says that all projects with a positive NPV shall be undertaken (or in other words accept all projects with NPV=PV-I>0).

The reason for a firm to make investments in projects with NPV>0 is that shareholders are made better off compared to alternative uses of funds. (Hence, the wealth of the shareholder is not increased by a distribution of funds directly to the shareholders by means of repurchase of shares or dividends.) The shareholders referred to are the ones that are outsiders in the sense of not working in the firm. All their consumption takes place outside the firm. As suppliers of capital they are therefore assumed to be interested only in the return on the firm's investments. These shareholders cannot benefit from consumption-on-the-job in the way described by Jensen and Meckling (1976). Projects with NPV<0 due to consumption-on-the-job can only benefit insiders like the management of the firm. The wealth of the shareholders is thus negatively affected by such projects.

The market value of the firm M_t bears a direct relation to the sum of the present values of all the running projects that the firm has invested assets in over time. In an efficient market the market value of the firm is equal to the sum of the present values of these projects. The present value (PV_t) of investments (I_t) during a time period will increase the market value of the firm if PV_t is larger than the depreciation of assets from earlier investments (I.e. $M_t – M_{t-1}=PV_t – Depreciation$, see e.g. Gugler, Mueller and Yurtoglu, 2002b).

Considering that the market can make errors in the estimation of future cash flows the expression for change in market value in a period t can be written as

$$M_t - M_{t-1} = PV_t - Depreciation + \mu_t \qquad (1)$$

where μ_t represents the error the market makes in the estimation of future cash flows. In an efficient market unbiased estimates of the error term are made and μ_t has an expected value of, and a nominal distribution around, zero.

The net present value rule prescribes that managers shall invest in projects up to the point where NPV=0. Otherwise, the management does not act in the interest of the shareholders. A NPV=0 implies that $PV_t = I_t$ or that

$$\frac{PV_t}{I_t} = 1 \tag{2}$$

In the same fashion NPV>0 (unused profitable investment opportunities) implies $\frac{PV_t}{I_t} > 1$ and NPV<0 (managerial discretion of consumption-on-the-job character) implies $\frac{PV_t}{I_t} < 1$.

Like Gugler, Mueller and Yurtoglu (2002b) we can rewrite (2) as

$$\frac{PV_t}{I_t} = q_m \tag{3}$$

with $q_m = 1$ for the project last accepted indicating efficient investment level, $q_m>1$ implying that the firm is not investing enough, and $q_m<1$ implying overinvestment in projects that have a return less than what is available elsewhere in the capital markets.

Inserting (3) in (1) gives

$$M_t - M_{t-1} = q_m I_t - Depreciation + \mu_t \tag{4}$$

As pointed out by Gugler, Mueller and Yurtoglu (2002b) it can from (3) and (4) easily be seen that q_{m} is related to Tobins's q in a way that justifies the denomination marginal q (q_{m}). While Tobin's q reflects the market value (M_t) divided by the replacement cost of all assets of the firm, q_{m} shows the relationship between the cost for a change in the stock of assets and the subsequent change in market value. The marginal character is evident.

By dividing both sides of (4) with M_{t-1} a normalization that is useful in empirical testing is accomplished. We get

$$\frac{M_t - M_{t-1}}{M_{t-1}} = -\delta + q_m \frac{I_t}{M_{t-1}} + \frac{\mu}{M_{t-1}} \tag{5}$$

where δ is the depreciation rate

Equation (5) assumes that the capital market is efficient in the sense that future cash flows are unbiased estimates. Unbiased estimation means that expected future cash flows are equal to the cash flows actually realized i.e.

$$E_t(CF_{t+i}) = CF_{t+i} \tag{6}$$

If that is correct, there are no biased valuation errors or bubbles in the stock market prices. This assumption might be more justified for some firms than others. It might for example be more difficult to forecast future cash flow for a firm working in a new and young industry (like the knowledge intense IT, telecom and biotechnology industries) than for a firm working in an old established industry with a lot of history to fall back upon. If there are large difficulties in estimating future cash flows, the investors might make systematic errors in the forecasting. During some periods they overestimate future cash flows while they underestimate them in others. If there are systematic errors made in the forecasting, (6) has to be rewritten as

$$E_t(CF_{t+i}) = CF_{t+i} + b_t \tag{7}$$

where b_t represents the systematic error.

Equation (5) can now be changed to

$$\frac{M_t - M_{t-1}}{M_{t-1}} = -\delta + q_m \frac{I_t}{M_{t-1}} + \frac{b_t}{M_{t-1}} + \frac{\mu}{M_{t-1}} \tag{8}$$

where b_t represents systematic error in the forecasting of future cash flows. (μ_t still represents the unbiased error the efficient capital market makes in the estimation of cash follows, and μ_t has an expected value of, and a normal distribution around, zero.)

Finally a few words about how investment is calculated. According to the originators, Mueller and Reardon (1993), and Gugler et al (2002b), the investment is calculated as;

I = After tax profits + Depreciation – Dividends + ΔDebt + ΔEquity + R&D + ADV

where ΔD and ΔE are funds raised using new debt and equity issues. R&D and ADV (advertising expenditures) are also forms of investment, which may contribute to a company's market value.

Two further properties of the marginal *q* that is worth noting are; first it obviates the need to determine the individual firms' cost of capital, since that is already accounted for through the markets discounting of the future cash flows; and secondly marginal *q* in a similar way allows for different degrees of risk in the different firms (for a risky firm the investors will expect a higher return and vice versa).

4. Hypotheses

Formulating the theory of marginal *q*, as in section two above, allows us to study how the financial markets evaluate investments in time periods that can be characterized as booms or recessions. Do the financial markets evaluate investments in both booms and recessions equally accurately or is there a difference? The sometimes very large fluctuations in stock prices over time makes it hard to believe that we can always trust the prices set by the market. The experience from the five years around 2000 supports the impression that this was an example of a stock market bubble. In bubbles stock prices increases higher than what is justified by increased future cash flows from investments during booms, and in the same fashion subsequent drops in stock prices are not completely justified by lower future cash flows. If bubbles like these exist and are not accounted for, they are likely to influence marginal q; q_m, in equation (5). To account for this bubble effect we thus formulate equation (8). And, our first hypothesis for a stock market bubble is:

Hypothesis 1: During a boom the investment performance, marginal q, will be higher than during a recession.

The logic behind this hypothesis is that during a boom the increase in stock prices is so strong that it cannot be explained only by fundamental investments in an efficient capital market. Psychological factors of different kinds as described in e.g. Shiller (2000) will also have an influence. Although these factors are difficult to specify in an equation, they will in a boom be reflected in a higher and more positive influence on stock prices than what is fundamentally justified. The opposite forces will be at play in a recession.

It is also likely that systematic errors in the forecasting of future cash flows could be more prevalent for certain types of industries than others. The age of an industry might matter, for instance. In a young industry there is much more pure uncertainty about the future. There is no history to fall back on in analyses of the probability of future events. Guesses that are more or less well founded will have larger importance in the predictions than for older industries that have been analysed over a longer time span. It is also easier in a boom to be overoptimistic about the future for these young industries than for old industries. The reason would be that in old industries experience works as a modifying factor in the estimation of cash flows. In a recession the sentiments are reversed. The experience of being wrong and losing money from being too optimistic makes investors overly pessimistic in the next period. Such a change in behaviour of investors vis-à-vis young industries could partially explain a stock price bubble. The five years period around the millennium shift, characterized by a sharp rise and subsequent fall in stock prices, seem to fit nicely into this picture. Based on this reasoning our hypothesis about young industries is:

Hypothesis 2: For firms working in new industries systematic errors in the predictions of future cash flows cause a positive bias in the change of market values during a boom and a negative bias during a recession.

If hypothesis 2 is true, investment is no longer the only explanatory factor of changes in market values. An additional factor of a bubble character that affects the valuation of young industry firms has to be added in times of market turbulence. Equation (5) has to be replaced by equation (8) in a model that tries to explain changes during times of great market turbulence and uncertainty.

5. Variables, Data and Method

To differentiate between the two types of industries, the established (primarily manufacturing) of the "old" economy and the young knowledge intense of the "new" economy, a multiple equation model is required. Table 1 offers a description of the variables used in the two equation models applied here.

Table 1. Description of Variables

Variable:	Definition:

$\frac{M_t - M_{t-1}}{M_t}(O)$	Change in market value for old industry firms
$\frac{M_t - M_{t-1}}{M_t}(N)$	Change in market value for new industry firms
$I_t/M_{t-1}(O)$	Investment ratio for old industry firms
$I_t/M_{t-1}(N)$	Investment ratio for new industry firms
Where:	
M_t	Market value at the end of period t.
M_{t-1}	Market value at the end of period t-1.
I_t	Investment in period t calculated as I = After tax profit + Depreciation – Dividends + Δ Debt + ΔEquity + R&D + ADV where ΔD and ΔE are funds raised using new debt and equity issues, R&D and ADV sales expenditures.

The data used in the regressions is provided by UC-Select and consists of accounting data for the firms listed on the Stockholm Stock Exchange from 1997 to 2003. To test our hypotheses that the investment performance measured as marginal *q* is affected by a stock market bubble, and that it is for new industry firms that systematic valuation errors are made, the time period 1998-2002 is divided into two. The two-year period from 1998 to 1999 represents a distinct boom-market, whilst that from 2001 to 2002 is characterized by an equally apparent stock market decline. New industry firms are represented by those working in the industries biotechnology, IT and telecommunication.

Several criteria were applied in the selection of firms to be included in the data set. Excluded from the sample were firms with accounting periods less and/or different than a full calendar year running from January to December. To be included in the sample the firms also needed to have stock market data reported by Affärsvärlden, which is the major Swedish database for stock market data. As a result of this second criterion, firms not belonging to the major stock exchange lists, the A- or O-lists, were excluded from the sample. (In other words only firms listed on the A- and O-lists of Stockholm Stock Exchange were included.) The last selection criterion was that the companies in the sample for 1998-1999 had to be listed on any of these two lists during both years. In the same fashion the sample for 2001-2002 consists of firms present on the A- and O lists during the whole period. The above-stated criteria ensure a reasonable level of trading in the share, i.e. liquidity in the share, and that valid comparisons can be made for the same firms for all years.

Summary statistics of the variables used are provided in Tables 2 and 3.

Table 2. Summary Statistics 1998-1999

	Obser-vations	Mean	Std Error	Mini-mum	Maxi-mum
DM(O)	170	0.118	0.361	-0.811	2.189
I/M_{t-1} (O)	170	0.204	0.208	-0.332	1.305
DM(N)	46	0.487	0.696	-0.738	2.698
I/M_{t-1} (N)	46	0.136	0.202	-0.312	0.648

Table 3. Summary Statistics 2000-1999

	Obser-vations	Mean	Std Error	Mini-mum	Maxi-mum
DM(O)	266	-0.05	0.349	-0.906	2.471
I/M_{t-1}(O)	266	0.114	0.227	-0.671	1.353
DM(N)	108	-0.339	0.358	-0.891	1.268
I/M_{t-1}(N)	108	-0.02	0.284	-1.105	1.499

To empirically test the relationship between investments and market value two different methods are employed. First an ordinary least squares estimation (OLS) is made for old, respectively, new industry firms for each of the two time periods 1998-1999 and 2001-2002. Then a seemingly unrelated regression estimation (SUR) is performed. The reasons to make a SUR estimation is firstly that the existence of a stock price cycle that affects the valuation of firms might make the error terms of our two sets of firms correlated. If that is the case OLS estimation is no longer the accurate method to be used. The generalized least squares estimation (GLS) used in SUR has to be applied. Another reason is that by introducing restrictions on the coefficients a SUR estimation allows us to test if there is a significant difference between the old and new industry firms during the two time periods. The two equations that will be estimated for the two time periods 1998-1999 and 2001-2002 are:

$$\frac{M_t - M_{t-1}}{M_{t-1}}(O) = -\delta(O) + q_m(O)\frac{I_t}{M_{t-1}}(O) + \frac{\mu}{M_{t-1}}(O) \qquad (9)$$

and

$$\frac{M_t - M_{t-1}}{M_{t-1}}(N) = -\delta(N) + q_m(N)\frac{I_t}{M_{t-1}}(N) + \frac{\mu}{M_{t-1}}(N) \qquad (10)$$

In the regression the parameters δ(O), q_m(O), δ(N) and q_m(N) are estimated. The parameter δ(*i*) can be interpreted as a proxy for the depreciation rate. The coefficient q_m, marginal *q*, shall in a perfect capital market mirror how efficiently the resources of the firm are used. A firm that is wasting its resources will have a q_m less than one.

If our hypotheses 1 and 2 are true the q_m will differ between boom and recession and this difference will be especially noticeable for new industry firms. A prerequisite for these hypotheses is that the capital market is inefficient in the sense that bubbles occur. This inefficiency of a bubble character will exist for these new industries because the experience of evaluating future cash flows of investments is limited. The probability of being over optimistic and over pessimistic in the evaluation of future cash flows in a new industry sector is likely to be much higher than for old industries.

To confirm and test the robustness of the SUR estimations a panel data model was constructed, see equation 11.

$$\frac{M_t - M_{t-1}}{M_{t-1}} = -\delta + q_m \frac{I_t}{M_{t-1}} + D_{NEWIND} \qquad (11)$$

In this model we estimated average marginal *q* for the firms in the sample as well as the effect of a new industry dummy-variable. The panel data model was estimated using three statistical methods; first an ordinary least square regression (OLS), then a Fixed Effects model, and finally a Random Effects model. Theoretically the best model for our estimation would be the fixed effects model which considers specific time effects.

6. Results

Tables 4, 5, and 6 present the results of our study. A distinction is made between four different cases. For each of the two periods 1998-1999 and 2001-2002 regressions are run for old and new industry firms. A three-step statistical procedure has been applied. An ordinary least squares model is first used in a comparative analysis of the periods and industries. In a second step a seemingly unrelated regression model (SUR model) was estimated in order to take possible correlations between error terms into consideration and test structural differences between the two types of industries. In the SUR-estimation the number of observations used is equal to the smallest data set, in this case meaning that the number of observations for new industry firms sets a limit in both periods. In the third step, testing the robustness of the results, panel data estimations are made for the full sample of firms in the two periods.

Table 4 shows the OLS results. All coefficients are significant at least at the five per cent level. The results indicate that new industry firms are different from firms in old industries. While old firm's exhibit a marginal *q* that does not deviate widely between the two periods, the results for the new industry firms show a completely different picture. The coefficient for I_t/M_{t-1}, the marginal *q*, varies a lot between the two periods. From a value of 1.634 in the boom period 1998-1999 the marginal *q* for new industry firms drops to only 0.441 in the recession period 2001-2002. The value of the constant term also changes in an extraordinary way, from a value indicating a sharp appreciation of 26 per cent during the boom, the assets are in the following recession period depreciated by 33 per cent. This pattern indicates overreactions in the valuation of assets of new industry firms. The old industry firms seem to be much more accurately and consistently valued over time. The marginal *q* is a bit lower than 1 indicating that some (but not much) of the investment funds could have been more profitably used elsewhere in the economy. The estimated constant term indicate that there is a relatively stable depreciation of assets over time (around 10%). These results confirm hypothesis two, that a specific effect related to firms working in new industries affect the market valuation, and consequently the fundamental investment analysis offered by marginal *q*.

Table 4. OLS . Change in market value ($\frac{M_t - M_{t-1}}{M_t}$) is the dependent variable.

	Old industry firms		New industry firms	
	1998-1999	2001-2002	1998-1999	2001-2002
Constant	-0.077* (2.37)	-0.148** (7.42)	0.264* (2.39)	-0.330** (7.42)
I_t/M_{t-1}	0.955* (8.55)	0.855** (10.85)	1.634* (3.577)	0.441** (3.85)
N	170	266	46	108
R^2	0.30	0.31	0.23	0.12
Adj R^2	0.30	0.31	0.21	0.11
F-values	73.2	117.9	12.8	14.8
D-W	1.8	2.1	1.9	2.3

Note: t-values are in parentheses. * *denotes significant at 0.01 level. *denotes significant at 0.05 level

As a second step in the statistical analysis a SUR-estimation is made. Table 5 shows the results of the SUR estimation. In the SUR estimation the number of observations is determined by the smaller data set, that is, the number of new industry firms in the boom period 1998-1999. Consequently, the number of usable observations for old industry firms is reduced to the first 46 observations from 1998 to 1999 and the first 108 observations from 2001 to 2002. There is a correlation of 0.22 between error terms of old and new industry firms in 1998-1999 and -0.02 in 2001-2002.[3] The estimated parameters of the two equations (9) and (10) in the period 1998-1999, differ more than in 2001-2002, compared to the OLS-estimation. The depreciation rate for old industry firms is increased in 1998-1999 and made more similar to the rate in the subsequent recession period. It is again worth noting that the q_m-value for new industry firms changes dramatically over the two periods.

Of special interest for this study is that the constant and the coefficient q_m differ significantly between old and new industry firms in 2001 and 2002. There is also a difference for 1998-1999 even though this difference is only significant at the 13 per cent level.

Table 5. SUR . Change in market value ($\frac{M_t - M_{t-1}}{M_t}$) is dependent variable.

	1998-1999		2001-2002	
	Old industry firms	New industry Firms	Old industry firms	New industry firms
Constant	-0.124**	0.284**	-0.156**	-0.330**
	(2.68)	(2.64)	(4.56)	(10.26)
I_t/M_{t-1}	0.759*	1.492**	1.090**	0.444**
	(4.44)	(3.41)	(8.27)	(3.91)
N	46	46	108	108
R^2	0.29	0.22	0.39	0.12
Adj R^2	0.28	0.21	0.38	0.11
D-W	1.9	1.9	2.0	2.3
Test of equal coefficients	$\chi^2(1) = 2.25$		$\chi^2(1) = 13.76$**	

Note: t-values are in parentheses. * *denotes significant at 0.01 level. *denotes significant at 0.05 level

Regarding the results in Table 5, the tendency to make systematic mistakes in the forecasting of cash flows seems to be larger when evaluating young industries compared to old established industries, which would support hypothesis two. Furthermore, the mistakes change character, during a stock market boom there is a positive bias, while the bias is negative during recessions.

[3] Multiplied by degrees of freedom these correlations give us chi-squared distributed test statistics of 10.12 and respectively 2.38 (see Griffith, Hill & Carter 1999, p. 552). Hence, a null hypothesis of no correlation between the residuals at the 5-per cent level can only be rejected for the first time period.

A further interpretation of this result could be that the greater the number of new industries there is compared to mature industries, the more likely bubbles are to appear in the stock prices.

In order to verify the results of the SUR-estimation three panel data models are estimated for the two time periods. Table 6 presents the results of these estimations.

Table 6. Panel Data Estimation with Dummy Variable

Dependent variable: Change in market value $\left(\frac{M_t - M_{t-1}}{M_t}\right)$

	OLS		**Fixed Effects Model**		**Random Effects Model**	
	1998-1999	2001-2002	1998-1999	2001-2002	1998-1999	2001-2002
Constant	-0.105** (-2.62)	-0.129** (-6.39)	-	-	-0.098 (1.23)	-0.128** (-2.86)
I_t/M_{t-1}	1.091** (8.40)	0.694** (10.63)	1.055** (8.21)	0.676** (10.38)	1.060** (8.26)	0.678** (10.42)
NEWIND	0.443** (6.73)	-0.195** (-5.39)	0.441** (6.79)	-0.198** (-5.51)	0.441** (6.80)	-0.197** (-5.49)
N	216	374	216	374	216	216
R^2	0.33	0.33	0.35	0.34	0.33	0.33
Adj R^2	0.32	0.32	0.34	0.34	-	-
F-values	51.3	90.31	37.77	63.8	-	-

Note: t-values are in parentheses. * *denotes significant at 0.01 level. *denotes significant at 0.05 level

All three panel data models support the results in the previous OLS and SUR estimation. Both the OLS_{panel}, and the Fixed Effects model have significant estimates (significant at 0.01 level) of the marginal *q* and the effects of new industry. For the random Effects model all but one estimate are significant at the 0.01 level. Arguing that the specific time period had a substantial impact, the Fixed Effects model would be most accurate for our model. Indeed, the Fixed Effects model has the highest explanatory value and significant estimates of all coefficients. The Hausmann test also indicates that the Fixed Effects model has the best predictive power of the three models.

For all firms in the sample, that is when there is no division into subgroups, the estimated marginal *q* should be somewhere in the region of one, otherwise firms would make, on average, inefficient investment decisions. Or to put it in another way, a marginal q less than (larger than) one would imply that an investment of one would make the market value change less than (larger than) one i.e. overinvestment (underinvestment). In the panel data models the estimated marginal *q* is an average for the whole sample. In the boom period 1998-1999 the average marginal q for all firms lies between 1.05 and 1.09. For the recession period 2001-2002 the investment performance is dramatically lowered, marginal *q* is on average between 0.68-0.69. This is consistent with our reasoning that during a recession the market is very skeptical about investment opportunities, and during a boom the market is overoptimistic. These results support the findings of the OLS and SUR estimation models and thus confirm the presence of a specific valuation effect of firms working in the so called new industry. It also verifies the finding that the investment performance and subsequently valuation of firms change dramatically due to changes in market sentiments.

7. Conclusion

The yearly changes in stock prices and market values of firms can be large. As Shiller (1981) has demonstrated, the prices and values seem to move more than what can be justified by changes in fundamentals. The fundamental explanatory factor used in this paper is investment. According to the marginal *q*-theory originating from an article by Mueller and Reardon (1993), investment is the most appropriate fundamental factor for the explanation of changes in market values. Gugler, Mueller and Yurtoglu (2002a and 2002b) have subsequently in a number of empirically oriented papers shown the strength of the marginal *q*-theory. Common in this empirical research are long-term relationships that are estimated.

This paper has a short-term perspective. Investment represents the fundamental factor explaining how market values change in a stock price cycle consisting of a rise followed by a fall in stock prices. We find that the investment performance (marginal *q*) for firms listed on the Stockholm Stock Exchange change, during both period 1998-1999 and 2001-2002, varies in a bubble-like fashion for new industry firms (represented by biotechnology, IT and telecommunication). The increase in market values during the boom, and the decrease in market values during the subsequent recession, is significantly greater for these new industry firms than other firms. In fact the marginal q is pretty stable for the mature industry firms. Investors seem to be more prone to make systematic errors in their forecasts for new industry firms. To understand why such systematic errors occur, bounded rationality and limited industry experience could add to explanations of psychological nature in the behavioral finance literature.

References

Brealey, R. A. and S. C. Myers, (1991), *Principles of Corporate Finance*, 4th ed. McGraw-Hill, New York.

Evans, L.L., (2003), *Why the Bubble Burst: US Stock Market Performance since 1982*, Edward Elgar, Cheltenham.

Griffiths, W. E., Hill, R. Carter and G. G. Judge, (1993), *Learning and Practicing Econometrics*, New York: John Wiley & Sons, Inc.

Grundfeld, Y., (1960), The Determinants of Corporate Investment, in A.C. Harberger (ed.), *The Demand for Durable Goods*, Chicago: Chicago University Press, 211-66.

Gugler, K., D. C. Mueller, and B. B. Yurtoglu, (2002a), Marginal *q*, Tobins *q*, Cash Flow and Investment, mimeo, University of Vienna.

Gugler, K., D. C. Mueller, and B. B. Yurtoglu, (2002b), Corporate Governance and the Return on Investment, mimeo, University of Vienna.

Gugler, K., D. C. Mueller, and B. B. Yurtoglu, (2004), "Marginal q, Tobin´s q, Cash Flow , and Investment", *Southern Economic Journal*, 70:512-531.

Gugler, K., and B. B. Yurtoglu, (2003), "Average q, Marginal q, and the Relationship between Ownership and Performance", *Economics Letters*, 78:379-84.

Hayashi, F., (1982), "Tobin´s Marginal q and Average q. A Neoclassical Interpretation", *Econometrica* 50:213-24.

Jensen, M. C. and W. H. Meckling, (1976), The Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure, *Journal of Financial Economics*, 3, 305-60.

Modigliani, F. and M. Miller, (1958), The Cost of Capital, Corporate Finance, and the Theory of Investment, *American Economic Review*, 48, 261-97.

Mueller, D. C. and E. Reardon, (1993), Rates of Return on Investment, *Southern Economic Journal*, 60, 430-53.

Sheeran, P., and Amber, S., (2004), *The International Political Economy of Investment Bubbles*, Ashgate, Aldershot.

Shiller, R. J., (1981), Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends? *American Economic Review*, 71, 421-36.

Shiller, R.J., (2000), *Irrational Exuberance*, Princeton University Press, Princeton.

Shiller, R.J., (2002), "Bubbles, Human Judgement and Expert Opinion", *Financial Analysis Journal*, 53:589-610.

Shleifer, A., (2000), *Inefficient Markets: An Introduction to Behavioral Finance*, Oxford University Press, Oxford.

Tobin, J., (1969), A General-Equilibrium Approach to Monetary Theory, *Journal of Money, Credit and Banking*, 1, 15-29.