Abstract

The aim of this paper is to investigate the nature of the links between the stock market reactions to signi…cant news in the information set, relevant to investment decisions, and how …rms from a panel revise their investment plans in light of the same information.

The data on revisions in investment plans also makes it possible to estimate the relative importance of di¤erent sources of uncertainty: micro, sectoral or macro, which is an important issue in business cycle research. It is also relevant for models of investment behaviour and for empirical models on panel data. The statistical method we use is nested (co-)variance components. Our main …ndings are that the link between stock market reactions to news and the …rms' revisions of investment plans is weak, and that micro-level uncertainty is the dominant source of uncertainty driving ‡uctuations in investment spending.

Investment plan revisions and share price volatility[1]

Anders Johansson[2] & Karl-Markus Modén[3]

November 10, 1997

[1]We are grateful for financial support from the Economic Council and for valuable advice from Lars-Erik Öller at the National Institute of Economic Research.

[2]University of Gothenburg, Vasagatan 1, S-411 80, Gothenburg.

[3]Industriens Utredningsinstitut (IUI), Storgatan 19, Box 5501, S-114 85 Stockholm, and University of Gothenburg.

1 Introduction

The stock market often attracts considerable interest due to its characteristics of a gambling casino. But what role does the stock market play with respect to the real investment decision taken by individual firms whose shares are traded on the stock exchange? According to an optimistic view about stock markets, they perform the beneficial function of allocating capital to its best social use by immediately reacting to changing demand- and supply conditions through price changes. The more pessimistic view is that the stock market is mainly a "sideshow" (see e.g. Morck, Shleifer & Vishny [16]) with little impact on the crucial decision taken at the firm level. If this is true the role of the stock market as an important factor behind the growth performance of capitalist economies may be greatly overstated. In the best case, the stock market is the place where capitalists fight their battles for ownership and control[1]. In the worst case, stock markets are inefficient in the sense that they fail to value firms according to their "fundamental" factors[2]. In the latter case, the stock market may actually contribute to a waste of resources if the management of a firm, which is overvalued, seizes the opportunity to raise capital cheaply and invest it in projects with a negative net present value discounted with the correct, higher, discount rate, (however, one must of course compare the stock market institution with other capital market arrangements, such as systems dominated by banks and credit markets, these may be plagued by other types of agency problems.)

In this paper we analyze the sources of uncertainty that determine firms' investment behavior. We do not estimate any investment function directly. The connection with traditional investment models is that the results of this paper may help to shed some light on one of the premises of Tobin's-q-theory of investment. This theory provides a link between the stockmarket's valuation of firms and their investment behavior. How strong and reliable is this link? If new information about variables of fundamental importance for firms' future profitability is reflected in shareprices, and also leads firms to revise their investment plans, the stock market may be a reliable predictor of future investments. If the stock market is not efficient in reflecting information the relationship with investment may be weak, and investment models built around the q-theory, are likely to perform poorly.

The appealing feature of the Tobin's-q model is that shareprices incorporate expectations about future cashflows. However, while the theory pertains

[1] Of course, to get the best possible matching of owners to firms, i.e., the most competent owners, is important but it is not the issue we consider here.

[2] This does not necessarily preclude that the stockmarket is "informationally efficient," i.e., that it takes into account all the publicly available information as soon at it arrives.

to marginal-q; we only observe average-q and the conditions for average-q to be a good proxy for marginal-q; are restrictive. Hayashi [10] showed that the production function and adjustment cost function must be linearly homogeneous. Even if this were true, the connection between changes in average-q and changes in the preferred capital stock, and thus changes in the rate of net investment, may be weak. A requirement for a good correspondence between these variables is that the stock market valuation is based on the same information set as the firms have at their disposal. If firms' investment decisions are based on expected values of fundamental factors, such as input- and output prices, shareprices must be based on the same set of factors. If this is not the case, changes in shareprices will be poor predictors of investment changes.

Even if investors have the same information as firms have, shareprices may not always be based on fundamental valuation. Some traders may choose not to be informed about fundamentals, e.g., if it is costly to acquire information, but instead choose to trade on the basis of changes in shareprices themselves. Such behavior may induce an excess volatility, and phenomena such as "mean reversion." A further possibility is that the level of shareprices deviates from the fundamental level by a term that is unrelated to any fundamentals, a "rational bubble". The possibility of bubbles, possibly of a bursting character[3], implies that there may be no unique equilibrium price and that there can be large deviations from the market fundamentals. This could happen even if markets are informationally efficient and expectations are formed rationally.[4]

The conclusion of this discussion is that there are several theoretical reasons for Tobin's-q to be only weakly related to net investment on the firm level. In this paper we will indirectly "test" the q-theory by investigating the extent to which revisions in investment plans are correlated with changes in shareprices, and whether the sources of uncertainty that govern those revisions are the same as those that determine changes in shareprices. A weakness of our approach is that we cannot state in quantitative terms how large the correlation should be, or to what extent the sources of uncertainty should be the same. On the other hand, the approach can tell us if there exists significant uncertainty at different levels. This is important in theoretical macroeconomics and in models of the investment process[5] since if uncertainty is mainly of an idiosyncratic nature, aggregative models with a representative agent facing only aggregate uncertainty are obviously incomplete. On the empirical level, popular GMM-estimators for dynamic models

[3]See Blanchard, O. and Fischer,S., (1989), p. 222.

[4]However, we are not aware of any empirical study that documents the existence of bubbles.

[5]See for example Pindyck,R. and Dixit,A. (1994), p. 247-249.

with panel data often requires that uncertainty is not of an aggregate nature since panels are often short in the time dimension and expectational errors might not be zero in a cross-section average for a given time period. Consequently, these errors cannot be averaged out over time and the common practice of using time-dummy variables might be insufficient.[6]

2 Theoretical Background

The representative firm maximizes its value, shown in equation (1) below, i.e., the present discounted value of its expected future cash flows. The discount rate used must in general be adjusted to reflect the firm's, or project's, risk. According to the capital asset pricing model (in its consumption form[7]) a project with returns positively correlated with future consumption, will be worth less for a risk-averse owner, than one with a negative correlation, given that the projects have the same expected return. In equilibrium, this project will therefore require a higher risk premium than a negatively correlated project would require. This conclusion hinges on the assumption of diminishing marginal utility of consumption that implies that marginal utility is low when aggregate consumption is high, and vice versa.

The value of the firm at time t to a representative owner will be

$$V(\Omega_t) = E\left[\sum_{s=1}^{\infty}\left(\frac{(1+\gamma)^{-s}U'(C_{t+s})}{U'(C_t)}\right)\pi_{t+s} \mid \Omega_t\right] \tag{1}$$

where γ is the owner's rate of time preference, $U'(C_{t+s})$ is the marginal utility of consumption in period $t+s$, π_{t+s} is cash flow[8] in period $t+s$; and Ω_t symbolizes the information set at time t: The latter includes all technological and economic information necessary to form expectations about future cash flows, resulting from the firms optimal plans. We use the standard assumption that information is increasing over time and that nothing is forgotten, so $\Omega_t \subset \Omega_{t+j}$; for all $j \geq 0$.

The discount factor in each period depends in general on both the time period and the state of nature, and can be interpreted as the marginal rate of substitution between consumption at time t and consumption in each future time period and state. Equation (1) is a general formulation, but to simplify

---

[6] See Schankerman, M, [20], Pakes, A. [18] or Altug, S. and Labadie, P. p.300[1].

[7] See, for example, Blanchard,O and Fischer,S. p. 292.

[8] Cash flow is profits minus investment expenditures: $\pi_t = p_t q_t - \sum_i w_{ti} z_{ti} - p_t^I I_t - C(I_t; K_t)$; where $p_t q_t$ is total revenue in period t; $\sum_i w_{ti} z_{ti}$ is total cost of variable factors, $p_t^I I_t$ is the cost of purchasing I_t units of investments goods and $C(I_t; K_t)$ is the cost (in terms of output foregone) of installing the new investments goods.

the analysis, risk neutrality is often assumed coupled with a constant discount rate. In this case we may rewrite equation (1) as

$$V(\Omega_t) = E\left[\sum_{s=1}^{\infty} (1+\gamma)^{-s} \pi_{t+s} \mid \Omega_t\right] \tag{2}$$

The firm's maximization problem boils down to choosing an investment plan, $\{I_{t+j}\}_{j=0}^{\infty}$, to maximize $V(\Omega_t)$. Following Schankerman [20], we write the optimal investment plan as a function of the current information set

$$I^{*}_{t+j} = F(\Omega_{t+j}); \tag{3}$$

where the star indicates optimal value.

Since Ω_{t+j} is not known in period t, the planned optimal investment at time $t+j$ must be based on the expected value of the variables in the information set at that time. Firms are assumed to have rational expectations about the future values of these variables. The investment plan j periods into the future is the expected optimal plan, based on the information set at time t. This is a function of the information set at time t:

$$\hat{I}_{t,j} = E(I^{*}_{t+j} \mid \Omega_t). \tag{4}$$

The firm is assumed to revise its optimal plan as new information arrives. The revision in planned investment for period $t+j$, between periods $t-1$ and t, can be written as:

$$\Delta I_{t,j} \equiv \frac{\hat{I}_{t,j}}{\hat{I}_{t-1,j+1}} - 1 \tag{5}$$

Equations (4) and (5) together imply

$$E(\Delta I_{t,j} \mid \Omega_{t-1}) = 0 \tag{6}$$

Equation (6) follows from the assumption that firms have rational expectations about the future and leave no available information at period $t-1$ unused. Only new information (news/innovations) accrued between period $t-1$ and t, will lead firms to revise their future investment plans.

According to the efficiency hypothesis the stock market is efficient in the sense that agents cannot form a profitable trading strategy from (at least) commonly known information. New information is supposed to be quickly incorporated into stock prices so that any extra profit that can be earned on it is small and unimportant. One can talk about efficiency with respect to different information sets and we will assume that the stock market is efficient with respect to the same information set as the firms' managers are using. This makes it possible to interpret stock returns as well-informed revisions of expected future dividends and gives us a second measure of "news in the information set." This measure has been suggested by Pakes [17] and Schankerman [20] and is an approximation to a result derived in a continuous time model by Pakes [17]. To explain the idea we use a very simplified example as follows.

Assume an unchanged number of shares for the firm and risk neutral agents. Then the ex-dividend value of the firm, which we here denote Z_t should satisfy

$$Z_t = p_t N = E\left[\sum_{i=1}^{\infty}(1+\gamma)^{-i}\pi_{t+i} \mid \Omega_t\right] \tag{7}$$

where p_t is the ex-dividend stock price in period t, N is the number of shares outstanding and d_{t+i} is dividend per share in period $t+i$. Assuming that the cash flow is distributed as dividends, meaning that $\pi_{t+i} = d_{t+i}N$; and taking the difference between p_t and $(1+\gamma)p_{t-1}$; gives us

$$E\left[\frac{p_t + d_t - p_{t-1}}{p_{t-1}} - \gamma \mid \Omega_{t-1}\right] = 0; \tag{8}$$

which is the standard arbitrage condition for risk-neutral traders with a constant interest rate, i.e., we are assuming efficient markets with respect to the information set Ω: Multiplying and dividing in (8) by the number of shares leads to

$$E\left[\frac{Z_t + \pi_t - Z_{t-1}}{Z_{t-1}} - \gamma \mid \Omega_{t-1}\right] = 0: \tag{9}$$

This is also equal to, by using (8),

$$E\left\{\frac{[Z_t + \pi_t - (1+\gamma)^{-1}(E(Z_t + \pi_t) \mid \Omega_{t-1})]}{(1+\gamma)^{-1}(E(Z_t + \pi_t) \mid \Omega_{t-1})} - \gamma \mid \Omega_{t-1}\right\} = 0$$

which can be rearranged as

$$(1+\gamma)E\left[\frac{Z_t + \pi_t}{E((Z_t + \pi_t) \mid \Omega_{t-1})} - 1\right] = 0:$$

Taking $Z_t + \pi_t = V(\Omega_t)$ as the cum-dividend value and neglecting the discounting we get the unexpected relative change in value

$$\hat{q} = \frac{V(\Omega_t)}{E(V(\Omega_t) \mid \Omega_{t-1})} - 1 \tag{10}$$

which is a fair game, or martingale difference, with respect to the information set.[9]

---

[9] The assumption of risk neutrality is sufficient, but not necessary, for a constant and

3 Data description

The dataset, starting in 1975, comes from the so called "planning survey", distributed yearly by the Federation of Swedish Industries[10] to a sample of its member …rms. The survey is sent out to the same companies each year and we therefore have a panel of observations. The sample comprises between 210 and 225 units of observation each year. The sample attrition rate has been high. This is mainly due to frequent reorganizations and ownership changes throughout the population of industrial corporations during the sample period. But some disappearances are also due to bankruptcies, or closing downs of individual plants. If an observation unit has disappeared altogether, it is replaced by a new one in the same industry. The total number of companies, or units, which have been included over the nineteen-year period, 1975-94, is about 475.

The survey questionnaire consists of three parts; the …rst part concerns turnover, employment, wage costs, intermediate input costs and investment in buildings and machinery. Firms are also asked to supply their plans, or forecasts, for the next year about the same variables. The second part contains mainly questions about the …rms' (qualitative) assessment of the development of sales, employment, prices etc., for the coming year. The third part includes specialized questions that di¤er from year to year.

A unit of observation in the planning survey is usually a subsidiary to a larger, stock market quoted, company. However, in some cases the unit of observation is a part of company, e.g., a division or branch. Many units have owners that are listed on the Stockholm Stock Exchange, but other forms of association, such as producers'- or consumers' cooperatives are also represented. In some cases the observation unit is wholly owned by a foreign corporation, which is not quoted on the Stockholm Stock Exchange. These cases are important since we only have shareprice information from that particular stock exchange. As was pointed out above, there are frequent

unpredictable excess rate of return; a constant relative risk aversion coupled with independent dividend growth rates also leads to this result (see [13], p. 1605). In general, asset returns will not be unpredictable if agents are risk-averse. If risk is predictable – as it will be if price changes are clustering; large (small) price changes are more likely to be followed by large (small) price changes, as in a GARCH-framework, and agents are compensated for risk – returns will be predictable since agents will demand a higher risk premium when risk is larger. If dividends are predictable then the conditionally expected returns will also be predictable and actual returns will be somewhat forecastable. This should not pose too much of a problem for us since GARCH-e¤ects, or predictability in general, ought not to be large in yearly data that we are using here. We will therefore regard the stock market excess rate of return as complementary indicator of news.

[10] Industriförbundet.

changes in the status of the unit of observation due to reorganizations or mergers. This forces us to drop a fairly large amount of observations since we require at least two consecutive years of consistent data – a plan in year $t-1$ and a realization in year t. If we actually had information on investment revision for each year and for each company, we would have had $18 \times 220 \approx 4.000$ observations. The actual number is approximately 2.700.

3.1 Revisions in investment plans

The survey is sent out in the middle of March and is returned during the period March-May. The companies thus report their investment plans for the year already in progress (for example, the 1994 survey asks about the actual investments in 1993 and 1992 and the plans for 1994). It is unclear exactly on what information the replies about plans are based. Companies usually make their budgets and other plans for the coming year in the early fall of the preceding year. On the other hand they have their total sales and cost numbers for the previous calendar year available and if those numbers include some surprises, budgeted investment plans may be changed. The period between the beginning of the new year and the answering of the survey (approximately the first quarter) may convey new information that may have further impact on plans. The question is how pre-committed firms are to their budgeted investment plans. We find it likely that the plans reported in the survey reflect a fair degree of pre-commitment, but it is also unlikely that firms bind themselves irrevocably to a certain plan. It should at least be possible for firms to increase the investment rate for projects that take a long time to build and/or install, and perhaps also to postpone others (or slow them down), in response to positive or negative news, respectively, since the budget period. We take the beginning of the year as the critical point in time and assume that deviations of actual investment expenditure from plan reflect news to the information set that have accumulated during the calendar year. However, one should be aware of the possibility that supply- and delivery distortions, etc., also cause deviations from plans. Such deviations are probably not due to news about fundamentals, but of a more practical nature. If they are considered as just temporary distortions, they have only a small effect on the share price. This stands in contrast to news about fundamentals that are of a permanent nature and likely lead to a larger share price reaction. The measured deviation of actual investment expenditure from plan may, however, be of the same order of magnitude in both cases.

3.2 Aggregation

Since a unit of observation in the survey can be either a subsidiary to, or a division of, a parent company we construct new units of observations by aggregating all observations included in the same industrial group. The parent company in the group will be the new unit of observation. This aggregation is necessary for the covariance analysis between stock market price revisions and investment plan revisions. Since the planning survey does not include any information about parent companies, we had to …nd that information from extraneous sources[11]. A related problem is that stock market companies often are of a conglomerate nature. This creates problems since the parent company typically has more plants or units than we cover in our sample. Presumably the stock market considers the whole company when setting prices. This means that our measures of correlation are biased, even if we cannot say in which direction they are at fault. Additionally, the "industry classi…cation" is fuzzy, and the interpretation of the sectoral component, in the covariance analysis between shareprice reactions and investment revisions, becomes somewhat muddled. An example may clarify the issue.

Consider parent company A, which is represented in the survey by four subsidiaries, two in industry i and two in industry j. Furthermore, assume that all subsidiaries are of equal size and have the same expected pro…tability. If sectoral shocks are less than perfectly correlated, a sector i shock may be partially o¤set by a contrary shock in sector j, and the share price reaction will depend on the relative strength of these shocks. One could easily imagine situations where each subsidiary reacts to its sector speci…c shocks in the way suggested by the theory, and the stock market observes and interprets these shocks correctly, but the observed share price revisions will still have a low correlation with revisions in investment plans. If subsidiaries are represented in correct proportions to the whole sectoral composition of company A, an aggregation of all four subsidiaries will smooth out the aggregate revisions and decrease the total variation in investment revisions.

3.3 Descriptive Statistics

The sample is strati…ed into …ve major sectors of the manufacturing industry: i) consumers goods; ii) building- and construction materials; iii) other intermediate goods; iv) investment goods and v) raw materials. In Table 1 the average size according to the number of employed and yearly turnover

[11] We used "Koncernregistret," which is compiled annually by Statistics Sweden, and annual reports of the subsidiaries that generally includes information about ownership changes.

Table 1: Average size in 1993 of companies in main subsectors of the survey. Turnover is measured in 1993 Million SEK.

Sector	Employment	Turnover	Number of firms
Total	930	1,488	213
Consumer goods	1,248	2,306	38
Construction	488	476	12
Intermediate goods	824	1,297	60
Investment goods	768	1,099	77
Rawmaterial	1,125	1,730	26

(in million SEK) in 1993 for each sector is tabulated.

Table 2 shows some statistics about the percentage differences between plans and actual outcomes for three variables; employment, sales and investment. In Figures 1, 2 and 3 the frequency distribution for these revisions are plotted. It is apparent from the table and figures that investment revisions, or deviation from plans, are much more variable than either employment or sales revisions. However, all means are very close to zero.[12] It may also be of interest to look at the time-series of each type of revisions. From Figure 4 it appears that revisions in sales and employment are quite highly correlated, while investment revisions are weakly correlated with the other two. This graphical impression is confirmed in Table 3 where the correlation coefficients between investment revisions and, sales and employment revisions are tabulated.

In Figure 5 the level of real investment in the Swedish manufacturing sector is plotted against the investment plan revisions from our planning data.[13]. It appears that actual changes in investment levels and revisions of plans are relatively highly correlated during the first half of the observation period. Between 1988 and 1990 the investment level increased sharply (about +40%), just to fall back even more from 1990 to 1992 (-45%). During the

[12] It should be pointed that it is gross investment, not net, that are measured. This means that there may be situations where particularly bad news may induce the firm to contract its capital stock, by selling or scrapping assets. The negative investment revision, with assets sales included, would then be less than minus one hundred percent. For positive deviations there is nothing that constrains the observations to be greater than one hundred percent, even though we have truncated the distribution at that number in figure 1.

[13] We don't use actual investment level data from the survey, since the composition of the panel is changing from year to year. This makes such comparisons inappropriate. However, the panel data comprise on average 40% of the manufacturing sector, and a comparison with aggregate data from the official statistics is therefore possible.

Table 2: Summary statistics about deviations of outcome from plan for employment, sales and total investment, in percent.

	Employment	Investment	Sales
Mean	0.25	0.25	1.85
Standard deviation	31.85	66.92	45.47
Max value	782	860	1,193
Min value	-98.60	-100.00	-98.00
Number of observations	659	915	955

…rst of these two-year periods investments fell short of plans by about 10%, and during the sharp downturn in 1991-92 actual investment fell short of plans to an even larger degree (18-16 %).

3.4 Stock Market Data

We have used data on stock market rate of returns for approximately 80 companies (for the total period) listed on the Stockholm Stock Exchange between the years 1976 and 1993. Each return was calculated from the beginning to the end of the year. This measurement period di¤ers from the one we used for the investment revisions data. We have two reasons for that. First, there is no risk-free interest rate for the appropriate nine months period except possibly for the latest years. Second, and more importantly, there seems to be seasonality in the excess returns; the ratio of the mean to the standard deviation drops from 0.36 to 0.03 when we go to the nine-month return from March to December – the mean itself drops almost to zero. Average excess return per year is also substantially reduced so this does not depend on occasional "odd years," which implies that risk is mostly compensated for in the beginning of each year. As a measure of the yearly risk free interest rate we have used yields to maturity on Treasury Bills[14]. The excess rate of return is calculated as price change plus dividends divided by initial price minus the risk free interest rate. Table 4 shows some descriptive statistics for this variable and for the companies included in the empirical study, the results of which are discussed in section 5.

For the purpose of our model we have classi…ed the companies into sectors[15] on the basis of their sectoral classi…cation in the investment revisions data. This cannot be done in a straightforward fashion since many of the

[14] Statsskuldväxlar and Statskammarväxlar.

[15] Industry classi…cation is ISIC rev. 2.

Table 3: Correlations between revisions in plans for employment, investment and sales.

	Employment	Investment	Sales
Employment	1.000		
Investment	0.112	1.000	
Sales	0.855	0.012	1.000

companies listed on the Stockholm Stock Exchange are conglomerates, as we mentioned earlier. Even when we aggregate to only four sectors there remain some large companies that operate in more than one of the sectors. Finally, we decided to use only two sectors when studying the comovement of the variables; the first three sectors shown in Table 4 are aggregated into one sector. This was necessary in order to avoid having too few observations in several sector/year combinations. Table 4 also shows that in all sectors the excess rate of return has been large and volatile during this period.

4 The model and the econometric method

Since we want to focus on the sources of uncertainty, and as a first step simply try to decompose the total risk in micro and macro risk, we have chosen a non-structural approach. This has the obvious advantage of not requiring us to specify a firm's technological and market restrictions and hence get results that are robust with respect to these conditions. The drawback of our method is the lower precision compared with what the imposition of "true restrictions" could give. The method we have chosen is based on variance and covariance components ([20]), and it allows us to separate micro from macro risk, using revision data. Micro shocks are transmitted in various ways[16] and if one uses only actual changes in investments, these micro shocks are already transmitted across the economy and will look like macro or sector shocks. We assume that one agent's micro shocks are private information and not included in other agents' information sets.

We hypothesize that our two news variables ΔI_{ijt} and $\Delta\pi_{ijt}$; the investment revision and the excess rate of return for firm i in sector j and for year t, have constant means and three nested variance components. The whole model, including the variance components, is given as equations (15) to (22); the expected values of each type of revision are

[16] See, for example [14], [15], [12] or [8]

Table 4: Statistics about stock price excess rate of returns, 1975-1993, for companies included in the planning survey.

Sector	Obser-vations	Mean	Std. Error of Mean	Min	Max	Vari-ance
Total	790	0.168	0.017	-0.726	3.706	0.216
ISIC 31-32	32	0.229	0.071	-0.573	1.439	0.162
ISIC 33-34	185	0.161	0.038	-0.691	3.706	0.274
ISIC 35-36	133	0.235	0.045	-0.726	2.554	0.271
ISIC 37-39	440	0.146	0.020	-0.700	1.816	0.179

$$E(\Delta I_{ijt} \mid \Omega_{t-1}) = k \tag{11}$$

$$E(\hat{\Delta}_{ijt} \mid \Omega_{t-1}) = m \tag{12}$$

The constant k; for the investment revisions, represents a possible budgeting bias, or rather a bias from incomplete budgeting at the time of the survey. Though, this is not very likely to be important since the survey is sent out well within the year for which the firms are budgeting. The constant m; for the excess rate of return, is supposed to capture the risk premium on stocks. This constant risk-premium is consistent with the standard CAPM (or conditional CAPM with constant conditional betas and conditionally expected market returns) if one considers random sampling from a population of companies. First, the conditional expected excess return is (conditioned on a given firm i being drawn) given by

$$E(\hat{\Delta}_{ijt} \mid i) = beta_i E(\hat{\Delta}_{mt}) = beta_i m; \tag{13}$$

where $\hat{\Delta}_{mt}$ is the excess rate of return or risk premium on the market portfolio, and m represents the unconditionally expected return. Furthermore,

$$E(\hat{\Delta}_{ijt}) = E(beta_i)m = m: \tag{14}$$

The expected beta-value is equal to one when the expectation is taken over the distribution of firm betas. A randomly selected firm, without knowledge of the specific firm that will be drawn, will be expected to have the rate of return of the market index. In fact, our sample is not random but selected to represent a large part of the manufacturing industry, but since this mainly means large companies that are often quite diversified their mean cross section beta is probably around one. Our situation is different from standard error-component models used in econometrics that would use a regression function for the conditional mean and then add orthogonal error terms; that is, the sampling process is envisaged in a different way. The set-up used here mirrors the fact that our unbalanced data set represents less information and does not allow us to estimate any conditional mean function.

We assume that news in the information set Ω_t can be divided into three nested parts; one macro component for each of the two news variables that affects all firms, α_t and a_t, one sectoral component that only affects the firms in a particular industry, β_{jt} and b_{jt}, and an idiosyncratic factor that pertains to each individual firm, γ_{ijt} and c_{ijt}. The model is defined as

$$\Delta l_{ijt} = k + \alpha_t + \beta_{jt} + \gamma_{ijt} \tag{15}$$

$$\Delta \hat{q}_{ijt} = m + a_t + b_{jt} + c_{ijt} \tag{16}$$

where the constants k and m were discussed above, and the random variables in (15) and (16) are assumed to depend on underlying shocks which influences both equations, or only one of the equations. These latter shocks are indicated by primes and double primes below.[17] Formally we have

$$\alpha_t = \varepsilon_t + \varepsilon'_t \tag{17}$$

$$\beta_{jt} = e_{jt} + e'_{jt} \tag{18}$$

$$\gamma_{ijt} = u_{ijt} + u'_{ijt} \tag{19}$$

$$a_t = \delta_1 \varepsilon_t + \varepsilon''_t \tag{20}$$

$$b_{jt} = \delta_2 e_{jt} + e''_{jt} \tag{21}$$

$$c_{ijt} = \delta_3 u_{ijt} + u''_{ijt}. \tag{22}$$

The error components in (15) and in (16) are supposed to be orthogonal to each other, and to themselves over time, and have finite variances (the same assumptions are used also for the more basic shocks). The common shocks

[17] These "variable specific" shocks could also contain measurement errors. However, without further information it is impossible to separate out the measurement errors.

ε, e and u are normalized so that the response parameters for the investment revisions are unity. The variances and covariances are

$$Var(\Delta I_{ijt}) = \sigma_{\alpha}^2 + \sigma_{\beta}^2 + \sigma_{\gamma}^2 \tag{23}$$

$$Var(\Delta\hat{I}_{ijt}) = \sigma_a^2 + \sigma_b^2 + \sigma_c^2. \tag{24}$$

$$Cov(\Delta I_{ijt}, \Delta\hat{I}_{ijt}) = \sigma_{\alpha a} + \sigma_{\beta b} + \sigma_{\gamma c} \tag{25}$$

The covariances in the latest of these expressions are, for example,

$$\begin{aligned} \sigma_{\alpha a} &= E((\varepsilon_t + \varepsilon_t^{0})(\delta_1 \varepsilon_t + \varepsilon_t^{00})) \\ &= \delta_1 Var(\varepsilon_t) \end{aligned}$$

with similar expressions for the other two covariances.

The index for each component shows the type of the shock; index t, for year t, corresponds to a macro shock. Even though the years that we use are not random, we assume that the effect of any particular year on revisions is random, and effects all firms in the same way. The index jt signifies a sector shock in any particular year, and all firms in a given sector and a given year is influenced in the same fashion by this shock. Finally, the index ijt represents a micro, or idiosyncratic, shock.

The nestedness of the various shocks means that sectoral shocks are interpreted as deviations around macro shocks. We have not included any component with only index j that would correspond to a sector-specific random effect in a standard error components model and therefore we hypothesize that there is no sectoral shock that is independent of time. It is natural to nest the sectoral shock within the aggregate shock since, with nearly 20 years of data, a random component that affects a sector once and for all is not plausible. By definition, a shock can only be a shock once and it should be incorporated in the plan for the next year; it should not induce any serial correlation in the one year investment plan revisions. The idiosyncratic shocks, in turn, are viewed as deviations around sectoral shocks. As we mentioned above, the two variables are allowed to be partly determined by different factors. For example, investment is often thought to be subject to delivery lags, supply distortions, time to build lags etc. Short run disturbances like unforeseen delivery lags could then in principle account for a large part of the difference between plan and realization, without any kind of news in the information set leading to firms revising their plans. This is, however, not true if firms have rational expectations; they would take this into account when formulating their plans and only surprises in these frictions would affect the revisions. The plan for the next year would take these disturbances into account, leaving no systematic e¤ect on the revision variable. This is allowed for in this "variable speci…c" random term.[18]

To summarize, the model implies that the common factor in the disturbances at each level a¤ect the two variables di¤erently. The assumed error structure also entails that the components are correlated across the equations. An obvious shortcoming of the model is that di¤erent shocks are aggregated. Each covariance component, which is assumed to consist of several shocks, can only be either positive or negative. Theoretically some shocks can move the two variables in di¤erent directions (such as an oil price shock that leads …rms to increase investment in energy saving equipment but which simultaneously decrease pro…ts, and hence q) and other disturbances will move them in the same direction. Since we cannot identify more than one type of shock at each level, the estimates will simply be an average over di¤erent shocks, with the resulting danger of cancellation and underestimation of the magnitude of the shocks. A second shortcoming is that the response parameters are the same for each …rm and each time period.

The variance/covariance components pertaining to (15) and (16) will be estimated with an unbiased "analysis of variance estimator" for unbalanced data[19] [20]. First one partitions the sums of squares and the cross-products of the two variables in various ways. Then one takes the mathematical expectations of the derived expressions, and …nally, one sets the sample moments equal to the theoretical moments and solves for these. This delivers unbiased estimates.[21]

---

[18] The model also allows for measurement errors at each level in the respective variables as long as these are not correlated between the two variables, but the variances for these measurement errors and other possible factors that only a¤ect one of the variables cannot be separately identi…ed. It is only possible to estimate the variances of the three "summary components" in each equation plus the three covariance components. The estimates of the covariance components will be less contaminated by measurement error since these are probably uncorrelated across variables.

[19] See Searle [21], chapters. 10-11 and Searle et al. (1992)[22] chapter 11.

[20] We are also trying to use the ML method in order to get better tests of the strict positivity of the variance components and to possibly make (mis-)speci…cation tests.

[21] With unbalanced samples the empirical second moments will not be proportional to F-distributed random variables. The sums of squares are not true sums of squares but rather "analogous sums of squares" (see Searle p. 433) and can even be negative. The sums do not in general have $\hat{A}^2$-distributions, not even under normality. Expressions for the variances for the estimators, under normality assumptions, are given in an appendix in Searle's book, and they depend on the unknown parameters. Simply using the estimates for these will give unbiased estimates of the variances but little seems to be known about their e¢ ciency. How does one test if a variance component is strictly positive? In a balanced framework

4.1 Heterogeneous response

The model we estimate constrains all companies to have the same response to shocks. This means that if firms have heterogeneous responses to macroeconomic or sectoral shocks this might be measured as micro shocks and thereby exaggerate the latter. We therefore try to calculate how large these biases are. A simple way to do this is to use only two types of shocks; micro and macro shocks, and let the response parameters vary with the firms. The derivation of the model we use is described in the appendix. We show there how to derive the following equations

$$Var(\phi_{ijt} \mid j;t) = \sigma_u^2 + \left(\frac{\sigma_{\pi_1}}{\bar{\pi}_1}\right)^2 \left(\frac{\phi_{\cdot jt}}{n_{jt}}\right)^2 \tag{26}$$

$$Var(\Delta I_{ijt} \mid j;t) = \sigma_\gamma^2 + \left(\frac{\sigma_{\pi_2}}{\bar{\pi}_2}\right)^2 \left(\frac{\Delta I_{\cdot jt}}{n_{jt}}\right)^2 \tag{27}$$

$$Cov(\phi_{ijt}; \Delta I_{ijt} \mid j;t) = \sigma_{u\gamma} + \left(\frac{\sigma_{\pi_1\pi_2}}{\bar{\pi}_1\bar{\pi}_2}\right) \left(\frac{\phi_{\cdot jt}}{n_{jt}}\right) \left(\frac{\Delta I_{\cdot jt}}{n_{jt}}\right) \tag{28}$$

which we estimate with OLS. In the appendix it is further explained how one can correct the observed micro variance for heterogeneous response to macro shock, and thus obtain a better measure of the importance of genuine micro shocks.

5 Estimates

Table 5 shows the variance and covariance decompositions based on the estimated components at firm or conglomerate levels. Looking at the variance components, the results indicate that there is only a significant micro component for the investment revisions, while all the components are significantly different from zero for the rate of return variable. This corresponds partly with Schankerman's results, but the micro component for the stock market rate of return seems to be more important in our estimate. The investment

one derives F-tests. Under normality, each sum of squares component is χ^2-distributed and independent of the other components. For unbalanced designs one can use a similar procedure as an approximation. We use an approximation from Cummins and Gaylor [9]. We have also used maximum likelihood for the variance components with similar results, except for the variance for the sector component in the excess rate of return variable which is then not significantly larger than zero. Regarding the covariance components we use the same approximation without any justification; even though the grounds for using it are weaker since cross products and not squares are used.

revisions seems una¤ected by the macrolevel uncertainty that contrasts with Schankerman's …ndings. This result does not change even if we discard "outliers". Furthermore, it does not change much if we look at plant level data with 20 sectors and with separate estimates for machinery, equipment and buildings. However, the sector component is slightly larger at the plant level (up to 10%). It is possible that the large micro e¤ect for the investment revisions are due to measurement errors that are common in survey/panel data.

In the last column of Table 5 we show the covariance decomposition. All components matters with the micro e¤ects being the largest but now it is not at all so dominating as it is for the investment revisions variance.[22] In contrast to Schankerman's results, the sector e¤ect is smaller than the macro e¤ect but we only use two sectors while he used 19.

The results of admitting heterogeneous responses are shown in rows six and seven in Table 5. For both the variances the micro component shrinks considerably. Stock returns being dominated by aggregate shocks is plausible, given the extensive covariation between stocks, as explained by theories like CAPM and APT. For the covariance the heterogeneous responses to macro shocks are negative, meaning that investment revisions and rate of returns move in opposite directions when macro or sectoral shocks occur. This could partly explain the small overall correlation between investment revisions and rates of return (see below). However, in the regressions for the covariance speci…cation the parameter $\frac{¾¼_1¼_2}{¼_1¼_2}$ is estimated to be only -0.2 with a standard error of nearly 0.3. In statistical terms there should not be any correction for heterogeneity. Given this, the stock return variance and the covariance have almost the same micro versus macro plus sectoral decomposition. In summary, both micro and aggregate uncertainty matter for both our variables with micro variance dominating the investment revisions, though this is damped when we consider the covariation between the variables that contains less measurement errors.[23]

6 Further connections between revisions

The results indicates that uncertainty matters at all levels, the microlevel having the largest impact. What is the importance of this result? More gen-

[22] The result for the covariance is somewhat changed if we use stock market data from March to December each year; the micro component increases to 78% while the macro component decreases to 17%.

[23] Unfortunately we cannot test for signi…cant di¤erences in the variance decomposition between the investment revisions and the returns. Absent measurement errors,this could say if one of the basic premisses behind Tobin's Q-model hold water.

Table 5: Variance decomposition for investment revisions and rate of return, in percent.

Component	Var(¢I)	Var($\hat{q}$)	Cov(¢I; $\hat{q}$)
Homogeneous response:	.	.	.
	.	.	.
Micro	98.6	64.6	43.3
Sector	1.4	3.0	16.2
Macro	0.0	32.4	40.5
T1¤	0.96	11.3	5.17
	(0.53)	(0.00)	(0.00)
T2¤¤	1.29	1.94	6.56
	(0.19)	(0.01)	(0.00)
Heterogeneous response:	.	.	.
	.	.	.
Micro	80.0	45.0	55.0
Macro+sectoral	20.0	55.0	45.0
Number of observations	759	726	540

Note:¤Approximate F-test of the null hypothesis that the macro component, ¾$^2_{®}$; ¾$^2_{a}$; or ¾$_{®a}$; is zero.¤¤ Approximate F-test of the null hypothesis that the sector component, ¾$^2_{-}$; ¾$^2_{b}$, or ¾$_{-b}$; is zero. Prob.-values in parenthesis.

erally, are the variables good indicators of news in the underlying information sets? One can get a notion about this by regressing our revision variables on each other and on other revision variables that we have in our data set. In this way we can determine how well these revision variables can predict each other and thereby, since they are all supposed to be determined on the same information set, are "news indicators".

To the basic revision variables we added: contracted sales, and the following expenditure variables: wages, material, electricity, fuels and cash ‡ow. These variables are de…ned as the investment revision variable was de…ned. The only variable that might not be obvious is the cash ‡ow variable that is measured as a residual: sales minus factor expenditure. Expenditures on overhead are not included in our measure of cash ‡ow revisions since the data does not include expectations for this item. We decided to use variables that are mixtures of prices and quantities in order to directly use the …rms expectations that are given for these variables and to avoid further measurement bias from using aggregate price indexes (additional errors arises by estimating expectations for output and factor prices etc.).

Since there might be measurement errors in the data set we decided to discard outliers with an absolute value in excess of 300%. In Table 6 we report the regressions for ¢I and ¢r. In comparison with Table 5, the number of observations drops by almost 50% when all variables are included. The White-test for heteroskedasticity does not reject homoskedasticity but the Shapiro-Wilk test for normality rejects that the residuals are normally distributed.[24] We therefore decided to do a robustness check by further restricting the sample. A natural restriction to consider when the panel is as unbalanced as ours, and has as many outliers, is that …rms should have at least nine full observations so that they have at least answered the questionnaire fully during half of the sample period. One might suspect that our data for smaller …rms and plants, which dominates among the units with few complete observations, contain more measurement errors. At the same time we expect that these …rms' stocks are traded less e¢ciently at the stock exchange, due to less frequent trading or simply because there is a smaller public interest in these …rms as compared with the very large and multinational …rms.

The results from these two regressions are also shown in Table 6 below the columns (c) and (d): The investment revisions regressions shows that the only variable with any signi…cant in‡uence is the stock market return variable. Not much of the variation is explained with these revision variables in either of the two regressions. Formally, an F-test of the joint signi…cance of the regression would not reject the null. The variation in the stock market return is much better predicted when regressed on the investment revisions and sales revisions. In all columns the investment variable/return variable is signi…cant at the 3%-level (but normality is rejected in columns (a) and (b)): This con…rms, in our opinion, that our variables are measures of news and not dominated by measurement errors. An absence of statistically signi…cant parameters would make the assumption of our variables as news indicators for a common information set doubtful. However the correlations between the variables are not stable; all correlations between the revision variables drop when we calculate pairwise correlations for all variables without requiring complete records for every variable. This also suggests that the partially complete observations are more contaminated by measurement errors then the complete ones. For example, in the sample that we used for our variance and covariance components, the overall correlation between investment revisions and the stockmarket excess returns is only 0.025 and not signi…cantly

[24] For a description of these two tests, see Spanos, A. [23], pp. 465-467 and p. 452.

di¤erent from zero at any standard signi…cance level.[25] This correlation varies somewhat across sectors,[26] but is still low and suggesting a weak link between the stock market and the …rm's investment decisions.[27] The only signi…cant correlation which seems to be robust is that between sales revisions and stockreturns.[28]

7 Conclusions

We …nd that investment revisions, under the restriction of homogeneous response, are dominated by micro, or …rm speci…c, uncertainty. When we consider possible heterogeneity among …rms this result weakens considerably (from 98.6% to 80%). The stock market excess return variable is also dominated by idiosyncratic uncertainty, but the other two components are also signi…cantly greater than zero. Here, the heterogeneity correction makes the aggregate shocks account for roughly 55% of the variation so it makes a substantial impact on the result. Finally, the covariation between the two variables is dominated by micro shocks even if uncertainty at all three levels seems to matter. A bias-correction for heterogeneity does not seem to be statistically warranted for the covariance. Linear regressions con…rm that the investment revisions are hard to predict with our variables; only the stock return has a signi…cant in‡uence. We conclude that, despite some evidence for measurement errors, the investment revisions and the stock market prices are only partly based on the same information set. This con‡icts with the basic premisses behind the q-theory.

[25] Despite that, our estimates of the covariance components are signi…cantly greater than zero. The variances of the two variables are simply much larger than the covariance between them.

[26] In results not reported here it is slightly negative or zero for ISIC 31-32 and around 0.10 for ISIC 35-36, ISIC 37-38, and signi…cantly greater than zero at the 5% level. The correlation gets even weaker when using returns from the period March-December.

[27] But, in results not reported, we used the same sample as in the regressions (with the correlation between ¢I and **φ** equal to 0.08) to estimate the covariance components. Then the macro component is slightly larger than the micro component.

[28] We have also estimated variance and covariance components for the other revision variables with results that are very similar to the reported results. The other revisions are dominated by micro shocks, have low correlations among themselves, and sales and wages are correlated with returns with a slightly larger role for macro shocks than the investment revisions has.

Appendix: Derivation of the heterogeneous response model

A simple way to make a heterogeneity correction of the components is to use only two types of shocks; micro and macro shocks, and let the response parameters vary with the firms. Formally, we use the following model ([20], p. 17)

$$
\begin{aligned}
\Delta q_{ijt} &= m + (\bar{\pi}_1 + \pi_{1,i})\,\varepsilon_{jt} + u_{ijt} && (A.1)\\
\Delta l_{ijt} &= k + (\bar{\pi}_2 + \pi_{2,i})\,\varepsilon_{jt} + \nu_{ijt} && (A.2)\\
w &= [\varepsilon_{jt}, u_{ijt}, \nu_{ijt}] \sim NID(0, D)\\
z &= [\pi_{1,i}, \pi_{2,i}] \sim NID(0, \Sigma)
\end{aligned}
$$

The same indexing conventions are used as in (15) to (25), except that now ε_{jt} denotes a combined macro and sector shock. Furthermore the idiosyncratic shocks are now non-nested. The shocks ε, u and ν are supposed to follow and iid multivariate normal distribution with a diagonal covariance matrix $D.$ In addition, the response parameter z is assumed to be independent from these shocks. Each firm "draws" a response parameter for each of the two variables, from a bivariate normal distribution. This gives the conditional moments (conditioning on year and industry)

$$Var(\Delta q_{ijt} \mid j, t) = \sigma_u^2 + \sigma_{\pi_1}^2 \varepsilon_{jt}^2 \qquad (A.3)$$

$$Var(\Delta l_{ijt} \mid j, t) = \sigma_\nu^2 + \sigma_{\pi_2}^2 \varepsilon_{jt}^2 \qquad (A.4)$$

$$Cov(\Delta q_{ijt}, \Delta l_{ijt} \mid j, t) = \sigma_{u\nu} + \sigma_{\pi_1\pi_2} \varepsilon_{jt}^2 \qquad (A.5)$$

These moments depends on the unobservable macro shock. To derive estimable equations we first subtract the overall sample mean from Δq_{ijt} and Δl_{ijt}, but for simplicity, keep the same notation for the zero-mean variables. We also let a dotted index denote a summation over the corresponding index. Utilizing that

$$\text{plim}\,(\Delta q_{\cdot jt}/n_{jt}) = \bar{\pi}_1 \varepsilon_{jt}$$

since all random variables involved are independent of each other and over time, and analogous probability limit for the other variables, we can approximate the unobservable shocks with consistent estimates and derive the following equations

$$Var(\Delta\pi_{ijt} \mid j, t) = \sigma_u^2 + \left(\frac{\sigma_{\pi_1}}{\bar{\pi}_1}\right)^2 \left(\frac{\Delta\pi_{.jt}}{n_{jt}}\right)^2 \qquad (A.6)$$

$$Var(\Delta I_{ijt} \mid j, t) = \sigma_\gamma^2 + \left(\frac{\sigma_{\pi_2}}{\bar{\pi}_2}\right)^2 \left(\frac{\Delta I_{.jt}}{n_{jt}}\right)^2 \qquad (A.7)$$

$$Cov(\Delta\pi_{ijt}, \Delta I_{ijt} \mid j, t) = \sigma_{u\gamma} + \left(\frac{\sigma_{\pi_1\pi_2}}{\bar{\pi}_1\bar{\pi}_2}\right) \left(\frac{\Delta\pi_{.jt}}{n_{jt}}\right) \left(\frac{\Delta I_{.jt}}{n_{jt}}\right) \qquad (A.8)$$

We add error terms that will include measurement errors from the first step and then we estimate the specifications using OLS. The estimates will be consistent when the number of firms for a given sector/year combination and the number of time points goes to infinity, but will contain a finite sample bias. The standard errors will be biased downwards so an "insignificant estimate" can safely be set to zero. If the mean revisions within sectors for each year are close to the overall means then the corrections for heterogeneity will be small since aggregate shocks are then simply not important. If, on the other hand, the aggregate shocks are important and there is heterogeneous response then the variances within sectors/years will increase with the size of the shock, and this phenomenon will be captured by the regression coefficients that are estimates of squared variation coefficients. The original parameters are not identified in these regressions; only their ratios and ratios squared are identified, but that is sufficient for our purpose. The regression coefficients are then used to calculate the heterogeneous response in the following way. First, we use the standard formula for the rate of return (the other expressions are similar).

$$\begin{aligned} Var(\Delta\pi_{ijt}) &= Var[E(\Delta\pi_{ijt} \mid j, t)] + E[Var(\Delta\pi_{ijt} \mid j, t)] \qquad (A.9) \\ &= \bar{\pi}_1^2\sigma_\varepsilon^2 + \sigma_{\pi_1}^2\sigma_\varepsilon^2 + \sigma_u^2 \end{aligned}$$

Here, the first term is the variance of the conditionally expected value ($m + \bar{\pi}_1\varepsilon_{jt}$), and the last two terms comes from (A.3) and is equal to the measured micro variance from the previous model. These two terms are, respectively, the expected value of the variance component due to heterogeneous response; $\sigma_{\pi_1}^2\sigma_\varepsilon^2$; and the genuine micro shock. From the previous estimates under homogeneous response we have an estimate of the sum of these two components, call it Var_m: With this we can derive

$$
\begin{aligned}
\frac{Var_{micro}}{Var_{tot}} &= \frac{Var_m - \sigma^2_{\mu\pi_1}\sigma^2_{\varepsilon}}{Var_{tot}} \\
&= \frac{Var_m}{Var_{tot}} - \frac{\sigma^2_{\mu\pi_1}}{\mu\pi_1^2}\frac{\sigma^2_{\varepsilon}\mu\pi_1^2}{Var_{tot}} \qquad (A{:}10) \\
&= \frac{Var_m}{Var_{tot}} - \frac{\sigma^2_{\mu\pi_1}}{\mu\pi_1^2}\left(1 - \frac{Var_m}{Var_{tot}}\right)
\end{aligned}
$$

which gives the percentage of the total variance attributable to the micro component.

References

[1] Altug, Sumru and Labadie, Pamela, Dynamic Choice and Asset Markets, Academic Press, 1994.

[2] Bertola, Guiseppe and Ricardo J. Caballero, "Irreversibility and aggregate investment," Review of Economic Studies 61, pp. 223-246, 1994.

[3] Blanchard, Olivier J. and Stanley Fischer, Lectures on Macroeconomics, MIT Press, Cambridge, Mass., 1989.

[4] Blundell, Richard et al., "Investment and Tobin's Q - evidence from company panel data," Journal of Econometrics 51, pp. 233-257, 1992.

[5] Brainard, William C. and James Tobin, "Pitfalls in financial model building," American Economic Review 58(2), pp. 99-122, May 1968.

[6] Caballero, Ricardo J., and Robert S. Pindyck, "Uncertainty, investment, and industry evolution," NBER Working Paper No. 4160, September 1992.

[7] Chirinko, Robert S., "Business fixed investment spending: Modelling strategies, empirical results, and policy implications," Journal of Economic Literature 31, pp. 1875-1911, December 1993.

[8] Cooper, Russel and John Haltiwanger, "Inventories and the propagation of sectoral shocks," American Economic Review 80, pp. 170-190, March 1990.

[9] Cummins, W. B. and Gaylor, D. W., "Variance Component Testing in Unbalanced Nested Designs", Journal of the American Statistical Association Volume 69, Number 347, Theory and Methods Section, pp. 765-771, September 1974.

[10] Hayashi, Fumio, "Tobin's marginal q and average q: A neoclassical interpretation," Econometrica 50(1), pp. 731-53, January 1982.

[11] Jensen, Michael, "Agency cost of free-cashflow, corporate finance and takeovers," American Economic Review 76, pp. 323-29, 1986.

[12] Jovanovic, Boyan, "Micro shocks and aggregate risk," Quarterly Journal of Economics 102(2), pp. 395-410, May 1987.

[13] LeRoy, Stephen F., "Efficient capital markets and martingales," Journal of Economic Literature 27(4), pp. 1583-1621, December 1989.

[14] Long, John and Charles Plosser, "Real business cycles," Journal of Political Economy 91, pp. 39-63, February 1983.

[15] Long, John and Charles Plosser, "Sectoral vs. aggregate shocks in the business cycle," American Economic Review pp. 333-36, May 1987.

[16] Morck, Randall, Andrei Shleifer and Robert W. Vishny, "The stock market and investment: Is the market a sideshow?" Brookings Papers on Economic Activity 2, pp. 157-215, 1990.

[17] Pakes, Ariel, "On patents, R&D and the stock market rate of return," Journal of Political Economy 93, pp. 390-409, April 1985.

[18] Pakes, Ariel, "Dynamic structural models, problems and prospects: mixed continuous discrete controls and market interactions", Advances in Econometrics, Sixth World Congress. Vol. II. Ed. by Sims, C.A., Cambridge University Press, 1991.

[19] Pindyck, Robert S. and Andrés Solimano, "Economic instability and aggregate investment," NBER Macroeconomic Annual 8, pp. 259-303, 1993.

[20] Schankerman, Mark, "Revisions of investment plans and the stock market rate of return," NBER Working Paper No. 3937, December 1991.

[21] Searle, S.R., Linear Models, Wiley and Sons, 1971.

[22] Searle, S.R., Casella, G. and McCulloch, C.E. Variance components. Wiley and Sons, 1992.

[23] Spanos, Aris, Statistical foundations of econometric modelling, Cambridge University Press, Cambridge, 1986.

Figure 1: Frequency distribution of revisions in employment plans, 1981 - 1993.

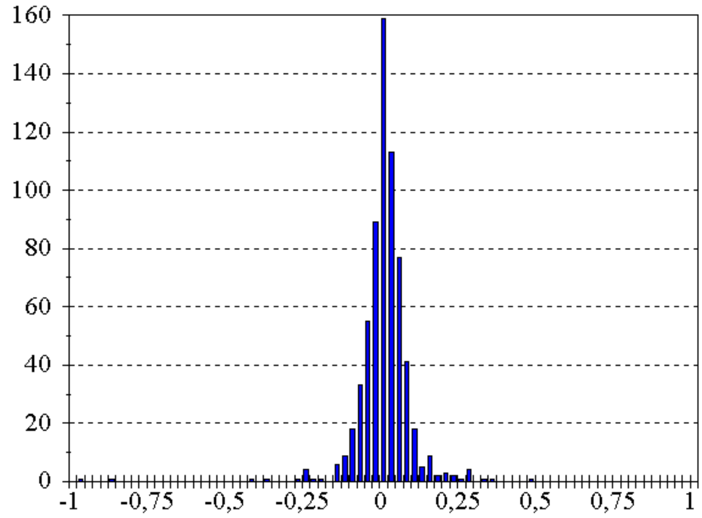

Figure 2: Frequency distribution of revisions in sales plans, 1975-1993.

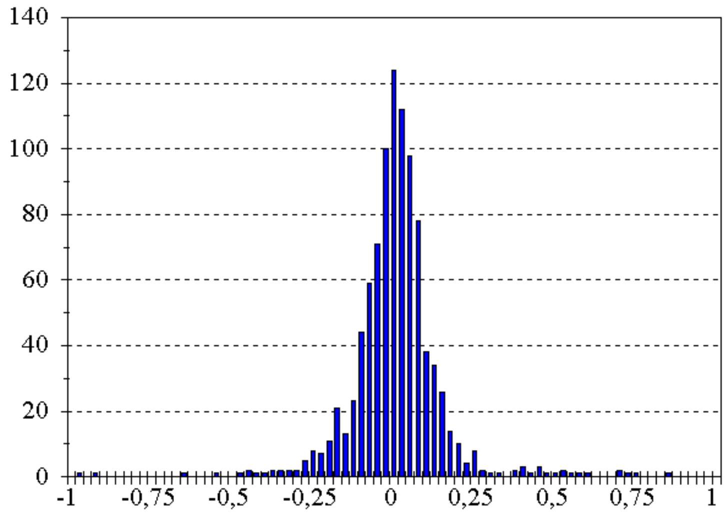

Figure 3: Frequency distribution of revisions in investment plans, 1975-1993.

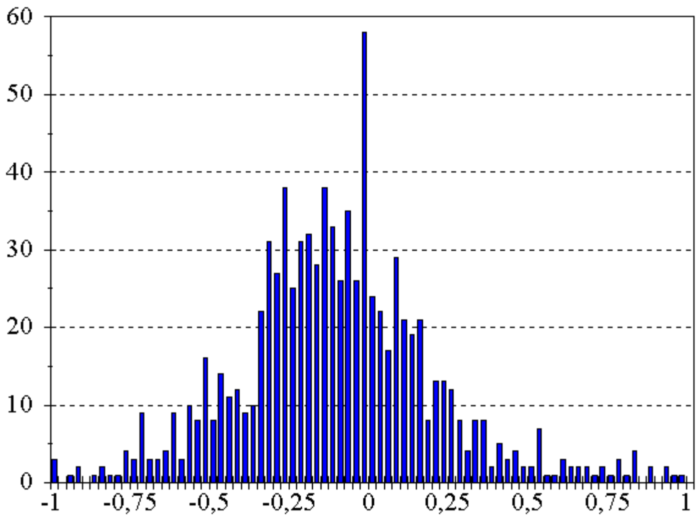

Figure 4: Time series behavior of aggregated revisions in employment-, sale- and investment plans.

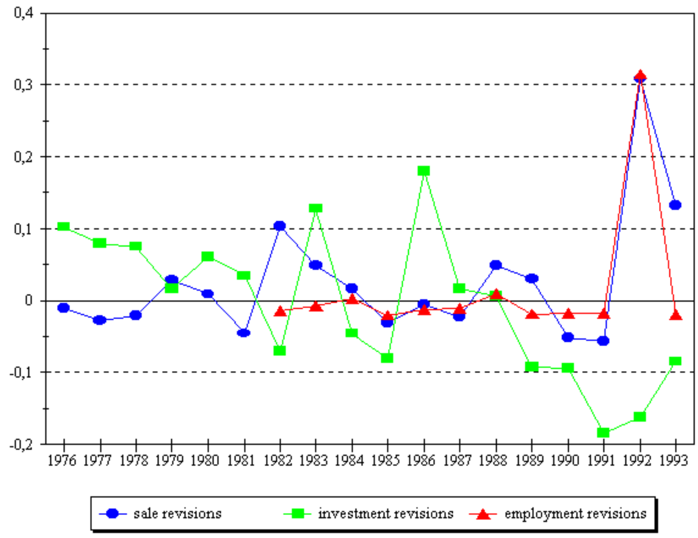

Figure 5: Real investments in equipment and structures in the manufacturing sector and revisions in investment plans from the planning survey, 1975-1993