CIRET Studien 24

The Use of Survey Data for the Analysis of Business Cycles

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Centre for International Research on Economic Tendency Surveys, Munich

CIRET - STUDIEN

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Preface

The present study deals with the importance of the results of entrepreneurial surveys for the analysis and forecast of cyclical fluctuations. The study is almost exclusively of a macro-economic nature. The data employed - which are to be examined with respect to their explanatory value - are time series developed from the results of business and investment tests. The reader will understand that the author, a member of the Austrian Institute for Economic Research in Vienna, mainly relies on statistical material of entrepreneurial surveys conducted by his institute. In addition, data from the EEC countries and Japan are employed. The subject of the study only justifies it being made available this publication to a larger circle of economists working in this field. We look forward to a fruitful discussion of the results.

O. Anderson W.H.Strigel

THE USE OF SURVEY DATA FOR THE ANALYSIS OF BUSINESS CYCLES

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1. Introduction

1.1. Objectives and Structure of the Investigation

In macroeconomic theory expectations and anticipations play an important role. The analysis of cyclical fluctuations has to ask time and again inhowfar subjective considerations are of importance. Unfortunately, the contribution of expectations and of planning behavior rarely finds its way into empirical verification, because both have a reputation for being hard to measure. One possibility to find indicators for the actual importance of subjective influences is to make use of the information contained in business and consumer surveys, both of which have been conducted for decades.

The present study examines the contribution of time series which have been derived from entrepreneurial surveys to the analysis and the forecasting of cyclical fluctuations. The empirical part of this study uses mainly data which have been collected by the Austrian Institute for Economic Research for the manufacturing sector, in addition data from the EEC countries and from Japan will be used.

Most European business surveys distinguish between so-called business test and investment tests. Business tests aim for great simplicity; the questions are designed so that they can be answered by a company officer without the use of statistics; in general, the questions are qualitative[1]. They concern evaluations (order stocks, inventory stocks, capacity utilization, business climate) als well as short-term (three to six months) expectations (on production and prices). For Austria this type of information has been collected for the manufacturing sector since 1963.

The investment tests aim at the collection of investment expenditure data (sometimes for one quarter, mostly for a whole year). In general, quantitative information is collected. In addition, quantitative information on inventories, sales, and sometimes also on capacity utilization and expansion is collected. For Austria, investment data as well as data on planned capacity expansion are compiled primarily for

1) For statistical implementation this qualitative information is turned into quantitative data by deriving the percentage share of "high" and "low" answers (or the balance between these).

the manufacturing sector; information on sales and inventories is collected only ex-post (therefore the investigation of these indicators is left out in this study).

In the U.S., there is no strict separation between these two types of surveys. In general it can be said that quantitative surveys on investment and sales expectations play a larger role. The surveys center on the most important (=largest) enterprises (similar to Japan) and do not attempt to achieve exact representation of all size classes. In the U.S. most surveys of this kind are conducted by private firms for the purpose of market research (most important expection: the OBE survey). In Europe it is mainly the economic interest of the various economics research institutes which accounts for these surveys[1].

Following the European tradition we will at first look at the business tests (chapter 2). A survey of the literature will attempt to bring some order into the vast array of studies on qualitative surveys. Most of these have either been carried out directly by the IFO-Institute in Munich, or have been initiated through this institute by the CIRET[2] organization, or at least access to them has been opened through IFO.

The question incorporating expectations into macroeconomic theory so far has yielded only very few theoretical statements (chapter 2.2), in addition very little empirical work has been done in this field. To evaluate the quality of the business test (chapter 2.3.) it is also necessary to study the reporting behavior of the firms. The question of whether business test information exhibits a lead or a lag with respect to production depends on the transformation-relation chosen between business test variables and production.

The chapter on investment surveys also starts with a review of the literature (3.1.), which however is dominated by studies from overseas. This is followed by an attempt to establish a system for classifying the various efforts to use investment anticipations (plans) for

1) For an overview of the U.S. surveys, see: DOWMAN "29", NBER "97", BONHOEFFER-STRIGEL "18".

2) Center for International Research on Economic Tendency Surveys, Munich, D-8000, Poschingerstraße 5.

forecasting purposes (3.2.). At the same time some terminological clarifications are attempted.

This is followed by an investigation of the Austrian experience with the tendency of firms to underestimate investment, as well as with sectoral differences and short-term forecasting errors (3.3.). It is possible to separate the investment plan revisions into steps which each have distinct determinants. A comparison of the forecasting performance of Austrian investment anticipations with alternative methods is carried out and followed by a discussion on including such information into macroeconomic models (chapter 4).

The existing difference in the behavior of individual sectors give rise to a hypothesis on dual investment behavior (chapter 5): large capital-intensive firms plan their investment expenditures in a different way (and also encounter different problems when trying to execute their plans) than labor-intensive small and middle-sized firms. The differences between these two groups are shown with regard to investment behavior, activity parameters and plan fulfilment.

The investigation of the contribution of the business surveys to business cycle theory and the theory of expectations (chapter 6) has few precedences in the literature. Alternative expectational hypotheses are tested by means of business test data; the problem is investigated inhowfar expectational time series exhibit some inherent systematic behavior (this is tested by using a complex mathematical technique, i.e. the Box-Jenkins method) and the question is discussed whether expectations reinforce or dampen cyclical fluctuations. Finally, the contribution of expectations to the latest recession is analyzed.

1.2. Explanation of Frequently Used Terms and Concepts

By the "level" of a time series we mean the form in which it is usually published.For an index of production this is a time series with basis 100 and values which are higher or lower than 100 depending on the development of production; for business test data, levels are the balances of the shares of firms reporting positive, resp. negative answers (in this way the balance of the percentage shares of firms which report increasing, resp. decreasing production is called a "level" series, even though the survey question actually asks for information on a change). Such series (level series) are denoted by capital letters in tables and equations, changes (differences) by

small letters, or if specified more closely, by also mentioning the type of transformation used. A list of often used variables see page 95.

By "transformation" of a time series we mean the forming of differences or trend deviations (deviation from an exponential trend in percent = TD). Absolute differences are denoted by an "A", which comes after the name of the variable; relative differences by an "R". When quarterly data are used it is necessary to specify whether we are using differences with respect to the same quarter of the previous year (A4, R4; "annual change"), or with respect to the previous quarter (A1, R1; "quarterly change"), if no specific note is made, annual changes are implied.

Entrepreneurial expectations and evaluations are marked by an asterisk (+), investment anticipations by an "IA". Statistically significant regression coefficients are marked $^{++}$, which describes a significance level of 95 %. Numbers underneath the regression coefficients are the standard error in percent of the regression coefficient.

To find out whether one time series exhibits a lead or a lag with respect to another series, simple correlations are carried out repeatedly by shifting one series against the other (usually by one quarter). When the highest correlation coefficient is achieved, the lag behavior of the series has been determined. A list of the publications quoted in the text will be found at the end of the study; they are numbered in alphabetical order, e.g. ZARNOWITZ "142".

2. Qualitative Business Cycle Indicators

2.1. A Brief Survey of the Empirical Literature

A complete survey of the empirical literature concerning business surveys would require a publication of its own. The bibliography by M. Ziegler ("143") which was compiled ten years ago comprises already 110 pages, and the CIRET Centre in Munich has a file of more than 1.000 titles. Thus here we will only give a short characterization of the main streams in the existing literature, in order to establish a framework for our own empirical results. After the IFO Institute in Munich took up business surveys[1] in 1949, the literature was dominated by descriptive work and papers which set out to justify the use of "qualitative" surveys in the eyes of a sceptical public. Langelütke "77", Marquard and Strigel "85" in Germany belong to this category, as well as Piatier "102" in France and Bosse "20" and Pfanzagl "106" in Austria.

A next step were investigations on the quantification of qualitative surveys and the connected problem of the indifference interval in surveys (up to how large a percentage change do firms report "no change"?). Marquard and Strigel "85", Riedl "110" and, foremeost, O. Anderson jun. have to be mentioned here ("12"). This discussion has been closed, at least for the time being, by O. Anderson who proved that qualitative answers under certain conditions can be interpreted, as if there were a connection between the frequency of plus, minus, constant on the one hand and the actual quantitative change in the variable surveyed on the other hand. In this phase the complexity of mathematical and statistical methods reached a peak.

The following phase was characterized by empirical investigations of the business test variables, mainly with respect to consistency and rationality. Some of these investigations had endogenous character, i.e. an ex-ante answer was compared with an ex-post statement (both from a direct survey), in other a business test variable was compared to an "objective" variable (exogenous test). The question of how expectations are formed (e.g. in connection

1) see W.H. STRIGEL "126" "130".

with order stocks) was analyzed, mainly in micro-economic investigations[1], the lower variance of survey variables, and the fact that their mean values do not correspond to reality (E. Streissler & Hoschka "122") were discoverad in macro-economic analysis.

With the increasing length of the available time series the level of aggregation increased and the question was asked what role the business test series could play in macro-economic short term forecasting. The correlation coefficient was introduced as the standard measure of their quality, average leads and lags became an indicator of their prognostic applicability. Theil's forecasting coefficient (Thury "135") and spectral analysis (Courtois "31") were also applied. Among the quickly increasing number of contributions during this phase we would like to mention the studies by Lindlbauer ("79" "80"), Strigel ("127"), Pentenrieder ("103") and Thury ("135") as well as Aiginger, Bayer, Schenk ("6") for Austria. The common finding in all these studies is that from a macro-economic point of view the business test time series provide relatively consistent results, both when several indicators are compared to one another and when compared with "objective" statistical magnitudes. Lindlbauer and Thury find a lag when these series are used to predict turning points, Nerb ("98") finds them coinciding and Strigel, Pentenrieder and especially Courtois find a lead. The differing results are due to the different choice of a transformation-relation between the index of production (e.g. devation from a trend, changes with respect to previous month or previous year) and the business test variables (level, change with respect to previous month or previous year). There is general agreement on the "information lead" characteristic of the business test variables due to their quick availability, and on the smoothness of the series.

At the beginning of the seventies the survey time series were at last sufficiently long to allow their use in econometric models and in systems of cyclical indicators. The tendency to replace large "structural models" with smaller "forecasting models"

1) see e.g. the investigation by O. Anderson "11" on three subsectors in the textile industry, as well as that by Jochems and Theil "133" on the Dutch shoe industry.

certainly promoted the use of survey variables. The analysis of the influence of business test variables on the model structure and the performance of the models is still in its beginnings. The lack of theoretical penetration apparent in the systems of cyclical indicators and the realization that objective theories were not able to explain all cyclical events in the seventies furthered the increased use of subjective data. This equalization of subjective information was formalized by the decision of the Industry Committee of the OECD in June 1975 to include survey results into the "Main Economic Indicators" on an equal basis. Synoptic tables on the extension of business tests and the respective survey programs can be found in "25").

2.2. Expectations in Economic Theory

The role of expectations in macro-economic theory has been recognized at least since Keynes ("72") and the Stockholm School. Keynes' "marginal efficiency of capital" as the most important criterion determining investment aims at the expected return to capital (which depends on the expected cyclical situation). His concept of "liquidity preference" is based on the uncertainty of future events[1]. The Stockholm School (Myrdal, Ohlin, Lindahl, Lundberg following Wicksell's theory of cumulative processes) stresses the difference between ex-ante plans and ex-post realizations[2]. The psychological business cycle theories, whose most eminent representative is Pigou, emphasize the importance of expectations for the core processes of the business cycle. At the present time Jöhr "67" puts a lot of emphasis on the role of expectations ("socio-psychological predisposition" to the cumulative process[3]).

The influence of expectations is even more important for separate individual parts of economic theory : price theory cannot be

1) E. STREISSLER, W. WEBER "124".

2) see G. NERB "98".

3) Arguments relating to the relatively inferior role of expectational variables in empirical research are designed to point to three analysis: Katona "71" maintains that economists found out about the importance of expectations faster than psychologists, but do not want to make use of them a) because they have not been measured at all, or only for entrepreneurs, b) because it was thought that expectations of individual economic subjects compensate each other and c) because the theories on the formation of expectations were inadequate. Jöhr "67" points to three preoccupations against psychological business cycle theories: a) a cyclical model must be objective, b) expectations cannot be proven wrong and c) expectations could create turning points at any time. G. Tichy "137" points out that entrepreneurs often interpret the business situation wrong, because they are influenced too much by the past situation.

thought of today without expectational considerations; the stability of demand and supply in the commodity market depends to a large extent on the specific assumptions about the expectations of demanders and suppliers; inventory theory relies on hypotheses concerning sales expectations.

It remains quite a surprise that neither the importance of tides of optimism and pessimism for the cyclical situation has been tested, nor the differing synthetic expectations hypotheses (extrapolative, regressive, adaptive) have been investigated with the aid of business surveys. A lone exception is the contested issue relating to the regressivity of Railroad Shippers forecasts in the U.S. "22" "47". The present study attempts to contribute foremost to these two neglected fields (tides of optimism and pessimism, behavioral hypotheses).

2.3. The Application of the Austrian Business Test to Forecasting

2.3.1. Reporting Behavior

The survey program of the business test of the Austrian Institute for Economic Research is limited to six questions: Four relate to assessments (order stocks, foreign orders, finished goods inventories, capacity utilization), two to expectations concerning the future of the firm in the next three to four months (with respect to production and prices). In general there are three possible answers: high, normal, low resp. increasing, constant, decreasing. In order to obtain time series for each variable, the positive answers are balanced against the negative answers[1].

Two interesting aspects have evolved in the reporting behavior during the fourteen years in which the survey has been conducted. On the average, antrepreneurs consider their export orders to be too low. The preponderance of firms which report pessimistic assessments in the long run is so strong that the average value of the balance is -17%. The total order situation is also on the

1) Strictly speaking the balance is calculated as the share of the (weighted) positive answers in the total number of answers minus the share of the (weighted) negative answers. Thus the indifferent answers are not being used, a symmetrical indifference interval is assumed.

average assessed as being unsatisfactory, but not to the same degree as the export orders (long term average = -7%). The preponderance of firms which assess their inventories as "too high" over those that desire higher finished goods inventories, is 12 percent. In addition, nearly half the firms reported in the long run that they could produce more given higher demand.

TABLE 1: Reporting Behaviour in the Austrian Business Test

These assessments point to a high level of aspiration for the firms. They consider values as normal which lie above those reached in reality. This observation is important for the interpretation of individual results insofar as e.g. an equal number of firms reporting exports as being too high or too low has to be interpreted as signalling a favorable cyclical situation.

An analysis of the question on production expectations shows that in the long run average increasing production is expected. The preponderance of nine percent, however, must be judged low in comparison to the average growth of industrial production. The proponderance of firms which expect increasing selling prices over those which expect decreasing prices is significantly higher (+19%). This means that answers referring to expected price changes occur more frequently than answers referring to volume changes, in spite of the fact that in the period under investigation actual price increases on the average were lower than volume increases (4 1/2 % vs. 6%). This can mean that firms plan to increase prices more often than production, or that the indifference interval for price increases is lower than that for volume increases.

All indicators in the business survey exhibit very marked cyclical movements: for example, the maximum value of the preponderance of positive assessments of the export orders is +23%, the minimum value -68%.

These series also show relatively low disturbance terms. This smoothness is quite important for forecasting purpose and can be measured with the help of the (first) coefficients of autocorrelation. For the assessment variables these lie between .90 and .93, while e.g. the autocorrelation coefficient for quarterly production is much lower (R = .80). The expectational indicators are a bit less smooth: production expectations show quarterly swings similar

TABLE 1:

Reporting Behaviour in the Austrian Business Test

	ASSESSMENTS								EXPECTATIONS			
	Order Stock		Export Orders		Finished Stocks		Free Capacity		Production		Selling Prices	
	AM	SD	AM	SD	AM	SD	AM	SD	AM	SD	AM	SD
Manufacturing	- 7	22	-17	23	12	15	47	15	9	12	19	19
Basic goods	- 6	19	-14	34	15	21	39	19	13	18	6	21
Investment goods	- 8	32	-19	30	10	23	53	20	5	15	22	24
Consumption goods	- 8	32	-19	30	10	23	53	20	5	15	22	24
Mining	-19	25	-18	52	28	24	41	23	- 5	14	10	16
Oil	- 4	38	-23	42	20	49	51	49	33	45	7	44
Basic iron & steel	0	62	- 5	56	- 4	47	51	32	0	31	19	44
Nonferrous basic metals	- 4	52	- 3	51	2	34	41	25	9	19	4	35
Stone Quarrying , clay	-18	30	-25	34	14	25	55	19	- 0	26	22	25
Glass and glass products	-26	37	-30	30	29	32	25	25	19	19	25	26
Chemicals	5	28	4	36	- 4	28	36	16	22	18	8	26
Pulp & paper	- 1	43	- 3	44	10	23	24	21	11	13	13	36
Paper processing	- 4	25	-30	25	12	13	56	16	21	17	18	31
Furniture	- 7	34	-32	31	4	25	50	21	10	21	22	24
Food products, beverages	-13	14	-40	16	2	8	71	14	8	11	25	19
Leather	-33	23	-51	26	36	24	66	14	15	23	14	41
Leather products	- 8	22	-16	22	11	17	35	18	7	16	27	17
Textiles	0	27	-11	24	22	16	38	16	11	14	20	22
Wearing apparel	- 3	19	-34	14	17	12	29	13	11	16	27	14
Casting	-13	47	-24	38	5	33	49	29	3	18	17	32
Non electrical machinery	1	28	- 6	25	4	19	49	18	8	15	24	25
Transport equipment	-33	42	-47	41	30	40	56	33	4	25	38	35
Metal products	-11	26	-22	25	27	18	51	17	12	12	25	23
Electrical machinery	0	26	-28	19	29	24	63	21	11	21	19	25

AM = Arithmetic Mean (1963-1976)
SD = Standard Deviation (1963-1976)

to those of actual production and price expectations are the only indicator with larger irregular swings than production.

TABLE 2: Smoothness of Business Test Variables

The survey questions concern indicators which have close causal relations with each other. This fact accounts for a strong similarity of the time series. The closer correlation of the assessment variables with each other and their smoother behavior are to be expected: all assessments concern stock variables. The expectational variables, on the other hand, ask for the change in a flow or a price and therefore have to react more strongly. This is reflected in higher short term movements as well as in the earlier mirroring of turning points as against in assessments.

2.3.2. Estimating Changes in Production with Qualitative Data

After investigating the reporting behavior of the firms and the consistency of the business test time series ("internal control") we would like to analyse their contribution to the diagnosis and prognosis of the industrial cycle. The measure for the industrial cycle is the index of industrial production. This "external control" requires assumptions about the choice of a transformation - relation between survey variables and production index. The problem of the correct transformation falls into three parts: which transformation shall be used for the production index (e. g. change as against previous year, deviation from a trend), which transformation shall be used for the survey variable and which type of function (linear, logarithmic, etc.) shall be applied to the selected transformations of both series.

Partly for the sake of simplicity, but also because other than linear transformations did not show any significantly different results, we will restrict ourselves to linear relations. Of all possible transformations of the production index we will investigate quarterly changes, annual changes and deviations from a trend. For the survey variables we will look at the level of the balance (this corresponds to trend deviation of the production index, because business series do not exhibit a trend), their quarterly and their annual changes. Even this restriction leaves us with nine possible transformation relations (see Table 3).

TABLE 2:

Smoothness of Business Test Variables
(1st Order Coefficient of Auto-Correlation)

Indicator	Coefficient of Autocorrelation (R)
Assessment of Order Stocks (AOS)	0,92
Assessment of Export Orders (AEO)	0,92
Assessment of Finished Stocks (AFS)	0,90
Assessment of Free Capacity (AFC)	0,93
Average of Assessments[1)]	0,92
Production Expectations (PRE)	0,81
Selling Price Expectations (SPE)	0,77
Average of Expectations[1)]	0,79
Composite Indicator (CI)	0,85
Compare:	
Production Index (PI, R4)[2)]	0,80

1) Mean of the individual coefficients of Autocorrelation
2) Annual change of the quarterly index

TABLE 3: The Importance of Transformation - Relations between Production Volume and Business Test Variables

Most frequently the annual changes in production are related to the level of the survey variables. This choice assumes a priori that the highest positive values in the survey coincide with the highest growth rates in production. This assumption makes economic sense for the production expectations, while for order stocks or capacity utilization the peaks should occur later. Thus when this transformation is used it leads to unjustified negative results concerning the forecasting performance, especially of the assessment variables.

Another possibility is to relate quarterly changes in production with levels of the test variables. Since quarterly changes on the average indicate turning points even earlier than annual changes, the result will be even less favorable than above. Applied to the production expectations this transformation relation would in the strict sense correspond to the survey question[1]. Several empirical studies have shown, however, that in general entrepreneurs do not know their quarterly production changes and to a large extent report annual changes. As far as the assessment questions are concerned it makes no sense to compare evaluation of orders with quarterly changes of the production.

A third relation compares deviations from a production trend to the level of business test series (which correspond to deviations from a trend in so far as the observations move around a "normal level"). This relation seems to make economic sense for the assessment variables: the highest order stocks, the lowest inventories and the highest degree of capacity utilization are expected to occur when the trend deviations in production are highest. Production expectations should reach their maximum earlier, since rates of change usually reach their peak before deviations from the trend.

1) The question reads: Will your production increase in the next three to four month? To be able to answer this question correctly the entrepreneurs would have to know their seasonally adjusted quarterly production volume. But even on the macro scale quarterly changes in the production volume exhibit considerable irregular errors in spite of highly complex seasonal adjustment methods: the correlation coefficient between two adjacent quarterly growth rates is -.40 in Austria.

TABLE 3:

The Importance of Transformation - Relations between Production Volume and Business Test Variables

Production index	Business Test Variables: Level	Annual Change[1]	Quarterly Change[1]
Annual Change[2]	R = 0,88 lag 1,5 quart.	R = 0,85 lead 0,2 quart.	R = 0,77 lead 1,3 quart.
Quarterly Change[2]	R = 0,72 lag 2,0 quart.	R = 0,80 lag 1,2 quart.	R = 0,77 lead 0,2 quart.
Trend Deviations[2]	R = 0,77 lead 1,0 quart.	R = 0,43 lead 2,7 quart.	R = 0,28 lead 3,7 quart.

The coefficients of correlation as well as the mentioned lead resp lag of the business test variables are themselves arithmetic means over the six individual coefficients of correlation between one business test variable and the production index. The data were smoothed by calculating a 3-quarter-moving avarage.

1) absolute

2) relative

In theory the comparison of an annual change in production with an annual change in the business test variable would be equivalent to the above approach (with the exception of a constant term). The annual change in production is equivalent to the annual change in the deviation from the trend (apart from the constant which signifies the trend), and the same transformation is used for the business test series. The advantage of this relation would be that the forecast would directly aim at that magnitude which lies in the center of cyclical reporting, namely the annual rate of change in production.

Other transformations are, of course, possible, but correspond less to economic the questions posed and economic behaviour than the ones mentioned above.

The choice of the correct transformation-relation is of basic importance to the exactness of the reflection of the production situation by mean of the business test, as well as to forecasting purposes.

If the annual changes in production are compared to the levels of the business test variables, the latter exhibit an average lag (averaged over the six variables) of one and one half quarters. When quarterly changes in productions are used, the lag increases to two quarters. Deviations from the production trend in conjunction with the level in the test variables exhibit a lead of one quarter, the theoretically equivalent comparison of annual changes in both series shows a slight lead of the test variables, however.

Other investigations also show the same dependence of the measured forecasting performance of business tests on the transformation-relation chosen:

Lindlbauer "79" finds a lag of the survey variables based on the choice of the first transformation-relation mentioned (annual change in production with level in survey), Strigel "127" and a EEC study "31" find a lead of the survey indicators by choosing deviations from the production trend.

Whether or not a business survey indicator exhibits a lead or a lag need not depend on the choice of a randomly selected transformation, since the character of the survey questions asked points

logically to specific transformations. The four assessment questions are actually questions concerning trend deviations: to be able to asses order stocks as high or low one must have in mind a certain explicit or implicit trend value. Thus the non-transformed values of the survey variables should be related to trend deviations in production. As mentioned above, an equivalent and from a practical point more attractive relation[1] consists of the annual changes in both variables. For both alternatives all four assessment series coincide with production, even though for some turning points they exhibit a lead. Since the correlation coefficient for these relations is also higher than for all other alternatives, the theoretically plausible choice is reinforced by statistical criteria.

TABLE 4: Maximizing the Correlation between Production Index and Business Test Variables

When asking about production expectations, one really asks about a change. Thus the respective business test series should be related to a quarterly or annual change in production, but certainly not to the trend deviation. Since the quarterly change series moves very erratically, we recommend the use of annual production changes. This relation shows on the average coinciding behavior between survey variables and production, while some turning points are seen earlier in the survey variables. The correlation between these transformations is higher than between theoretically less plausible ones.

There is no logical relation between any transformation of the production series and the price expectation variable. Correspondingly, the correlation coefficients are very low. If this series is related to other price variables, however, the correlation is similar to that of production expectations, and a lead of one to two quarters is exhibited.

CHART 1: The Composite Indicator and Its Components

2.3.3. Formation of a Composite Indicator

The closeness of correlation between business test variables and growth of industrial production points to the possibility of estimating quantitative production by means of these survey data.

1) The practical attractiveness consist in the direct estimate of annual change in production, which is more often to be forecasted than trend deviation.

TABLE 4:

Maximizing the Correlation between Production Index and Business Test Variables

(Correlation and Timing)

Production Index; compared to Business Test Variable	order stocks		export orders		finished stocks		free capacity		production expectation		selling price expectation		average of all indicators	
	t	R	t	R	t	R	t	R	t	R	t	R	t	R
1) Annual Change resp. level	-1	0,86	-2	0,82	0	-0,84	-1	-0,77	0	0,81	-5	0,44	-1,5	0,76
2) Trend deviation resp. level	0	0,84	0	0,78	0	-0,79	0	-0,90	+2	0,53	+1	0,60	+0,5	0,74
3) Quarterly change resp. level	-2	0,52	-3	0,53	-3	-0,52	-3	-0,44	-2	0,54	-1	0,20	-2,3	0,46
4) Annual change resp. annual change	0	0,86	0	0,81	0	-0,86	0	-0,90	+1	0,67	+1	0,70	+0,3	0,80

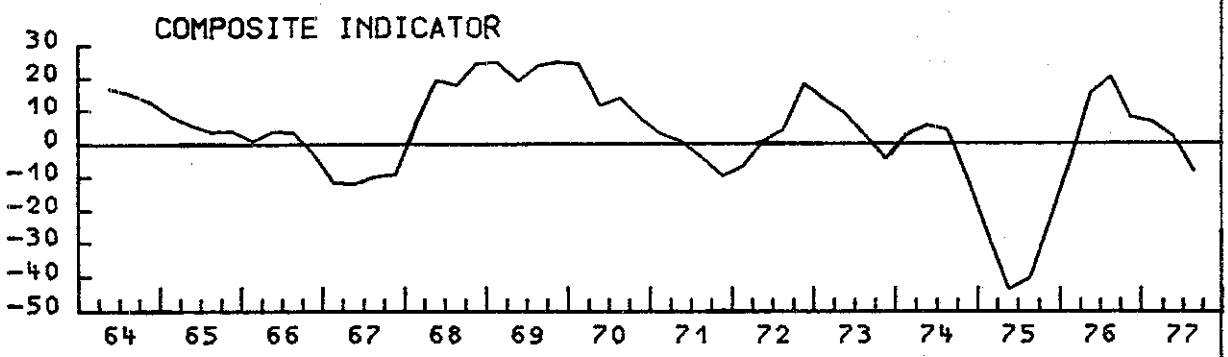
t indicates the temporal shift measured in quarters, for which R is maximized

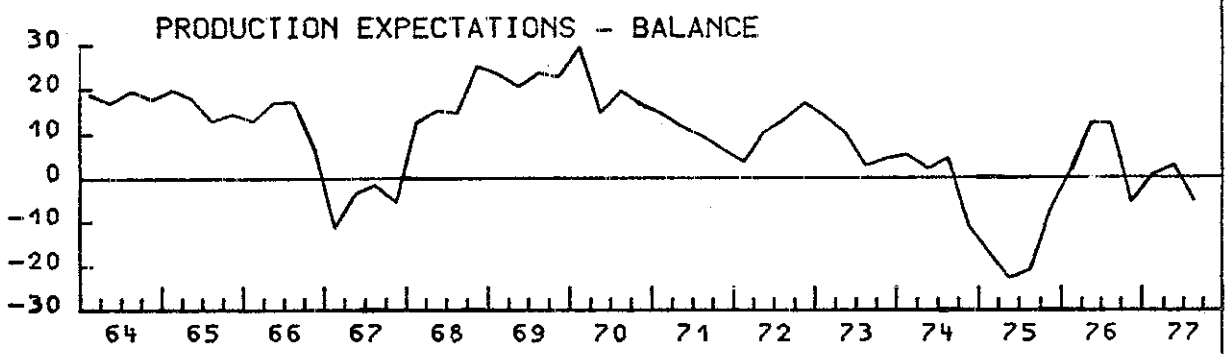
\+ in column t indicates lead of business test variable

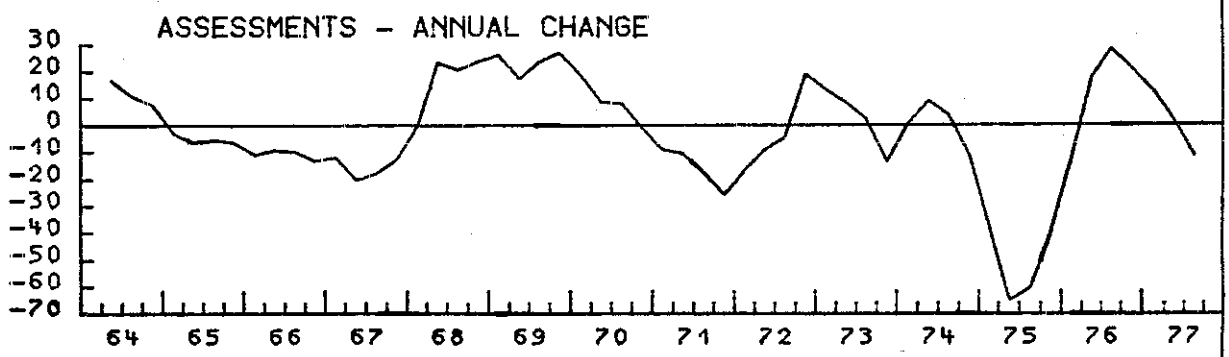
\- in column t indicates lag of business test variables

Underlined coefficients mark those transformation-relations which correspond most closely to the questions posed.

CHART 1: THE AUSTRIAN COMPOSITE INDICATOR AND ITS COMPONENTS







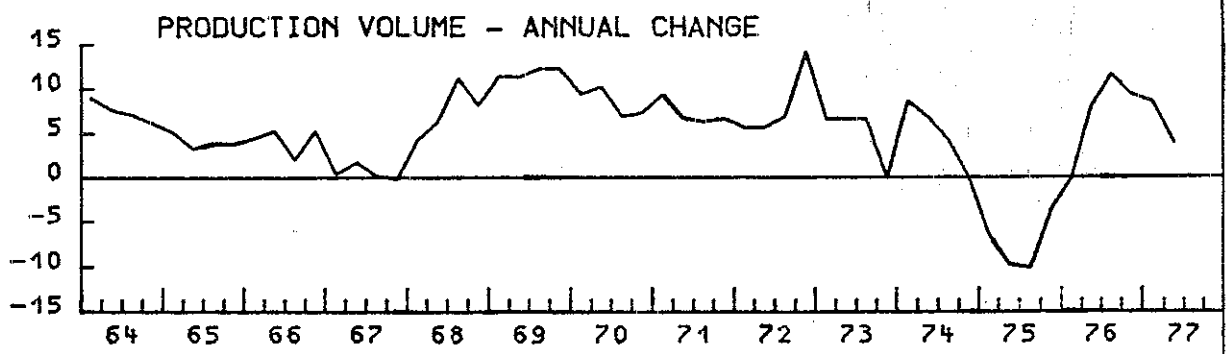


TABLE:5: Equations to Forecast Industrial Production by Means of Business Test Variables

Estimation of the growth in production by means of production expectations shows quite good results. The estimated production levels coincide with reality insofar as they show the peak in 1969 to be higher and wider than that of 1964, or the recession of 1975 to be deeper than that of 1967. But the estimate does not show the full force of the recession of 1975 and captures the recovery of 1976 only in part. When changes in the assessment variables are used to estimate production, the severity of cyclical changes is captured quite well.

This differing estimating behavior - production expectations lead to small cyclical swings, assessment changes to large ones - are a clue to the researcher to combine both pieces of information into one. The simplest form would be to add the values of the business test variables in their respective transformation. Such a "Composite Indicator" on the one hand comprises a combination of the information content of the individual indicators, on the other hand it results in a smoothed series, since errors in the variables are reduced or eliminated as long as they are different between indicators. The advantage of the formation of such a vertical average[1] (over several indicators at one time) compared to a horizontal average (over several periods for one indicator) lies in the fact that it does not involve any loss in time[2].

The calculation of the composite indicator brings the hoped-for results. The growth of industrial production is mirrored better than when the individual series are used and the new indicator is also smoother. Its movements coincide with those of production, several turning points are announced in advance.

1) In actual calculation we used a weighting system, since four changes in assessment variables are combined with only one expectational variable. Thus the contribution of the assessment variables is divided by four. In this way the closely related assessment variables together obtain the same weight as the production expectations.

$$CI = \frac{\frac{AOS,A4 + AEO,A4 - AFG,A4 - AFC,A4}{4} + PRE}{2}$$

CI = composite indicator
AOS,A4 = abs. annual diff. in assessment of order stocks
AEO,A4 = abs. annual diff. in assessment of export orders
AFS,A4 = abs. annual diff. in assessment of finished stocks
AFC,A4 = abs. annual diff. in assessment of free capacity
PRE = level of production expectations

2) A similar vertical average is used in the formation of the business climate indicator of the IFO Institute which combines the assessment of the present business climate with that of the future one ("127") or by PEHTENRIEDER ("103") who constructs two climate indicators for the EEC countries.

TABLE 5:

Equations to Forecast Industrial Production by Means fo Business Test Variables

	R^2	
PI, R4 = $\underset{27}{2,23} + \underset{12}{0,34}$ PRE^{++}	0,58	Assessment of Production Expectations, Level
PI, R4 = $\underset{7}{5,58} + \underset{8}{0,18}$ AOS^{++},A4	0,74	Assessment of Order Stock, Annual Change
PI, R4 = $\underset{8}{5,54} + \underset{10}{0,16}$ AEO^{++},A4	0,67	Assessment of Export Orders
PI, R4 = $\underset{7}{5,65} - \underset{9}{0,24}$ AFS^{++},A4	0,71	Assessment of Finished Stocks
PI, R4 = $\underset{5}{5,66} - \underset{6}{0,32}$ AFC^{++},A4	0,84	Assessment of Free Capacity
PI, R4 = $\underset{11}{5,16} + \underset{18}{0,13}$ SPE^{++},A4	0,38	Selling Price Expectations
PI, R4 = 4,11 + 0,15 CI^{++}	0,80	Composite Indicator

PI, R4 = Production Index, Annual Change compared with same quarter of last year.

The exact questions read:

Will your production during the next three to four months increase, remain its present level or decrease?

Do you evealuate your present order stock as high, normal or too low?

Do you eveluate you export orders as high, normal or too low?

Do you eveluate your present stocks of finished goods as high, normal or too low?

With your available capacity could you produce more, if demand were stronger?

Will your prices during the next three to four month increase, remain at their present level or decrease?

The questions are formulated in such a way that positive balances of PRE, AOS, EOS, SPE and negative balances of AFS and AFC indicate favourable business situations.

Composite indicators for individual industry sectors show in a lead of one quarter (before production) in seven sectors, only in three cases do they exhibit a lag. The closeness of fit for most sectors is very good. As expected it is smallest in those sectors in which changes in production are primarily determined by supply conditions.

2.3.4. SUMMARY: The Performance of Business Test Variables as Forecasting Instruments.

When used in the logically sound transformation-relations the business test results on the average do not exhibit a clear lead or lag in relation to production, but show rather coinciding behavior. In individual periods or variables a lead of one or two quarters exists; the number of sectors in which a lead is visible is also higher than those with a lag.

The business survey time series are smoother than the production series, especially when composite indicators are formed. Even if they were just as smooth as the production series and had not lead at all, they still have the advantage of being available for analysis earlier by nearly one quarter than the official production statistics. In addition, the survey series are representative for all of Austrian industry and never have to be corrected afterwards.

In this way these series fulfill practically all criteria required e.g. by the National Bureau of Economic Research for cyclical indicators: causal relationship with the cycle, smoothness, historical correlation, representativity, few revisions, quick availability.

3. Quantitative Investment Surveys

3.1. Literature on Investment Surveys

Most existing surveys ask for investment plans in quantitative terms. In the countries outside Europe the investment survey often is part of a more global survey covering sales, sales expectations, capacity utilization and sometimes also financing possibilities, production and inventories[1]. Most European surveys on investment anticipations do not cover these other areas, mainly because special qualitative surveys deal with them separately (e.g. business tests).

In the U.S. the Railroad Shippers have been surveyed since 1927 concerning their turnover expectations. There has been a lot of discussion on the regressivity of these expectations[2]. For the period after World War II the most frequently cited survey is the one which is conducted by the Office of Business Economics of the U.S. Department for Commerce and the Securities and Exchange Commission (OBE-SEC[3]). Since 1947 quarterly and yearly investment plans have been collected and published in the Survey of Current Business. There exists also a McGraw-Hill Publishing Co. quantitative survey on investment, sales and capacities[4].

The survey by Dun & Bradstreet centers on employment, inventories, prices and profits of small firms. The collected data have short-term character and are similar to the European business tests (see HASTEY in "96"), insofar as they also use the raw information to create balances of the positive and negative answers. A more thorough review of U.S. surveys is contained in BONHOEFFER & STRIGEL ("19"). For Canada the Bureau of Statistics has conducted bi-annual surveys on annual quantitative Investment plans since 1945 (see FIRESTONE in "95"). The Japanese surveys, one by the Bank of Japan, the other by the Economic Planning Authority, concentrate on the large enterprises.

1) see e.g. the survey of the Bank of Japan, Shimamura "115". Concerning the statement that these surveys in the U.S. are mainly quantitative, see BAISSIE in "95".

2) see e.g. BOSSONS-MODIGLIANI "22", and the literature cited there, and FERBER "47".

3) Plant and Equipment Expenditure Survey. The same authorities also collect quantitative information on inventory stocks and sales, and also assessments on inventories; see e.g. BONHOEFFER & STRIGEL "19".

4) EISNER has used this survey in his studies.

The latter is a bi-annual survey, which is described in BABA und MATSUGI "14". The very comprehensive quarterly survey by the Bank of Japan collects data on quantitative change of sales, investment and finance variables, but also assessments similar to the data collected in European business tests. For all these variables information is requested for one quarter ahead, for the present situation and the actual performance in the past quarter.

Most European investment surveys also emphasize quantitative information (even though the IFO Institut, after comparing results of qualitative and quantitative surveys, now emphasizes qualitative information; BONHOEFFER "47") but rarely ask for sales expectations or quantitative data on financing problems of inventories. Most countries collect annual investment data, even though the survey concerning investment expenditures for one year is repeated several times. The reason for only collecting annual investment expenditures and neglecting financing information may be due to the generally smaller firm size in Europa and the very strong interest in data protection by European firms.

The lack of information on quarterly investment anticipation need not necessarily reduce the content of information. Several investigations have shown that the quarterly pattern of actual investment expenditures sometimes increases the error terms in the surveys (see FRIEND & THOMAS "53", ROWLEY & TRIVEDI "111" as well as WIMSATT & WOODWARD "140"; EVANS "42"). If data on investment expenditures for one year are collected several times, the error terms for the individual firms are reduced as well as the systematic error of macro-data. On the other hand, the forecasting performance on the macro-level must not improve at all (COLLIANI "29") or only slightly (GERSTENBERGER "56"). There is general agreement on the fact that the forecasting performance of these surveys decreases significantly when investment expenditures are estimated for more than one year ahead (GREENWALD "58", ZARNOWITZ "141", HART "64", GERSTENBERGER "56").

The wide majority of studies which concentrate on comparisons between investment anticipations and actual expenditures agree that entrepreneurs have a tendency to underestimate their investment expenditures by about one tenth on the average. For the U.S. this result holds true for the OBE-SEC survey (see FRIEND & BRONFENBRENNER "49", "50") and for the Mc Graw Hill survey

(GREENWALD "59")[1]. For Europe studies show this tendency for Germany, Austria, Sweden, France, Finland and the Netherlands[2]. No significant tendency to either over- or underestimate the investment volume can only be found for Canada (FIRESTONE in "95", LEVINE in "96") and for the survey by the Japanese Ministry of Economics (MORIGUKI "91", BABA & NATSUGI "14"). Another Japanese survey (Bank of Japan, see SHIMAMURA "115", KUNIGAKI "76") and the survey by the Board of Trade and the Department of Industry in Great Britain (PENRICE "102", AGARVALA "3", Ministry of Technology "86") reveal a tendency for over-estimation. In all these cases large firms are overrepresented. For both countries there exist investigations which show that if smaller firms are better represented, this tendency to overestimate investment expenditures disappears.

Many other investigations support the view that the degree of the tendency to underestimate actual investment expenditures depends on the size of establishment (EISNER in "23", FRIENDin "23", FRIEND and BRONFENBRENNER in "50", FOSS & NATRELLA "48"). This question must be distinguished from the one that asks whether large firms' answers are more accurate even after correcting for the average error, a view which is commonly held. BONHOEFFER ("17") finds no connection between a firm's accuracy and its size[3], and the investigations by FRIEND and BRONFENBRENNER "49" and the one by FIRESTONE (in "95") also go into this direction.

There exists wide agreement on the question whether annual (or quarterly) movements around the average tendency to underestimate depend on the cyclical situation, but there is less agreement on the factors which influence these movements (profits capacity, availability of credit, capacity utilization, sales, unexpected sales). Survey results (by FOSS & NATRELLA "48", FIRESTONE in "15", FRIEND "49") on the reasons for the under-estimation of the base as well as of the cyclically varying parts will be discussed together with the Austrian survey results.

1) see also WIMSATT & WOODWARD "140", BASSIE in "95", FOSS & NATRELLA "48".

2) BONHÖFER "17", COLLIANI "29", AIGINGER "5", LONQUIST "82", MALHOMME "83", KONSKENSKYLÄ "74", MOUCHART, THEIL and VORST "92".

3) MALHOMME "83" finds that firms that have long-term investment plans do not forecast their expenditures more accurately.

The recognition of a systematic tendency to under-estimate initially gave rise to mechanical correction techniques; later on it was attempted to come to grips with the cyclical part of the plan revisions. There is a wide range of possibilities, especially with respect to the choice of the dependent variable (actual investment expenditures, change in actual expenditures, difference between actual and planned investment, in absolute terms or in standardized form, etc.). The next section will attempt to offer a systematic survey of this large number of attempts. It should be mentioned that the number of investigations of the reasons for investment plan revisions, on the differences by sector, size group and program of production went down as correction attempts be came more usual.

3.2. Systematic Overview of Forecasting Methods Using Investment Anticipations

Investment Anticipations[1] can be used for forecasting investment expenditures without specific correction procedures only when no systematic differences exist between the plans and the realizations. Today, most institutions which publish data on investment anticipations point out systematic errors, or even publish the plans in already corrected form.

The simplest procedure to correct for over- or under-estimation in the plans is to use mechanically a percentage mark-up or mark-down, derived from past experience. If there are reasons to believe that the error changes slowly over time, the correction factor should be calculated using only the last few years (e.g. three years, see LÖNQUIST "82"). The correction factor can be universally applied to all of industry, or can be differentiated (e.g. by sector[2] or firm size).

Some studies make use of a simple linear regression (without an additional cyclical variable) between investment plans and actual expenditures. This technique can also be classified under the correction methods; it contains a bit more information than the mechanical correction mentioned above. This method can account for cyclical differences in the tendency to under-estimate, if e.g. a negative constant term is combined with a regression coefficient larger than one. This is, of course, a very rough way to account for a cyclical

1) In spite of the differende in the true meaning of the words, in this study the terms "investment anticipations" and "investment plans" are used as synnonyms.

2) ODE calculates realization rates on a sectoral level and regresses these on time or on the respective quarter, in order account for linear and non-linear changes in the correction factor; see e.g. WIMSATT & J.T. WOODWARD "140", p. 36 f.

component of under-estimation, because the relative size of the plan revision depends on the volume of the investment plans (regardless of the fact whether the plans are high because of an increasing trend in investment expenditures or because of the business situation)

TABLE 6: The Use of Investment Anticipations (IA) in the Forecast of Actual Investment

In addition, cyclical changes which occur after the information of the plan are not taken into account. In spite of these short-comings the regression of actual investment expenditures on their anticipation is a very frequently used for forecasting, as well as an "alternative model" to investment functions[1].

It would be advisable to take specific account of cyclically differing revision behavior by means of additional variables. MODIGLIANI has termed this method "realization function". Common to all realization functions is the "explanation" of actual investment by investment plans plus cyclical variables.

There is a class of realization functions which uses only variables which are not yet known at the time the investment plans are established by the firm. These "classical" realization functions assume that all information which was known before the plan was established, is already included in the plan (see e.g. MODIGLIANI's answer to KLEIN "89"). The advantage of distinguishing analytically between factors which influence the plans and factors which influence their revision is countered by the disadvantage that such a forecast of investment also requires the forecast of the cyclical (independent) variable[2]. This assumes that the forecaster is less surprised by cyclical turning points than are the entrepreneurs.

1) see e.g. BONHOEFFER "17", IFO-forecasting method; ROWLEY & TRIVEDI "111"

2) When forecasting by means of a "classical" realization function variables already known can be included if the forecast takes place after the establishment of the plan, and if in the meantime some information has become available on the cyclical variable;
see e.g. the extension into the future of investment plans by means of recent business test data in LINDLBAUER & PUHANI "81".

TABLE 6:

The Use of Investment Anticipations (IA) in the Forecast of Actual Investment (I)

Anticipations uncorrected

$$I_t = IA_t$$

↓

Mechanic corrected anticipations

$$I_t = IA_t + \frac{1}{t}\sum_{i=1}^{t} (I_{t-i} - IA_{t-i}) \qquad \text{"82", "140"}$$

↓

Regression technique (without cyclical variable)

$$I_t = f\,(IA_t) \qquad \text{"16", "111"}$$

$$i_t = f\,(ia_t) \qquad \text{"111"}$$

$$\frac{IA_t}{I_t} = f\,(\text{Time}) \qquad \text{"140"}$$

↓

Realisation Functions

"Classical" Realisation Functions $\left[I_t = f\,(v_t, IA_t)\right]$

$$I_t = f\left[(S_t - S_t^+), IA_t\right] \qquad \text{"90", "64"}$$

$$I_t = f\left[(Y_t - Y_t^+), (I_{t-1} - IA_{t-1}), IA_t\right] \qquad \text{"15"}$$

$$I_t = f\left[Cap_t, Y_t, CF_t, IA_t\right] \qquad \text{"40"}$$

$$I_t = f\left[Y_t, M_t, IA_t\right] \qquad \text{"74"}$$

$$I_t = f\left[Y_t, p_t, IA_t\right] \qquad \text{"101"}$$

$$I_t = f\left[\frac{IA_t}{TDI_t}, Y_t\right] \qquad \text{"3"}$$

$$I_t = f\left[(S - S^+), z_t, cap_t, IA_t\right] \qquad \text{"91"}$$

$$I_t = f\left[AOS_t, IA_t\right] \qquad \text{"81"}$$

$$i_t = f\left[s_t, ia_t\right] \qquad \text{"96"}$$

"Bastard" Realisation Functions $\left[I_t = f\,(V_{t-i}, IA_t)\right]$

$$I_t = f\left[IA_t, I_{t-i}, S_{t-i}\right] \qquad \text{"75"}$$

$$I_t = f\left[IA_t, \left(\frac{\text{Orders}}{\text{Cap}}\right)_{t-i}, CF_{t-i}\right] \qquad \text{"38"}$$

$$I_t = f\left[IA_t;\ IA_t = m\ (B)\ (1-B)\ CS^+\right] \qquad \text{"68"}$$

Revision Functions $\left[I_t - IA_t = f\,(V_t, V_{t-i})\right]$

$$\frac{I_t - IA_t}{IA_t} = f\left[\frac{S_t - S_t^+}{S_t^+}\right] \qquad \text{"90"}$$

$$I_t - IA_t = f\left[\left(\frac{IA_t}{TDI_t}\right), Y_t\right] \qquad \text{"3"}$$

$$I_t - IA_t = f\,(S_t - S_t^+) \qquad \text{"14"}$$

$$I_t - IA_t = f\left[(S_t - S_t^+), z_t, cap_t\right] \qquad \text{"91"}$$

$$\triangle\frac{I_t - IA_t}{IA_t} = f\left[\frac{S_t - S_t^+}{S_{t-i}}, p_{t-i}, \frac{I_{t-i} - IA_{t-i}}{I_{t-i}}\right] \qquad \text{"39"}$$

$$\frac{I_t}{IA_t} = f\left[\frac{S_t}{S_t^+}, \frac{BORR_t}{S_t^+}\right] \qquad \text{"115"}$$

↓

Anticipation Functions

$$IA_t = f\,(V_1, V_2)$$

↓

Econometric Modells

Note: This table aims at a systematic presentation of the multitude of approaches described. It is neither complete with regard to authors nor the variables used. In order to facilitate the overview we standardized the nomenclature used in the individual studies and disregarded some differences in the variables used (partly plans partly appropriations), as well as the lag structure, the time horizon of the plans, etc. The complete intent of each study can only be found by going back to the original sources.

V^+	= denotes anticipatory variable	TDI	= Trend Deviation of Investment
I_t	= Actual Investment in year t	CS	= Capital Stock
IA	= Anticipated Investment	B	= Lag Operator
S	= Sales	i	= Lag periods (it used as subscript)
Y	= Gross National Product	BORR	= Borrowing
Cap	= Capacity Utilization	V_1, V_2	= Variables
CF	= Cash Flow	z	= Interest Rate
M	= Money Supply	AOS	= Assessment of order stocks
P	= Profit	$\triangle$	= absolute difference

The incorporation of cyclical variables which were known already at the time of the formation of the plan ('bastard" realization functions) can be justified by the statement that not all known variables are included into the decision process immediately and with their full weight (viz. distributed lags, JORGENSON "69"). Under this assumption all deteminants of investment expenditures can be used in any time distribution pattern desired (KRICKE "75", EVANS & GREEN "40", JORGENSON "69", SACHS & HART "112").

Expenditures as well as their determinants can enter the functions either in absolute form or transformed. If a strong trend and high multicollinearity exist, differences should be used. Frequently the level of investment expenditures is explained by the level of the anticipations plus the change in the cyclical variable. Such a function assumes quite strong cyclical variability of the plan revisions, it lowers multicollinearity between the explanatory variables and can be interpreted as a combination of an "imponderable" element in the basic plan with a rate of realization that shows strong cyclical movements. (SACHS & HART "112", BALL & DRAKE "15", EVANS & GREEN "40", KONSKENKYLÄ "74"). SACHS & HART "112", KRICKE "15" and JORGENSON "69" all use levels for the cyclical variable, LEVINE (in "96") transforms all variables into differences.

Often the target of explanation is not the realized level of investment expenditures (or their difference), but rather the difference between actual and planned investment (either in the form of absolute differences, or as a quotient - EISNER "37", e.g. uses the absolute difference of the relative difference). This leaves more degrees of freedom for the incorporation of the determinants of plan revisions. A variable which significantly influences the first investment plan (e.g. capacity utilization or prices) can have an additional influence on plan revisions (if investment plans were used as explanatory variable high multicolinearity would result). We would like to call this subgroup of functions "revision functions", because emphasis is put on explaining the revisions of investment plans. This approach has been tested by MODIGLIANI "90", AGARVALA "3", BABA "14", EISNER "37" and SHIMAMURA "115", among others[1].

1) Some authors build a bridge between this approach and the "classical" realization function by interpreting the latter as the special case in which the coefficient of anticipations is different from one, e.g. MORIGUKI "91", MODIGLIANI "90", AGRARVALA "3".

The most frequently used cyclical variables are variables expressing unexpected developments concerning sales. These often are not based on actual survey data, sometimes they are approximated by synthetic variables or instrumental variables, such as order cancellations (SACHS & HART "112"). Sometimes GNP is used for this purpose (EVANS & GREEN "40", AGARVALA "3"). EVANS and GREEN also make use of capacity utilization and financing variables, others use orders, long-term loans or expansions of capacity.

Anticipation functions form an intermediate step towards internalizing investment plans into models. These functions are supposed to show how investment plans are formed (JORGENSON "69", LEVINE in "96", EISNER "37"). The use of anticipatory data in econometric models is dealt with in chapter 4.

3.3. Forecasting Performance of Investment Plans

The question whether anticipations can make a significant contribution to short-term forecasts has long been dominated by the negative experiences of the sales expectations of the U.S. railroad shippers which yielded results that were even worse than those of naive forecasting methods (MODIGLIANI & SAUERLENDER "87", HULGREN in "95"). Now it is generally recognized that investment plans yield better forecasts than naive methods; the only question that remains to be answered is whether they do better than more sophisticated investment functions.

ZARNOWITZ "14" stresses that especially investment plans which are corrected for a trend error do better than causal alternatives and also than models[1)]; OKUN "101" and KRICKE "75" reach similar results. EVANS "42" confirms this only for the industrial sector.

JORGENSON "70" mentions that investment functions with seven explanatory variables are superior to realization functions. FRIEND and THOMAS (using the same data) respond that this is not true when corrections are made for reporting behavior, and also if JORGENSON had used in his functions only variables which had already been known at the time of the forecast. If both these points were taken into

1) ZARNOWITZ mentions that when compared to investment orders plans exhibit a shorter lead, but are more reliable ("142", p. 442).

consideration, anticipation functions would be superior. The results would be eben better, if investment anticipations and "objective" variables were used together. This discussion leads to a call for caution when comparing plans and functions: such comparisons make only sense if equally sophisticated methods are used for both techniques and if the same availability criteria are applied to the explanatory variables.

There is no discussion on the question whether anticipations are a good instrument to forecast turning points. THOMAS & FRIEND "134" mention this as a major advantage, EVANS reports that anticipations are inferior in that respect.

3.4. The Austrian Investment Survey

This survey on which our investigation is based, has been conducted by the Austrian Institute for Economic Research since 1964[1)]. The aim of the survey is the collection of quantitative annual investment expenditure data. The survey is conducted twice a year (in spring and in fall). Every fall information is collected on the investment plans for the current year and the next year. After the end of each year information on this year is collected two more times, thus for every year there are five pieces of information (=plans).

The questionaring program in detail:

Time of Survey	Fall t-1	Spring t	Fall t	Spring t+1	Fall t+1	Spring t+2
Plan	1st pl. t	2nd pl. t	3rd pl. t	4th pl. t	-	5th pl. t= final result
	IA1	IA2	IA3	IA4		I ≡ IA5

t stand for a specific year.

If the year in question were 1970 (=t), the first investment plan (=anticipation) for this year would be collected in fall 1969 (=t-1), the second plan in spring the third in the fall of 1970 (=t), the fourth plan in the spring of 1971 (=t+1); in the spring of 1972 (=t+2) the final data on 1970 investment is collected (fifth plan = I_t = actual investment).

3.4.1. The Phenomenon of Systematic Underestimation

The results of the investment surveys are systematically lower than actual investment expenditures. The degree of underestimation on the

average amounts to 15 percent[1] and exhibits cyclical variations. In 1971 the underestimation reached 27 %, during the mild recessions of 1962 and 1967 actual expenditures were still higher than the plans. Only in 1975, when production was reduced by 8 percent, the plans were gradually revised downwards. This average under-estimation of 15 % is higher for Austria than for most other countries. This may be due to the small and middle-scale size of Austrian industry and its very rapid growth. Moreover, information on the first plan is collected earlier than in some other surveys (October of previous year).

The tendency to underestimate actual investment is stronger for equipment than for plant expenditures. For investment in plant the factors which tend towards underestimation (corrections in price and project) are counteracted by delays in the completion of construction[2].

TABLE 7: Extent of Plan Revision According to Individual Steps and Firm Size

That part of investment expenditures which has not been previously planned shows a significant tendency to expand capacity: On the average planned capacity expansion (which is reported together with the respective investment plans) was five percent above the previous year. Capacity expansion actually achieved by the end of the year was on the average of six percent, so that non-planned investment expanded overall capacity by one percent (or roughly one fifth of the total capacity increase). This effect exhibits strong cyclical variations. During recession years it remains quite low, or is even negative, in boom years it amounts to one to two percent. These plan revisions which affect capacity show that underestimation of investment expenditures occurs not only for reasons of estimates of prices and costs[3].

1) Average 1964/76; calculated as $\left(\frac{5^{th}\text{ plan} - 1^{st}\text{ plan}}{5^{th}\text{ plan}}\right) \cdot 100$
If instead of the 5^{th} plan the 1^{st} plan were used in the denominator, the average result would be 17 %.

2) see e.g. FRIEND & BRONFENBRENNER "49" who state that plans for investment in plant are more accurate; for a contrary statement see FIRESTONE in "95" and LONNQUIST "82".

3) see also GORT "58" who argues against using prices as the most important argument for underestimation of investment by showing that in the energy sector actual capacity expansion is below planned expansion.

TABLE 7:

Extent of Plan-Revision According to Individual Steps and Firm Size

Plan Revision in %	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
1st step	-	+ 7	+10 ½	+ ½	+ 6	+10	+ 6 ½	+ 8	+ 8	+14 ½	+ 8 ½	- 3 ½	+ 8 ½
2nd step	- 8 ½	- 2 ½	+ 1	+ 1 ½	- 6	- 3 ½	- 2	+ 6	+ 5 ½	- 5 ½	- 2	- 5 ½	- 6 ½
3rd step	+ 8 ½	+ 8	+ 3 ½	+ 7 ½	+11 ½	+ 2	+10 ½	+12½	+12	+ 2	+ 6	+ 4 ½	+ 9
Full extent	-	+12 ½	+14	+ 9 ½	+11 ½	+ 9	+14 ½	+26 ½	+25	+11	+12 ½	- 4	+11

Firms employing

Average 1964/76	All Sizes	0 - 99	100 - 499	500 - 999	1.000 and more
1st step	+ 9	+14	+ 5	+ 6 ½	+ 8 ½
2nd step	- 2	+ 2	0	- 3	- 3 ½
3rd step	+ 7 ½	+12	+ 7 ½	+11 ½	+ 6
Full extent	+14 ½	+31	+12 ½	+14	+ 9

1st step: $\frac{IA2 - IA1}{IA5} \cdot 100$

2nd step: $\frac{IA3 - IA2}{IA5} \cdot 100$

3rd step: $\frac{IA5 - IA3}{IA5} \cdot 100$

Full extent: $\frac{IA5 - IA1}{IA5} \cdot 100$

3.4.2. Differences by Sector

This underestimation effect differs from sector to sector. For manufacturing as a whole the first plans are 15 % below actual investment. In some sectors the plans on the average are higher than expenditures (oil, vehicles, mining), in other sectors plans are revised upwards by nearly 50 % (leather and shoe, leather products, furniture, metal products, apparel).

These differences can best be explained by differences in capital intensity (capital stock per employee) and firm size[1].

TABLE 8: Extent and Annual Variance of Plan Revision in the Industrial Sectors

Higher capital intensity goes hand in hand with lower tendency to underestimate. Most capital intensive sectors have to plan their investment expenditures a long time ahead[2], because they constitute very stringent bottlenecks and cannot easily be substituted. These investment projects normally consist of a number of mutually dependent units, and delays in one unit result in great problems for the whole project. Normally in such sectors investment processes are more highly formalized, and budgets exist for emergency situations. It is also true that in the capital intensive sectors those types of investment which do directly concern the production process (storing, transport, etc.) are more important than for more labor intensive sectors, and those types are probally planned more thouroughly than storing, transport etc.. In the more labor intensive small-scale firms investment decisions are made throughout the year, investment goods which are mass products can be ordered quickly and can achieve capacity increasing effects quite rapidly.

1) A positive statistical test has been conducted by means of rank correlation coefficients. The same results hold when firms are grouped into size classes (see table 7). Average underestimation in firms with fewer than 100 employees is 31 %, in large firms with more than 1.000 employees it is only 9 %. See also the results of a U.S. investigation on the reasons for decreasing investment plans by CROCKETT & FRIEND "26".

2) For this reason these sectors show very marked medium-term investment variations, but quite long annual variations.

TABLE 8:

Extent and Annual Variance of Plan-Revision in the Individual Sectors

	Extent[1)]	Standard Deviation
Manufacturing	+14,6	6,1
Basic goods	+ 1,5	13,2
Investment goods	+17,0	10,4
Consumption goods	+17,0	5,7
Mining	- 3,1	19,2
Oil	-14,7	24,1
Basic iron & steel	+ 7,1	22,1
Nonferrous basic metals	+ 1,3	24,2
Stone quarrying, clay	+20,0	19,4
Glass and glass products	+24,3	21,3
Chemicals	+ 8,7	10,6
Pulp & paper	+ 8,0	20,3
Paper processing	+19,9	29,4
Furniture	+32,0	17,8
Food products, beverages	+11,5	12,3
Leather	+27,9	26,4
Leather products	+32,9	17,1
Textiles	+24,9	12,4
Wearing apparel	+29,9	12,9
Casting	+19,9	17,7
Non electrical machinery	+17,4	6,7
Transport equipment	- 2,8	23,8
Metal products	+31,2	10,4
Electrical machinery	+17,9	8,5
Average of sectors with high underestimation	+26,3	18,5
Average of sectors with low underestimation	+ 5,1	17,2

1) $\frac{IA5 - IA1}{IA5} \cdot 100$

The average rate of growth of production of a sector does not exert any noticeable influence on the degree of underestimation. The same holds for the different degrees in the acceleration of growth for the different sectors during the sixties. By the same token no influence is exertedd by the degree of regularity of annual growth in production or in investment expenditures.

The fact that some sectors on the average show a smaller degree of underestimation than others is no proof that from these plans better forecasts for actual investment can be deduced[1]. On the contrary, those sectors which have a relatively high estimation error exhibit very regular errors. The average plan revisions of sectors that show marked underestimation are more regular[2] than in sectors with small revisions. This phenomenon points to the fact that in sectors with lower underestimation (but higher variance) the revisions are determined by two compensating factors which dominate according to the cyclical situation. A positive business situation promotes investment plans, but after certain bottlenecks have been reached in the investment goods sector, the completion of investment projects tends to be delayed by significant periods. Depending on the respective weight of these two factors, positive or negative revisions will result.

1) Often lower average underestimation in the capital intensive sectors is set equal to more exact expenditure plans, as e.g. in BONHOEFFER , "29", p. 29: "Capital intensive sectors not only have to plan their investment expenditures a longer time ahead, they also have to plan more accurately. This accounts for the fact that in these sectors on the average the accuracy of reported plans is higher". The present study finds that in capital intensive sectors plans are closer to actual expenditures, but they also fluctuate more strongly and thus are not more accurate. The same holds for size groups: in firms with more than 1.000 employees the standard error of the revisions is slightly higher (7,5 %) than in firms with less than 100 employees (7,0 %), despite the fact that the average errors bias this measure in favour of the big enterprices (Average: 9% vs 31%)An U.S.study by FRIEND & BRONFENBRENNER "49" shows that on the plant level the plans of large firms are also more accurate as far as the variance is concerned. This result does not necessarily contradict the one for Austria, since firm results can compensate one another in such a way that on the sector level revisions become more regular.

2) The standard error of the revisions is the same for sectors with high and low under-estimation, a measure taken into account for the different average errors would give significantly lower errors in the former group.

An international comparison shows a striking similarity in the ranking of the sectors that tend twoards high or low underestimation[1]. All surveys show that revisions are highest in apparel, and lowest or not existing in the petroleum and chemical sectors. An international "hierarchy" of this sort has to be expected due to the dependence of revisions on technological requirements.

3.4.3. Results of a Special Survey on the Reasons for Plan Increases

In spring 1972 the Austrian Institute for Economic Research conducted a special survey on the reasons for plan increases. This survey was carried out, after plan revisions had reached peak values during a period of three consecutive years.

Among the possible answers price increases over the original cost estimates[2] was the most frequently mentioned answer. It can safely be assumed that entrepreneurs do not only mean price increases for identical products, but also include increases because of varying unforeseen circumstances into this answer.

The second and third most frequent answers referred to new technological information which became known during the investment process: on the one hand "technological innovations occur between the planning and the completion of the investment projects", on the other hand "central investment projects requires supplementery investment expenditures"[3]. Both motives are rated equally important on the average, the first one applies more to investment goods sectors and the chemical industry, the others to consumption goods sectors and smaller firms.

Another motive for plan revisions is "necessary overhauls of and alterations in existing machinery"; this motive was judged important by slightly over 50 percent of the firms. It applies even more than

1) When the ranking is compared with that in the Netherlands (MOUCHART, THEIL, VORST "92", p. 83) the rank correlation coefficient is .94, if compared with the U.S. (GREENWALD "59") the rankings are identical.

2) F. MODIGLIANI & H.M. WEINGARTNER "90" cite a U.S. investigation in which one third of the firms stated to have taken into consideration price increases for investment goods, one third assumed constant prices and one third did not consider price changes at all.

3) E. STREISSLER "120", p. 95 f stresses the importance of additional machinery for purpose of a flexible combination of labor and capital.

the previous ones to involuntary and unforeseen increases in investment expenditures. Its importance decreases rapidly as firm size increases, because in such firms the large number of existing machines accounts for more regular incidents of this kind, and also makes the expenditures more foreseeable[1]. "Contraction of planned investment depending on available financing" and "Problems in attributing large projects to a single financial year" both depend in their importance on the average time span of the investment project and thus are more prevalent in large firms.

All the motives mentioned so far imply a certain degree of outside influence. They assume a passive entrepreneur who is either taken by surprise by price increases or is forced by technology to increase his investment expenditures. These motives account for the systematic part of the error in the plans, they form the "base" of the underestimation. They are responsible for underestimation even in times of recession.

TABLE 9: Results of a Survey on Causes of Underestimation in Austria

The following motives were designed to catch the empirically proven cyclical part of plan revisions. But both reasons, "Only large projects are planned, smaller ones are decided upon depending on the cyclical situation during the second half of the year", and "Investment expenditures are based on very cautious assumptions about profits; the actual development of profits offers a margin for necessary additions", were termed unimportant by a majority of the firms surveyed. But exactly these motives were emphasized by those sectors which underestimate their investments significantly.

Availability of credit was not deemed important by many firms. This result conforms to the findings of a Swedish[2] and three American[3] studies. A study which was conducted for a much less favorable

1) see I. FRIEND & BRONFENBRENNER "49", p. 16.

2) The Swedish study "Effects of Credit Policy" "35" examines the effects of monetary restriction on plan revisions during the years 1969 and 1970 and finds (p. 161) that the restrictive policy had a certain investment-dampening effect, and its termination revived investment. Both effects were found to be of only small importance when compared to other factors, however. The strongest effects were seen in the size class 50 to 200 employees.

3) FRIEND & BRONFENBRENNER "49", p. 87; FOSS & NATRELLA "48"; J. CROCKETT, I. FRIEND, H. SHAVELL "32". Even the effect of the strongest restriction of credit in the U.S. for the after-war years was only less than minus one percent on investment expenditures of the current year and slightly more than one percent for the following year. The two previous studies had indicated even smaller effects exerted by conditions on the credit market.

TABLE 9:

Results of a Survey on Causes of Underestimation in Austria
(Investment Test 1972)

	very important (1)	important (2)	less important (3)	rather unimportant (4)	Index[1]
Planning investment expenditures primarily concerns central investment projects; necessary supplementary expenditures cannot easily be prejudged.	16	38	33	13	+ 8
Planning concerns large projects. Smaller ones (especially those which can be depreciated immediately) are decided upon in the second half of the year according to the cyclical situation.	3	37	33	17	- 2
Between the first investment plan and the end of the project technological innovations occur which increase the competitiveness substantially without necessitating a complete revision of the planning.	20	34	29	17	+ 8
Capacity expansion and rationalizations constitute the object of planning: necessary overhauls of and alterations in existing machinery cannot be prejudged correctly.	16	38	29	17	+ 6
Investment plans are decided upon on the basis of cautious profit assessment: the actual development of the profits then offers a margin for necessary supplements.	12	30	25	33	-26
Credit availability becomes known only during the course of the current year and thus influences expenditures.	5	13	27	55	-72
In general prices in cost estimates are considerably exceeded, even when no actual expansion of the project occurs.	27	39	25	9	+36
According to financing opportunities investment projects can be speeded up or slowed down.	12	27	39	22	-24
Attribution of current large investment projects to a specific financial year is not always completely possible.	20	34	25	21	+ 6
Other reasons:	3	5	0	92	-88

1) Calculated by means of the following formula:

$$\frac{2x_1 + x_2 - x_3 - 2x_4}{2x_1 + x_2 + x_3 + 2x_4} \cdot 100$$

x_1 ... percentage of firms reporting very important

x_2 ... percentage of firms reporting important, etc.

cyclical situation (1957/58) shows that for that phase credit availability played a relatively more important role.

We can state as a conclusion that entrepreneurs attach importance to all motives which relate to the systematic underestimation (the "base"), but consider those which point to annual fluctuations in the revisions as quite minor. A study has shown that in the U.S. cyclical reasons play a much larger role (especially sales and profit conditions)[1].

For the U.S. the most important reasons for the "base" underestimations were "incomplete planning", "routine underestimation" and "breakdown of machinery". A Canadian study (FIRESTONE in "95") mentions in first place planning of unforeseen projects and puts little emphasis on cost increases (only eight percent of all cases) and on sales increases.

3.4.4. Underestimation of the Variance

Investment plans of individual years are more similar to each other than actual investment expenditures. The standard error of the plans lies around 10,4 %, that of actual investment is 13,3 %. This discrepancy corresponds to the general experience that entrepeneurial evaluations (MODIGLIANI & SAUERLENDER "87", CARLSON "23") as well as macroeconomic forecasters regularly tend to underestimate changes. One economic explanation for the area of investment planning is that decisions are made concerning central investment units, and that mark-ups or mark-downs are applied depending on the cyclical situation. It is probable that here also a non-linear "plan error function" applies (similar to that of forecasters): the economic loss of a deviation of the plan from reality probably increases more than proportionately in relation to the increasing planning error (e.g. with the square of the planning error)[2].

It is interesting that for some individual sectors the variance of actual investment expenditures is not larger than that of the plans. In exactly half the sectors the variations of the plans are larger than those of actual expenditures. A possible explanation for this

1) see e.g. FRIEND & BRONFENBRENNER "49".

2) Average (absolute) forecasting error increases just as it does when macroeconomic forecasts are corrected for the error in the variance.

is that sometimes it is exactly the most extreme plans (e.g. doubling of investment or no investment at all) which cannot be carried out in practice.

3.4.5. Distinction of Individual Steps of the Revision

Since investment plans for each year are collected five times, it is possible to divide the total revision into steps and to investigate these for cyclical variation and entrepreneurial evaluation. We can distinguish three individual steps: step one denotes the difference between the first and the second plan, step two that between the second and the third plan and step three the difference between the third plan and the final result (= fifth plan)[1].

3.4.5.1. The First Step of Revision

With the exception of 1975 plans were increased between the first survey (in the fall of year t-1) and the second survey (spring of the year for which information is collected) in all years. The average increase amounted to nearly ten percent. 1975 the plans were lowered by 3 1/2 %, the smallest positive revision occured in 1967 (+ 1/2 %), the largest in 1973 (+ 4 1/2 %). The standard error of the revision is higher for this phase than for others. The annual variations in the amount of the revision can be well explained by cyclical variables[2]. Capacity utilization as well as its rate of change, and also profits show high positive correlation. In addition high degrees of correlation are exhibited by business survey variables, especially when changes in the indicators are used. If the determinants are combined, 70 % to 80 % of the variation in annual revision can be explained. During this phase the revision is higher, the better the cyclical situation and the faster it improves.

TABLE 10: Explanatory Equations for Plan Revisions in Austria

3.4.5.2. The Second Step of Revision

In general investment plans are lowered between the spring survey and the fall. On the average this decrease is quite low (- 2 %), but it reached - 6 % in 1968 and 1975[3]. During this phase capital

1) 1st step: revision from first plan (fall t-1) to 2nd plan (spring t)
2nd step: revision from 2nd plan (spring t) to 3rd plan (fall t)
3rd step: revision from 3rd plan (fall t) to 5th plan (spring t+2).
The fourth plan is not investigated seperately, because it is nearly identical to the ffinal result.

2) Only the price series for investment goods shows an insignificant negative correlation (R = - .06).

3) Already the fact that the highest decreases in plans occurred in such diverse years as 1968 (beginning of recovery) and 1975 (recession) shows that there is no marked cyclical influence.

TABLE 10:

Explanatory Equations for Plan Revision in Austria (1965/75)

1) 1st Step

Rev = 2,206 + 0,173 PRE + 0,344 p, 1.Q^{++} 63 50 36	R^2 = 0,73 DW = 2,63
Rev = 4,943 + 0,965 CAP^{++} + 0,248 p, 1.Q 34 45 57	R^2 = 0,75 DW = 2,67
Rev = 5,51 + 0,511 TD,PI^{++} + 0,194 PRE^{++} 22 38 44	R^2 = 0,72 DW = 2,13
Rev = 7,50 + 0,415 TD, PI^{++} + 1,078 CAP^{++} 10 40 30	R^2 = 0,80 DW = 2,58
Rev = 1,17 + 0,448 s^{++} + 0,183 PRE 140 36 47	R^2 = 0,73 DW = 2,12

2) 2nd Step

Rev = -1,782 - 0,165 aeo^{++} + 0,267 prig 70 29 79	R^2 = 0,68 DW = 1,59
Rev = -2,05 - 1,651 aos, 3.Q^{++} + 0,286 prig 65 33 79	R^2 = 0,62 DW = 1,25

3) 3rd Step

Rev = 8,87 + 0,117 AOS, 4.Q^{++} - 0,091 p 11 26 51	R^2 = 0,71 DW = 2,43
Rev = 6,80 + 0,099 PRE, 4.Q + 0,604 empl.$^{++}$ 10 46 36	R^2 = 0,63 DW = 2,60
Rev = 10,94 + 0,203 AFS^{++} - 0,014 p, 4.Q 16 34 49	R^2 = 0,59 DW = 1,40
Rev = 8,53 + 0,119 AFS^{++} + 0,0921 pre, 4.Q 12 42 53	R^2 = 0,56 DW = 2,30
Rev = 3,149 + 0,253 afs + 1,134 PI (3.Q-1.Q)$^{++}$ + 0,446 pi 59 46 33 47	R^2 = 0,76 DW = 2,37

TABLE 10 (forth):

4) Total Revision

$Rev = \underset{25}{9,16} + \underset{49}{0,908}\ TD, PI, 1.Q + \underset{57}{0,285}\ PRE$	$R^2 = 0,57$ $DW = 1,35$
$Rev = \underset{68}{-5,41} + \underset{20}{2,945}\ pi^{++} - \underset{28}{0,456}\ aos^{++}$	$R^2 = 0,79$ $DW = 1,69$
$Rev = \underset{316}{-0,93} + \underset{21}{2,260}\ pi^{++} - \underset{32}{0,283}\ AEO^{++}$	$R^2 = 0,76$ $DW = 1,58$
$Rev = \underset{25}{7,53} + \underset{31}{0,821}\ pi, 4.Q^{++} + \underset{34}{0,980}\ TD,PI,2.Q^{++}$	$R^2 = 0,74$ $DW = 1,71$
$Rev = \underset{18}{23,55} - \underset{34}{1,256}\ Ss^{++} + \underset{21}{2,494}\ TD,PI,2.Q^{++}$	$R^2 = 0,80$ $DW = 2,00$
$Rev = \underset{18}{70,83} + \underset{20}{1,578}\ AFC^{++} + \underset{29}{1,484}\ pi^{++} - \underset{23}{1,041}\ AOS^{++}$	$R^2 = 0,89$ $DW = 1,49$
$Rev = \underset{25}{447} + \underset{23}{0,721}\ pi, 4.Q^{++} + \underset{19}{3,095}\ TD,PI,2.Q^{++} - \underset{25}{4,956}\ AFS^{++}$	$R^2 = 0,92$ $DW = 2,59$

Notes:

The dependent variables (Rev) are

1st step: $\frac{IA2 - IA1}{IA4} \cdot 100$

2nd step: $\frac{IA3 - IA2}{IA4} \cdot 100$

3rd step: $\frac{IA4 - IA3}{IA4} \cdot 100$

Total Revision $\frac{IA4 - IA1}{IA4} \cdot 100$

As indipendent variables annual data are used, if no quarter (1.Q, 2.Q etc.) is specified

TD,PI ..... trend deviation of the production index

PRIG ..... price index for investment goods

EMPL ..... employment

CAP ..... capacity untilization

intensive firms reduce their plans (petroleum - 5 %, steel industry - 3 %, basic non-ferrous metals - 4 %), as well as firms with more than 500 employees (- 5 %). On the other hand, labor intensive firms (leather + 21 %, wood and furniture + 11 %), as well as smaller firms (with less than 100employees, by + 20 %) increase their plans significantly.

Two contrary tendencies - additions to plans for smaller and more labor-intensive firms, and project delays for large-capital-intensive firms - account for this irregular cyclical effect. When the amount of the revision is explained by variables indicating the cyclical activity[1], only insignificant coefficients result (most of them are negative). On the other hand, the change in capacity utilization or in the business test variables exert a significant influence. Functions containing several variables show a smaller coefficient of determination for this phase than for others. Good results can be achieved e.g. by combining the positive influence of price increases for investment goods with the negative influence of changes in the evaluation of the cyclical situation. The faster the economy booms the less investment plans of large firms can be realized. Nominal plans are increased by price increases and the need of additional capacity for smaller firms.

3.4.5.3. The Third Step of Revision

Between fall and the end of the year (time of data collection: spring of the following year) investment plans are increased by an average of 8 percent. All twelve years included in the investigation show a plan increase, the highest one occurred in 1971 (a year with good domestic, but shaky foreign situation, by 15 %), the lowest rate of revisions occurred in 1973 (+ 2 %). The latter result was significantly influenced by the "oil shock".

These plan revisions exhibit a pro-cyclical pattern, but it seems that there is a important effect of random errors. On the one hand institutional changes (introduction of integration agreements, tax breaks) normally occur at the turn of a year, on the other hand it seems that the high revision during this phase covers up certain delays in construction (several capital-intensive sectors during this phase show negative revisions of the plans). Since in this

1) Production growth, untransformed business test variables.

phase most additional investment expenditures concern mass products (instead of special equipment), this type of delay does not play a large role.

When revision functions are estimated business test variables (normally showing a pro-cyclical pattern) are most important. In two equations the coefficients of profit change are negative, but one should not put too much emphasis on this result: because in this phase the wish to make use of tax deductions and all possible forms of depreciation leads one to expect a positive influence of profits on revisions.

3.4.6. The Cyclical Component of Total Revision

The separation into several steps has shown that the different phases are influenced by different factors. We saw a significantly pro-cyclical effect for the first phase, a counter-cyclical one for the second phase (due to limitations in capacity) and again a pro-cyclical one in the third phase.

The total revision (between the first plan and the final results) exhibits a pro-cyclical influence. Here we want to analyze the factors that exert the strongest influence on the variations in plan revisions.

Of all possible cyclical variables capacity utilization of the current year explains the degree of under-estimation best. Thus it seems that capacity utilization, which also plays an important role in investment functions, increases the necessity of additional investment expenditures (which have to be decided upon during the year), but also makes these possible (by means of increasing profits and also increasing prices). There certainly are technological and supply-determined limitations to quick increases in capacity by means of additional investment expenditures, but data on capacity expansion show that especially in labor intensive sectors short-term capacity expansions are possible.

The relatively largest differences between actual revisions and those estimated by means of capacity utilization occur during the early years of the boom: in this phase capacity utilization improves rapidly, but plan revisions are not very substantial yet. Higher revisions become only necessary when a ceiling is approached, but

at that time the costs of additional projects will be highest. The coefficient of determination for this correlation is lowered by the "stray" value of 1973, a year in which initially plans had been increased as expected, but then fell prey to the oil shock during the later phase[1].

Other determinant factors for plan revisions are the dynamics of production and its rate of change during the year. Business test variables can explain between 40 % and 60 % of the cyclical variation of revisions.

Up to 1971 profits and price increases for investment goods are a rather important determinants for revisions, but for the whole period they are not good explanatory variable. Price increases for investment goods should have led to sizable revisions between 1973 and 1975, actual revisions were quite low, however. In 1976 prices hardly increased at all, but the plans were increased quite significantly. The profits situation of 1974 led one to expect very high plan revisions, but the oncoming recession prevented this.

When several determinants are combined, approximately three quarters of the variation can be explained. Combinations of pro-cyclical variables with counter-cyclical ones yield high degrees of determination (around 90 %). This result should not be taken too seriously, however, due to the low number of degrees of freedom (11 years, two to three explanatory variables). But it is a fact that the process of plan revision is influenced by pro-cyclical as well as counter-cyclical factors: counter-cyclical revisions in capital-intensive sectors and especially during the second phase of revisions, pro-cyclical ones during the first and the third phases, and especially in smaller firms.

3.4.7. Comparison of the Forecasting Performance with Alternative Forecasting Methods in Austria

The question considered here concerns the performance of plan revisions in forecasting investment expenditures. They will be compared to so-called "naive models" and investment functions. The mean

1) Other investigations of the plan revisions before 1972 (see AIGINGER "4") had shown higher coefficients of determination.

(absolute) forecasting error of these techniques is compared to that of the first investment plan and the results from the realization functions[1].

3.4.7.1. "Naive" Forecast

Three approaches were used for this method: investment expenditures are equal to last year's (no change = 1 naive), they increased by the average growth rate (naive 2), they increased by previous year's rate of increase (same change = naive 3). All three methods yield an annual absolute error of around 1 bill. S for the period 1956 to 1973, i.e. about 10 % of the investment expenditures (1,002, 1,005, 0,927 bill. AS. respectively).

TABLE 11: Comparison of Forecasting Performance of Anticipations with Alternative Models

3.4.7.2. Investment Functions

Investment functions for Austrian industry (STANZEL "118", AIGINGER "5") use profits, value added, capacity utilization and a flexible accelerator as determinants.

All functions which use only one exogenous variable do little better than the naive approaches as far as the average forecasting error is concerned.

Both forms (Equ. 2,5 and 2,6 in Table 11) of the flexible accelerator (capital stock principle, deficit principle, see Appendix), as well as a combination of profits and capacity utilization reduce the error by nearly one half (500 million AS per year). In the latter combination however, the regression coefficients are statistically not significant due to multicolinearity between the variables; besides this approach is not suited (in contrast to the accelerator approach) to reflect the strong medium term movements of investment expenditures.

3.4.7.3. Forecast by Means of Investment Anticipations

The absolute average error of the (uncorrected) first anticipation (IA1) is about twice as high as that of the naive forecasts. When corrected for the systematic tendency to under-estimate, the error

1) The time span of the investigation was extended back to 1955 by 'transforming' the earlier qualitative data into quantitative plans.

TABLE 11:

Comparison of Forecasting Performance of Anticipations with Alternative Models

	mean absolute error sample period 1956/73	ex post forecast 1974/76
1) Naive Forecast		
1.1. $I_t = I_{t-1}$	1.002	1.338
1.2. $I_t = I_{t-1} \cdot (100 + i_{t-1})$	927	2.192
2) Investment Functions without Anticipations		
2.1. $I_t = f\ (\text{VALUE ADDED})_t$	959	2.577
2.2. $I_t = f\ (\text{VALUE ADDED})_{t-1}$	930	3.464
2.3. $I_t = f\ (\text{CAPACITY UTILISATION})_t$	1.516	3.922
2.4. $I_t = f\ (\text{VALUE ADDED; AOS})_t$	844	2.175
2.5. $I_t = f\ (\text{VALUE ADDED}_{t-1}, \text{CAPITAL STOCK}_{t-2})$	582	3.134
2.6. $I_t = f\ (\text{CAPITAL STOCK DEFICIT}_t; \text{TREND})$	487	3.109
2.7. $I_t = f\ (I_{t-1})$	904	1.700
3) Anticipations (without cyclical variable)		
3.1. $I_t = (IA1_t)$	647	1.850
4) Realization functions		
4.1. $I_t = f\ (IA1_t; PRIG_t)$	580	3.313
4.2. $I_t = f\ (IA1_t; prig_t)$	461	3.053
4.3. $I_t = f\ (IA1_t; \text{Capital Stock Deficit}_{t-1})$	540	1.651
4.4. $I_t = f\ (IA1_t; TD, PI_t)$	569	1.063
4.5. $\frac{I_t - IA1}{I_t} = f\ (IA1_t; TD, PI_t)$	654	324

PRIG ..... price index for investment goods

TD, PI ... trend deviation of the production index

becomes smaller than for the naive methods (838 mill. AS, i.e. 8 %). When the plans are corrected by means of last year's revision or the underestimation of the variance of the plans, no improvement is achieved.

When actual investment is regressed on investment plans (Equation 3.1 in Table 11), the statistical significance is higher and the forecasting error lower than in all investment functions with only one exogenous variable. The error amounts to 647 mill. AS (=around 6 %) and is surpassed only when the accelerator approach is used.

3.4.7.4. Investment Plans in Combination with "Objective" Determinants

In most cases a combination of investment plans with "objective" determinants (profits, production) yields no increase in the coefficient of determination. In addition the coefficients become less significant because of high multicollinearity. The superiority of investment plans over "objective" determinants can be seen by the fact that the regression coefficients of the plans remain significant and do not differ very much from those of the simple regressions (in contrast to those of profits and price increases in investment goods). The relatively best combination of investment plans is with capacity utilization (Equation 4.4), or alternatively with the flexible accelerator (Equation 4.3). This can be interpreted to mean that capacity considerations do not enter into the investment plans completely. This assumption is corroborated by the importance of capacity utilization for investment plan revisions. The average forecasting error of these equations amounts to between 450 and 580 mill. AS.

When investment expenditures are explained by means of the plans and the current change in "objective" variables ('classical' realization functions), both the rate of growth of profits and of investment goods prices yield significant coefficients. For the latter equation (4.2 in Table 11) the average error term amounts to 461 mill. AS.

3.4.7.5. Testing for Stability of Realization and Investment Functions

The forecasting error for the period after the sample period (i.e. 1974 to 1976) is about ten times higher than for the sample period. The best forecasts would have been (which at that time nobody would have believed) that investment expenditures would remain at last year's level. When using investment plans it would have been best not

to correct them even for the systematic error. During the three years 1974 to 1976 for the first time since World War II investment expenditures fell by one quarter. Thus nobody could expect that forecasting methods which are based on historical information could yield any acceptable results. The method which yielded the lowest forecast performed best.

Two other methods are suited better to test for the stability of the estimated functions. The first method leaves out the year for which investment is to be estimated (open window method), the other calculates the regression initially for ten years and then adds on one year at a time.

Both techniques emphasize the importance of investment plans for the forecasting of investment expenditures: when investment is regressed on investment plans, the coefficients show less random changes than those of investment functions or those of an auto-regressive scheme.

All these tests indicates (as does the literature cited in the text) that investment plans (when corrected) are slightly superior to simple investment functions for forecasting purposes. The combination of subjective with objective information (either in the form of realization functions or of revisions functions) shows for the period under investigation that further improvements are possible. But these functions are as far as Austria is regarded not stable enough to warrant significant improvement for any forecasting period. Moreover, it has to be kept in mind that combined estimates either contain objective magnitudes for the period for which the forecast is made (in this case an additional forecasting error arises for the exogenous variable, which does not occur when simple investment plans are used) or objective magnitudes of the past which do not reflect the rather abrupt cyclical changes as experienced in the last few years.

4. The Role of Business Survey Data in Econometric Models

4.1. A Survey of Some Models

The empirical fact that the predictive performance of investment anticipations are at least equal if not superior to investment functions led to their inclusion into econometric models.

TABLE 12: Survey Data in Econometric Models

This table shows that in addition to quantitative investment anticipations in the U.S. often a variable denoting housing starts is included in disaggregated investment equations. In the U.S. qualitative data are not used in models, even though FAIR "44" tests their explanatory power. For Germany POSER "109" has included the evaluation of inventory stocks and of order stocks. The same variables are used in a Japanese "183", a French "83" and an Austrian "114" model. For Germany NIESSEN uses the evaluation of the business climate, of order stocks and price expectations.

In addition to investment equations (which include classical investment functions (e.g. FRIEND & THOMAS "53") as well as equations which just add on anticipations to increase the coefficient of determination data from business surveys are primarily used in inventory equations; the Austrian model also uses them in a price equation and in the monetary sector. NIESSEN uses them to explain sales, incoming orders and production.

4.2. Evaluation of the Performance of Survey Data in Models

The most important advantage - next to their contribution to the explanatory power of the individual equations - of survey data is their availability for at least a short time ahead, which aids in avoiding the errors that arise from forecasting other exogenous variables. Moreover, most qualitative data yield information on cyclical turning points relatively early and they also are less multicolinear with other exogenous variables than most "objective" series. HAITOVSKY and TREYZ "60" developed an instrument that enables one to show the extra advantage of using survey variables in a model in comparison with individual equations. This advantage is greater: a) the more the error term is reduced also in those equations which do not contain survey variables, b) the more the regression coefficients of other exogenous variables decrease in that equations which do contain

Table 12

Survey Data in Econometric Models

Name, Country, Number in Bibliography	Model Type, Characteristics	Survey Data Used	Type of Equation, Transformation	Role of Variable in Model; Philosophy of Model	Test of Influence of Survey Data
KLEIN, USA, "97"	separate model, 29 behavioral equations	OBE–SEC quantitative investment anticipations (housing starts)	investment function, "bastard" realization function	exogenous	short–term forecast
FRIEND & JONES USA, "97"	separate, small "forecasting model" 4 behavioral equations	OBE–SEC quantitative investment anticipations	change in investment and inventories	exogenous	short–term ex post forecast
CROCKETT & FRIEND, USA "33"	small "forecasting model" with tax variables	OBE–SEC quantitative investment anticipations, (housing starts)	change in investment and inventories and housing construction	exogenous	ex post comparison of models with and without anticipation data
THOMAS & FRIEND, USA "134"	small model with several policy variables	OBE–SEC quantitative investment anticipations	change in investment and inventories	exogenous, classical realization function, no added–on anticipations	ex post forecast better than naive models; better than Wharton model, better than OBE only for short term; permanent superiority of investment equation
LIEBENBERG HIRSCH & POPKIN USA, "78"	OBE–Model 1966, "forecasting model", 49 equations	OBE–SEC quantitative investment anticipations, (housing starts)	level of investment expenditures	exogenous (anticipation error for two quarters)	very satisfactory ex post forecast for GNP; small error for investment expenditures, slight tendency to overestimate GNP
H. TSUCHIJA Japan, "138"	Bank of Japan, large structural model	qualitative evaluation of order stocks and inventories (Bank of Japan)	evaluation of inventories	endogenous	–
EISNER & JORGENSON, USA "37", "68"	Brookings Model, structural model	OBE–SEC quantitation investment anticipations	change in investment	endogenous; not contained in standard model; "pure lag relationships" useful for simulations	–
HAITOVSKY & TREYZ, USA "60", "61"	investitation of Wharton III, 47 structural equations	OBE–SEC quantitative investment anticipations, (housing starts)	level of investment expenditures	exogenous; "added–on" anticipations	version containing anticipations, performs better for sample period; same error for forecasting period (significant average error, small error because of unqual covariance)
FAIR, USA "44"	separate model, "forecasting model"	OBE–SEC quantitative investment anticipations; test of quantitative and qualitative inventory data	level of investment expenditures	exogenous; (reduced form of a realization model); endogenization worse than extrapolation of trend, "catches changes in policy, since they influence expectations"	satisfactory test for stability, better than Wharton and OBE even when their forecasts are "revised"
ADAMS & KLEIN, USA "2"	investigation of Wharton III	OBE–SEC quantitative investment anticipations	level of investment expenditures	investment depends on distributed lag of anticipations and on current values of "objective variables"; endogenized in version 3	models without anticipations perform worse than those with exogenous anticipations; these perform worse than version 3; true for investment (only as long as anticipations are collected), less for GNP (four quarters long)
POSER, FRG "109"	separate model, Darmstadt Technical University, "forecasting model"	qualitative evaluation of inventories and orders	change in investment and inventories	exogenous; philosophy similar to Fair	ex post evaluation
NIESSEN, FRG, "100"	separate model, Research Group for Social Economics	qualitative assessment of business climate, orders, and price expectations	sales, prices, incoming orders, production	exogenous; "combination of econometrics with social economics"	ex post forecasts, test for stability
SCHEBECK & THURY, Austria "114"	model of the Austrian Institute for Economic Research, 25 behavioral equations	qualitative data, order situation, assessment of inventories, production expectations	money supply, demand deposits, savings deposits, deflator of business investments, inventory changes	exogenous	–

survey variables, and c) the higher is the covariance of the errors in the model equations.

Two main disadvantages arise from using survey data. One is that they reach ahead only one quarter or at most one year, the other that they might destroy the model structure. The latter argument initially lead to using survey variables primarily for forecasting models (FRIEND & JONES "51", FAIR "44") which do not purport to correctly reflect the structure of economic processes. It is probably true that part of a change in the economic policy framework can be captured via its influence on "subjective" variables, but this alone cannot replace a structural model.

It is not necessarily true, however, that the model structure must be destroyed, if survey variables are included. From all the possible functions which make use of anticipations and objective variables one can choose those which can be interpreted in a structural sense. JORGENSON's ("68") proposal to make "restricted estimates" by stating limits for admissable coefficients goes into the same direction. MARIANO & SCHLEICHER "84" showed that the technique of "Kalman Filters" can be used to include into a model the information contained e.g. in investment plans, without changing a model structure. The technique essentially consists of a formalized correction of the constant term; the Kalman filter determines the degree to which the investment forecast is influenced by anticipations (the filter is estimated by comparing the error terms in equations one and two in Table 13).

TABLE 13: The Kalman Filtering Technique

If survey variables were used as endogenous variables, the problem of their only short prognostic horizon and that of the disturbance of the model structure could be avoided (at least in theory). This technique has been used by ADAMS & KLEIN "2" for the Wharton Model, it has been carried out for qualitative variables in the Japanese model, and it is planned to be included into the French model. But, of course, endogenization is no sufficient condition for the causal interpretability of a model. If survey variables are valued for their "imponderable" nature, this implies that there must be narrow limits to their "explanation". Fair gave up trying to endogenize anticipation data, because their estimates turned out worse than simple extrapolations; ADAMS & KLEIN maintain for investment functions that

TABLE 13:

The Kalman - Filtering - Technique (see "84")

(1) Structural Equation

$$I_t = \alpha_1 I_{t-1} + \alpha_2 V_t + \xi_1$$

(2) Anticipation Equation

$$IA_t = \alpha_3 + \alpha_4 I_t + \xi_2$$

(3) Joint Model

$$\hat{I}_{t+1} = \alpha_1 I_{t-1} + \alpha_2 V_t + K_{t+1} \left[IA_{t+1} - \alpha_3 - \alpha_4 \left(\alpha_1 I_t + \alpha_2 V_{t+1} \right) \right]$$

(4) Filter

$$K_{t+1} = \frac{\alpha_4 \sigma^2_{t+1} I_t}{\alpha_4^2 \sigma^2_{t+1} I_t + \sigma^2_Z}$$

ξ_1, ξ_2 ..... error terms

K_t ..... Filter

their advantage over alternative models without anticipations disappears starting at the period for which endogenously estimated anticipations are used.

The difficulties that arise from comparing the forecasting performance of alternative models are widely known (sample period, forecasting period, ex ante forecast, ex post forecast, correction of constant terms, etc.). When judging their own models, most authors are quite satisfied with the contribution of anticipatory variables. CROCKETT and FRIEND "33" state the superiority of a model with anticipations over one without. FRIEND and THOMAS "53" maintain that an ex post forecast of their own model comes out better than in naive models; their model is also judged superior to the OBE and Wharton models for one to two quarters, after that period it performs still better than the Wharton model but worse than the OBE model (this holds for GNP estimates; when investment is projected the superiority persists). LIEBENBERG et al. "78" emphasize the very accurate forecasting performance of their model, even though there is a tendency to overestimate GNP. FAIR prefers the performance of his model especially to the unrevised Wharton and OBE models, but also to the revised versions.

ADAMS and DUGGAL "1" compare three versions of the Wharton Mark III Model. The standard version does not contain anticipations, the second version includes endogenous survey data and a third version uses anticipations exogenously as far as available, and estimates them endogenously for later periods. The forecasting error for the equations concerned, but also for other equations, is significantly reduced, especially when actual anticipations are used. In the GNP estimates there is an improvement in version two, and even more so in version three. This improvement is smaller, however, than the sum of improvements in the individual equations. In addition, ADAMS and DUGGAL note an improvement in the forecast of turning points as well as lower model multipliers. FROMM and KLEIN "54" find that this advantage is limited to the forecasting period, they find little improvement for the sample period. Their comparison of eleven econometric models also corroborates the superiority of FAIR's model (outside the sample period). CHRIST "30" also states an improvment of the Wharton Model during the forecasting period, no matter whether the constants are corrected or not.

For the Austrian model (SCHEBECK & THURY "114") it is not possible to compare versions with and without anticipation variables. But it seems certain that business test variables have brought about an improvement insofar as they are able to indicate turning points quite early, in contrast to other exogenous variables. AIGINGER "7" has shown with the help of small test models that the covariance of the error terms for two equation goes down when survey variables are included into one of them. Moreover, the regression coefficient of the "objective" determinant goes down when survey variables are included. This leads one to expect an improvement in the forecasting performance which goes beyond the effect of the individual equations. When Kalman Filtering was applied, the error was reduced by 10 % to 20 %.

5. Incorporation of Experiences from Investment Data Collection into a Dual Theory of Investment

5.1. Some Theoretical Statements Concerning Planning of Investments

Traditional theory has little to say about the process of investment decisions from the planning stage to the realization of the project. The micro-economic mathematical investment decision theories normally assume that a single decision is made. How realistic this is can be shown by the fact that smaller firms in general have not yet planned half their investment expenditures by the beginning of the year. These micro-economic error margins which remain hidden behind highly aggregated information easily amount to one third of the total investment expenditures even for larger firms. In addition, for large firms which carry out large investment projects a special error source arises, since it is very hard to attribute a certain part of the investment project to a certain fiscal year, especially when delays occur.

Macroeconomic theory offers a wide array of determinants of investment, but rarely hints at possible divergences between anticipations (plans) and realizations.

The central theoretical concept goes back to MODIGLIANI[1]: entrepreneurs initially decide upon a "first step" preliminary investment

1) see MODIGLIANI in "23".

plan. Factors which become known during the execution of this plan then determine the difference between this first plan and final expenditures.

JORGENSON "68" maintains that all investment is rooted in a wish to change the income stream of the production factor capital. Architects plans and cost estimates follow, as well as the provisions of the financial means. Then orders go out. Such a segmentation of the investment process leads to the use of distributed lag estimates; this approach differentiates more than just into factors that are known before and during the investment process.

EVANS "40", "41", "42" postulates a dual investment decision and thus makes it possible to incorporate investment plan revisions into traditional investment theory: the first plan has a forecasting horzon of about one year, a second decision is made shortly before the investment project is actually started. These dual plans account for a two-peaked weighting scheme for the lags of the determinants of the investment functions.

Empirical investigations show that MODIGLIANI's "first step" in reality is taken under very cautious assumptions. This caution may well be rational[1] if the following conditions exist: firstly, if it is easier from the organizational point of view to increase plans than to lower them (in this case rationality dictates to decide on a lower plan when the situation is uncertain) or secondly, if the loss function is not symmetrical: if too high an investment volume (which cannot be lowered) is decided upon, e.g. by 10 %, this will incur greater economic losses than if the estimate is too low by the same margin.

For small firms probably both these conditions hold. Their additional investment requirements can quite easily be satisfied even in years of high capacity utilization. Reduction of capacity, on the other hand, in times of unexpected slack in demand is not possible to the same degree. For large firms these considerations do not apply, because their anticipations on the average correspond to their realizations.

1) see also CARLSON "28".

5.2. Elements of a Dual Theory of Investment

The diverse behavior on the part of capital intensive large firms (group 1) and labor intensive small and middle-sized firms (group 2) with respect to investment plan revisions is only part of a basic difference in planning and production processes between these two groups[1].

Large, capital-intensive firms have long-term plans concerning production, and thus also the growth of their capital stock. This is true, on the one hand because the ability to plan ahead increases with firm size, on the other hand because the types of investment in which large firms engage (large projects, vertically integrated processes) require long-term planning. The major determining factor for these medium-term investment plans is the expected expansion of demand in relation to available capacity, i.e. expected capacity expansion. Financing considerations are of less importance, because the degree of self-financing for such firms is quite high, access to the capital market relatively easy, and also because the large number of products produced and sold by these firms steadies the stream of profits. In this group unexpected fluctuations in demand are countered by variations in price and differences in capacity utilization. Adjustments via the factor capital are difficult, those via changes in labor rather ineffective.

This type of behavior results in smaller and rather counter-cyclical variations in the investment anticipations; it can be empirically proven by the existence of severe medium term breaks in the trend (stagnation over several years is followed by rapid increases) and low annual fluctuations of investment expenditures. The accelerator principle (e.g. deficit principle, see Appendix 1) is better able to explain investment than are approaches which use flow variables (sales, profits). Trend variables are not very significant for this group. Between the best and the worst year capacity utilization differs by 13 %, one third of the years shows decreases in prices. The highest increases in employment are 3 1/2 %, the highest decreases - 3 1/2 %.

TABLE 14: Different Entrepreneurial Behavior in Two Industrial Sectors

1) see AIGINGER "8".

TABLE 14:

Different Entrepreneurial Benaviour in Two Industrial Sectors

	Capital-intensive sectors dominated by large-scale enterprises[1]	Labour-intensive sectors dominated by small enterprises[2]
1) Investment Functions		
	$I_t = \underset{48}{1.151} + \underset{15}{0,14}$ Value Added$^{++}_t$ $R^2=0,72$	$I_t = \underset{3.978}{-6} + \underset{10}{0,13}$ Value Added$^{++}_t$ $R^2=0,86$
	$I_t = \underset{9}{3.339} + \underset{17}{0,19}$ Capacity Def.$^{++}_t$ $+\underset{93}{38}$ Time $R^2=0,86$	$I_t = \underset{12}{1.335} + \underset{26}{0,16}$ Capacity Def.$^{++}_t$ $t + \underset{31}{72}$ Time^{++} $R^2=0,91$
2) Plan Revisions		
	Average - 4,1 %	Average +29,8 %
3) Capacity Utilization		
	Max 94,2 % Min 81,3 %	Max 87,4 % Min 81,6 %
4) Employment Variation		
	Max + 3,5 % Min - 3,7 %	Max + 5,6 % Min - 8,5 %

1) Mining, oil, basic iron, non-ferrous basic metals, chemicals, pulp & paper.

2) Metal products, wood products, textiles, wearing apparel, leather & leather products, paper processing, glass & glass products.

The basic investment decision of the labor-intensive smaller and medium-sized firms concerns only one half of total investment; the remainder is decided upon during the course of the year, depending on the cyclical situation. These firms employ more mass-produced machines, a fact which makes this behavior possible. The fact that investment is financed out of current profits requires cautious investment plans. At the same time this group is more flexible with respect to changes in employment than are large firms. In this group price changes without concomitant changes in employment occur less frequently due to the higher share of wage costs.

For this group investment expenditures grow parallel with the growth of production, thus there are no medium-term breaks in the trend, in investment functions, flow variables are more important than capital stock. Fluctuations in capacity utilization are about one half of those in capital intensive firms, prices do not go down in recession years. The span of the employment situation between good and bad years (+ 5 1/2 % to - 8 1/2 %) is twice as high as for the other group.

This difference in flexibility between the capital-intensive and the labor-intensive sectors could give rise to a modified theory of disproportionality: when an unexpected recovery occurs in the cyclical situation one sector is able to adjust its capacity rapidly, but this adjustment is hampered by supply difficulties in the other sector. Once this latter sector is able to expand its supply, demand in the labor-intensive sector has already again gone down. Thus free capacities are available at a time when they are no longer required. This hypothesis still has to be investigated in more detail, there is however an indicator that it might apply: in general the cyclical pattern of industrial production shows two peaks. After the first peak has been reached, the growth rates decrease for a while and peak again[1)]. It can be shown that this double-peak pattern prevails especially in the production of investment goods, where the first peak is caused by purchases of smaller machinery, the second one by the delivery of large investment projects. In between deliveries go down, but order stocks and working hours in the machinery industry

1) see STREISSLER "123", AIGINGER, BAYER, SCHENK "6"; when the cyclical pattern is measured by means of trend deviations, the two peaks are replaced by a "plateau", in contrast to a narrow "valley" shape during recession.

remain high. The fact that investment expenditures for the labor-intensive group peak earlier can also serve as proof for the above hypothesis, as well as the fact that this group reaches its highest capacity increase earlier than the other group.

6. The Contribution of Business Surveys to the Verification of Business Cycle Theory and the Theory of Expectations

The forecasting performance of the business cycle test has been its most investigated quality, even though it may not be its most important one[1]. Expectational data gain special importance when they are not linked to "objective" data by means of a simple algorithm.

This unique contribution of survey information shall be investigated by examing four problems: Do business surveys yield information on the correctness of three alternative hypotheses of how expectations are formed? Is it easy to come by these data on account of their particular inherent characteristics? Do expectational and planning variables rather reinforce or dampen cyclical fluctuations? What is the contribution of expectations to the recession of 1974/75?

6.1. Testing Synthetic Expectational Hypotheses

Since there is little information on the expectations of the economic agents, in empirical investigations expectations are often approximated by means of synthetic variables. In general three techniques are used to generate these variables: either it is assumed that expectations are extrapolative (i.e. it is assumed that past experience is continued), or regressive (a return to a "normal" situation is expected) or that they are adaptive (that the subjects learn form past mistakes)[2].

For this investigation we will use (qualitative) production expectations and quantitative investment plans for Austria, as well as Japanese data on expected percentage changes of production and sales in

1) see e.g. NBER "96", STRIGEL "127".

2) Up to now business surveys have hardly been used to decide between these alternatives. One exception is the discussion on the regressivity of expectations ("21", "47", "96"), especially concerning the Shippers' Forecasts, but in this case the primary source of interest was not the attempt to distinguish alternative hypotheses, but rather the unsatisfactory forecasting performance.

Another exception is the investigation of price forecasts along the lines of the "rational-expectations-hypothesis". See CARLSON "26-28" and the literature cited there.

the current and the following quarter.

6.1.1. Alternative Definitions of "Extrapolative Expectations"

When examined more closely it turns out that the assumption that past values are extrapolated into the future is not as simple as it appears[1]. What actually is extrapolated? Levels, changes or the acceleration of a change of a variable? Are expectations extrapolative when past expectations are repeated or when past actual changes are expected again, etc.?

To make things simpler we assume that expectations are extrapolative under one of the following three assumptions:

- the weakest condition is that the expected change of a variable (production, sales, investment expenditures) is significantly related to its last actual change:

(E1) $v_t^+ = \alpha_2 \, v_{t-1}$ weak extrapolative expectations are proven if $\alpha_2 > \Theta$

- a stronger criterion[2] is that the expected level of a variable depends on the realized level of the past period and on the change of the past period. A positive sign for the second coefficient is required.

This implies that if a positive change took place in the last period, another positive change (of whatever size) is expected for the current period.

(E2) $V_t^+ = \alpha_2 \, V_{t-1} + \alpha_3 \, (V_{t-1} - V_{t-2})$ Stronger extrapolativ expectations are proven if $\alpha_3 > \Theta$

1) A more thourough version of this section will be published by the author in one of the forthcoming IFO-studies. There it is shown under which restrictive assumption in a deterministic world the equations E1, E2 and E3 are identical. In empirical testing, however the approach E1 favours the verification of the extrapolative hypothesis, the approach E3 that of regressive expectations. In addition to these inherent biases of the equations used there are differences according to the width of the field defined as extrapolative versus regressive. This decision reflects in different criteria for the critical regression coefficients ($\alpha > 0, \alpha > 1, \alpha = 1$).

2) see BOSSONS & MODIGLIANI "21", CARLSON "26".

- the third, and strongest criterion for extrapolativity (see e.g. TURNOVSKY "139") requires that the expected change in a variable depends on that of the previous period as well as on the change of the growth rate of the previous period: a positive second coefficient is required. Since the second variable describes the acceleration of growth, a positive coefficient means that a further acceleration is required for the current period, if growth has already accelerated in the previous period.

(E3) $v_t^+ = \alpha_2 v_{t-1} + \alpha_3 \underbrace{(v_{t-1} - v_{t-2})}_{(v_{t-1} - v_{t-2}) - (v_{t-2} - v_{t-3})}$ Extreme extrapolative expectations are proven if $\alpha_3 > 0$

6.1.2. Alternative Definitions of "Regressive Expectations"

By the same token, the expectation that a certain normal situation is reached again can mean several things. A high constant term in an equation which relates expectations and realizations could be interpreted to indicate regressivity, but a high constant can also be caused by other factors (e.g. errors in specification or in transformation between quantitative and qualitative variables).

(R1) $v_t^+ = \alpha_1 + \alpha_2 v_{t-1}$ Weak regressive expectations are proven if $\alpha_1 > 0$

Regressivity can be defined as a mirror image of extrapolation. In this way regressivity would prevail if higher growth is expected after the development has slowed down during the previous period. In the same way, a negative change in the growth rate would be expected after a period of acceleration (see TURNOVSKY "139"). In this way the implicit normal situation could be described in terms of a change, and a formal confirmation would require a negative coefficient in equation R2. (E3 = R2)

(R2) $v_t^+ = \alpha_2 v_{t-1} + \alpha_3 (v_{t-1} - v_{t-2})$ Strong regressive expectations are proven if $\alpha_3 < 0$

A stricter test (in analogy to E2) would require that the expected level of a variable depends on its previous value and on the change in this period, the last coefficient being below zero. In this case

each growth would lead one to expect a decrease, thus the implicit normal situation would be a certain level. TURNOVSKY "139" mentions this stricter definition, which mirrors E2[1].

(R3) $V_t^+ = \alpha_2 V_{t-1} + \alpha_3 (V_{t-1} - V_{t-2})$ Extrem regressive expectations are prove if $\alpha_3 < \Theta$

6.1.3. Alternative Definitions of "Adaptive Expectations"

We speak of adaptive expectations when production expectations vary proportionately with the previous forecasting error.

In its original formulation by NERLOVE "99" the change in expectations is a function of the difference between expectation and realization of the previous period:

(A1) $v_t^+ - v_{t-1}^+ = \alpha_2 (v_{t-1} - v_{t-1}^+)$

A less strict test requires that the expected change depends on the previous period's expectation and the actual change in the previous period. This equation A2 would be formally identical to A1 if

$\alpha_2 + \alpha_3 = 1$ and $\alpha_1 = \Theta$.

(A2) $v_t^+ = \alpha_1 + \alpha_2 v_{t-1} + \alpha_3 v_{t-1}^+$

In contrast to the mirroring definitions of extrapolativity and regressivity, the adaptive hypotheses cannot be formulated in relation to another hypothesis, because under the present assumptions forecasting errors play a role, where as the other hypotheses rely only on past values[2].

6.2. Empirical Results

For the majority of cases the hypothesis of extrapolative expectations, resp. plans can be proven in the sense that expectations are significantly related to previous realizations (see Equation 1 on Table 15). But in no case the coefficient of determination is higher than 50%, so that not even the weakest test is passed overwhelmingly. For the longer-term Japanese expectations (and short-term sales expectations) no connection exists with previous information. On the contrary, the constant terms play a larger role, while for Austria

1) The approach used by FERBER "6", "21" to test for regressivity is similar to the one used here. Since he uses actual shipments lagged four quarters, a positive sign is not a sufficient indicator for extrapolative expectations, but a positive coefficient of more than .75 is required.

2) Under certain restrictive conditions the identity of adaptive expectations and the generation of expectations out of past realisations can be demonstrated.

they are insignificant.

TABLE 15: Tests for Alternative Generation-Hypothesis of Survey Variables

The test whether the level of expectations depends on the level of realizations and their change can only be carried out for investment anticipations. It turns out that the coefficient of the change variable is insignificant (see Equation 2 in Table 15) so this test does not point to either extrapolativity (E2) or to the strictest conditions for regressivity (R3). The strongest criterion for extrapolativity is rejected most vehemently, correspondingly there is proof for the milder form of regressivity (see Equation 3 in Table 15). In Austria the acceleration of growth[1] is negatively correlated with production expectations, the same holds for longer-term Japanese sales and production expectations. For sales Expectations even those for the current quarter are regressive in our sense. In the other cases no significant influence of acceleration on the survey variables can be detected.

The hypothesis of adaptivity in its stricter form (requiring proportionality of the change in expectation with the previous forecasting error) can only be proven insofar as the majority of the other variables investigated shows the expected sign; the coefficients are not different from zero, however (see Equation 4 in Table 15)[2]. If expectations are made to depend on past realizations or past expectations (see Equation 5 in Table 15), the statistical problems increase without yielding any improvement in the explanatory power. The exogenous variables are highly inter-correlated, the coefficients of determination are not higher than in simple regressions.

1) The choice of the period for which acceleration is measured has a certain influence on the degree with which the extrapolative hypotheses is rejected and on the significance with which the regressive one is accepted. If acceleration is measured as the difference of growth from one quarter to the next, the irregularity of quarterly changes disturbs the significance of the relationship (because of differences in the data of Easter and other seasonal rest factors, etc.). If changes of growth rates between quarters two periods apart are measured, the level of significance increases. In the table the results shown use annual difference of quarterly changes. Not one of the alternative to the published tested cases shows a significantly positive sign (and thus proof of extrapolativity); in seventeen out of twenty cases (five time series, four different lags each) the sign is negative, in ten cases the coefficient is significant.

2) The lower degree of variation in the expectations as compared to reality plays an important role both for the test for regressivity (in the approach used initially by FERBER) and the approach testing for adaptive expectations. When the results are corrected for the error in the variance, the adaptivity approach in its stricter form fits the data better.

TABLE 15:

Test for Alternative Generation-hypothesis of Survey Variables

Equations	qualitative production expectations (Austria, PRE)	quantitative investment anticipations (Austria, IA1)	quantitative production expectations (Japan) regarding current quarter	quantitative production expectations (Japan) regarding next quarter	quantitative sales expectations (Japan) regarding current quarter	quantitative sales expectations (Japan) regarding next quarter
$v_t^+ = \alpha_1 + \alpha_2 v_{t-1}$	$\alpha_1 \equiv 0$	$\alpha_1 \equiv 0$	$\alpha_1 = 2,35^{++}$ (19)	$\alpha_1 = 2,81^{++}$ (7)	$\alpha_1 = 3,36^{++}$ (11)	$\alpha_1 = 3,04^{++}$ (8)
(1)	$\alpha_2 = 1,73^{++}$ (10)	$\alpha_2 = 0,64^{++}$ (27)	$\alpha_2 = 0,15^{++}$ (44)	$\alpha_2 = 0,02$ (275)	$\alpha_2 = 0,02$ (361)	$\alpha_2 = 0,00$ (1149)
	$R^2 = 0,52$	$R^2 = 0,49$	$R^2 = 0,09$	$R^2 = 0,00$	$R^2 = 0,00$	$R^2 = 0,00$
$v_t^+ = \alpha_1 + \alpha_2 v_{t-1} + \alpha_3 (v_{t-1} - v_{t-2})$		$\alpha_1 \equiv 0$				
(2)		$\alpha_2 = 0,99^{++}$ (3)				
		$\alpha_3 = 0,01$ (999)				
		$R^2 = 0,96$				
$v_t^+ = \alpha_1 + \alpha_2 v_{t-1} + \alpha_3 (v_{t-1} - v_{t-2})$	$\alpha_1 \equiv 0$	$\alpha_1 \equiv 0$	$\alpha_1 = 2,35^{++}$ (13)	$\alpha_1 = 2,48^{++}$ (12)	$\alpha_1 = 2,34^{++}$ (21)	$\alpha_1 = 2,17^{++}$ (14)
(3)	$\alpha_2 = 3,70^{++}$ (24)	$\alpha_2 = 0,59^{++}$ (34)	$\alpha_2 = 0,11$ (78)	$\alpha_2 = 0,08$ (64)	$\alpha_2 = 0,26^{++}$ (48)	$\alpha_2 = 0,21^{++}$ (38)
	$\alpha_3 = -2,17^{++}$ (45)	$\alpha_3 = 0,10$ (219)	$\alpha_3 = 0,01$ (308)	$\alpha_3 = -0,09^{++}$ (36)	$\alpha_3 = -0,23^{++}$ (36)	$\alpha_3 = -0,20^{++}$ (27)
	$R^2 = 0,59$	$R^2 = 0,55$	$R^2 = 0,11$	$R^2 = 0,14$	$R^2 = 0,14$	$R^2 = 0,23$
$v_t^+ - v_{t-1}^+ = \alpha_1 + \alpha_2 (v_{t-1} - v_{t-1}^+)$	$\alpha_1 = 2,43$ (76)	$\alpha_1 \equiv 0$	$\alpha_1 \equiv 0$	$\alpha_1 \equiv 0$	$\alpha_1 \equiv 0$	$\alpha_1 \equiv 0$
(4)	$\alpha_2 = 0,46$ (130)	$\alpha_2 = 0,47$ (78)	$\alpha_2 = -0,10$ (109)	$\alpha_2 = 0,05$ (72)	$\alpha_2 = 0,08$ (131)	$\alpha_2 = 0,06$ (106)
	$R^2 = 0,01$	$R^2 = 0,17$	$R^2 = 0,02$	$R^2 = 0,04$	$R^2 = 0,00$	$R^2 = 0,02$
$v_t^+ = \alpha_1 + \alpha_2 v_{t-1} + \alpha_3 v_{t-1}^+$	$\alpha_1 \equiv 0$	$\alpha_1 \equiv 0$	$\alpha_1 = 1,77^{++}$ (24)	$\alpha_1 = 1,24^{++}$ (30)	$\alpha_1 = 2,63^{++}$ (20)	$\alpha_1 = 2,22^{++}$ (20)
(5)	$\alpha_2 = 0,59^{++}$ (49)	$\alpha_2 = 0,17$ (259)	$\alpha_2 = 0,03$ (297)	$\alpha_2 = 0,01$ (235)	$\alpha_2 = -0,04$ (242)	$\alpha_2 = -0,02$ (297)
	$\alpha_3 = 0,58^{++}$ (24)	$\alpha_3 = 0,52$ (67)	$\alpha_3 = 0,34$ (54)	$\alpha_3 = 0,55^{++}$ (21)	$\alpha_3 = 0,26$ (55)	$\alpha_3 = 0,29^{++}$ (46)
	$R^2 = 0,53$	$R^2 = 0,50$	$R^2 = 0,15$	$R^2 = 0,36$	$R^2 = 0,06$	$R^2 = 0,08$

\+ anticipatory variable

++ significant 95 % level

Test for weak extrapolative expectations ..... α_2 in Equ. (1) positive

Test for stronger extrapolative expectations ..... α_3 in Equ. (2) positive

Test for extreme regressive expectations ..... α_3 in Equ. (2) negative

Test for extreme extrapolative expectations ..... α_3 in Equ. (3) positive

Test for stronger regressive expectations ..... α_3 in Equ. (3) negative

Stronger test for adaptive expectations ..... α_2 in Equ. (4) positive

Weak test for adaptive expectations ..... α_2 und α_3 in Equ. (5) positive

The conclusion of all these tests is that simple hypotheses do not offer good forecasts for expectations resp. anticipations. Extrapolativity exists only in the sense that expectations are somehow connected to realizations which have just become known; any stronger test is rejected by the data. Regressivity in the sense of constantly changing signs of the growth rates cannot be proven with the existing data, but there are indications that expansion is expected to slow down just after accelerations, and vice versa. This can be interpreted to point to high degrees of uncertainty and to a lack of ability to influence the variables: for investment expenditures no sign of regressivity can be found, for production which is closer to the firms realm of influence regressivity is less strong than for sales; it is also stronger for longer-term expectations than for short-term expectations.

6.3. Inherent Characteristics of Expectations (A Box-Jenkins Analysis)

One of the reasons for the relatively low explanatory value of the hypotheses mentioned above (whose aim it was to explain expectations by means of objective data) might be that it is not possible to "transform" quantitative series into qualitative variables by means of linear transformation methods. Another possible method would be to "create" a synthetic variable by using the inherent tendencies within a time series, e.g. by making the production expectations of one period depend on the previous quarter's expectations (first order auto-regressive scheme).

(1) $PRE_t = \underset{131}{1.155} + \underset{12}{0.8050}\ PRE_{t-1}$ $\quad R^2 = 0.61$, $DW = 2.10$

(2) $PRE_t = \underset{9}{0}\ + 0.8516\ PRE_{t-1}$ $\quad R^2 = 0.61$, $DW = 2.24$

There exists a formal mathematical-statistical method for the investigation of complex inherent systematic tendencies within time series, the so-called Box-Jenkins method ('24'). This technique explains time series as a combination of auto-regressive and moving-average processes and carries out trend and seasonal adjustments simultaneously with the process analysis.

The Box-Jenkins-Model in its univariate form is expressed in the following way:

$$(1-B^s)^D\ (1-B)^d\ (1-\phi_1 B-\ldots-\phi_p B^p)(1-\Psi_1 B^s-\ldots\Psi\ B^{Ps})(Z_{t-}\mu) =$$

$$= (1-\theta_1 B-\ldots\ldots\ \theta_q B^q)(1-\xi_1 B^s-\ldots\ \xi_Q B^{Qs})\ \xi_t$$

If seasonal adjustment techniques are onitted (in the production expectation time series analyzed here seasonal variations do play a certain role, but influence the process only slightly) a simpler model results:

$$(1-B)^d\ (1-\phi_1 B\ \ldots\ \phi_p B^p)(Z_t-\mu) = (1-\theta_1 B\ \ldots\ \theta_q B^q)\ \xi_t$$

Here Z_t is the time series to be analyzed (under certain conditions it has to be corrected for its means value μ); the series is seen as a function of the random variable ξ_t (with an expected value of zero and constant variance). B is a shift parameter ($B^1 Z_t = Z_{t-1}$; $B^m Z_t = Z_{t-m}$). The first term on the left-hand side corrects the time series for a trend factor (in this terminology an absolute first order difference would be formulated as $Z_t - Z_{t-1} = (1-B)Z_t$) ϕ denotes the auto-regressive parameter, p their width (e.g. $1 - \phi_1 B$ would be a first order auto-regressive parameter, $1-\phi_1 B-q_4 B^4$ would denote a combination of a first order and a fourth order autoregressive process. θ are moving-average operators, q their width.

The dominant process inherent in the tested series is a first order auto-regressive process. To this process one could add a moving-average process of fifth order or a fifth order auto-regressive process[1)] (their explanatory power is very small). Both added processes cannot avoid the fact that the artificially generated series indicates the turning point of production expectations one quarter too late and cannot explain more than 65 % of the variation in production expectations.

1) The regression coefficients (α_2, α_3) reach the following values (in parentheses the 95 % confidence intervals):

   1st order auto-regressive process: α_2 = .76 (.58, .94)

   2nd order auto-regressive process: α_2 = .79 (.60, .98)

   α_3 =-.23 (-.55, .09)

   Auto-regressive, Moving-average process (ARIMA 1,0,1)

   α_2" = .80 (.62, .98)

   α_3" = .30 (.01, .59)

Thus it seems that, production expectations can neither be artificially generated from data on previous actual production (as had been shown in chapter 6) nor from the inherent tendencies of the time series.

These findings lead to the recognition that there is no way to approximate the information contained in the actually collected data through artifical methods. Another fact points into the same direction: the unexplained part of the variation in the business test series (e.g. in the auto-regressive equations)[1] exhibits a lead of two quarters in comparison with actual production.

6.4. Do Expectations Increase Cyclical Fluctuations?

The psychological theories of the business cycle (PIGOU, JÖHR) assume that business expectations reinforce cyclical fluctuations by being too optimistic during the boom and too pessimistic during the recession.

The Austrian Business Survey offers only qualitative ex-ante, the official statistics provides quantitative ex-post information. A comparison of these two series cannot contribute to the solution of this question, because a possible stronger variation in expectations can be due either to the transformation mechanism chosen or to a real difference between subjective and objective data. The Investment Test shows that quantitative investment anticipations exhibit less fluctuation than actual expenditures; in very bad years investment plans are either increased only slightly or lowered significantly; in good years they are increased by about one third. This behavior results in higher variation of investment and in differences between realized investment expenditures and anticipations. The same holds for actual capacity expansion as compared to anticipations.

TABLE 16: The Underestimation of Change in Ex-ante Data

The survey of the Bank of Japan confirms the existence of lower cyclical variation also for (quantitative) production expectations and

1) This idea that the unexplained part of an equation can be interpreted as actual expectations, I owe to E. STREISSLER.

TABLE 16:

The Underestimation of Change in Ex Ante Data

	Standard Deviation	Range
Change in Industrial Production, Japan		
Expectation regarding next quarter	0,7	2,4
Expectation regarding current quarter	1,1	5,1
Ex post change	2,3	10,4
Change in Industrial Sales, Japan		
Expectation regarding next quarter	0,7	2,5
Expectation regarding current quarter	1,1	4,2
Ex post change	2,0	8,9
Change in Investment, Japan		
Expectation regarding next quarter	2,6	11,1
Expectation regarding current quarter	5,9	24,9
Ex post change	5,5	21,1
Changes in Investment, Austria		
First Anticipation	10,4	33,0
Ex post change	13,3	41,2
Changes in Capacity Increase, Austria		
Expectation regarding current year	1,5	4,9
Ex post change	1,9	6,5
Balance of firms reporting change of production volume, FRG		
Expectation regarding next three month[1)]	13,1	62,0
Ex post report for the last month[1)]	11,3	56,3

1) These time series cannot be compared in respect of their variance because the ex post series has a horizon of one month only. If the balances of the ex post series for the three individual months are summed up (this procedure is now an overestimation of ex post change) the standard deviation amounts to 30,0 and the range to 117,3.

sales expectations. The variation of the first expectations (for the next quarter) is less than one half of that of the realized values. During boom years the actual increases have never been expected, the same holds for recessions. It can be shown that longer-term expectations are underestimated to a higher degree than short-term expectations.

For Germany, the comparison between ex-ante and ex-post questions is more complex. Even though both questions ask for qualitative information, the ex-ante question of production expectations has a time horizon of three months, the ex-post question only one of one month.

Higher variation is a priori to be expected for the ex-ante question. In reality variation for both question is about the same. Thus the above statement about the lower variation of expectations as against realizations is also confirmed for Germany.

CARLSON finds that price expectations show too little variation in relation to realized values[1]. He also finds that variation decreases with increasing forecasting horizon (see also "47","87","132").

CHART 2: The Underestimation of Production Change in Ex-ante Variables

All these findings do not confirm the hypothesis that in general expectations increase cyclical fluctuations. There is rather evidence to the contrary. The reasons for this low variance will be examined in a later study. They do not correspond to the hypothesis of rational expectations, since the variance of expectations also does not correspond to past experience[2].

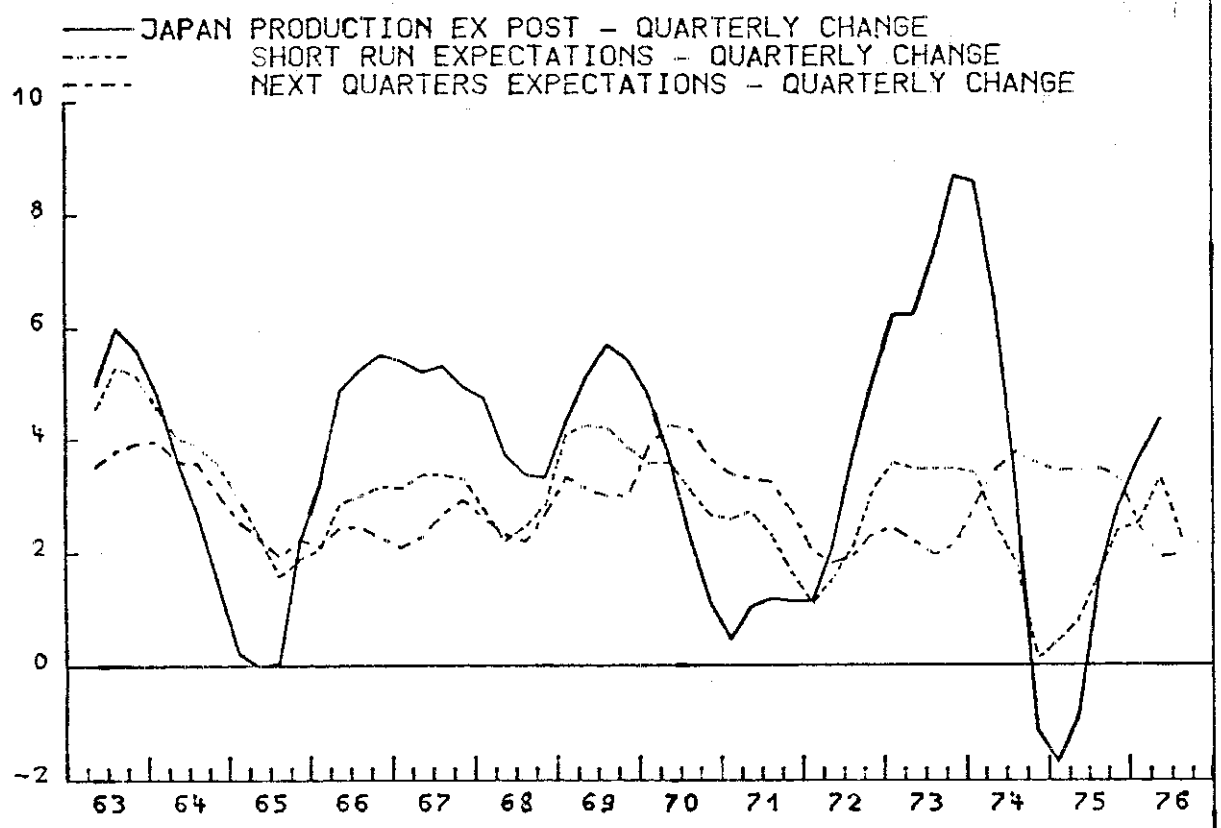
6.5. The Contribution of Expectations to the Interpretation of the Recession of 1974/75

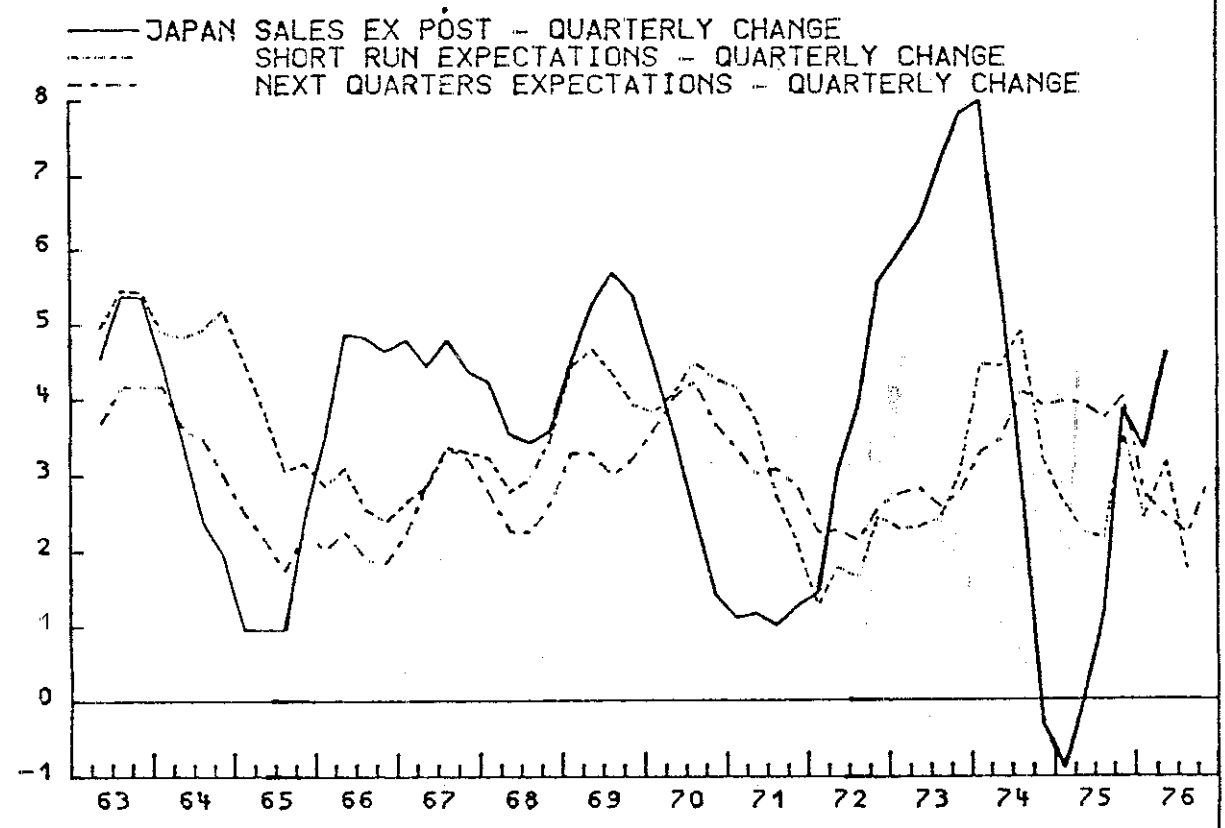
The fact that expectations were found to have no general reinforcing effect on cyclical fluctuation does not imply that the opposite might not hold for individual periods.

1) forecasts collected by Livingstone, see CARLSON "28".

2) In my opinion this low variance does not permit the conclusion that it is uneconomial or irrational to harbor such expectations (see CARLSON "26", THEIL "132"). For the connection with investment expenditures see chapter 5 of this investigation.

CHART2: THE UNDERESTIMATION OF PRODUCTION CHANGE IN EX ANTE VARIABLES





wifo

After the oil crisis of October 1973 all expectations improved in the face of rather hectic purchases of inventory stocks (though they did not improve as much as did actual production). In the survey of April 1974 all indicators improved once more, especially finished goods stocks were evaluated to be too small to an extent which previously had occurred only in boom years. These false expectations, which for production expectations persisted far into the third quarter of 1974, when production was already going down, certainly contributed to the severity of the recession. After this misconception was recognized, expectations fell during one quarter faster than ever before.

In this special case expectations did not cause an especially severe recession because they were too pessimistic from the start, but rather because they interpreted the initial build-up of inventories as an actual increase in demand.

The example of the oil crisis indicates the importance of business surveys for the interpretation of cyclical developments just because expectations turned out to be wrong in that case.

7. Summary of the Results

1. Empirical analyses on the character and the peculiarities of business serveys exhibit very similar results, as long as the same methods and criteria of analysis are used. The time pattern between cyclical indicators and production is similar, most surveys show a slight superiority of investment anticipations as compared to alternative forecasting methods; also similar in most studies are the differences in plan corrections by size and capital intensity of the sectors. All this points to very constant entrepreneurial behavior (as well as reporting methods), which seems to be rather independent of the size and the traditions of individual countries.

2. Differing results reported in the literature arise from different methods being applied. This starts already with the scope of the survey: when mainly large firms are questioned, the systematic underestimation of planned expenditures remains small; when the sample is stratified widely, the underestimation becomes larger; when investment expenditures are surveyed on a quarterly basis, it is important to realize that project delays play a larger part relative to gaps in planned expenditures (which are important when annual investment expanditures are the object of the survey).

When business test data are correlated with growth rates of production, production expectations may exhibit a small lead, but more often they are completely synchronized. Most other indicators show a marked lag. When the level of the business test variables are compared with deviations from a production trend, a lead becomes visible.

3. Among these possible transformation-relations between qualitative business test time series and production (from official statistics) in this study we use for the evaluation series the relation between the annual growth rate of production and the annual (absolute) change of the business test variable; for production expectations we use the annual rate of growth of production and the non-transformed balance series (which already in itself measures expectations of a change). These relations make theoretical sense, and are confirmed by the closeness of correlation.

4. The Austrian Business Survey results show that Austrian entrepreneurs exhibit a high level of aspiration: In the long-run average they are dissatisfied with their order books (especially from abroad) and evaluate the magnitude of their stocks of manufactured goods as too high. On the average production is expected to rise, but less than selling prices (even though in reality prices have risen less). Expectational magnitudes are more sensitive to fluctuations than judgmental variables.

5. The business test data exhibit those qualities which are required for cyclical indicators: few random fluctuations, quick availability, no ex-post corrections. Their relationship with the variables for whose forecast they are used, is quite stable. Their time pattern coincides quite closely with production, there may even be a slight lead. In any case they offer to the analyst an information lead, since they are available earlier than objective data. When individual time series are combined to a composite indicator, some of the remaining irregularities can be further reduced. Vertical averaging avoids losses of time periods. It can safely be stated that business test variables at least form a valuable supplement to objective data.

6. Investment anticipations (plans) tend to underestimate actual investment expenditures. This tendency increases with the number of small firms in the survey, with the time period for which expenditure data are collected, and the further in the future this period lies. The tendency to underestimate varies with the cyclical situation.

It is possible to vary the degree of statistical sophistication when making forecasts with investment plans in the same way as when investment functions are used. When simple forecasts are made by means of investment plans (without additional cyclical variables) they are slightly superior to those of similarly simple investment functions; when investment plans and objective variables are used as determinants of investment, explanatory power and statistical significance of the coefficient of the investment plans is higher than that of other variables. It is of additional advantage that investment plans are known for the forecasting period, while all non-lagged objective determinants have to be estimated.

7. The present attempts to incorporate business survey data into econometric models look very promising. Problems of the model structure should in my opinion be solved by choosing equations which can be interpreted in a structural sense, or by correcting the constant term, rather than by making survey data endogenous. The advantages of business surveys as far as model interdependency is concerned can be shown by using an Austrian model as an example.

8. Experience with investment surveys and investment functions leads one into the direction of a dual theory of investment:

the group of capital-intensive large firms in the medium term invests depending on its expected demand for additional capacity (accelerator), small medium-term changes in the development of demand lead to large changes in the investment programs. For the short run the more immediate danger arises that investment plans lag during recovery phases and that planned capacity expansion cannot be realized. Investment plans do not vary much in the short term, also variations in employment of labor do not result in significant cost savings and do not expand production possibilities. Thus it becomes necessary to vary prices, and capacity utilization fluctuates very strongly.

The investment behavior of small scale, labor-intensive sector is very different. Firms invest, expand their capacities and vary employment depending on short-term requirements and possibilities.

9. Business survey results show that many of the usual hypotheses on how expectations are formed and on their effects on the cycle do not correspond to reality.

At most entrepreneurial expectations are extrapolative in the sense that it is more likely for consecutive survey reports to be answered in the same way than differently. No proof can be found for the stricter criterion that a past change can be expected again, or even than an earlier acceleration is extrapolated into the future. Rather one can find proofs that in such cases a slowing-down or a trend reversal will be expected (regressive expectations). In general, expectations can hardly be explained by simple behavioral assumptions. It was also not possible to detect any inherent strong systematic tendencies within the expectation series, which would facilitate extra-

polation into the future. It is rather the unexplained residuals (the real expectations?) which exhibit a prognostic lead of about one half year.

This result indicates that expectations should be measured empirically by means of surveys rather than estimated by "synthetic" variables.

Expectations and anticipations both are rather on the cautious side, their variance is below that of ex-post (objective) variables. This contradicts the hypothesis of "rational" expectations, on the other hand it seems very plausible to call this type of behavior in uncertain situations rational.

10. Expectations have a rather dampening influence on the business cycle, at least in the sense that they do not reinforce the boom through short-term over-optimism and deepen the recession through short-term pessimism. It seems more probable that expectations that do not come true reinforce changes in the cyclical situation: in general, expectations are less "flexible" than reality. They are rather cautious during boom times and do not turn pessimistic away when the last phase of the cycle approaches. In a similar fashion expectations signal the lower turning point simultaneously with reality (or they exhibit even a slight lead), but this happens to a much lesser degree than the generally very abrupt improvement in production. Regarding the last recession (1974/75) expectations improved after the oils crisis; this misjudgment later on probabily had a reinforcing effect on recession, but not in the sense that entrepreneurs has expected recession to set in all the time and thus had created it through their own behavior.

11. A very promising field of study seems to be the investigation of the influence of entrepreneurial behavior on the cyclical process. Macro-analytical methods will probably be limited for this purpose, but micro-economic analysis can easily be performed with the help of the Business Survey. It should be investigated whether the assumption of cautious entrepreneurial expectations could not contributs much more to avoid the explosion of multiplier-accelerator model than the imposition of synthetic " floors " and "ceilings". Another still very promising field of investigation is the study of investment

plan revision under the aspect of different size and branche structures. For some countries data exist covering periods of about thirty years. These should make it possible to show the strong cyclical and the weaker, but undeniably existing-counter-cyclical component of plan revisions. It would furthermore be interesting to investigate the tensions that are created within the manufacturing sector through the differing investment behavior of labor-intensive small and medium-size firms on the one hand, and capital-intensive large firms on the other hand.

Appendix 1: How to make empirical use of the economic content of the accelerator principle[1)]

In the present investigation two forms of the flexible accelerator were found to yield good results for those investment functions which make use of objective variables. One of the basic reasons why the flexible accelerator proves so superior in the explanation of Austrian (and also German) data is its ability to explain the medium term fluctuations in manufacturing investment (investment boom 1955 to 1962, stagnation until 1968, followed by several years of very high investment expenditures).

The specific approaches used here rely on the "capital stock adjustment principle" and the "deficit principle". In what follows we will show that other approaches either cannot be tested correctly (naive accelerator) or contradict the basic economic concept of the accelerator principle (flow approach).

1. Naive Accelerator

The basic assumption of the naive accelerator is the constancy of the capital-output ratio. From this follows that investment depends on the change in demand.[2)] This leads to the basic economic observation that investment fluctuates much more than demand (because the change in demand fluctuates more than the level of demand). This "transmission" function from small changes in demand to large changes in investment holds for short-term as well as for medium-term fluctuations.

The empirical verification of the naive accelerator principle on the original (first) level, namely regression of the capital stock on production, poses statistical problems because of the strong common time trend of both series. When investment demand is estimated in this way, it does not reflect the development of actual investment very closely. For this reason the accelerator principle is frequently applied by making investment (to be exact, net investment) depend on the change of production (second level). This transformation is justified only when the original function is deterministic.

1) see AIGINGER "5".

2) We do disregard replacement demand in this appendix.

If one assumes for instances that both capital stock and production depend on time and a sinus term also that capital stock lags about one or two years behind production, one can show that the second level of estimation actually estimates an ellipsis and not a straight line. There is an exact mathematical proof for this statement[1], the figure shows moreover that this assumption corresponds to reality.

From this a threefold consequence results for regression estimates: firstly, the estimated regression coefficient does not correspond to expectations, neither in Austria nor in foreign investigations (it should correspond to the capital-output ratio); secondly, the estimated regression line fits the empirical data only poorly; thirdly, the fluctuations of the estimated investment expenditures are weaker than those of production, instead of stronger. This last observation contradicts the economic concept of the accelerator as well as reality.

CHART 3: Testing the Naive Acceleraton Principle on Two Levels

1) If one assumes that production is a function of time and a sinus term (1), and the same holds for capital stock (2) only with a shift of the sinus term by $\frac{\pi}{2}$ (given the empirical duration of a business cycle of four to five years, this corresponds to a lag of capital stock of a little over one year), then capital stock is an exponential function of production (3), which is superimposed by a fluctuation whose amplitude is constant to a percentage of the value coordinate. If the growth in production and the growth in the capital stock form the level of analysis, an ellipsis results, whose mid-point is determined by g_1 and g_2 and whose half-axes are $a_1 c$ and $a_2 c$ (8).

(1) $P_t = A_1 e^{g_1 t} + a_1 \sin c\, t$

(2) $K_t = A_2 e^{g_2 t} + a_2 \cos c\, t$

(3) $K_t = P_t^{\frac{g_2}{g_1}} \cdot e^{\alpha \cdot \sin[cf(P_t)+\beta]}$

P_1 = Production
K_1 = Capital Stock
$A_1, A_2, A_1', A_2', g_1, g_2, a_1, a_2, c, \alpha, \beta$ = Konstante

$p_t = \frac{d P_t}{dt} \cdot \frac{1}{P_t}$ $\quad k_t = \frac{d K_t}{dt} \cdot \frac{1}{K_t}$

(4) $\ln P_t = A_1' + g_1 t + a_1 \sin c\, t$

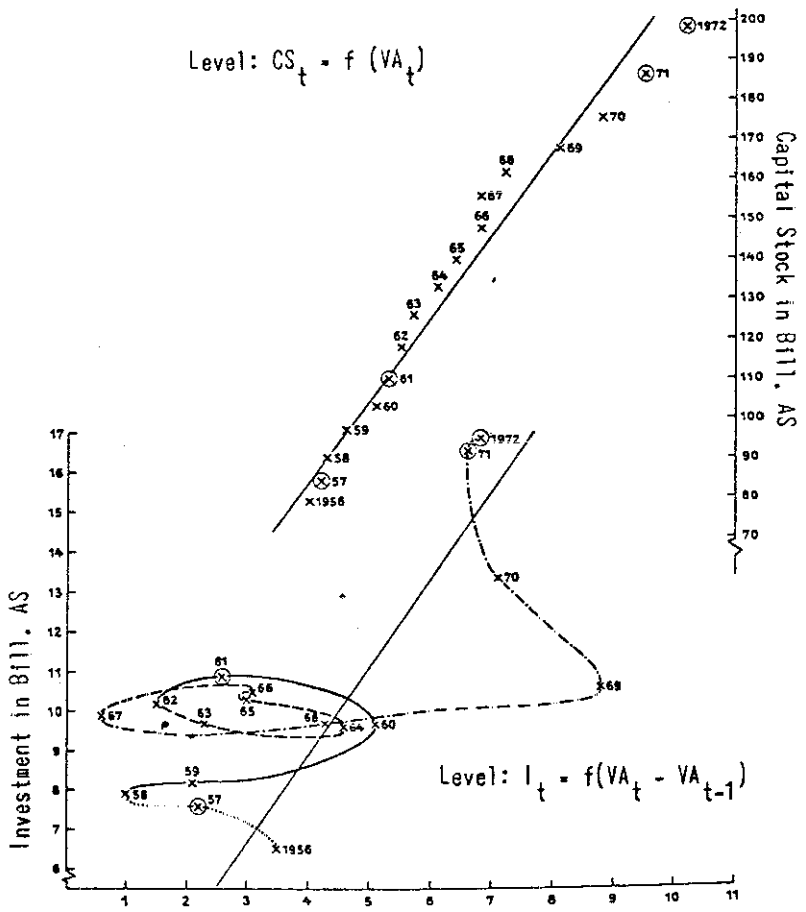
(5) $\ln K_t = A_2' + g_2 t + a_2 \cos c\, t$

(6) $\frac{d(\ln P_t)}{dt} = \frac{d P_t}{dt} \cdot \frac{1}{P_t} = g_1 + a_1 c \cos c\, t$

(7) $\frac{d(\ln K_t)}{dt} = \frac{d K_t}{dt} : \frac{1}{K_t} = g_2 - a_2 c \sin c\, t$

(8) $\frac{(p_t - g_1)^2}{a_1^2 c^2} + \frac{(k_t - g_2)^2}{a_2^2 c^2} = 1$

CHART 3: Testing the Naive Acceleration Principle on Two 'Levels'



CS = Capital Stock
VA = Value Added
I = Investment

Note: The ellipsis derived under special theoretical assumptions can be observed using the actual data.

2. The Flexible Accelerator

A large number of investigations has been untertaken which deal with this type. Common to all of them is that the levels of specific variables (production, profits, capital stock, etc.) are used to explain in fluctuations in investment expenditures[1].

In my opinion functions which use only production or profits, but not capital stock, for determining investment do not deserve to be grouped under the heading "accelerator functions". Such "flow models" offer no a priori reason why investment should fluctuate stronger than production. In this way they rather form a counter-position to the accelerator models. It can be shown empirically that such approaches underestimate investment exactly in those periods when capital-stock considerations would lead to contradictory results.

TABLE 17: Comparison of Two Types of the Flexible Acceleration Principle

The most frequently used type of flexible accelerator makes investment depend on the level of production and the lagged capital stock. This approach is more flexible than the naive accelerator in so far as it takes account of actual capacity utilization and also takes into consideration that it is not possible (nor desirable) to close the full capacity gap in every year. Estimation problems arise, since in some estimates the capital stock coefficient degenerates to a trend term[2]. In these cases this approach becomes similar to making investment depend on the trend deviation of production. This degeneration is more likely to occur, the less the growth of the capital stock fluctuates, the higher then multicolinearity of the explanatory variables and the less complete is the explanation of investment. When German and Austrian data are used for the estimate, the coefficient of capital stock is slightly "too low"[3]. This has the effect that medium-term fluctuations can be explained much better

1) for a survey of the literature see "5".

2) see KLEIN "73".

3) It would be "correct" if the regression coefficient of capital stock would correspond to the ratio of value added to capital stock to capital coefficient as indicated by the capital coefficient. This ratio in reality for Austria is 1 : 2, in the estimated equation 1 : 3.

TABLE 17:

Comparison of Two Types of the Flexible Acceleration Principle

	Capital Stock Adjustment	Deficit Principle
Austria	$I_t = \underset{77}{0.817} + \underset{11}{0.4848}VA^{++}_{t-1} - \underset{16}{0.1636}CS^{++}_{t-2}$	$I = \underset{10}{3.737} + \underset{9}{0.2348}\,(\beta VA_{t-1} - CS_{t-2})^{++} + \underset{6}{0.477}time^{++}$
R^2	0,95	0,97
DW	0,92	1,21
Mean absolute error	471	388

Turning Points	Estimated	Actual	Estimated
1956	7,2	6,5	6,8
1962	10,0	10,2	10,2
1968	9,9	9,7	9,8
1971	16,3	16,7	16,4

Fed.Republic of Germany

	$I_t = \underset{1.123}{-0.173} + \underset{21}{0.2117}VA^{++}_{t} - \underset{35}{0.0845}CS^{++}_{t-1}$	$I = \underset{17}{6.272} + \underset{17}{0.1636}(\beta.VA_t - CS_{t-1})^{++} + \underset{8}{1.213}time$
R^2	0,91	0,94
DW	1,28	1,59
Mean absolute error	1.112	902

Turning Points	Estimated	Actual	Estimated
1957	13,9	12,3	13,1
1962	17,4	19,1	17,8
1968	19,9	17,5	20,0
1971	25,3	25,3	25,1

VA = Value Added
CS = Capital Stock
ß = Capital Output Ratio

than in the flow models, but still their explanation remains incomplete.

For this reason the coefficient of capital stock and production were constrained to assume their "correct" relation (=capital output ratio), by calculating the deficit in capital stock[1] and entering this deficit term into the equation together with a trend variable. The results of these estimates for both countries are superior to the capital-stock adjustment approach, as far as the coefficients of determination, the economic interpretaion of the coefficients, the Durbin-Watson statistics and the reflection of medium-term investment fluctuations are concerned.

Appendix 2: Business Survey Data in the Macro-Economic Forecasting Model of the Austrian Institute for Economic Research

The macro-economic forecasting model of the Austrian Institute for Economic Research comprises 25 behavioral equations and 55 definitional equations. This quarterly model which was built by SCHEBECK and THURY does not make use of investment anticipations, because they contain only annual information. The qualitative data of the business test, on the other hand, are used as exogenous variables in five questions.

- The equation explaining cash circulation makes use of production expectations (with negative sign as a proxy for the counter-cyclical behavior of cash) together with property income, labor income, the rate of return of newly issued stock, the consumption of consumer durables, the currency reserves of the national bank and the number of nights spent in Austria by foreign tourists.
- The explanation of demand deposits uses the evaluation of order stocks (positive sign), profits, labor income, rate of return of newly issued stock and the GNP deflator.

1) The deficit was calculated by multiplying production by the capital output ratio and subtracting the actual capital stock.

- Savings deposits are explained by means of disposable property income, labor income, durable consumption and the evaluation of order stocks (as negative proxy for the cycle).
- The deflator of private investment is estimated by an index of collectively bargained wages, world prices, an exchange rate index, as well as the evaluation of inventories and production expectations (positive sign).
- Inventory change is explained by means of total sales, the rate of return of newly issued bonds, inventory change of the previous period and the evaluation of inventories and of order stocks.

The incorporation of these business survey variables increased the coefficient of determination for the equations involved. The decisive criterion for the inclusion of these variables was that they had to be able to be interpreted at least as proxy variable for economic behavior.

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List of Variables

A	absolute difference (see page 4)
AEO	assessment of export orders
AFC	assessment of free capacity
AFS	assessment of finished stocks
AM	arithmetic mean
AOS	assessment of order stocks
B	lag operator
BORR	borrowings
CAP	capacity utilisation
CF	cash flow
CI	composite indicator
CS	capital stock
EMPL	employment
I	actual investment
i	lag periods (if used as subscript)
IA	investment anticipations
IA1, IA2	first anticipation, second anticipation
K	Kalman filter
M	money supply
P	profit
PI	production index
PRE	production expectations
PRIG	price index for investment goods
R	relative difference (see page 4)
REV	revisions (see page 41b)
S	sales
SD	standard deviation
SPE	selling price expectations
TD	deviation from an exponential trend
t	time index
V	variable (actual)
V^+	anticipatory variable
VA	value added
W	error term
Y	gross national product
z	interest rate
Z	time series
α, β	regression coefficients

Variables applied only for one special purpose (page 66, 78) are explained on the page they are used.

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