AN EVALUATION OF THE PREDICTIVE VALUE OF THE INVESTMENT SURVEY OF THE BANK OF FINLAND INSTITUTE FOR ECONOMIC RESEARCH

by Heikki Koskenkylä

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Contents

1. The Statistical Background of the Investment Survey

The benefit the decision-makers derive from an investment survey depends on the length of time is required before the results become available. For those who carry out the survey it is important that the costs incurred are not disproportionate in regard to its use. Both of these factors are in favour of a sample survey. The investment survey carried out by the Bank of Finland Institute for Economic Research (SPINK) has since its commencement been based on a sample consisting of approximately 600 enterprises. The following deals with the survey only as far as it concerns manufacturing.[1] The population of the survey comprises all manufacturing enterprises having more than 20 employees and those established during the year the survey is made and planning to have more than 20 employees. The sample is derived from the register of firms used for the industrial statistics of the Central Statistical Office, which forms a part of the Finnish Official Statistics, by applying systematic stratified sampling. The wood and paper industry, the metal industry and other manufacturing each form a sub-population from which a sample is collected by using the above-mentioned method. Large enterprises have all been covered by the sample, while from medium-sized every second and from small ones every fifth firm has been included. The sampling ratio is thus 1/1 for large enterprises and the actual sample comprises only medium-sized and small enterprises. During its existence the sample

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1. The investment in mining and electricity, water etc. works are estimated in a slightly different way. In mining the survey includes all enterprises and the latter are divided into two strata.

has been revised three times; the same sample has been used for four successive surveys. The problems arising from an amalgamation of a firm with another not included in the survey have been dealt with separately in each case. As the approach used in the SPINK is orientated towards individual enterprises it may be difficult in some cases to decide which sub-population they belong to. Usually the firms have been placed in the sector that takes the greatest share in their activity. Large enterprises representing various sectors have, however, also been asked to indicate their investment by sector.

Table XX provides an example of how a sample can be distributed among the various sectors and by the size of enterprise. The sample has been collected in autumn 1968 and is being used at present.

Table XX Distribution of the sample collected in autumn 1968 by sector and size of enterprise

Number of employees	Wood and paper industry	Metal industry	Other manufacturing
500 -	25	21	36
100 - 499	19	36	103
21 - 99	41	91	172

Returning the questionnaire is voluntary for the enterprises and the results of the surveys are not published in the official statistics. So far the firms' attitude towards the survey has been very favourable. The responding percentage weighted by the number of employees for instance has clearly exceeded 90 per cent every time. Only small enterprises have failed to answer whereas the response has usually been almost 100 per cent in the other two strata. The firms' favourable attitude is also

evidenced by the fact that the returned questionnaires have, as a rule, been filled out carefully paying attention to every question.

The time-table for SPINK has been prepared to enable maximum possible utilization of its results by the Bank of Finland Institute for Economic Research in forecasting cyclical development. Respondents have usually been asked to return the questionnaire for the spring survey by the end of May. The corresponding time limit for the autumn survey has usually been the beginning of November. The questionnaires are sent about 2 - 3 weeks before the termination of the period. If the questionnaire is not returned within a week after the date specified a new request for a reply is sent. If there is still no result one more written request is made asking the firm to return the questionnaire. Only after this is the firm excluded from the survey at that time.

Estimating is made by ratio estimation method. Auxiliary variable used in the ratio estimator has been the number of employees. The estimate of the total value of investment (Y_{Rs}) for a sub-population s (s=1,2,3,) is then as follows:

$$Y_{Rs} = \sum_{h} \frac{y_h}{x_h} X_h \quad , \; h=1,2,3$$

x_h = number of employees in stratum h of the sample

X_h = - " - h of the population

y_h = the value of investment in stratum h of the sample

2. Results from the Surveys 1963 - 1968

The first actual investment survey was carried out in autumn 1962. The first two surveys were, however, experimental and the results from them have been received with great reservation. In the following only surveys made between autumn 1963 and spring 1969 are dealt with. The confinement of the study within this period gives, in addition, the benefit that the method of survey remained unchanged throughout the period.

This period covers one cycle; the lowest investment figures appeared in 1963 and 1968 and the peak was reached in 1966.

2.1. Reliability of Level Estimates

Table 1 displays a comparison of forecast total value of fixed investment in manufacturing with actual figures obtained on the basis of the investment survey. These forecasts are estimates obtained from the answers of the enterprises after revisions due to the method used in the survey. It has to be noted that the sample was revised three times during the study period, which means that forecasts for the same year may have been based partly on answers from different enterprises. However, this fact will not have been of great significance because the investments of the so-called large enterprises have continuously accounted for about 70 - 75 per cent of the total value of investment in manufacturing while the share of medium-sized enterprises has varied between 15 and 20 per cent and that of small ones between 5 - 10 per cent. A separate study has shown that the standard deviation of the estimate of the

first forecast of the total value of investment has been at the maximum 5 per cent of the value of the estimate. Moreover, the standard deviations of the estimates of actual values have been considerably smaller than this. The forecast and actual values of investment are expressed in this paper as follows:

e_1 = the first forecast obtained in autumn of year t-1 for the value of investment in year t

e_2 = the second forecast obtained in spring of year t for the value of investment in year t

e_3 = the third forecast obtained in autumn of year t for the value of investment in year t

t_1 = the first estimate obtained in spring of year t+1 for the value of actual investment in year t

t_2 = the second estimate obtained in autumn of year t+1 for the value of actual investment in year t

t = 1964, 1965, 1966, 1967 and 1968

Table 1. Forecast and actual values of fixed investment in manufacturing per year in 1964 - 1968

1.1. Machinery and equipment

"t_1" = 100

	1964	1965	1966	1967	1968
e_1	85	79	78	86	..
e_2	99	87	91	87	89
e_3	98	99	92	..	99
t_1	100	100	100	100	100
t_2	100	103	..	95	...

1.2. Construction

	1964	1965	1966	1967	1968
e_1	97	81	93	95	..
e_2	101	87	103	89	83
e_3	100	95	97	..	84
t_1	100	100	100	100	100
t_2	100	98	..	100	...

1.3. Total investment

	1964	1965	1966	1967	1968
e_1	90	79	83	89	..
e_2	99	86	95	88	96
e_3	99	96	94	..	95
t_1	100	100	100	100	100
t_2	100	101	..	96	...

.. Only provisional survey was made during devaluation period.

... The figures will not be available until December 1969.

The table reveals that the firms have systematically underestimated their investments when answering the questionnaires. The first forecast e_1 has throughout been the least reliable while e_2 and e_3 have been almost equally good in 1964 and 1966. The reliability of the estimates given by the firms thus seems to decline sharply as the time distance for the forecast increases. This indicates that planning of investment is rather short-spanned.

Firms have been able to forecast the value of their investment in construction better than that of investment in machinery and equipment. This is evidenced especially clearly in the first forecast made with a time distance of three quarters on average where the difference is considerably greater than in the other two forecasts.

The value of actual investment is estimated twice a year. The estimates obtained in spring and autumn on the value of actual investment have usually been almost the same. The estimate obtained in spring 1968 of the value of actual investment in the previous year was, however, substantially greater than the final result. This might be due to the fact that the firms were inclined to overestimate the price-increasing effect of the devaluation in autumn 1967.

2.2. Forecasting Changes in Investment

Table 1 illustrates the reliability of the level estimates obtained on the basis of the answers of the firms. In the following a separate study is made of the firms' ability to forecast relative changes in the value of their investment per year from

a varying time distance. In Table 2 each forecast estimate is compared with an estimate of the value of the previous year's actual investment as obtained on the basis of the same survey. The actual relative changes in the value of investment per year are also included in the table.

Table 2. Forecast and actual relative changes of fixed investment in manufacturing per year in 1964 - 1968
The estimate of the value of the previous year's investment obtained on the basis of the same survey = 100

2.1. Machinery and equipment

	1964	1965	1966	1967	1968
e_1	108	94	94	79	..
e_2	122	101	109	73	115
e_3	123	115	106	..	118
actual	125	120	116[1]	82[2]	120[1]

2.2. Construction

	1964	1965	1966	1967	1968
e_1	140	102	86	99	..
e_2	137	110	90	90	107
e_3	136	119	86	..	102
actual	135	124	89[1]	96[2]	106[1]

2.3. Total investment

	1964	1965	1966	1967	1968
e_1	119	97	91	85	..
e_2	127	104	102	79	112
e_3	127	117	99	..	112
actual	129	122	106[1]	87[2]	116[1]

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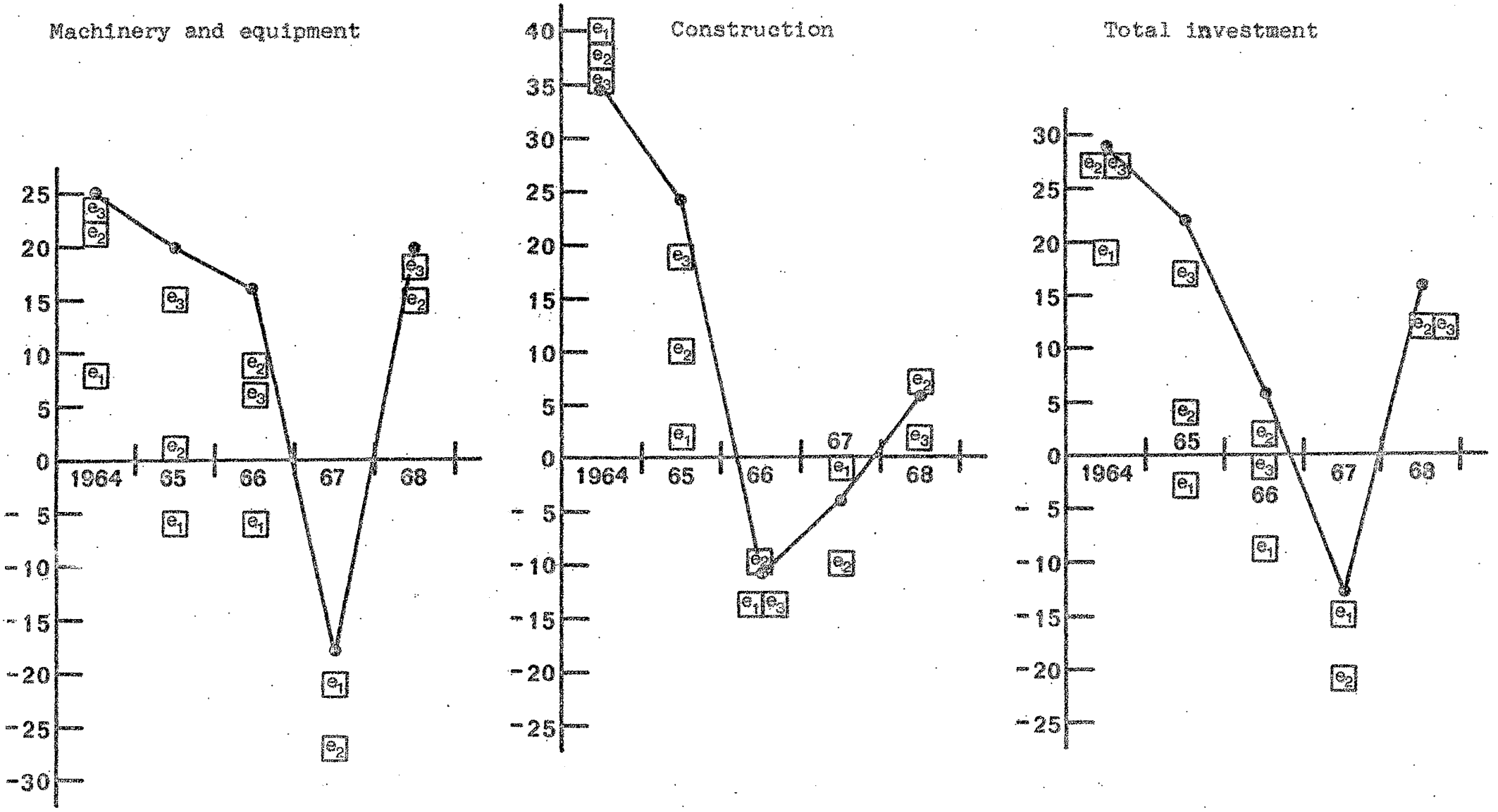
1. According to spring survey.
2. The result of the spring survey of the previous year = 100.

Forecast annual relative changes in the value of fixed investment in manufacturing as compared with actual values, change from previous years, %



e actual

Also when forecasting a change of their investment the firms tend to be too cautious. This is especially true for investment in machinery and equipment. In the first 1965 and 1966 surveys the forecasts on investment in machinery and equipment were strongly underestimated. In 1964 the forecast was also rather weak its error being 17 percentage units. In 1967, on the other hand, when the value of investment was in fact considerably smaller than in the previous year, the answers in the first survey for this year were fairly accurate.

The change in investment can be better forecast as far as investment in construction is concerned. The firms gave the correct sign for the relative change in their construction investment in the first forecast for each year. In 1966 and 1967 in particular the first forecast was highly reliable the error being no more than 3 percentage units in both these years. Thus the same conclusion can be made regarding construction investment as investment in machinery and equipment; the answers are fairly accurate in the first survey when the value of investment is actually declining (see also Chart 1).

2.3. Effects of Price Changes on Forecast Reliability

In the last ten years the price level of fixed investment in manufacturing has been relatively stable, increasing on average by 3 per cent per year. A comparison of changes in prices with the errors made in forecasts indicates clearly that possible errors made in forecasting the price component do not by far suffice to explain the differences between the forecast and actual value of investment.

Table 3. Forecast and actual value of fixed investment in manufacturing 1964 - 1968, by the size of firms

3.1. Large enterprises

"t_1" = 100

	1964	1965	1966	1967	1968
e_1	85	77	81	87	..
e_2	99	80	94	90	100
e_3	99	98	94	..	90
t_1	100	100	100	100	100
t_2	101	101	..	87	..

3.2. Medium-sized and small firms

	1964	1965	1966	1967	1968
e_1	108	85	87	89	..
e_2	102	102	96	76	83
e_3	99	89	94	..	95
t_1	100	100	100	100	100
t_2	104	97	..	93	..

Table 4. Forecast and actual relative changes in the value of fixed investment in manufacturing per year in 1964-1968, by the size of firms
The estimate of the value of the previous year's investment obtained on the basis of the same survey = 100

4.1. Large enterprises

	1964	1965	1966	1967	1968
e_1	113	94	86	77	..
e_2	128	98	98	79	120
e_3	129	119	97	..	121
actual	130	121	104	82	120

4.2. Medium-sized and small enterprises

	1964	1965	1966	1967	1968
e_1	138	106	109	94	..
e_2	125	121	112	76	93
e_3	123	110	105	..	89
actual	124	123	112	100	100

2.4. Dependence of Forecast Reliability on Sector and Size of Firm

The results obtained reveal that the reliability of forecasts does not significantly depend on the sector the firm represents. Tables 3 and 4 show, however, that the reliability of forecasts differs to some extent depending on the size of the firm. According to Table 3 medium-sized and small enterprises have often had a better forecast e_2 than e_3 and in 1967 their e_1 was better than e_2, whereas the forecasts of large enterprises listed in the order of their reliability is clearly e_3, e_2, e_1. Table 4 shows that medium-sized and small enterprises have forecasted the change of investment better than large enterprises.

3. The Reliability of Forecasts according to a Cross-Section Analysis

The influence of the size of firms on the relative reliability of forecasts has been reviewed above on the basis of the reliability of aggregative forecasts of the firms distributed according to their size. However, the significance of this factor may be illustrated much better by making a cross-section analysis of the accuracy of the forecasts of individual firms. Table 5 compares the first aggregative investment forecasts of the firms in 1967 with the corresponding actual investment figures. Because the sample was revised in autumn 1968 the comparison is made on the basis of answers given for the spring survey. It can be seen that the share of those investments the forecasts of which deviated by more than 90 per cent from the actual values

was 17 per cent for large enterprises but as much as 50 per cent for medium-sized and small firms. Despite the fact that the firms underestimate their investment on average there is also a great number of both large and small enterprises whose forecasts are too optimistic. Thus it seems that the individual firms' errors may to a considerable extent eliminate each other. In addition, the medium-sized and small enterprises often expect in the autumn of one year that investment in the following year will be nil even though some replacement investment is invariably undertaken. It is possible that this phenomenon is even more common than is indicated by the cross-section analysis, for a considerable part of the enterprises having answered only after the second request have had a forecast of nil for the next year and this might indicate that some of the firms that failed to answer the autumn 1967 survey had by that time made no plans for investments in 1968.

Table 5. Distribution of large, medium-sized and small enterprises according to the reliability of the first survey for 1967
Forecasts have been compared with the estimates of actual investment obtained in spring 1968

	Large enterprises, per cent	Medium-sized and small enterprises, per cent
The forecast is 90-100 per cent smaller than actual value	1	23
The forecast is 60-89 per cent smaller than actual value	14	6
The forecast is 30-59 per cent smaller than actual value	18	12
The forecast is 0-29 per cent smaller than actual value	26	15
The forecast is 0-29 per cent greater than actual value	15	8
The forecast is 30-59 per cent greater than actual value	6	7
The forecast is 60-89 per cent greater than actual value	3	2
The forecast is more than 90 per cent greater than actual value	16	26
	100	100

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Banking Function in the United

21. TIMO HELELÄ Työnseisaukset ja teollis
1919 - 1939. 1969. 341 s.

22. SIRKKA HÄMÄLÄINEN Kotitalouksien säästämiseen vaikuttavista psykologisista tekijöistä ja niiden mittaamismahdollisuuksista. 1969. 177 s.

23. HEIKKI KOSKENKYLÄ An Evaluation of the Predictive Value of the Investment Survey of the Bank of Finland Institute for Economic Research. 1969. 12 s.