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A Quality Evaluation

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Abstract

In order to bridge temporary delays in the dissemination of official foreign trade statistics compiled by the National Board of Customs after the Finland's entry into the EU in 1995, the Bank of Finland decided to introduce a special survey on Finnish foreign trade in merchandise. It was felt necessary that balance of payments statistics should continue to be available without a break. This paper describes the survey employed and the feasibility of the results.

It seems evident that Finnish exports and imports can be satisfactorily estimated using a cut-off survey of very modest sample size. The Bank of Finland foreign trade survey provided a timely and accurate description of the underlying developments in the external stability. Because the National Board of Customs now has a functional statistical system for foreign trade, the Bank of Finland trade survey was discontinued in December 1996.

Keywords: business surveys, foreign trade, balance of payments statistics

Tiivistelmä

EU-jäsenyyden myötä Suomen tulliselvitysmenettely muuttui, mikä hidasti tilapäisesti Tullihallituksen ulkomaankauppatilastojen julkaisua. Tämän vuoksi Suomen Pankissa päätettiin, että maksutasetilastoinnin edellyttämät ulkomaankaupan ennakkoluvut tavarakaupan osalta laaditaan väliaikaisesti Suomen Pankin erityiskyselyn pohjalta. Tämä kysely käynnistettiin tammikuussa 1995 ja lakkautettiin joulukuussa 1996. Tässä keskustelualoitteessa kuvataan käytettyä kyselymenetelmää sekä arvioidaan kyselyn tuottamia tuloksia.

Asiasanat: yrityskyselyt, ulkomaankauppa, maksutasetilastointi

Contents

1   Introduction

The compilation of Finnish balance of payments statistics has traditionally been regarded as a responsibility of the Bank of Finland, the Finnish central bank. The balance of payments statistics are compiled by the Bank's Information Services Department and require the input of about 30 persons.

Data for balance of payments statistics are collected from a number of sources and are worked up to suit the balance of payments framework. Data sources can be classified into two categories: (i) basic data collected by the Bank of Finland and (ii) data collected by other institutions, primarily government authorities responsible for collecting statistics.

Finland's cross-border business transactions in merchandise, ie the trade account, are included in the Finnish balance of payments statistics. The main source for the trade account is the foreign trade statistics compiled by the National Board of Customs.
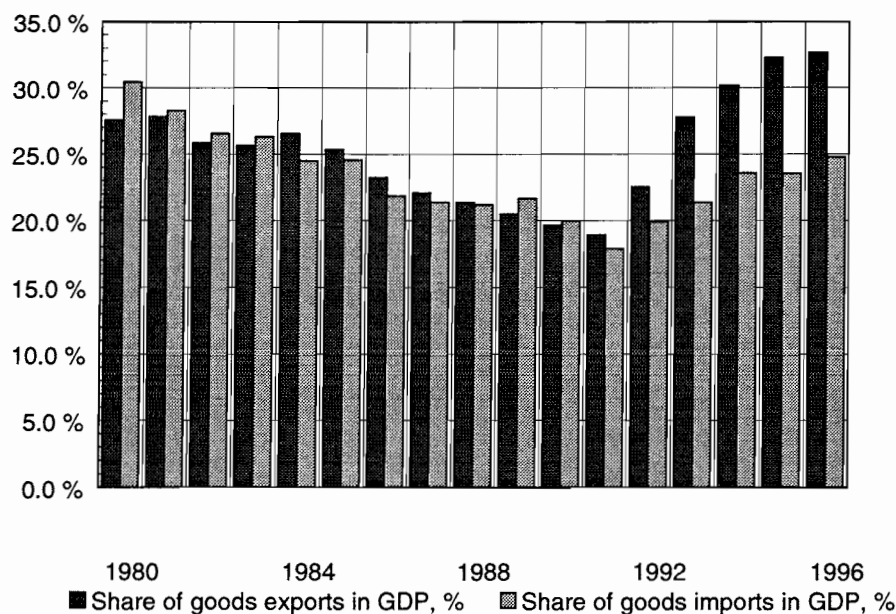
Finland's EU membership in 1995 meant that Finnish foreign trade is nowadays divided into two categories: internal (EU) trade and external (non EU) trade. Although the National Board of Customs continues to publish the official data on all Finnish foreign trade, the introduction of new data collection practices due to EU membership meant severe delays in the availability of Finnish trade figures. Whereas prior to EU membership the data on monthly imports and exports was published in the middle of the next month, the trade statistics experienced almost six-month delays in the first part of 1995. However, from early 1997 the National Board of Customs has been able to report on Finnish foreign trade with a reasonable delay.

Since Finland is a very open economy, the foreign trade balance is one of the key fundamentals in describing Finland's economic performance (Figure 1.1 gives the share of the Finnish exports and imports in GDP). With a background of severe deficits and long-term indebtedness, the trade account data has had effects on interest rates and on the markka exchange rates whenever the information has not been in line with market expectations. Furthermore, a lack of data might set off rumours which could lead to adverse effects on the functioning of the financial markets.

That is why the Bank of Finland decided to introduce a special survey on foreign trade in order to ensure the prompt availability of trade account estimates. The survey was planned as a temporary one starting from January 1995, and it was discontinued in December 1996. Furthermore, it was also decided that the survey estimates would be replaced later in the balance of payments statistics by the official foreign trade data from the National Board of Customs.

Figure 1.1   **Finnish foreign trade in merchandise 1980–1996**

1980   1984   1988   1992   1996
■ Share of goods exports in GDP, %   ▨ Share of goods imports in GDP, %

In this study we discuss experiences with the Bank of Finland's foreign trade survey and examine how successful it was. The paper is divided into five sections. In the section 2, we present some theoretical and empirical considerations on the design of the survey. These include the objectives of the trade survey as well as the steps involved in the survey design. Section 3 deals with the structure of the survey. Besides the technical details of the survey, we also present the work flow chart for the survey, ie we describe the practical implementation of the survey. Section 4 contains an ex post evaluation of the survey estimates. Specifically, we compare the estimates from the survey with the official figures from the National Board of Customs. Finally, section 5 presents our concluding remarks.

Before going into detail, some related studies should be mentioned. Kariluoto (1996) and Hilpinen (1996b) present thorough explanations of Finland's balance of payments compilation methodology. Kariluoto (1996) also includes documentation on balance of payments data sources and final time series data on the Finnish balance of payments for the years 1975–1992. Previous publications on the Bank of Finland's foreign trade survey are Hilpinen (1995, 1996a).

2   The design of the survey: theoretical and empirical background

There are several steps involved in the planning and implementation of a survey. For example, the IMF Balance of Payments Compilation Guide (1995, p. 187) states that an effective survey design requires well-defined objectives, sufficient legislative authority, thorough coverage of the population or activity being measured, appropriate methodologies, well-designed survey forms, responsive reporters, good statistical processing procedures, appropriate levels of resources,

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and responsiveness to the needs of users. According to Cochran (1963), the design of a survey starts with the definition of the objectives of the survey. Although this should be trivial, it is often the case that in a complex survey one easily forgets the objectives when dealing with the details, which in turn may lead to decisions that are inconsistent with the objectives of the survey. In the context of the present survey, there was one main objective and several secondary objectives. These are listed in Table 2.1.

Table 2.1   **Objectives of the trade survey**

Main objective:	To produce monthly estimates of total values of Finnish goods exports and imports with reasonable precision and with a lag of five weeks.
Secondary objectives:	Cost effectiveness Ease of implementation

By definition, the main objective of the foreign trade survey was to produce estimates of Finnish foreign trade in goods. One should note that the aim was to estimate the total values of exports and imports. Since estimates were used for the compilation of Finnish balance of payments statistics, which is published monthly, foreign trade estimates should also be available on a monthly basis and with a five-week delay. This has been the standard for balance of payments statistics. Of course, these estimates should also be reasonably precise for the balance of payments statistics framework. As mentioned earlier, these estimates were not official as such, that is, they have been replaced as soon as possible by the official figures from the National Board of Customs.

Secondary survey objectives include cost and ease of implementation. The survey should not be too expensive to carry out and not excessively complicated. That is, given the temporary character of the survey, it should not cause a great amount of extra work for compilers and data providers. Ease of implementation serves two aims. First, if the design is very complex, it may lead to errors in the production of the estimates. Secondly, the reporting of estimates to data users is more transparent if the survey method is easy to understand.

Since exports and imports concern different issues, it was decided todivide the trade survey into two parts: export survey and import survey. The steps involved in the design of the surveys are presented in Table 2.2.

The population of the trade survey is very large: in respect of the export survey it was defined to be the aggregate of all Finnish residents (individuals and enterprises) that export goods from Finland. The population for the import survey was defined similarly, ie the aggregate of all Finnish residents that import goods to Finland.

In order to conduct a survey, one must have a sampling frame, ie a list or register of the population elements from which the sample is drawn. It should be stressed that the finding of an appropriate frame is difficult because it should cover the whole population and avoid overlap.

The frame for the trade survey was constructed from the May – December 1994 foreign trade data compiled by the National Board of Customs. This data was enterprise-specific, and each enterprise was identified by an organization number.

The frame also included company-specific values of exports and imports in May – December 1994 as an auxiliary variable.

Table 2.2   **Steps in the survey design**

Population	*Export survey:* All Finnish residents that export goods from Finland *Import survey:* All Finnish residents that import goods into Finland
Frame	*Export survey:* Customs register of exports for 1994 (May – December) *Import survey:* Customs register of imports for 1994 (May – December) Elements of the frame are firms that are identified by company-specific organization number. Frame also includes company-specific information on value of exports and imports in 1994 (May – December) as an auxiliary variable.
Sample selection	*Export survey:* Nonprobability sample of 84 firms, that participate in the Bank's survey of external assets and liabilities. *Import survey:* Nonprobability sample of 84 firms (same as in export survey) + 179 additional firms from the frame ordered by import value.
Data collection method	Mailed questionnaire
Data collected	*Export survey:* Monthly value of exports (fob) *Import survey:* Monthly value of imports (cif)
Estimation method	Stratified grossing-up: see section 3
Organization of field work	See section 3
Reporting	Monthly estimates published in balance of payments publications

Needless to say, this frame was by no means perfect. It lacked details on imports and exports of individuals and, of course, the frame becomes quickly outdated as new companies evolve. However, since enterprises make up the bulk of Finnish foreign trade (close to 100 per cent) and monitoring new enterprises is fairly easy, the frame was considered satisfactory.

After defining the frame, one may proceed to the issue of sample selection. Because of the large number of elements in the frame, a census – ie a survey in which every element of the frame is studied – was found to be in conflict with our study objectives: a census would not produce estimates with reasonable speed and cost. That is why it was decided to use sampling, ie to study only part of the population.

Basically there are two types of samples: (i) probability samples and (ii) nonprobability samples. In probability sampling, each element of the frame has a known chance of being included into the sample. The sampling is done by mathematical decision rules that leave no discretion to the researcher. What probability sampling allows one to do is to calculate the sampling error, that is, the likely extent to which the sample value (estimate) differs from the corresponding population value (parameter or true value). In other words, probability sampling

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makes it possible to measure the accuracy of the estimate (for more on probability sampling, see eg Cochran 1963 and Pahkinen et al 1994).

In nonprobability sampling, selection of the sample is based on the judgement of the researcher. This means that one is not able to calculate the sampling error, that is, one has no idea how accurate the estimates calculated from a nonprobability sample are. However, one should note that there is no guarantee that the results obtained with a probability sample will be more accurate than those obtained with a non-probability sample; what the former enables the researcher to do is to measure the precision of the sample estimate. Ultimately, the choice of sampling method depends, among other things, on the study objectives and the characteristics of the population.

Two issues had a major role in the selection of the sampling method. First, besides the fact that Finland is a country of small enterprise population, the distribution of these firms according to the size is very skewed and only a small fraction of enterprises are involved in foreign trade. Whereas the total amount of operating enterprises in the corporation register is some 260 000 organizations, there were only 12 056 exporters and 14 353 importers in 1994. This can be seen from Table 2.3, where details on export and import transactions in 1994 are presented. Table 2.3 is calculated from the Bank of Finland's foreign payments data. This database includes payments made from Finland to abroad and vice versa. The data is classified by payment purpose, currency and the nonresident party's country of domicile. All payments executed in 1994 and classified as export or import payments were included in the table. However, since these payment figures differ slightly from actual customs declarations, they are not equivalent to the official figures on exports and imports from the National Board of Customs.

Also by examining Table 2.3, one can note that the share of the largest firms in foreign trade was quite high: 201 of 12 056 firms involved in exporting had a share of 80 per cent of the total value of exports in 1994. Similar concentration of import trade can also be seen from the table. This in turn means that it is quite easy to achieve wide coverage with a very modest sample size.

The second issue in the selection of sampling method relates to the compilation of the Finnish balance of payments statistics. Statistics on capital movements and stocks of foreign assets and liabilities are primarily based on surveys (for more on the Bank of Finland's balance of payments surveys, see Kariluoto 1996 and Hilpinen 1992). Since the enterprises engaged in these surveys are easily accessible, their inclusion in the trade survey was very tempting. That is, these firms are accustomed to the reporting practices, and so the inclusion of these enterprises in the surveys is highly cost-effective.

Table 2.3 **Classification of enterprises involved in foreign trade**

Classification of enterprises by value of their payments on export and import of goods in 1994.

	Category 1 Largest firms	*Category 2* Medium-sized firms	*Category 3* Small firms	*Total*
Export transactions				
Value (million FIM)	131 563	23 545	8 957	164 066
per cent of total	80.2 %	14.4 %	5.5 %	100 %
Number of firms	201	776	11 079	12 056
Import transactions				
Value (million FIM)	65 690	27 832	12 981	106 503
per cent of total	61.7 %	26.1 %	12.2 %	100.0 %
Number of firms	177	978	13 198	14 353

After considering these two issues, it was decided that a nonprobability sample would be used. All the enterprises that take part in the monthly survey of external assets and liabilities were included in the trade survey. This group of firms, 84 industrial and commercial enterprises, covered some 70 per cent of export flows in May – December 1994. In the case of the export survey, this was considered as a satisfactory sample. However, in the case of import survey, it was decided to increase the number of enterprises. This was done by sampling enterprises from the frame in order of values of import flows in May – December 1994 up until the coverage reached some 70 per cent. This resulted in a sample size of 263 enterprises, including all the 84 enterprises included in the export survey. Because of the selection procedure for the samples, we refer to a cut-off survey. This approach could also be referred to as partial coverage collection sampling.

To summarize, the sample for the trade survey was a nonprobability sample which, for the export survey, consisted of 84 enterprises (all the enterprises of the Bank's external assets and liabilities survey) and, for the import survey, 263 enterprises (all the enterprises in the Bank's external assets and liabilities survey plus 179 other enterprises). Descriptions of the sample and the estimation procedure are given in section 3 below.

It was decided that data collection would done by mail and the questionnaires were posted to the selected firms. The questionnaire asked the firms to report their invoiced value of foreign trade on a monthly basis. This meant that the trade condition (cif, fob) varied considerably. However, later the instructions were changed, and the firms were advised to report the value of foreign trade according to concepts and definitions similar to those applied by the National Board of Customs.

The questionnaires were processed at the Bank's Information Services Department, where the estimates were also calculated. The organization of these field operations is further examined in section 3 of this paper

The estimated trade figures were included in Finland's monthly balance of payments publication – Finland's Balance of Payments Statistical Bulletin. They were also published in the Bank of Finland Bulletin as well as in the Bank of Finland Statistical Review on Financial Markets. All these publications included a

note that the foreign trade figures were based on the Bank of Finland's trade survey and should be considered as preliminary. As mentioned earlier, these estimates were replaced later by the official foreign trade figures from the National Board of Customs.

3   Implementation of the foreign trade survey

3.1   Estimation procedure

As mentioned earlier, sample selection for the trade survey was done on a nonprobability basis. Since no formal estimation procedures exist for samples of this type, a simple grossing up was chosen. In grossing up, one multiplies the survey figures by a constant. This constant is based on the coverage of the survey (value share of sampled enterprises of the total value of exports or imports), which is estimated from the sampling frame. For instance, since the enterprises included in the export survey sample covered some 70 per cent of Finnish exports in May – December 1994, grossing up the survey total required multiplication by the inverse of the coverage, that is $100/70 = 1.43$.

In this type of grossing up, one makes the assumption that the relationship between population and sample is stable from period to period, ie that the coverage does not change. This assumption is quite strong, but given the structure of Finnish foreign trade, it should be quite plausible in the short run.

However, as the value growth of Finnish exports was clearly concentrated in the pulp and paper industries and the new telecommunications industry in the prevailing cyclical situation, the simple grossing up procedure was found to overestimate total exports. Similarly, prices in some large import sectors, such as crude oil and ore importers, are very volatile, and thus would distort the results of simple grossing up.

That is why the samples of both surveys were divided into two groups, or strata, according to the value of exports and imports, and a stratified grossing up procedure was applied. That is, for exports the seven largest and for imports the three largest enterprises were separated and in grossing up figures for the above-mentioned enterprises were added as such, whereas the rest of the sample was multiplied by respective shares of total exports or imports. Tables 3.1 and 3.2 present the details of the grossing up procedure.

Considering the grossing up procedure for the export survey, we see that the estimates were formulated as follows. First, the export figures for the seven largest exporters were taken from the survey as such. Then, the export figures of the other 77 enterprises included in the sample were multiplied by a grossing up factor of 1.90. The sum of these two figures was the estimate for exports. Formally, the estimate for exports, Y, was calculated using the sample figures as follows

$$Y = \sum_{i=1}^{7} Y_{1,i} + 1.90 \sum_{i=1}^{77} Y_{2,i}$$

where the $Y_{1,i}$ (i = 1, ..., 7) denote the sample values for the first stratum and the $Y_{2,i}$ (i = 1, ..., 77) denote the sample values of the second stratum. The estimate for imports was calculated similarly using the import survey sample and a grossing up factor of 1.62.

Table 3.1   **Grossing up procedure for the export survey**

Stratum	Number	Value share, %
1. Largest firms	7	35
2. Other firms in the sample	77	34
3. Not surveyed	..	31
Total	..	100

Grossing up factor for stratum 2: 1.90 (100-35)/34

Table 3.2   **Grossing up procedure for the import survey**

Stratum	Number	Value share, %
1. Largest firms	3	15
2. Other firms in the sample	260	52
3. Not surveyed	..	33
Total	..	100

Grossing up factor for stratum 2: 1.62 (100-15)/52

As mentioned earlier, since the sample here is not a probability sample, we cannot make any definitive statements about the accuracy of the estimate ex ante. Still, given the large coverage of the sample and the stratified approach to the grossing up, we approximated these estimates to have a error term below 10 per cent. This was the conclusion of the pretests and pilot studies done during the planning stage of the survey. Furthermore, as month-to-month variations in foreign trade are considerable, it was decided that an error margin below 10 % could be regarded as satisfactory (see Hilpinen 1995). In section 4 of this paper we evaluate whether the survey estimates were in line with our expectations. Before that, we briefly describe the work flow of the survey, that is, how the field operations were carried out.

3.2   Field operations

The field operations of the trade survey may be divided into three phases: contacting respondents, coding and editing of data, and estimation. Since it was decided to conduct the survey by mail, the contacting of respondents was done by sending questionnaires to the selected enterprises. Firms were asked to return these

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questionnaires on a monthly basis by the 15th of the following month. That is, the export or import figures for January were to be reported by February 15.

As questionnaires came back to the Bank, the person in charge of data coding checked them. If there were some enterprises that did not return their questionnaires the 15th, they were contacted by telephone. The response rate was practically 100 per cent. If there were any obvious omissions or errors in responses, queries were made by phone.

After the coding and data editing, in the estimation phase, a personal computer with off-the-shelf spreadsheet software was used to produce preliminary estimates via the grossing up procedure described above. This took place usually between the 20th and 25th days of the month. These estimates were presented in the monthly meeting of the balance of payments statistics team. Then the final trade estimates were formulated and published by the first week of the next month in the balance of payments bulletin. The flow chart in figure 3.1 describes the different phases of the trade survey.

Overall, the compilation of monthly trade estimates required the input of one statistician in the coding and data editing stage and an input of one economist in the estimation stage. The work load caused by the trade survey to the statistician was on average about one week per month and to the economist much less. Furthermore, no additional resources, such as new computers or software, were needed in the execution of the survey.

Figure 3.1 **Flow chart of the implementation of the trade survey**

The dates relate to estimates of the previous month, ie for example, estimates for January were prepared during February and published in March.
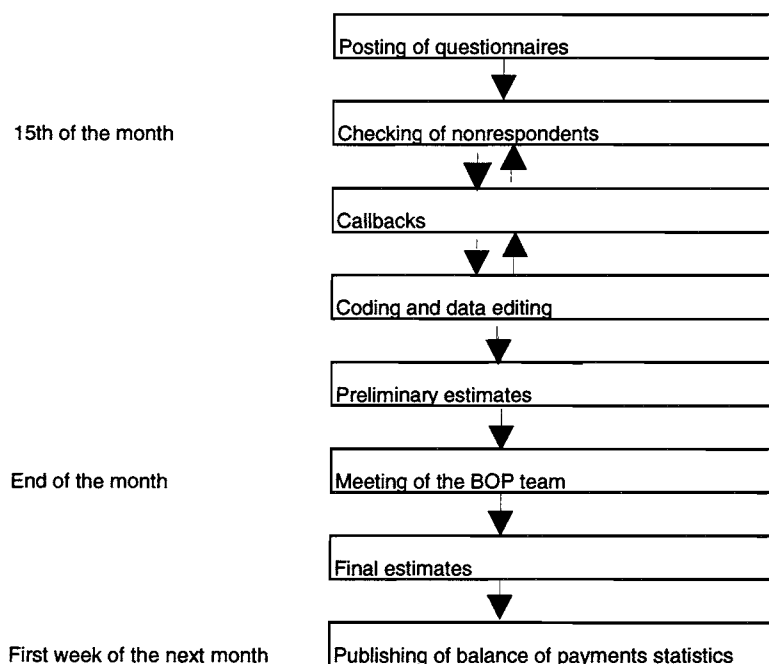
4   Foreign trade survey – ex post evaluation

Evaluation of the trade survey may be accomplished by comparing survey estimates with official figures from the National Board of Customs. In this section, we study the behaviour of the error term and describe it with the aid of several graphs. For the sake of simplicity, no rigorous statistical time series analysis is employed.

As mentioned earlier, the survey produced monthly estimates for exports and imports of merchandise during the period January 1995 – December 1996. These estimates were included in the balance of payments publications and are reported in the survey estimate column in the appendix, Table A.1 for imports and Table A.2 for exports.

To be precise, the survey estimates were not published as such, instead some judgmental corrections and adjustments were made. These published estimates are reported in separate columns in Tables A.1 and A.2 and are labelled as final estimates. In most cases the difference between survey estimate and final estimate is of minor importance and consists mainly of rounding off the survey estimate to the nearest total FIM 100 million. However, during the period January to July 1996, the survey estimates for imports were adjusted substantially downwards on the basis of preliminary 1995 data from the National Board of Customs. Since the National Board of Customs repeatedly revised the preliminary data, the downward adjustment of survey estimates was discontinued in August 1996.

The official trade figures from the National Board of Customs are also reported in appended Tables A.1 and A.2.[1] The third column presents the customs preliminary figures and the fourth column the final customs figures. The first preliminary of the customs data were available with six month delays in 1995. Toward the end of 1996, the delays diminished to two months. The final figures appeared after a delay of more than one year.

Descriptive statistics on the various trade figures are presented in Table 4.1. As one can note, the difference between the Bank's survey estimate and the final estimate is neglible. However, there are large differences between preliminary and final customs figures. These revisions of customs trade data was a new phenomen which users of the data were not used to and caused some confusion.

Since in this paper we are ultimately interested in how well the survey methodology performed, our analysis will not be concerned with the Bank's final estimates or the preliminary customs figures. Instead, we will concentrate solely on the original survey estimates and final customs figures. We have defined the survey error as the difference between the final customs figure and the survey estimate. This error term is given Tables A.1 and A.2.

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[1] Customs data as of May 1997

Table 4.1		Descriptive statistics on the various Finnish foreign trade estimates. Million FIM.		
	Survey estimate	Final estimate	Customs preliminary	Customs final
Exports				
1995	172 766	172 300	171 631	176 021
1996	181 938	182 300	175 299	185 798
Imports				
1995	136 049	135 600	120 033	128 556
1996	138 500	134 000	131 036	140 996

Time series for the survey estimates and final customs figures are depicted in Figure 4.1 for exports and in Figure 4.2 for imports. As one can note, in both cases the Bank's survey estimates have followed quite closely the trend of the official figures. However, some clear deviations can be found. Furthermore, it seems that the export survey has consistently produced somewhat better estimates than the import survey.

Figure 4.1   **Finnish merchandise exports 1994-1996**

Bank of Finland's survey estimates and official figures from the National Board of Customs
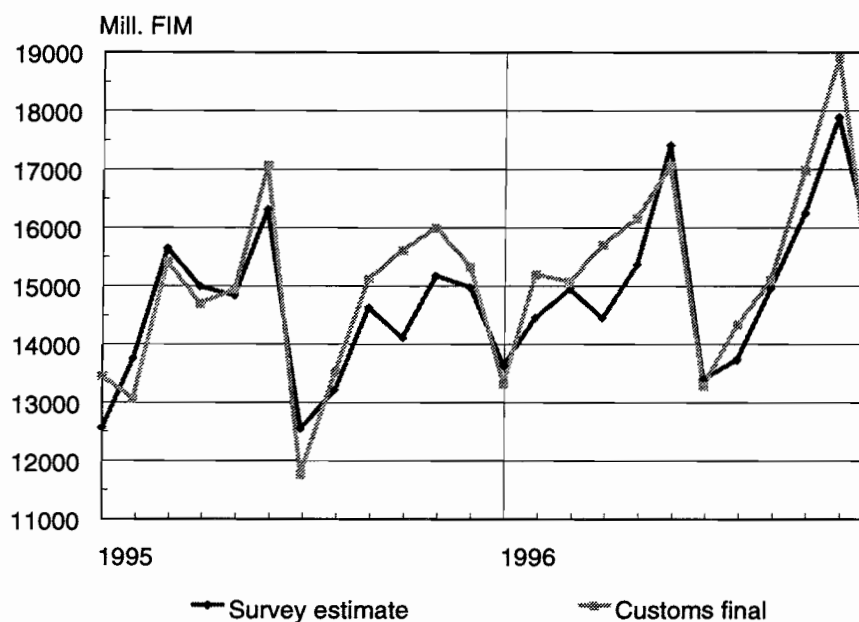
Figure 4.2   **Finnish merchandise imports 1994-1996**

Bank of Finland's survey estimates and official figures from the National Board of Customs

Mill. FIM

— Survey estimate   —— Customs final
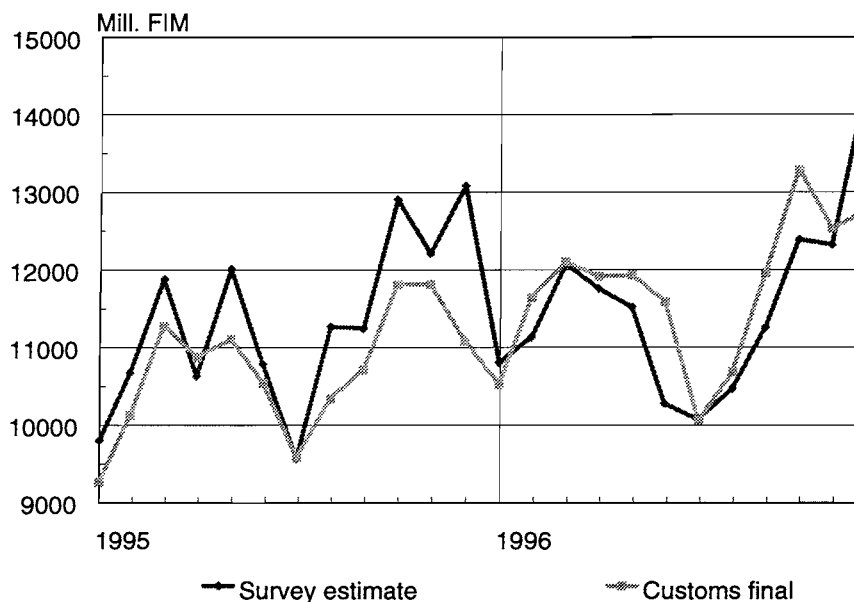
Figure 4.3   **Errors in trade survey in 1994-1996, per cent**

Error % = (Customs figure - Survey estimate)/Customs figure

—— Export survey error %   —— Import survey error %
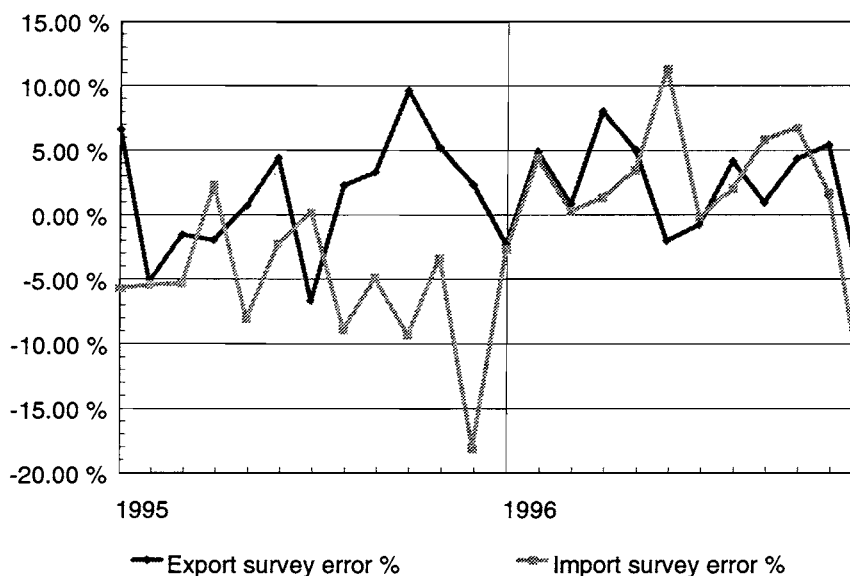
Figure 4.3 presents the survey errors in percentage terms. We consider the estimates to be good if the absolute value of the error term is below 5 per cent and moderate if the absolute value is 5-10 per cent. In the light of these benchmark values, both surveys have performed quite well. In the case of the export survey, 15 observations out of 24 fell in the 5 per cent error range. In the case of the import survey, the results were slightly poorer: 13 observations out of 24 had a

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error margin below 5 per cent. However, the 10 per cent error margin was never breached in the export survey. Again, the results were poorer for the import survey, in which the 10 per cent error margin was breached three times. The extreme values were higher for the import survey, with the error peaking at -18.1 per cent in December 1995.

Table 4.2 presents various measures of survey accuracy (see Makridakis et al 1989, pp. 56–59). Mean error is the simple average of the errors. A simple average of absolute errors is denoted as mean absolute deviation. These two measures can also be calculated for percentage errors, being labelled mean percentage error and mean absolute percentage error respectively. Still another measure of estimate accuracy is the mean squared error, which is the average of squared errors. The (population) standard deviation of errors as well as maximum errors are also reported in the table. One should note that mean squared error is equal to the squared standard deviation plus the squared mean error.

There are several conclusions that can be drawn from Table 4.2. First, one can see that the average of error terms for the export survey is positive. This is to say that the estimates for exports have been lower on the average than the actual figures during the survey period. However, given the error standard deviation of 633, the bias in the export survey is not statistically significant.

Secondly, the average import survey error is negative, which means that the estimates of the import survey have been somewhat higher on average than the actual customs figures. However, there is no statistically significant evidence on the bias.

Thirdly, the mean squared error is clearly higher for the import survey than for the export survey. This means that when one considers both aspects of the error term together, the bias and the standard deviation, the export survey has performed better. Although the absolute bias is of the same magnitude for both surveys, the export survey is clearly more accurate. This can be seen from the error standard deviations: 633 for the export survey and 757 the for import survey.

Table 4.2   **Accuracy measures**

Monthly observations, 1994–1996. Total of 24 observations. Million FIM unless otherwise stated.

	Export survey	Import survey
Mean error (ME)	296.4	-208.2
Standard deviation of errors (STDEVP)	633.3	757.3
Mean absolute deviation (MAD)	595.4	601.9
Mean squared error (MSE)	488993.8	616798.8
Mean percentage error (MPE)	1.7 %	-2.0 %
Mean absolute percentage error (MAPE)	3.9 %	5.3 %
Maximum absolute error (MaxAE)	1502.7	2003.1
Maximum absolute percentage error (MaxAPE)	9.6 %	18.1 %

The percentage accuracy measures put the survey performance in clear perspective. On average, the error in the export survey was 1.7 per cent and in the import survey -2.0 per cent. The means of absolute percentage errors were 3.9 per cent and 5.3 per cent for the export survey and import survey respectively.

Moreover, we tested whether these error series posessed serial correlation. According to the Box-Ljung statistic (see eg Greene 1993, p. 558), both error series appeared to be nonautocorrelated. That is, both series were found to be white noise processes.

To sum up, we conclude that the Bank of Finland's foreign trade survey has performed quite well. The errors have been of reasonable magnitude. Almost all the estimates have been within the 10 per cent error margin. However, it seems that the volatility of the error term has been larger for the import survey than for the export survey. Furthermore, both surveys were found to be unbiased with nonautocorrelated error terms.

In order to get a better grasp on the survey error term, it is useful to examine the different error sources. Basically the errors in the survey arise because of sampling errors and non-sampling errors. These error sources are listed in Table 4.3.

Table 4.3   **Errors in sample surveys**

A. Sampling errors

B. Non-sampling errors
       Observational errors
       Non-response errors
       Coverage errors
       Processing errors

Since in a sample survey only a part of the population is studied, estimates are bound to deviate from actual figures. This error, which is caused by the fact that not every element of the population is included in the survey, is called sampling error. Sampling error is simply the difference between the sample estimate and the true population parameter, given that there is no non-sampling error present.

Basically there are two ways to reduce the amount of sampling error. The sample size can be increased or more sophisticated sampling techniques can be used.

Besides sampling errors, non-sampling errors can affect the results of the estimates. These include observational errors, non-response errors, coverage errors and processing errors (see eg Penneck 1995)

Observational errors are measurement errors which are caused, for example, by poor questionnaire design. Non-response errors arise because some companies selected in the sample refuse to be a part of the sample. Coverage errors result from failures of the sampling frame such as the failure to include all units of the population, the inclusion of some inappropriate units and double counting. Processing errors are caused by errors in data handling, that is, in the editing and coding of the data.

Analysis of the causes of the error term in the Bank's trade survey is still in its infancy. That is, we have not analysed how much non-sampling errors contributed to the error term. However, much effort was expended in trying to minimize the non-sampling error. The design of the questionnaire was done carefully with special emphasis on reporting instructions. Moreover, the data handling was checked thoroughly. Also, the response rate was close to 100 per cent, so non-response errors are negligible. Still, the amount of coverage errors and observational errors might have been substantial. In order to analyse this issue, one

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should compare the firm-specific data from the National Board of Customs with survey data as soon as it is available.

5   Conclusions

In this paper we have described and evaluated the Bank of Finland's foreign trade survey, which was carried out on a monthly basis during January 1995 – December 1996. The aim of the survey was to bridge the severe delays in the publication of official trade statistics by the National Board of Customs. The delays were due to the implementation of new practices in the National Board of Customs' statistical system connected with Finland's entry into the EU. However, nowadays the National Board of Customs is able to publish the trade statistics with reasonable delay and so the Bank of Finland has discontinued its foreign trade survey.

Basically, the design and execution of a survey involves trade offs between the precision of the survey estimates, time constraints and cost constraints. After careful considerations, a survey based on nonprobability sampling was introduced. Because of the sampling method used, we call it a cut-off survey. A total of 84 firms were asked to report the monthly values of their exports and 263 firms were asked to report the monthly values of their imports. The estimates for total exports and imports were calculated via a stratified grossing-up procedure.

Our analysis shows that the estimates produced by the trade survey performed quite well. The majority of survey errors were below the 10 per cent percent margin and on average the error terms were close to zero. However, it is unclear how much of the survey error can be attributed to the method used and how much was caused by other errors, such as observational and coverage errors. Still, it is evident that exports and imports were satisfactorily estimated with this type of cut-off survey.

Also, an important factor in the implementation of the survey was the close contacts between data compilers and reporters. Since the sampled enterprises were already involved in other balance of payments surveys conducted by the Bank of Finland, they were familiar with the reporting procedures. Furthermore, cooperation with these enterprises has been fruitful and businesslike, which shows up in the almost 100 per cent response rate and also, we believe, in the accuracy and reliability of the data.

References

Cochran, W.G. (1963) **Sampling Techniques.** 2nd edition, Wiley.

Greene, W.H. (1993) **Econometric Analysis.** 2nd edition, Macmillan.

Hilpinen, J. (1992) **Yrityskyselyt maksutaseen laadinnassa.** Suomen Pankin keskustelu-aloitteita, 34/92. Available also in English: "Enterprise Surveys Used in the Compilation of Finnish Balance of Payment Statistics", Bank of Finland, Statistical Services Department, Working document 6/1992.

Hilpinen, J. (1995) **Compilation of Early Warning Indicators for Foreign Trade Employing a Cut-Off Survey.** Bank of Finland Discussion Papers 25/95.

Hilpinen, J. (1996a) **Foreign Trade in the Finnish Balance of Payments in 1995.** Bank of Finland Bulletin, Vol. 70 No. 2

Hilpinen, J. (1996b) **Balance of Payments Statistics: Data Collection, Compilation and Analytical Issues.** Bank of Finland, Information Services Department. Working Papers 5/96.

International Monetary Fund (1995) **Balance of Payments Compilation Guide.** Washington, D.C.

Kariluoto, J. (1996) **Finland's Balance of Payments.** Bank of Finland Studies A:98.

Makridakis, S. – Wheelwright, S. (1989) **Forecasting Methods for Management.** 5th edition, Wiley.

Pahkinen, E. – Lehtonen, R. (1994) **Practical Methods for Design and Analysis of Complex Surveys.** Wiley.

Penneck, S. (1995) **Measuring the Accuracy of the National Account.** Presentation, International Conference on Survey Measurement and Process Quality, April 1–4, 1995, Bristol.

Appendix

Table A.1   **Import Survey Data**

Month	Survey estimate	Final estimate	Customs preliminary	Customs final	Survey error	Survey error %
9501	9801	9800	7931	9272	−529	−5.7 %
9502	10677	10400	9035	10126	−551	−5.4 %
9503	11878	11700	10778	11278	−600	−5.3 %
9504	10629	10600	10001	10878	250	2.3 %
9505	12008	12000	10404	11109	−899	−8.1 %
9506	10785	10800	10047	10549	−236	−2.2 %
9507	9568	9600	8753	9585	17	0.2 %
9508	11262	11300	9802	10344	−918	−8.9 %
9509	11240	11200	10382	10714	−526	−4.9 %
9510	12906	12900	11371	11806	−1100	−9.3 %
9511	12211	12200	10899	11815	−396	−3.4 %
9512	13083	13100	10630	11080	−2003	−18.1 %
9601	10805	10100	9423	10526	−279	−2.6 %
9602	11132	10200	10661	11641	509	4.4 %
9603	12070	11400	10725	12105	35	0.3 %
9604	11754	11300	10663	11913	159	1.3 %
9605	11514	10900	10384	11931	417	3.5 %
9606	10274	9800	10007	11589	1315	11.4 %
9607	10074	9600	9663	10058	−16	−0.2 %
9608	10469	10300	10274	10685	216	2.0 %
9609	11259	11300	11546	11959	700	5.9 %
9610	12393	12400	12680	13289	896	6.7 %
9611	12326	12300	12246	12536	210	1.7 %
9612	14432	14400	12764	12764	−1668	−13.1 %

Survey error = Customs final − Survey estimate
Survey error % = Survey error / Customs final

All figures in million FIM unless otherwise stated

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Table A.2   **Export Survey Data**

Month	Survey estimate	Final estimate	Customs preliminary	Customs final	Survey error	Survey error %
9501	12565	12400	12956	13452	887	6.6 %
9502	13753	13700	11851	13067	−686	−5.2 %
9503	15651	15300	14762	15412	−239	−1.5 %
9504	14992	15000	14368	14704	−288	−2.0 %
9505	14839	14800	14730	14947	108	0.7 %
9506	16311	16300	16776	17068	757	4.4 %
9507	12551	12600	11408	11766	−785	−6.7 %
9508	13217	13300	13202	13525	308	2.3 %
9509	14626	14600	14819	15126	500	3.3 %
9510	14113	14100	15851	15616	1503	9.6 %
9511	15173	15200	15826	16007	834	5.2 %
9512	14976	15000	15082	15331	355	2.3 %
9601	13635	13600	12395	13325	−310	−2.3 %
9602	14457	14400	14308	15201	745	4.9 %
9603	14952	14900	14153	15075	123	0.8 %
9604	14449	14500	14494	15710	1261	8.0 %
9605	15361	15500	14970	16175	814	5.0 %
9606	17408	17600	15829	17060	−348	−2.0 %
9607	13396	13400	12830	13292	−104	−0.8 %
9608	13738	13800	13745	14338	600	4.2 %
9609	14958	15000	14567	15103	145	1.0 %
9610	16254	16300	15034	16990	736	4.3 %
9611	17884	17900	18355	18910	1026	5.4 %
9612	15447	15400	14619	14619	−828	−5.7 %

Survey error = Customs final − Survey estimate
Survey error % = Survey error / Customs final

All figures in million FIM unless otherwise stated

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