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BANK OF FINLAND  
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Frame updates 2000 and the 2001 design of the Bank of  
Finland Balance of Payments enterprise surveys

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## **FRAME UPDATES 2000 AND THE 2001 DESIGN OF THE BANK OF FINLAND BALANCE OF PAYMENTS ENTERPRISE SURVEYS**

### *1. MAIN FEATURES OF THE BOF BOP SURVEY SYSTEM*

In the Balance of Payments Statistics, the responsibilities are shared between Statistics Finland and the Bank of Finland. The Bank of Finland is responsible for compiling the Financial Account and Investment Income, while Statistics Finland collects and compiles the majority of the Current Account data. The Foreign Trade Statistics collected by the Board of Customs are used both in National Accounts and in Balance of Payments. The Bank is responsible for consolidating and disseminating the entire Balance of Payments and for estimating the monthly aggregates of services, transfers and capital account (no monthly data collection) for the ECB MKIs.

The Bank of Finland employs a family of surveys to meet the international data requirements. The Balance of Payments and the IIP data are collected simultaneously, and the respondents have to reconcile stocks, flows and related income. The survey design is based on an end investor / issuer approach and gives sector breakdowns in compliance with National Accounts. A broker survey is built to acquire household sector data. (See annex 1, the list of surveys).

The enterprise and banking structures constrain the surveys to a cut-off or a census type with only a few exceptions. This approach requires a continual study of relevant target populations (in practise frames) used in the BoP surveys.

### *2. AIM OF THE FRAME PROJECT*

A large frame project was initiated at the end of 1999. The Finnish BoP Statistics suffered from an exceptionally high (negative) errors and omissions item in 1998. This tendency towards negative errors was evident for some years. Due to a long history of current account surpluses and the resulting accumulated liquidity in the economy, it was assumed that all firms having foreign assets did not fall within the prevailing frame which originally was put together in the early 90's.

Frame problems are faced both in the high frequency foreign assets -liabilities survey and in the annual direct investment surveys. The relevance of the prevailed frames was checked during summer and autumn 2000 employing large frame surveys. Special benchmark surveys were conducted in some items in early 2001. The final aim of the project was to redesign the Balance of Payments surveys with appropriate selection, stratification and sampling as well as to establish routines to maintain the survey populations and frames. These functions constitute the core of a survey process (see annex 2).

### 3. REGISTERS AVAILABLE

Traditionally, the Bank of Finland receives an annual update of the official enterprise register from Statistics Finland containing some 200 000 entries. However, this is too large and not targeted for BoP purposes. The official register, however, contains an extremely useful subset of 700 consolidated enterprises (Consolidated Register). The frame study became possible when the register of export- and import enterprises containing more than 12000 exporters and over 17000 importers was acquired from the Customs Office (Customs Register) in summer 1999 for the first time. Subsequently, it was agreed that an update will be received annually. The Bank of Finland have also obtained a balance sheet database of the 500 largest enterprises in Finland (Etlatieto Ltd) annually. However, the frame study requires a more comprehensive set of balance sheet data and a data base of some 7000 enterprises was acquired from private sources (Balance Consulting Ltd). The Balance Consulting data can be summed up to the consolidated enterprise level, amounting to some 700 consolidated concerns. Moreover, this register spans nearly 5000 single enterprises and will be updated annually. (See annex 3)

None of the registers mentioned above contain information on the Bank of Finland monthly BoP survey target variables (the y's). Thus a *frame survey* was considered necessary, covering some 2000 respondents, a number restricted by the resources of the department. The registers presented two major problems: Firstly, the official register does not contain balance sheet variables. Secondly, in the private registers containing balance sheet data, the definition of the statistical unit varies between a firm and a consolidated enterprise. The quality of the firm identification data in the Balance Consulting data was not always sufficient and extensive manual cross-checking between registers was required before the data were functional and comparable.

The register problem in direct investment is different in that solutions are more readily available. The Bank of Finland has continually maintained registers, both concerning investment objects in the domestic economy and enterprises investing abroad. Recently, Statistics Finland has intensified its activities in the former area, keeping registers on structures of Finnish enterprises. Because ownership register updates always lag behind, the monitoring of recent mergers and acquisitions is of major importance. Since the Statistics Finland register activity in direct investments abroad is limited, register maintenance by the Bank of Finland is crucial. To facilitate this work, the foreign assets and liabilities frame survey included qualitative question as to whether the respondent has foreign affiliates.

The 1999 register of the direct investment enterprises in Finland consisted of 2000 enterprises. Maintaining this register is increasingly the responsibility of Statistics Finland. The 1999 register of Finnish enterprises investing abroad contained 1150 entries. Here the activity of the Bank of Finland is noteworthy.

#### 4. *DIFFERENT FRAMES FOR DIFFERENT SURVEYS*

A multiple frame structure has been established for the current BoP financial account survey system. Different parts of the BoP, direct investments, other financial items and trade related financial items require different frames.

The direct investment registers described above include all necessary frame data and are thus ready to use. The practise has been that the frame lists are checked with occasional frame surveys, as conducted in 2000.

Financial items like portfolio investments, bank loans and deposits, etc, have specific enterprise structures, and frame lists could be constructed, for example) employing enterprise balance sheets. Such data available in Finland are the balance sheets collected by Balance Consulting Ltd.

Considering the overlap of the respondents in four surveys in 2001, direct investments abroad (DIA) 400, direct investments in Finland (DIF) 800, monthly and quarterly foreign assets and liabilities (ALH) 115 as well as annual foreign assets and liabilities (ALA) 250, the following data can be derived from the frame lists (in practise from the mailing lists):

$$\begin{aligned} \text{DIA} \cap \text{DIF} &= 70, \\ \text{DIA} \cap \text{ALH} &= 68, \\ \text{DIA} \cap \text{ALA} &= 47, \\ \text{DIA} \cap \text{DIF} \cap \text{ALH} &= 20, \\ \text{DIA} \cap \text{DIF} \cap \text{ALA} &= 9, \\ \text{DIF} \cap \text{ALH} &= 41, \\ \text{DIF} \cap \text{ALA} &= 56. \end{aligned}$$

The differences in the frames/surveys for various parts of the BoP financial account are illustrated in annex 4.

For export receivables and advance payments, the export register, and for advance import payments and import credits, the import register, respectively, constitute superior target populations. With identification data, these registers stand ready for use. According to past experience, exports and export receivables are heavily concentrated and a very simple design is adequate to collect running short frequency information. More enterprises actively import. The data collection procedure must include a simple running survey and an occasional, major survey in order to find out the correct levels. The large import credit surveys as conducted in 1996 and 2001 have been four-strata probability surveys with some 400 respondents.

#### 5. *ANALYSIS ON AND SELECTION OF AUXILIARY VARIABLES*

Auxiliary information was needed to find enterprises to be included in the frame of the monthly/quarterly foreign assets -liabilities survey. The relevance of the potential auxiliary variables was studied statistically. The data diagnostics for each potential auxiliary variable were carried out and the outliers were sought.

The auxiliary variables (the x's) were regressed (over the current sample) against the target variables (the y's) to establish a relationship between them. The x's with high correlation (against the y's) could be adopted as main auxiliary variables and enterprises having high value x's would be selected for the frame.

In order to simplify the empirical test the number of main target variables in the BoP survey (excluding direct investment and trade credits/receivables) was limited to two: Total foreign assets and total foreign liabilities. The potential auxiliary variables<sup>1</sup> were regressed in the logarithmic form one by one against the target variables.

It turned out that the *ex ante* hypothesis of the potentially best auxiliary variables was confirmed, because the total of financial assets on the asset side and total liabilities were among statistically most appropriate. In fact, the regression models did not find any significant difference between various candidates for auxiliary variables (see annex 5). And finally, the frame list was cut off at the point where the total liabilities and financial assets totalled to about FIM 10 million. It was estimated from the former survey sample and the balance sheet data that the share of foreign liabilities amounted to some 20 per cent of total liabilities in average. This relation was assumed to be even lower in smaller enterprises. Accordingly, *the new frame survey* covered 1935 enterprises/consolidated enterprises. The prevailed respondents (238 enterprises) of the monthly survey were exempted.

#### 6. *THE FRAME SURVEY ON FOREIGN FINANCIAL ASSETS AND LIABILITIES (EXCL. DIRECT INVESTMENTS AND TRADE CREDITS)*

The frame survey was designed to include only the main items of the financial account, the liabilities enquired were bonds, money market papers, loans, financial leasing and deposits. The types of assets included were equities, bonds, money market papers, financial leasing and deposits. In addition, a qualitative question, whether the respondent has foreign affiliates was included.

The response rate of the survey was 90.5 per cent but it turned out that in most cases enterprises reported just zero in foreign assets and liabilities other than trade credits and receivables. Only 301 respondents of the 1935 surveyed reported figures other than zeros in the items covered. On the other hand, the number of firms reporting to have affiliates was considerable. According to the survey result on the enterprise level, the frame for high frequency (monthly and quarterly) enterprise survey including the core group of large enterprises reporting also inter-company credits and trade credits consists of 539 enterprises (See annex 3). In terms of respondents, this is equates some 370 respondents since many firms give consolidated responses. Furthermore, the size of the population changes constantly and in a census type collection new respondents must be included as they appear.

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<sup>1</sup> Turnover, Dividends, Interest yield, Interest expenditure, Total profits, Fixed assets, Current assets, Shares and investments, Cash and other receivables, Financial assets, Assets, total, Equity, Bonds issued, Loans from credit institutions, Long term liabilities, Short term liabilities, Liabilities, total, Turnover + liabilities, Turnover + financial assets

The results also showed that the errors and omissions were not caused by large frame errors in the monthly enterprise survey. The coverage (in stocks) of the sample of the monthly survey at the end of 1999 exceeded 90 per cent of the total population in the major items and the full coverage survey caused only minor revisions to the 1999 data. On the other hand, a giant multinational enterprise like Nokia may be a likely source for errors because it is not even conceptually clear which country all their transactions belong to. The growth of Nokia accelerated especially in 1998.

The empirical frame distributions of the stocks of financial assets and liabilities (other than direct investments and trade related items) and their data diagnostics are presented in annexes 6A, 6B and 6E. In practise, the data contain enterprise and consolidated enterprise figures. The number of enterprises / respondents in each is of course smaller than the total frame also because some respondents (169) only have assets and some others only liabilities (132). In fact, it could be that assets and liabilities would require different frames, because only 70 respondents have both. The zero-replies are excluded as well. The classified frequency distribution charts are in logarithms in order to decrease the positive (to the right) skewness. The log distributions are not skewed but flatter than the normal distribution. The cumulative percentage distributions highlight the importance of large enterprises which suggests a cut-off collection.

## 7. *THE 2001 DESIGN OF THE HIGH-FREQUENCY BOP SURVEY*

The low number of non-zero responses and the limited amount of small enterprises excluded probability sampling in the future design of the high frequency BoP survey. Changes occurred in the list of respondents but the cut off-type collection was continued. Instead of a monthly survey, this survey can be characterised in 2001 as a multi frequency survey since only a small portion of enterprises responds on a monthly basis, a slightly larger group quarterly. Most enterprises in the frame are approached annually. Questions concerning inter-company loans and trade credits were included as before even though the coverage in trade credits is inadequate. This solution somewhat increases the number of respondents resulting in a situation as reported in annex 3.

This design gives a coverage of 80 per cent monthly and of 95 per cent quarterly in relation to the stock of main items. The most widely spread items are loans in liabilities and deposits in assets, while in some items the level of 100 per cent is reached with a mere handful of enterprises. Only 35 respondents are needed to reach the 80 per cent coverage on average since many enterprises reply on a consolidated basis. Additional 80 respondents are required to reach 95 per cent coverage quarterly, while annually, some 250 respondents have to be added to make the census. In practise, the flows are almost always fully covered quarterly, since enterprises having a small stock very seldom have flows. The tail is very often empty; the enterprises may have an occasional loan and other transactions do not appear. Thus the probability that flows would be missing quarterly falls below 5 per cent. The annual part of the multi frequency survey can be reduced without any noteworthy loss of information.

The studies also revealed that in a small country like Finland all necessary details cannot be baked into high frequency surveys, but structural data are collectable only on lower frequencies. This is caused by extremely skewed enter-

prise populations and by the dominance of a few major enterprises. Detailed monthly data would cause severe confidentiality problems. Nokia, for example, has clearly pointed out this problem in the detailed monthly data and is against all additional details on high frequencies.

## 8. DIRECT INVESTMENTS

The results of the frame surveys revealed that the number of enterprises in direct investment registers had decreased compared the situation in 1999. The response rate was 78 per cent in direct investments abroad and 90 per cent in direct investments in Finland. This yielded detailed information on close to 600 enterprises in the FDI abroad and 1250 enterprises in the FDI in Finland. In reality the frames are somewhat larger because of non response. Thus the *potential* frame lists include some 900 enterprises for the FDI abroad and 1800 enterprises for the FDI in the domestic economy.

The logarithmic frequency distributions of the direct investment abroad stocks and cumulative percentage distributions appear in annex 6C as well as the data diagnostics in annex 6E. The same information is presented on the direct investments in Finland in annexes 6D and 6E. The total number of enterprises in charts is lower than presented elsewhere in this paper because the zero-replies are excluded. The log transformations decrease the skewness of the distributions markedly make the distributions flatter than the normal distribution (kurtosis clearly smaller than 3). The designs of both annual direct investment surveys were revised according to the results of the frame surveys. Even though the large enterprises overwhelmingly dominate the cumulative distributions, the structural data requirements call for a more complicated survey design. Especially the outward FATS requirements of the Eurostat compelled the Bank to refine the design of the FDI abroad survey from the earlier practices.

The annual survey on direct investment abroad collects data stratified according to the main industrial activity and to the size of investment. Large enterprises responding to the multi frequency survey and enterprises in finance and insurance activities with stock of FDI larger than FIM 30 million (5 million euro) make up two take-all strata. The third take-all stratum consists of new investors and the fourth of small investors in activities other than manufacturing, trade, transport and some services. The investors in the above mentioned activities with stock of investment less than FIM 30 million are sampled in four strata. The total number of respondents will add up to some 400. The realised increase in the number of respondents is mainly caused by the Eurostat FATS requirements.

The survey of direct investments in Finland is also a stratified sample survey. Two take-all strata exist in the latter survey: Major enterprises with share capital more than 50 million FIM and all new direct investment enterprises. These two strata total to more than 600 respondents. The sampled strata with stock of investment less than 50 million (by main activity, the same as above) as well as a take-all from other activities raise the total number of respondents to 800.

## 9. TRADE RELATED FINANCIAL FLOWS

The 95 per cent coverage is beyond reach in export receivables and import credits. For imports credits a stratified sample survey is being conducted in 2001. The list of importing enterprises (18 000 in 1999) supplied by the Board of Customs was used as a frame. The frame was divided to five strata employing Neyman allocation, The fifth stratum was exempted from the survey because it consists of units importing annually less than 0.3 Million FIM (0.05 Million euro). The imports of this fifth stratum amount to less than 0.3 per cent of total imports. The enterprises responding to the multi frequency survey were exempted as well. The total sample size was some 400 enterprises. The survey results (available in summer) will provide appropriate levels and the grossing-up procedure for the variables in the multi frequency survey will be updated accordingly.

For export receivables the coverage of the running monthly and quarterly surveys is greater than in import credits, but not adequate to employ a simple grossing-up procedure. However, one target is that the total stock of the export receivable could be estimated using econometric techniques employing the prevailing small enterprise population of the multi frequency survey along with the complete export register. This would facilitate the production of rolling monthly statistics without any increase in the enterprise reporting burden. A project for this purpose will be initiated in autumn 2001.

### Literature:

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- (2) Michel A. Hidioglou: *The Construction of a Self-Representing Stratum of Large Units in Survey Design*, in *The American Statistician* 1986, Vol 40, No 1
- (3) W.G. Cochran: *Sampling Techniques*, John Wiley & Sons, Inc., 1963
- (4) Pierre Lavallée and Michel A. Hidioglou: *On the Stratification of Skewed Populations in Survey Methodology*, June 1988, Vol 14. No 1, pp. 33-43 *Statistics Canada*
- (5) Dan Hedlin: *On Stratification of Highly Skewed Populations*, in *R & D Report, Research-Methods-Development* 1998:3, *Statistics Sweden*
- (6) Risto Lehtonen and Erkki J. Pahkinen: *Practical methods for Design and Analysis of Complex Surveys*, *Statistics in Practice Series*, John Wiley & Sons, 1995
- (7) Carl-Erik Särndal, Bengt Swensson and Jan Wretman: *Model Assisted Survey Sampling*, *Springer Series in Statistics*, ISBN 0-387-97528-4, New York, 1997
- (8) *Invited Papers in The Second International Conference on Establishment Surveys*, June 17 –21, 2000, Buffalo, New York.



Bank of Finland  
 Statistics Department  
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### Reporting scheme for BOP Financial Account, investment income and IIP data collection

Target respondent population	Frequency of reporting	Number of reporting institutions	Coverage (in relation to stocks)	Timeliness (time for submission after the end of the reference period)
<b>Foreign assets and liabilities (stocks and flows)</b>				
MFIs	Monthly	13	Full	15 banking days
Other financial institutions	Monthly	16	Full	15 banking days
Other financial institutions	Quarterly	11	Full	15 banking days
Enterprises	Monthly	35	80% cut-off	15 banking days
Enterprises	Quarterly	35+80	95% cut-off	15 banking days
Enterprises	Annually	35+80+250	Full	4 months
Central government	Monthly	4	Full	15 banking days
Central government	Quarterly	3	Full	15 banking days
Local government	Quarterly	6	Full	15 banking days
<b>Foreign asset and liability stocks with geographical breakdown</b>				
Other financial institutions	Annually	27	Full	4 months
Enterprises	Annually	115	95% cut-off	4 months
<b>Portfolio Investment asset stocks with geographical breakdown</b>				
Mutual fund -companies	Annually	23	Full	2 months
<b>Securities trade between residents and non-residents</b>				
Securities brokers	Monthly	27	Full	15 banking days
<b>Direct Investment in Finland</b>				
MFIs	Annually	13	Full	4 months
Other financial institutions	Annually	27	Full	4 months
Enterprises	Annually	800	Sample survey	4 months
<b>Direct Investment abroad</b>				
MFIs	Annually	13	Full	4 months
Other financial institutions	Annually	27	Full	4 months
Enterprises	Annually	400	Sample survey	4 months

## A SURVEY PROCESS

### 1. TARGET & CHARACTERISTICS

Definition of main target variables, frequency and characteristics according to user needs  
Legal background and first contacts to enterprise organisations

### 2. POPULATION & REGISTERS

TARGET POPULATION  
(in theory)

GENERAL ENTERPRISE REGISTER  
(in practise), example: 2 mill. enterprises

### 3. LIMITATION PROCESS

Other information, auxiliary variables related to survey variables, check and update of frame data

### 4. FRAMES

LARGE ENTERPRISES

Examples:  $F_1=2000$

KNOWN FROM VARIOUS  
SOURCES RELEVANT  
TO SURVEY

$F_2=20000$

ASSUMED RELEVANT  
TO SURVEY

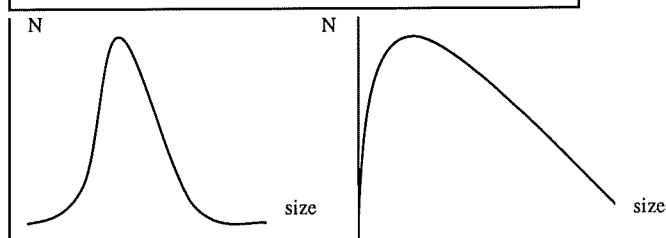
$F_3=40000$

### 5. TARGETED SURVEY POPULATION

SURVEY POPULATION

$N = F_1+F_2+F_3$   
Example:  $N=62000$

#### Possible distributions of survey population



Survey variables or auxiliary variables

### 6. FORMS

Form planning and form laboratory tests; the IT solution for the forms, form piloting, consultations with respondents: form details, availability of data and respondent instructions

### 7. SAMPLING

TAKE-ALL  
STRATUM

Example  $n_1=2000$   
Sampling rate 100 %

TAKE SOME

Example  $n_2=2000$   
Sampling rate 10 %

STRATA

Example  $n_3=1200$   
Sampling rate 3 %

Total sample  
in example  
 $n=n_1+n_2+n_3=$   
5200

Boundaries and strata sizes: Variance (precision), total sample size, costs, statistical allocation algorithms available (survey- or auxiliary variables)

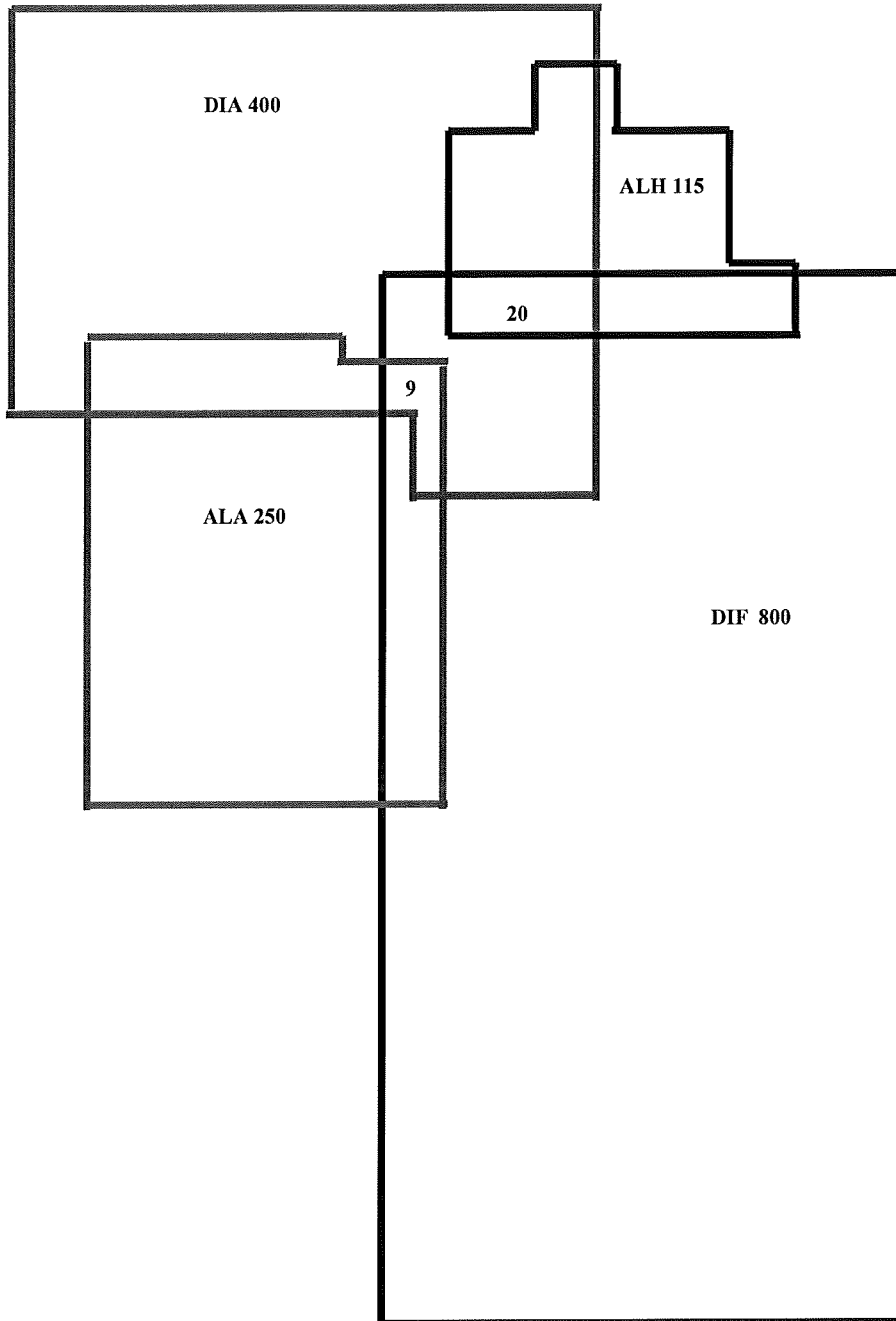
### 8. DATA COLLECTION

IT application for collection and information system; database, input and output

9. Validation of returns, imputation for non-response, treatment of outliers, estimation (grossing-up), processing the results, update of the frame, improvement of methods, etc



### OVERLAP OF RESPONDENTS IN FOUR SURVEYS



DIA = direct investments abroad  
DIF = direct investments in Finland  
ALH = assets and liabilities, high frequency  
ALA = assets and liabilities, annually

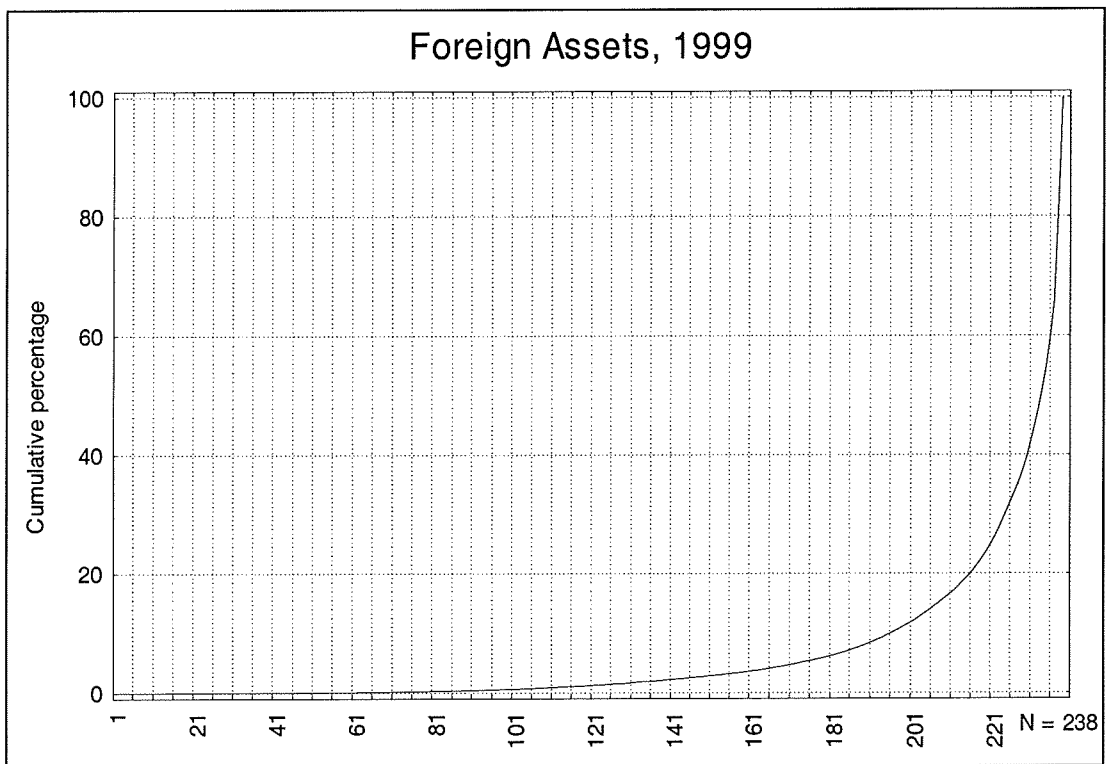
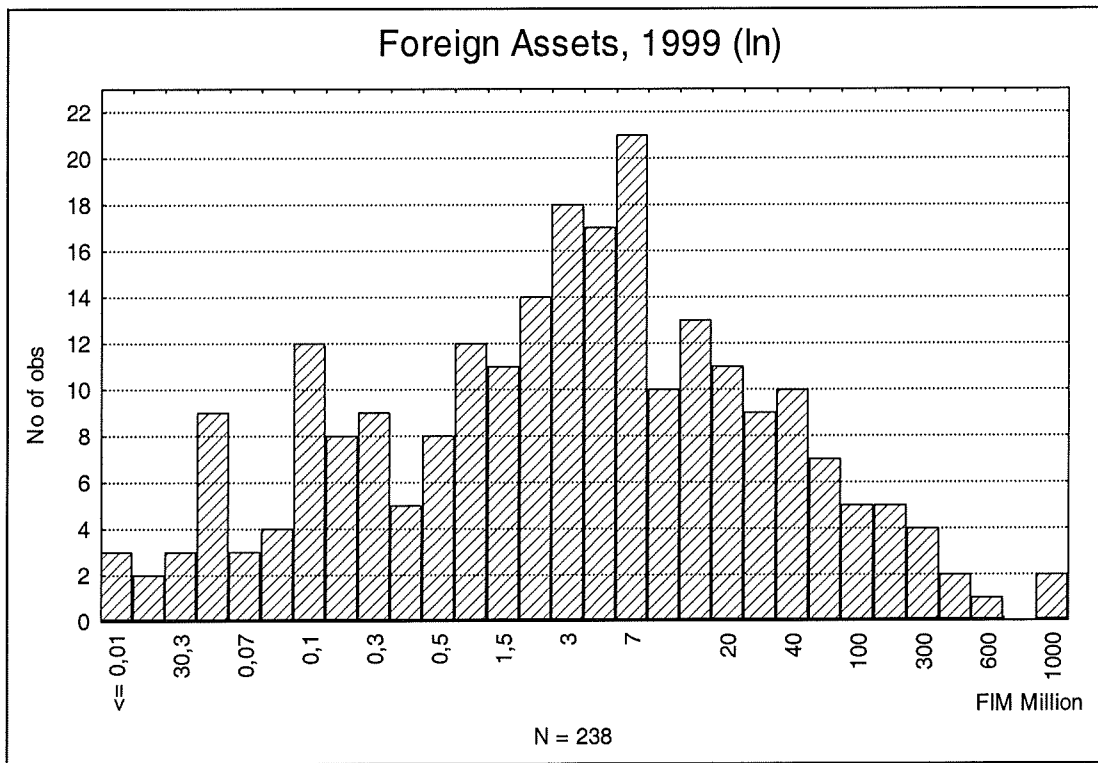
### Total Foreign Liabilities as Dependent Variable

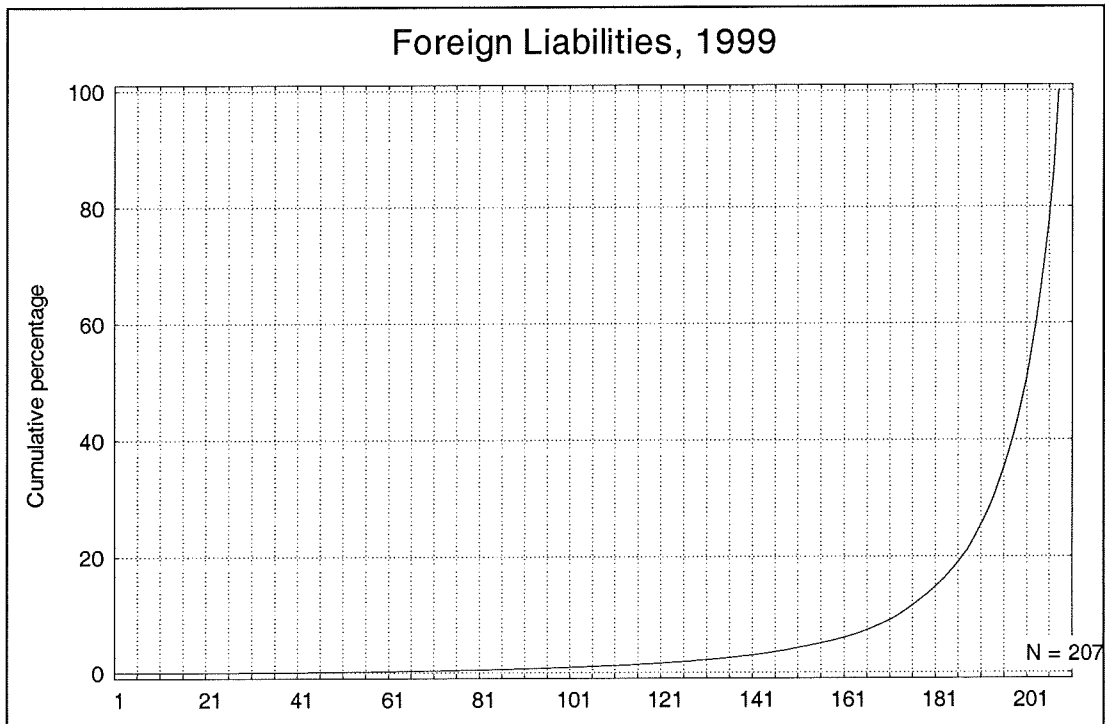
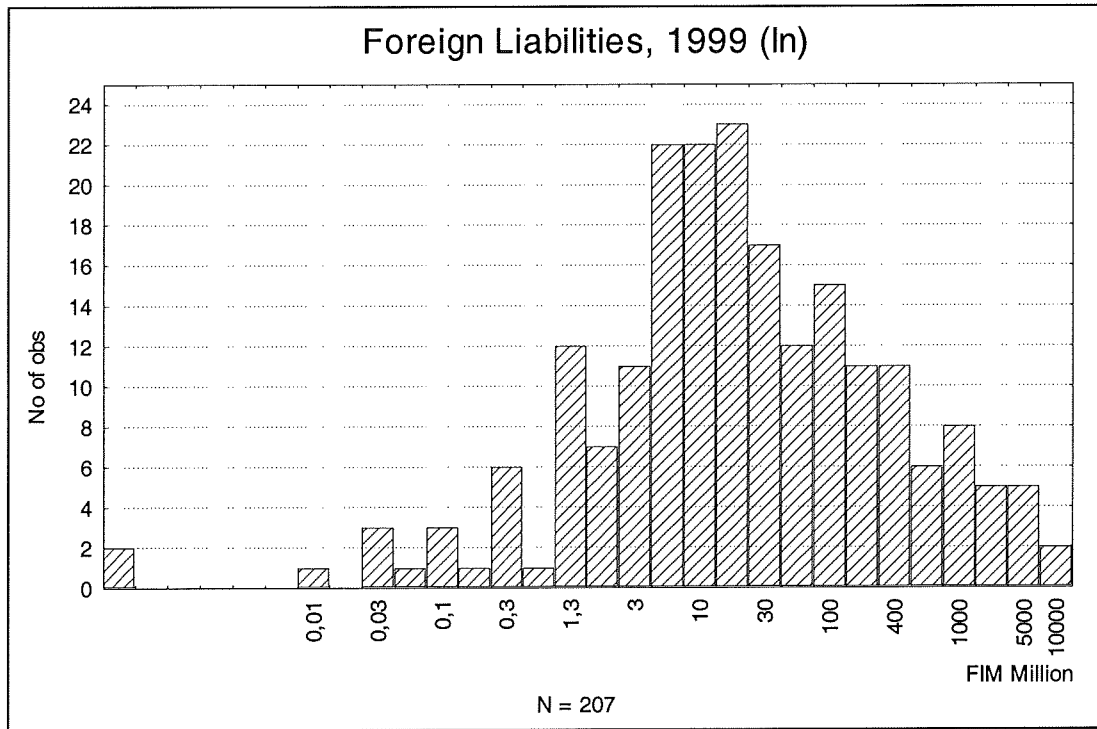
Independent variable	B	St. Err. of B	t(64)	R2	F	Outlier/ number	St. Err. Of Estimate
Turnover	0.70	0.02	28.18	0.93	794.20	2	1.63
Current assets	0.92	0.04	21.15	0.87	447.20	3	2.12
Financial assets	0.82	0.03	27.97	0.92	782.09	2	1.65
Loans from credit institutions	0.96	0.04	22.73	0.89	516.68	6	1.99
Long term liabilities	0.84	0.02	34.90	0.95	1217.80	5	1.34
Short term liabilities	0.82	0.03	30.52	0.94	931.21	2	1.52
Liabilities, total	0.74	0.02	34.20	0.95	1169.80	3	1.36
Turnover+liabilities	0.66	0.02	30.22	0.93	913.04	3	1.53
Turnover+financial assets	0.67	0.02	28.06	0.92	787.09	2	1.64

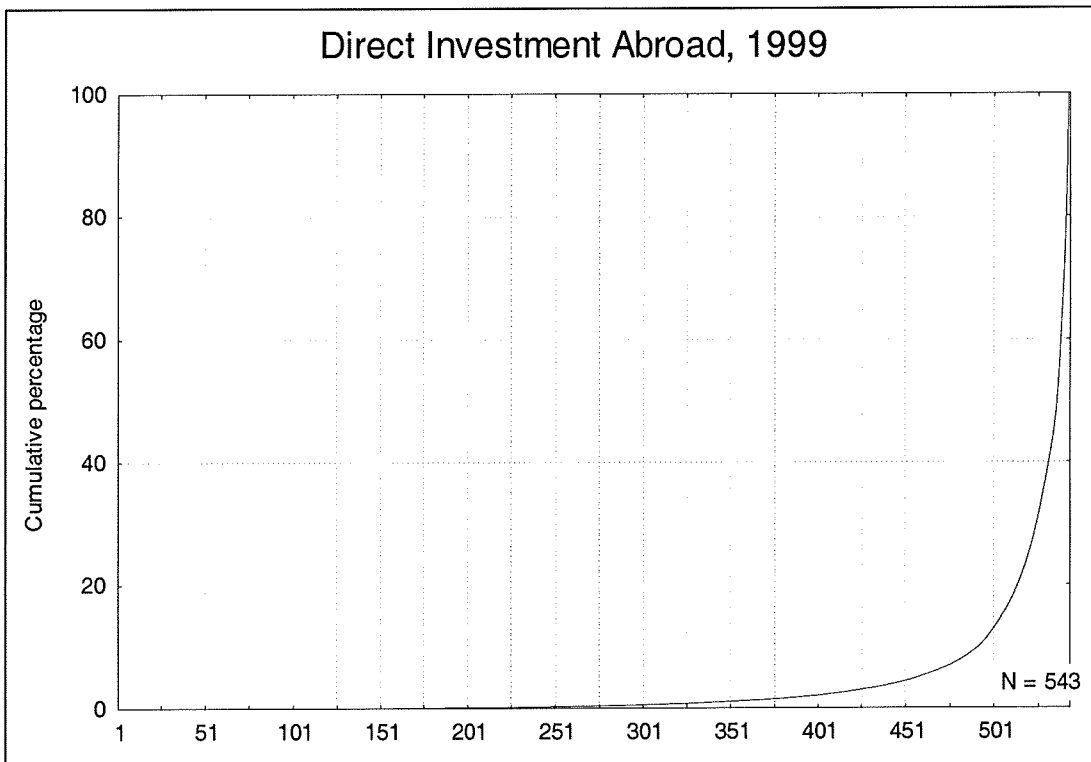
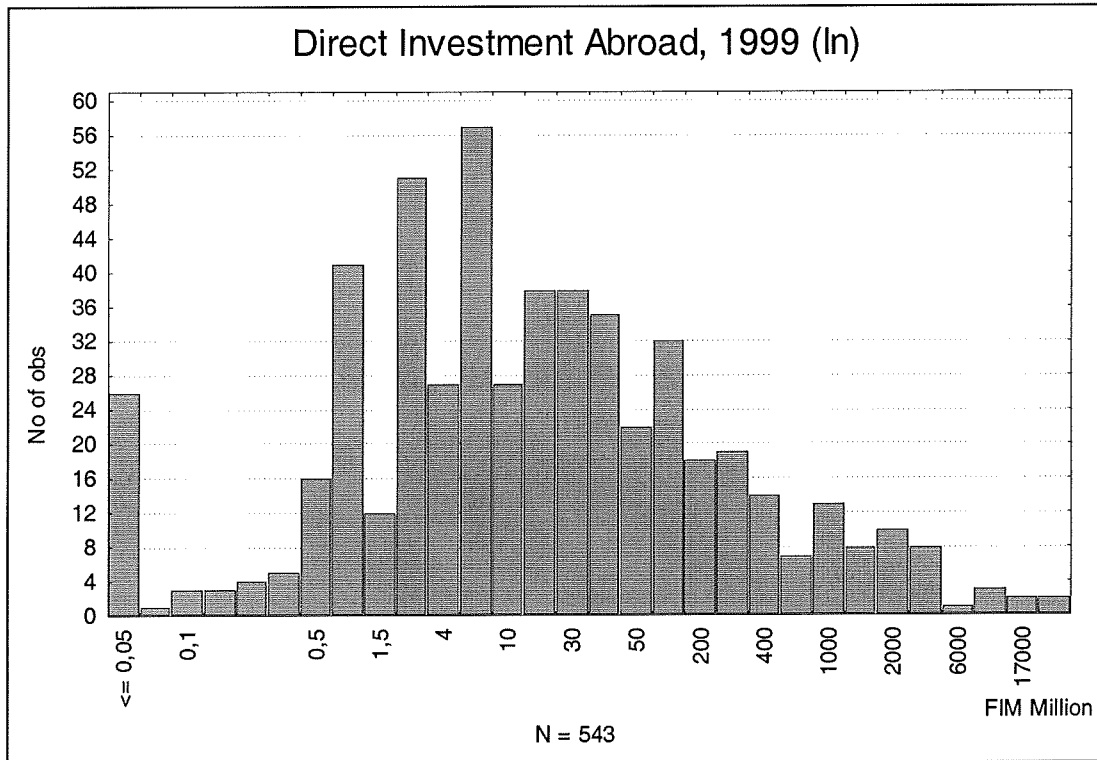
### Total Foreign Assets as Dependent Variable

Independent variable	B	St. Err. of B	t(55)	R2	F	Outlier/ number	St. Err. of Estimate
Turnover	0.59	0.02	25.93	0.92	672.45	3	1.41
Current assets	0.79	0.04	22.14	0.90	490.23	3	1.63
Financial assets	0.69	0.03	27.38	0.93	749.76	2	1.34
Loans from credit institutions	0.76	0.07	11.14	0.69	124.04	2	2.85
Long term liabilities	0.71	0.03	23.07	0.91	532.02	3	1.57
Short term liabilities	0.69	0.03	26.25	0.93	689.02	3	1.40
Liabilities, total	0.63	0.02	26.99	0.93	728.69	3	1.36
Turnover+ liabilities	0.56	0.02	26.34	0.93	694.05	3	1.39
Turnover+financial assets	0.69	0.03	26.25	0.92	689.02	3	1.40

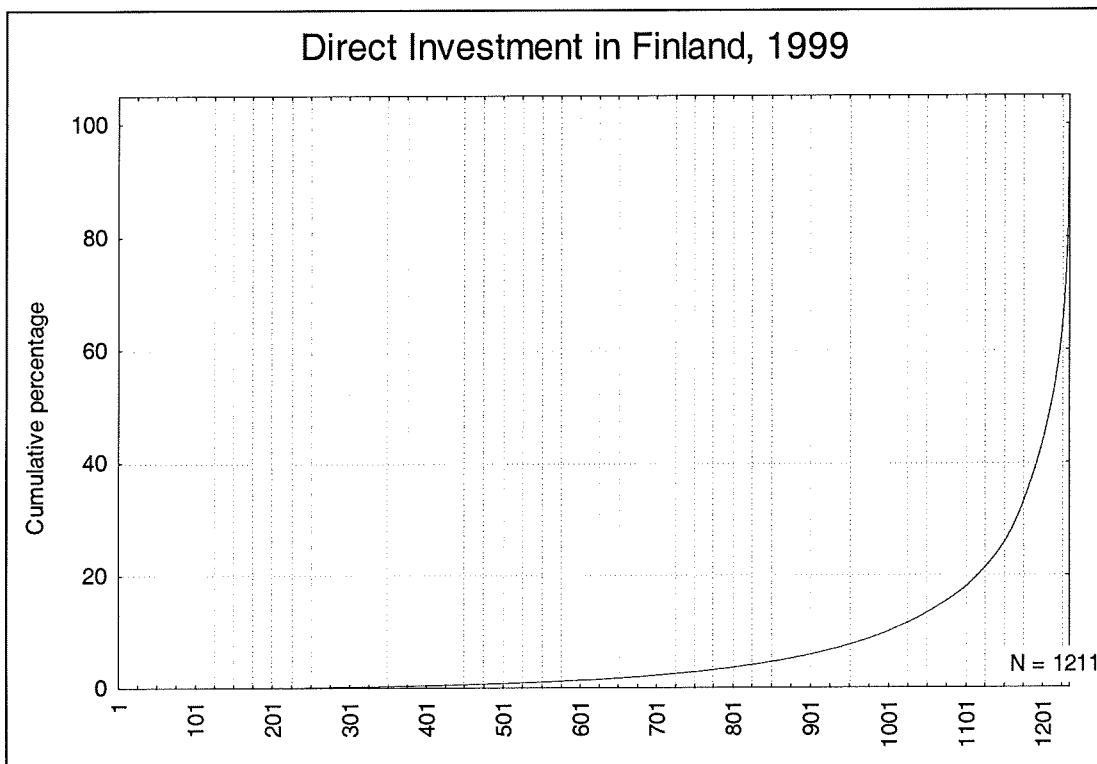
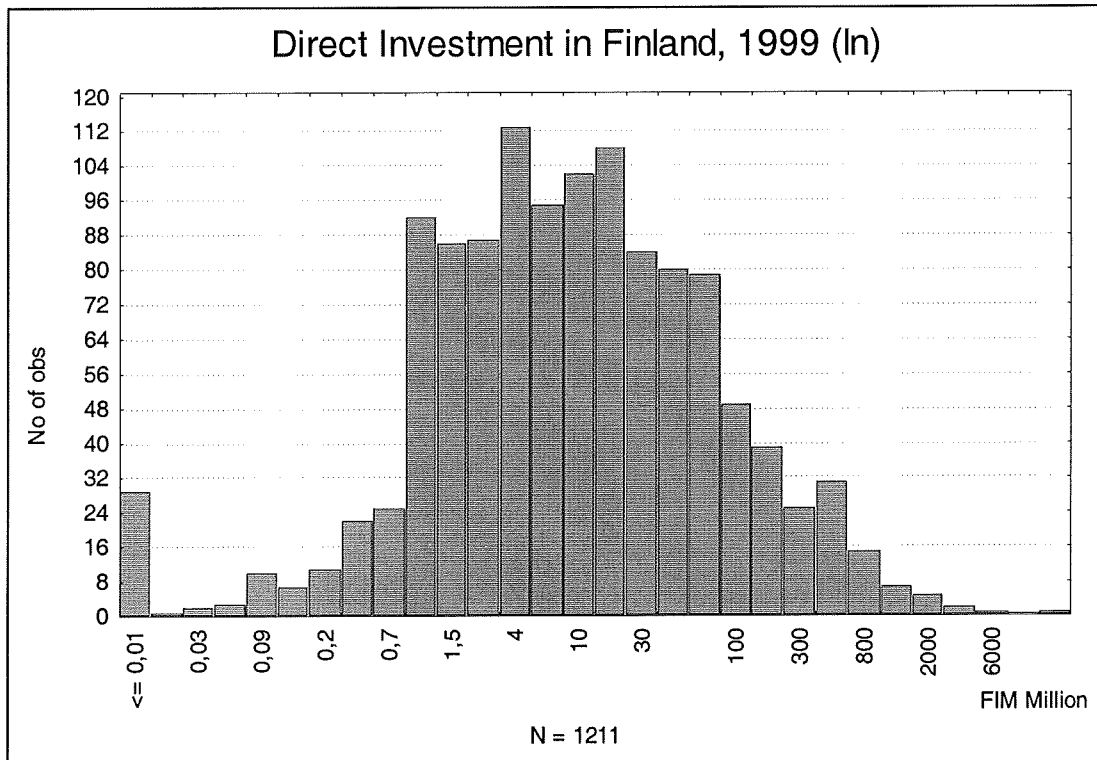
All variables in logarithms and models estimated without a constant











	Valid N	Median	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.	Skewness	Kurtosis
Foreign liabilities (FIM Million)	207	24.50	82716.25	0.00	10990.69	6.47	137.84	1211.45	5.35	35.46
Foreign liabilities (In)	207	3.20	669.86	-8.18	9.30	1.87	4.93	2.83	-0.69	1.86
Foreign assets (FIM Million)	238	3.51	9732.69	0.01	1783.72	0.49	16.34	166.55	8.40	79.40
Foreign assets (In)	238	1.26	250.14	-4.90	7.49	-0.72	2.79	2.57	-0.12	-0.46
Direct investment in Finland (FIM Million)	1211	9.00	119294.60	0.01	19582.20	2.36	43.20	641.22	24.49	715.00
Direct investment in Finland (In)	1211	2.20	2724.05	-4.61	9.88	0.86	3.77	2.28	-0.36	0.85
Direct investment abroad (FIM Million)	543	12.00	237512.35	0.03	34041.84	2.29	83.99	2242.09	10.22	126.01
Direct investment abroad (In)	543	2.48	1424.86	-3.51	10.44	0.83	4.43	2.73	0.13	0.02