Can we believe the results of researches based on business surveys?

by

István János TÓTH* – János VINCZE+

Budapest, 2000

*: senior research fellow, Institute of Economics Hungarian Academy of Sciences, e-mail: tothij@econ.core.hu
+: advisor of the Dept. of Economics and Research, National Bank of Hungary e-mail: vinczej@mnb.hu

Topics

When making economical studies based on questionnaires made by the companies, it is essential to clarify how much we may trust the accuracy and genuineness of data given by the managers of the firms, how much accurate, reliable and valid results do these surveys give. Thus, how far do these results correspond to the multitude of companies chosen? Three questions are to be examined. Firstly, the *accuracy* of data. Secondly, the extent of random errors, i.e. the *reliability* of the survey. Thirdly, we have to investigate the consistently existing distortions and their degree made during the inquiry, i.e. the *validity* of data[1]. More precisely we are to investigate the following questions:

a) How far do the data given in the questionnaires reflect the situation of the companies appearing also in statistical registers? This can be questioned because giving accurate data on the situation of the firm increases time needed to fill the questionnaire. Therefore, on many occasions the managers give only approximate data. What are the limitations of the acceptance of these imprecise figures? If the estimated date given by the managers of the company show great inaccuracy compared to otherwise measurable data, it suggests that it is only a waste of time to inquire these features.
b) Are there any regular differences in the accuracy of data among particular groups of the companies? If there are, this could be a warning for the planning of the research. In the case of some groups of companies and characteristics, it is questionable whether there is any use of making the survey.
c) The third question that is raised is whether the inquiry distorts or not in respect to the willingness of the companies to reply depending on their actual business situation. Thus, does a firm in worse situation, having difficulties, display systematic and significantly worse willingness to respond than does who have a well-established situation with good business prospects? In case we find indications of this type of distortion, than we are not allowed to generalise our results directly, these do not represent the situation of the multitude of companies.

We think we have put up enough questions, in order to raise doubts in our readers about the accuracy and validity of all empirical economical research that is based on conclusions of questionnaires of companies. These include *ad hoc* researches made with a particular research goal, as well as the regularly made business forecast surveys based on the answers of the companies. This problem can be raised as either it is impossible to answer the questions – as we do not have any information concerning those not surveyed, about the parameters to be examined - or in case these controlling examinations could theoretically be accomplished, the researchers making the *ad hoc* surveys or business surveys usually forget about them. However, it would be essential to examine the accuracy, the reliability and the validity of all results gained from empirical analysis relying upon questionnaires filled out by economical actors.

[1] About the reliability and validity see Carmines, E. G. – Zeller, R. A. *Realibility and Validity of Assessment*. SAGE Publications. Inc. Beverly Hills. London Carmines et al., 1979.

The survey

Rejecting the previous practice, in this study we will examine the accuracy and validity of an *ad hoc* survey[2] of a company sent through the post, that had to be filled out individually. Hereby, we follow a research strategy that was successful in a former empirical study, also sent through the post[3].
We aimed during the selection of the sample, to include in the survey (PRICE98) a wide range of companies from the competition sector, with the exception of micro- and small businesses. The business behaviour and management of the latter differ quite considerably from the other parts of the enterprising sector. The micro- and small businesses are usually built upon family or acquaintance connections, selling on local markets, supporting the maintenance of the family as economical units. And as such, they can hardly be separated from the households, which gives the infrastructural background and capital resources of their existence. Therefore, we have defined the standpoints of the selection so to include into the multitude of the companies those who meet the following requirements:

- active in the manufacturing industry, construction or trade
- the value of total assets according to their balance sheet made in 1996 exceeds 0 (this was made to eliminate the non-existing companies)
- the number of employed was greater than 20 person in December 1997 or
- according to the company's balance sheet made in 1996, their net sales was greater than 250 million forints.

By giving the joint requirement of the number of employed and the net sales (net turnover), our aim was to prevent the exclusion of companies from the examination that employ only a few persons, but have significant turnover. These are unlikely to belong to the group of small businesses mentioned above.

The addresses were given by the Hungarian Central Statistical Office (HCSO, in Hungarian: Központi Statisztikai Hivatal) according to the company's balance sheet data made in 1996 (the most current information available at the beginning of our research in May 1998) and labour statistics of the HCSO. The inquiry was made by TÁRKI. 5026 companies have met the requirements; these companies formed the chosen population. We have selected randomly a sample of 3030 companies, to whom we have sent the questionnaire of the research at the last week of May. Out of more than 3000 companies, we have received 451 answers till the 15th of July 1998, which gives a 14.9 per cent of responding rate. This is not considered bad in comparison to the posted surveys - where usually it is advised that the questionnaire consist of only a few questions – in our case we have made a rather extensive questionnaire. We have to admit, that like in the British survey used as our model of research[4], we had to rely on the active participation of questioners, as in the case of

[2] The topic of survey was the price setting behaviour of Hungarian firms. The first results of the survey, see : Tóth I. J. – Vincze J.: *Magyar vállalkozások árképzési gyakorlata*, (Price setting behaviour of Hungarian firms), Working Papers of National Bank of Hungary 1998/7, (in Hungarian).
[3] See Tóth I. J.: Market links and groeth capability of enterprises in a transforming economy: the case of Hungary In: Csaba, L. (ed): The Hungarian SME Sector Development in Comparative Perspective, CIPE-KOPINT-DATORG, Budapest, 1998. pp. 29-59.
[4] See : Hall, S. – Walsh, M – Yates, T.: How Do UK Companies Set Prices? Workshop on Monetary Policy, Price Stability and the Structure of Goods and Labor Markets, Perugia. 27-28- June 1997 (mimeo), and

approximately 160 questionnaires, the inquiry was not made through the post, but the questioners personally delivered the questionnaire to the management of companies appearing on the list, and waited for its completion.

In respect of the features of the surveys posted, as in other cases, the bigger companies more frequently completed and sent the questionnaires back than the smaller ones. Therefore, the sample of responders distort towards the bigger companies: for example the ratio of companies employing more than 250 people among the responders is more than two fold bigger than the ratio corresponding to their weight in the selected population of firms. The proportional differences among the sectors can be attributed to the same effect. Thus, the sample of responders did not reflect the ratio of the sectors and the company sizes of the population of firms (see Table 1.). After re-weighting the distribution of the sample of responders according to their sectors and company sizes, it did not differ significantly from the ratio of the 5026 companies chosen.

Table 1.
Distribution of the selected population of firm and the surveyed sample (PRICE98) by sector and employment
(%)

	Selectad population of firm (*N*=5026)	Surveyed sample (*N*=451)
Sectors (sector codes)		
Food products, beverages and tobacco products (15,16)	8.7	9.5
Textiles, clothing, leather and fur products(17-19)	9.0	8.2
Timber, paper and printing industry, publishing (20-22)	5.6	6.2
Chemical industry (23-25)	4.1	4.4
Non-metallic mineral products (26)	2.0	1.8
Metallurgy and metal treatment (27,28)	6.8	8.2
Manufacture of machinery (29-35)	11.4	15.1
Other manufacturing industries, recycling (36,37)	2.4	3.3
Construction (45)	15.3	11.5
Trade (51,52)	34.7	31.8
Total	*100.0*	*100.0*
Categories according to number of employees (head)		
At least 20	18.9	15.5
21 – 50	43.0	33.0
51 – 250	30.0	35.3
Above 250	8.1	16.2
Total	*100.0*	*100.0*

According to our sample selection strategy, we have chosen bigger companies for our examinations. Thus, these play a non-negligible role not only in a regional, but also in the whole domestic market. As a great proportion of the big companies of the processing industry conveying to domestic markets export abroad also, the role of the companies inquired additionally to the domestic sales, is substantial in regard of the export sales.

Small, I. – Yates, T. A Shred of Survey Evidence on why (or at least where) Prices are Sticky. Workshop on Monetary Policy, Price Stability and the Structure of Goods and Labor Markets, Perugia. 27-28- June 1997 (mimeo).

The selected 5026 companies give a negligible proportion of the corporations participating in the Hungarian enterprising sector. (According to analysis of the KSH, 114 thousand legal entity joint investments operated in 1996. These include almost all the companies comprised in the selected population of firms; i.e. they give 4.4 per cent of the population of the firms with legal entity.) Nonetheless, if we consider the number of employed, the volume of domestic and exporting sales this group plays a fundamental role in the Hungarian economy (see 2. Table).

Table 2.
The weight of selected population in the Hungarian economy in 1996

	Hungarian economy (1)	Selected population of firms (2)	Share (2)/(1) (3)
Number of employee (thousand head)	1702	453	26,6
Domestic net sales (billion HUF)*	6150	2805	45,6
Export sales (billion HUF)	1537	606	39,4

* *Only manufacturing, construction and trade*

At this point the question can be imposed: to what can we compare the data of the survey of the companies, in order to consider it accurate? Naturally, it is not worthy to compare the data obtained to "reality". For the real situation ought to be surveyed in this case, similarly as we ask the opinion of the company managers about several parameters of their firms. In order to study the real situation we must define it first. And this can not be done unambiguously.

We may solve this known theoretical analysis problem by establishing a reasonable abstract definition concerning the measurable object to be examined in advance and search for its indicators, or by making studies corresponding the definition independent from each other. In our case, we can compare the results of our questionnaire study to the data otherwise published by the companies themselves. These data about the companies are displayed in statistical registers and in balances sheets of the company.

We will examine two questions. On one hand the *accuracy* of the data obtained from the answers given in the questionnaire about a precisely defined characteristic, *the net turnover* and on the other hand the reliability of the examination in the light of the distortion of the willingness to respond. When analysing the reliability of the companies situation two variables, the *growth rate of the net turnover* and *the operational return proportional to the number of employed* have provided the basis of our judgement. Out of these two features the first always explicitly characterises the dynamics, whereas the latter demonstrates the profitability. Furthermore, we use additional control variables in our analyses (see Table 3.).

Table 3.
The number of companies in the accuracy and validity tests

	Selected population	Surveyed firms
Number of firms in the original analysis	3030	451
Number of firms in the accuracy test in case of net turnover	300	300
Number of firms in the validity test in case of		
– growth rate of net turnover	1620	296
– growth rate of employment	1584	289
– operational profit/employment in 1995	2418	368
– operational profit/employment in 1996	1728	313
– growth rate of operational profit	1630	301

During our examination we have combined several available data resources (see Table 4.).

Table 4.
The contents of data sources used

	Original data sets				Result (matched) data set
Name of data set	HSCO - Addresses	PRICE98	Balance sheet data set in 1995	Balance sheet data set in 1996	PRICE-BALANCE SHEET
content	Name, sector, and statistical code of firm, generated code of firm	Responses of firm of survey questionnaire, Generated code of firm	Statistical code of firm, Sector Net turnover, Employment, Operational profit	Statistical code of firm, Sector Net turnover, Employment, Operational profit	Statistical code and sector of firm, From the survey: Net turnover and Employment of firm in 1996, From balance sheet data set: net turnover, employment, operational profit of firm in 1995-96

We had to face the problem that due to missing data, not all the indicators needed for our examination were provided. Not all questioned answered and not all indicators were available in the case of every company of selected population.

Among the selected population of the firms, as mentioned at the description of the survey, originally 5026 companies participated. Out of the 3030 firms selected randomly, 451 companies have returned our questionnaire. However, the tests required can not be accomplished, because there are significant data missing as shown in Table 3. among the third, and the half of the responders receptively.

Results

Relative error

For defining the accuracy, as mentioned previously, we have observed the differences between the answers of the questionnaire and the balance sheet, in the case of the net turnover in 1996. We have developed a variable that compares the degree of variance of the two indicators to their mean. This way we can estimate the amount of variance the indicators value add up to.
We defined the size of error (variance), that we call relative error (RE) by the followings:

$$RE_i = \frac{\sqrt{(t_i - k_i)^2}}{1/2(t_i + k_i)}$$

Where t_i is the data from the company balance sheet, k_i is the data derived from the questionnaire for all cases from i =1…n.

As zero and negative values are not permitted $k_i > 0$, $t_i > 0$ and thus $0 \leq RE_i < 2$ to all i.

Between the two indicator value a smaller *RE* represents a smaller, while a larger value means a larger error. If the value of *RE* is zero then the value of the two indicators are identical. Let us have a look at the values of *RE* in regard of the net turnover (see Table 5.).

Table 5.
Main statistics of the difference of responses in the balance sheet (1996) and the survey (PRICE98) and the relative error

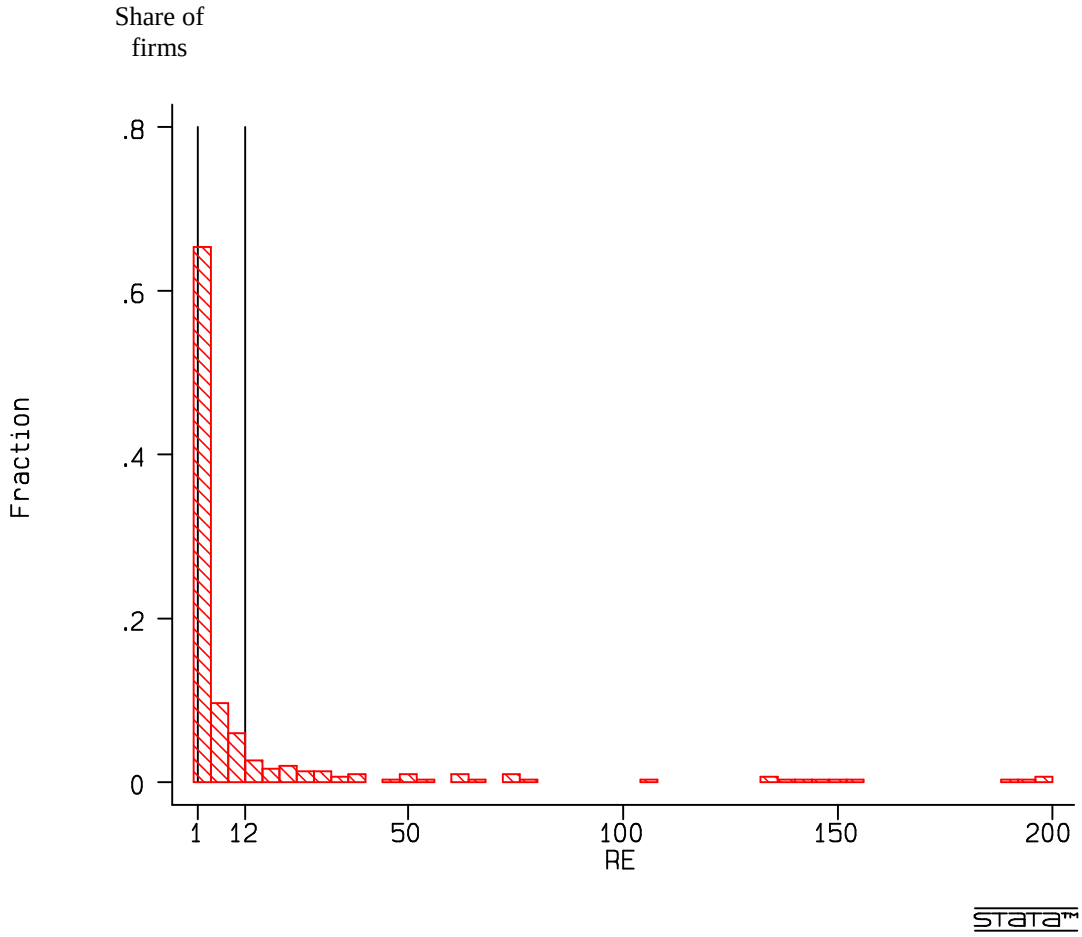
Cégcsoport	Difference in term of net turnover		
	Average	Standard deviation	Median
Total sample in the test (N=300)	-352.92	3757.60	102.00
21–50 head (N=118)	-19.45	147.28	86.00
51–300 head (N=128)	- 55.80	701.68	212.00
Above 300 head (N=54)	-1785.91	8710.62	-48.00
	Relative error (*RE*)		
Total sample in the test	0.130	0.332	0.008

We can see from Table 5., that the mean of *RE* has a quite significant standard deviation. Thus, in most cases there are no essential differences among the two observations, but certain excessive error cases increase the mean. However, the mean value of *RE* is still just so big, that the difference of the two indicators gives only 13 per cent of the observed indicators.

If we consider the distribution of the observed cases according to the *RE*, we can see that at more than 60 per cent of the companies the error is 1 per cent of the mean observed

indicators. And among 80 per cent of the firms it only reaches 12 per cent. The 1. Figure shows the distribution of the responding companies by the percentile value of RE.

1. Figure
Distribution of surveyed firms by the percentile value of RE



Do the estimation distort systematically?

Let us investigate, whether the degree of divergence (in term of RE) conceals any systematic distortion. We have studied the degree of divergence (size of RE), as well as the correlation between the net turnover and the number of employed given in the questionnaires. The two latter are also characteristic indicators of the size of the company. (All three constituents – presuming a lognormal distribution – were calculated as the logarithm of the original value.) The results indicate that the degree of the relative error increases in parallel with the reduction of the company size, i.e. the smaller companies usually gave less accurate answers than the larger ones (see Table 6.).

Table. 6
*Correlation coefficients between the relative error and the indicators of firm size**

	Log of *RE*	Log of employment	Log of net turnover
Log of RE	1,0000	-0.2774	-0.2245
		(293)	(300)
Log of employment		1,0000	0.5257
			(404)
Log of net turnover			1,0000

**: All coefficients are significant at 0.05 level*
Note: case number are in the brackets

Naturally, this will raise the question: does the relative error, besides being relatively greater among the smaller companies, conceal a systematically one way distortion? We might presume that the smaller companies – due to being involved in a greater extent in the *hidden economy* – **"**return" smaller net turnover in the balance sheets, than admit during the survey. In order to elucidate this question we have defined a variable (X), which shows the tendency and size of the divergence of the two observations. In addition, we have taken the divergence between the data of the net turnover given according to the balance sheets (B), and the questionnaire (Q), so that X = B - Q. Furthermore, we have determined an ordinal variable (EQ), which can take three values:

- -1, if X is smaller than zero (the sum indicated in the balance sheets is smaller than the ones given in the questionnaire) and the divergence is greater than 5 per cent of the value given in the balance sheets;
- 1, if X is greater than zero (the sum indicated in the balances is greater than the ones given in the questionnaire), and the divergence is greater than 5 per cent of the value given in the balances;
- otherwise 0.

Thus this means that if the responder has given the net turnover with a difference greater than ± 5% in the questionnaires compared to the one indicated in the balances, than we have interpreted this as significant divergence. We believe, we have defined the value that we consider accurate as strictly as required. Accordingly, the distribution of the companies in relation to their tendency of divergence was the following:

given in the balances sheet < indicated in the questionnaire	17.3%
given in the balances sheet ≈ indicated in the questionnaire	69.3%
given in the balances sheet > indicated in the questionnaire	13.3%

Thus the distribution of the variable indicates, that approximately 70 per cent of the inquired has given its net turnover with a difference only of ±5% in the questionnaire, compared to the data announced in the balance.

Afterwards, we have investigated how does the mean and the deviation of the companies net turnover and number of employed vary among the groups of firms, in respect of the EQ. We have presumed as a null hypothesis, that within the particular groups of companies neither the net revenue, nor the mean of the number of employed differ considerably from each other, i.e. the managers of the smaller companies during the survey "mistake" in the same way, as do the ones of larger companies. To confirm the hypothesis we have done analyses of variance (here, as previously, we have presumed the lognormal distribution of the number of employed and net income) the results of which is shown in Table 7.

Table 7.
Mean values of logarithm of employment and net sales by groups of firms in respect of EQ

Categories of EQ	Logarithm of net turnover	Logarithm of employment
	In the given company group	
Given in the balance sheet < indicated in the questionnaire	13.03	4.47
Given in the balance sheet ≈ indicated in the questionnaire	13.04	4.52
Given in the balance sheet > indicated in the questionnaire	12.31	3.90
F value	4.381	4.936
Sign. of F	0.013	0.008
N	300	293

The results do not support our original hypothesis about the inverse correlation between the tendency of distortion and the size of the company. That is, the smaller companies do not give systematically larger values during the investigation than they have stated in their balances. However, in light of our results, we have to reject our null hypothesis. The tendency of distortion and the size of the company are not independent from each other. Namely, it can be noticed among the groups obtained according to the *EQ*, that the data significantly differ depending upon the number of employed and the net turnover (the F statistics significant values indicate this), just on the contrary as we have expected. The companies pronouncing a larger value during the survey than given in the balance sheets, were plausibly from the group of smaller companies. Their mean net turnover and number of employed were significantly smaller than the other companies'.

Are the results valid?

Another way of verification is the investigation of the validity of the survey. Since in the original research we wanted to analyse the role of the profitability and growth capability of the companies in the determination of their prices, it is helpful to clarify that the groups inquired represent the selected population of firm. Hence, the willingness to reply does it not depend on the profitability or the growth capability of the companies? We have therefore studied the growth rate of the net turnover and of the number employed in 1996. Also we have inspected the operating results proportional to the net turnover and its changes according to the balance sheets among the companies answering and also among those not answering our questionnaire. We have introduced a variable (SSAMPLE) to indicate the responding willingness to our survey. This variable is 0 if the company had not responded, and 1 if it had filled out the questionnaire.

The explanatory variables were the following:

PQ96M: operating profit / net turnover in 1996,
PQ95M: operating profit / net turnover in 1995,
DP65M: the operating profit/ net turnover changes in 1996 (PQ96M/PQ96M),
LNDL65M- the logarithm of annual change of employment (number of employed in 1996/ number of employed in 1995),
LNDQ65M- the logarithm of the net turnover change in 1996 (net turnover in 1996/ net turnover in 1995).

According to our initial hypothesis, the two groups of firms significantly differ by their profitability and growing capability. Thus, the situation of the firms answering and their profitability is better compared to those not answering. Therefore, we gain a distorted picture if we base on the survey our estimation of the firms effect on price setting depending on their growth capability and profitability.

We have used two more variables during the analysis, which characterised the firm's size and sectors, as we tried to exclude the effect of the answering willingness from the effects depending on the firm's size and sector. This was necessary, as the original sample was not proportional concerning the firm's size and industry group, therefore it is likely, that the reason for refusing to answer was also due to the effect of the firm's size and industry besides the firm's situation (which we want to test).

We have studied in all cases of explaining variables, in view of the firm's size and industry, whether they ameliorate considerably the likelihood of answering. In light of the results (see Table 9) we have to reject the hypothesis that the firms in better position hold a greater willingness to answer.

Only in the dynamics of the net turnover of 1996 (*LNDQ65M*) can we observe weak correlation, and even this is just on a 10 per cent level significant. Nor is the tendency of the connection is what we have expected previously. On the contrary, we can postulate a lower rate of turnover increase among the responders in 1996 than among the non-responders. Hence, despite our former expectations the situation and growth capability of the non-responders seems to be more favourable compared to the responder's. This can easily be explained: as the original goal of the investigation was to study the characteristics and constituents of the domestic price setting, the only exporting or principally exporting firms answered in a smaller ratio during the survey than the other firms. In Hungary the principally exporting firms could increase its net turnover considerably in 1996 - like in 1997 and 1998 - than those not or to a lesser extent exporting[5]. The domestic price setting of the primarily export producers is either not sensible or belongs to the less important decisions of the managers. This may be the explanation of the smaller willingness to answer of the companies producing for export. However, the smaller weight of the firms principally exporting and the absence of the only exporting firms did not contradict with our original research assumptions as during the study of the price forming behaviour we wished to reveal the viewpoints of the price formation of the products sold in the domestic market.

[5] See: Tóth I. J.: *Outstanding expectations, more balanced growth. The business situation and perspectives of the Hungarian Largest Exporting Manufacturing Firms*. Business Cycles Research Papers 2000/1, TARKI, 2000.

Table 8.
Relationships between the willingness of answering and the growth capability and profitability of firms (logistic regression models)

	Dependent variable = SSAMPLE				
	Model 1	Model 2	Model 3	Model 4	Model 5
Sectors					
Food products, beverages and tobacco products	4.12	0.04	0.04	0.04	0.04
Textiles, clothing, leather and fur products	0.93	1.67	1.62	1.64	1.55
Timber, paper and printing industry, publishing	0.89	1.52	1.49	1.51	1.50
Chemical industry	0.77	1.26	1.31	1.34	1.30
Non-metallic mineral products	0.62	1.09	1.11	1.11	1.11
Metallurgy and metal treatment	1.15	1.73	1.76	1.78	1.84
Manufacture of machinery	0.97	1.70	1.66	1.73	1.66
Other manufacturing industries, recycling	1.51	2.35	2.50	2.47	2.52
Construction	0.75	1.32	1.27	1.30	1.26
Trade (reference)					
Employment (head)					
– 20	0.61**	–	–	–	–
21–50	1.88**	1.60**	1.58**	1.61**	1.56**
51–250	0.93	0.74**	0,77*	0.77*	0.77*
Above 250 (reference)					
PQ95M	1.00	–	–	–	–
PQ96M	–	1.00	–	–	–
DP65M	–	–	1.00	–	–
LNDQ65M	–	–	–	0.79+	–
LNDL65M	–	–	–	–	0.93
N	2468	1763	1664	1653	1413
-2 log-likelihood	1195.36	1620.63	1542.11	1530.80	1493.04
Model KHI^2	97.36	46.52	40.20	44.06	37.31

Note: the value of exp(b) are in the cells
\+ *p < 0,1*
* *p < 0,01*
** *p < 0,001*

Table 9.
Distribution of firms by the willingness to answer and the share of export sales in total net turnover, %

		Willingness to answer		
		Did not answer	Did answer	Total (N)
Share of export turnover in the total Net turnover	The share of export is lower than 90%	81.3	18.7	100,0 (1612)
	The share of export is at least 90%	88.7	11.3	100,0 (151)
	Total	81.9	18.1	100,0 (1763)

Non of the five explaining variables studied (see Table 8.) had influenced the willingness to answer. Though the rate of the net turnover growth was somewhat higher among the non-answerers than the ones answering, this was a natural consequence of the selection of research goal – the analyses of the domestic price setting behaviour. Accordingly, the sample of responders reflects appropriately the growth capability and business situation of the not exclusively exporting firms of the selected population of firms.

Conclusions

We have aimed in our study to answer to the question how much we can trust the accuracy and validity of the surveys made by postal sent out self-filled questionnaires. Furthermore, how far can we build on these managers estimations (regarding their firms data) obtained from these studies during business tendency surveys or other economical researches.

The results show that the managers' estimations do not differ substantially from the ones given in the firm's balance sheets, and only at a minor proportion of the firms can we observe greater inaccuracy. Moreover, it can be observed that the rate of inaccuracy changes adversely to the size of the firm: it is relatively more considerable among the smaller than the larger firms. Consequently, the researches that are based exclusively on data gained from self-filled questionnaire inquiries of small business managers may contain greater uncertainty and distortion, than those made among middle and large firms. We could also perceive that we do not have to deal with systematic distortion during the voluntary answering that would derive from a greater willingness to respond among the group of managers of the firms in better situation, with better business results than among those with worse results. The results obtained support the presumption that during the business surveys no distorted result comes from the voluntary answering. According to our present knowledge, we do not have any reason to doubt the accuracy and validity of these studies. However, obscure questions remained. We mention three as an example: 1) we do not know which factors influence the accuracy and validity of the leaders answers aside from the characteristics studied; 2) we do not know the *reliability* of the business surveys; 3. nor have we any information whether the willingness to answer correlate with the short-term prospects and expectations of the firms.