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RESPONSE BURDEN AND DATA QUALITY IN BUSINESS SURVEYS: THE EXPERIENCE OF BANCA D'ITALIA

by Marco Bottone*, Lucia Modugno* and Andrea Neri*

Abstract

In this paper we analyze the dynamics of response burden in the main business surveys conducted by Banca d'Italia and we investigate its relationship with some data quality indicators. We find evidence of a significant increase in actual burden over time which has contributed to amplifying the perceived burden. Our results also show a clear link between a respondent's perceived effort and the probability of not answering some important questions (such as those relating to expectations of future investments and turnover) or of dropping out of the survey. Further, we find that firms reporting a high perceived burden tend to provide inaccurate answers to quantitative questions and to choose the first plausible response when confronted with complex questions.

JEL Classification: C8.
Keywords: response burden, business survey, item and unit non-response, measurement error.

Contents

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1. Introduction[§]

Banca d'Italia has a long-standing tradition of conducting business surveys. The main one is the Survey of Industrial and Service Firms (INVIND hereafter). It has been carried out annually since 1972 and gathers information on investments, gross sales, the workforce, expectations and other economic variables relating to Italian industrial and service firms with at least 20 employees. Another important survey is the Business Outlook Survey of Industrial and Service Firms (BOS). It has been conducted since 1993 in order to respond to short-term economic analysis needs. It mainly collects qualitative information on firms' performance and on their future expectations. Both surveys are used by Banca d'Italia to monitor the economic outlook, to study firms' behavior and to assess the effectiveness of economic policy measures.

At the beginning, both surveys had limited objectives and the response burden put on firms was minimal. Over the years, the complexity of the surveys has steadily increased to meet growing information needs. The consequent increase in the response burden has raised concerns about its effects on data quality. These concerns are based on findings that businesses can reduce an excessively high response burden by not responding at all, by responding too late or by responding with data that is less accurate than required (Bavdaž 2010). Moreover, the response burden in business surveys has long been a concern for national statistical institutes (Eurostat 2009, Bavdaž et. al 2015).

Response burden is generally measured in hours spent (the number of dispatched or completed questionnaires times the average completion time) or in financial terms (by multiplying the hours spent by the average hourly cost of respondent's time) (Snijkers et al. 2013). Some studies suggest monitoring other aspects in addition to the actual burden. For instance, Dale et al., 2007, suggest measuring the perceived response burden (defined as the perception of time and effort required to fill in the questionnaire), the perceived causes of response burden (measured as reasons for time consumption) and the motivation (measuring perceived usefulness to business and society).

In this work, we first measure the actual response burden imposed on businesses in the two main business surveys conducted by Banca d'Italia. We use two indicators: the number of pages in the questionnaire and the number of fields to be filled in and we study their evolution over time. We then focus on respondents' perceived burden. We test the hypothesis that it is not just the actual burden itself but the perception of time and effort that is likely to affect several dimensions of data quality, such as the propensity to participate in the survey, to provide all the information requested and to give accurate answers. Time passes quickly if the topic is interesting and if the respondent feels that he or she is able to answer the questions posed. In contrast, time passes slowly for the respondent if he or she thinks that answering the survey questions is an unprofitable activity or if he or she feels incompetent to answer them. To our knowledge, few studies have investigated the link between perceived burden and data quality in business surveys (Giesen 2011). Our study hopefully contributes to filling this gap in the literature. Moreover, the analysis is particularly relevant for the surveys run by Banca d'Italia since they rely on firms' voluntary participation.

[§] The views expressed are not necessarily shared by the Bank of Italy. We thank Giovanni D'Alessio and Alfonso Rosolia for comments.

2. The business surveys at Banca d'Italia

The survey of Industrial and Service Firms began in 1972[1] and only covered industrial processing firms with at least 50 workers. Over the years the sample size has grown progressively . Since 1999, it has included all manufacturing firms as well as energy firms and those in extractive industries; since 2001 it has incorporated firms with 20 to 49 workers and since 2002 non-financial private service firms with at least 20 workers. From 2002 onwards, the sample has consisted of about 4,000 firms, of which around 3,000 belong to the industrial sector and the remaining to the service sector.

The survey uses stratified sampling. The strata consist of combinations of the branch of activity, size class (in terms of the number of employees) and region in which the firm's head office is located. Firms that have been interviewed in past waves and which are still in the target population are always contacted for a new interview. Note that a firm can drop out of the sample either by its own accord, on account of bankruptcy or because it has fallen below the surveyed size threshold. Firms with more than 5,000 employees are self-representative units (for further details see Banca d'Italia, 2017).

The interviews are conducted between February and April by Banca d'Italia's territorial branches. The questionnaire is usually composed of two parts: a core part collecting quantitative information on actual and expected structural characteristics and a monographic section for conjunctural analysis. To try to contain the costs incurred by respondents, a random subset of firms (rotation) are asked some of the questions in the monographic section.

The BOS began in 1993 and is carried out between September and October. The survey is run on the same sample of firms used in the INVIND survey and has the same reference population. This questionnaire also usually consists of a standard section and a special section but it contains mainly qualitative questions that are always asked of the whole sample so there is no randomization.

In the period 2014-16, the samples used for the two surveys widely overlapped: most firms were interviewed for both surveys in the same year (Table 1). Moreover, Table 2 shows the number of waves to which firms have participated: almost half of the surveyed firms continued to participate in the same survey and a total of about 2,500 firms were interviewed six times in this period. Between 1984 and 2016, some 13,081 firms participated in the survey. These were interviewed between 1 and 57 times in 33 years, according to the distribution in Figure 1. In particular, more than 2,700 firms (21%) were surveyed at least 20 times in this time span. Of these, 53% at least seven times and only 18% just once (either for INVIND or for BOS).

3. Actual response burden

When INVIND was launched, its initial aim was to have fresh quantitative information about the year just ended on relevant macroeconomic aggregates. The official estimates of these statistics would have been

[1] Microdata are available since 1984.

disseminated later by the National Institute for Statistics. Analogously, the BOS was conceived to collect fresh qualitative information about the economic outlook. In recent years there has been greater timeliness in the dissemination of national accounting estimates and a wider availability of official high-frequency macroeconomic indicators. These two factors have contributed to reducing the use of business surveys for nowcasting purposes and to focus on the forecast of future periods and of distributional aspects, partly motivated by the development of modern micro-econometric techniques.

Business surveys have also increased the variety of topics covered in their questionnaires over time. In addition, other aspects such as the number of questions asked, the length of the wording of each question and of the relative response options, and the number of instructions included to assist in completing the questionnaire have contributed to increasing its length and complexity. Finally, the overall complexity has also been affected by the intrinsic difficulty of questions that are based on counterfactual scenarios or that require specific information that can involve various participants or even external consultants.

In order to study the evolution of the actual response burden over time we use the following indicators:[2]

- the number of pages which, despite being a rough indication of complexity, reflects not only the number of questions and their length but also the need to provide instructions to the questionnaire;
- the number of fields to fill in (the number of variables).

Information on the time required to fill in the questionnaire and the number of people involved is only available for the 2016 INVIND survey.

Figure 2 shows the evolution of the complexity of the INVIND and BOS over time.[3] The data confirm a progressive increase in the complexity of the INVIND questionnaire from 1984 to 2016. In particular, the number of variables more than tripled during the period, with greater growth occurring between the late 1990s and the early 2000s. Since then, the total number of variables in each questionnaire has remained stable, while the number of pages has increased considerably: it has tripled since 2001 and quintupled since the beginning of the survey. This marked increase took off in 2009, when for the first time the instructions for the respondents were placed below each question instead of in a separate document as previously done. This change increased the length of the questionnaire by about 5 pages in that year alone. Since then, the inclusion of longer and more complex questions, of numerous and long response options and of further instructions needed to explain the meaning of the terms used have further lengthened the questionnaire to 20 pages.
The BOS questionnaire has also undergone similar changes, albeit more gradually, particularly with regard to the number of variables (Figure 2, yellow line).

[2] When the question is asked to a subset of the sample (in order to reduce response burden), its contribution to the value of the indicator is reduced accordingly.
[3] For simplicity, the plot shows only the points in which the number of pages has changed.

4. Perceived response burden

The increasing number of respondents for the different surveys as well as the growing complexity of the questionnaires have rendered it important to monitor the possible dissatisfaction of respondents. Since 2003 for INVIND and since 2010 for BOS, a question has been included about the respondents' perceived burden. It allows for four possible responses ranging from 1 ('low') to 4 ('excessive')[4]. Figure 3 shows the available time series of the opinions given about the response burden of the INVIND and the BOS questionnaires. The red lines represent the share of firms declaring a 'high' or 'excessive' response burden and the green lines the share of those that find it low (we dropped the 'average' category since it remains more or less stable over time). In order to compare trends, we overlap the series of the number of variables (the black line, on the right axis). Over the period, the percentage of firms reporting a 'low' response burden in the INVIND questionnaire is rather stable at low levels. On the contrary, the share of firms declaring a 'high' burden is always greater than 35%, but in a cyclical pattern. As we expected, the perceived burden moves quite a lot with the objective burden represented here by the number of variables. Moreover, using the measures of actual response burden available for the 2016 wave, we find an increasingly positive relationship between the time spent and the declared response burden (Table 3).

The perceived burden of the BOS (Figure 3 on the right) follows a different trend, as one may expect given the questionnaire's smaller size. In fact, respondents' opinions are reversed with respect toINVIND. Namely, the share of firms reporting a 'low' response burden is always higher than the share of those believing it high. Also, in this case, we note an improvement in respondents' perceptions after 2012, seemingly correlated with the reduction in the number of variables.

To evaluate the relationship between the perceived response burden and the various factors that can affect it, we created a dummy variable equal to 1 if the perceived response burden is high or excessive and 0 otherwise, then we estimate a logistic regression using the following covariates:

- three indicators of the questionnaire's complexity: the total number of variables, pages and quantitative information required;
- the total number of waves (for both the BOS and INVIND) to which firms have participated at that time;
- indicators of the firm's performance, i.e. the yearly variation of turnover and employment and the ratio between investment and turnover in the previous and current years;
- firm characteristics such as firm size, the sector of activity and geographical area.

The first set of variables refer to decisions about the survey design which are under Banca d'Italia's full control, while firm characteristics and performance are mainly used as control variables. It is worth noting that the indicators of the questionnaire's complexity do not vary among respondents in a given wave, they only change over time. In order to account for the possible confounding effects of other time-varying factors, we include the growth rate of the (per capita) annual sectorial value added among the covariates. This variable should capture the effects of the economic cycle on the perceived response burden.

[4] The response categories are: 1='low'; 2= 'average'; 3= 'high'; 4= 'excessive'.

As expected, an increase in the total number of pages and variables in the questionnaire is significantly linked to an increase in the probability of a large or excessive perceived response burden from respondents, with the former playing a stronger role than the latter (Table 4). This evidence can be explained by the fact that the number of pages is the element of the questionnaire that is the most immediately perceivable and measurable by firms. However, it is important to note that the number of variables used as a regressor refers to the total number of fields in the questionnaire. The number of questions can differ across firms since it depends on the specific answer chosen for the filter question. Interestingly, the amount of quantitative information asked seems to be unrelated to the wide variation in the probability of reporting a higher response burden, probably because of the type of information asked. Indeed, quantitative questions in the INVIND questionnaire mainly concern balance sheet data that are probably not so difficult for the respondent to obtain. Furthermore, the probability of observing a high response burden has a 'U-shaped' relationship with the number of waves to which firms have participated (Figure 4): it initially decreases as the total number of waves increases but then, after around 10 waves, it starts to rise. The initial decrease may be the result of two things. First, it could be due to a self-selection process: firms who find the questionnaire burdensome may decide to drop out the following year. As a result, the sample consists of collaborative firms that don't think that participation requires an excessive effort. A separate analysis of this problem, known as attrition, is provided in Section 5.2. Second, the decrease could reflect the presence of a learning process over multiple waves that makes it easier for firms to complete the questionnaire. However, the reduction in the response burden is less intense as the frequency of interviews increases, meaning that, at some point, a certain level of stress could take over, thereby raising the burden.

Perceived response burden is also associated with factors that do not depend on the survey design and that are out of Banca d'Italia's control. For instance, response burden decreases for businesses located in the South of Italy and for those working in the service sector. Large firms report a high burden especially when the number of surveys they have participated in increases. This result could also be due to the fact that the interviewers are trained to make a big effort to convince large businesses to keep participating; moreover, firms with more than 5,000 employees are always eligible to take part in the survey even if they have refused to do so in the past. Since firms cannot easily drop out of the survey, they are likely to manifest their dissatisfaction by reporting that filling in the questionnaire is very burdensome and time-consuming, especially if they have been interviewed many times.

Finally, contrary to our expectations, we don't find strong evidence that better economic performance has a negative relationship with perceived burden. In fact, the variation in turnover, the variation in employment and the ratio between total investment and turnover both in the surveyed year and in the preceding year are not significant.

When the respondent is faced with difficult questions, with having to provide data that is hard to obtain or with topics that are out of his or her area of expertise, answering the questionnaire may require the involvement of more than one participant or even external consultants. In the 2016 wave, we collected information on the number of people (internal and external) involved in the survey, and we found that the higher the perceived response burden the higher the number of people needed to complete the questionnaire (see Table 5).

In 2016, firms were also asked to assign a score from 1 to 10 regarding the influence exerted by five factors on the response burden. Table 5 shows the averages of the assigned scores for every factor and for every level of perceived response burden. Firms declaring a high response burden complain more about the questionnaire's length and the need to involve more people to obtain the required data.

For the BOS we observe a similar behavior but with unsurprisingly lower average scores.

5. Perceived response burden and data quality

Data quality can be defined as 'fitness for use' of statistical information. It is usually measured through six dimensions: relevance, accuracy, timeliness, accessibility, interpretability, and coherence (Statistics Canada, 2003).

In this paper, we focus on data accuracy, that is, the degree to which the information correctly describes the phenomena it was designed to measure.

One of the main implications of a higher response burden concerns the firm's decision not to respond. On one hand, interviewers can encounter the reluctance of contacted firms to participate in the survey (unit non-response, attrition). On the other, when the cognitive demands of a survey begin to exceed the motivation or ability of respondents, they often employ a set of response strategies that allow them to reduce the effort that they have to expend without leaving the survey altogether. Some of these strategies include skipping some questions (item non-response), using the 'don't know' or 'no opinion' response option, or choosing the first reasonable response (Krosnick 1999; Vannette and Krosnick 2014). Other behaviors include speeding through the survey by giving low-effort responses or not fully answering open-text questions. In the following subsections, we provide some empirical evidence of how these aspects affect data accuracy using the INVIND survey.

It is worth mentioning that we also find some evidence that response burden may affect timeliness (that is, the delay between the reference point to which the information pertains and the date on which the information becomes available). We measure it with a dummy variable, where 1 represents questionnaires submitted within the first three months of the fieldwork and 0 represents those submitted after that date. We run a logistic regression analysis which includes the perceived burden and a set of other control variables (Table 6). Our results show that firms reporting a high burden have a significantly lower probability of completing the survey within the first three months. Based on these findings one can speculate that perceived response burden may also affect the quality of late responses and the timeliness of the final output.

5.1 Unit non-response (attrition)

A high response burden can affect not only the response behavior but also the decision not to participate in the survey. This phenomenon is known as attrition.

We found that the propensity to leave the panel significantly increases for firms that reported a high response burden in previous surveys. In particular, the share of firms that participated in the INVIND in 2015 but not in the following BOS rose from 11% among those believing the burden to be modest to 14% among those considering it excessive. On the other hand, the share of firms which dropped out of the panel after the 2016 BOS rose from 16% to 21% as the declared burden increased.

To further investigate the role of response burden on attrition we create a dummy variable equal 1 for firms that dropped out of the sample in 2016 and regress this variable on the perceived response burden in 2015, the total number of waves firms have participated in, their characteristics and measures of their performance (Table 7). The results show a significant increase in the probability of attrition for firms that report an excessively high response burden and for those that do not answer the question on response burden. The number of interviews plays a significant role in reducing the probability of attrition, confirming the existence of possible learning effects (as already shown in Table 4). Finally, the variation in the number of employees that we use as a proxy of economic performance has a significant effect in reducing the probability of attrition. This may partly be due to the fact that firms that reduce their labor force below a certain threshold are no longer eligible for an interview. However, these results are confirmed even if we replicate the estimates to exclude from the sample all the firms that claim to have dropped out because of reasons linked to temporary or permanently difficulties and therefore no longer belong in the target population. As a consequence, we interpret this result to mean that firms with better performance have a lower probability of dropping out of the survey. Our interpretation is strengthened by the results discussed in D'Aurizio and Papadia (2016), who find that the probability of participating in the INVIND in a given year is positively affected by the economic performance of the firm in the previous year.

5.2 Item non-response

The response behaviour of survey participants depends on many factors. Some respondents may decide to answer hastily and carelessly, since they perceive the survey as too time-consuming. In other cases, they may limit their responses to certain questions or only to those that are necessary to complete the questionnaire. Sometimes, the interviewers accept a partially completed questionnaire submitted by reluctant firms provided they have provided the most important information. This behavior may become more likely as the complexity of the questionnaire grows.

Figure 5 shows the cumulative distributions of firms according to their share of missing items in the 1998 and 2016 waves. In these two years, the questionnaires present very different levels of complexity: the number of variables increased from about 200 to about 300, the number of pages from about 5 to about 20. In order to

make the two distributions comparable, we selected only industrial processing firms with more than 50 employees and excluded the compulsory variables. We find that, over the last twenty years, in conjunction with a higher actual response burden, the 90th percentile of the share of item non-response rises from just over 35% in 1998 to 60% in 2016. Moreover, the share of firms answering at least half of the non-compulsory questions decreases by about 20 percentage points.

Item non-response rates vary across different sections of the questionnaire. We find that sections requiring qualitative information on easy-to-understand topics (such as the section about funding) get relatively low non-response rates. These rates increase when the complexity of the formulation of the question and of the terminology used grows.

The increase in the share of missing variables also involves questions that are of great importance for the purposes of economic analysis. Figure 6 shows the time series of the percentage of missing data on questions about expectations on investment and turnover for the next year. Although their complexity has kept constant over the years in terms of formulation, the share of missing answers about investment plans exceeds 10% in 2016, against less than half that figure in the 80's; the share related to expectations on turnover (collected since 1996) rises from about 3 to more than 6%. This implies that the response burden can involve the potential loss of information on historical and important variables, as well as on new ones.

As a further analysis, we estimate two regression models for the probability of not answering the questions about expected turnover and investment as a function of the perceived response burden, some firm characteristics, indicators of firm's performance and time dummies (Table 8). The probability of not answering is significantly greater for firms that perceive an excessive response burden and is even stronger when the respondent does not even provide an answer to the question on response burden. A missing value to this question (which is at the end of the questionnaire) is generally a sign of early abandonment of the survey which is usually a consequence of an excessive perceived burden. The main implication of this result is that special caution should be used in estimating totals and growth rates based on these variables since the missing answers cannot be considered to be randomly distributed.

5.3 Response error

We also find some evidence that respondents react to an excessive perceived burden by providing inaccurate answers.

We first use administrative records on firms' balance sheets (from CEBIL/CERVED database) to create a proxy of response error for each business participating in the INVIND survey. The proxy is computed as the difference (in absolute terms) between the value of turnover reported in the survey and the value resulting from the administrative records. The median value of the difference is around €100,000 (about 1% of the median value of turnover) and is quite stable over time (Figure 7). Yet, the highest percentiles (80th and 75th) increase and this may signal some worsening of the situation in recent years.

The response error is positively associated with the perceived response burden. Table 9 shows the results of a quantile regression of the proxy of response error on a set of variables (variation in employment and turnover, the sector of activity, geographical area and firm size) including a dummy variable for the firms reporting an elevated or excessive response burden. The regression is computed for three different quantile levels (0.25, 0.50 and 0.75). Results show that an high perceived burden is positively associated with the response error on turnover. In particular, for the median and the 75th percentile of the distribution, the proxy of response error increases respectively by about 10 and 20 thousands of euro for firms declaring high response burden.

A second experiment addresses a question about firms' expectations on future prices. Respondents are asked to report the main factor that is likely to affect future price dynamics. Firms are randomly assigned to two groups for which the order of the response options is reversed. Specifically, in group A the factors are ordered as follows: 1 for total demand; 2 for changes in the financial burdens borne by the firm; 3 for competitors' prices; 4 for labour costs; 5 for raw materials prices; 6 for expectations for exchange rates; and 7 for inflation expectations. In group B the options are in reversed order. Figure 8 shows the distribution of the responses in the two random samples (A and B) according to the level of perceived response burden. If the answers are independent of the order of the response options, there should not be significant differences between the two distributions. We find that in general, this is not the case. Respondents seem to select the first plausible option they find, without going through the whole list of possible answers. For instance, the share of firms selecting the response 'total demand' is significantly higher when this option is presented in the first position (group A) than in the second one (group B). The same result holds for the other more popular answers ('competitors' prices' and 'raw materials prices'). We also find that this situation worsens for businesses that report a high response burden. In general, the difference between the frequencies of each response option in the two random samples is lower for firms that perceive a low response burden compared with the others. Respondents complaining about the excessive effort are therefore less willing to spend more time going through the whole list of response options in order to provide a more accurate answer. They are more likely to choose the first plausible option they are presented.

6. Concluding remarks

In this paper we have analyzed the dynamics of response burden in the main business surveys conducted by Banca d'Italia. In particular, we have examined the factors affecting the perceived response burden and how they are associated with some indicators of data quality. We focus on the perceived burden since it is directly related to some respondents' behavior that may negatively affect data accuracy.

Our results show that the actual response burden significantly increased from 1984 to 2016: in the INVIND survey the number of variables more than tripled, with a more significant growth between the late 1990s and the early 2000s. The decision to ask a group of questions to a subset of the sample only partly mitigated this increase. Moreover, the number of pages tripled since 2001 and even quintupled since the beginning of the survey, partly because the notes and instructions for respondents increased in length.

Such an increase negatively affected the perceived response burden in the INVIND survey. In particular, we find that the number of pages of the questionnaire has a stronger effect on respondents' perceptions than the actual number of questions. This is not surprising considering that fact the 'size' of the questionnaire is the first characteristic respondents use to estimate the effort they will have to put in to complete it. Moreover, our results show that perceived burden has a 'U-shaped' relationship with the number of waves the firm has been in involved in: it initially decreases but then, after around 10 years of participation, it starts to increase.

Actual response burden is not the only factor affecting perceived burden. Large firms report higher burdens, especially when they have been interviewed many times, whereas perceived burden decreases for firms located in the South of Italy and for those working in the energy sector.

We also find that perceived burden is likely to have negative effects on several elements of data quality.

First, it affects the timeliness of the responses. Firms complaining of a high burden tend to delay their participation in the survey.

We also find that the probability of attrition increases with the perceived burden. Since perceived burden also depends on factors (such as the economic performance of firms) which are associated with the target variables measured by the surveys, attrition could be a serious issue for the economic interpretation of survey results.

Moreover, even if the firm participates in the survey, an excessive perceived burden is associated with a high probability that the respondent will not complete the whole questionnaire. Since the interviewers are instructed to convince firms to provide at least the information on the core variables, response burden mainly results in missing answers to the non-core questions and in particular to those that require more effort to answer. This is, in particular, the case for questions about firms' expectations on future investment and turnover.

Finally, our results show that respondents react to an excessive perceived burden by providing inaccurate answers to quantitative questions such as the one about turnover or by choosing the first plausible response option when confronted with complex questions.

These findings confirm that monitoring and reducing perceived response burden should be a priority for data producers. This study also offers some indications on how they can reduce perceived burden: both by reducing actual burden and by influencing how respondents feel about the survey.

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Appendix: tables and figures

Table 1: Number of firms interviewed for INVIND, BOS and for both in the period 2014 – 2016

		Invind			
		No	Yes	*Total*	Year
BOS	No	0	651	*651*	2014
	Yes	717	3609	*4326*	
	Total	*717*	*4260*	*4977*	
	No	0	680	*680*	2015
	Yes	607	3715	*4322*	
	Total	*607*	*4395*	*5002*	
	No	0	614	*614*	2016
	Yes	676	3595	*4271*	
	Total	*676*	*4209*	*4885*	

Table 2: Frequency of firms (percentages in parenthesis) that have participated in each number of waves from 2014 – 2016

	Total number of interviews					
	1	**2**	**3**	**4**	**5**	**6**
INVIND	1403	1278	2740	-	-	-
	(23.7)	(21.6)	(46.3)	-	-	-
BOS	950	1226	3154	-	-	-
	(16.1)	(20.7)	(53.3)	-	-	-
INVIND & BOS	846	629	526	686	745	2482
	(14.3)	(10.6)	(8.9)	(11.6)	(12.6)	(42.0)

Figure 1: Density of firms by the total number of interviews in the time-span 1984 – 2016

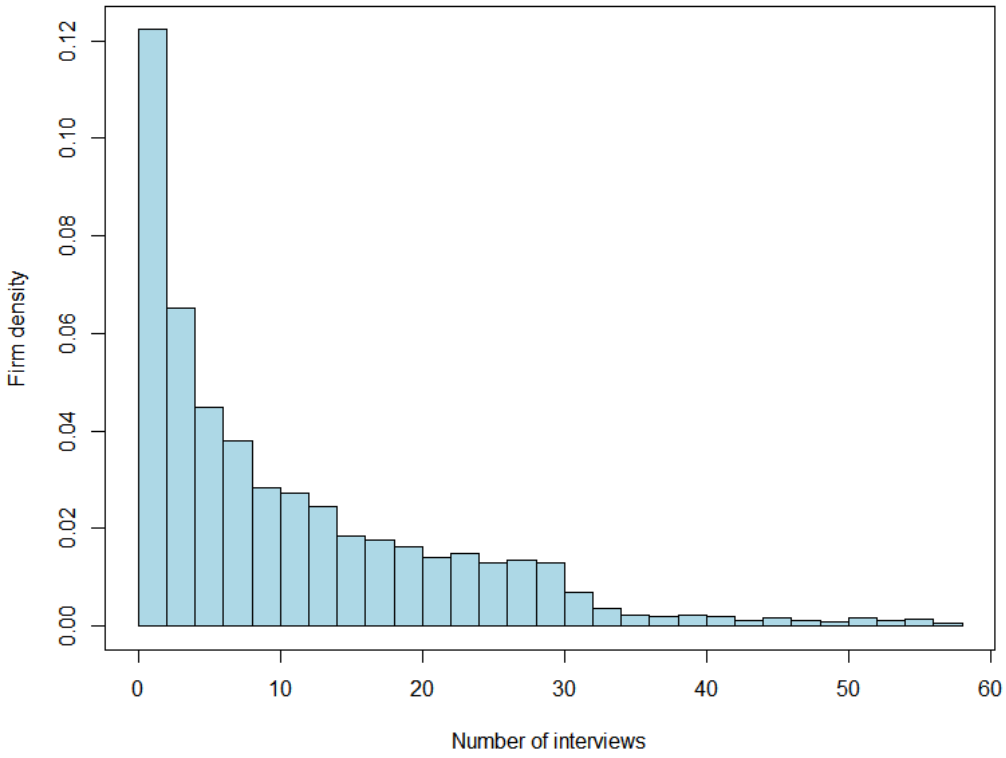


Figure 2: The complexity of INVIND and BOS questionnaires over time

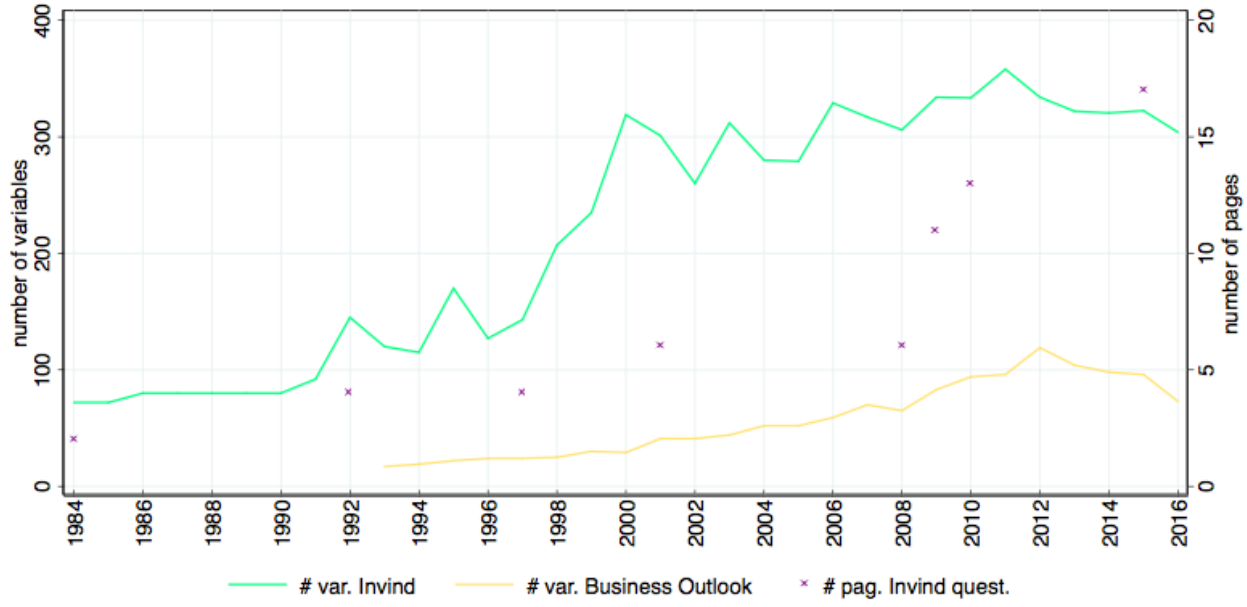


Table 3: Average time per level of response burden

Response burden	Average time (hours)
Low	1.8
Average	3.7
High	6.4
Excessive	8.2

Figure 3: Firms' opinion about the questionnaires' response burden over time

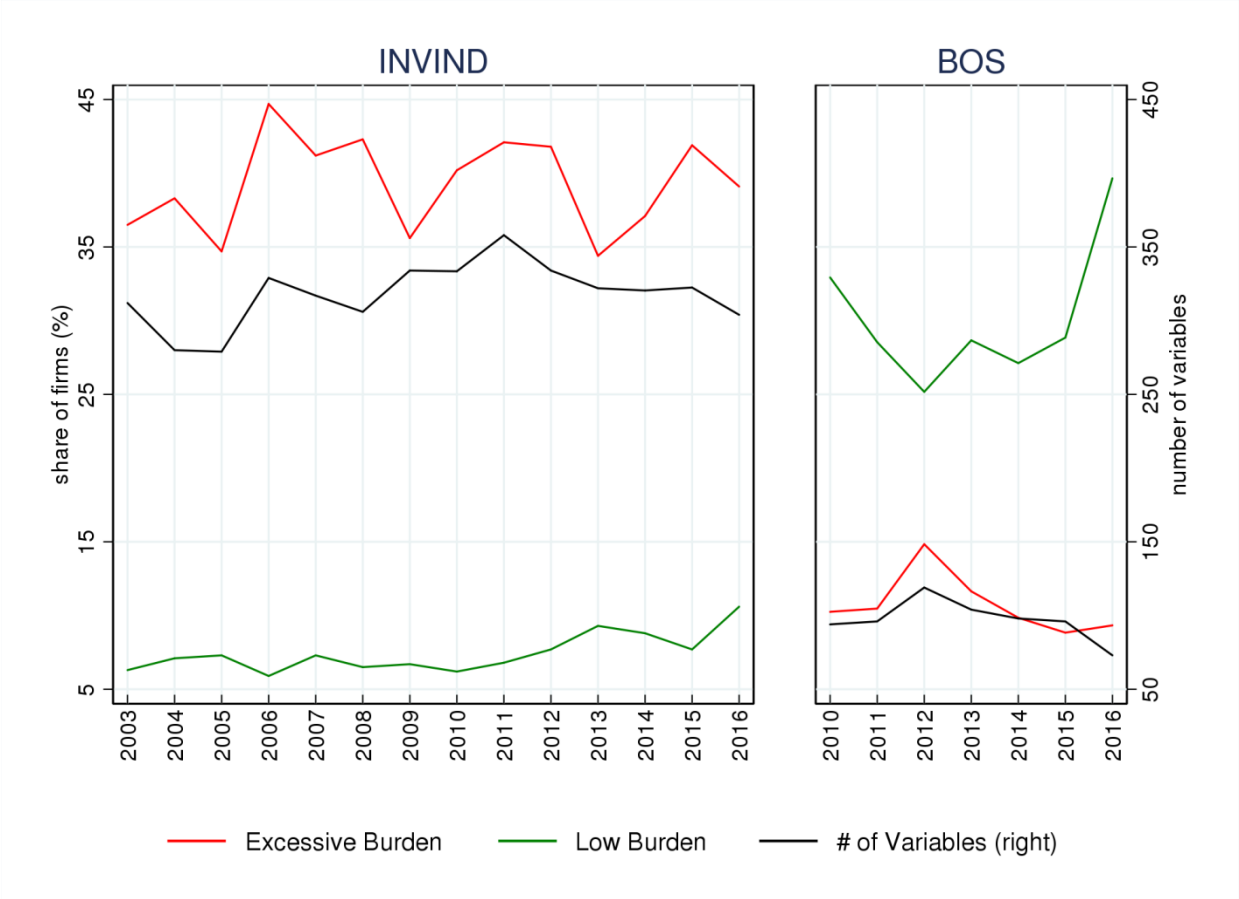


Figure 4: Estimated Probability of reporting a higher response burden

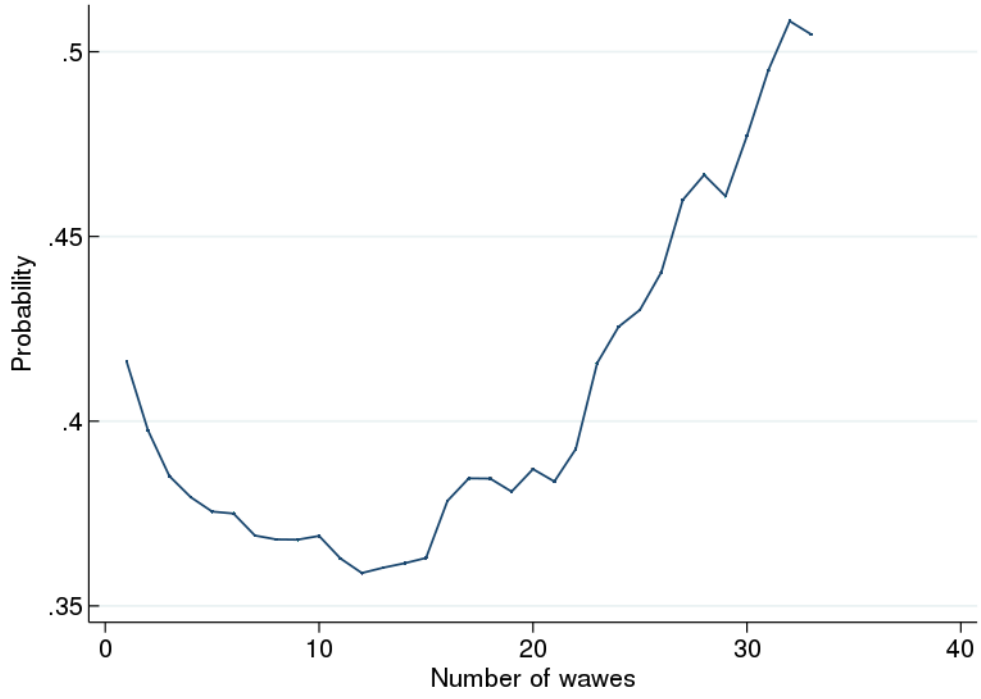


Table 4: Probability of reporting a high ('elevated' or 'excessive') perceived response burden (logit model)

nVariables	1.003**
	(0.001)
nPages	1.025***
	(0.006)
nQuant	1.000
	(0.001)
nPresences	0.932***
	(0.008)
nPresences2	1.001***
	(0.000)
log(empl)	1.076
	(0.067)
Δ turnover	0.966
	(0.048)
Δ empl	0.994
	(0.113)
Inv/Tur_tm1	0.894
	(0.067)
Inv/Tur_t	1.079
	(0.088)
size 50-199 X waves	1.006
	(0.007)
size 200 - 499 X waves	1.023**
	(0.007)
size >499 X waves	1.030***
	(0.008)
Δ per capita Val. Add. Set.	2.649**
	(0.817)
Energy sector	0.717***
	(0.057)
Service sector	0.789***
	(0.027)
North-East	1.309***
	(0.056)
Center	0.977
	(0.042)
South and Islands	0.875***
	(0.035)
50-99 employees	1.526***
	(0.105)
100-199 employees	1.413***
	(0.147)
200-499 employees	1.277
	(0.192)
500-999 employees	1.179
	(0.240)
>1000 employees	1.213
	(0.326)
_cons	0.160***
	(0.053)
N	51,064
Pseudo R-sq	0.021

Odds ratio; Standard errors in parentheses.

* p<0.05, ** p<0.01, *** p<0.001

INVIND 2003 - 2016 waves. Missing cases to the question on perceived response burden are excluded.

Table 5: Score average for each factor disaggregated by the perceived response burden (INVIND 2016)

RESPONSE BURDEN	Too many questions	More people involved	Use of unclear terms	Not exhaustive response options	Difficulties in choosing the answer
Low	3.2	2.3	2.1	2.1	2.1
Average	4.8	4.2	2.9	3.0	3.2
High	7.0	6.1	4.0	3.4	4.0
Excessive	8.3	7.2	4.9	4.0	4.7

Table 6: Probability of submitting the questionnaire within the first 3 months of fieldwork (logit model)

Per.Res.Bur = Average	0.985
	(0.083)
Per.Res.Bur = High	0.997
	(0.090)
Per.Res.Bur = Excessive	0.838+
	(0.085)
Per.Res.Bur = Missing	0.452***
	(0.048)
log(empl)	1.055
	(0.091)
Δ turnover	0.902
	(0.078)
Δ empl	0.637+
	(0.148)
Inv/Tur_tm1	0.926
	(0.123)
Inv/Tur_t	0.679*
	(0.124)
Energy sector	0.929
	(0.087)
Service sector	0.821***
	(0.037)
North-East	0.840**
	(0.050)
Center	1.140*
	(0.069)
South and Islands	1.014
	(0.058)
50-99 employees	0.950
	(0.076)
100-199 employees	0.830
	(0.111)
200-499 employees	0.865
	(0.172)
500-999 employees	0.988
	(0.269)
>1000 employees	1.075
	(0.393)
_cons	0.546+
	(0.173)
N	25,399
Pseudo R-sq	0.044

Odds ratios; Standard errors in parentheses. + p<0.10, * p<0.05, ** p<0.01, *** p<0.001

INVIND 2011 - 2016 waves

Table 7: Probability of attrition in the 2016 wave (logit model)

	Attrition
nPresences	0.904***
	(0.016)
Per.Res.Bur = Average	1.452
	(0.414)
Per.Res.Bur = High	1.356
	(0.425)
Per.Res.Bur = Excessive	1.992*
	(0.599)
Per.Res.Bur = Missing	2.527**
	(0.827)
log(empl)	0.641
	(0.178)
Δ turnover	1.148
	(0.304)
Δ empl	0.225**
	(0.129)
Inv/Tur_tm1	0.672
	(0.382)
Inv/Tur_t	1.593
	(0.909)
Energy sector	1.213
	(0.336)
Service sector	0.899
	(0.125)
North-East	1.996***
	(0.371)
Center	1.379
	(0.294)
South and Islands	1.070
	(0.217)
50-99 employees	1.367
	(0.340)
100-199 employees	1.984
	(0.841)
200-499 employees	2.535
	(1.590)
500-999 employees	2.937
	(2.544)
>1000 employees	7.024
	(8.134)
_cons	1.102
	(1.123)
N	4,395
Pseudo R-sq	0.074

Odds ratios;
Standard errors in parentheses.
* p<0.05, ** p<0.01, *** p<0.001

Figure 5: Cumulative distributions of firms for shares of missing variables in INVIND 1998 and 2016

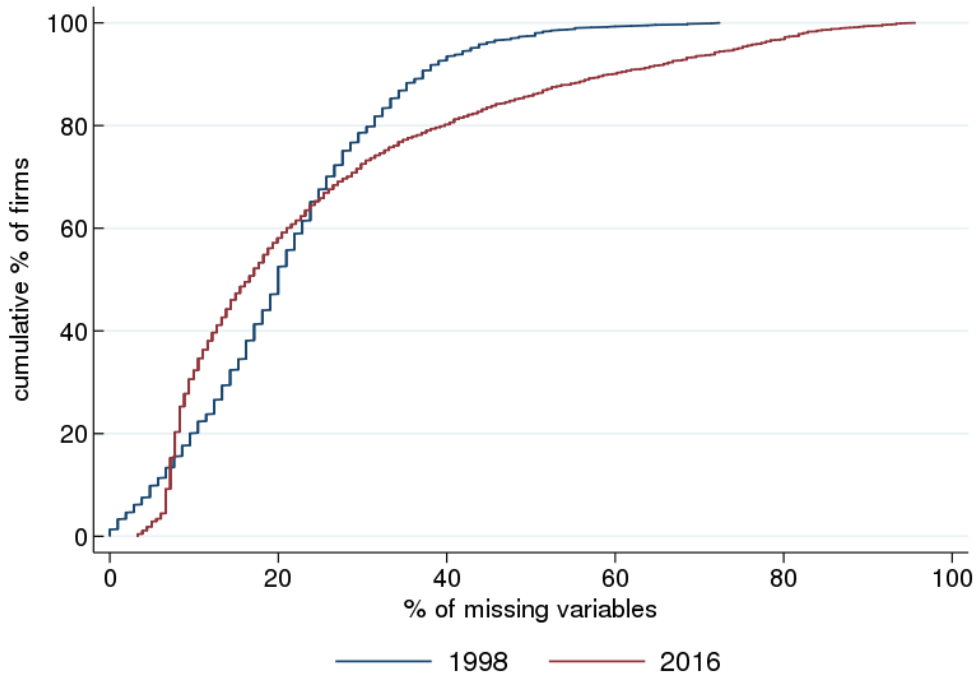


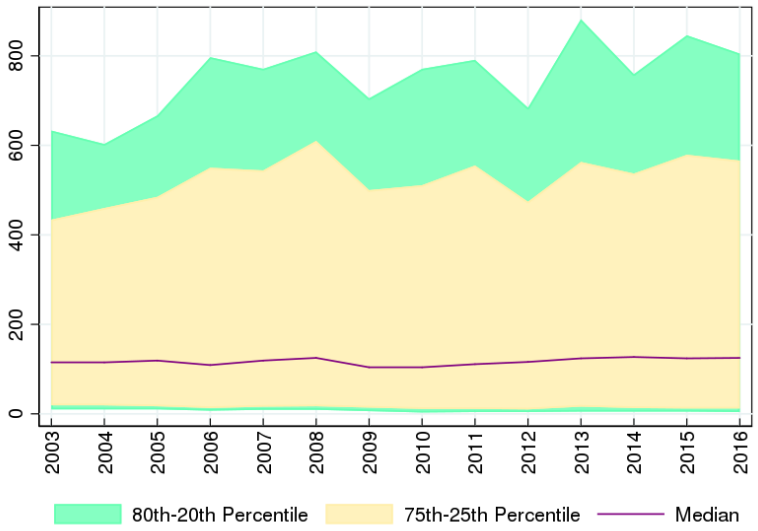
Figure 6: Share of missing data on questions about expected investment and expected turnover

Table 8: Probability of item non-response (logit model)

	(1) Non-response on expected investment	(2) Non-response on expected turnover
Per.Res.Bur = Average	0.941	1.047
	(0.054)	(0.086)
Per.Res.Bur = High	1.033	1.142
	(0.063)	(0.098)
Per.Res.Bur = Excessive	1.366***	1.776***
	(0.089)	(0.159)
Per.Res.Bur = Missing	2.742***	3.736***
	(0.169)	(0.315)
log(empl)	1.187***	1.241***
	(0.045)	(0.054)
Δ turnover	0.992	0.758**
	(0.012)	(0.064)
Δ empl	1.097	0.660**
	(0.084)	(0.104)
Inv/Tur_tm1	1.023	1.036
	(0.022)	(0.026)
Inv/Tur_t	1.108*	1.002
	(0.057)	(0.036)
Energy sector	1.348***	1.634***
	(0.089)	(0.128)
Service sector	1.174***	1.163***
	(0.033)	(0.042)
North-East	0.886***	0.756***
	(0.032)	(0.034)
Center	0.794***	0.654***
	(0.028)	(0.030)
South and Islands	0.657***	0.545***
	(0.023)	(0.025)
50-99 employees	0.836***	0.664***
	(0.038)	(0.039)
100-199 employees	0.755***	0.604***
	(0.050)	(0.049)
200-499 employees	0.794*	0.738**
	(0.073)	(0.080)
500-999 employees	0.804	0.804
	(0.101)	(0.117)
>1000 employees	0.801	1.021
	(0.137)	(0.200)
_cons	0.0811***	0.0327***
	(0.012)	(0.006)
N	58,262	58,262
Pseudo R-sq	0.039	0.071

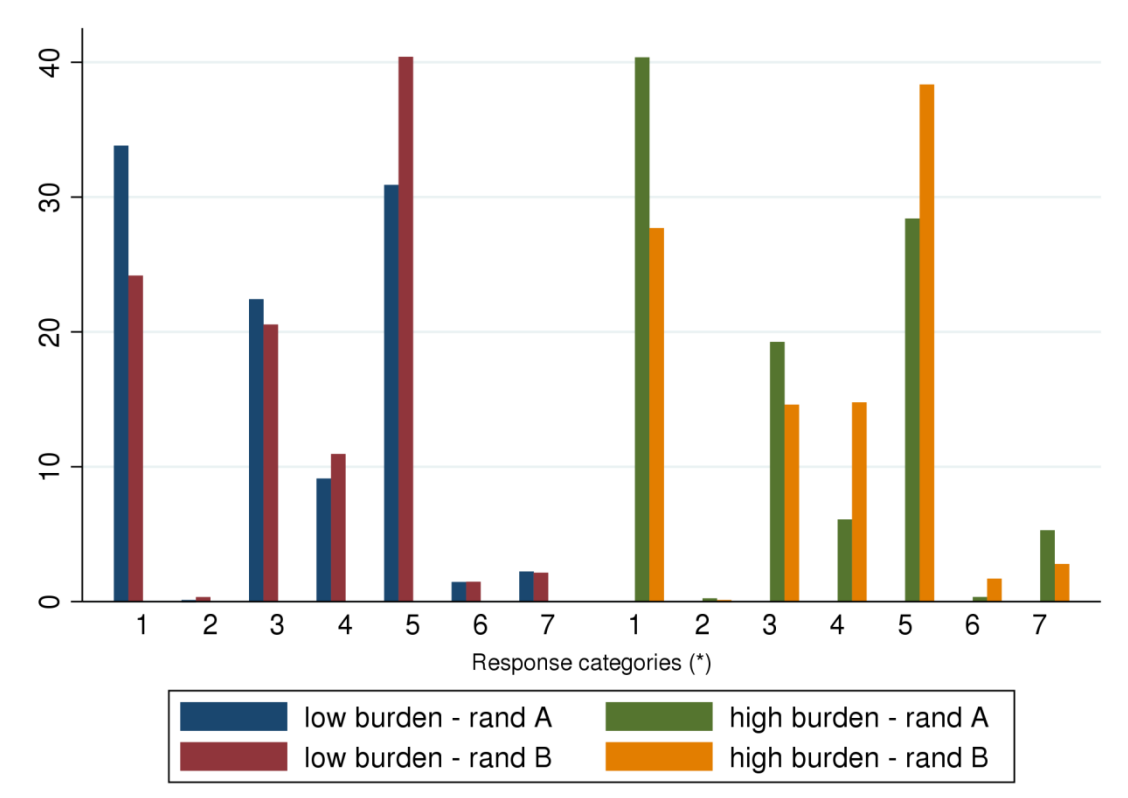
Odds ratios; Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001. Both regressions include time dummies. INVIND 2003 - 2016 waves.

Figure 7: Response error on turnover* (percentiles, thousands of euro)



*Absolute value of the difference between the value declared in the survey and the one from administrative records.

Figure 8: Distribution of factors affecting the expected price dynamics of firms. Randomized experiment with reversed response categories (percentages).



(*) Response categories: 1=total demand; 2=change in the financial burdens borne by the firm; 3=competitors' prices; 4=labour costs; 5=raw materials prices; 6=expectations for exchange rates; 7=inflation expectations. For group A the response options are ordered as above. For group B the order is reversed. INVIND 2017.

Table 9: Response error in turnover* (quantile regression)

	(1)	(2)	(3)
	Q=0.25	Q=0.50	Q=0.75
high_burden	0.808	9.684*	22.00*
	(0.705)	(4.104)	(11.093)
Δ turnover	6.746*	42.17***	225.7***
	(2.737)	(10.683)	(31.344)
Δ empl	-10.64**	-30.50*	-93.08
	(4.126)	(14.971)	(64.776)
log(empl)	4.690**	61.01***	214.0***
	(1.542)	(7.152)	(21.491)
Energy sector	25.10*	185.0***	833.7***
	(10.411)	(35.832)	(135.885)
Service sector	10.09***	80.84***	353.6***
	(1.495)	(6.559)	(24.648)
North-West	0.586	0.403	7.590
	(1.293)	(4.430)	(13.029)
North-East	-6.022***	-23.08***	-39.53**
	(1.114)	(4.275)	(13.577)
South and Islands	15.18***	66.37***	239.2***
	(1.951)	(6.829)	(27.401)
50-99 employees	1.332	3.956	14.41
	(1.800)	(8.059)	(25.873)
100-199 employees	10.47**	93.26***	378.3***
	(3.517)	(17.475)	(56.509)
200-499 employees	35.85***	323.3***	1640.8***
	(6.527)	(30.003)	(110.241)
500-999 employees	132.8***	900.9***	4844.2***
	(18.905)	(115.271)	(445.468)
>1000 employees	456.6***	3929.9***	25574.7***
	(71.540)	(336.426)	(1688.907)
_cons	-3.765	-150.1***	-561.3***
	(5.442)	(24.555)	(72.992)
N	45,578	45,578	45,578

*Absolute value of the difference between the value declared in the survey and the one from administrative records.
Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001. All regressions include time dummies.
INVIND 2003-16 waves.