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Unveiling participant level determinants of unit non-response in business tendency surveys

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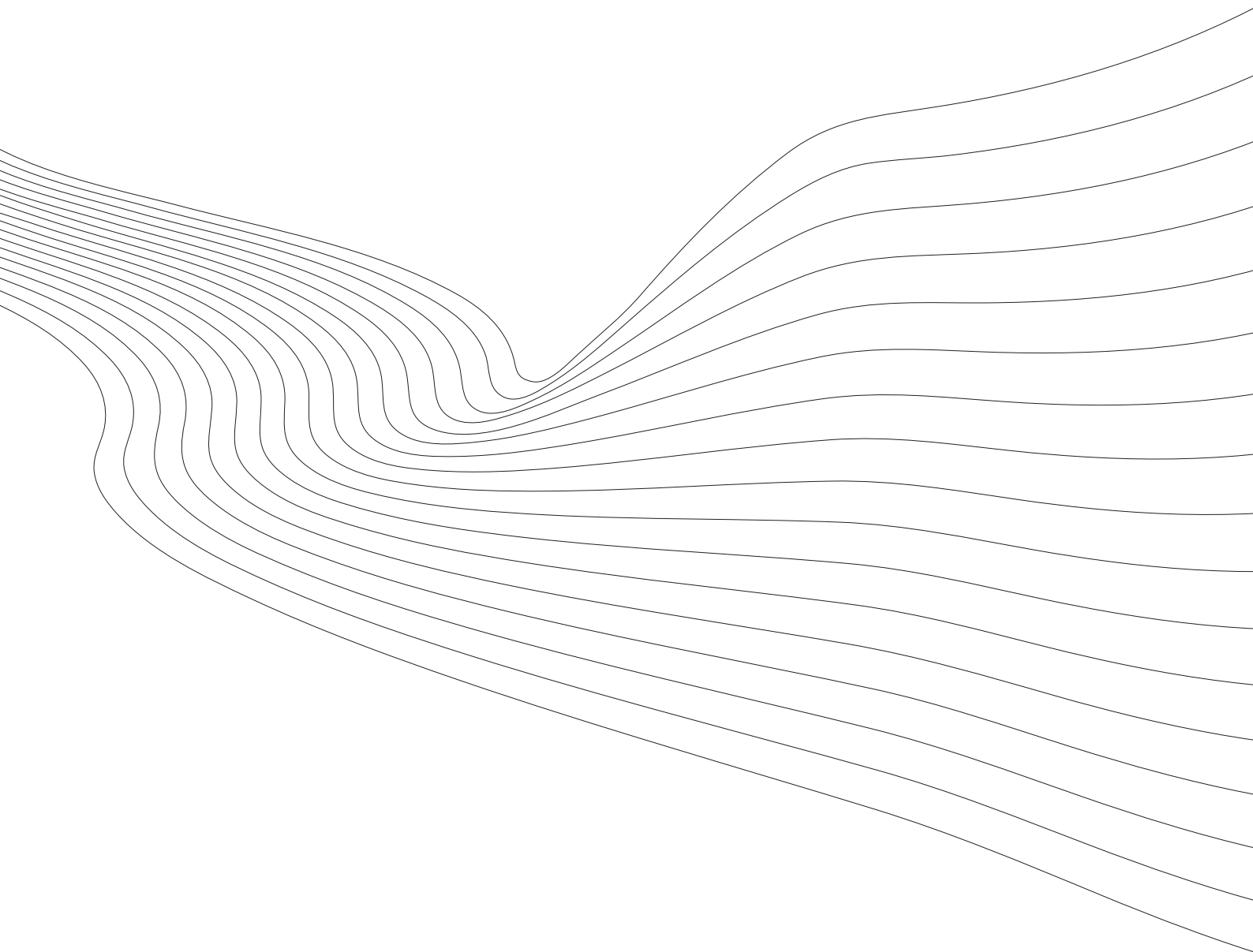
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Unveiling Participant Level Determinants of
Unit Non-Response in Business Tendency Surveys

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Abstract

Business Tendency Surveys (BTS) continue to be an important source of timely information on business cycles in many countries. We address quality of economic survey data by uncovering the relation between unit non-response and participant characteristics on company respectively respondent level. We use a unique, matched dataset that merges rich business tendency survey panel data with data from an exclusively conducted meta survey. Our meta information enhances the set of firm characteristics by information such as valuation of business tendency surveys or perceived response burden. We use different count data models to explain non-response count. Our models include weighted count data regressions as well as a two part hurdle model. We find that response burden, a company's survey track record, timeliness and participation mode are the strongest and most robust predictors of unit non-response. We also find a weaker negative effect of the business situation on unit response. Remarkably we do not find a significant influence of neither company size nor valuation of BTS on the propensity to respond to periodical qualitative BTS.

Keywords: Unit non-response, business tendency surveys, response behavior, participant level, selectivity, qualitative surveys, hurdle model, count data

JEL code: C83, C80

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1 Introduction

Business Tendency Surveys (BTS) have established themselves as an important source of timely information and are implemented in many countries. Researchers and policy makers alike rely on indicators build on BTS data such as the Ifo Index (Germany) or the KOF Barometer (Switzerland). Thus it is important for survey conductors to monitor the quality of their data closely and to adapt their methodology to changes in participant behavior as well as to new technical developments in information and communication technology. Still though – despite the idiosyncratic nature of BTS (Dillman, 2000) and vast changes in the degree humans feel committed to requests in general – contributions of economic survey researchers to the methodological literature are rather scarce. The panel nature of BTS promises interesting insights to the behavior of long-term survey participants. At the same time survey researchers of many fields court for the attention of their increasingly distracted participants and continue to worry about non-response.

In this paper we intend to contribute to the research on data quality and unit non-response in particular by investigating characteristics and attitudes of long-term BTS participants. While many studies on data quality rather use metrics on the survey wave level we are explicitly looking at the respondent level. In other words we are evaluating the quality and relevance of individual survey participants as opposed to studying survey wave level effects. We use a rich BTS dataset from the KOF Swiss Economic Institute and match it with data from an exclusively conducted meta survey. The matched dataset extends our set of participant characteristics by aspects such as valuation of BTS or perceived response effort.

The remainder of the paper is structured as follows: the subsequent chapter will give an overview of related studies in the field. We continue to describe our unique, merged dataset. A detailed description of our empirical strategy follows after the data section. The methodology section consists of two major parts: First we explain how we account for selectivity issues caused by merging data from different surveys. Second we discuss the different models to estimate unit non-response counts. Finally we present our estimation results, draw model comparisons, summarize our most robust results and provide an outlook for further research.

2 State of Research in the Field

In its essence our paper is most closely related to the work of Seiler (2013). However, while Seiler (2013) looks into non-response behavior of Germany’s manufacturing survey, our study is based on data from the Swiss service sector. Also, the fact that we include respondent specific characteristics is another distinction of our paper from previous studies. We find that respondent characteristics do explain unit non-response to a substantial extent.

More generally speaking our thoughts are based on various aspects of the literature in survey methodology. First we classify BTS within surveys in general. From a methodological perspective our work is located in the field of surveying organizations. Most prominently Dillman (2000) points out the idiosyncrasies of surveying organizations: “people are asked to report information for an entity that is distinct from them personally” (Dillman, 2000, p. 324). Second the work on non-response and handling missing data by Little and Rubin (2002) and Groves, Dillman, Eltinge, and Little (2002) has been influential to us. Third, we have common ground with the work on meta information, particularly with Abberger, Birnbrich, and Seiler (2011) and Abberger, Bannert, and Dibiasi (2014) who gathered additional meta information by conducting surveys about surveys. The following subsections address literature on non-response and missing data as well as related work on meta information in further detail.

2.1 Non-response and Missing Data

The concept of non-response is usually defined as the rejection of an individual to participate in a survey (Groves, Dillman, Eltinge, and Little, 2002). In order for non-response to occur some sort of contact between participant and survey conductor is assumed, e.g. in form of an email invitation. In this sense individuals not being included in the set of contacted individuals are not accounted for in the concept of non-response. However, in our paper the set of potential non-respondents is defined as a slightly larger group: Companies who were contacted but could not be reached are also counted as non-respondents. Due to limitations of our dataset we cannot distinguish these companies from those who were reached but explicitly refused to answer. However this classification seems justifiable when we consider the customer relationship management and long term relationship that KOF Swiss economic institute has established with its survey participants.

The literature distinguishes between item non-response which relates to not answering single questions and unit non-response which means a particular participant (unit) does not answer at all

in a particular wave. In the latter case the survey conductor does not gather any information on the company which hinders survey based sample adjustment in the post processing of the dataset. Non-response might lead to several problems, such as bias the estimators projection or inflate its variance (Groves, Dillman, Eltinge, and Little, 2002).

Several statistical methods deal with missing data caused by non-response. The ultimate success of these methods depends heavily on the systematics of non-response. Little and Rubin (2002) provide a useful classification of missing data: Data can be missing completely at random (MCAR), missing at random (MAR) or not be missing at random (NMAR). Data is called MCAR if the missing data mechanism does not depend on the (observed or unobserved) data. That is missingness does not depend on the data values. This is a very strict assumption in practice at times which is why the weaker concept of MAR is widely used in applied research. MAR refers to a process in which the missing data mechanism depends only on observables. Data is said not be missing at random (NMAR) if missingness depends on the missing values.

In order to understand what causes non-response, a list of possible factors which have to be controlled for has to be found. Willimack, Nichols, and Sudman (2002) developed a conceptual framework on participation in business surveys¹. Taken from an earlier version of Groves and Couper (1998), Willimack, Nichols, and Sudman (2002) maintain the dichotomy of factors which are under the control of the researcher and factors the researcher has no influence on. The factors which are under control of the researcher are factors related to survey design, including sample design, instruments offered to answer the survey, time schedule and offered confidentiality. Factors which are out of the researcher's control are divided in three subgroups, namely external environment, factors related to the business and factors related to the respondent. External factors include economic conditions and the legal and regulatory requirements. Among business related factors we find firm characteristics, such as size, industry, organizational structure as well as a company's philosophy and availability of resources. Finally we have a group containing factors of the respondent itself, such as sex, age, authority, capacity and motivation. Although the concept does not raise claim of completeness it offers, in our view, a quite comprehensive list of factors which should be controlled for when identifying non-response.

¹The graphical depiction of the conceptual framework taken from Willimack, Nichols, and Sudman (2002) can be found in Appendix B.

2.2 Meta-information on BTS

As stated initially the focus of our work is at the participant level as we are evaluating what drives participants' reliability in business tendency surveys. Meta information on participants and the survey process itself is crucial to this paper. Hence the pioneering work of Abberger, Birnbrich, and Seiler (2011) who ran a survey about surveys to gather feedback is an important source of inspiration for us. While the study by Abberger, Birnbrich, and Seiler (2011) was limited to German trade firms we base our study on Abberger, Bannert, and Dibiasi (2014), which collected background information of firms from the Swiss service sector. The survey itself was conducted in summer 2013 and collected feedback data from the same set of firms that also had been taking part in the regular KOF BTS of the Swiss service sector.

3 Data

All data used in this paper stem from surveys conducted by the KOF Swiss Economic Institute. The KOF Swiss Economic Institute has just celebrated its 75th anniversary in 2013 and has been conducting BTS for decades. KOF has implemented BTS in eight sectors, namely manufacturing, construction, retail trade, wholesale trade, service sector, hotels and restaurants, project engineering and financial and insurance activities. By today KOF surveys include more than 11'000 companies. The following subsections introduce both datasets used in this paper and elaborate on the data generating process of the feedback survey dataset.

3.1 KOF BTS in the Service Sector

We chose to focus on the KOF BTS in the service sector because of its comparatively young age and decent share of online participants. Being established only in 2006 the service sector survey does not suffer from revisions of the questionnaire or changes in official sector classification schemes during that timespan². Revisions could cause artifacts in the data and thereby hamper the process of disentangling the relation between participant characteristics and response behavior. Also, paper based as well as online participation was possible right from the start of the survey so participants were not potentially influenced by the introduction of an additional survey mode.

²The official sector classification schemes in Switzerland is called NOGA and basically follows the European NACE scheme. Due to structural and administrative changes sector classification schemes are revised about once in a decade. Also these revisions are often linked with revisions of the questionnaire itself which can also lead to (temporarily) changes in response behavior.

This paper uses a sample containing a total of 51241 observations that were generated from the fourth quarter of 2006 until the fourth quarter of 2013. On average, close to 1'800 companies per wave responded during that timespan³.

The available sample covers the following set of sectors according to the NACE 2-digit sector classification: 49-53, 58-63, 68-70, 72-75, 77-82, 86-88, 90-93, 95, 96. The sample does not contain any firms belonging to the sector accommodation and food service activities (NACE 55-56) nor does it contain any firms belonging to the financial and insurance sector (NACE 64-66). The quarterly KOF questionnaire for the service sector consists of ten qualitative questions and one question with several non-mutually exclusive items.

3.2 A Survey About Surveys

In order to gather additional participant characteristics besides standard firm properties we conducted a meta survey in summer 2013. We gain information on three major aspects:

- companies' understanding of the concept of general business situation
- companies' valuation of BTS
- measuring capacity utilization in the service sector

In advance of the survey we ran an interviewer pre-test to check the validity of our questions and items as well as the relevance of our set of questions to regular participants. We adjusted our questionnaire accordingly which left us with 10 questions covering the areas listed above⁴.

3.3 Merged Sample

We continue to merge both samples described above. Because the feedback survey was only conducted once we need to assume that the information gathered in this survey is time invariant. This is highly plausible for a short period around the conduction of the feedback survey. As the underlying company policies and structures are not volatile – we decided to limit our analysis to

³About one third of these observations are not part of the sample that is used to represent Switzerland because several regions would be over-represented. Nevertheless this additional regional data is also used to investigate unit non-response and not distinguished further. We have also tested for sample affiliation effects and could not find evidence for any effects.

⁴The full questionnaire can be found in Appendix A.

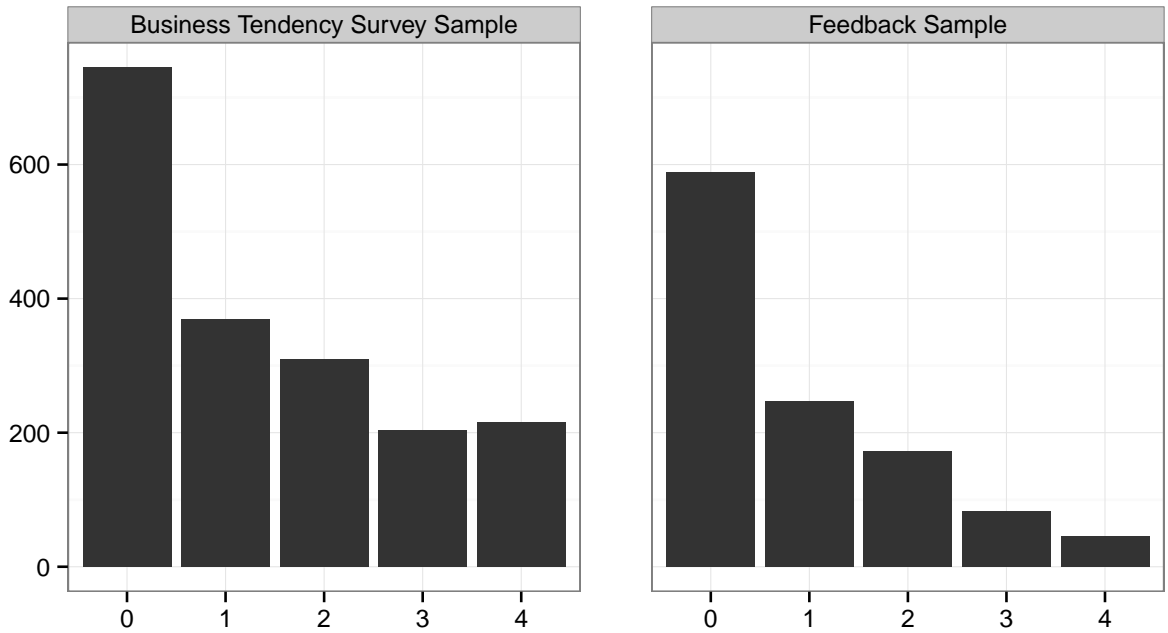


Figure 1: Unit Non-Response Count by Samples

two quarters before and two quarter after the conduction of the feedback survey. Hence, we subset our data into two chunks: data that was generated in the year of the feedback survey, namely 2013, and data that was gathered before.

We use the entire 2013 data to analyze unit response in that year by using standard firm characteristics and the additional firm data generated from the feedback survey. Any company that took part in the feedback survey conducted in the second quarter of 2013 and was invited to any of the regular BTS in 2013 is part of the sample. The 2013 subset contains 1136 companies. The dataset before 2013 is used to compute variables such as a company’s survey track record which is used to proxy a companies motivation in 2013. Figure 1 shows the distribution of unit non-response count in 2013 for each of the two samples: in the left facet we see the distribution of unit non-response count for all companies that have been invited to take part in the regular BTS. The right facet shows the unit non-response count of the regular BTS in 2013 for those who also took part in the feedback survey. Section 4.1 describes how BTS data before 2013 is used to predict participation in the feedback sample in order to account for selectivity.

Variable	Type	Dataset	Description
Company			
unit_nr_count	count	BTS	Number of unit non-response quarters during the year 2013 with zero if the company never missed a survey and four if the company did not participate at all
unit_nr_ratio	continuous	BTS	Record of past participation ratio: 0 = individual always participated before 2013, 1 = individual never participated before 2013.
avg_run	continuous	BTS	Approximate average timeliness of past answers: 0 = fast, 1 = medium, 2 = slow
valuation	metric	feedback	Importance of BTS: 1 = not important, 5 = important (5 items)
timeliness	categorical	feedback	Describes when a firm usually responds to a questionnaire. Answering straight away is the reference. time = whenever the person has time, deadline = answer right before the deadline, reminder = only when a reminder is received.
employees	log	company information	Size of a company: log number of employees
region	categorical	company information	Espace, Lake Geneva Region, Northwestern Switzerland, Eastern Switzerland, Ticino
sector_class	categorical	company information	Part of the service sector, DL1, DL2, DL3
CU	continuous	feedback	Capacity Utilization in percent, used to proxy business tendency at the firm level
staff_shortage	binary	feedback	Indicate whether a company has problem to hire suitable staff
Respondent			
gender	categorical	respondent information	male = 0, female = 1
language	categorical	respondent information	Italian, French, German
position	categorical	feedback	position of the person that answers the questionnaire: head of department, administration, someone else, no answer
response_burden	binary	feedback	perceived response burden high = 1, else 0
surveys	count	feedback	amount of surveys the respondents answer on average in one year
Survey Design			
human	binary	BTS	0 = no responsible person known, 1 = contact person available
participation_mode	categorical	BTS	Paper, Online, Mixed

Table 1: Variable Description

3.4 Variables

This section presents the variables extracted from our merged dataset that are used in our analysis described in section 4. Table 1 classifies the displayed variables according to the conceptual framework (Willimack, Nichols, and Sudman, 2002) discussed in section 2.

The first two variables display a company's response track record in the regular business tendency surveys. The variable *avg_run* is the average rank of an ordered categorical variable which represents return time. The variable *unit_nr_ratio* is introduced to capture a firm's history of not responding at all (unit non-response). It covers the share of un-returned questionnaires before 2013. Both variables proxy a company's motivation towards BTS.

The variable *valuation* stems from the feedback survey which asked companies to evaluate the use of business tendency surveys in general. The variable *timeliness* captures a company's perceived timeliness and thus proxies company's policy towards surveys. Companies were asked for their standards in processing regular BTS with respect to reaction time using the following items: answer right away, answer when time permits, answer before deadline or only answer after being reminded. It is difficult to form expectations on company policy, but we expect other routines than answering right away to cause higher non-response. The variables *employees*, *region* and *sectorclass* control for firm specific size, region and sector effects. In our view no clear expectations exist on different regions or sectors. The variables *CU* and *staffshortage* measure the availability of resources to a company. Both variables are taken from the feedback survey. The variable *CU* enters the model with indicated capacity utilization in percentage points and *staffshortage* as a binary variable. We use both variables as an indicator for the firms' individual business situation. In the sense of Willimack, Nichols, and Sudman (2002) the variables presented above are subject to company. In turn the variables described below relate to the respondent.

Ex ante both variables, *gender* and *language*, are not expected to influence non-response in any direction. The variable *position* indicates which position the respondent has within the firm. Both Abberger, Birnbrich, and Seiler (2011) and Abberger, Bannert, and Dibiasi (2014) show that business tendency surveys in Germany and Switzerland are mostly completed by persons in management positions. Tomaskovic-Devey, Leiter, and Thompson (1994) already pointed out that the position of the respondent can predict non-response. We expect non-response to increase if the questionnaire is filled out by a person on a lower hierarchy level because such persons are not as well as informed as managers about the overall situation and thus need to put more effort in answering. Also we believe that managers' decisions to take part are likely to be more systematic. Further we introduced a binary variable for perceived response burden: If the perceived time to answer is longer than 10 minutes, it is labelled burdensome. We expect the perception of burden to increase non-response. Whereas the variable *responseburden* covers the burden caused by BTS in the service sector, the variable *surveys* counts the number of surveys from any survey conductor. Again the variable stems from the feedback survey.

The variables described in both of the previous paragraphs were basically out of a researcher’s control. The following set of variables is related to survey design and therefore under control of the researcher. We also investigate how survey design related variables affect unit non-response. The variable *human* indicates whether a contact person within a company was addressed or just a neutral invitation was sent to the company. The work by Dillman (2000) as well as our experience within the KOF survey section show that addressing a person within a company decreases non-response. The downside of addressing a person could be employees leaving a company. Several invitation letters got returned unopened with a remark that the addressed person has left the company. Both effects work in different directions and could overall cancel out. However, we expected that the net effect is negative, because fluctuation of employees within the sample is relatively small compared to the commitment effect of addressing a person directly. So, addressing persons within a company directly is expected to decrease non-response.

The categorical variable *participation_mode* indicates the medium a company has chosen to participate. Participants can either take part paper based or online. Because we aggregate over one year the binary choice is supplement by a mixed category indicating that not all quarters of 2013 were answered using the same participation mode. Ideally participation mode has no influence on non-response. Nevertheless we expect an increase in non-response for internet participants as well as for those whose switched their medium within 2013. Our expectations are based on the fact that companies who intend to drop out are sometimes convinced that they can reduce the effort by answering online.

4 Methodology

Our empirical strategy is to model unit non-response count using different regression models in order to identify drivers of unit non-response on the firm level. To measure firm level unit non-response itself we count how many times a firm refused to answer in the standard quarterly BTS during the course of 2013. Our estimations focus around the year 2013 because of the limitations caused by the feedback survey conducted in summer 2013.

Unit non-response count $NR_{unit} \in \{0, 1, 2, 3, 4\}$ is the dependent variable in all of the following regression models except for the probit model described in section 4.1. All of the models assume that the explanatory variables which we obtained from the feedback survey are time invariant over the course of one year. This assumption is highly plausible because variables such as surveys answered

per year or responsible department are not likely to change as they are subject to company policy and attitude of the management⁵.

Section 4.2 describes different model specifications within the generalized linear models framework all of which estimate the coefficients of possible drivers of unit-response on the firm level. Section 4.1 describes a preliminary step of computing inverse probability weights that we can use later to account for selectivity issues.

4.1 Accounting for Selectivity

As described in section 3.3 we make use of a merged sample which contains data from the regular business tendency surveys as well as from the feedback survey. Thus the sample used in our regressions contains only firms that are part of both datasets. This may lead to self-selection bias because long-term reliable participants of the regular surveys may be more likely to provide feedback than firms that frequently drop out from the regular surveys. Furthermore we might also have introduced a home made selection issue: Due to increased activity of the KOF survey office during the conduction of the feedback survey online participants have been reminded more often than usual to take part in the survey. If not accounted for, these aspects could lead to wrong conclusions: if a large share of reliable online participants was mobilized to take part in the feedback survey online we might conclude that taking part online resulted in fewer non-response.

In turn we expect selection into our merged sample not to be random. Thus we follow Little and Rubin (2002) who have shown how to account for selectivity when data is not missing at random. More precisely we make use of inverse probability weighting to weigh (Horvitz and Thompson, 1952) our observations given their conditional propensity to end up in the merged sample. Figure 1 of section 3.3 compares the distribution of our main variable of interest, namely unit non-response count: especially the tails indicate that the merged sample and the original BTS sample are not equally distributed.

We estimate the probability of being in the merged sample – i.e. to be invited to the BTS and to have taken part in the feedback survey – given a set of firm characteristics. Remarkably we were even able to collect feedback data for several firms that did not take part in the regular survey all year. This information is very valuable since we usually do not have any information on mid- and long-term non-respondents. Formally we estimate:

⁵See also Appendix 6 for a comprehensive documentation of the variables obtained from the feedback survey.

$$P(FB = 1|X) = \Phi(X'\beta), \quad (1)$$

where P denotes probability and Φ denotes the cumulative distribution function of the standard normal. The binary variable FB equals 1 if a company took part in both surveys feedback and regular BTS. FB equals 0 if this was not the case. X is a matrix of firm characteristics that were collected before 2013. The fitted values (propensity scores) fv are transformed and normalized as follows:

$$w_i = \frac{1 - fv}{fv} \quad (2)$$

$$w_{norm,i} = \frac{w_i}{\frac{1}{n} \sum_{i=1}^n w_i} \quad (3)$$

We use $w_{norm,i}$ as weights to account for selectivity in all of our regression models described in section 4.2. These inverse probability weights put more emphasis on observations that have a lower propensity to be in the merged sample given their characteristics. These observations would be under-represented without weighting.

4.2 Estimation of Unit Non-Response in the GLM Framework

As stated before all of our regression models to estimate non-response use the same set of covariates X to explain the dependent variable $Y \in \{0, 1, 2, 3, 4\}$. Following Cox and Smith (1989) all of the models presented in this subsection can be described as generalized linear models that consist of three components:

1. A *random component* Y_i
2. A *systematic component* η which is defined as: $\eta = \sum_1^p x_j \beta_j$ where p is the number of covariates
3. a link between the random and the systematic component which is defined as $\eta = g(\mu)$

Accordingly $g(\cdot)$ is called the link function. We compute two different specifications within this framework. First, we specify a classical linear model as a common starting point for discussion.

This implies that $Y_i \sim N(\mu, \sigma^2)$ as well as using the *identity* function for the link. Section 5 shows estimation results for an unweighted model and a weighted version respectively. The weighted model uses the inverse probability weights $w_{i,norm}$ to account for sample selection.

Obviously the discrete dependent variable $Y_i \in \{0, 1, 2, 3, 4\}$ is not represented well by a Normal Distribution. Thus we adjust the GLM framework presented above to describe a Poisson model. Poisson models are among the most common models for count data and can also be specified within the GLM framework (Cameron and Trivedi, 2013). In order to do so we assume $Y_i \sim P(\mu)$ and set the link function $g(\cdot) = \log$. Cox and Smith (1989) and Cameron and Trivedi (2013) show that the Poisson model can also be estimated using iteratively weighted least squares (IWLS). Thus the inverse probability weights $w_{i,norm}$ can be implemented in similar fashion as in the basic specification discussed above. Again, we display a weighted as well as an unweighted version in section 5. Note that these weights do not necessarily improve the fit as they are not chosen by optimization, but to adjust for selection bias.

4.3 Estimation of Unit Non-Response in a Two Part Model

Though basic count data models do a better job of fitting the data than the classical linear model employing a two part model as suggested by Zeileis, Kleiber, and Jackman (2008) helps further. We specify a hurdle model which consists of two parts: First, a binomial part models the decision to participate in general as opposed to not participating in one or more periods. Second, a count part models how often non-response actually occurs $Y_i \in \{1, 2, 3, 4\}$. Formally:

$$f_{hurdle}(y; x, z, \beta, \gamma) = \begin{cases} f_{zero}(0; z, \gamma) & \text{if } y = 0 \\ (1 - f_{zero}(0; z, \gamma)) \cdot f_{count}(y; x, \beta) / (1 - f_{count}(0; x, \beta)) & \text{if } y > 0 \end{cases} \quad (4)$$

Note that we use the same regressors $x_i = z_i$ to keep our models as comparable as possible though it is not required to use the same set of regressors. Zeileis, Kleiber, and Jackman (2008) suggest that the hurdle model might be slightly preferable over the zero-inflation model which is discussed in their same paper because its interpretation is more intuitive ⁶.

⁶Note that from a theoretical point of view zero-inflation is still the more correct specification, however, due to computations issues resulting caused by only few available observations in certain variable manifestations it is not possible to estimate our baseline model using zero-inflation framework

In our case we model a process that determines whether a firm drops out completely and a second process that determines how often a firm decides to drop out. It is plausible – particularly in a quarterly survey – that there is a separated process that controls the decision whether to integrate a regular survey into a company’s workflow and therefore take part every single time or not to have such a policy.

5 Discussion of Estimation Results

This section discusses the estimation results of the models presented in the previous chapter. The section is subdivided in three parts: First we present estimation results that were computed within a standard GLM framework. Namely we discuss unweighted and weighted versions of the classical linear model as well as maximum likelihood estimations of Poisson regression models. Second we present estimation results of the two part model described in section 4.3. Finally we discuss the robustness of our main findings to variations of our model specification. As stated before our baseline model shown in equation 5 uses the same set of covariates for all estimations.

$$\begin{aligned}
 \text{unit_nr_count} = & \alpha + \text{avg_run} * \beta_1 + \text{unit_nr_ratio} * \beta_2 + \text{valuation} * \beta_3 + \text{timeliness} * \beta_4 + \\
 \log(\text{employees}) * & \beta_5 + \text{gross} * \beta_6 + \text{sector} * \beta_7 + \text{cu} * \beta_8 + \text{staff_shortage} * \beta_9 + \text{language} * \beta_{10} + \\
 \text{position} * \beta_{11} & + \text{response_burden} * \beta_{12} + \text{surveys} * \beta_{13} + \text{human} * \beta_{14} + \text{participation_mode} * \beta_{15}
 \end{aligned} \tag{5}$$

5.1 Basic GLM Estimation Results

Table 2 provides GLM estimation results for the classical linear model, a weighted linear model, Poisson and Weighted Poisson estimations. Both weighted models are calculated using the weights discussed in 4.1. Standard errors for ML-Poisson and weighted Poisson are re-estimated using the sandwich R package⁷.

Comparing coefficient estimates in Table 2 shows that the signs of the coefficients as well as significance levels are more or less stable throughout all estimation methods used. There are no extreme changes in the estimation results between models. Our data backs a Poisson distribution rather than the Normal assumed in the other models which is why we focus on the weighted Poisson model for the remainder of this discussion. Although the fit is slightly worse for the weighted versions, we

⁷For further details see also Zeileis (2004) and Zeileis (2006).

stay with the weighted models here, because weights were chosen not to optimize the fit but based on the fact that our descriptive analysis suggested to account for selectivity.

	OLS	WLS	Poisson	Weighted Poisson
(Intercept)	0.17 (0.35)	0.60 (0.33)*	-1.27 (0.37)***	-0.75 (0.38)**
avg_run	0.33 (0.13)**	0.23 (0.10)**	0.06 (0.10)	-0.04 (0.10)
unit_nr_ratio	1.63 (0.20)***	1.49 (0.18)***	1.64 (0.18)***	1.34 (0.20)***
valuation	0.01 (0.02)	0.00 (0.02)	0.00 (0.03)	-0.01 (0.03)
timeliness_time	0.45 (0.07)***	0.54 (0.08)***	0.80 (0.12)***	0.86 (0.13)***
timelinessdeadline	0.13 (0.17)	0.16 (0.15)	0.57 (0.20)***	0.64 (0.20)***
timelinessreminder	1.09 (0.17)***	1.29 (0.16)***	1.12 (0.16)***	1.23 (0.17)***
log(employees)	-0.04 (0.03)	-0.01 (0.03)	-0.02 (0.03)	0.02 (0.03)
grossEspaceMittelland	-0.11 (0.12)	-0.11 (0.12)	-0.09 (0.13)	-0.09 (0.17)
grossGenferseeregion	-0.18 (0.23)	-0.47 (0.21)**	-0.18 (0.25)	-0.40 (0.28)
grossNordwestschweiz	-0.28 (0.11)**	-0.20 (0.11)*	-0.35 (0.14)**	-0.25 (0.16)
grossOstschweiz	-0.22 (0.14)	-0.27 (0.18)	-0.30 (0.13)**	-0.27 (0.13)**
grossTessin	-0.39 (0.47)	-0.68 (0.50)	-0.82 (0.41)**	-1.20 (0.30)***
grossZentralschweiz	0.00 (0.17)	-0.04 (0.17)	-0.03 (0.14)	-0.02 (0.13)
sector_class_DL2	0.11 (0.09)	0.22 (0.09)**	0.11 (0.09)	0.18 (0.10)*
sector_class_DL3	0.10 (0.08)	0.16 (0.08)**	0.11 (0.08)	0.08 (0.09)
cu	0.00 (0.00)*	-0.01 (0.00)***	-0.01 (0.00)**	-0.01 (0.00)***
staff_shortage	-0.07 (0.07)	-0.05 (0.07)	-0.11 (0.07)	-0.10 (0.09)
language_F	0.12 (0.21)	0.62 (0.19)***	0.06 (0.23)	0.38 (0.26)
language_I	0.19 (0.47)	0.63 (0.45)	0.56 (0.38)	1.19 (0.26)***
position_department	0.17 (0.10)*	0.19 (0.10)*	0.16 (0.10)*	0.18 (0.10)*
position_admin	-0.04 (0.15)	-0.21 (0.14)	-0.02 (0.19)	-0.17 (0.19)
position_other	0.12 (0.16)	0.32 (0.16)**	0.13 (0.18)	0.23 (0.18)
position_no_answer	0.19 (0.46)	0.04 (0.57)	0.00 (0.51)	-0.16 (0.58)
response_burden_D	0.21 (0.07)***	0.32 (0.07)***	0.19 (0.07)***	0.25 (0.08)***
surveys	-0.01 (0.01)	-0.02 (0.01)**	-0.01 (0.01)	-0.02 (0.01)*
human	0.00 (0.25)	-0.21 (0.19)	-0.06 (0.22)	-0.25 (0.19)
participation_mode_online	0.57 (0.07)***	0.72 (0.08)***	0.87 (0.12)***	0.84 (0.13)***
participation_mode_mixed	0.94 (0.39)**	0.61 (0.19)***	0.89 (0.30)***	0.67 (0.24)***
AIC	2303.04	2700.41	1933.22	2094.05
BIC	2445.64	2843.02	2071.07	2231.90
Log Likelihood	-1121.52	-1320.21	-937.61	-1018.03
Deviance	687.37	735.89	852.71	761.66
Num. obs.	857	857	857	857

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 2: Estimation Results: Basic Models

The variable *avg_run* shows changes in significance between linear estimations and Poisson estimations. While the coefficient is positive for all methods the variable is not significant in the Poisson models. This shows that answering later during course of a survey period is not a strong indicator for unit non-response – at least not to distinguish the exact number of non-response occurrences. Our variable *unit_nr_ratio*, which is simply the share of returned questionnaires before 2013, is a

good predictor of unit non-response in 2013. In other words past unit non-response is a strong predictor for future non-response.

A companies' general assessment of the use of BTS, captured by the variable *valuation*, does not have a significant influence on non-response. This finding might be surprising at first but it is in line with findings for other types of surveys made in previous studies. Couper, M.P., Singer, E., Conrad, F.G., and Groves, R.M (2008) show that altruistic reasons are one of the most prominent reason to take part in a survey motivation. More than 30 percent of their participants indicated that they take part in surveys due altruistic motivation. Porst and von Biel (1995) report similar results for a study based in the German speaking area.

The variable *timeliness* captures the perceived timeliness of a company's answers. It can be regarded as the subjective analog to the variable *avg_run* that was discussed in the previous paragraph. Remarkably the subjective assessment of when a firm usually returns a questionnaire is a much stronger and more robust predictor than the true average return time. The variable *timeliness* covers attitude towards surveys or return policy much better than a long term average on the individual level. The effect itself goes in the same direction for all model specifications: companies who elect not to answer immediately on a regular basis have a higher propensity to not respond.

Strikingly the size of the company is not significant in any specification. Thus we cannot attribute a robust effect to company size captured by the number of employees. This is somewhat surprising as larger companies should have a better infrastructure to handle surveys. However we cannot see a meaningful effect of company size in our estimations. With a country as heterogenous as Switzerland we expect to have regional differences in the unit non-response rate. We use Zurich as a reference category and compare the Zurich region to six other regions defined by the Swiss Federal Statistical Office. Regions other than Zurich answer more often than Zurich based companies. The strong effect that can be observed for Ticino is rather an artifact caused by the fact that Ticino is the only Italian speaking part of Switzerland. It is hard to disentangle a true regional effect from the language effect because the sample contains only two non-Italian speaking companies located in Ticino and only two italian speaking respondents located outside Ticino.

Distinction at the sector group level shows significant differences when weighting is applied. This is plausible because questions are relevant to a very different degree across different subgroups of the service sector. This effect needs to be closely monitored because sampling with respect to sectors should not be deterred in order to represent an entire sector. We use the variables *staff_shortage* and *cu* to proxy the business situation at the company level. Capacity utilization and employment are

strongly correlated with the business cycle and can thus help to learn about a company's business situation – even if that company has not answered this question in the regular business tendency survey. However, while a higher capacity utilisation seems to decrease companies' non-response count, staff shortage has no significant influence.

If the responding person is working as a head of department as opposed to being in an ownership or management position, non-response increases. While this effect is robust in all of the basic specifications, lower hierarchy levels are not significantly different. The variable *reponse_burden* is a binary indicator for the perceived response burden. Participants' subjective categorical assessment of response time is summarized into a single binary indicator whether or not more than ten minutes are spent answering the regular BTS. The variable *reponse_burden* is highly significant in all model setups and increases unit non-response as expected. On the other hand the actual number of surveys that a company answers is not significant in any of the specifications. Also, we cannot find an effect of addressing contact persons within the company as opposed to not addressing a specific person within a company. The latter result may also be due to the share of companies addressed without a specific contact person being too small in our sample.

KOF BTS are multi-mode surveys allowing participants to answer either paper based or online. The categorical variable *participation_mode* captures the mode with paper based participation being the reference category. We have a third category *mixed* besides *paper* and *online* which denotes participants who have changed their participation mode during the course of 2013 and therefore can neither be summarized as *paper* nor *online*. Online participation as well as mixed participation modes increases unit non-response in all specifications. The latter is likely due to a KOF policy which tries to convince drop-outs who used to answer on paper to answer online arguing that online participation is more timely and less burdensome. This increases the share of unreliable participants without a clear policy with respect to surveys within the group of mixed participants. Moreover this type of participant is also more likely to be in the group of web based participants if the switch occurred before 2013. In the literature we find mixed results for mode preferences and differences in response rates in multi-mode surveys. Tse-Hua Shih and Xitao Fan (2007) provide a meta analysis of mixed mode studies. They find the response rate in web based studies to be worse by 8 percent on average, but report very high standard deviations (32 %) for response rate differences across all studies. Response rate differences, however, are very different across studies and go in either direction. This heterogeneity is clearly in line with our results as it shows that mode preferences and adaption of the internet are clearly provider, participant and survey specific determinants.

5.2 Two Part Model Estimation Results

We estimate a two part model in order to account for an excess number of zeros compared to a basic count data model. The following section discusses the estimation results of the *hurdle model* described in section 4.3. The binomial part presented in table 3 models whether a company has not responded in at least one out of four quarterly survey waves. The Poisson part models how often a company chose to not respond given the company did not respond at least one time. The hurdle specification models the company’s decision whether to incorporate a regular BTS in a company’s workflow or not.

	Count model	Zero model
(Intercept)	-1.16 (0.51)**	0.66 (0.88)
avg_run	-0.08 (0.10)	0.75 (0.32)**
unit_nr_ratio	0.98 (0.24)***	2.61 (0.49)***
valuation	-0.03 (0.03)	0.05 (0.07)
timeliness_time	0.66 (0.20)***	1.28 (0.21)***
timeliness_deadline	0.58 (0.26)**	0.81 (0.39)**
timeliness_reminder	1.01 (0.23)***	2.71 (0.62)***
log(employees)	-0.02 (0.04)	0.08 (0.07)
grossEspaceMittelland	0.02 (0.16)	-0.48 (0.34)
grossGenferseeregion	-0.17 (0.23)	-0.79 (0.57)
grossNordwestschweiz	-0.35 (0.20)*	-0.34 (0.30)
grossOstschweiz	-0.48 (0.26)*	0.30 (0.54)
grossTessin	1.06 (1.25)	-4.87 (3.17)
grossZentralschweiz	-0.35 (0.24)	0.61 (0.47)
sector_class_DL2	0.19 (0.12)	0.12 (0.26)
sector_class_DL3	0.08 (0.11)	-0.10 (0.22)
cu	0.00 (0.00)	-0.03 (0.01)***
staff_shortage	0.05 (0.09)	-0.36 (0.19)*
language_F	0.38 (0.19)**	0.21 (0.54)
language_I	-0.96 (1.25)	4.36 (3.09)
position_department	0.23 (0.11)**	-0.03 (0.27)
position_admin	-0.32 (0.23)	0.07 (0.39)
position_other	0.02 (0.18)	1.12 (0.46)**
position_no_answer	0.68 (0.72)	-1.71 (2.00)
response_burden_D	0.29 (0.10)***	0.49 (0.19)**
surveys	-0.01 (0.01)	-0.04 (0.02)**
human	-0.03 (0.25)	-0.79 (0.55)
participation_mode_online	0.66 (0.16)***	1.51 (0.21)***
participation_mode_mixed	0.58 (0.24)**	1.67 (0.71)**
AIC	2079.02	2079.02
Log Likelihood	-981.51	-981.51
Num. obs.	857	857

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3: Hurdle Model

Both timeliness and the non-response track record of a company are significant indicators of whether a company chooses the clean slate policy or to not respond at times: Companies who answer late on average and had a past of not responding are more likely to not respond. However, only the history of unit non-response is a good indicator to predict how often a company does not respond. True response time does not help to predict unit non-response count. Again perceived timeliness is highly significant in both parts of the model. Companies which deviate from answering right away

are more likely to not have a policy to always respond. Also unit non-response occurs more often for companies who do not answer directly after receiving the questionnaire. Capacity utilization is used to proxy the business situation on company level. Companies with a higher average capacity utilization in 2013 are more likely to respond. This finding contradicts Seiler (2013) and Harris-Kojetin and Tucker (1999), who find higher non-response during economically satisfactory times and argue that rise in non-response is driven by fewer available capacity. This statement rather refers to inter-temporal comparison, while we compare long-term participants with each other. We believe that a quarterly survey which is answered in about five minutes by the vast majority of the participants is not affected by a company having scarce (technical) capacity available. Thus we argue that the reduction of non-response by positive business situation is driven by a mutual correlation of response and running a business successfully with being well organized. However, capacity utilization does not help to distinguish how often reliable companies are that eventually drop out. The variable *response_burden* has a similar impact in both parts of the model as it had in the basic GLM based models: Respondents who perceive a high burden are less likely to incorporate a policy to always answer to BTS. Also respondents who perceive the burden to be high tend to not respond more often. Again answering online or paper based does have a significant coefficient. Thus unit non-response is more likely to occur for online participants or those who switched the participation mode during the course of 2013.

5.3 Variation and Robustness of Results

This section discusses four variations of our baseline model in order to check the robustness of our findings to changes in model specification. We pay particular attention to variables which decrease the sample size because of limited availability. Table 4 shows four variations of the baseline specification: Model 1 includes a gender distinction instead of controlling for a human contact person, Model 2 leaves out firm characteristics such as size, region and sector. Model 3 leaves out both business situation proxies and model 4 lacks all firm characteristics. All of the variations shown in table 4 are designed as a weighted Poisson models and are estimated by maximum likelihood.

Model 1 does not change the overall picture, yet female participants tend to answer less than their male counterparts. Model 2 backs our thought that the significance of the effect of the Italian language was rather an artifact. When we leave out regional specifications language which is highly collinear with being located in Ticino turns insignificant. Model 3 increases the sample size by 95

	Full	Model 1	Model 2	Model 3	Model 4
(Intercept)	-0.75 (0.38)**	-0.99 (0.31)***	-0.78 (0.39)**	-1.60 (0.21)***	-0.67 (0.26)***
avg_run	-0.04 (0.10)	-0.05 (0.10)	-0.10 (0.10)	-0.08 (0.10)	
unit_nr_ratio	1.34 (0.20)***	1.31 (0.19)***	1.40 (0.20)***	1.39 (0.20)***	
valuation	-0.01 (0.03)	0.00 (0.03)	-0.01 (0.03)	0.00 (0.03)	
timeliness_time	0.86 (0.13)***	0.82 (0.13)***	0.85 (0.13)***	0.86 (0.13)***	
timeliness_deadline	0.64 (0.20)***	0.64 (0.21)***	0.68 (0.20)***	0.67 (0.18)***	
timeliness_reminder	1.23 (0.17)***	1.19 (0.17)***	1.28 (0.17)***	1.31 (0.17)***	
log(employees)	0.02 (0.03)	0.02 (0.04)			
grossEspaceMittelland	-0.09 (0.17)	-0.11 (0.17)			
grossGenferseeregion	-0.40 (0.28)	-0.38 (0.28)			
grossNordwestschweiz	-0.25 (0.16)	-0.26 (0.17)			
grossOstschweiz	-0.27 (0.13)**	-0.17 (0.13)			
grossTessin	-1.20 (0.30)***	-0.98 (0.28)***			
grossZentralschweiz	-0.02 (0.13)	-0.01 (0.12)			
sector_class_DL2	0.18 (0.10)*	0.16 (0.10)			
sector_class_DL3	0.08 (0.09)	0.08 (0.09)			
cu	-0.01 (0.00)***	-0.01 (0.00)***	-0.01 (0.00)**		
staff_shortage	-0.10 (0.09)	-0.07 (0.09)	-0.10 (0.10)		
language_F	0.38 (0.26)	0.40 (0.26)	0.12 (0.12)	0.11 (0.12)	0.27 (0.15)*
language_I	1.19 (0.26)***	1.01 (0.23)***	0.16 (0.17)	0.17 (0.18)	0.17 (0.26)
position_department	0.18 (0.10)*	0.14 (0.10)	0.18 (0.10)*	0.15 (0.09)	0.15 (0.11)
position_admin	-0.17 (0.19)	-0.26 (0.25)	-0.16 (0.19)	-0.13 (0.14)	-0.18 (0.17)
position_other	0.23 (0.18)	0.20 (0.16)	0.20 (0.17)	0.18 (0.18)	0.22 (0.16)
position_no_answer	-0.16 (0.58)	-0.17 (0.62)	-0.13 (0.61)	-0.05 (0.71)	-0.46 (0.78)
response_burden_D	0.25 (0.08)***	0.24 (0.08)***	0.20 (0.08)**	0.22 (0.08)***	0.42 (0.10)***
surveys	-0.02 (0.01)*	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)*	-0.02 (0.01)**
human	-0.25 (0.19)		-0.21 (0.18)	-0.14 (0.15)	-0.25 (0.19)
participation_mode_online	0.84 (0.13)***	0.87 (0.13)***	0.82 (0.13)***	0.85 (0.13)***	1.25 (0.14)***
participation_mode_mixed	0.67 (0.24)***	0.78 (0.25)***	0.74 (0.29)**	0.74 (0.26)***	1.50 (0.21)***
sex_female		0.16 (0.09)*			
AIC	2094.05	2011.87	2092.32	2271.02	2582.62
BIC	2231.90	2149.24	2187.39	2358.38	2641.01
Log Likelihood	-1018.03	-976.93	-1026.16	-1117.51	-1279.31
Deviance	761.66	744.70	777.92	851.16	1147.30
Num. obs.	857	843	857	947	959

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4: Variations of the Model Specification

observations leaving out the information on capacity utilization and staff shortage. Again only the variable *position_department* turns insignificant. Model 4 neglects all firm specific characteristics. The remaining variables control for respondent characteristics and survey design. The results are mostly in line with the baseline model though the log likelihood is substantially lower than in the full specification. The number of surveys is significant with the sign pointing into the intuitively correct direction. This results holds for three out of our five specifications. Overall our main findings are robust to changes in the model specifications. Also, our main findings still hold when modify the sample substantially by excluding poorly available variables.

6 Conclusion and Outlook

The process that determines non-response in BTS is fairly complex and cannot be modelled fully. Further complexity is introduced by the fact that participants are answering on behalf of companies

instead of representing themselves. Nevertheless our regressions are able to model a substantial part of the process described in the conceptual of Willimack, Nichols, and Sudman (2002). Also in our paper, we are able to disentangle important drivers of unit non-response. The perceived response burden as well as the response track record of the companies are highly robust drivers of unit non-response. Also a company's timeliness of returning the questionnaires is a robust and influential predictor of unit non-response. The last of our most influential drivers of unit response is the participation mode. Online participants as well as participants who switched modes recently are less likely to respond on a consistent basis than paper based respondents. We believe that this is not a true mode effect in the sense that presenting questions online does affect the result and the likeliness to respond. Companies who are less committed and answer more adhoc are rather attracted by the ease of online response. Also companies who drop out from the paper based survey are encouraged to try out reducing the burden by taking part online.

Besides the strongest and most robust effects it also noteworthy that company size did not have a robust influence on unit non-response in our study. This is clearly a desired result as the sample is not deterred by missing data in the case of the KOF Swiss Economic Institute BTS in the service sector. On the other hand capacity utilization which we used to proxy business situation on the individual level has a significant influence. Companies with a better business situation are more likely to respond on a regular basis. During the pre-test we had experienced that the companies' ability to effortlessly report is highly heterogeneous in a very diverse service sector. Being well structured is likely correlated with both running a business successfully and being able to report effortlessly. Thus this result is not surprising but could potentially be highly dependent on the sector. Sectors that require to send signals to suppliers or customers in order to secure contracts are more used to transparently display their business situation. It is not desirable that unit non-response is affected by the business situation in the way described above. Obviously such a selection mechanism would lead to overly optimistic assessment of the general business situation because companies with dis-satisfactory business situations are more likely to drop out. However, the effect is not as robust and influential as the effects discussed in the previous paragraphs. The fact that we find only little (business situation) or no influence (size) of economic variables on the missing data mechanism makes KOF survey data very suitable for inference on the Swiss service sector.

In the future further feedback data from other sectors is needed to generalize our findings – most prominently from the manufacturing sector. We suggest to implement regular feedback surveys that alternate through sectors in different periods to gather feedback from each sector every couple

of years. This would help to monitor changes in the data generating process more closely. Also, if we regard unit non-respondents as the tightest and largest single cluster within the BTS dataset, answers can be further grouped into other clusters. New research could check whether other respondent groups are also partly driven by non-economic aspects. This type of research contributes to improve methodology in economic surveys and helps economic survey conductors to adapt surveys and panel management. Also our work emphasizes the importance of participant relationship and panel management. If participants do not drop out at random they need to be replaced carefully. Also our results with respect to company policies and overall participation patterns emphasize the importance of recruiting new companies explicitly to a panel survey as opposed to just recruiting firms to a single wave.

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Appendix A: Feedback Questionnaire



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Please note:

- Confine your answer to the sector specified in the questionnaire
- Consider the business activity of offices in Switzerland only
- Please colour in the appropriate field
- Read the notes overleaf
- Return before 30 June 2013

All data will be treated in the strictest confidence

1. Assessment of the Business Situation

a) Please tick the importance to you of each of the following factors in assessing the current business situation:

	unimportant 1	2	3	4	very important 5
Turnover	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quantity of sales/volume	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inventory	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enquiries/offers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Incoming orders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Customer frequency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Corporate earnings/margin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cost situation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Liquidity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
General sentiment in the sector/overall economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other: _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

b) Do you use a yardstick to assess the business situation? If so, how do you compare it?

- With the targets/expectations/ for the month under review
- With the situation of major competitors or the situation in the sector
- With the general economic situation
- With a previous business situation
- Other: _____
- We don't use a yardstick

↳ If you make a comparison with a previous business situation: with which business situation do you compare it?

- Previous month
- Same month of the previous year
- Same month of the previous year
- Average business situation in recent years
- Business situation in the corresponding month of recent years
- Other: _____

2. Business Expectations

Please tick the importance to you of the following list of factors in assessing the business performance expected in the (coming 6 months):

	unimportant 1	2	3	4	very important 5
Factors/indicators of own business	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic forecasts for our sector / for the overall economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
General sentiment in the sector / overall economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
General sentiment in the client sector	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trends in household earnings /labour market situation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Macroeconomic domestic production / investment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Macroeconomic imports / exports	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Political/general legal framework	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. Seasonal Fluctuations

We ask our survey participants to eliminate purely seasonal fluctuations from questions on business and employment expectations. If this is feasible, what approach do you use to eliminate purely seasonal fluctuations?

- Elimination of seasonal fluctuations not possible or feasible
- Comparison with previous year
- Comparison with average trends in the same months of previous years
- Empirical values
- Other: _____

4. Business Activity

Could your company's existing capacities cope with increased demand at present?

- Yes No

↳ If yes: We could increase our business activity by % ausweiten.

- Question is irrelevant for our company



5. Number of Surveys

a) How many surveys do you (personally) complete on average in a year?

	0	1	2	3	4	>4
KOF	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Official statistics/FSO	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Market researchers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industry association	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other: _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

b) Does your company have a routine for replying to surveys?

The KOF Business Tendency Surveys are usually...

...answer immediately after receiving the questionnaire

...answered when time permits

...answered just before the deadline for submission

...answered when a reminder is received

c) How long does it usually take to fill out the KOF Business Tendency Surveys (in minutes)?

<5	<10	<15	<20	<30	<45	<60	>60
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. Personal Data

a) In which department of your company are KOF Business Tendency Surveys normally completed?

Management

Staff Position

Controlling

Accounts

Statistics

Procurement

Sales

Marketing

Other: _____

b) What position does the person who usually completes the surveys occupy in the company? (With reference to the questionnaire)

Owner/manager/board member

Departmental head

Administrator

Other: _____

c) How many people are involved in completing the KOF Questionnaire (Quarterly Business Tendency Survey)?

one two three more than three

7. Significance of Business Tendency Surveys

How do you rate the benefit of business tendency surveys in general?

unnecessary					important
1	2	3	4	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

8. Capacity Utilisation

a) Please tick the importance to you of each of the following factors in assessing the capacity utilisation of your business:

	unimportant				very important
	1	2	3	4	5
Working hours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Personnel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Productivity per employee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tech. Capacities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surface area/existing stock of buildings and premises	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Material consumption	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Capital used	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Licences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Customer frequency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other: _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

b) If the demand for your services exceeds your existing capacities, would you be able to increase your capacities at short notice?

	impossible				perfectly possible
	1	2	3	4	5
Personnel-related factors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other, non personnel-related factors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. Recording Capacity Utilisation

a) If possible, assess the average capacity utilisation in the last 3 months based on...

...personnel-related capacity (in %):

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
50	55	60	65	70	75	80	85	90	95	100	105	110	115	120					

or: question is not relevant to our company

...non personnel-related, technical capacity (in %):

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
50	55	60	65	70	75	80	85	90	95	100	105	110	115	120					

or: question is not relevant to our company

b) If the demand for your services exceeds your existing capacities, would you be able to increase your capacities at short notice?

productive % unproductive % not specified

c) Do you use a time recording system?

Yes

No, but we plan to introduce one

No

10. Staff Shortage

a) Have your activities been hindered in the past by a staff shortage?

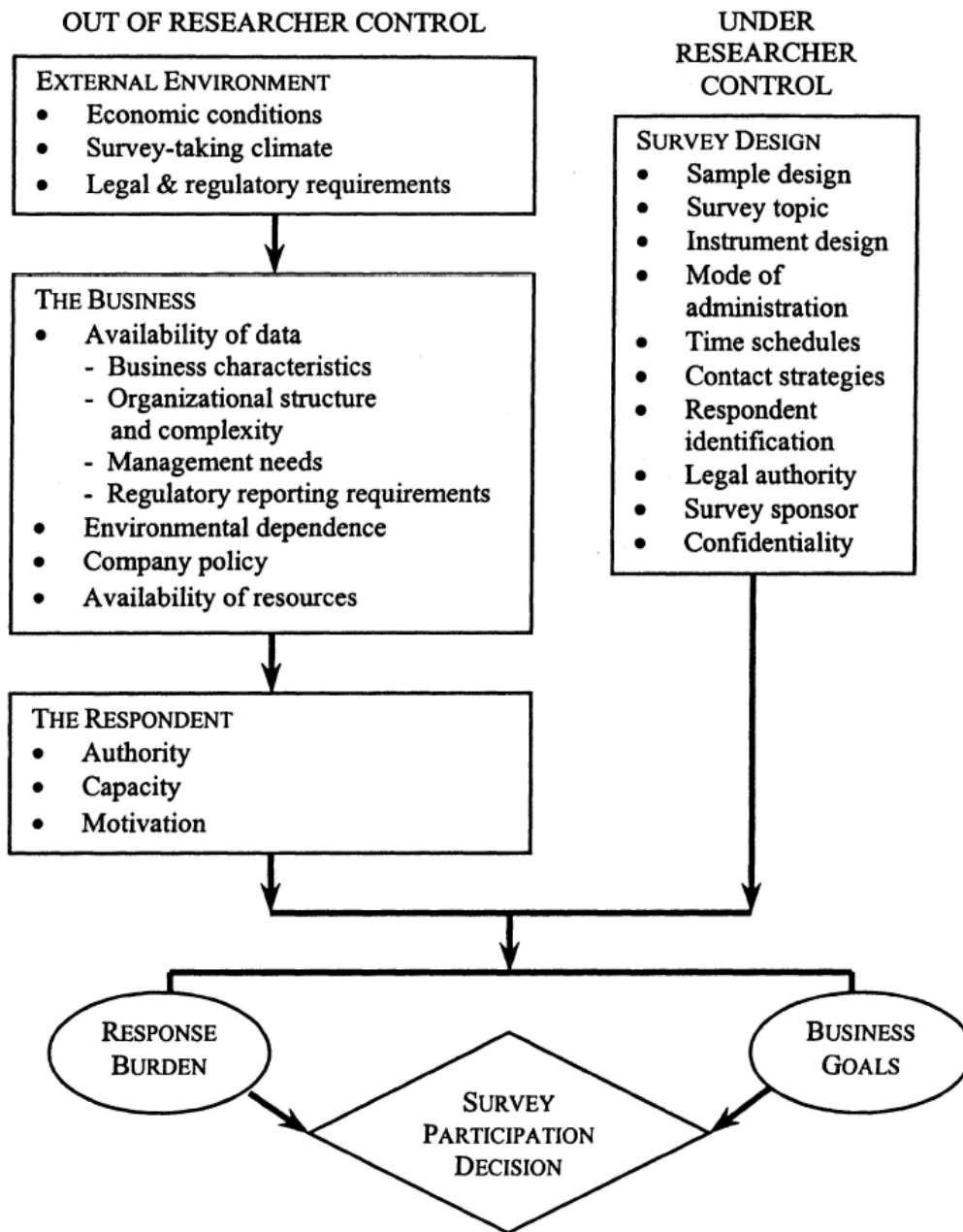
Yes No

b) If there were problems recruiting suitably qualified staff, this was attributable to

the lack of availability of staff with relevant qualifications

the excessive costs of employing staff with relevant qualifications

Appendix B: Conceptual Business Survey Nonresponse Framework



Appendix C Selectivity

Table 5 shows the results of the probit model described in 5. The ratio of unit non-response relative to a company's participation is clearly the strongest predictor of ending up in a the merged sample. Firms that answer more consistently are also more likely to take part in 2013 one time feedback survey. Also web based participants are more likely to participate. These results are perfectly in line with our expectations. Thus we are confident that the suggested models can account for the selectivity concerns raised in section 4.1. Figure 2 shows further that weighting⁸ approximates the original distribution slightly better than the merged sample. The distribution of normalised weights, computed according to Formula 2, is shown in Figure 3. It shows that normalisation keeps weights resasonably close.

⁸The histogram "Weighted" shows the distribution of unit non-response count for those firms, which have a fitted value above 0.5

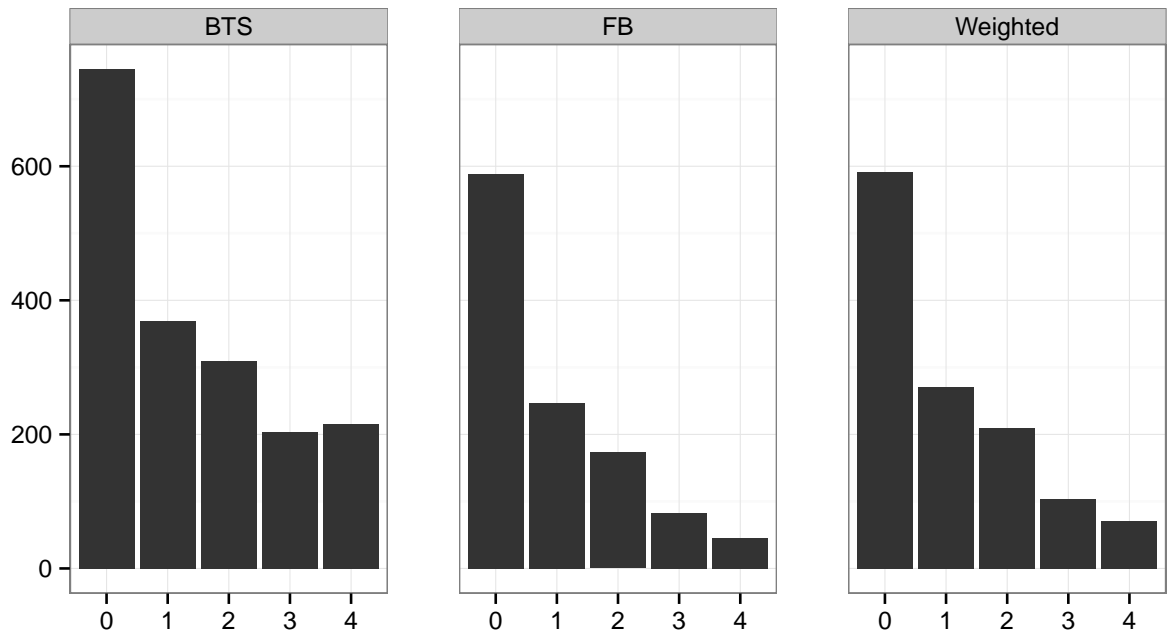


Figure 2: Unit Non-Response Count by Samples

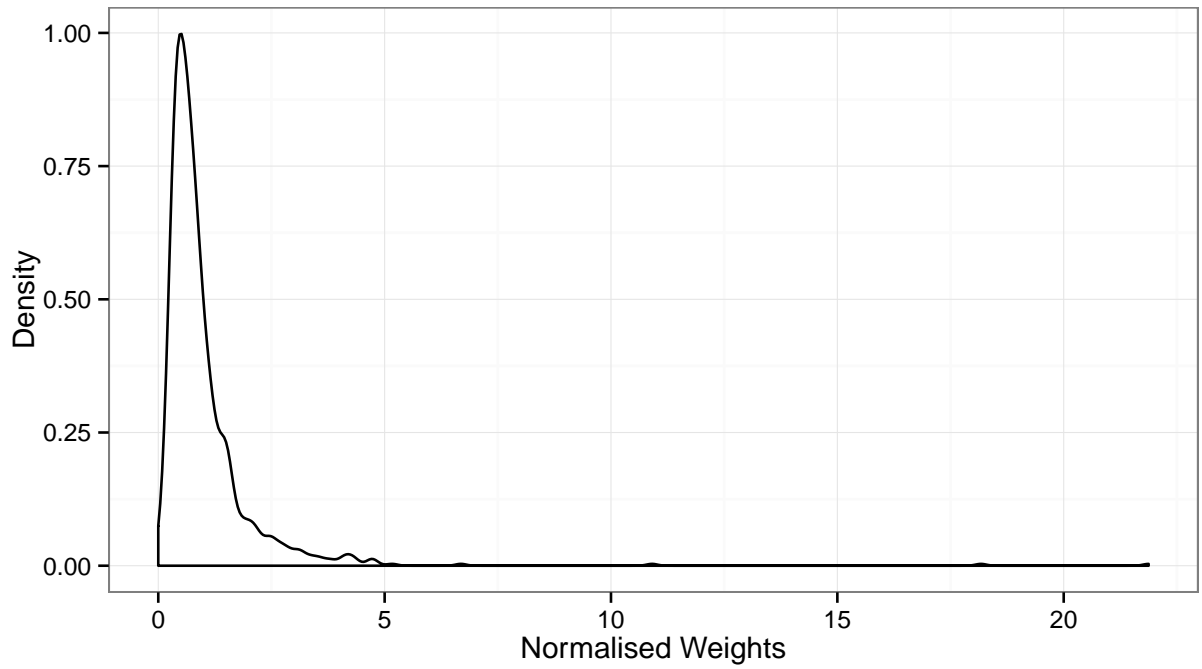


Figure 3: Density of Normalised Weights

Table 5: Accounting for Selectivity

	Probit
(Intercept)	1.02 (0.45)**
unit_nr_ratio	-1.03 (0.21)***
sample_age	-0.01 (0.08)
employees	0.00 (0.00)
sex_female	-0.33 (0.08)***
sex_none	-0.16 (0.23)
sector_2d50	0.03 (0.57)
sector_2d51	-0.77 (0.29)***
sector_2d52	-0.17 (0.31)
sector_2d53	-1.09 (0.51)**
sector_2d58	-0.02 (0.31)
sector_2d59	-0.48 (0.44)
sector_2d60	0.42 (0.84)
sector_2d61	-0.37 (0.35)
sector_2d62	-0.26 (0.19)
sector_2d63	-0.09 (0.29)
sector_2d68	-0.36 (0.21)*
sector_2d69	-0.39 (0.21)*
sector_2d70	-0.48 (0.25)*
sector_2d71	0.25 (0.49)
sector_2d72	-0.33 (0.26)
sector_2d73	-0.09 (0.24)
sector_2d74	-0.43 (0.38)
sector_2d75	-0.20 (0.54)
sector_2d77	-0.25 (0.40)
sector_2d78	0.11 (0.29)
sector_2d79	-0.44 (0.29)
sector_2d80	-0.46 (0.58)
sector_2d81	-0.62 (0.27)**
sector_2d82	-0.07 (0.30)
sector_2d86	-0.35 (0.18)*
sector_2d87	-0.61 (0.21)***
sector_2d88	-0.19 (0.24)
sector_2d90	-0.28 (0.35)
sector_2d91	0.31 (0.45)
sector_2d92	3.72 (235.03)
sector_2d93	-0.72 (0.28)**
sector_2d95	-5.58 (235.03)
sector_2d96	0.03 (0.23)
mode_internet	-0.18 (0.20)
mode_mixed	-1.22 (0.31)***
avg_run	-0.34 (0.13)***
internet_ratio	0.37 (0.22)*
canton_AR	0.23 (0.72)
canton_BE	-0.05 (0.20)
canton_BL	-0.73 (0.36)**
canton_BS	-0.18 (0.29)
canton_FR	-0.01 (0.34)
canton_GE	-0.22 (0.21)
canton_GL	-0.26 (0.92)
canton_GR	0.15 (0.34)
canton_LU	0.22 (0.27)
canton_NE	-0.22 (0.45)
canton_NW	0.02 (0.79)
canton_OW	5.00 (156.82)
canton_SG	0.61 (0.30)**
canton_SH	4.85 (151.84)
canton_SO	0.30 (0.29)
canton_SZ	0.12 (0.45)
canton_TG	-0.23 (0.33)
canton_TI	0.55 (0.27)**
canton_UR	-0.32 (0.55)
canton_VD	-0.13 (0.24)
canton_VS	-0.18 (0.30)
canton_ZG	-0.11 (0.38)
canton_ZH	0.11 (0.15)
AIC	1853.78
BIC	2204.06
Log Likelihood	-860.89
Deviance	1721.78
Num. obs.	1491

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$