

Müller, Christian; Wirz, Aniela; Sydow, Nora

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A note on the Carlson-Parkin method of quantifying qualitative data

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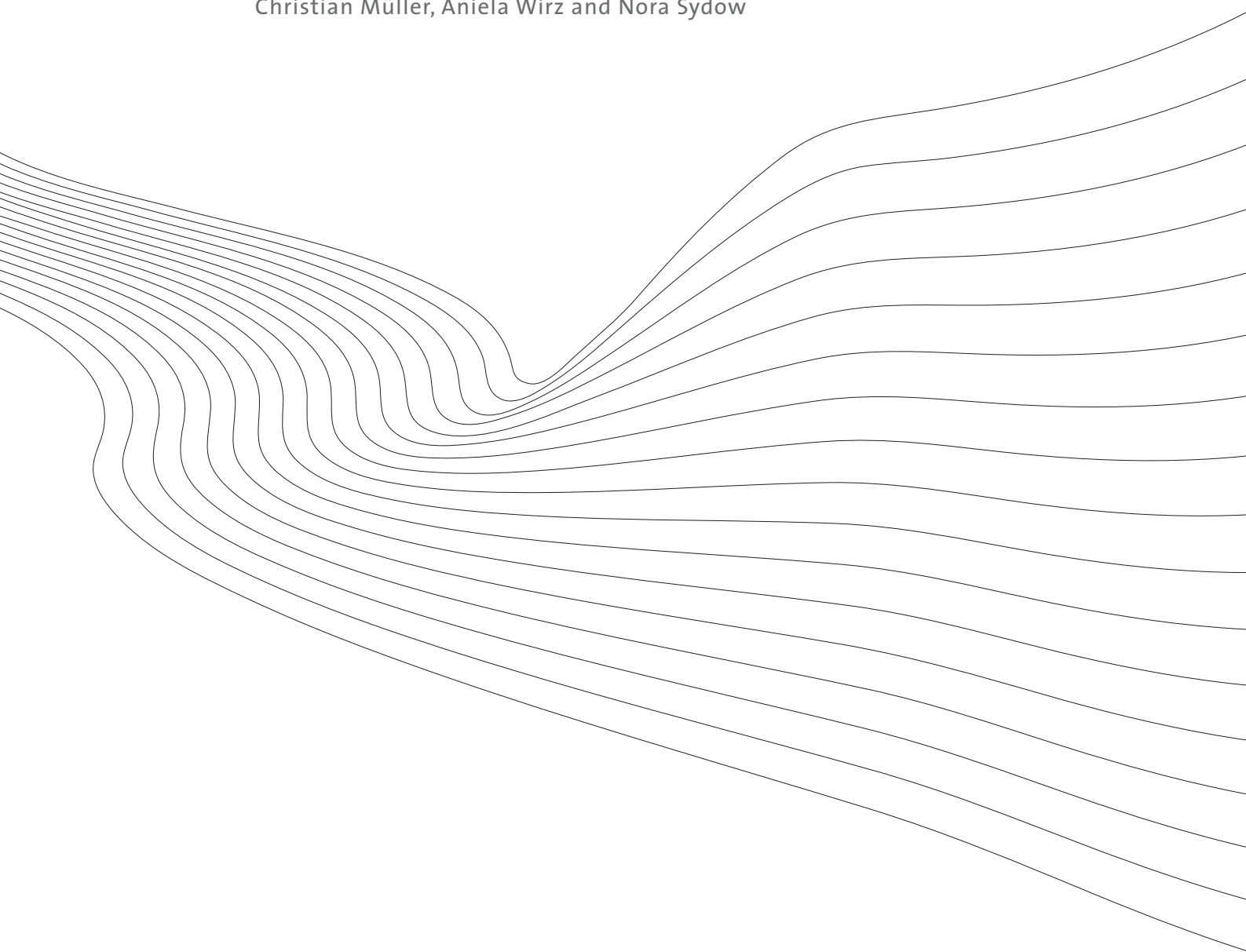
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A Note on the Carlson-Parkin Method
of Quantifying Qualitative Data

Christian Müller, Aniela Wirz and Nora Sydow



KOF

ETH Zurich
KOF Swiss Economic Institute
WEH D 4
Weinbergstrasse 35
8092 Zurich
Switzerland

Phone +41 44 632 42 39
Fax +41 44 632 12 18
www.kof.ethz.ch
kof@kof.ethz.ch

A note on the Carlson-Parkin method of quantifying qualitative data

Christian Müller* Aniela Wirz Nora Sydow

ETH Zurich

KOF - Swiss Economic Institute

Weinbergstrasse

CH · 3092 Zürich, Switzerland

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Abstract

Qualitative surveys enjoy huge popularity among business cycle analysts and research institutes since they provide fast information on the stance of the economy. However, in order to derive quantitative statements researchers have to rely on assumptions about the relation between quantitative and qualitative information. This paper introduces a micro data set that combines individual quantitative and qualitative information and presents first tests of common assumptions. It suggests a modification of the Carlson and Parkin (1975) method and a solution to the zero response problem.

JEL classification: C42, C82, E2, D10

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*Corresponding author. Contact details: e-mail: cmueller@kof.ethz.ch, fon: +41 44 632 4624, fax: +41 44 632 12 18

INTRODUCTION

Qualitative surveys provide fast and reliable data on, for example, the performance of enterprises. The data generation and processing is comparably cheap for both, the survey conductor and the survey respondents. These advantages have their price, however. The issues surveyed are usually of quantitative nature, such as turnover, investments, expenditures and so on. It therefore invokes the problem of having to transform the qualitative data back into quantitative information. This transformation hinges on a number of critical assumptions about distributional functions and forecast capabilities, cognitive skills, reliability of respondents and response mechanisms.

The result of the quantification process thus depends on a number of unobservable factors that impede the possibilities to assess the method and to possibly improve over existing approaches. The most important hassle usually is the lack of corresponding quantitative data that would help to better understand the relationship between the quantitative and the qualitative information. Moreover, such data would have to be made available at the individual level thus impairing the advantage of the qualitative approach.

In this paper we present results from a data set that matches qualitative data and its quantitative counterpart on a micro level. Owing to exceptional circumstance this data set provides information on both the qualitative response to a survey question and the quantitative figure it relates to. As this survey data is also used by official statistical offices, it also represents a role model for real life applications. The research presented here partly relates to similar data sets as well which are under investigation in a series of complementary research projects which try to shed

light on the link between quantities and qualitative assessments on an individual-by-individual basis.

One outcome of the project so far is a suggestion for a modification of the popular Carlson-Parkin method (Carlson & Parkin 1975, henceforth CP). We propose a new way of calculating the assumed thresholds and a solution to the zero-response problem.

The remainder of the paper is organised as follows. The next section describes the data before the CP method is recalled. Then, the possibility of extending the approach to more detailed information is discussed and these information are provided given the new data set. Finally, an application illustrates the suggestions and conclusions will be drawn.

1 THE DATA

1.1 Retail sector survey

At the centre of this paper is a data set that comprises information from more than 2300 enterprises in the retail sector which are surveyed monthly on a number of questions relating to their turnovers. These firms are asked to provide details of their revenues in either a subcategory of the retail business or their total revenues. For example, one question reads “What was your revenues in foods and beverages in the last month?” Likewise, the related turnover of the month before is demanded as is a qualitative forecast for the revenues in the following three months. For the latter the questionnaire offers the three response categories “increase”, “unchanged”, and “decrease”. The firms are then asked to tick a related box.

This survey has been in place since April 2005. It is the result of a reduction in the budget of the Swiss Federal Statistical Office (Bundesamt für Statistik, BFS) which was forced to save on some of its activities. As the Swiss Institute for Business Cycle Research (KOF) at the Swiss Federal Institute of Technology Zurich (ETH Zurich) has also been surveying the retail sector, it was asked to conduct a new survey that would generate the required information. Prior to 2005 the KOF only asked for qualitative responses while the BFS collected only quantitative figures. The merger of these two now provides us with the micro data on both quantities and qualities.

So far, the data of sixteen months is available. After correcting for missing values the sample contains information on the business data for twelve business subcategories, or total turnover of about 1631 firms. This yields 12979 observations, or 3735 when total turnover is considered separately.

When answering, the firms are asked to abstract from seasonal variations such as time of the year and holidays. Even though it can be assumed that individuals are not fully capable of actually doing so, this problem is put aside for the moment.

The realised value against which we compare the reported expectation is either the percentage from the current to the average of the following three months, or the percentage change from the past three (including the current) months to the average of the following three months. We also checked absolute changes. The resulting empirical distribution of the realised variables are so heavily skewed and dominated by few outliers that we did not deem it useful to build the analysis on this variant.

1.2 Quarterly survey in the industry

The second data set of the broader project relates to a survey in the Swiss industrial sector. This survey is conducted each quarter and addresses approximately 1600 firms with a response rate of around 65 percent. It has been running for 40 years of which the past 21 are of particular interest for this paper since during this time the relevant questions have remained unchanged. These questions are: “Are your technical capacities – a) insufficient, b) just right, or c) too high.” as well as “What is the degree of technical capacity utilisation.” The latter is answered by ticking a box out of thirteen which range from 50 to 110 each representing a five percent interval.

Quite obviously, firms with insufficient or superfluous capacities should be expected to adjust in the following period. Therefore, the change in the answers to the second question from one wave to the other can be matched to the statement about capacity level in the current quarter. As in the retail sector, KOF has the survey details on an individual basis.

1.3 Investment survey – biannual survey in the industry

In addition to the regular quarterly survey in the industry KOF conducts two annual surveys which address the investment plans of industrial firm. In the first survey, firms are asked to report whether or not they intend to invest, specifically, whether they plan to invest more, as much, or less than in the previous period. In the second survey, which is conducted a few months later and in collaboration with the BFS, they are asked to report the actual investment of the current as well as in the

past year. This again provides the opportunity to compare expectations, or rather intentions in this case, to the actual outcome.

A particularity of this survey is that it provides investment plans and realisations in two different categories. These are building investments, investment in capital goods, and total investment. This almost trebles the available information.

1.4 Reporting conventions

This paper is about the possibilities to derive patterns in survey responses and their potential for refining standard methods. Therefore, several conventions for reporting the survey characteristics appear desirable.

The standard table will be built like table 1.

Table 1: Contingency table – Example

		realisation			
		–	=	+	sum
	–	mm	me	mp	D
expectation	=	em	ee	ep	E^*
	+	pm	pe	pp	U
sum		M	S	P	A

Read from the left the rows report the reported expectations, statements (implied intentions), or intentions with respect to the issue questioned. These are the qualitative responses. The columns provide information on the quantitative realisations. For example, if a firm expects its revenues to increase in the following three months and it actually happens, then this would show up in the section labelled pp. Thus, if the table entries represent percentages $pp = 12$ would imply that twelve percent of the respondents expected and experienced an increase in their turnovers. Alternatively, pp might be a vector containing information such as median, mean,

standard deviation and so forth.

Finally, the column labelled ‘sum’ provides information on the marginal distribution for either columns or rows. For example, $D = 15\%$ implies that 15% of all respondents expected an increase in the turnovers. Consequently, $M + S + P = D + E^* + U = A$ must hold for reported percentages as well as number of observations

This form of the table follows Ivaldi (1992). If, for example, the entries correspond to percentage shares of the individual responses, then the table has the convenient feature that rational forecasts can be identified by comparing the diagonal to the off-diagonal elements. If the diagonal elements were all larger than the off-diagonal elements of the same row, the most frequent outcome of a guess matches the expectation.

2 EMPIRICAL RESULTS

We now present the contingency tables for the three surveys described. Since two of them (retail and investment) can be split into up to thirteen orthogonal subsamples, we obtain more than just three such tables. The current paper presents five of these tables. In the retail sector we look at the percentage changes in revenues over the whole sample in all thirteen categories (food and beverages, clothing, ..., total if not specified otherwise), and at absolute changes in turnovers. For the latter the last category is chosen which is total turnover.

The annual investment survey in the industry collects data on building investment, investment in capital goods, and total investment.

All tables report the results for the maximum available observations. No care is

taken of potentially systematic non-responses and other possible distortions. Furthermore, the responses are not weighted by the number of employees for example. They thus represent the purely individual information. Likewise, other issues such as time dependence are left for future research.

< Table 2 here >

< Table 3 here >

Tables 2 and 3 summarise the information from the retail sector. In table 2 we use percentage changes in the revenues in order to moderate the size effect of very large companies. It has the drawback that first, some firms who are only occasional doing business may report very drastic percentage changes such as from close to zero in the current month to a positive figure over the next three months. Consequently, the implied increase can be huge in percentage terms. Second, using percentages implies a lower bound of -100% which can cause problems theoretically when it comes to specifying distribution functions (see section 3).

In contrast to table 2, table 3 uses absolute changes in turnover. Apart from many similar features it conveys a very important difference. This is the order of the means. Notice that the lowest mean in any of the subgroups (pp, pe, ...) should be the one for mm while the largest should be in group pp. Looking at absolute turnovers, pp's mean ranks only third. Hence, outliers in the subsamples certainly play an important role. The impact of outliers reduces when considering percentage changes instead. In yet another attempt (not reported) we used three months on three months percentage changes in revenues. This led again to a severe reduction in the number of outliers while preserving the main patterns of the aggregate responses.

The intermediate conclusion therefore is to refer to percentage changes.

< Table 4 here >

In table 4 the industrial capital utilisation is considered. Here, we do not work with an implicit rather than with an explicit expectation–realisation relationship. The emerging patterns are nevertheless in line with the other evidence. A distinct feature in comparison the retail sector result is certainly the prominence of the middle response category “stay the same”, or short “=”. In this case the observed realisations matches the reported expectations in the majority of cases while it did not so in the retail sector. The reason, however, is easy to understand. Turnovers can be regarded an approximately continuous variable with zero (changes in) turnovers having practically probability zero. The same does not hold for technical capacities since they can never be observed as accurately as revenues. Hence, low variations in capacities may all be looked at as no change. Moreover, the questionnaire provides pre-defined ranges of capacity utilisation. Thus any change in capacity utilisation within a five percentage point margin are considered “no change”.

< Table 5 here >

< Table 6 here >

Tables 5 and 6 display a summary of the results for the investment survey. It shows the relationship between investment plans and realisations. Ranking the three types of surveys according to the role of chance this survey certainly ranks lowest. This is because in neither of the other situations the responding firms have as much control over the outcome. In the retail sector the change in revenues very

strongly depends on the demand of customers which can hardly systematically be influenced by a single firm. Therefore, the qualitative responses very much reflect the expectations about an exogenous, stochastic variable. This is also more or less the case for the capacity utilisation though probably to a lesser extent. Investment decisions in contrast are generally considered medium to long-run issues which are taken by the firms themselves. Therefore, only few stochastic factors should be able to revert those decisions. For example, a financing plan may not work out and delay the project, weather conditions may speed up or slow down the work on a building site. In sum, the observation that the concurrence of expectations (intentions) and realisation is the largest here should not come as a surprise.

2.1 Response patterns

In this section some of the patterns that emerge from the various surveys are pointed out. They will prepare the ground for adjusting one of the more popular approaches to quantification to be laid out in the following section.

The first criterion to be looked at is the (weak) rationality criterion suggested by Ivaldi (1992). Ivaldi suggested to check whether or not the most frequent outcome of, say, an “increase” expectation would actually be matched by a realised increase in the measure under consideration. As outlined before, this should show up in the diagonal elements being the largest in each row when looking at the response shares. In all the tables the respective rows are always the top rows for each of the qualitative response categories.

Indeed, in all but one (table 4) summary statistics imply that the weak rationality criterion is met. Where it is not met with respect to the middle qualitative response

category (tables 2, 3) it can easily be justified by the data properties.

Having in mind that an increase might be expected when there are good reasons for the respondents to believe so, one could argue that the subsample of firms who both expect and experience an increase should feature the largest mean. Thus, the rank of the pp element (bottom right) should be the highest. Comparing all tables, one can notice that this actually the case. The counterpart to the pp element is mm. In analogy to what has been said before, we should expect the lowest rank for the mean in this section. However, there is no clear cut evidence in favour of this hypothesis. We find support in only three out of the five cases. However, in the two other situations we either look at absolute changes (table 3) which incur the problem of outliers, or an implicit rather than explicit expectation–realisation relationship is considered (table 4).

There is yet another, and maybe striking, feature that stands out. Across the board – that is independent of the specific issue inquired and independent of the definition or scaling of the variables – the median of the middle qualitative response category is zero. Moreover, when firms respond “no change” it seems as if they had really no idea of what was going to happen. As many of those experience an increase as do a decrease of the quantity in question. The largest difference between the corresponding shares is 1.35 percentage points. This is certainly very moderate. In addition, the absolute value of the median is always zero, or so close to zero given the standard deviation (table 3 median: 213, s.d.: 8305427) that it can effectively be regarded zero.

We are going to call this observation the “conditional absolute median” (CAN) regularity in order to emphasise the fact that it holds for the subsample which

conditions on the middle qualitative response category and that the zero results independent of how the quantitative variable is defined, be it in relative terms or else.

3 THE PROBABILITY APPROACH TO QUANTIFICATION

In this section we briefly review one standard quantification procedure, the so-called probability approach. After this we demonstrate how this approach can be modified using CAN. Finally, a short assessment of the features of the resulting estimates are given.

3.1 The standard approach (CP)

The seminal paper on quantification is the contribution by Carlson & Parkin (1975). They developed what is today usually referred to as the probabilistic approach.

Alternative approaches have followed the pioneering work by Anderson (1952) and Theil (1952) who suggested the so-called regression approach. It has been enjoying widespread popularity in the aftermath of Pesaran's (1984) applied paper. Special aspects have been investigated that are relevant for one or for both approaches such as the meaning of the middle category (Ronning 1984), the potential role of control questions or variables (Henzel & Wollmershäuser 2005, Smith & McAleer 1995), and equation inversion (Cunningham, Smith & Weale 1998).

The CP method builds on addable individual probability distributions of the

underlying quantitative issue. Survey responses are given in accordance with the individual perception of the stance of the economy, for example. The aggregate probability distributions' mean is assumed to be related to the aggregated mean of the quantitative economic variable in question.

In detail, CP assume $i = 1, \dots, N$ agents, who form expectations about the realisation of a variable $y_{i,t}$. If $y_{i,t}$ denote changes, then let $Y_{i,t}$ denote the level of the variable of interest. A typical example of $y_{i,t}$ may be the changes in the overall price level, or the aggregate change in turnovers. The corresponding individual expectations are denoted $y_{i,t}^e$, the aggregated values being given by $y_t = \sum_{i=1}^N \omega_i y_{i,t}$ and $y_t^e = \sum_{i=1}^N \omega_i y_{i,t}^e$ respectively. The relative weight of individual i in the population is ω_i . A typical survey question would then ask if the agent expects $Y_{i,t}$ to 'go up', to 'stay constant' or to 'go down' (abbreviated u, c, d for simplicity). Accordingly, series of $u_{i,t}, c_{i,t}$ and $d_{i,t}$ form the survey responses having values zero or one depending on whether the corresponding question was approved (usually value one) or negated (value zero).

CP suppose that $y_{i,t}^e$ is formed on the basis of a subjective probability distribution $f_i(y_{i,t}|I_{i,t-1})$ which is defined as the expected changes of $Y_{i,t}$ given information set I_i at time $t - 1$. The important aspect here to notice is that there exists uncertainty about the realisation of $Y_{i,t}$. The individual probability distributions are such that they can be aggregated to an aggregate standardised probability distribution $g(y_t|\Omega_{t-1})$ where $\Omega_t = \bigcup_{i=1}^N I_{i,t}$ is the union of the individual information sets.

Furthermore CP pose that the individuals have some indifference interval in mind which leads them to give answers according to the rule of

ASSUMPTION 1 (Deterministic response).

$$(1) \quad \begin{aligned} d_{i,t} &= \begin{cases} 1 & \text{if } \mu_{i,t} \leq a_{i,t} \\ 0 & \text{else,} \end{cases} \\ c_{i,t} &= \begin{cases} 1 & \text{if } a_{i,t} < \mu_{i,t} < b_{i,t} \\ 0 & \text{else,} \end{cases} \\ u_{i,t} &= \begin{cases} 1 & \text{if } \mu_{i,t} \geq b_{i,t} \\ 0 & \text{else.} \end{cases} \end{aligned}$$

where $\mu_{i,t} = y_t^e$ is the first moment of the individual probability distribution function $f_i(y_{i,t}|I_{i,t-1})$. Finally, estimates for y_t^e can be obtained by

ASSUMPTION 2 (Invariance and Feasibility).

1. *Subjective invariance:* $f_i(\cdot) = f_j(\cdot) = f(\cdot) \quad \forall i, j$,
 $a_{i,t} = a_{j,t} = a_t$ and $b_{i,t} = b_{j,t} = b_t \quad \forall i, j$
2. *Feasibility:* $f(\cdot)$ has finite first and second moments.

If Assumption 2 holds, then $y_{i,t}^e$ can be regarded as an independent drawing from the aggregate distribution $g(\cdot)$ with mean y_t and variance σ_t^2 . Defining U_t, C_t and D_t as the respective shares of the answers ‘go up’, ‘stay constant’ and ‘go down’ in the sample, one can write

$$\begin{aligned} \text{prob}\{y_t \leq a_t | \Omega_t\} &= D_t \\ \text{prob}\{y_t \geq b_t | \Omega_t\} &= U_t. \end{aligned}$$

Furthermore, denoting by G the (normal) cumulative distribution of $g(\cdot)$, by ψ_t the inverse of G at D_t and by ρ_t the inverse of G at $(1 - U_t)$ we have

$$\begin{aligned} \psi_t &\equiv G^{-1}(D_t) = (a_t - y_t^e)/\sigma_t \\ \rho_t &\equiv G^{-1}(1 - U_t) = (b_t - y_t^e)/\sigma_t \end{aligned}$$

which can be re-arranged to obtain

$$(2) \quad y_t^e = \frac{b_t \psi_t - a_t \rho_t}{\psi_t - \rho_t}$$

$$(3) \quad \sigma_t = \frac{a_t - b_t}{\psi_t - \rho_t}.$$

Using the following assumptions 3 CP derive operational values for y_t^e .

ASSUMPTION 3 (Symmetry and Rationality).

1. *Symmetry and time invariance:* $-a_t = b_t = \delta \forall t$ and $a_t < b_t$,
2. *Unbiased expectations:* $\delta = \sum_t y_t / \sum_t m_t$ with $m_t = (\psi_t + \rho_t) / (\psi_t - \rho_t)$.

The expected value for y_t can be calculated as $\tilde{y}_t^e = \delta \frac{\psi_t + \rho_t}{\psi_t - \rho_t}$ where δ is a scaling factor which ensures that \tilde{y}_t^e equals the realised value, y_t .

CP's method has been extended in several ways. For example, assumption 3 can be dropped in order to cope with possibly time varying thresholds. Likewise, a_t and b_t have been considered to depend on observable state variables like past observable changes in y_t , for example. As Nardo (2003) notes, however, attempts to allow $a_{i,t}$ and $b_{i,t}$ to vary with i have not been successful due to missing micro data.

Another drawback of the CP method is the zero response problem. If either of the U_t and D_t is zero then the derivation of the underlying quantitative information breaks down in the sense that the variance collapses to zero.

3.2 The CAN adjustment

In the light of the observed survey response patterns the following adjustment of the CP approach might be considered.

ASSUMPTION 4 (Conditional Absolute Null).

$$\int_{-\infty}^0 f_i(\cdot | c_i = 1) = \int_0^{\infty} f_i(\cdot | c_i = 1)$$

Using assumption 4 we may write:

$$\phi_t \equiv G^{-1}(E_t) = (-y_t^e)/\sigma_t$$

where $\phi(\cdot)$ denotes the inverse of G at $E_t \equiv D_t + (1 - D_t - U_t)/2$.

Re-arranging ψ_t, ρ_t , and ϕ_t obtains

$$(4) \quad y_t^e = a_t \frac{\phi_t}{\phi_t - \psi_t}$$

$$(5) \quad y_t^e = b_t \frac{\phi_t}{\phi_t - \rho_t}$$

$$(6) \quad \sigma_t = \frac{a_t}{\psi_t - \phi_t}$$

$$(7) \quad \sigma_t = \frac{b_t}{\rho_t - \phi_t}$$

and for the relationship between a and b we get

$$(8) \quad a_t = b_t \frac{\phi_t - \psi_t}{\phi_t - \rho_t}$$

Assuming again time invariant thresholds offers the opportunity to calculate a and b by scaling them on the sample mean. For N observations in the sample this results in two equivalent sets of thresholds.

$$(9) \quad a_1 = \sum_t y_t / \sum_t \frac{\phi_t}{\phi_t - \psi_t} a_1$$

$$(10) \quad b_1 = a_1 \frac{1}{N} \sum_t \frac{\phi_t - \rho_t}{\phi_t - \psi_t}$$

$$(11) \quad a_2 = b_2 \frac{1}{N} \sum_t \frac{\phi_t - \psi_t}{\phi_t - \rho_t}$$

$$(12) \quad b_2 = \sum_t y_t / \sum_t \frac{\phi_t}{\phi_t - \rho_t}$$

It is worthwhile calculating both sets as it provides the flexibility to cope with the zero-response problem. This can be seen by regarding the estimator for the expected

value:

$$(13) \quad y_t^e = \begin{cases} a_1 \frac{\phi_t}{\phi_t - \psi_t} & \text{if } D_t \neq 0, \text{ or} \\ b_2 \frac{\phi_t}{\phi_t - \rho_t} & \text{if } U_t \neq 0, \\ 0 & \text{if } U_t = D_t. \end{cases}$$

The standard deviation can be estimated as:

$$(14) \quad \sigma_t = -\frac{y_t^e}{\phi_t}$$

3.3 Comparing CP and CAN

Having suggested an adjustment to the standard CP method one might wonder what the effect may be. Notice that neither of the two procedures explores the sample information for the variance. This, is of course not intended at all since the data is very often not available. Instead only some average information on y_t is usually at hand, or one might purely use some pre-defined scaling value in order to produce a quantitative time series from the qualitative data. Doing so generalises the approach considerably even though one might rightfully assume that threshold values could otherwise be derived which would match mean and variance exactly.

One very obvious advantage of the CAN procedure is its capability to address the zero response problem. In the CP approach a zero response in either U_t or D_t collapse of the variance formula. The same happens when $U_t = D_t$. When applying CAN the first problem is not present while in the other case no progress is made. However, while for $U_t = D_t$ CP cannot identify the mean, the mean would be zero under CAN.

A second issue that arises with the CP method is the negative standard deviation. Whenever the average D and hence ρ are rather small then m can turn negative and the supposed thresholds change their relative position to the null. The reason

could be one or more of the following. Time invariance may not hold, the normality assumptions is violated, individuals may not be homogenous and the weights for aggregation are not chosen appropriately. Similar problems arise with the CAN adjustment. Hence, CAN does not offer an improvement in this situation.

We may now further investigate the variance issue. If there was anything to gain from the CAN adjustment, this should show up in a variance which is closer to the sample variance. The following table summarises the results for the variance estimation. For simplicity we only report the relative size of the estimated standard errors to the sample variance.

< Table 7 here >

Table 7 shows that the CAN variation yields useful extra information. In all regular cases ($a < b$) considered, the estimates for the standard deviation are closer to the sample estimates in comparison to the CP approach. This can be inferred from column 'ratio' which should feature a one if there was a perfect match. For example, when quantifying the capacity utilisation data, the CAN differs from to the (true) sample value by 33 percent while CP deviates by 39 percent. In the regular cases the difference can become quite considerable. The minimal gain of applying CAN is .6% going up to more than 15% where gain is defined as the percentage reduction in the absolute distance from the actual ratio to the optimum due to applying CAN instead of CP.

3.4 Further research

In this paper we augmented the popular CP approach making use of a survey response regularity that could be identified using individual data. Many important features of the standard approach have not been touched upon, however. These are, among other things the normality, homogeneity and time invariance assumptions. Since all of these can be scrutinised with the help of the described data sets this will be on top of the agenda soon.

Furthermore, given the CAN augmentation we are also going to apply the method to time series of qualitative data in order to compare the outcome to the corresponding quantitative information which will allow a more detailed comparison of the two methods.

4 SUMMARY AND CONCLUSIONS

In this paper we used aggregated individual information for identifying survey response patterns which could eventually be translated into an alternative way of quantifying qualitative data.

The backbone of all methods is the assumption that individuals behave rationally in the sense that their forecasts prove right on average. Using the individual quantitative information we indeed find support for this assumption. So far, we cannot yet tell whether or not the individuals possess equal forecasting abilities, but if they do not, it appears that their inabilities cancel to by and large.

Comparing three different surveys and five different data sets we could establish the fact that the median of the realised quantitative values for the subgroup of

respondents in the so-called middle category is exactly zero. This observation has been labelled conditional absolute null regularity (CAN). The suggested variant of the quantification method using CAN builds on the popular CP method and thus inherits also some of its deficiencies.

The advantage of the new procedure is twofold. First it provides variance estimates that are considerably closer to the (usually unobservable) sample variance, and second it provides a solution to the zero-response problem.

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Table 2: Percentage change in turnover (all items) current to next three months

expectation	realisation			sum	
	-	=	+		
-	13.59	0	8.54	22.14	%
	1764	1	1108	2873	obs.
	-19.0	0	16.0	-6.0	median
	1	4	8	-	mean*
	20.0	0	2046	1272	s.d.
=	24.10	0.34	24.27	48.71	%
	3128	44	3150	6322	obs.
	-13.0	0	14.0	0	median
	3	4	7	-	mean*
	17.0	0	1592	1125	s.d.
+	10.20	0.04	18.92	29.15	%
	1324	5	2455	3784	obs.
	-11.0	0	20.0	8.0	median
	2	4	9	-	mean*
	16.0	0	1972	1589	s.d.
sum	47.89	0.39	51.72	100.00	%
	6216	50	6713	12979	obs.
	-14.0	0	16.0	1.0	median
	18.0	0	1817	1308	s.d.

The table is based on surveys conducted monthly from April 2005 to November 2006.

* Rank statistic. The rank of the means is given (1–smallest to 9–largest).

Table 3: Absolute change in total turnover current to next three months

expectation	realisation			sum	
	-	=	+		
-	15.42	0	10.47	25.89	%
	576	0	391	967	obs.
	-18650	0	13000	-2587	median
	3	4	7	-	mean*
	947187	0	1054105	1009888	s.d.
=	21.42	0.19	22.60	44.20	%
	800	7	844	1651	obs.
	-20083	0	17739	213	median
	1	4	8	-	mean*
	11600000	0	2639612	8305427	s.d.
+	10.87	0.05	18.98	29.91	%
	406	2	709	1117	obs.
	-28244	0	43963	6572	median
	2	4	9	-	mean*
	2141633	0	2227179	2247809	s.d.
sum	47.71	0.24	52.05	100.00	%
	1782	9	1944	3735	obs.
	0.00	0	21413	468	median
	7840785	0	3560386	6024214	s.d.

The table is based on surveys conducted monthly from April 2005 to November 2006.

Table 4: Percentage change in technical capacity utilisation

expectation	realisation			sum	
	−	=	+		
−	2.68	3.43	2.16	8.28	%
	2091	2675	1686	6452	obs.
	-7.69	0	7.96	0	median
	2	4	8	–	mean*
	7.54	0	11.90	11.74	s.d.
=	24.08	33.00	22.73	79.81	%
	18765	0	17700	62157	obs.
	-6.67	0	7.14	0	median
	3	4	7	–	mean*
	6.92	0	10.63	10.99	s.d.
+	3.05	4.32	4.54	11.91	%
	2376	3364	3536	9276	obs.
	-8.33	0	11.76	0	median
	1	4	9	–	mean*
	7.17	0	12.85	13.93	s.d.
sum	29.82	40.75	29.43	100.00	%
	23223	31740	22922	77885	obs.
	-7.14	0	7.69	0	median
	7.17	0	11.16	11.47	s.d.

The table is based on surveys conducted each quarter between 1985 and 2006. The expectation is coded as the implied reaction following the judgement about the available technical capacities: “too low” implies increase, “just right” implies no change, “too high” implies decrease of technical capacities.

Table 5: Absolute change in investment in capital goods year on year (mio CHF)

expectation		realisation			sum	
		−	=	+		
−	−	12.24	1.34	5.58	19.08	%
		342	38	153	533	obs.
		-789	0	350	-236	median
		1	4	8	−	mean*
		6010	0	5942	6120	s.d.
=	=	19.41	4.33	18.89	42.61	%
		542	121	527	1190	obs.
		-300	0	335	0	median
		3	4	7	−	mean*
		3508	0	5854	4723	s.d.
+	+	12.85	3.15	22.31	38.31	%
		359	88	623	1070	obs.
		-456	0	797	129	median
		2	4	9	−	mean*
		24020	0	9208	15801	s.d.
sum		44.50	8.84	46.65	100.00	%
		1243	247	1303	2793	obs.
		13502	0	7669	10610	s.d.

The table is based on surveys conducted annually between 1997 and 2005. The expectation is equivalent to the reported investment plans.

* Rank statistic. The order of the means is given (1–smallest to 9–largest).

Table 6: Absolute change in investment in buildings year on year (mio CHF)

expectation	realisation			sum	
	−	=	+		
−	13.71	7.12	5.48	26.31	%
	335	174	134	643	obs.
	-700	0	339	-24	median
	1	4	8	−	mean*
	6585	0	5860	5738	s.d.
=	11.91	23.57	12.93	48.40	%
	291	576	316	1183	obs.
	-149	0	215	0	median
	3	4	7	−	mean*
	4164	0	9857	5611	s.d.
+	5.93	4.75	14.61	25.29	%
	145	116	357	618	obs.
	-400	0	1000	103	median
	2	4	9	−	mean*
	7133	0	4655	5392	s.d.
sum	31.55	35.43	41.41	100.00	%
	771	866	1012	2444	obs.
	5933	0	7305	5628	s.d.

The table is based on surveys conducted annually between 1997 and 2005. The expectation is equivalent to the reported investment plans.

* Rank statistic. The order of the means is given (1–smallest to 9–largest).

Table 7: Estimates of standard errors – efficiency gain through CAN

data reference	method	estimate	ratio	CAN gain (%)
Table 2	sample	1308.00	1.00	
	CP	302.87	.23	
	CAN	377.88	.29	7.46
Table 3	sample	6024214.00	1.00	
	CP	-1307258.26	-.22	
	CAN	-1526811.26	-.25	(-2.99)
Table 4	sample	11.47	1.00	
	CP	7.02	.61	
	CAN	15.21	1.33	16.02
Table 5	sample	5628.00	1.00	
	CP	305.21	.03	
	CAN	366.05	.03	.59
Table 6	sample	10610.00	1.00	
	CP	-9698.00	-1.72	
	CAN	-16351.00	-2.91	(-43.41)

The table compares standard deviation estimates. The reference is the sample estimate (row 'sample'). The column 'ratio' reports the ratio between the sample estimate and the alternative specified in the second column. The 'gain' is defined as the percentage reduction in the absolute distance to one between CP's and CAN's ratio.