

The ZEW/Creditreform business survey: Sampling frame, stratification, expansion and results

by

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Abstract: No other area of the German economy has developed so emphatically in the past ten years as has that of business-related services. Regardless of its growing overall economic importance, official statistics fail to provide economic researchers and economic policy with current data on the business-related services sector. In such a situation where quantitative information about certain sectors is lacking, data obtained from business surveys give important information on the state of the economy. The outcome of such surveys crucially depends on the expansion factors attached to the responses of individual firms. In this paper it is shown how a robust method of calculating expansion factors can be obtained using known auxiliary totals from the population. Robust in this sense means that the expanded data of the ZEW/CREDITREFORM business survey are insensitive to changes in the sample design while the non-expanded data are not.

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Non-technical summary

While the business-related services sector has increasingly gained in overall economic importance and media-attention in recent years, official statistics still fail to provide economic policy and economic researchers with current data on the state of this part of the economy. The ZEW/CREDITREFORM business survey in the business-related services sector aims at filling this information gap at least partially. It is being carried out since the second quarter of 1994 and asks questions on recent turnover, profit, price, demand and employment growth.

It is of crucial importance for any kind of business survey to find reliable expansion factors which are used to weight firms participating in a business survey by its individual relative economic importance. The firms participating in the ZEW/CREDITREFORM business survey are weighted by their shares in turnover. Such weights are attached to first to account for the sample design and second to account for the different implication a large firm reporting, say, decreased turnover has on the entire economy than of a small firm reporting a decrease in turnover. If no expansion takes place, small and large firms would be treated equally, and the differences inherent in firm sizes (or, likewise in sectoral or regional affiliation) would not be accounted for.

This papers shows how a reliable and robust method of calculating expansion factors can be found even if there is little information on the target population.

1 Introduction

In the past years, hardly any other sector of the German economy has developed as dynamically as the service sector. The structural change from manufacturing industries towards services has deepened in the last decade. Even within manufacturing industries a structural change is appearing: firms from the manufacturing sector increasingly offer services such as project consulting, maintenance and repairs. Moreover, structural changes also take place within the services sector. Business-related services are gaining in economic importance while traditional service sectors, such as retail and gross trade are losing in relative significance.

A main reason for the success of business-related services has been increased outsourcing activities of the manufacturing sector. Tasks not primarily related to the main business field have been transferred to legally independent services firms. However, the strong growth of business-related services has led to a heightened attentiveness as far as the public, the media and politics are concerned. In official statistics, business-related services still play a rather subordinate role. Although around 80 separate statistics are available, covering varying characteristics such as the number of enterprises, firms and employees, a systematic recording of services is missing.¹ This concerns the industrial classification used by the different statistics, the unit of investigation (firm, plant or person) and the periodicity of these statistics. As a result, it is not astonishing that no exact figures can be released which constitute the overall economic importance of business-related services. Even the Federal Statistical Office has only little information on business-related services at its disposal almost.² To compensate for the lack of current data on business-related services, the Center for European Economic Research (ZEW) carries out a quarterly business survey for the business-related services sector since June 1994 in collaboration with Germany's largest credit rating agency CREDITREFORM.

Since there is little information on business-related services in official statistics, the ZEW/CREDITREFORM business survey in some ways bears similar importance as the well known ifo-business surveys which were de-

¹Link (1996) refers to the usability of official statistics for the service sector more precisely.

²The Federal Statistical Office estimates, for example, the Gross National Product for business-related services on the basis of turnover tax statistic which is available with a delay of 18 months and a statistic on the number of employees which is processed quarterly by the Federal Labor Office with a delay of about six to seven months.

veloped after World War II to modernize and supplement the official statistics (Strigel, 1997). A further advantage of the ZEW/CREDITREFORM survey is that the results can already be published between one and a half to two weeks after the end of the data collection period. As Oppenländer (1997) claims, this up-to-dateness is an important reason why economic survey data should at least be viewed as equally important as quantitative data.

In past years, the ZEW/CREDITREFIRM business survey has clearly increased in terms of recognition in the media and economic policy. On the basis of this survey, the Service Sector Business Survey, an economic indicator for business-related services was developed in 1998 (Kaiser and Buscher, 1999).

The lack of availability of official statistics on business-related services has an immediate effect on the business survey carried out by ZEW and CREDITREFORM: a target population as the basis for the sampling frame and the calculation of expansion factors can only be determined with difficulties. In this paper we show how robust — in the sense of robustness with respect to changes in the sample design — expansion factors can be calculated in spite of the problematic data situation.

The following chapter illustrates in short the recording of business-related services in official statistics. Section 3 gives a brief overview of the ZEW/CREDITREFORM business survey, motivates the expansion of the survey to the target population and describes the determination of turnover in the realized sample. A detailed description how the total turnover of the underlying population is established is given in section 4. Section 5 describes how expansion factors are calculated, this is followed by a brief discussion of the results in section 6. Finally, section 7 gives a brief outlook on further research in the context of the SSBS.

2 Recording of business-related services in official statistics

Auxiliary data from sources outside the survey are needed to highlight growth and importance of business-related services and to derive the expansion factors. Out of the 80 individual statistics which the Federal Statistical Office has available, four are potentially usable for this task. These

are: (1) the Mikrozensus, (2) the turnover tax statistic, (3) the quarterly cost–structure statistic and (4) the employee statistic. Although all four statistics are not primarily constructed for the recording of the service sector, they can be considered as secondary statistics. In general there is the problem that all four statistics are only available with considerable delays and are therefore only partly suitable for current economic phenomena. It is also problematic that the four statistics are not really comparable since they are based on different levels of investigation. In this regard, the Mikrozensus is a household survey, the turnover tax statistic is targeted at the firm level (just like the quarterly cost–structure statistic), and the employee statistic on the plant level.

By collecting the information available on the business–related services sector from the four statistics listed above, we are able to report some figures on growth and economic importance of business–related services.

While total employment has fallen by about about 11 percent in West Germany between 1982 and 1996 — from around 8.1 to 7.2 million —, the number of employees in the service sector (including services brought about by the state) rose by about 22 per cent, from 10.2 to 12.4 million. Within the service sector the area of business–related services has particularly gained in importance — above all the sectors of business consulting, advertising, rental and waste disposal. In these areas, the number of employees has increased in the period, from merely 1 million to 1.8 million: a rise of 89 per cent.

The business survey of the ZEW and CREDITREFORM aims at providing information on this fast growing part of the German economy since official data lack this information.

3 The ZEW/CREDITREFORM business survey

3.1 Definition of business-related services

To our knowledge, no clear and generally–accepted definition of business–related services exists. Its definition is cause for a quite controversial discussion in the literature. We follow the convention proposed by Hass (1995), Klodt et al. (1997) and Strambach (1995), who define business–related services by simple enumeration of certain sectors.

In this paper, the following sectors are defined as business–related services (NACE–Rev. I code in parenthesis):

Branche	NACE–Rev. I code
Computer and related activities	72100, 72201–02, 72301–04, 72601–02, 72400
Accounting & book–keeping, tax consultancy	74123, 74127, 74121–22
Management Consultancy	74131–32, 74141–42
Architectural activities	74201–04
Engineering activities	74205–09, 74301–04
Advertising	74844, 74401–02
Renting of automobiles & transport equipment	71100, 71210
Renting of other machinery & equipment	45500, 71320, 71330
Cargo handling and storage	63121, 63403, 63401
Sewage & refuse disposal	90001–90007

According to Hass (1995), business–related services represent an important link between the secondary and tertiary sector. They support the quality and distribution of products. Furthermore, it is presumed in literature that the area of business–related services eases the way to innovation, as is indicated in Licht et al. (1997). Additionally, as Steil (1997) points out, business–related services show a clearly above–average firm foundation rate. Some authors such as Audretsch and Yamawaki (1991), Hass (1995) and Lichtblau et al. (1996) use Input-Output tables to show that the relationship between services — here, particularly the business–related services — and manufacturing is not way substitutive, as Fourastié (1950) amongst others had stated. The relationship between both areas is complementary instead.

3.2 The business survey

ZEW and CREDITREFORM send out a one page questionnaire every three months to about 3,500 firms belonging to the ten sectors listed above. The survey is constructed as a panel data set. It is a stratified random sample, stratified with respect to the ten sectors, five size classes (two for East and three for West Germany), as well as with respect to regional affiliation (East/West Germany). The stratified target population thus consists of 50 cells.

A sample refreshment takes place on an annual basis. Firms which have

not taken part in the survey for more than six times in a row are removed from the panel. First survey results of the pilot study and a description of the original sample survey can be found in Saebetzki (1994). Current survey results are released in the media and in ZEW publications.³

The ZEW/CREDITREFROM business survey starts three weeks prior to the end of a quarter. Questionnaires and a personal letter to the prospective survey respondent are sent out by mail. The questionnaires are returned to the ZEW mostly by fax. After two weeks, those firms who have not replied are sent a reminder. Altogether, the response rate amounts to about 30 percent. As a thank you for filling out the questionnaire, the partaking firms receive an analysis in the form of a four page report containing the main findings of the survey. In addition, they can draw further information over the internet.

The questionnaire is divided into two parts. In the first part the firms are requested to indicate on a three point Likert scale whether their turnover, prices, demand, returns and number of employees have, in the respective previous quarter, either decreased, stayed the same, or increased. Moreover, they are supposed to give an assessment for the forthcoming quarter. The second part of the survey is dedicated to present-day economic and political issues. Issues cover on-the-job-training, wage negotiation and dispersion of general wage agreements (Kaiser and Pfeiffer, 2000; Kaiser and Pohlmeier, 2000), innovation and demand for heterogeneous labor (Kaiser, 1998) and adjustment to demand fluctuations (Kaiser and Pfeiffer, 2000) and the introduction of the Euro and export propensity (Kaiser and Stirböck, 1999).⁴ Though to both the first and the second part of the survey expansion factors are applied, the following discussion focuses on the business cycle part of the survey.

3.3 Why attach expansion factors?

The main issue of the ZEW/CREDITREFORM business survey is to monitor the development of business related services in Germany. Since comparability of the realized sample population cannot be guaranteed since

³The ZEW offers to send current survey results to an interested public. Send an email to konjunkturumfrage@zew.de to receive copies.

⁴In a related study, Kaiser (1998a) analyzes the impact of political events on answering patterns in business surveys.

firms do often not respond as expected, weighting of the realized sample assures comparability to the target population — at least concerning some known auxiliary totals (Hidioglou 1995).

First, the structure of the realized sample data with regard to the three stratification variables (sector, size, region) is determined by the frame population and the sample design. Since no official business register is available in Germany the sample is drawn from the “MARKUS” firm data base made available to the ZEW by the CREDITREFORM. It is a CD-Rom containing information on the entire set of firms found in the registers of CREDITREFORM. Beside the industrial classification code and number of employees, the data base contains firm turnover, firm addresses and, in most cases, a contact person. As far as possible, newly founded enterprises are recorded into this frame. Though this database does not actually cover the entire population of firms in Germany, the MARKUS data base is the most complete sampling frame available for Germany (Licht and Stahl, 1995). However, East German firms and large firms are over represented in the MARKUS data base. This fact is not adjusted for in the sample design for two reasons: East German firms development very heterogeneously and turnover is concentrated on large firms.

The second factor determining the structure of the realized sample is the response mechanisms, i.e. the firm’s ‘decision’ to answer the questionnaire. It is widely known from other business surveys that the probability to participate in a mail survey is influenced by several factors (Paxson et al. 1995). In the ZEW/CREDITREFORM business survey, different response probabilities show up in the given strata. The response rate does not differ much across West and East German firms with the related figures being 24 and 28 percent, respectively. It, however, differs across the individual sectors.

The smallest response rate is seen amongst computer activities where it is 25.1 percent. The highest response rate, with 37.2 percent, is in the sewage & refuse disposal sector.⁵ Table 1 displays the response rate of the SSBS in the third quarter of 1999 (22nd wave).

⁵These figures relate to the 22nd wave of the survey (III. quarter of 1999).

Table 1: Response rate across sectors, firm size and regional affiliation (22nd wave, 3rd quarter 1999)

	West Germany			East Germany		
	1–19	20–59	>59	1–24	> 24	
Computer activities	20.0	17.1	27.3	35.7	46.7	25.1
Accounting, book-keeping	25.3	25.4	54.8	43.2	15.4	29.5
Management consulting	28.7	36.8	24.3	37.0	20.8	29.2
Architectural act.	24.1	30.2	32.0	34.1	45.5	27.8
Engineering act.	25.9	41.7	34.2	41.5	61.4	37.3
Advertising	23.3	25.0	25.6	31.6	33.3	25.5
Renting of automobiles	22.5	31.8	42.1	19.4	30.0	25.5
Renting of machinery	19.4	27.9	41.7	38.2	28.6	27.0
Cargo handling	18.0	24.1	24.8	38.5	47.1	26.5
Sewage & refuse disposal	18.2	31.0	43.2	34.9	36.4	30.2
	22.6	27.7	31.2	35.9	40.7	28.3

These factors — biased sample population, sample design and response mechanism — require expansion of the realized sample. Auxiliary information about all firms belonging to the ten sectors listed above is needed to derive expansion factors. Since turnover is the variable which is looked most at in the economic analysis, expansion factors have to be found such that the total weighted turnover of the realized sample equals the total population turnover (for more details see section 4).

3.4 Determination of turnover of the survey firms

Turnover figures are not asked for in the questionnaire. These figures are gathered from the aforementioned MARKUS firm data base. The MARKUS data base does not reveal the turnover figures for all of the partaking firms.⁶ The missing values must therefore be estimated.

The most important input factor in the production of services is labor. If output is approximated by turnover, the number of employees stands in direct proportion to the size of turnover. We therefore explain turnover by the number of employees in a regression and replace the missing turnover

⁶The MARKUS-data base only contains turnover figures for around 98 percent of the firms. (Base: 22nd wave (III. Quarter of 1999) and MARKUS from August 1999.)

values with the estimated values. The information which has been collected in the MARKUS data base contains the number of employees for almost all of the firms in our sample. Since, apart from the number of employees, sectoral and regional effects may also influence turnover figures, these variables are also taken into account for the estimation.

The data collected in the MARKUS data base identify around 78,395 firms in the business-related services sector.⁷ For 75,793 (97 percent) firms (of which about 9,974 are from East Germany), the MARKUS data contains both turnover figures and the number of employees. These data forms the basis for estimating the missing turnover values by means of a median regression.⁸ The estimations were carried out separately for East and West Germany and the ten sectors.

Finally, it has to be pointed out that our regression results lead to estimated turnover figures which appear to be unreasonable, since they are either ‘too small’, negative, or ‘too large’. In these cases, a separate way of estimating the missing turnover data is chosen. The turnover figures of the firms are estimated via the average turnover per employee. In addition, the mean turnover per employee (U_{prom}) is calculated individually for the ten sectors and East and West Germany. In order to avoid the situation where a large bias occurs through a company having extremely large or small turnover, those firms which have a turnover per employee of either more than 1 million DM or less than 100,000 DM are not taken into account. If the turnover per employee of firm i is below than 20,000 DM or above 1 million DM, then the turnover of this firm (U_i) is replaced with $U_i = U_{prom} * m_i$, whereby for U_{prom} , the corresponding mean of the turnover per employee is chosen with respect to sectoral affiliation and with respect to the firm either being in East or in West Germany. The variable m_i denotes the number of employees of firm i .

In the majority of cases, estimating the turnover by way of the regression suffices. Only for firms with up to seven employees does it lead to negative turnover in the individual sectors or rather, as is the case in the above comments, to turnovers per employee which are regarded as being too small.⁹

⁷Referring to the MARKUS data of August 1999.

⁸Because of outlier problems, a median regression was preferred over an OLS regression.

⁹In the 22nd wave for example, only three firms, which had only five employees, were affected by this correction. Out of the ‘large’ firms, none of them were affected by the turnover correction introduced here.

4 Determination of the survey population

4.1 Stratification

Calculating expansion factors requires a description of the target population to which the realized sample is expanded. Since turnover is the variable which is looked at in the economic analysis, weighting factors have to be found such that the total weighted turnover of the realized sample equals the total population turnover.

Distinctions between East and West Germany, the ten sectors listed above as well as between different size classes have to be made when information on total turnover is gathered. The basic information on total turnover of the business-related services sector are obtained from the turnover tax statistic which is the only information available at the disaggregated sectoral level used in the ZEW/CREDITREFORM business survey. This basic information does not distinguish between size classes and is available at a biennial basis until 1996 and at an annual basis from 1996 on. The statistic is published with a delay of about 18 month. In the turnover tax statistic, every company which has more than 25,000 DM of taxable turnover per year is recorded. The Federal Statistical Office make these data available at a five digit classification level.

The original sample of the ZEW/CREDITREFORM business survey, which was drawn in spring 1994, was stratified into ten sectors, East and West Germany, and six size classes (1–49, 50–99 and more than 100 employees). Table 2 shows how the firms in the sample were distributed as following according to old size class definition relative to the absolute number of firms in West and East Germany in the sample, respectively. Table 2 clearly indicates that the old size definition lead to very thinly occupied cells for the largest size classes. The cell occupation of the largest size class is even thinner in East Germany.

Table 2: Sample population across cells relative to the total number of firms in East and West Germany according to the old size definition (22nd wave, 3rd quarter 1999)

	West Germany				East Germany			
	1-49	50-99	> 99	total	1-49	50-99	> 99	total
Computer activities	6.4	2.3	3.1	11.7	8.9	0.5	1.4	10.9
Accounting, book-keeping	9.2	1.1	1.0	11.3	6.5	0.0	0.5	7.0
Management consulting	6.4	1.8	2.8	11.0	5.0	1.0	0.5	6.4
Architectural act.	5.6	0.3	0.2	6.1	4.8	1.1	0.3	6.2
Engineering act.	8.6	1.8	2.4	12.8	14.4	3.5	1.0	18.8
Advertising	7.4	1.8	2.0	11.2	5.8	0.8	0.2	6.7
Renting of automobiles	5.4	0.4	0.3	6.1	6.4	0.6	0.2	7.2
Renting of machinery	6.3	1.0	1.0	8.3	7.0	1.0	0.3	8.3
Cargo handling	6.1	2.3	2.9	11.3	8.3	2.9	1.6	12.8
Sewage & refuse disposal	6.7	1.5	2.0	10.2	10.5	2.6	2.6	15.7
total	68.0	14.1	17.9	100.0	77.6	13.9	8.5	100.0

Table 3: Sample population across cells relative to the total number of firms in East and West Germany according to the new size definition (22nd wave, 3rd quarter 1999)

	West Germany				East Germany		
	1-19	20-59	> 59	total	1-24	> 24	total
Computer activities	4.3	2.5	4.8	11.7	6.1	4.8	10.9
Accounting, book-keeping	5.0	4.6	1.7	11.3	5.1	1.9	7.0
Management consulting	4.0	2.6	4.3	11.0	3.4	3.0	6.4
Architectural act.	4.4	1.3	0.5	6.1	3.5	2.7	6.2
Engineering act.	6.7	2.2	3.9	12.8	10.7	8.1	18.8
Advertising	4.2	3.8	3.2	11.2	4.3	2.4	6.7
Renting of automobiles	4.1	1.5	0.5	6.1	5.1	2.1	7.2
Renting of machinery	4.0	2.7	1.6	8.3	5.0	3.4	8.3
Cargo handling	3.9	2.8	4.6	11.3	4.6	8.1	12.8
Sewage & refuse disposal	4.2	2.7	3.2	10.2	7.0	8.6	15.7
total	44.9	26.7	28.4	100.0	54.8	45.2	100.0

In order to guarantee an almost equal distribution of firms across the size cells, we thus introduce a new system of dividing things up. It is now layered according to ten branches, three size classes for West Germany (1-19, 20-59 and more than 60 employees) and two categories for East Germany (1-24 and more than 25 employees). This is done to ensure that ‘small’ firms are considered sufficiently well in the turnover expansion. A further categorization of large firms (60 or more employees in West Germany, 25 or more in East Germany) does not appear necessary. Table 3 redisplay Table 2 with the new size class definition applied.

In each of the cells containing the target population of the ZEW/ CREDITREFORM business survey, the turnover of each responding cell firm is expanded onto the total cell turnover. The turnover figures obtained from data from the turnover tax statistic have to be divided up into the 50 subpopulations which are determined by affiliation to East or West Germany, five size classes and ten sectors.

4.2 Separation of total turnover onto the subpopulations

Since the Federal Statistical Office separated the turnover tax data into East and West Germany only up until 1994, categorization of the turnover into the two regions for the subsequent years is problematic. For 1996 and the years following, we must determine turnover of each region from the figures for the whole of Germany. We therefore assume constancy over time in the share of East and West German firms in total turnover of each of the business-related services sectors. The total turnover of each of the ten sectors is thus split up between East and West Germany according to the 1994 shares. This proceeding can be justified by the fact that the share of turnover, which was allotted to East and West Germany in 1992 and 1994, remained fairly constant in the individual sectors. The largest shift amongst turnover shares was seen in management consultancy. There, the West German share rose from 84.5 per cent to 91.9 per cent between 1992 and 1994. In general, the share of turnover of West Germany in 1992 deviates from the mean turnover share of 1994 by two percent at the most. For the shift of turnover share in the individual sectors from East to West Germany (or vice versa), there is no tendency.

While the turnover shares between East and West Germany remained fairly constant over time, the distribution of turnover varies considerably across the ten sectors in consideration. The shares of East and West German firms for the other sectors are found somewhere between these two extremes. Beneath the over-proportional content of East German firms in the sample, these sector-specific differences in the distribution of turnover across West and East Germany makes it necessary to split up total turnover into East and West Germany separately for every sector.

Due to the publication lag and the bienniality of the turnover tax statistic,

further preparatory work must be done with regard to setting up the stratified target population.¹⁰ Turnover figures for 1998 are established through extrapolation of the growth rate from 1994 to 1996 for the ten sectors separately. Turnover figures for the years between the official recordings, i.e. 1995 and 1997, are established by interpolation.

As a basis for splitting up the target population into different size classes, the MARKUS data are used again. Since these data contain employment figures for almost all firms, splitting up the total turnover of the target population taken from the turnover tax data into different size classes is done by calculating the shares of each size class and splitting up total turnover by these shares for each stratum of the population.

In order to avoid a bias in favor of the large size class category, firms with more than 1000 employees were not considered — that was 0.15 percent of the total number of firms (according to the MARKUS data of August 1997).

5 Calculation of expansion factors

Attaching expansion factors to firm data implies accounting for the overall economic relevance of for example a large firms compared to a small firm. While for a large and a small firm the percentage decline of turnover may be the same, e.g. 10 percent, the absolute decrease for, say, the large firm may be 1 million DM and for the small firm only 1,000 DM. The share of answers from the 22ndh wave of the ZEW/CREDITREFORM business survey (III. quarter of 1999) clarifies this issue. Without expansion, a total of 35.2 percent of business-related services revealed that they had experienced increased turnover in relation to the II. quarter of 1999. For 44.9 percent of the firms, the turnover stayed the same and amongst 19.9 percent, turnover figures declined. If turnover expansion factors are used, using the method which is described in this section, then a different picture arises. In that case, 42 percent of the firms state to have increased turnovers, 38.7 percent report unchanged turnover figures, and 19.3 percent claim to have a decrease in turnover. Or formulated more correctly in respect to turnover: 42 percent of the turnover belong to firms which

¹⁰At present, the turnover tax statistic was available biennially up to the year 1996. The statistic of the year 1997 was published after calculation of the expansion factors was determined.

experienced an increase in turnover, i.e. amongst 16.4 million DM (39 million DM \cdot 0.42), an increase in turnover occurred.

In that respect though, no evidence of the complete development of turnover in the sector of business-related services can be found. This would only be possible if quantification techniques were used.¹¹

In this section we formally describe the way expansion factors are calculated. Let $U_{i,j}$ denote the turnover of company i from cell j , with $i \in \{1, \dots, n_j\}$, whereby n_j represents the number of firms of each cell in our realized sample. Subsequently $n = \sum_{j=1}^{50} n_j$ is the sum of firms in our

sample survey. $U_j = \sum_{i=1}^{n_j} U_{i,j}$ is the turnover in our sample which is gained in one cell. Furthermore, let G_j represent the turnover which is gained in one cell of the target population and G the turnover of the target population.

The expansion is to be carried out over individual cells. This leads to cell specific expansion factors H_j^A and the following equation:

$$G_j = \sum_{i=1}^{n_j} H_j^A U_{i,j} \text{ or } H_j^A = \frac{G_j}{U_j} \forall j \in (1, \dots, 50)$$

If this cell factor H_j^A is multiplied with the turnover of the company, then the individual expansion factor $H_{i,j}^A$ for company i comes about as follows:

$$H_{i,j}^A = U_{i,j} H_j^A$$

$$\text{or } H_{i,j}^A = U_{i,j} \frac{G_j}{U_j} \forall i \in Z_j \wedge \forall j \in (1, \dots, 50).$$

5.1 Outliers

Below it is explained, how firms which emerge from the expansion as ‘special cases’ are dealt with. These firms are only taken into account in the calculations as one occasion (Lee 1995). That means the factor $H_{i,j}^A$ is set to $U_{i,j}$ for the i th of cell j firm classified as an outlier. The following types of firms are considered as outliers: (1) firms with large turnover or (2) firms with large turnover per employee, both relative to the turnover figures in the corresponding cell. Naturally, this action influences the calculation of

¹¹See Seitz (1989) for a survey of quantification techniques.

the expansion factors of the remaining firms in every cell that contains a special firm because $\sum_{i=1}^n H_{ij}^A = G_j$ has to be fulfilled. This is explained in greater detail below. In the case of a turnover share which is ‘too high’ in the corresponding cell Z_j :¹²

1. Determination of the turnover share of an individual firm which would arise from a uniform distribution of the turnover figures across all firms in the cell. This results from $\frac{1}{n_j} \quad \forall j \in \{1, \dots, 50\}$.
2. Determination of the turnover share of an individual firm in the sample. This results from $\frac{U_{i,j}}{U_j} \quad \forall i \in Z_j \wedge \forall j \in \{1, \dots, 50\}$.
3. If the actual turnover share of an individual firm is more than twice of the turnover share arising from a uniform distribution of turnover across all firms in the cell, this firm is considered as an outlier.

Turnover per employee being ‘too high’ therefore comes about when the turnover per employee exceeds 1 million DM. In that instance, the company is treated as an outlier. For these firms, the following notation is to be introduced. In it, \mathbb{D}_j represents the amount of firms who are in the j th cell and are special cases. In the 17th wave, 35 of the 972 firms were he ‘special cases’ and were expanded with a factor of 1. This

represents 3.6 per cent of the total firms.

Since the special cases are not considered in the expansion, the total turnover U_j^* of a company in a cell, for which the expansion is to be carried out, decreases. This is a result of $U_j^* = \sum_{i \notin \mathbb{D}_j} U_{i,j}$. Likewise, in order

to reduce the corresponding turnover figures, total turnover of the cell is: $G_j^* = G_j - \sum_{i \in \mathbb{D}_j} U_{i,j}$. The expansion is then taken up using G_j^* . From that,

the corrected expansion factor comes about follows:

$$H_{i,j}^* = U_{i,j} \frac{G_j^*}{U_j^*} \quad \forall i \notin \mathbb{D}_j$$

Since the special firms are only included in the calculation with their own turnover (i.e. without cell factor), the following is obtained:

$$H_{i,j} = U_{i,j} \quad \forall i \in \mathbb{D}_j.$$

¹²The following explanation therefore always relates to a particular cell, even when it is not explicitly specified.

5.2 Item non-response

Firms taking part in the survey may leave one question unanswered. This is called ‘item non-response’. The value of the corresponding variable is then replaced by ‘missing’. The indicator variable $\mathbb{1}_i^{increased}$ takes the value 1, if company i has stated that, in comparison to the last quarter, it has recorded increased turnover (prices, profits, demand, number of employees). If this is not the case, then $\mathbb{1}_i^{increased}$ is coded with 0. In analogy, we proceed with the indicator variables $\mathbb{1}_i^{equal}$ (for unchanged turnover) and $\mathbb{1}_i^{decreased}$ (for decreased turnover). Thus $j \in \{1, \dots, 50\}$.

If a company i is in one cell, then: $\mathbb{1}_i^{increased} + \mathbb{1}_i^{equal} + \mathbb{1}_i^{fallen} \neq 1$, where $M_{j,k}$ is the amount of firms which have a missing value in the j th cell at the k th variable. For the affected variable, these firms are not taken into account. Thus, for total turnover in the sample which is relevant for the

the sing abq

6 Discussion

For the representation of survey data, balances are often calculated from the individual firm responses. This balance — such as the one obtained from the question related to turnover — results from the share of firms which indicated that they recorded increased turnover, minus the share of firms which indicated that they recorded decreased turnover. If the *non-expanded* balance is positive, then the majority of *participating* firms were able to realize a growth in turnover. It can, however, still be possible, that the business-related services sector actually realized a decrease in turnover. This happens for example if small firms experienced growth while large firms experienced a decline.

In the ZEW/CREDITREFORM economic survey there has twice been the phenomenon that, without expansion of the turnover variables the turnover balance slipped into the negative area, whereas with expansion it never ranged in the negative area. This occurred since before the second quarter of 1997, East German firms were overrepresented in the sample. East German firms come to much worse judgements of their economic situation since the end of 1994.¹³ The expansion corrects for this effect resulting from the sample design. Expanded and not expanded turnover balances are shown in Figure 1.¹⁴

Figure 1: turnover balances weighted and unweighted

Since there are no formal tests with which the quality of expansion methods can be checked, an evaluation of our expansion factors turns out to be difficult. A piece of information regarding the robustness of our expansion factors, however, is given by the effects changes in the design of the sampling frame have on the the outcome of the ZEW/CREDITREFORM business survey. Since the beginning of the ZEW/CREDITREFORM business survey, the number of firms in the sample has increased twice, notably in the second quarter of 1995 (an increase from 1046 to 1807 firms) and in the second quarter of 1997 (an increase from 1755 to 4166 firms). In the second enlargement, the over-proportional representation of East Ger-

¹³Originally, an over-proportional amount of East German firms were included because little was known about their response behaviour at that time.

¹⁴It is clear from Figure 1 that the survey data exhibit seasonal fluctuations. A suitable method to resolve this seasonality for a short time series is suggested in Kaiser and Buscher (1999).

man firms was removed since, in the course of time, the response rate of East German proved to be higher than that of their West German competitors. Figure 2 displays the total number of participants in every wave of the ZEW/CREDITREFORM economic survey and the relationship between the West and East German firms who answered. In the second enlargement, this relationship changed from 1.5 (first quarter of 1997) to 2.9 (second quarter of 1997).

Due to the better turnover evaluations of West German firms, it is to be expected that the sample enlargement leads to an unusually large and positive increase of the turnover balance. In fact the unweighted balance increases by 24.1 per cent whereas if expansion factors are attached, it does so only by 18.8 percent. Our expansion factors thus seem quite good at correcting changes in the sample design.

Figure 2: # of participating firms

7 Summary and further research

In spite of its growing economic importance, the service sector is still insufficiently recorded in official statistics. In situations constituted by a lack of data, business surveys become a very important instrument in observing the economy.

With the example of the ZEW/CREDITREFORM business survey for business-related services, we show how a suitable method of calculating expansion factors can be found even when there is little information on the target population. On the basis of data from turnover tax statistics and from a data base provided by a credit rating agency, the target population is set up and stratified into ten sectors, East and West Germany as well as into five size classes (three for West Germany, two for East Germany). The target population is thus divided up into 50 cells. The responses of the individual firms are expanded proportionally to their turnover share in one of the related 50 cells. A comparison of expanded and not expanded survey results shows that we have found a robust method of calculating expansion factors since the expanded balances do not respond to changes in the sample design as the not expanded figures do.

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Figure 1

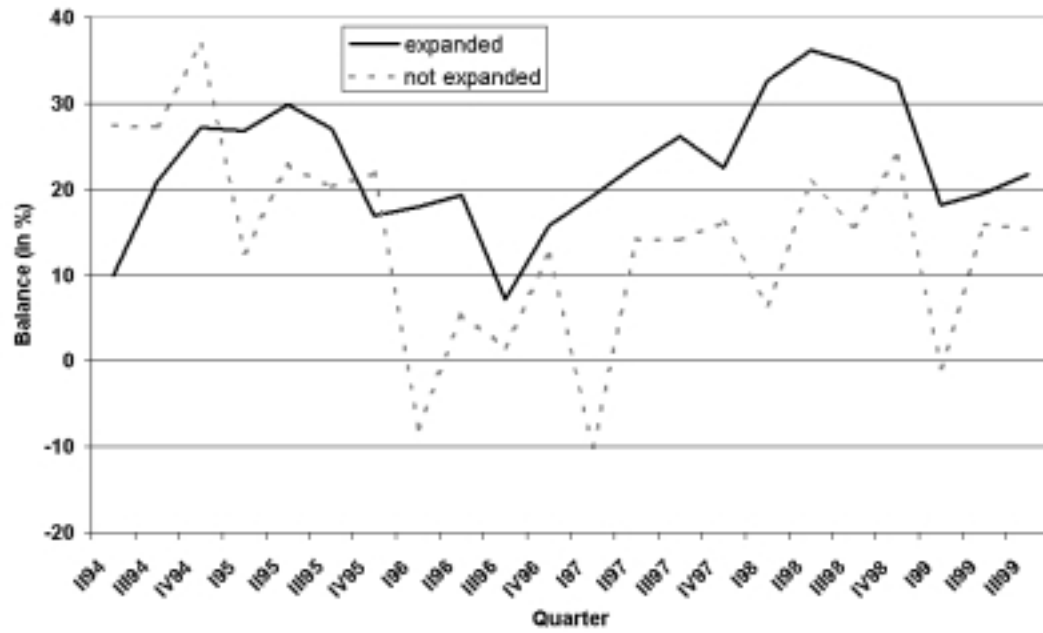


Figure 2

