Using Admin Data – Estimation approaches

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Revisions of STS-estimates

Daniela Röstel
DESTATIS, e-mail: daniela.roestel@destatis.de

Abstract

In order to reduce the statistical burden on its enterprises Germany uses VAT data in combination with survey data to produce short term statistics (STS) in the “other services” sector. However, when VAT data are needed to estimate turnover growth rates for this statistical purpose the administrative data is not complete. Missing values in VAT data are imputed by using information of units with complete and plausible data. The use of incomplete VAT data for STS-purposes may affect the extent of revisions. For a start this paper describes current plausibility checks of STS-estimates in the German “mixed mode-model” and findings from international comparisons. Since incomplete VAT data could lead to bias, further work focuses on the analysis of revisions. First results are presented. This work is carried out in the framework of the ESSnet AdminData.

Keywords: Timeliness, STS-estimates, VAT data, revisions

1 Introduction

In short term business statistics administrative data are used by several National Statistical Offices for monthly and quarterly estimates, partly in combination with survey data. Since the second quarter 2007 Germany uses administrative data for STS-purposes. To produce quarterly STS turnover indices in the “other services” sector Destatis combines survey with VAT data in form of a mixed-mode model, a combination of a survey for large enterprises and administrative data for smaller and mid-sized enterprises. In Germany large enterprises are defined as enterprises having an annual turnover of at least EUR 15 million or more than 250 employees based on information in the Business Register. The use of administrative data in combination with a survey for large enterprises requires checking the plausibility of combined STS-estimates. Results often reflect “suspicious” developments which may have various reasons. These might stem from incomplete matching procedures, differing NACE codes for the same unit in different sources, developments in the population that are not yet covered by some sources etc. The following chapter describes current methods of plausibility checks of combined turnover data and findings from international comparison, carried out in the framework of the ESSnet AdminData partnership.
2 Plausibility checks of combined turnover data

In German service short term statistics Destatis uses a three stage approach to check plausibility of the combined VAT- and survey data. The plausibility checks are executed bottom-up, i.e. (1) first in the monthly/quarterly VAT deliveries, (2) then in the quarterly data derived from stored VAT data and (3) finally, in the combined data (VAT estimates + survey data). Each month the fiscal authorities of the 16 Länder send all the current VAT declarations to Destatis which have been processed in the tax agencies since the last delivery. There are monthly, quarterly and yearly VAT payers classified according to their VAT payments of the previous years. The latter are disregarded for STS-purpose because of the lacking information about the distribution of the turnover throughout the year. [Lorenz 2011] The first plausibility check examines monthly/quarterly VAT data deliveries received from fiscal authorities and corrects identified values in a fully automated process. Then, quarterly VAT data are calculated on enterprise level from stored VAT data. The second plausibility check identifies automatically important outliers of quarterly VAT data but each correction is a case-by-case decision carried out manually. The third plausibility check which revises combined data (survey + admin data) may show that a single detail of the whole process has a distorting impact on the results. The check does not always work well. An identified problem has to be pinpointed and sometimes it is even difficult to decide whether there is a problem or not. In any case it has to be treated manually as a single case and eventually to be corrected. Finally, international findings are presented.

2.1 Plausibility checks of delivered monthly/quarterly VAT data

Automated plausibility checks in the VAT data deliveries are conducted on the micro level. Approximately 1% to 3% of the total number of VAT declarations has negative turnover values which are replaced. This approach is in line with the statistical definition of turnover for STS-purpose. Furthermore, extreme outliers resulting from input errors on the part of fiscal authorities are identified by the following plausibility check. First of all, the median of the last six submitted monthly turnover values is calculated for monthly payers, for quarterly payers the median of the last four quarterly turnover values is used to allot enterprises to one of the defined classes. For each class specific error conditions are defined. For instance, enterprises with a median of less than 1,000 Euro per month in case of monthly payers or with a median of less than 1,000 Euro per quarter in case of quarterly payers or new starting enterprises will be tagged as extreme outliers if turnover of a natural person exceeds 15 million Euro or turnover of other legal form rises above one billion Euro. Another example, enterprises with a median of more than 1,000,000 Euro per month will be marked as outliers if they tenfold the median turnover. The higher the median the stricter is the plausibility check. Identified extreme values are imputed in the same way as missing values.

2.2 Plausibility checks of quarterly data derived from stored VAT data

In addition to the procedure described above, quarterly data derived from stored monthly/quarterly VAT data are checked for plausibility. This check serves to ensure the quality of results at the level of the Länder and the federal level. It aims to identify those units generating very high turnover that feature either a very strong increase or decrease of quarterly turnover or which do not have a quarterly turnover value in the previous or current quarter.

First of all, those units that generated turnover of at least one percent at two digit level in their Land are tagged. Then quarterly data of marked units are checked on the micro level for following different types of errors:

1. Missing quarterly turnover value of previous or current quarter
2. Strong increase or decrease of quarterly turnover: To discover strong rise or decline in turnover all enterprises are allotted to turnover size classes. Starting point of the algorithm is the biggest size class, that means if the enterprise’s turnover of the reporting quarter or
of the previous quarter exceeds 100 million Euro size class number five will be applied. If that is not the case, it will be examined, whether the turnover of the reporting quarter or the previous quarter rises above 50 million Euro and so on. Thereafter, the rates of change are calculated as quotient between the turnover value of the reporting quarter and turnover value of the previous value and are compared with defined thresholds (lower limits are reciprocal to upper limits). Outliers are those enterprises, whose rates of changes go below the defined lower limit of the size class or pass over the upper limit. For instance, if an enterprise generated 60 million Euros in the previous quarter and 20 million Euros in the current quarter it will be allotted to size class number four. The rate of change is three and passes over the upper limit of two.

Identified outliers of all types of errors are listed in a checklist. Due to short time frame identified outliers are checked manually by the Statistical Offices of the Länder and if necessary corrected by the time of the first revision at t+150 at the latest. Owing to a legislation amendment Destatis and the Federal Statistical Offices of the Länder are authorized now to clarify inconsistencies in the VAT data directly with the enterprises. Those outliers that influence results at t+60 at the federal level are disqualified until their final verification. Turnover values will be included in the STS-estimate if the suspicious development appears to be real after an extra check.

This plausibility check focuses on detecting “suspicious” developments caused by enterprises generating very high turnover at the two digit level in their Land. Missing quarterly turnover value of the previous or current quarter may result – besides from starting and stopping enterprises representing real developments – from an incomplete matching procedure. Incomplete matching is for instance caused by a change of the tax number without submission of the former tax number. That may be the case when an enterprise moves from one to another Land. Companies also merge or split up. It may also be the case when incorporations into a VAT group, respectively a spin-off from VAT group occur or the tax number of the parent company changes in case of a VAT group membership.

A very strong increase or decrease of quarterly turnover may result – besides from real developments such as seasonal patterns or insolvency proceedings – from errors in the data. This is not a problem when enterprises are part of the survey because survey data takes priority over VAT data, but in the other cases where VAT data are used. This is for instance the case, if the enterprise belongs to a VAT group. Changes in the structure of the VAT group – such as a new VAT group member outside the scope of service statistics – might lead to a major alteration of the generated turnover in the VAT declaration. To distribute the turnover declared by the parent company the allocation code stored in the Business Register is used. This allocation code is only adjusted once a year. Therefore, it does not allow for recent developments. Moreover, a strong rise in turnover might also point to linking problems of VAT data for instance when a monthly payer delivered VAT data in last month of the previous quarter with a new tax number and in current quarter for all month. If this enterprise is very large it will be tagged as an outlier at this point.

2.3 Plausibility checks of combined turnover data

Finally, Destatis checks the plausibility of combined turnover data on the macro level. This check aims to identify abnormal developments and allows for the correction of results on the one hand. Due to a lack of experience in the processing of multiple source data, examinations on the macro level can also reveal methodical or even technical shortcomings.

For the plausibility check, first the rates of change in turnover are separately calculated for survey turnover data and turnover estimates stemming from administrative sources at each NACE class. After that, the plausibility of early administrative estimates is checked against the developments of survey data. Secondly, Destatis compares the shares of turnover derived from survey data collection in relation to the total turnover (survey + admin data).
This is done for each four digit level and for each quarter. For instance, to check plausibility of the rate of change between the first to the second quarter the share of turnover of the survey for the first quarter is compared with the share of turnover of survey data collection for the second quarter. Supposing that the shares of turnover derived from the survey in relation to the total turnover remain relatively constant in each NACE class – due to the number of large enterprises in the survey and their generated turnover – large alterations point to problems. In general, more than half of the total turnover in the “other services” is derived from the survey, the remaining turnover stems from administrative sources. Thirdly, the extents of revisions are monitored in a non-automated manner.

2.4 Findings from international comparison

The German methods of plausibility checks of combined data were compared with national practices of Netherlands, Finland and Italy. Checking the development of administrative data with those of survey data on aggregated level is a very common practice. Automated checks on a high aggregated level seem to be more efficient than on lower levels. Finland checks survey and VAT data for the enterprises having the largest impact on the indexes. Germany found out that differences between administrative data and survey data on individual data level are not systematical. Concerning revisions, the legislative frame allows Statistics Finland to check revisions on micro level. Italy is experienced in the decomposition of the revisions errors into its components including revisions errors caused by late reporting units in the administrative data. The check of metadata described by Statistics Netherlands serves in the broadest sense to check plausibility of combined data to avoid errors resulting from units that cannot be linked to their statistical counterparts. The extension of the current plausibility checks applied in German service statistics on weighty inconspicuous units may lead to further improvements. [Röstel 2011]

3 Revisions of STS-estimates in Germany

In the statistical sense revisions are a reworking of results for instance by using new data or improved methods. Revisions result from changes in the data at different states of revision. According to the current state of knowledge revised results are the “better” results. But statistical users are confused by high extends and high numbers of revisions. Likewise credibility of first results may be questioned. Since incomplete VAT data could lead to bias this chapter focuses on analysis of revisions. At first, the timeliness issue in the German approach is described. Then potential causes of revisions are explained by taking the example of German STS-estimates in “other services”. Further, first analyses carried out on the macro level are presented.

3.1 Various reasons for revisions

The revision of an index in German STS service statistics results from various causes. In the survey missing values of reporting units are manually estimated or if not replaced by VAT data. The missing values in VAT data are imputed. Moreover, extreme outlier values in the deliveries of the tax authorities detected by a first plausibility check are imputed as well. Furthermore, another plausibility check of VAT data aims to identify important units with missing quarterly turnover values or strong changes in turnover. Those detected outliers that influence results at the federal level are disqualified for generating first results at t+60. In addition, huge, “inconspicuous” quarterly turnover values in VAT data which cannot be linked with the Business Register will be checked in future as well to avoid double counting and erroneous codes of economic activities.

At the first and second revision (at t+150 and t+240) VAT data deliveries become more and more complete. The turnover stemming from the survey may also change. In addition, the verification of outliers and of huge unlinked values may cause revisions. However, stopping units cause revisions as well. This is the case when missing
values are imputed for generating first results but after a certain period of time VAT declarations are still missing and it is assumed that the unit stopped its activity. Such a list of specific influences on the revised results differs from one to another country. It depends on applied methods and assumptions. But when using administrative data in combination with survey data for STS-purpose it seems to be useful for European countries to investigate the influence of incomplete administrative data on revisions.

3.2 Timeliness issue in German VAT data

At the time when the VAT data is needed for statistical purposes the data is incomplete. Yearly payers representing more than 2% of the total turnover of a year are disregarded for STS-purposes because of lacking information about the distribution of the turnover throughout the year. From the remaining enterprises 50% are monthly VAT payers representing more than 90% of the turnover in most of the NACE-sections while the quarterly VAT payers represent less than 10% respectively. If all enterprises met the legal deadline of t+40 days for their VAT declaration, the VAT turnover data (delivered at t+52) would be complete for producing STS-indices at t+60. In practice, however, the data is incomplete. Some enterprises are late with their VAT declaration, so their turnover is transmitted in one of the following deliveries. Approximately 6% of the turnover is missing at t+60 in "other services". [Lorenz 2011]

To decide in which cases a value is considered to be missing the following criterion are used. It is assumed that an enterprise is still operating when 60 days after the end of the reporting period (month/quarter) even if its turnover is missing, when at the same time the turnover of the previous period is available. In this case it is expected that the VAT declaration will be delivered in the next month. Hence the missing value is imputed. The missing values are imputed on micro level by using information of units with complete and plausible data. Divided into several groups by two size classes, NACE-two-digits and the period of VAT declaration (monthly/quarterly payers) group-specific growth rates of the total turnover from the previous period (t-1) to the current period (t) are calculated and multiplied with the turnover in t-1 of each group member with missing data in t. The level of completeness of the data rises steadily until 180 days after the end of the period the data is considered to be complete. [Lorenz 2011]

3.3 Analysis on macro level

Based on data for the first quarter of 2009 onwards Destatis carried out a quantitative analysis of the total extent of revisions. The “mix mode model” used in German STS service statistics combines absolute turnover values from both sources without using weights. Turnover indices are chain indices calculated on NACE-four-digit level and compiled on NACE-two-digit level by using weights. At t+60 first results are published, at t+150 results are revised for the first time and the final results are generated at t+240.

Turnover indices in “other services” at 2 digit-level were examined. Examples are shown in Figure 1. The first chart shows the turnover indices at each revision. The green line represents the first results at t+60 for each quarter. The yellow line illustrates turnover indices at t+120. And the red line shows the final results at t+240. Note that the turnover index is a chained index. Hence, revisions of preceding quarters lead to revisions in the current quarter, although the data base may not have been changed. The second diagram shows the extent of the revisions in terms of index points. The yellow bars present the values for the first revisions and the red bars for the second revisions. The extents of revision differ between service branches. For instance, in NACE 62 “Computer programming, consultancy and related activities” the first publicized turnover index of the reporting period first quarter 2009 is 99. Then, the index of first revision is 83. In the second revision it is 98 presented in the first chart of Figure 1. That means the turnover index of first revision of the reporting period first quarter 2009 is 16 index points less than in the first publication. The extent of revision between the first and the second revision is 15 index points illustrated in the second chart of Figure 1. These revisions are unusually high and it seems to be some mistake in the first revision.
When using a “mix model” approach genuine causes of revisions are not obviously. Differences in the rates of change between versions lead to revisions. Figure 2 shows the rates of change of WZ 58.11 at first publication, first revision and for final results at different reporting periods. The yellow bar indicates the rates of change calculated from total turnover (VAT data + survey data). In addition, rates of change were calculated separately for the survey represented by violet bars and showing the development of large enterprises. The brown bars illustrate rates of change of those VAT data that are used for all other enterprises. They show the development of small and medium sized enterprises. Concerning the reporting period second quarter 2010 the rate of change calculated from the total turnover is plus 52% at the first publication and minus 2% at the first revision. At the same time the rate of change calculated separately for the VAT data changes form 117% at the first publication to minus 13% at the first revision.

Figure 2: Rates of change of VAT data, survey and total turnover
The link to survey data or VAT data can be done by the information about the absolute turnover values of current and previous period by source. Figure 3 illustrates that the shift of the total rate of change between the first publication and the first revision at the reporting period second quarter 2010 results from a large reduction of VAT turnover concerning the current turnover value.

Figure 3: Absolutes turnover values by sources

![Absolute turnover values by sources](image)

Note: Current quarter (AQ), previous quarter (VQ)

The analysis by data source shows that high changes of the rates of changes between versions are caused on the one hand by survey data and on the other hand by VAT data. It seems natural that survey data may cause high revisions due to the fact that large enterprises are surveyed and minor numbers of alterations may lead to high extents of revisions. Late reporters replace manual estimates. In the following economic activities differences between the rates of change of one specific reporting period exceeding 10 percentage points are caused by changes in survey data: WZ 51.10 “Passenger air transport”, WZ 58.21 “Publishing of computer games”, WZ 59.13 “Motion picture, video and television programme distribution activities”, WZ 61.90 “Other telecommunications activities”, WZ 62.02 “Computer consultancy activities”, WZ 62.09 “Other information technology and computer service activities”, WZ 62.20 „Activities of call centres” and WZ 82.92 „Packaging activities”. However, Germany notices that VAT data also effects also high revisions. For instance, in the first publications of the second quarter 2010 the rate of change is 52% in WZ 58.11 “Book publishing” and minus 2% in the first revision due to the fact that the VAT turnover value of the currents quarter is lower in the state of first revision. Concerning WZ 82.92 „Packaging activities”, in the first publications of the second quarter 2010 the rate of change is minus 5% and 7% in the first revisions due to increase of VAT turnover of the current period value. In any case, the actual cause can be only identified by data analysis on the micro level.

4 Further plans

The ESSnet Admindata has been set up in order to develop best practices and make recommendations in the uses of administrative data and accounts data in European STS business. The extent of revisions and the most commonly used quality indicators, average error and average bias, are currently only provided for the entire population. To test the validity of practices on the use of incomplete administrative data to produce STS-estimates recommendations will be provided to distinct the average error and bias due to the accumulation effect in the VAT part from the average error and bias in the total estimate. Moreover, within the administrative data part effects of incompleteness of administrative data, starting and stopping enterprises and revised declarations will be investigated. It is to be clarified, whether methods applied to encounter the timelines issue in administrative data produce similar quality in normal periods as well as in abnormal periods.
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