Compilation of first estimates of turnover indices in recession - managing dissimilar fluctuations of small and large enterprises

Compilation of first estimates is challenging. Statistics Finland releases preliminary turnover indices with a delay less of 28 to 50, at which point the first value added tax data (VAT) is not available. Thus, the first release is based only on the sample. The accuracy of preliminary data against index point figures calculated from the total payment control data degrades when the development in the small enterprises differs from the large enterprises and when the imputation of missing values is inefficient. This is more often the case during recession as well as during expansion. As a result economic fluctuations make the compilation of preliminary estimates even more challenging.

Finland has relatively few large enterprises: the 2,000 enterprises surveyd account for majority of Finland's economic activity. Therefore, year-on-year changes in, for example, sales of the large enterprises correlate well with aggregate changes for all enterprises. However, the differentiation of the development among enterprises of different sizes varies depending on industry. For example, turnover has grown at a faster rate in small manufacturing enterprises than in large enterprises in Finland in the 21st century (see figure 1). In construction sector, the difference was most notable: the turnover of small and medium size enterprises went up by the average annual rate of 10,7 per cent, whereas that of large enterprises stood at 4,5 per cent.
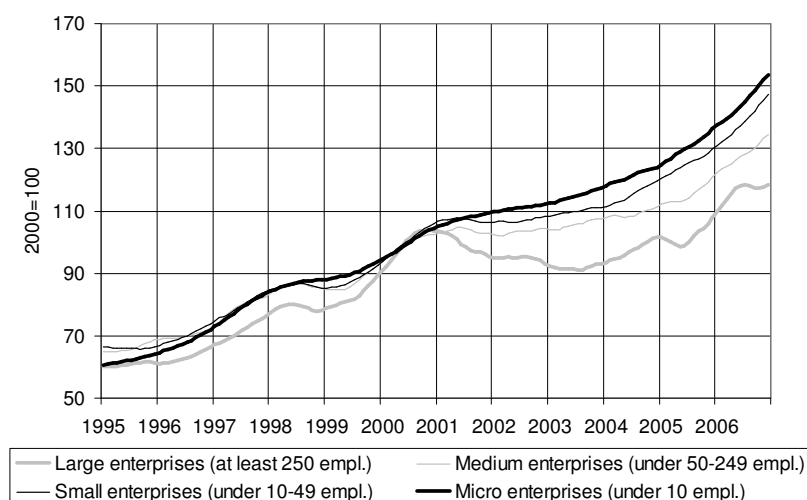

Figure 1. Development (trend) of turnover in enterprises of different sizes in manufacturing industry 1995-2006. Source: Statistics Finland, Tailored Trend Indicator Services, Graduate Thesis, Kiema 2007.

Statistics Finland

18 August 2009

Department
Name
Contact information

Because global business cycles affect the large enterprises engaging in a foreign trade first, the discrepancy is amplified when economy is shifting from relatively rapid economic growth to relative stagnation. On the other hand, small enterprises are less likely to survive from economic fluctuation or at least they tend to reach the growth path slower than larger ones. Thus, growth and recession usually affect companies of different size at different points in time.

When studying quarterly and monthly turnover growth rates by enterprises size from the beginning of year 2008 to March 2009, it was found that the decline of growth started simultaneously among enterprises of different sizes (See figure 2). The turnover growth stagnated in the latest quarter of year 2008 and the growth rates sank under zero in the first quarter of year 2009 in all size categories.

Figure 2. Development of turnover growth rates in enterprises of different sizes in all branches, Tailored Trend Indicator Services, Olsson 2009.
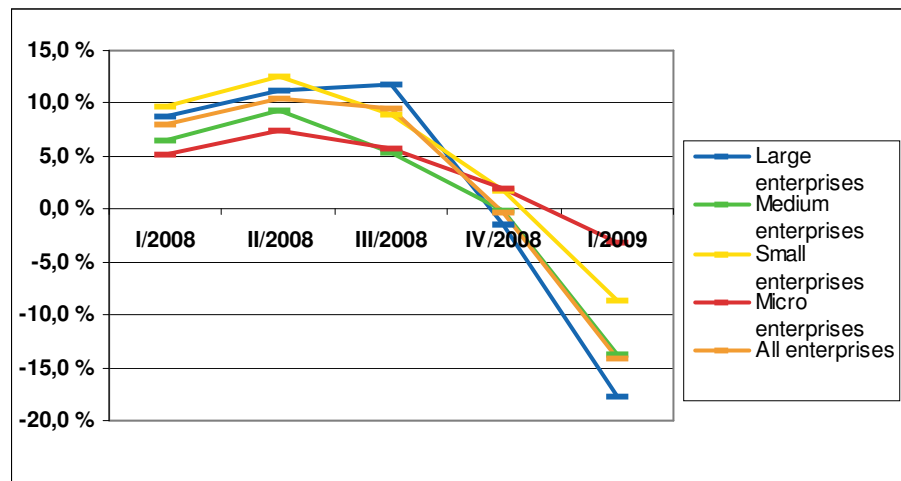
The differences in the intensity of decline in turnover growth rate between different enterprises in different sizes was much clearer. The turnover growth rate of large enterprises (annual turnover over 50 million Euro) plummeted under zero in the last quarter of 2008, while the growth rate of small (annual turnover less than 10 million Euro) and medium sized (annual turnover less than 50 million Euro) enterprises was positive. In the first quarter of 2009, the turnover growth rate was more negative in large enterprises (-17,8 %) than in medium sized (-13,8 %) or small enterprises (-8,7 %).

The timing and depth of current economic down turn was examined also by industry. Surprisingly, turnover of large manufacturing enterprises declined less than the growth rate of smaller enterprises in the last quarter of year 2009. However, in the first quarter of 2009, the turnover growth rate of large manufacturing firms was more negative than the growth rate of smaller manufacturing firms. In construction sector the recession hit largest enterprises the most. The turnover of large construction enterprises decelerated

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18 August 2009

already in the third quarter of 2008. In whole sale and retail trade, turnover of large (-16,6 %) and medium sized (-14,1 %) firms declined significantly more than the turnover in small firms (-7,5 %) or micro-firms (-5,8 %).

Recession inflicts also imputation of missing values, which is based on historical turnover values of enterprises. Imputations are made for the latest month and the second latest month to the pairs of values thus obtained. If an enterprise has missing data for three or more months, imputation is not performed at all and the imputations performed earlier become deleted since business is assumed to have finished.

Five different imputation rules are used for enterprises with missing data (t = month to be estimated):

$$\hat{x}_t = \frac{x_{t-1} + x_{t-2} + x_{t-3}}{x_{t-13} + x_{t-14} + x_{t-15}} \times x_{t-12}$$
(Mean annual change)

$$\hat{x}_t = x_{t-1}\sqrt{\frac{x_{t-1}}{x_{t-2}}\frac{x_{t-2}}{x_{t-3}}}$$, (Geometric mean of monthly changes)

$$\hat{x}_t = x_{t-1},$$ (Previous turnover)

$$\hat{x}_t = avg(x_{t-1}, x_{t-2}, x_{t-3}),$$ (Mean turnover)

$$\hat{x}_t = x_{t-12},$$ (Turnover of comparison month)

The methods are tested with data concerning the five latest months. A model with less than 20% maximum proportional forecast error is admissible. A model with greater than 20% and less than 50% maximum proportional error is non-admissible. The method which largest prediction error is the smallest is chosen. Due to strict criteria the proportion of units for which a value is imputed is rather low.

Imputation does not perform well for the enterprises with abnormal observations. Against this background, Statistic Finland has controlled imputations as well as outlier treatment more carefully than in a normal economic situation. The most significant imputations are checked manually and statistician is also able to edit the values. During the manual editing statistician can obtain information about the impact of the imputations as a whole. If imputations seem to fail the method can be excluded from calculations for this once.

There is currently no stratification in the inquiry. In addition, the index-formula is applied on the aggregated level immediately. When data is poorly accumulated, notable changes in large enterprises can influence the index too much. To correct this, the statistician can decide to decrease the weight of the deviant enterprise. When the outliers for a given month have been manually identified, the weight is automatically lowered according to the whole population and not just the part included in the inquiry.

Monitoring of revisions against the comprehensive VAT data also makes it possible to estimate the efficiency of imputation. Performance is measured

18 August 2009

Department
Name
Contact information

by how much the revision of the change percentage decrease when the imputation is used compared to the case with no imputation. Naturally, this measurement method is not ideal, because revisions result also from other things than accumulation of data. Other reasons for the revisions are changes in classification category (e.g. change of industry) or in value or source data, company reorganisations or enterprise openings and closures.

In retail trade imputations have improved the accuracy of preliminary figures against index point figures calculated from the two times accumaleted total pament control data from January to June 2009 (See table 1). With revision data with and without imputation from only 6 months, it is yet imposible to estimate whether our current imputation method has been efficent during economic turning point or not. The impact of imputation on revision has to be examined also from other branches of industry and the performance of imputations has to be studied also by firm-level.

Table 1. Year-on-year changes in volume of sales with and without imputations, definite volume of sales and follow-up of revisions of preliminary releases with and without imputations retail trade.

Statistical year	2009					
Month	1	2	3	4	5	6
Volume of sales with imputation (+ 45 days)	2,5	-5,7	-1	-0,1	-4,3	-0,2
Volume of sales without imputations (+45 days)	2,7	-5,5	-1,3	0,4	-4	0,4
Definite volume of sales (+105 days)	1,4	-6,2	-0,3	-1,9	-4,8	-1,2
Revision with imputation	**-1**	**-0,5**	**0,7**	**-1,8**	**-0,5**	**-1**
Revision without imputation	**-1,3**	**-0,6**	**1**	**-2,3**	**-0,8**	**-1,6**

Previously also aggregate level estimation based on ARIMA-models was applied. It was conducted on the activity division level after the indices based on inquired and imputed data were ready. However, in some cases the model can fail. Because of this, statistician had to evaluate if there was systematic difference in the development of the non-surveyed and nonrespondent companies compared to surveyed respondents. This was done by comparing the year-on-year changes of the companies in estimation to the whole division's changes. Based on statistician's evaluation on whether the ARIMA-estimation was likely to improve the accuracy or not, the aggregate estimation was included or excluded in index calculation. The method is no longer in use, because it was time consuming and didn't prove to lead to significant improvements on the results.

Current methods we use intent to improve the quality of data acquired from the survey. Nevertheless, revisions have increased since the beginning of year 2008 at least in construction and in service sector. At the moment we are developing a macro-level report, which generates monthly information among other things about the year-on-year changes of the non-inquired and inquired firms, comprehensiveness of sample and the impact of imputations. Our future plan is to add a method which would take into account the influ-

18 August 2009

ence of the companies which are left outside the inquiry. This will most likely be done with the help of regression model so that the rest of the population would be estimated as a whole.