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Estimating Contributions to GDP Growth by Structural Decomposition of Input-Output Tables

Topic 2 – Learning more from what we already know

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Introduction

Factoring real GDP changes is important information for macro analysts, and through them and the media, for the general public as well. It is no coincidence that contribution to growth tables by production and expenditure approach are among the most frequently cited sources of statistical offices. They are the basis of all reports after the publication of the latest growth data.

Techniques for calculating growth contributions can be learned from the methodological background of the tables referred above, or in more detail, from statistical studies and other professional publications. This paper, however, differs from those in several respects. The focus is not on the part effects behind the most current quarterly GDP volume index and the related chain-linking problems. Instead, structural decomposition analysis (SDA) of input-output tables is used for measuring growth contributions. Input-output tables are published with a much longer time lag than flash estimates of GDP, but the chance to analyse a deeper structure of the economy can compensate for less current information. With the methods presented here, one can detect not only the direct effects of the changes of branches' own value added levels and the final products flowing to different sectors, but considering the domestic purchaser-supplier relations one can also estimate the multiplicative growth effect of the final demand of each industry. This is the rationale for Leontief's demand-pull input-output model.

Methods / Problem statement

The problem is introduced and the methods are explained using a fictive example, two extremely simplified constant price input-output tables.

Firstly, I show how common contribution breakdown can be connected to the input-output data set. Hereinafter, not only the data but also the underlying economic model is needed. After reviewing the sufficient theoretical and technical background for the basic matrix equations of input-output multipliers, I perform a structural decomposition analysis of the real GDP between the two fictive tables on two dimensions, on one hand, according to the terms of value added SDA equation (change in value added ratios, domestic direct requirement coefficients, and final demand), and on the other hand, by industries. I then carry out a more comprehensive examination of the variations of the Leontief inverse and the final demand structure. After this, an alternative SDA approach is introduced which differs from the standard textbook scheme. Here, not the value added appearing at the companies of each industry, but the value added generated by the final demand and its multiplication through upstream value chains, i.e. GDP changes of all supplying domestic links involved gives final demand industries' contribution to economic growth.

All the results in our fictive example are recalculated according to this alternative SDA method.

Results / Proposed solution

To show how proposed techniques work in practice I analyse the components of Hungary's GDP growth in the year 2012. The latest input-output table published by the Hungarian Central Statistical Office is valid for the year 2010, however, supply and use tables at current prices are available for 2011 and 2012, as well. Using these, I have calculated industry by industry tables with the “fixed product sales structure” method. From the 2012 table I have generated a previous year price version with RAS technique using the available previous year price margins.

Both SDAs show that the most significant positive factor in the GDP volume index in 2012 was the change of the value added ratios, and the most negative were modifications in domestic purchaser-supplier relations and gross fixed capital formation.

Factoring by industries yields decided differences between the two SDA methods. Although lists of the top 10 greatest growth industries show a large overlap, contribution values differ considerably. The growth contribution of the number one industry, the manufacturing of motor vehicles, for example, was more than one and a half times higher according to the supply chain effect calculation, in spite of the fact that the multiplication power of this industry is one of the lowest in the Hungarian economy, and furthermore, it even decreased in the year under investigation.

Conclusions

These and similar detailed, final demand component and industry specific analyses can be performed using the methods proposed in this paper. Of course, concrete results of the fictive examples and the highlighted year of the Hungarian growth history are interesting, but are not the main message. The significance of this study is the technique itself. Estimating contributions to GDP growth by structural decomposition of input-output tables could be a useful tool for macroeconomic analysis and a support for policy decisions, showing not only the surface, but giving deeper picture as well.

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