

Cross Country Productivity Comparison With Missing Factor Endowments

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In this paper, we evaluate country differences by estimating bilateral productivity differences, using information of income (GDP) and various production factors (i.e. capital, labour, and natural resources). This method is called development accounting, and is used to estimate the extent to which income differences are accounted for by differences in factor endowments, or by productivity differences (Caselli, 2005; Hsieh & Klenow, 2010).

One of the first steps required to explore differences between countries, is to ensure comparability. The various factors should be denominated in common terms, to ensure they can be consistently compared between countries. The World Bank's international comparability program (ICP), and the wider pricing index literature (e.g. Deaton & Heston, 2010) have contributed significantly, as they provide the tools derive internationally comparable prices. However, before questions about comparability of factors are considered, we should consider the factors themselves. Specifically, can bilateral country comparisons be made, when countries possess different factors; In other words, when some factors are 'missing' from certain countries?

In this paper, we argue that missing factors are indeed a problem for productivity comparisons, and outline our approach to deal with this problem. To illustrate our approach, we specify a productivity comparison with the customary stocks of capital (e.g. machines) and human capital (labour and its quality), but also include the stock of sub-soil assets (e.g. oil, iron ore) as production factors. The stock of sub-soil assets serves our illustration well, as it is made up of different assets, with which not all countries are endowed. Oftentimes, even multiple asset types are missing. We use the methodology of the PWT 9.0 (Feenstra et al., 2015) as a starting point, and proceed by including the aggregated stock of sub-soil assets to the productivity comparison, much like capital and labour are included. Finally, the 14 stocks of each sub-soil asset are added to each country's production function individually, allowing us to take them into account separately. As the endowments of certain assets are missing for some countries, this final case gives rise to the missing factor endowment problem, and will be used to illustrate our approach. To deal with the missing endowment problem, we use an approach inspired by Inklaar & Diewert (2016). We take an industry perspective allowing us to approach each country's economy as a collection, or summation, of its industries. Additionally, we assume a part of the production factors to be unique to a specific industry; in terms of our illustration, each of the dis-aggregated sub-soil assets is specific to a

particular mining industry. Using these assumptions, we can subtract the value added, capital and labour of one or more industries from the aggregate economy. Such subtractions will yield a truncated representation of an economy, expressed without the subtracted industries. Through estimating truncated economies, we can ‘remove’ industries, and with it, the factors that two countries do not have in common. This will yield representations of economies in terms of a common set of factors, with which we can make bilateral comparisons without the problem of missing endowments. Our results suggest that, by using our approach to the missing endowment problem we can avoid some of the bias that is introduced when factors are inappropriately aggregated. More specifically, the results show that the correction to the relative productivity estimates is influenced by the importance of the truncated factors. Additionally, including sub-soil assets in our productivity comparisons is by no means trivial; our results show that estimates can be altered by up to 50% in some cases.

Sources

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