Calculating the Added-Value of Iran's Economy by the Use of "Input-Output table" (The Year of 2001)

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Abstract

Developing the input-output tables of Iran's economy is of such a high importance that, formulating and studying the added valu in Iran's economy by making use of input-output tables is the most important issue dealt with in this article. In order to more accurately investigate the use of input-output tables of the economy of Iran in the years which they are offered, it has been attempted to calculate the value added in vari-ous sectors of the economy using input-output tables in the year 2001 in Iran.

Keywords: Input-output table, the economy, Iran, value added, output, supply, consumpti-on.

Introduction

The analysis of economic policy in a micro-consistent framework demands both theory and data. A common theoretical basis for economic analysis is the Shoven-Whalley (1992) applied general equilibrium framework which is quite exible and can be applied to a large number of economy-wide issues (commercial policy, tax reform, environmental policy, etc.). The Shoven-Whalley approach is normally based on a multi-sectoral dataset, such as can be provided by an input-output table. While, in a textbook expositi-on, the development of the model and the dataset are conceptually separate activities; in practice, these two activities proceed in parallel.

Input-output analysis has received renewed attenti-on in recent years as input-output (I-O) tables are increasingly used in the empirical analyses of different topics, such as material flows, environmental issues, sustainable development, embodied technology, etc. This is partly due to the improved availability and quality of nati-onal input-output tables as well as modern IT capabilities that allow for more complex analyses to be undertaken. An area where input-output informati-on has been used less is globalisati-on, largely due to the fact that published input-output tables do not have the same sector classificati-on and price basis definiti-ons, and therefore often lack internati-onal comparability.

Globalisati-on is high on policy and research agendas in many countries as the pace and scale of today's globalisati-on process is without precedent. Growth in world exports and imports has been accelerating since the 1980s, far exceeding the growth in world GDP. Since the second half of the 1990s, globalisati-on has been particularly boosted by the strong increase in foreign direct investment (FDI) (OECD, 2008).

Moreover, current economic integrati-on is no longer restricted to the Triad . the United States, Europe and Japan . but now extends to new large global players like Brazil, Russia, India and China (BRICs). Furthermore, current globalisati-on displays some distinctive features (OECD, 2007; Grossman and Rossi-Hanberg, 2006; Baldwin, 2006) as producti-on processes are increasingly fragmented geographically, resulting in the emergence of global value chains. Informati-on and communicati-on technologies (ICT) have made it possible to .slice up. the traditi-onal value chain (Porter, 1985) and activities that previ-ously had to be carried out in the same locati-on in order to reduce costs. Instead of total industries and their complete value chains, particular fragments of producti-on are now increasingly clustering locally.

Important restructuring has taken place within companies and industries, resulting in the outsourcing, offshoring and relocati-on activities. Final products and, increasingly, also producti-on of intermediates are being offshored within these global value chains, giving rise to increased trade through exports and imports. Multinati-onal firms play a prominent role in these global value and supply chains as they have a global reach that allows them to co-ordinate producti-on and distributi-on across many countries and shift their activities according to changing demand and cost conditi-ons.

Another key characteristic of current globalisati-on is that it increasingly extends to FDI and trade in services. Many service activities are becoming increasingly internati-onalised, especially as ICT enables services to be produced irrespective of locati-on. Improvements in technology, standardisati-on, infrastructure growth and decreasing data transmissi-on costs have all facilitated the sourcing of services from abroad. Rapid advances in ICT have also increased the tradability of many service activities and created new kinds of tradable services. In particular, .knowledge work. such as database and informati-on processing services and research and consultancy services can easily be carried out via the Internet and through tele- and video-conferencing. Activities such as call centres have also begun to be offshored.

As global value chains and the related offshoring may have important impacts on nati-onal economies and employment, more accurate empirical measures of globalisati-on have been called for. However, the new characteristics of globalisati-on make empirical measurement of current globalisati-on a difficult and challenging exercise. While trade and FDI data have traditi-onally been used to measure globalisati-on, both are too broad to measure the size of global value chains and the extent of offshoring. Due to the emergence of global value chains, trade has increased not only in finished goods and services but also, and especially, in intermediates such as primary goods, parts and components, and semi-finished goods. Exports of final goods are no longer an appropriate indicator of the (internati-onal) competitiveness of countries, as following the emergence of global value chains, final goods increasingly include a large proporti-on of intermediate goods that have been imported into the country (,OECD 2008).

In general, official data on employment, trade and FDI typically provide some insight into offshoring, but do not provide a complete picture (US Government Accountability Office, 2004). Firm-level data (often collected through surveys) may provide the most complete informati-on on the globalisati-on of value chains and offshoring, but firms are often reluctant to furnish details on their outsourcing/offshoring and especially relocati-on decisi-ons given the sensitivity surrounding these phenomena. Input-output tables, which are typically available for all industries albeit at an aggregated level, offer complementary insights into the globalisati-on of value chains as they provide informati-on on the value of intermediate goods and services that have been imported from outside the country. A key advantage of I-O tables is that they classify goods according to their use (as an input into another sector.s producti-on or as final demand) instead of classificati-on schemes that divide goods into intermediate and other categories based on their descriptive characteristics. Another key advantage of I-O tables is that they also include informati-on on (domestic and internati-onal) inputs of/in services sectors, so that the fast-growing offshoring of services activities can be monitored (OECD, 2008). The purpose of this study is to calculate the value added in vari-ous sectors of the economy in Iran using input-output tables in the year 2001.

Input-Output Tables

Data for a particular country or regi-on are often organized in the form of an input-output (I-O) table which presents a static image of the economy. However, an I-O table is not a model. In order to analyze how the economy works and make predictions on the effects of policy changes, a model of the economy has to be created. The information contained in the I-O table provides a basis for the creation of a plausible model. An input-output (I-O) table contains the valuable information about the market allocati-on of resources in an economic system. Based on this information, a variety of general economic equilibrium models can be created. Detailed data on the ows among different sectors of an economy can be used for building static models or can serve as a benchmark dataset for dynamic models. Modern computerized economic techniques enhance traditi-onal input-output analysis developed originally by Wassily Leontief (1936) (Leontief, 1966). An I-O table describes the ows among the various sectors of the economy. It represents the value of economic transactions in a given period of time. Transactions of goods and services are broken down by intermediate and final use. An I-O table also shows the cost structure of production activities: intermediate inputs, compensation to labor and capital, taxes on production (Rutherford and Paltsev, 1999).

Derivation of input-output tables in practice

In many countries, the supply and use tables are rectangular in the sense that there are many more products than industries distinguished. The CPA product classification is indeed much more detailed than the NACE industry classification. Thus, for example, the primary output of an industry at 3-digit NACE level can be broken down in various products at 4 or 5-digit CPA level. This is in particular the case for goods, much less for services.
Before applying the product technology, each product should be assigned to a primary producer. The existing link between CPA and NACE normally will provide an easy assignment of products to industries. Several products will have to be assigned to the same industry. That implies that in the product technology these products are assumed to share the same input structure. There may be cases, for example if products are distinguished at the working level that do not exactly correspond to a CPA number, where the assignment is not obvious and has to be made on the basis of assumed technology.

The assignment of products to industries can then be used to aggregate the supply table to obtain a "square" version. This is required to apply the product technology assumption. It is strictly speaking not required to aggregate the use table at this stage. However, to ultimately obtain a square symmetric input-output table, an aggregation of the use table will be necessary at some point. It may therefore also be done before the calculation of the symmetric input-output table (Eurostat, 2008).

The calculation of the symmetric input-output table

There are basically two ways of carrying out this important step: using the matrix multiplication or Almon's method.

Matrix multiplication

We saw above that in the product technology
Use table = IO coefficient matrix ✳ Supply table.

Thus, the IO coefficient matrix can be calculated as
IO coefficient matrix = Use table ✳ inverse(Supply table)

This formula shows clearly why the supply table has to be square. The symmetric input-output table (in values) itself is then obtained by multiplying the IO coefficients with the corresponding product output levels. See the next subchapter for more precise formulas.

The procedure will result in a matrix with a large number of very small elements, many of which are negative. Many elements are in fact not significantly different from zero. The causes of the larger negative elements have to be analysed in detail. The solutions (Dealing with negatives) should be used to remove some of the causes of the negatives. This leads to changes in the product or industry classification, the assignment of products to primary industries, or corrections for errors.

When these adjustments have been made, the symmetric input-output models can be calculated again, resulting in less negative elements. This can be continued until the number and value of the negative elements becomes acceptable. This is the case when it can be considered that these negatives are the normal "noise" in the compilation process, due to unavoidable heterogeneity and statistical error within the normal confidence ranges. In terms of the formulae used here: the symmetric input-output table will be acceptable if the "difference matrix" is acceptable.

At that stage the remaining negatives can be eliminated. A rounding procedure on the values of the symmetric inputoutput table will already remove all insignificant elements (positive and negative). The final balancing can be done using a mathematical routine such as the RAS procedure. By setting all negatives to zero (and perhaps adjusting manually some clearly wrong positive elements) and then adjusting with RAS to match the totals, the necessary compensations will automatically be made. It must be realised that these adjustments are very minor to the total value contained in the symmetric input-output table and should fall within the normal statistical error. If that is not the case, more work has to be done on removing negatives. A final check on the symmetric input-output table obtained in this way can be done by re-calculating the use table (Eurostat, 2008).

Almon's method

Clopper Almon from the University of Maryland developed a method which is fully consistent with the product technology assumption and calculates a non-negative symmetric input-output table directly (Almon 2000). The method is not an alternative to product technology, only a special mathematical algorithmn to calculate the symmetric input-output table which is based on product technology assumption.

The method applies the product technology by calculating the SIOT row by row, and taking care of negatives as soon as they appear. The moment a negative threatens to appear, the amounts transferred are reduced. The method leaves the row totals unaffected, but there is no guarantee that the column totals are maintained. It is therefore necessary to perform a RAS procedure or the like to balance again row and column totals.

The fact that no negatives appear also means that the negatives cannot be used to analyse the quality and homogeneity of the supply and use tables. However, the results of Almon's method can be checked by recalculating the use matrix. In a similar way as above, this check gives information on where to improve the supply and use tables or the product classifications (Eurostat, 2008).

Comparing both methods

Statistics Netherlands has compared both methods of calculating the symmetric input-output tables in terms of results and ease of use (Vollebregt and van Dalen 2002). It turned out that it is difficult to give a clear argument in favour of one or the other. In terms of computing time, both methods are equivalent. If well-programmed, both methods can be easy to use, although for both it remains necessary to address the largest negatives manually.
The Almon method had a slight advantage compared to the RAS procedure: the adjustments that need to be made by RAS are generally smaller than in the matrix multiplication method. Also, the distance between the recalculated "New Use"matrix and the original use matrix is smaller for Almon. The more negatives are taken care of manually, the more the two methods converge.

The results of the two methods may differ. It is, however, not easy to predict where differences will occur and how large they will be (Eurostat, 2008).

Recalculation of the use table

Independent of the choice between the two methods set out in the previous section, a symmetric input-output table will produce a result that will not be entirely consistent with the original supply and use tables.
due to remaining heterogeneity and errors, we obtain the following model:
Use table = IO coefficient matrix ✳ Supply table + Difference matrix

with a non-zero difference matrix. The difference matrix can be obtained by first calculating the "New Use" matrix.

The differences between the original and the recalculated use tables can be interpreted as indicating the adjustments that would have to be made to the use table to make it consistent with the symmetric input-output table. The differences should therefore be within the normal statistical error in the elements of the use table. To evaluate whether this is the case, the differences should be reviewed by the compilers of the columns of the use table. If some of the differences are unacceptably large, further work on refining the ymmetric input-output table must be done (Eurostat, 2008).

The 2001 I-O Table for Iran

The 2001 input-output table is the fourth set of tables prepared by the Statistics Center of Iran. It is a set of statistical tables which is prepared using the results of 53 comprehensive and detailed survey conducted by Statistics Center of Iran and also detailed financial information received from more than 300 agencies, companies, institutions and financial performance of government agencies as well as using all official statistics and detailed information published by the ministries and government agencies such as the Trade Statistics Yearbook of Iran, the general budget law of the country and the information set and prepared in 12 volums of budget settlement.

Table 1. Simplified model for the supply table of the 2001 Statistics Center of Iran

Activ subj / products	ISIC classification 1 . 2 . … . n	All economic subjects	Imports		Modified c.i.f/ f.o.b on imports	Tax on imports	Subsidized imports	Total suply on the producer prices	Commercial added	Transportation added	Total supply on the buyer prices
			Goods	Services							
1 . 2 . . . . N Based on CPC classification	Output of range of activities separately (market & non-market) in terms of products										
Modified c.i.f / f.o.b on imports											
Total											

Conclusion

According to the definitions presented for commercial activities including: purchase, preparation, storage, maintenance, transportation and distribution of goods in table 1 and 2, the added value of each of these measures and activities in the national economy can be seen. Also, by making comparison between the share of commercial sector with other economic sectors, one will note the important and significant role of this sector in the national economy of Iran.

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