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Should national accounts be taught by macro-economists or statisticians?

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Abstract

National Accounts as a subject taught at economics-oriented universities is a field on the borderline between macroeconomics and (economic) statistics. It is based on the logic of economic theory, on which a system of quantified statistical indices is built. However, will economic knowledge be sufficient for the student's understanding of not only the substance and logic of national accounts, but also of the substance of indices and their mutual relationships, constructions and the balance documents of the national accounts? The authors of the present paper have, for many years, been teaching National Accounts at universities, to both statisticians and non-statisticians.

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1. Introduction

National Accounts as a subject taught at economics-oriented universities is undoubtedly a field on the borderline between macroeconomics and (economic) statistics. This fact is implied by the very substance of National Accounts.

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1 Cf. for example Archambault and Boeda (1999), Hronová et al. (2009), Lequiller and Blades (2006), Malherbe (1992).
2 In this paper, "National Accounts" (capitalised) is used for the university subject, while "national accounts" (in lower case letters) stands for the system of the accounts used in the national economy.
as a descriptive model of the national economy based on macroeconomic statistical considerations. It stems from the logic of economic theory, on which a system of quantified statistical indices is built. Without economic theory, national accounts would not be a system but just a collection of indices. And vice versa: without statistics, national accounts would be just a description of notions and their mutual relationships without the ability to quantify them. In other words, statistics takes from economic theory its notions and their mutual relationships, looking for the (best) corresponding indices and ensuring that the relationships between indices (i.e., variables) derived from relationships between notions were also valid.

We have to keep these basic ideas in mind in order to answer the question asked in the title of this paper. Who should be teaching National Accounts to university students of economic fields? Economists? Statisticians? Moreover, will mere economic knowledge be sufficient for the student's understanding of not only the substance and logic of National Accounts, but also of the substance of indices and their mutual relationships, constructions and the balance documents of the national accounts (in particular input-output tables and integrated economic accounts)? Is it possible to work with the national accounts data without knowing (at least on the user level) statistical procedures for data collection and processing, methods of statistical deflation, and other statistical methods and procedures?

2. From economic theory to statistics

Let us have a look at the basic problem in the relationship between the economic theory and economic statistics, which seems to be a key one from the viewpoint of our main question; we will show it as a simple example of a path from a relationship defined within economic theory to a relationship between indices and their values in the system of national accounts. This simple case may enable us to realise that, once we progress from notions to indices, we have to consider not only their definitions, but also their properties, methods of valuation, etc. And in national accounts we must add relationships between indices that make up the basic structure of the system – national accounts form an extensive system of mutually intertwined indices and their values.

Following the Keynes economic theory\(^4\), which is the economic basis for national accounts, equality between resources and use of goods and services is given as follows:

\[
Y = C + I + G + NX, \tag{1}
\]

where \(Y\) – output, \(C\) – consumption, \(I\) – investments, \(G\) – government purchases of goods and services, and \(NX\) – net exports.

Formula (1) represents a relationship between notions, i.e., it is an economic formula based on the fundamental method of social sciences, namely, abstraction. The theory is not interested in whether these relationships are also valid quantitatively. When we come to a verification of such a relationship on the basis of statistical data, we have to ask which indices are used to replace the general notions in formula (1). What is output \(Y\) here? Will it be domestic product or national product? Whether domestic or national, will it be net or gross? Perhaps the output index is even meant? And what is consumption here? Is it just the households' consumption? And does it stand for the households' consumption expenditure or their actual consumption? We can even hear that \(Y\) is the gross domestic product (hereinafter GDP), total output (or the quantity of manufactured output), total income or total expenditure. But all of these variables are different! It may not be a problem from the viewpoint of theoretical economists, but a statistician cannot accept such an approach: not even as an essential idea. Output and GDP are indices that are fundamentally different from each other both formally and by their contents; and, naturally, their values are different as well!

Arguments which theoretical economists bring forward to support the validity of Formula (1) are based on their methodology. By Formula (1) they want to represent the basic economic relationships that are valid within the "thought model" as a basis of economic theory. It is an approach possible within the framework of teaching macroeconomics, even if such unclear definitions of notions do not enable students to understand how the validity of

\(^3\) Cf. Giovanninni (2008).

\(^4\) Cf. Keynes (1991).
Formula (1) (and other, similar formulae) can be proved. Should they be able to verify it in a real economy, they must look for the corresponding indices – it means, turn to statistics, which provides indices that (more or less) express the economic notions used. Let us go through the ideal procedure to be followed by students progressing from economic notions to indices and their relationships and values so that the statistical data are understood and properly processed. It is clear that this way is not an easy one: a simple notion-index translation table is not a solution, and methods for representing national accounts play the key role.

As mentioned above, a balance between resources and the use of goods and services is valid in economic theory. Translating this observation into a form of index relationships, on the left hand side stands the value of goods and services produced and imported in the national economy, and on the right hand side we have their use for intermediate consumption and final consumption by the population and government, investments and exports. Hence it is true that

\[ O + Im = IC + FCE + GCF + Ex, \]  

where \( O \) – output, \( Im \) – imports of goods and services, \( IC \) – intermediate consumption, \( FCE \) – final consumption expenditure, \( GCF \) – gross capital formation, and \( Ex \) – exports of goods and services.

Statistics will not, however, be satisfied with expressing relationships between indices as variables copying the macroeconomic balance formula. Statistics must prove that the relationships are not only valid between the variables that represent the quantified forms of economic notions, but also between the values of these variables. An obstacle preventing the left and right hand sides of Formula (2) from being equal to each other is given by the fact that different types of prices are used in the definitions of different indices (output is expressed in basic prices, imports in CIF prices, intermediate and final consumption and the gross capital formation in purchase prices, and exports in FOB prices. If Formula (2) is to hold quantitatively, an "appraisal correction" must be added to its left hand side – so-called net taxes on products, representing a difference between purchase and basic prices. Formula (2) is thus transformed into Formula (3).

\[ O + Im + NTP = IC + FCE + GCF + Ex, \]  

where \( NTP \) – net taxes on products.

There is no economic reasoning to justify the addition of net taxes on products on the side of resources in Formula (2); such addition simply does not follow from the general equality between resources and use. It follows from the purely statistical substance of the observed indices, that is, by their definitions and the types of prices in which they are established and published. Economic theory does not pay any attention to such aspects. Here it is statistics which unambiguously defines all properties of the indices entering the formula for balance of resources and the use of goods and services.

Another modification of Formula (2) takes us to the final statistical form of Formula (1): now it is clear what is understood under product (namely, GDP in purchase prices); consumption and expenditure by general government are replaced with an index of final consumption expenditure by households, general government and non-profit institutions serving households; investments with an index of gross capital formation and imports and exports with indices of imports of goods and services and exports of goods and services. All of these indices and their values are found in the national accounts.

\[ GDP = FCE + GCF + (Ex – Im), \]

where \( GDP = (O – IC) + NTP \) is the gross domestic product in purchase prices.

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5 Interval indices are called transactions in national accounts.

6 More exactly on the account of the national economy and the account of the Rest of the world.
Is Formula (3) a true expression of Formula (1)? We cannot say precisely; but it is the only possible expression, and therefore the only possible "proof" of the validity of the formula derived on a theoretical basis. But, is it really so? Is the statistically expressed identity (4) between resources and the use of GDP a real proof that the theory is true? Perhaps statistics just "adapts itself" to the relationships defined within economic theory. If students are to understand which subject is the decisive one in this relationship between economic theory and statistics, the substance of statistical inference must be explained to them.

The national accounts on which the values of (not only) the above-mentioned indices can be found form a logical (though rather complex at first sight) system of tables and indices. Investigation of source information for the annual national accounts requires rather extensive statistical inference – mainly sample surveys. Before the statistical office publishes the values of major aggregates derived from the established data, a procedure in several stages takes place. At least, in addition to the data acquired from statistical records, there is aggregation of data from administrative and other resources, and also model estimates (where data sources from inference are lacking). Then modifications come, in particular conceptual (methodological) adjustments, and adjustments for exhaustiveness (to include legal but uncovered, as well as hidden and illegal parts of the economy). After these demanding and laborious stages, balancing is carried out; in our example, the index values are adapted to comply with Formula (4). The resulting index values in Formula (4) are given by the requirement that the equality between the resources and the use of GDP must hold. Here economic theory is a dominant factor: values of macroeconomic indices are adapted so that the basic balance relationships hold on which national accounts are based. Nonetheless, this fact will only be understood by those who know the substance of statistical inference.

Statistics thus adjusts the resulting values of the macroeconomic indices according to the balancing relationships stemming from economic theory; on the other hand, it infringes on these relationships, depending on the valuation of indices in Formula (4). Namely, Formula (4) holds if aggregates are expressed in current prices and "classical" constant prices, but it does not hold with respect to valuation in chained previous years' prices, reference \( n \); in other words, in this case it only holds in years \( n \) and \( n + 1 \). This notion of chained previous years' prices is presented by some statistical offices as constant prices, reference \( n \) is usually hard to be grasped by the normal user who does not know the statistical substance of this notion. This statistical substance is implied by elementary relationships of index theory.

We can imagine an aggregate value in year \( n + k \) in the previous years' prices chained to the basis of year \( n \) as the given aggregate in year \( n \), expressed in current prices, multiplied by a sequence of year-to-year Laspeyres chained volume indices. In fact, practical application goes the other way around when coming from valuation in current prices to previous years' prices chained to the basis of year \( n \): namely, aggregates are deflated in current prices with the aid of Paasche pricing indices. These procedures result in non-additivity of Formula (4), hence the equality between resources and the GDP use is not valid any more. This is a principal infringement on the relationships defined by economic theory, and it cannot be understood without knowledge of statistics. It is one of the most difficult parts of National Accounts to explain the system of valuation of major aggregates, and especially the chained previous years' prices. Statistical interpretation of this concept is, however, a necessary precondition for students' understanding the data on national accounts, as well as relationships between major aggregate values expressed in different prices.

Let us once again consider Formula (3), which not only expresses the basic balance with respect to goods and services, but also serves as a basis for one entire section of national accounts devoted to description and analysis of the origin and use of goods and services, resulting in the input-output tables. The substance of these tables must be explained on the basis of Formula (3), which holds not only for the national economy as a whole but also for

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7 Methodological adjustments are aimed at explaining the differences between the corporations' and national accounts and other sources of data and the methodology of the ESA 1995 Standard (or rather ESA 2010 now).
8 We deliberately use plural here: the rule of value balancing in compliance with generally defined relationships governs not only Formula (3), but the entire system of national accounts.
9 Classical constant prices (when goods and services in all observed years are values by prices valid in the chosen reference year) have now ceased to be used for valuation of macroeconomic indices. Previous year's prices have replaced them.
10 Sometimes they are simply called chained prices.
11 Except for years \( n \) and \( n + 1 \).
individual products (according to their classification). For each index in Formula (3) we thus get a vector of values, and a matrix in the case of intermediate consumption. Adding entries for industry's added value and production into the intermediate-consumption matrix we get the basic logical structure of the input-output tables (i.e., supply and use tables and symmetric input-output tables). Additional treatment of the contents of the input-output tables (valuations, transfers of by-products, trade margins, transportation margins, and conversion of resource-and-use tables to symmetric tables) would be inconceivable without knowledge of the statistical substance of that notion. In its turn, understanding the statistical basis of the input-output tables is a precondition for coming from descriptions of table structures to analyses based on those tables. At this point, econometricians may take the lecturing floor from statisticians.

Looking for a reply to the question cited in the title of this paper, we have chosen a simple but important balance relationship, in fact, the first among those a student learns about when studying National Accounts. The entire description and analysis of the origin and use of goods and services is based on the idea that the production is followed on national accounts according to what is produced\(^1\). From a simple Formula (3), which is based on a balance Formula (1) defined in economic theory, we get as far as the input-output tables – an extensive statistical document; unfortunately, not a very user-friendly one. By looking at individual stages on the way from Formula (1) via Formulae (3) and (4), we tried to demonstrate (on one of the balance relationships that are valid on national accounts) that, without understanding the statistical substance of indices (implied by their definitions, valuation, and methods of inference), students cannot grasp the ideas of the National Accounts, which prevents them from using such ideas in practice. The national accounts represent a very rich resource of information; unfortunately, the extent of the use of such information does not seem to correspond to that fact. One of the reasons is the misleading appearance of complexity and the large scope of this information system; but in many instances also a simplistic method of teaching, which prevents students (who later become potential users) from getting to the statistical aspects of the data presented. If National Accounts are presented to students as a purely economic model without their statistical aspects, students find it difficult to orient themselves in real statistical documents of the national accounts (input-output tables, accounts of sectors, national economy and the rest of the world, and integrated economic accounts); later (in practice) they either grow resigned to using them, or they use them incorrectly. In other words, the subject of National Accounts should be taught by a statistician experienced in both statistical theory and the practice of government statistics; and this subject should only be included after completion of macroeconomics and (at least) basic statistics.

3. Conclusions

The authors' experience with many years of teaching show that students are, without basics of statistics, unable to understand National Accounts to an extent that would allow them to make use of all data provided by this system of statistical information. The concept of National Accounts should not only make use of lectures but also tutorials at which students have hands-on experience with the contents of and differences between individual indices and their valuations. It is the only means for to understanding their substance, mutual relationships between index values, and the structure of the resulting documents of national accounts (input-output tables, accounts of sectors, the national economy and the rest of the world, and integrated economic accounts) and to the students' orientation in them. The structure of National Accounts is logical: its logic stems from economic relationships, but is ensured by the statistical basis of the information contained in them. National Accounts as a university subject should therefore be taught by statisticians, that is, within statistical subjects, and should only be included as late as in master studies at universities of economic orientation.

\(^1\) Another, more extensive part of national accounts follows the production according to who is the producer and deals with describing and analysing the formation, distribution and use of the income generated by the production. The principles mentioned in this paper equally apply to that other part of national accounts.
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