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## ACCOUNTING AND THE GDP MEASUREMENT SYSTEM

*Система вимірювання ВВП була опрацьована в середині ХХ століття без участі представників теорії бухгалтерського обліку. Незважаючи на початковий ентузіазм бухгалтерів, їх участь у роботі над системою вимірювання ВВП зникала, а обраний метод вимірювання цієї величини в малій мірі пов'язаний з фінансовою звітністю. У статті показано, що витратний метод дозволяє створити систему вимірювання ВВП, в якій необхідні дані знаходяться у звіті про фінансові результати, що заповнюється на підставі обліку витрат за їх видами. Ця система вимірювання також встановлює вимоги для мікропідприємств, які не провадять на даний момент бухгалтерського обліку. Стаття також включає в себе поглиблене роз'яснення величини ВВП та похідного показника продуктивності праці.*

**Ключові слова:** ВВП, витратний метод, система бухгалтерського обліку, відношення продуктивності праці.

### **Introduction. Why accountants did not contribute to origin of GDP system**

The GDP measurement conducted in line with the theory of national accounts is more similar to the black box than to an integrated computerized measurement system. Accounting in many economic organizations use computer systems to a large extent integrated, so we should aspire to the similar state at the measurement of the GDP. The GDP measurement has its history and she explains reasons of the current state of affairs. Presently a challenging of the European integration and forming common monetary area demands that we need a transparent information system guaranteeing the precision and clearness of the GDP measurement and related economic variables. However, implementing the integrated computer system needs of adopting the appropriate method for GDP measurement as well as a designing and implementing relevant source documentation for small micro companies creating the value added. The latter are in growing number.

In the period 1940 - 1960 and latter there was still a briskly discussed an issue of the GDP measurement as the effect of the natural development of the theory and accounting systems. Theoreticians of accounting supposed that the issue of calculating the GDP will produce developmental impulse of the theory and practice of accounting and its socioeconomic meaning will grow. New cognitive problems will be defined and solved, and integration of national economic statistics with source data will increase with systems of the accounting working in economic units. These expectations weren't fulfilled. Economists organized the GDP measurement, actually without the significant participation of accountants, and of course the double entry record appears in accounts GDP, as the

word of the belief that economic values aren't arising of nothing, so transfers of the value have their sources and destinations.

In this article is approached an accounting method and system of the GDP measurement. It is known that financial statements contain data needed for the GDP measurement, so it is possible direct calculating the GDP by adding the respective data up from these reports. In the current GDP measurement system cost method (called also income) is seen as the least credible. But this burden resulting from the past is, at present the situation reversed. The analyses included in this study show that the well clarified cost method is leading for GDP calculating by adding appropriate volumes up from financial statements. Moreover the cost method of the GDP measurement determines requirements of the reporting system to micro companies, so the designed system will involve all entities creating the added value. A precision of financial statements determines the precision of this method.

Consequently the main aim of the paper is to point out a method how to construct an integrated system of GDP measurement. The second aim is explaining how a small unit that not uses the double-entry accounting system can provide its input data to the system of GDP measurement.

### **Vanishing share of accountants at formation of GDP measurement**

As commonly known there are four methods of measuring GDP and each should lead to identical results. The measurement of the economic entity's accounting income does not depend on whether the account used is cost (flow) or balance account. Conversely, the calculation of GDP is far from this ideal. In practice, the measurement of GDP forms big differences. S.H. McCulla writes (2007, p.4) that in the United States result of the measurement by using product method is defined as GDP (gross domestic product), while the result of the measurement by the cost (income) method is called GDI (gross domestic income). It was assumed that the differences charge the

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GDI, which is considered to be less reliable than the product. Nonetheless, from the accounting point of view a greater trust is assigned to the cost (income) method of measurement since this way is based on the accounting records.

In the decades of the 30s and 40s in the US worked many prominent theorists specializing in economics and accounting. These scholars were naturally involved in solving problems in the design of the system National Accounting. E. Hagen in 1940 perceived GDP account system as the application of accounting principles to the entire economy. In particular, W. Cooper (1949) wrote that in the field of social accounting and national income accounting appeared a possible progress, the accounting historians could not imagine. W. Cooper recognized works on the GDP as well national income accounting as a natural development of accounting measurement system. It is worth to know that he was a competent and oriented person, working in government agencies. He saw the absence of representatives of accounting in these projects, and considered that without this state of affairs, it would be faster progress. It would be easier understood that the double accounting system is the key to measuring GDP and the all components. As indicated by (Ijiri, Sueyoshi, 2010) this scholar looked at the problem from a macro-economic perspective, while at the same time he was also an accounting theorist. He therefore strives to state in which the country's economy will become the accounting entity modeled like an enterprise or institution. National income would be an equivalent of the company income according to this approach. W. Cooper, (1953) demonstrated the feasibility of his ideas.

During the years 1940 - 1960, however, it seemed that the GDP measurement system will be created as a result of harmonious cooperation among economists and academics accounting. Ignace De Beelde (2009, pp. 354-368) wrote: "...As the National Accounting provides information on the macro-economy; it seemed that it will develop cooperation between economists and accountants. However, this cooperation was limited, even though there were initiatives combining the two professions... The current situation is characterized by a complete separation between the two groups..." This author describes the hopes that others scholars expressed in the field of accounting in connection with the development of the national income accounts. Even in the late fifties R. Mattessich (1959, p. 248), as well (Moonitz and Nelson, 1960) recognized that the definition of National Accounting is a system at a higher level of data aggregation and is a determinant for the development of accounting theory. However, subsequent years, the second half of the twentieth century, the hopes to jointly develop a system for measuring GDP slowly subsided. Economists introduced the name of National Accounts instead of National Accounting, and even this term is slowly disappearing. The university teaching under the name "National accounts" also disappeared.

As a result national accounts are not based on a recording of economic events, as it is in the accounting systems of enterprises and institutions. In addition, the

transaction value is different from the valuation of accounting standards. In national accounts, assets and depreciation are estimated at current cost or the price estimates if appear the lack of data. Accounts in the GDP and GNP calculations are actually combinations, type of reporting. It can be concluded that the double-entry recording is not a factor of integration of the accounting system and national accounts. What is the link, the use of data from accounting reports. De Beelde (2009, p. 360) states that as of 1972, the highest percentage of use of data from the accounting system for forming of the national accounts reached Hungary (92%).

#### **How the current GDP measurement system works?**

Theory and examination of the measurer called GDP came after the Great Depression, and this fact dates back to 1934 year, but work began in 1930 and lasted for decades. The main author of the theory was the Russian economist S. Kuznets (1901-1985), who worked on the subject of measuring GDP and economic growth while he was employed at the National Bureau of Economic Research in the US. For measuring GDP data are needed, which are the primary source of accounting systems; hence there were some expectations of the accounting theorists for fruitful cooperation and the emergence of significant growth momentum in the theory of accounting. Creating a system of accounts on which the measurement of GDP is supported with a use of dual recording is the work of the English economist Sir Richard Stone. This researcher has developed a system modeled on the double accounting and applied tables in which GDP components are subject to aggregation and cross-checks. His performances became the basis adopted by the United Nations for System of National Accounts. It is therefore assumed that it was R. Stone who has developed in the late 30s - and 40s of the twentieth century double-entry accounting system applied to GDP. But this is not an accounting system similar to those operating in companies or groups of companies.

The essence of the national accounts system presents K. Lada (2008, p. 28). The author writes: "... The fundamental principle of national accounts is the assumption that the manufactured products and services must be fully committed and distributed. In an open economy, taking part in the world trade, the total supply of goods and services consists of domestic production and imports. In contrast the distribution include: intermediate consumption, total consumption (individual and collective), and accumulation (gross fixed capital formation i.e. outlays for fixed assets and increases of working capital. This rule can be described as the following equality: **output + imports = intermediate usage + total consumption + gross capital formation + exports**. Gross domestic product is estimated independently from the sides of production and distribution. This means that in practice the left side of the above equation is usually different from the right, formed so called the total amount of unbalanced. Therefore, the final step is always a balance of both sizes. ... "

The outstanding Polish expert in measuring GDP and national accounts L. Zienkowski (2008, p.17) wrote: "... the consistency requirement, on which the whole concept of national accounts is based, broken already in case of estimates at constant prices, leads to the need for supplementary risky estimates and changing the data source. Without such estimates, however, we could not provide consistent data on production volume i.e. GDP and its reallocation to consumption, accumulation and net exports, nor to agree the results of the financial accounts with the results of non-financial accounts... ". It can therefore be concluded that the concept of a "faithful and complete picture" is not on the basis of the system of national accounts, so it is conceptually different from the financial reporting system.

#### The four methods of measuring GDP

As commonly known, the GDP is the sum of the market value of all final goods and services produced in a country in a given year. From this determination results directly two methods of measurement. **The first way**; by totaling the sales of final goods and correcting for the change in inventories. Note that using the sales tax system (instead of VAT) could be easier to compile the data needed to measure GDP. Tax returns filed by the company plus the change in products taken from the balance sheet reports can contain most of the required information. **The second way** is the summation of the value added of each company. This method is considered in respect to entire sectors not just to companies. **The third method** of measurement (called the product method) is the sum of the final expenditure on goods and services, that is, consumption and investment, and government spending for the purchase of goods and services. **The fourth method** (called cost or income method), is the most associated with the accounting system and accounting thinking. In this case GDP is the sum of outlays on production and profits. It is convenient to distinguish three components, namely labor costs (wages plus all the components) plus depreciation of fixed assets, plus taxes less subsidies. The last component are the gains as incomes or receipts from rents, interest and dividends.

For a numerical illustration, one can imagine the economy with only one final product, which, for example, is a standard loaf of bread. This product is made in enterprises. If even the bread is baked in inhabitant's homes, it is not subject to this measure. In principle, the GDP is composed of the data of economic entities entitled to production and marketing. We assume data for the analysis as follows:

Farmers produce grain and sells for 70 zł.

Elevator stores and transports selling for 100 zł.

Flour miller produces and sells for 150 zł.

Bread bakery produces and sells for 200 zł.

The numerical illustration of four methods of GDP measurement is as follows:

I. The total amount of value of final products:

The bread **200 zł**

II. The total amount of value added

$70 \text{ zł} + (100 - 70) \text{ zł} + (150 - 100) \text{ zł} + (200 - 150) \text{ zł} = \mathbf{200 \text{ zł}}$

III. The total amount of consumption and government spending (an illustration)

Consumption of population 170 zł + government purchases for poor's 30 zł) = **200 zł**

IV. The cost/income method (an illustration)

Depreciation 75 zł + Wages 80 zł + Gains 45 zł = **200 zł**.

In the above example, the amount of 70 zł, which farmers obtained, refers to the price of 100 kg of wheat in Poland. We know that many times there were protests against the low sale prices and the lack of demand, low farmers income, which may mean that grain prices do not always cover the reasonable costs. At this point it is worth noting that in the measurement of GDP it is ignored an influence of Nature. As we know, grain growth takes place primarily through photosynthesis. Because of this effect a product in an amount capable to feed a large number of people. Farmer seeded per hectare 250 kg wheat crop harvested order of 5000 kg, which allows the feed 14 people a year, assuming a standard 1 kg per day. The subject of measuring GDP is not the activity of nature but the work of employees and work of assets (depreciation). Similarly, the growth of trees in the forest is not subject to the measurement of GDP, while cutting down trees and selling the wood by organizational units increases GDP.

#### The cost method as a fundamental of the GDP integrated system

In Poland, for the calculation of GDP data come from accumulated financial reporting in the GUS (The Chief Statistical Office). This is the premise that suggests the feasibility of measuring GDP directly from the financial statements, and to create a system to measure as fully integrated due to the processing of the source data. Let us return to the example shown earlier, which considers the economy of one final product (bread). In this example, we can set a number of regularities that will be used to solve the given problem.

As we know, on the basis of the nominal accounts, profit and loss account shows the general formula: **Sales revenue(S) = Cost (K) + Income (Z)**. The costs also include taxes (other than income tax), and are matched to the sale revenue in accordance with the matching principle. To comply with the measurement time of GDP, as the cost of goods sold matched against sales revenue are the costs by type (KR) adjusted for the change in products ( $S_k - S_p$ ). The adjustment concerns accounts of work in progress and finished products. The result is the formula:

$$S = KR + (S_k - S_p) + Z$$

Where:  $S_p$  is initial balance,  $S_k$  is ending balance of products.

Now we select accounts detailing the types of costs, such as: (W) wages combined with contributions to pension funds and other factors, (M) depreciation of fixed assets, (T) the taxes (SMI) other costs, including usage of materials, media and external services. Now sales are represented by formula:

$$S = W + M + T + SMI + (S_k - S_p) + Z = W + M + SMI + (S_k - S_p) + (Z + T)$$

According to this specimen I use of the set of values applied in the process of bread making, starting with the work of the farmer. The data are shown in table 1, wherein in the third column is part of the acquired value of the intermediate products.

Elimination of intermediate products like salt

| Name       | S          | P       | W         | M         | SMI       | Z + T     | $S_k - S_p$ |
|------------|------------|---------|-----------|-----------|-----------|-----------|-------------|
| Farmer     | 70         | -       | 15        | 20        | 25        | 5         | 5           |
| Elevator   | 100        | 70      | 10        | 10        | -         | 5         | 5           |
| Mill       | 150        | 100     | 20        | 5         | 10        | 15        | -           |
| Mine       | 5          | -       | 2         | 2         | -         | 1         | -           |
| Bakery     | 200        | 150 + 5 | 15        | 20        | 5 - 5 = 0 | 10        | -           |
| <b>GDP</b> | <b>200</b> | Suma    | <b>62</b> | <b>57</b> | <b>35</b> | <b>36</b> | <b>10</b>   |

In Table 2, we obtain the compatibility of GDP calculated from the definition (200 zł) from the sum of columns wages, depreciation, cost (SMI), income and changes in products. But we know that each entry in column (SMI) is from a macroeconomic point of view an intermediate product, which is the final product of another economic entity. All of these items must be transferred out from the column SMI and at the same time, must be created a row for the manufacturer. It is because the values of column (SMI), meaning that the materials, media and services are the final products of other economic units than the bakery. Finally, column (SMI) is devoid of all values. It will remain only wages (labor costs), depreciation, taxes, gains and change of the products balances.

The considered example of the salt as an intermediate products disclosures the overall regularity. The salt is present as an intermediate in many products, so usage of salt enlarges production and sales of the mine. In Table 2, the value of wages, depreciation and (Z + T) were chosen to be consistent with the sale price (5.0 zł). We perceive that the salt consumed for different final products is represented by a similar sequence of values, as in the case of the production of bread. Then all these values are added together at process of GDP measurement. In practice, the GDP will be formed by adding the strings of value of variables: W, M, Z + T ( $S_k - S_p$ ) obtained from the financial report that is profit and loss account. In case of the mine this string of value is a measure of economic activity, i.e. the contribution to GDP. This statement applies to all the units regardless of whether they form the final product or not. Therefore, the measurement of GDP using this method can be consistently extended to all natural and legal persons whose activities are associated with wages, depreciation of fixed assets. For instance, it can be the anactivity of an individual farmer.

The accounting formula for calculating the GDP by cost method is as follows:

$$\text{GDP} = \text{Wage costs} + \text{Depreciation} + \text{Profit before tax} + \text{Taxes} + \text{Change SP}$$

In this formula, the SP denotes the change of value of the products balances. This means that totaling the indicated economic variables we compute the contribution of each economic unit in terms of value added, and this is what it comes to measuring GDP. The above formula shows either that GDP is the sum of value added generated in the economy. It is thus demonstrated that starting from the income method is possible to arrive at value-added method. They are equivalent.

The above formula raises the theoretical structure of the measurement system, tightly integrated with respect to the source data, allowing the measurement of GDP directly with financial reporting i.e. using accounting systems, in fact with a relevantly tailored statement of profit and loss. Organization of GDP measurement using the financial reports and institutions of the GUS does not seem difficult, but some changes will be needed. The list of changes is as follows:

- Establishment a mandatory form of statement "Profit and Loss", with the use of a generic system costs (cost grouped in line with their type).

- Budgetary units must maintain accurate records of fixed assets valuation and revaluation of their value by providing access to current depreciation amounts. Depreciation method should be carefully selected using mainly theoretically justified the declining balance method (Dobija, 2010).

- The adoption as a standard for budget units; income is zero.

- Introduction to farms a simple reporting line consisting of five indicated variables. Depreciation shall be calculated according to accepted standards and labor costs can be determined as not less than the minimum wage.

- Adopting an improved tax records for small business and micro enterprises in terms of GDP measurement.

The above constructed system involves all economic units no matter what kind of accounting system is applied. All units also farmers or self employing workers creating the value added are associated with the inclusion to system of the GDP measurement. This is possible since the accounting estimate of depreciation and salaries are not a great problem, which could not be solved. The indicated accounting method for calculating GDP is based on a relatively simple recording and reporting, which straightforward extension does not form of insurmountable difficulties.

Applying this method, there is also the possibility of recognition of gainful activities accomplishing in the households. If someone provides services, let us say beauty, in his apartment, so the mandatory records should enable the equipment's depreciation value and earnings being wages, which is sufficient for recognition in the GDP measurement system. In addition, women who choose to birth and upbringing of children should be employed by the state for a specified number of years in the family sector of the economy with at

least the minimum wage paid instead of a variety of social benefits.

In this state of things the mother's wages which are equivalent for the hard work can and should be a component of GDP. This is true, since earnings of hired nannies employed in the respective company are included in the measurement of GDP. The proposed method of the GDP measurement releases from only formal economic units as enterprises, so any activity which takes place with paying for work can be regarded as a contribution to the GDP.

## 2. Some interpretation of the GDP and the ratio Q as economic indicators

The GDP is a measure of economic activity to take place on the territory of the country. GDP as the one number is significant for economic evaluations together with values derived as: real GDP i.e. in line with prices of the previous year, GDPE or GDP per employee, GDPC, or GDP per capita, create a basis for assessing the macroeconomic performance and environment. We know that the formula of the GDP calculation is presented in mathematical notation as:

$GDP = W + M + Z + T + \Delta S$ , where  $\Delta S$  is the change in product balances.

Dividing the above equation by total wages  $W$  leads to the already well-known (Dobija, 2013) index of labor productivity  $Q$ . But now we get the additional interpretation.

$$Q = \frac{PKB}{W} = 1 + \frac{A}{W} + \frac{Z+T}{W} + \frac{\Delta S}{W} = \frac{1}{LS} \quad (F)$$

The formula F consists variable (LS) i.e. labor share, which is the share of wages in GDP, and this figure has its important economic interpretations. Recently the category of labor share was introduced in detail by D. Schneider (2011).

Let us see that, in the above presentation of the ratio  $Q$  can be seen that in the economy of primitive human being acting without assets,  $Q$  was close to the value of 1.0. Assets have a big impact at the ratio  $Q$  and it is consistent with the issues of economic growth research. Assets are always significant. The variable  $A/W$  is here a determinant of technical equipment of work i.e. how the work is technical armed with equipment (fixed assets) and what an availability of materials and resources is. The variable  $Z/W$  is a measure of the overall economy conjuncture, and level of management as well as the impact of the forces of nature. Due to the forces of nature the economy is a game with a non-zero, positive sum, and so all parties can obtain their part of profit, provided the appropriate management and equitable rights. In light of this recognition of the value of the GDP and the ratio  $Q$  can be concluded that the economic assessment of the economy in a given period should serve the pair (GDP,  $Q$ ) and not only the GDP. In contrast to the socio-economic assessment we need additional indicators particularly on the state and development of human capital.

The main applications of the  $Q$  have been introduced by M. Dobija [2004, p 71-98] and in many other studies as [Jędrzejczyk, Dobija, 2013]. By definition, the  $Q$  forms relationships with GDP as follows:

$$GDP = GDP \frac{1}{Q} + GDP \frac{Q-1}{Q} = W + GDP_A$$

The above formula introduces GDP as the two parts. The first ( $W$ ) is the labor share that belongs to all employees; the second is assets share assigned to assets. This sheds some light on GDP as the sum of all employees' earnings plus the part belonging to assets (depreciation + interest + rents + appropriate part of companies income) and correlates to the considered method of measuring GDP. Labor share is well known from theory of production. From the theory of the labor share is known [McConnell, and S. Brue, 1986, p. 463-465] that it is a fairly stable category.

We know many different types of criticism of GDP as the main economic indicator of growth. How is the GDP growing by increasing the number of divorces, or when more people encumber diseases, etc. As to increasing number of costly divorce, then grow earnings of lawyers, profits and taxes of the law firms. In the formula F it is recognizes by component  $(Z + T)/W$ . When instead people will build a bridge, the GDP will grow thanks to the technical component of the work equipment  $A/W$ . The new bridge will annually continue to contribute to the growth of GDP by the amount of depreciation. The bridge will also require maintenance (wages) and general improvements. People get also some satisfaction with the improved comfort of transportation, saving time and having the progress of civilization in general. Construction of the bridge will result in a significant change of the  $Q$ , and the divorce minimally, since there is not a significant increase in assets.

The source of criticism are usually an excessive expectations directed at GDP, especially those related to quality of life. GDP growth is clearly not the same as the increase in quality of life, and the reasons for this state of affairs lie largely in the nature of existential space. Among the fundamental rights underlying the socio-economic life (Dobija, Kurek, 2013) we find the second law of thermodynamics. This principle has many equivalent formulations, such as that the heat engine cannot run without dissipating some of the energy, or that the heat does not flow from a colder to a warmer body, but here it is worth recalling a sentence that said P. Atkins (2007, p. 77) "... wherever structure is to be conjured from disorder, it must be driven by generation of greater disorder elsewhere..." in other words; where something is built, there's something else at an even faster degree is falling into ruin since there is a net increase in disorder of the universe. To overcome the effects of the going into ruin we need more work and the a faster growth, so that circle of the positive feedback arises. Development in terms of economic activity measured by the GDP is not a panacea for all that is good for society. Still, this measure is indispensable in modern economic theory. Development should be balanced in order the nature be able to absorb and overcome the effects of the activities of the human species, but these are not only an economic issues, and economists can help a little.

The labor productivity indicator  $Q$  allows clearly maps the situation in the Euro currency area. This

area has been formed by the initial EU members except for the United Kingdom and Denmark, which have opted out of adopting the euro. Interpretation of the index Q confirms the suggestion of B. Beachill and G. Pugh [1998] regarding a "two speed" Europe. In fact, the states that introduced the euro area in 1999 year (with the exception of the UK and Denmark) have labor productivity over 3.2 and thus belong to the first speed group, while the countries that work with the Q close to 2.2 belong to the second speed group. There are also countries with the Q close or less than 2.0, as Greece or Portugal and candidates such as Poland. These countries are under great pressure to adjust to all required conditions determined by euro convergence criteria, known as the Maastricht criteria.

#### Conclusion

Bibliography analysis show that the measurement of GDP was organized by economists and the participation of representatives of accounting

was very limited. The method used in the current economic practice has a little reference to the theory of accounting.

Measurement of GDP does not arise from the reports of economic entities, as is a case at the consolidated financial statements. Therefore, the estimation of the values needed to balance the national accounts is significant at the measurement of the GDP. As a result, the current measurement system has a lot of estimates, which affects the credibility of the GDP. This is a big embarrassment for economics and accounting that the cost method is not the basis of GDP measurement. This results in a lack of integration of the system for measuring GDP with the accounting systems. Considerations show a clear possibility of implementation the accounting system of computing the GDP, as well the labor productivity index Q. The pair (GDP, Q) is the correct economic indicator of a country economic performance and its position in the world economy.

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