Natural resources as an assessment factor in alternative GDP dynamics

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Abstract. GDP is a key macroeconomic indicator which often serves as the basis for various classifications of the countries and also as a basis for the development of national and regional socioeconomic programs. The core methodology of GDP calculation is directly related to the US dollar, even under the current conditions of the extremely high international demand for this currency. However, in modern conditions, the importance of natural capital as a factor, that determines the level of economic development, is significantly increasing, the limited and rational use of natural resources should also be taken into account in economic progress of the countries assessing. For this very reason, the article offers an author’s own methodology of measuring GDP on the basis of world prices for natural resources (gold and also for the group of core food commodities). The paper tests the suggested methodology while analyzing the economic dynamics in the selected countries, from 2000 to 2019. Conclusions cover the issues of qualitative growth within the selected macroeconomic systems and also provide recommendations as to prospective directions for further application of the suggested methodology in statistical, analytical and forecasting practices around the world.

1 Introduction

During the last 70 years the indicator known as gross domestic product has been the most important macroeconomic criterion for all national economies across the world. It has also served as the solid statistical grounds for global ranking of countries and for various observations over their economic and social development. Finally, GDP has often served as a measure demonstrating the efficiency of the implemented reforms, national economic modernization and trade development.

One of the major consequences from the introduction of the Bretton Woods system is that all calculations and comparisons of GDPs across the states are based on the US dollar, adjusted as per purchasing power parity (PPP). In simple terms, this means comparison of national prices for the key commodities with those at the US market. And there is also a special place for deflator which shows the official cheapening of the reference currency in comparative terms.

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On the one hand, using one common currency as a calculation unit for different national GDPs is both logical and convenient (for example, as opposed to using the system of natural indicators). Besides, such use of the US dollar is logically predetermined by its global role of the reserve currency (and all financial institutions across the globe support this since national currency exchange is also formed based on the US dollar).

On the other hand, by now, there is already a range of open questions concerning the fairness of measuring national GDP dynamics stemming from the costs of produced/consumed commodities/services presented in USD. The market exchange rate of the latter seems to be still rather objective, however, the same cannot be said about the real purchasing power of the US dollar.

The value of USD which also serves the purposes of accumulation, exchange and assets’ use is itself highly dynamic and sometimes even unpredictable. Thus, can it really be used as the basis in evaluation of socioeconomic progress in other countries?

Purchasing power parity, once introduced by the expert and now actively used as a unification instrument in international comparisons, essentially serves to compare the US market environment with those in other countries across the globe. In particular, it is able to measure and compare supply and demand at the market of specific commodities and services. For example, the growing price for one specific commodity in the US can be caused by a whole range of reasons, including inflation, market imbalance, recently introduced measures of state regulation and so on. For example, the USA may suddenly introduce a new customs duty or a new tax. This, in turn, would cause a drastic rise in internal prices, for example, on all commodities that are taken into account when calculating PPP. This would automatically increase GDPs at PPP in all the countries, even though this increase won’t be supported by real growth of consumption or production in other countries. In a similar way, drop in prices at the US market (for example, due to the implemented measures aimed at state support of national producers) automatically assumes drop in GDPs at PPP in all other countries too.

Considering the already established practice of GDP calculations, we can outline its several bottlenecks which reveal the direct strong dependence of the GDP at PPP indicator from the purchasing power of the US dollar (while regulation over the latter is carefully managed by the US alone). In other words, this globally acknowledged economic indicator happens to be strongly dependent upon the situation at the internal markets of the USA. The level of prices inside the US serves as the reference point in defining PPP of other countries, thus, it indirectly predetermines their GDP indicators.

This dependence may limit the usability of GDP as the core socioeconomic indicator of the countries across the globe. In other words, GDP does not actually reveal the actual and current situation within the borders of complex international economic relations.

Therefore, our study is oriented on providing a brand new point of reference for more appropriate calculations of gross domestic product across the countries.

The research objective: stemming from the author’s view on the role of gold and food commodities as base products, to develop and present a new original methodology of GDP calculation. This methodology would further be used to analyze the long-term dynamics of GDP on a sample of contemporary economies.

Following this research objective, the research tasks are put forward:

- to consider the problematic places in the currently used methodology of GDP calculation in part of its use as the base data for comparative analysis across the countries and in development/implementation of various socioeconomic strategies;
- to carry out the analysis of GDP dynamics across the selected contemporary states from the standpoint of the newly offered methodology;
- to assess the dynamics of GDP based on natural capital index by the groups of countries classified by GDP levels and also GDP per capita levels (as of 2019);
- to determine the directions and conditions of using the suggested here methodology in the future.

According to the research objective and the research tasks above, the author puts forward the following hypotheses:

Hypothesis 1. Dynamics of the world GDP calculated as per natural capital index, in the long-term period of 2000-2019 has been much lower and less stable as compared to the official dynamics of the world GDP measured basing on USD.

Hypothesis 2. In less dynamic (in terms of GDP level based on USD) countries, economic growth would be significantly hindered by the growth of prices for food commodities during the whole period of 2000-2019.

Hypothesis 3. The growth of total GDP (food-based) in the poorest countries of the world would be higher than the same indicator of the richest countries due to the fact that dynamics of their economic growth is higher than the growth of the world prices for food commodities.

2 Literature review

The initial methodological basis for GDP calculations was once introduced by the System of National Accounts (SNA), and throughout the whole period of 70 years it was often criticized, thus, there were multiple attempts to modernize it.

For example, there are three approaches to measuring GDP - from the sides of expenditures, income and output. The specificity of their statistical calculations has been well presented by R. Allen. Tools to adjust GDP data taking into account the dynamics of inflation have been considered by A. Chowdhury [1].

Later on, Gumata, N. & Ndou, E. [2] continued studying this interdependence between inflation and GDP dynamics, and they determined the negative effect of price instability (under the inflation above 6% though) on the adequacy of traditional calculations of GDP.

Fixler, D. & Grimm, B. [3] have considered the rationality of various methodologies for GDP assessment, corrected taking into account the production cycles and the dynamics of business activity in a country.

There have been also several attempts to consider GDP as a synthetic indicator which is dependent upon the prices for major consumer commodities and business cycles dynamics [4, 5], or as dependable upon fluctuations in real estate prices [6], to interpret GDP in the light of monetary policy of the state (in particular, state policies in relation to reserves, internal and external debts) [7], to analyze GDP in the context of national spending on R&D and in relation to labour productivity [8].

Finally, researchers have considered GDP as a measure of efficiency for the national system of economic administration (and partially - as an indirect indicator of corruption [9]). Thus, we can state that alternative approaches to measuring and evaluating GDP have already found their applied explanation and grounding. And today GDP may be getting a new socioeconomic meaning, thus, its calculation methodology might be revised as well [10].

One of the popular direction in this modernization of the GDP calculation methodology is its socialization: newer scientific approaches are concentrated not only on the social value of GDP [11], but also on the intensively increasing role of social indicators in it (the state of labour capital, the index of human development, social differentiation indicators, social stability level and so on). Today these are the most vital criteria for measuring GDP [12-15].

At this, despite massive criticism of the already acknowledged methodologies and of the very vision on the socioeconomic contents of GDP, so far — to the best of our knowledge — there are not many potential prospects for the introduction of a new system/methodology for measuring GDP [16-18]. There have been hardly any attempts to make it more adequate to the dynamics of the ongoing socioeconomic progress. This situation has predetermined the objectives, motivation and logic behind this research.
3 Research methodology

In order to test the hypotheses put forward above, we have carried out the recalculation of the GDP indicators for the selected countries of the world in the time framework from 2000 to 2019.

Statistical data of the World Bank has been used in these recalculations.

The author’s own methodology has been used: gross domestic product has been now measured not in USD, as it was always the case, but adjusted by the value of some natural capital assets, which demonstrate the global demand and the prices for which are formed at the world markets.

These are: the gold (an asset with a very much limited supply, and the growth of this supply is limited by the volume of annual gold mining) and also food commodities (an asset with a not that limited supply, generally speaking).

As we see it, this methodology would allow:
- comparing economic development levels using the system of measures which are predetermined on the global level (by the global supply and demand) and are not dependent upon various national factors;
- increasing the overall adequacy of GDP calculations, making them more relevant to the current trends in actual production (excluding growth on the financial markets) and actual consumption;
- more realistic determination of the growth rates for the world and national economies, without the necessity to adjust them as per USD inflation and other currency fluctuations.

Fig. 1. World gold prices dynamics, 2000-2019, USD / troy ounce (data: https://ebius.biz/oms-investicii/).

Gold, as an asset with global demand, always has rather limited supply. The growth of gold supply has not been separately accounted for in the suggested here methodology due to the fact that the world price for gold (see Figure 1) is in any case the result of market adjustments.

Unlike gold, food as an asset of global demand, is a multicommodity. It is represented by a whole product line of agricultural products, the prices for which are global in their nature. In our study, we have used the food commodity index which we have calculated basing on the annual dynamics of prices for the following product categories: coffee, sugar, tea, cocoa,
wheat, rice, pork, beef, corn. Shares of all these categories within the total structure of the world agricultural export were also accounted for (see Figures 2, 3 and 4).

![Dynamics of the world prices for agricultural products, 2000 to 2019 (RBC data).](image1)

**Fig. 2.** Dynamics of the world prices for agricultural products, 2000 to 2019 (RBC data).

![Dynamics of the selected product categories' shares within the global trade volume, 2000 to 2019 (RBC data).](image2)

**Fig. 3.** Dynamics of the selected product categories’ shares within the global trade volume, 2000 to 2019 (RBC data).

![Dynamics of the total food commodity index, 2000 to 2019 (calculated by the author).](image3)

**Fig. 4.** Dynamics of the total food commodity index, 2000 to 2019 (calculated by the author).

### 4 Research results

Stemming from our results that are showing dynamic changes in the world prices for gold and for the selected food product categories, we can now track the dynamics of the world GDP, calculated based on the world prices of gold, food and traditionally — in USD (see Figure 5).
We can obviously see that in the period from 2000 to 2019 the global GDP, calculated in USD, grew by 2.23 times; in the same period, the global GDP, calculated food-based, grew much more moderately - by 1.49 times only. Finally, gold-based global GDP actually became lower in the same period and in 2019 it was 89% from its 2000 level.

Until 2011, GDP calculated based on gold and food was going down; this was predetermined by the rapid growth in the values of both assets, while the global GDP measured traditionally in USD was stably demonstrating growth, since 2009 and on.

Looking at Figure 5, we can state that from the standpoint of gold-based GDP all years under consideration became the “lost period”; from the standpoint of food-based GDP, 19 years (2000 to 2019) became the “lost period”. Finally, only from the standpoint of traditionally calculated GDP (dollar-based), only a short period of 2007-2009 did not demonstrate any growth. Therefore, we can conclude that our hypothesis 1 is statistically confirmed.

Fig. 5. World GDP in dynamics (calculated and designed by the author; the graph demonstrates dynamic changes in the indices, not their absolute values).

Fig. 6. GDP dynamics (as per gold, food and USD) in the 20 poorest countries of the world (in USD per capita, as of 2019), calculated and designed by the author.
Fig. 7. GDP dynamics (as per gold, food and USD) in the 20 richest countries of the world (in USD per capita, as of 2019), calculated and designed by the author.

Analyzing Figure 6 and 7, we can state that in the poorest countries, due to their high dynamics of GDP growth in USD (and this would be quite predictable in case of the poorest economies), the total GDP as per food index grew by 2.5 times (in the richest countries it grew by only 1.43 times). Situation with gold-based GDP in the poorest countries is somewhat better (90% of the 2000 level, while in the richest countries the level is 51%). At the same time, significant growth of food-based GDP started in 2011; thus, its statistics somewhat counterbalances the economic successes of the previous decade. Therefore, we can conclude that our hypothesis 2 is also confirmed.

During the period of 2000-2019, the most dynamically growing economies (Angola, Equatorial Guinea, Turkmenistan, Mongolia, Kazakhstan, Azerbaijan, Ghana, Tajikistan, Qatar, China, Laos, Chad, Sudan, Ethiopia, Nigeria, Timor Leste, Myanmar, Sierra Leone, Vietnam) the food-based GDP grew by 5.96 times, and the gold-based one - by 2.14 times. At the same time, USD-based GDP grew by 8.57 times.

On the other hand, during the same period under consideration, the 20 least dynamically developing economies (the Netherlands, France, Gambia, United States, United Kingdom, Germany, Portugal, Mexico, Dominica, Italy, Jamaica, Greece, Aruba, San Marino, Japan, Libya and a range of small Caribbean countries) had their food-based GDPs grew by as little as 1% only. This means that food prices growth in this group of countries downplayed economic growth (USD-based GDP growth in these countries was 1.48 times). Therefore, our hypothesis 3 is also confirmed.

5 Conclusions

The current system of national GDP calculation is often criticized because it is USD-based which means its key criterion is not objective essentially as it directly and strongly depends upon the functioning of a particular national financial system. Thus, the whole system of calculations becomes dependable upon the fluctuations in currency exchange rates (which are the derivative from the real production volumes and of the changes in internal and global consumption). In other words, the whole system of GDP calculations becomes dependent upon the financial markets’ fluctuations. Thus, in our research here we are offering a new natural capital based model for national GDP measurement; this model used dynamics of world prices for the commodities of global importance - gold (a global commodity with a very limited supply) and food (a group of commodities with a rather flexible supply).

It is the author’s standpoint that accounting for the world prices of the commodities with global importance, on the one hand, would downplay the formal component in GDP calculations (population welfare should not be seen as equal to having large amounts of USD on population’s hands).

Instead, now GDP can be measured basing on actual growth in population welfare (more opportunities to purchase vitally important commodities). Also, the current pricing mechanisms at the world markets of gold and food can actually smooth the influence of the market environment overall.

For example, growth of supply at the food market (due to bumper year, introduction of advanced agritechnologies, changes in the consumption patterns) could be now relatively quickly and smoothly compensated through dynamic adjustments in the world prices. This is one of the reasons why we choose world prices for food as one of the core elements in our methodology.

In a similar way, dynamics of the world prices (for both gold and food commodities) downplays the impact of the USD inflation and of the foreign currency exchange fluctuations:
when the currency exchange rate drops, consumption of food products would also go down, and this, in turn, would cause the adjustment of the world prices.

Our pilot testing of the suggested here methodology of GDP calculations based on gold prices and food commodities index allows us making several conclusions regarding the generally accepted international statistics and the need for its adjustment as per the constantly changing world prices for the commodities of global demand.

First and foremost, our study has confirmed that within the period from 2000 to 2019 there was hardly any actual growth in the world GDP, primarily due to fluctuations in the world prices for gold. Food-based global GDP, in the same period of 2000-2019, has been going up, however, in the time frame of 2000-2010 the growth of many economies was totally downplayed by the quickly growing prices for food. Due to high rates of economic growth in the poorest countries of the world these countries demonstrate significant increases in their food-based GDPs.

This obviously confirms that there is indeed a place for real improvement of population well-being in these countries (on average, by 2.5 times during 2000-2019). At the same time, relatively slow economic growth (USD-based one) in the richest countries has increased their capacity to purchase more food products by only 43%.

In 8 countries with the lowest dynamics of economic growth (in USD) throughout the whole period (2000 to 2019) there was hardly any growth in food-based GDP (this group includes, inter alia, Japan, Greece and Italy). This indirectly confirms there was any growth of real consumption within these economic systems while their GDP growth dynamics was also stably low (if taken USD-based).

The suggested here methodology of GDP analysis from the standpoint of the commodities with global demand and limited supply allows tracking economic growth changes in a more realistic way, from the standpoint of consumption. This, in turn, would enable the development of more effective national and regional strategies.

Our methodology/vision could be supplemented by other commodities with global demand and world prices. Or it can be actually limited down to regional prices for basic commodities (for example, for the purposes of comparing the dynamics of economic development in several countries with similar consumption patterns).

References

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