Journal of Siberian Federal University. Humanities & Social Sciences 3 (2010 3) 382-387
~ ~ ~

УДК 330.15

Green GRP as a Macroeconomic Indicator of Economic Growth of a Region (by the Example of Krasnoyarsk Krai)

Yevgeniya V. Zander*,
Yulia I. Startseva and Anton I. Pyzhev
Siberian Federal University
79 Svobodny, Krasnoyarsk, 660041 Russia [1]

Received 28.05.2010, received in revised form 4.06.2010, accepted 18.06.2010

The paper considers issues relating to the necessity to adjust macroeconomic indicators to incorporate the ecological component. Traditional indicators of economic growth preclude availability of reliable information about its quality. The authors consider one of indicators of regional statistics – Gross Regional Product and suggest an adjustment of UN environmental and economic accounting methods to evaluate green GRP for the region (by the example of Krasnoyarsk krai).

Keywords: natural capital, economic growth, natural resource, depletion of natural resources, environmental damage, gross regional product.

Introduction

Natural resources and natural environment are the basis of material production and life activity of the population. The state of environment, high-quality of its management, protection and restoration of its resources largely determine the rate of economic growth and production efficiency. The economic growth related only with maximum end value capture in production involving inefficient use of natural resources and environmental abuse has practically run dry. At the modern stage of society development environment-geared planning of self-sustained development of territories become important. Presently at the national level there are methods presupposing environmental friendliness, however, they have not found wide application in the Russian Federation yet.

Statement of Problem

The idea to adjust national accounts to incorporate environmental damage by economic activities was first put forward by Ahmed et al. (1989), Repetto et al. (1989) and Hartwick (1990).

The approach put forward by Hartwick is based on neoclassical growth model and an attempt to define «optimum» regulators of the national accounts system (hereinafter – RNA). Another approach arising out of the works by Ahmed, Repetto and other authors presupposes stage-by-stage changes in RNA. Currently disagreement exists among economists concerning the indicators to be used to reflect in the national accounts the environmental damage resulting from intensive industrial exploitation. In 1993 the United Nations Statistical Office (UNSO) together with several international agencies

* Corresponding author E-mail address: zander@lan.krasu.ru

proposed System for Integrated Environmental and Economic Accounting (SIEEA), based on widely used methodology proposed in the work by Ahmed et al. (1989).

Ecological and environmental accounting touches upon the subject of integrating the natural capital into national wealth along with the capital produced by human labor, and makes possible to evaluate environmental expenses (depletion and impact on the quality of natural resources). The natural capital comprises renewable resources (e. g. forest) and non-renewable (mineral resources), as well as environmental services. Ecologically adjusted (green) aggregates expanded by consideration of natural assets: feasible is to adjust not GNP only, but also net value added and national wealth.

To construct the «green» accounts traditional economic indicators are adjusted by two values: cost estimate of depletion of natural resources and ecological-environment pollution damage.

This study dwells upon one of basic indicators of macroeconomic statistics – Gross Domestic Product (NDP), and offers derivative adjustments of this indicator making possible to take into account the environmental factor at the regional level (by the example of Krasnoyarsk krai).

The indicator resulting from environmental transformation of GDP is the Environmentally Adjusted Net Domestic Product – EDP. This indicator is calculated on the basis of net domestic product in two stages.

1. Cost estimate of depletion of natural resource (DPNA) (production of oil, mining of mineral raw materials, deforestation, etc.) is deducted from the net domestic product (NDP).
2. Deducted from the produced indicator is the cost estimate of environmental damage (DGNA) (air and water pollution, waste disposal, soil depletion, underground water use).

Thus,

$$EDP = (NDP – DPNA) – DGNA.$$

The authors of this study adjusted the UN-developed methods for cross-country comparison. The adjustment was aimed to adapt the said methods to use it in territorial subjects specified by highly different environment conditions and large area of the territory. To make the required calculations instead of GDP the authors used an analog calculated by the regional statistics – Gross Regional Product.

Indicators, specifying ecological impact of intensive industrial exploitation: depletion of mineral resources and environment pollution damage attract most attention of researchers because it is their evaluation that arises difficulties. By the UN methods depletion of natural resources is measured as the total rent on resources. For the renewable resources (e. g. bauxites, copper, gold, iron ore, etc.) the rent is evaluated as the difference between the cost of manufacture at the world prices and total production costs. For the forest resources belonging to the renewable category the rent is calculated as the difference between the rental cost of logging the timber in the rough and relevant cost of forest regeneration. To calculate the forest rent considered is the commercial value of timber only. Other environmental services rendered by the trees, e. g. carbon binding or benefits of uncut forest are, at this, excluded. The authors of this study propose to evaluate the cost of extracted resources by the primary cost of resource extraction from the subsoil without regard to world market conjuncture.

An attempt to take into account the price of resources as the world prices results in a certain distortion of calculus from the standpoint of evaluating the depletion of natural resources. In this case the value of green gross regional

products may substantially vary over periods due to world price variation, and not to the variation of volume or evaluation of resource depletion.

Results

Krasnoyarsk krai specifics considered to evaluate we selected the following types of natural resources: non-renewable – nickel, copper, gold, oil, gas, coal; renewable – forest resources.

Evaluate depletion of nickel (Ni), copper (Cu) and gold (Au). By UN recommendations to evaluate the rent on these resources from the cost of their production at world prices it is required to deduct the total cost of their production. We should note, that all the said resources are released products of metallurgical production and are produced from respective ores: copper-nickel, gold bearing (oxidized and sulphide). The released metals referred to above whose world price is recommended for use by the UN, accordingly, comprise a substantial share of added value not related to depletion of natural capital, thus, the depletion estimate shall be considerably overestimated. According to the authors to evaluate the subsoil depletion damage is more correct by the primary cost of extraction of extracted ores, not by the primary cost of metal production, i. e. to take into account related immediately to the extraction process, and, as mentioned above, without regard to the world prices. Implementation of the author's approach to depletion of natural resources gives rise to the problem to define the cost of extracted copper-nickel ore from which later metals shall be extracted: nickel and copper (gold is considered in this paper below).

First, it is necessary to determine the share of cost of ore mining in the primary cost of released metal. Company reports comprise data on the volume of ore removed from a deposit and the output of produced metal. Since how much metal is produced from a specific ore type is not known, we use averaged indicators: total output of metal production and total ore production (not taking into account different content in the ore of the useful component – metal). The calculus yields average estimate of the share of the ore cost in the primary cost of the metal, then, multiplying it by the known primary cost of the metal have the cost of a ton of removed ore. Thus, the cost of ore to produce nickel in 2004–2006 was, on the average $US39 per ton, copper – $US25 per ton as the cost of ore was estimated indirectly, on the basis of the cost of released metal.

Nickel and copper are known to be extracted from the same volume of copper-nickel ore. Therefore, the cost of ore produced separately for the copper and for nickel should be averaged. On the basis of information provided in annual reports of OJSC Mining-And-Metallurgical Combine «Norilsk Nickel», production of one ton of nickel requires 116 tons of ore, to produce one ton of copper – 40 tons of ore. It can be assumed that from the total amount of ore required to produce 1 ton of nickel and copper (156 tons) 26 % is used to produce copper and 76 % – to produce nickel. Results of calculation are given in Table 1.

The cost of extraction of gold-bearing ores was estimated by the example of information in annual reports of OJSC Gold Producer «Polyus Zoloto» about specific deposits in the territory of Krasnoyarsk krai (Table 1).

To estimate the rent on energy resources the data on the extraction cost of coal, oil and gas and output of the said resources were taken from official financial statements of the largest producers: OJSC «SUEC», OJSC «Rosneft», OJSC «GAZPROM».

Methodological difficulties arise to calculate the rent on forest resource use. In addition to the cost of forest harvesting the UN calculations involve the cost of reforestation. At this, while the cost of forest harvesting can be found in financial statements of the companies operating

Table 1 – Estimate of depletion of individual types of mineral resources in Krasnoyarsk krai in 2004–2006.

Index	2004	2005	2006
Depletion of copper-nickel ore reserve, million rubles	14,534.48	14,785.87	14,147.71
Depletion of gold-bearing ore reserve, million rubles	3,870.97	4,240.41	5,051.60
Depletion of coal reserve, million rubles	7,399.69	8,955.89	12,589.93
Depletion of oil reserves, million rubles	461.31	538.48	532.55
Depletion of natural gas reserves, million rubles	200.28	264.28	534.5
Depletion of forest resource reserves, million rubles	8,137.36	10,506.43	11,590.85

Table 2 – Environmental air pollution damage in Krasnoyarsk krai in 2004–2006

Index	2004	2005	2006
Environmental damage by nitrogen oxide emissions, million rubles	12,539.26	14,884.27	12,468.66
Environmental damage by carbon oxide emissions , million rubles	92.88	93.03	79.41

in the territory of Krasnoyarsk krai, the statistical data on the cost of reforestation do not exist. Even though the forest resources belong to the renewable category and the rent on their exploitation is specific, in this study the said indicator was calculated in analogy with its calculation for the non-renewable resources. To make the estimates of depletion of forest resources compatible with earlier considered mineral resources the forest resource depletion was estimated by the cost of round-wood harvesting.

To measure the environmental pollution the UN methods use a very simple approach. Environmental pollution damage is estimated for carbon dioxide (CO_2) only, cost is, at this, moderately estimated by marginal world loss – $US20 per metric ton of carbon dioxide emission. This study makes an attempt to take into account the structure of pollutant emissions specific for Krasnoyarsk krai. Main pollutant in the krai is sulfur dioxide (SO_2), 90 % of which is emitted by OJSC Mining-And-Metallurgical Combine «Norilck Nickel». A problem arises here to estimate the cost of emission of this substance, because the Kyoto Protocol does not qualify sulfur dioxide among substances whose released volume is mandatory for registration, and for which there exist special Global Warming Potential (GWP) coefficients making possible to assess the emission volumes of controlled substances in CO_2-equivalent. It is this conversion that is used to evaluate economically the environmental pollution damage by substances other than CO_2. Therefore, in addition to the environmental damage by carbon dioxide emission, calculation of green GRP for Krasnoyarsk krai incorporated damage from nitrogen oxide only, whose volume was pre-converted into CO_2-equivalent by nitrogen-conforming GWP coefficient equal to 310 (see Table 2).

Green GRP estimates for Krasnoyarsk krai are presented in Table 3.

Calculate by UN methods NDP, DPNA, DGNA and EDP indices for Krasnoyarsk krai, using data of Table 3.

By Table 3 and Table 4 it is possible to make the following conclusions. First, taking into account depletion of natural resources and environmental pollution damage decreases GRP of the region by about 10 %. Speaking about the ratio of growth rate of net regional product (NRP) and green NRP, they actually coincide

Table 3 – Green GRP estimates for Krasnoyarsk krai in 2004–2006

Index	2004	2005	2006
GRP, million rubles	365,454.10	439,736.90	585,879.20
Consumption of fixed capital, million rubles	36,824.14	34,916.35	54,990.97
Environmental air pollution damage, million rubles	12,632.14	14,977.30	12,548.07
Depletion of mineral resources, million rubles	34,604.09	39,291.36	44,447.14
Green GRP (GRPg), million rubles	318,217.86	385,468.24	528,884.00
Green NRP (NRPg), million rubles	281,393.72	350,551.89	473,893.03
NRPg / GRP, %	87.07	87.66	90.27

Table 4 – NDP, DPNA, DGNA, EDP indices for Krasnoyarsk krai in 2004–2006

Index	2004	2005	2006
NDP, million rubles	328,629.96	404,820.55	530,888.23
NDP growth rate, % of the previous year	–	23.18	31.14
DPNA, million rubles	34,604.09	39,291.36	44,447.13
DPNA growth rate, % of the previous year	–	13.55	13.12
DGNA, million rubles	12,632.15	14,977.29	12,548.07
DGNA growth rate, % of the previous year	–	18.56	−16.22
EDP, million rubles	281,393.72	350,551.89	473,893.03
EDP growth rate, % of the previous year	–	24.58	35.18
EDP / NDP, %	85.83	86.59	89.26

(see Table 4). It is apparent that the slowdown in the growth rate of environmental pollution damage brings forth higher growth of green NRP. Positive can also be considered the trend of slowdown in the growth rate of environmental pollution damage (in 2005 the growth of the said index was 18.56 % with respect to 2004, and in 2006 – decreased by 16.22 % with respect to 2005) and the rate of depletion of natural resources (decreased from 13.55 % in 2005 to 13.12 % in 2006).

Conclusions

Thus, the study estimated green GRP for Krasnoyarsk krai with account of its economic growth specifics. Environmental damage inflicted to the region by its intensive industrial exploitation has been estimated. For indices specifying environmental damage we considered depletion of natural resources and the damage inflicted by emission of pollutants into the environment. Dynamics of both indicators has been found positive. The level of economic development and growth rates of the region made by the GRP index and its derivatives are shown to be overestimated due to disregard of environmental damage in this index. On the whole from the viewpoint of the authors to restrain environmental impact of industry requires to develop approaches to environment use on the compensation basis. The question is that the environmental policy of a country (region, municipal entity) should provide for tools making possible to charge the cost of environmental damage to a specific economic entity, making it either change the production technology for more ecologically «clean» ones, or invest into environment-protection measures funds adequate to sustain the assimilation potential of the territory. Presently tools by which the territorial powers could force the industrial

contaminators to control their activities are not available. There is a certain experience of developing methods for environmental-economic assessment of environment quality by international organizations and individual researchers, however, all of them are oriented to comparatively evaluate current state of environment of countries or regions and are unable to reflect effects of parametric variation specifying activities of industrial facilities. Therefore, an important need exists to develop an optimization model of environmental-economic development of a territory that will make possible to solve the problem set.

References

1. Ahmed, Y.A., Serafy, S. El, Lutz, E., (eds.), 1989. 'Environmental Accounting for Sustainable Development' (Washington, World Bank).
2. Repetto, R., Magrath, W., Wells, M., Beer, C. and Rossini, F., 1989. 'Wasting Assets, Natural Resources in the National Income Accounts' (Washington, World resources Institute).
3. Hartwick, J. M. (1977) 'Intergenerational Equity and the Investing of Rents from Exhaustible Resources', American Economic Review, 67 (5): 972–974.
4. Indicators of Sustainable Development: Guidelines and Methodologies, Third Edition, United Nations, New York, 2007.
5. Regions of Russia. Social-Economic Indices. 2007: Stat. Sb. / Goskomstat Rossii. – Moscow, 2007.
6. Ryumina, Ye. V., Anikina, A. M. Green estimate of economic development of regions // Prognostics Problems – 2009. – № 2.

Экологически скорректированный ВРП как макроэкономический индикатор экономического роста региона (на примере Красноярского края)

Е.В. Зандер, Ю.И. Старцева, А.И. Пыжев
Сибирский федеральный университет,
Россия 660041, Красноярск, пр-т Свободный, 79

В статье рассматриваются вопросы, связанные с необходимостью корректировки макроэкономических показателей с целью учета в них экологической компоненты. Известно, что традиционные показатели экономического роста не позволяют получить достоверную информацию о его качестве. Авторами рассмотрен один из показателей региональной статистики – Валовой региональный продукт и предложена модификация методики эколого-экономического учета ООН для оценки экологически скорректированного ВРП для региона (на примере Красноярского края).

Ключевые слова: природный капитал, экономический рост, природные ресурсы, истощение природных ресурсов, ущерб окружающей среде, валовой региональный продукт.