INTEGRATED ECONOMIC AND ENVIRONMENTAL NATIONAL ACCOUNTS. THE CASE OF UKRAINE

by

Iryna Mel'ota

A thesis submitted in partial fulfillment of
the requirements for the degree of

Master of Arts in Economics

Kyiv Mohyla Academy

2000

Approved by _____
Chairperson of Supervisory Committee

_____

_____

_____

Program Authorized
to Offer Degree_____

Date _____

Kyiv Mohyla Academy

Abstract

INTEGRATED ECONOMIC AND ENVIRONMENTAL NATIONAL ACCOUNTS: THE CASE OF UKRAINE

by Iryna Mel'ota

Chairperson of the Supervisory Committee: Anatoliy Voychak
Director of the Christian University

In this paper the System of National Accounts, methodology for calculation GDP, is investigated. Limitations of the existing measure, GDP, are examined, and new approaches of integrating economic and environmental accounts, improving the existing measure are considered. The practical experience of ecologically adjusted GDP in case of Ukraine shows the magnitude of overvaluation of conventional GDP. Analysis of obtained results gives the view of industrial production that reflects changes in its resource base. The benefits of economic and environmental accounting for policy-makers are discussed.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

ACKNOWLEDGMENTS

I thank to my advisor Professor Charles Steele for support and encouragement throughout my research. Special thanks are to Dr. David Snelbecker (HIID), Prof. Roy Gardner, Prof. Janusz Szyrmer, and Dr. Khwaja Sultan (HIID) for valuable advice and suggestions for improvement. I am grateful to Nastasia Rybianets and Yuriy Andriychenko (both from the Ministry of the Economy) for the help in the statistical data collection. Thanks also to Iryna Piontkivska and Yuriy Gorodnichenko. Although they probably did not realize it, both provided encouragement in discussions at critical times when my own enthusiasm wavered.

GLOSSARY

System of National Accounts (SNA). The system of economic information for economic process description and analysis developed by UN. The complex of balance models, which use statistical methods for generalized displaying and analyzing of national economy.

Sustainable state. One in which utility, consumption, natural capital stock are not declining through time. One in which resources are managed to maintain production and sustainable yield of resource services.

Defensive expenditures. The expenditures defined as money spent to maintain the household's level of comfort, security, or satisfaction, in the face of declines in quality of life due to such factors as crime, or pollution.

Chapter 1

INTRODUCTION

My thesis research addresses the following questions:

- Why is GDP not an adequate measure of the nations' development?
- What is integrated economic-environmental accounting?
- What would be the implications of the theory explored for recalculating Ukrainian well-being?

This last question is the main one of my thesis, although I address all three.

Several generations of economists have been debated what should be included in national accounts, and how should be measured these items. Do our measures show correctly the well-being of the nation? Criticism emphasizes the shortcomings of the conventional system of national accounts (SNA), as the framework for measurement of GDP: it does not adequately represent true income because environmental protection costs are treated as generating income and because depletion and degradation of natural resources are not charged against current income.

Development of national accounts (1940s and 1950s) took place in a period in which there was less concern about the impact of social development on the environment. These environmental effects were treated as externalities, which would be neglected. This view is no longer tenable and the challenge is to develop values that are more reasonable than zero. This would help to change the attitude of policy-makers: they will not protect the environment unless will see how much it is worth.

It is not possible to construct an adequate measure of economic well-being. Still it is possible to do a lot better than the GDP. One alternative measure, the Genuine Progress Indicator (GPI) starts with the same data that underlines the GDP, but then it is modified by both additions and subtractions (Cobb, 1995a):

1. The GPI subtracts so-called 'defensive expenditures' such as the cost of crime and environmental decay. Crime imposes large economic costs on the society, in the form of legal fees, medical expenses, damage to property and the like. Also it accounts for such things as long-term environmental damage and the loss of leisure time.

2. The GPI begins to account for the aspects of the economy that lie outside the sphere of monetary exchange. It assigns value to the life-sustaining functions of households, and communities. It also counts the value of services from public infrastructure such as highways and bridges that the GDP ignores.

3. The GPI treats such destruction as depletion of the earth's resources, degradation of the natural environment as rather cost than as gain. If today's economic activity uses up the physical resource base available for tomorrow's, then it is not creating well-being. It is borrowing from future generation and GPI treats such borrowing as a current cost.

4. The GPI adjusts for income disparities. The authors of the index tell us that poor benefit more from a given increase in their income than do the rich. Index rises when the poor receive a larger percentage of national income, and falls when their share decreases.

In the USA case GPI was measured from 1950s to the present. It rose in tandem with the GDP until the mid-1970s but then turned downward[1].

[1] Cobb Clifford, Ted Halstead, Jonathan Rowe, 1995, *The Genuine Progress Indicator: Summary of Data and Methodology*, Redefining Progress, San Francisco.

However, there is some contradiction of these new measures of progress (GPI in particular). The reason is that the entire attempt to attach cash values to all goods and bads is a bit problematic. Very often statisticians create such a measure that gets result as they want. Researchers should continue to try to value whatever they reasonably can, but they have to agree that, for example, degradation (such as extinction of nice views) is hard to include in national accounts.

Therefore, a more reasonable approach would be not to replace existing system of national accounts, but rather to consider some ways to improve the existing measure, GDP. This approach could complement the conventional SNA but would not be limited by the SNA framework. Environmental accounting currently is at the early stage of development, and is centered on the incorporation of environmental costs and benefits in the national accounts. The objective of my research is to provide a basis for implementation of integrated environmental and economic accounting (SEEA) that describes the interrelationship between the natural environment and the economy. Among major motivations are to revise and improve the existing valuation methods of economic activity and to identify the data gaps.

Considering the case of Ukraine, the aim is to explore **first**, **to what extent GDP as the proxy income overvalues national welfare**. A comparison of conventional and environmentally adjusted GDP could demonstrate also to what degree the results of our economic activities are achieved only by destroying the natural environment. **Second**, I would examine **the trend of the gap between conventional GDP and environmentally adjusted GDP**. Finally, I would look at the implication of environmentally adjusted GDP.

Environmental accounts would provide a means of measuring and monitoring changes in natural environment, accurately reflect resource shortages. This approach is in use in Canada, United States, the Netherlands, Norway and

France. Environmental accounting is at an earlier stage of development and is centered on the incorporation of environmental cost and benefits in the national accounts. They are the part of National Environmental Action Plans, which the World Bank requires for all International Development Association (IDA) borrowers, as a condition for having access to financing[2]. Therefore, implementation of environmental accounts is in the interests of policy-makers.

The main institution of national accounts is the System of National Accounts. Designed by the United Nation Statistical Office, it is a framework for calculating GDP in most countries. In the 1993, the UN Statistical Office proposed new System of Environmental and Economic Accounts that considers natural resource and pollution accounts. "A major difference between the SNA and the SEEA is that latter has more detailed asset classification, that more estimates are made in near-market or non-market areas (for depletion and degradation), whereas the SNA continues to concentrate on income and assets that can be valued based on market price information" (Hamilton, 1996, p. 7). SEEA is intended to support integrated social, economic and environmental policy by mean of integrated information system.

The paper organized as follows. Chapter 2 provides the survey of literature on background of integrated economic environmental national accounts. Chapter 3 discusses different approaches of environment and natural resource accounting and contains an overview of how these approaches could be incorporated into GDP. The practical experience of ecologically adjusted GDP and analysis of obtained results are introduced in Chapter 4. The final chapter presents implications of this research.

[2] Hamilton, Kirk, Lutz Ernest, 1996, 'Green national Account: Policy Uses and Empirical Experience', *World Bank Environmental Economic Series*, paper NO. 39

Chapter 2

SURVEY OF LITERATURE

The following is a brief analysis of published attempts at constructing environmental accounts.

Eisner (1988) is among the first who introduces a revision and extension of conventional measures of national income and product. He explains that current national income and product accounts need to be supplemented because they do not "show correctly the distribution of income and output within the population, their cyclical fluctuations, and their allocation to current consumption and accumulation of capital for the future… Our accounts measure not welfare itself but the nation's output of final goods and services, which are presumed to contribute to welfare" (p. 1612). Among the principles for extended accounts are concepts of inclusion of nonmarket activities, such as nonmarket work, the services of the environment, and human capital; development of comprehensive measures of investment, taking into account capital gains and losses. His view on natural resources disagrees with classical theory's according to which they are regarded as exogenous to production. In fact, they are not. Economic activity that increases the value of natural resources may be seen as investment, but economic activity that exhausts them may be seen as consumption. Then net investment is the value of additions to capital minus estimate of capital consumption, the depreciation in the value of capital. The paper examines also the structure of the 'the total income system of accounts,' which includes both market and non-market output. Appendices contain information on the valuation of household work, capital formation and capital consumption in land, natural resources and the environment.

The construction of welfare-adjusted measures of national accounts is the

subject of several academic studies in the United States (Nordhaus and Tobin 1972, Daly and Cobb 1989). These are presented as attempts to provide more realistic income measures. The first work is the Measure of Economic Welfare (MEW). It describes the major differences between MEW and GDP:

- imputation for the value of leisure time, household work,
- deduction for 'regrettable necessities', private intermediate product.

Nordhaus and Tobin also make adjustments for 'the disamenities of urban life: pollution, litter, congestion, noise, insecurity, etc.' The results, covering the period 1929-1965, present a growth of per capita income but lower rate than NDP.

Daly and Cobb (1989) used a similar rationale to create the Index of Sustainable Economic Welfare (ISEW). The conventional measures from national accounts are adjusted by imputations and subtraction in order to provide an improved measure of social income based on the notion of sustainability. The main differences from MEW are in the treatment of non-market activity (ISEW omits the value of leisure), defensive expenditures (ISEW omits health expenditures and investment), long-term environmental damages (not presented in MEW), adjustment for income inequity. There are also adjustments for depletion of non-renewable resources.

The GPI (Genuine Progress Indicator) is a version similar to the ISEW. Cobb, Holstead and Rowe (1995a) develop a new yardstick, the GPI, to begin to measure the performance of the economy as it actually affects people's lives. They make a technical overview of the GPI and how it addresses in inequities of the Gross Domestic Product (GDP) to provide a more accurate reflection of national progress. The GPI takes from the GDP the financial transactions that are relevant to well-being. It then adjusts them for aspects of the economy that

the GDP ignores. The GPI thus reveals the relationship between factors defined as purely economic and those traditionally defined as purely social and environmental. The GPI subtracts three categories of expenses that do not improve well-being:

- *defensive expenditures*, defined as money spent to maintain the household's level of comfort, security, or satisfaction, in the face of declines in quality of life due to such factors as crime, or pollution. Examples include personal water filters, security systems, or the cost of repainting houses damaged by air pollution.
- *social costs*, such as household costs of crime, or loss of leisure time as a component of consumption.
- *the depreciation of environmental assets and natural resources*, including loss of farmland, and old-growth forests; reduction of stocks of natural resources, such as other mineral deposits; and damaging effects of wastes and pollution.

They calculated GPI for USA and a wholly new view on the economy began to emerge. The GDP has depicted almost continual improvement over last fifty years. By contrast, the GPI increases until the mid- 1970s, but has followed a downward path ever since. Where the GDP has tripled in per capita terms, the GPI actually has fallen since 1976.

The primary objectives of these similar projects are to avowedly gain information on an advanced economic accounting system, to develop better analytical tools, to improve economic infrastructures. Most recently, attention has focused on extending the accounts to include natural resources and environment. From this point of view, interesting is the pilot study for Nova Scotia (Canada) presented by Colman (1998). His aim is to lay the foundation for broad economic development in the province. This project is not intended

as an academic exercise. The paper establishes a comprehensive framework for a practical policy-relevant index of sustainable development, and generates basis data for accounts. This study is the theoretical stage for a future practical implementation.

Several works contain detailed methodology description. Heal (1998) shows the benefits of viewing the environment as an economic asset that should be understood as a part of a nation's income, and explains how this approach can led to more conservative patterns of resource use. Chapters provide complete mathematical templates for the valuation of natural resources, the improved calculation of national income, and the conduct of the cost-benefit analysis.

Through the lens of conventional national accounting, resource depletion and natural environment degradation often misleadingly appear as desirable economic growth. El Serafy (1997) revises the old System of National Accounts (SNA) and proposes environmental 'satellite accounts.' As proposed, they rely on the valuation of environmental stocks. He developed the User Cost approach to value the stock of natural assets. The paper stresses that the SNA is primarily an economic framework, incapable of capturing all environmental change, and the national accounts are far more useful economically than environmentally. Greening the accounts would be optional for most wealthy countries, whose overriding environmental concern is pollution. This can be addressed directly through taxation and regulation. The paper argues that green accounting can only ensure income (sometimes called weak) sustainability, which should be considered as a step leading to an ecological (or stronger) sustainability.

Environmental accounting is of growing importance worldwide. In general, in the developing countries the problem of depletion of natural assets has highest priority. On the other hand, in many developed countries, degradation of the quality of air, land and water have special importance. Hamilton (1996)

describes and evaluates the range of experience with national accounting and the SEEA that has been published for both developed and developing countries. More important he critically examines the potential policy, in particular greener national accounting, aggregates such as genuine saving and 'Eco-Domestic Product.'

The recent version of the international System of National Accounts (SNA) (United Nations, 1993) addresses the possible incorporation of environmental costs and assets in the SNA. The report does not recommend the integration of environmental accounts into the core SNA. Instead, it proposes a system of so-called satellite accounts. These take the standard SNA as a starting point, and then show how the standard SNA stocks and flow in monetary and physical terms might be complemented by the inclusion of stocks and flows arising from interaction between the economy and environment. This report does contain the suggestions for a particular design and methodology. It rather should be considered as a guide to national accounts practitioners, who may wish to experiment with environmental accounting.

Chapter 3

THEORY AND METHODS OF VALUATION

There is no standardized approach to environmental national account and, therefore, the feasibility of the SEEA methods needs to be tested. The valuation of the use of natural assets is one of the most difficult tasks in environmental accounting. Approaches to this valuation mainly have been developed from cost-benefit analyses.

Three methods of valuation emerge in the Handbook of the Integrated Environmental and Economic Accounting (UN, 1993):

Market valuation

Under this approach, the decreasing quality of, for example, land may be reflected in its value if the market price reflects such changes. The advantage of this approach is the availability of comparable data on market values. The restriction of market valuation is that statistical work can be based only on observable data in monetary terms. However, environmental changes are not easy to monetise.

Direct non-market valuation

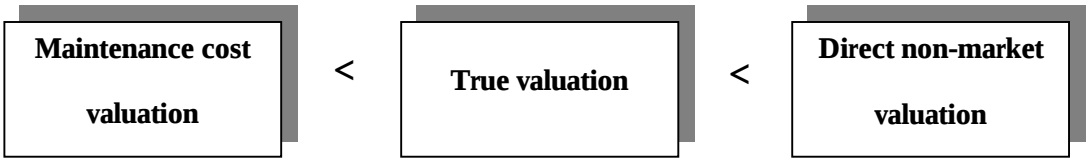
Can be applied for the case of the use of the natural environment as a public good. The best-known direct valuation methods are willingness-to-pay and willingness-to-sell approaches, so called contingent valuation. One of these methods is based on asking people what they would be willing to pay to avoid the environmental degradation. However, since people vary in income levels and in the seriousness with which they answer questions of this kind these approaches tend to be suspected in revealing the true preferences. On the other

hand, these valuation methods often present the only possible approximating value of natural environment.

Indirect non-market valuation

Actual damage cost caused by environmental deterioration could also be calculated on the basis of hypothetical cost (so-called defensive expenditures; see glossary). A common approach has been to establish certain desirable quality standards, and then to measure degradation as the deviation from these standards. The value of degradation can then be calculated as the cost of achieving the targeted quality standards. Damage cost comprises expenditures for maintaining the services of natural environment. The actual protection cost involves preventing a decrease in environmental quality, as well as the actual expenditures necessary to repair the negative changes. Example is environmental protection cost for the mitigation of damage to human health caused by decreased environmental quality. However, this approach is limited, since for the majority of environmental changes it is difficult to assign monetary values, which in turn do not provide a complete picture of economic use of natural environment. Environmental protection activities might not be sufficient to balance the negative impacts of economic activities. A weakness of such a method, also, is that it is dependent on current technology. This method estimates minimum cost of the environmental quality deterioration.

Described methods relate in the following way:



In the SEEA, the last approach plays a prominent role. The concept of maintenance cost is similar to the method of calculating the depreciation of

produced fixed assets: costs are calculated as the amount of monetary units necessary to keep the level of assets intact in order to sustain the same level of income in the future.

Gross Domestic Product adjusted for environmental damage

System of National Accounts does not adequately calculate actual income because depletion and degradation of natural resources are not deducted from current income. Therefore, GDP as the proxy income overvalues national welfare. The alternative measure, ecologically adjusted GDP can be calculated as follows:

Adj. GDP = GDP – Depletion and degradation of natural environment

Thus, I could find the solution to my **first question**: conventional GDP is overestimated by the value depletion and degradation of natural environment.

Changes in the natural environment affect the quality of society life sometimes positively but more often in a negative way. For example, when businesses use natural assets as inputs in production process, residuals – such as cadmium or sulphur oxides – are also produced and disposed in the natural environment. Up to a point, the environment is able to assimilate these residuals, beyond that point, however, significant environmental degradation affects the ability of the environment to provide raw materials to the economy. Degradation of natural environment quality may lead to economic feedback – lower yield, higher depreciation rate of capital inputs, additional cleaning costs, and increased health expenditures.

It is common to associate welfare with the level of income. Negative environmental change, cetera paribus, reduces welfare. To embody this change into accounts of income it would be necessary to express them in monetary terms. If we could do this, it would be a direct way to evaluate pollution damages. An alternative approach is to develop a system of accounts in physical

units. Thus nitrogen oxide emissions might be measured in thousands of tons, loss or gain of natural forest in hectares, decline in species in numbers, and so on. This approach makes it difficult to aggregate the effects of a number of environmental changes, since there is no standard unit of measurement in the aggregate system. Therefore, adjusted GDP is limited as an indicator of welfare to those environmental costs to which can be ascribed a monetary value. However, it does provide the more accurate picture of national income.

In adjusted SNA, I would include only the value of vital natural assets. A sustainable state is one in which utility, consumption, natural capital stock are not declining through time. "Sustainable development requires adequate water supply, sufficiently high land quality, protection of key ecosystems and the maintenance of air and water quality above minimum level"(UN, 1993, p. 19).

The **second question,** about the trend of the gap between the GDP and an Adjusted GDP, gives birth to the hypothesis that the gap for the period 1991-1998 for Ukraine has declined because of contraction of industrial output.

The simplified relation in vector form between the gap and industrial output can be written as following[3]:

$$\frac{\vec{I}_t \vec{P}_I}{GDP_t} = \frac{\vec{\theta}\vec{I}_t \vec{P}_E}{GDP_t} \qquad (2)$$

where $\vec{I}_t$ - vector of industrial output at time *t*, unit,

$\vec{P}_I$, $\vec{P}_E$ - vectors of prices of output and emission (e.g. royalties for use, fees for environmental degradation etc.) respectively,

θI_t - polluting emissions associated with I_t,

[3] Thanks to Prof. Steele and Dr. Snelbecker for the help with this formula.

$\vec{\theta}$ – vector of positive coefficients connected with level of technology, pollution abatement, composition of $\vec{I}_t$.

The last hypothesis can be formulated in the notation of formula (2): value of industrial output (LHS) and the value of polluting emission (RHS) are positively correlated.

Chapter 4

THE CASE OF UKRAINE

Environmental conditions of Ukraine

The problem of rational use of natural resources becomes of primary concern in Ukraine. During seventy years of command economy in Ukraine natural resources were not used very rationally, energy-intensive processes dominated in production; and the pollution control was extremely low. Little of investment funds were allocated to install or upgrade pollution control. Use of obsolete equipment that did not meet environmental requirements, high concentration of potentially environmentally dangerous plants in special regions, wearing out of productive assets of enterprises led to conditions of high probability of the environmental crashes and disasters. Very often, their consequences were unpredictable.

The accident at Chernobyl nuclear power plant (NPP) is a good demonstrative example. It has had a negative impact on the environment and on the health of hundreds of thousands of people involved in the clean up and those who still live in heavily contaminated areas in Ukraine. Due to the long half-life of the radionuclides released, a huge area will remain contaminated for generations to come. About 10 percent of the Ukrainian budget every year pays for work at Chernobyl and programs to aid civilians affected by the catastrophe[4]. International experts with Greenpeace estimated that total bill for those most affected by Chornobyl countries, Ukraine and Belarus, will exceed US$ 300

[4] Yuri Kostenko, Ukrainian minister of the environment and nuclear security, November 20, 1997 6:41 p.m. EST http://www.nando.net).

billion by 2015[5].

In Ukraine the so-called environmental revenue to the budget (royalties for use of natural resources, penalties for environmental pollution, Chornobyl fund) summed to 7% of the GDP in 1998. However, the expenditure side of budget implies that government spent only half of this amount on the environment. The natural resources in Ukraine are officially state owned but they are, actually, unowned given current management practices. A problem of property right leads to undervaluation and overexploitation of resources.

The following industries have larger influence on ecological condition in Ukraine: the electricity, gas and water production (5% share in the total industries and 36% of all toxic industrial emissions), processing industry (45% and 34% correspondingly), mining industry (4% and 25% correspondingly)[6]. In 1999 the average plant in Ukraine emitted into air about 311 ton of wastes, with metallurgy emitting 36 times more, and mining industry – from 6 to27 times more.

Because the balance sheet of the resource sectors does not measure the value of resource assets in the standard national accounts, the measure of productivity in these sectors is distorted, which then distorts measures of productivity. The specificity of Ukrainian case is that there are arrears on environmental payments. Plan and execution are different. These bills are unpaid by enterprises mainly due to contraction of production. Often such bills for state enterprises are just canceled by government. This practice can be viewed as permission for enterprises to continue to contaminate.

In Ukraine the industrial production has been declining since 1990.

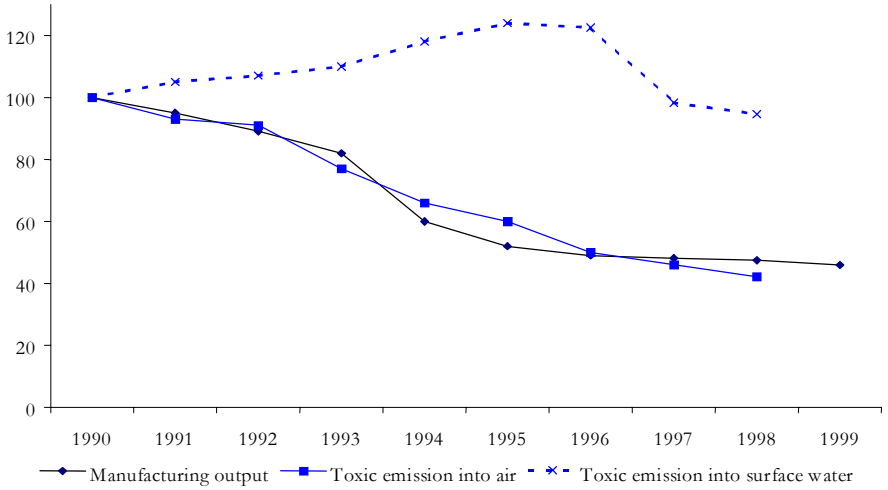
---

[5] Chernobyl: Ten Years After. Causes, Consequences, Solutions. April, 1996. http://www.greenpeace.org/~comms/nukes/chernob/read25.html

[6] State Statistical Committee, 2000, Statistical Bulletin. Environmental Report, 1999.

Accordingly, we could make the hypothesis that the natural environmental damage has been decreasing since that time as well. Here we face the trade-off between improvement in quality of environment and reduction in industrial output.

Figure 1. Indexes of manufacturing output and toxic emission into air and surface water by stationary sources, 1991-1999 (1990 = 100)



Source: my estimations based on the data of Ministry of the Economy and estimations of State Statistical Committee

Explanatory note:

Index of manufacturing output is a measure of output in real terms. Total industrial output is calculated in US$. Year 1990 is chosen as the base, its total manufacturing output is 100%. The indexes for following years are calculated as ratio of output in given year to output of base year (in percent). For example, for year 1995 Index $=Q_{1995}/Q_{1990}$, where Q_{1995} and Q_{1990} are the total manufacturing output measured in US$.

The same strategy is for calculating of indexes of toxic emission into the air and the surface water. The emission is measured in thousands of ton; year 1990 is chosen, as base, toxic emission in this year is 100%.

Figure 1 shows the same rate of decline of both industrial output and toxic emission into air over 1991-99. The emission into water has decreased only since 1995. There is difference in this trend because water pollution is not so closely related to industrial production as air pollution is. Although industry is the largest consumer of the water resources, "the percentage of contaminated sewage water in total sewage water is greatest in the housing and municipal service sector (62%)" (Piontkivska, 2000, p. 6).

Description of data used in natural environment statistic

Before beginning the construction of integrated environmental economic accounts, let us take a closer look at the data. Statistics of natural environment in Ukraine take into account qualitative and quantitative characteristics of natural resources, their use and influence of human activity on natural environment. The State Statistic Committee of Ukraine collects and computes data concerning environmental degradation and depletion. It presents annual reports on the main figures on the use and preservation of natural resources in Ukraine. The statistics of environmental protection uses indicators, which allow one to make detailed analyses of emissions. The numbers of sources of emissions, and the volume of pollution are tallied. The statistics also contains quality standards for concentration of harmful substances, detrimental acoustic, electromagnetic, and radiation fields impact, and health endpoints for toxic emission into natural environment. Toxic compounds usually found in the environment are classified according to aggregate state (liquid, solid and gaseous), concentration of primary ingredients (for example, sulfur, nitric, volatile compounds), the hazard of risk, and possibility of utilization.

For measuring environmental damage in monetary units, the methodology of calculating rates of levy standards (value in UAH per physical unit assigned certain pollutant) is determined. The Cabinet of Ministries of Ukraine sets rules for quality standards of toxic emissions for the following types of

environmental pollution[7]: emission into air, emission into water, allocation of wastes.

The above indicators serve for estimation of environmental damage in monetary unit terms. For example, the value of total toxic emission is calculated from the following formula[8]:

$$Q = \left(\sum_i C_i(\lambda) N_i \right) F Z(\lambda) V(\lambda), \quad (1)$$

where Q - environmental damage of toxic emission in monetary terms, UAH/year,

$C_i(\lambda)$ - toxicity coefficient of ingredient of type i ,

N_i - amount of toxic emission of substance of type i, ton/year,

F - rate of levy standards for damage caused by toxic emissions of substance i, UAH/ton. It varies for within- and over-limit discharges,

$Z(\lambda)$ - coefficient which account for relative hazard of pollution for specific area (for instance, urban vs. rural etc.),

$V(\lambda)$ - coefficient, which considers the degree of diffusion in the environment of substance of type i.

Normative tables contain indicators C, Z, V which are calculated according to influence of factor (λ) - concentration emission of toxic ingredient.

The serious shortcoming is that errors can be made during estimating of losses arising from pollution. Although official documents provide a lot of data of environmental monitoring, co-ordination of the efforts of the various authorities involved in this process tends to be weak. At the local levels environmental

---

[7] Cabinet of the Ministries of Ukraine, Decree # 303, 01.03.1999 *'On the Approval of Established the Standard Levies for the Pollution and the Collection of Levies.'*

[8] Economical Statistic: text book. 1998. Ed. Y. N. Ivanov. Infra-M. Moscow. Multiplicative relationship between the coefficients probably comes from Ehrlich equation (cited in S.M. Bruyn, J.C.J.M. van der Berggh, J.B. Opschoor article *in Ecological Economics,* 25 (1998) 161-175) , that relates environmental impact to population, affluence and technology.

inspection units lack modern facilities to process reliable data systematically. In many cases, they rely on data provided by enterprises themselves or by other authorities that collect corresponding data (Piontkivska, 2000).

Economic activities are reflected in the following articles of SNA adjusted for environmental damage:

1. Ecological payments for pollution;
2. Losses compensation and penalties for the violation of environmental legislation;
3. Expenses of repairing basic productive assets intended for own protection;
4. Operating cost of the enterprises on environmental protection.

There are the royalties charged for particular use of natural resources (based on the standard levies and limits use); for natural environment pollution (based on limits of contamination and allocation of wastes by industrial enterprises); for deterioration of natural resources (decline in yield of soil, forests etc.). Royalties within the limits are treated as cost of production, and quantities over the limits are charged against profit. Fees for deterioration are collected out of profit.

Estimation of environmental cost

The next step in constructing the environmental economic indicator is creating a separate natural asset account, in order to account for environmental changes in monetary terms. In principle, this valuation would be based on the potential maintenance or clean-up costs. These costs are approximated by ecological payments, expenses, and operating cost of enterprises; social payments and clean-up costs owing to the accident at the Chornobyl nuclear power; other environmental protection costs. Environmental adjustments are introduced on the basis of a relatively limited statistics. I estimate the cost of maintaining natural assets that corresponds with the value of the depletion and degradation of natural assets. Gross domestic product treats such expenditures (costs of environmental protection) as current income, therefore I subtracted this

Table1 . Estimation of environment cost incorporation into GDP Ukraine, 1998

			in thousands of UAH	% of total cost
1	Costs of maintaining of natural assets quantitatively and qualitatively (these correspond to the value of the depletion and degradation of natural assets)	Ecological payments for the environmental pollution of enterprises:	-245 621,6	6,1%
2		Expenses of enterprises on repairing basic productive assets intended for environmental protection	-150 208,3	3,7%
3		Operating cost of the enterprises on environmental protection	-1 774 548,1	43,9%
4		Expenses on works owing to the accident at the Chornobyl nuclear power	-1 858 080,9	46,0%
5		Cost on protection & reproduction of wild biota	-7 668,3	0,2%
6		Losses originating from forest fires	-4 555,7	0,1%
7		**Total costs**	**-4040682,9**	
8		**GDP in mln.UAH, 1998**	**102 593**	
9	=(8)+(7)	**Adj. GDP = GDP- Depletion and dation of natural**	**98 552,3**	
10	=(9)/(8)100%	**Gap between GDP and Adj. GDP**	**3,94%**	

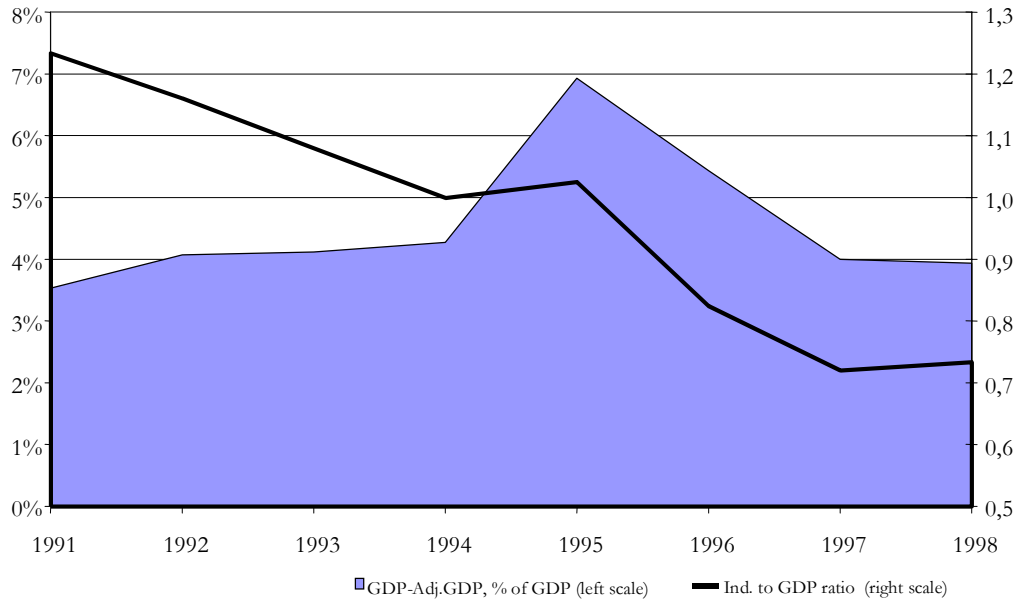
Source: my calculation, based on the data of the Ministry of the Economy and State Statistic Committee.

number from GDP to obtain ecologically adjusted GDP.

Table 1 presents the composition of environmental cost for the year 1998. The estimates suggest that GDP_{1998} is overvalued at least by 3,94% (UAH 4042,16 mln.). This number shows the gap between GDP and Adjusted GDP as the share of GDP in 1998. Then I examine the trend of the gap over time period 1991-1998.

Figure 2 shows the behavior of the gap as share of GDP (left scale) and industrial output to GDP ratio (right scale).

Figure 2. The Gap between GDP-Adj.GDP, as % of GDP vs. Industrial output to GDP ratio



Source: my calculation, based on the data of the Ministry of the Economy and State Statistic Committee

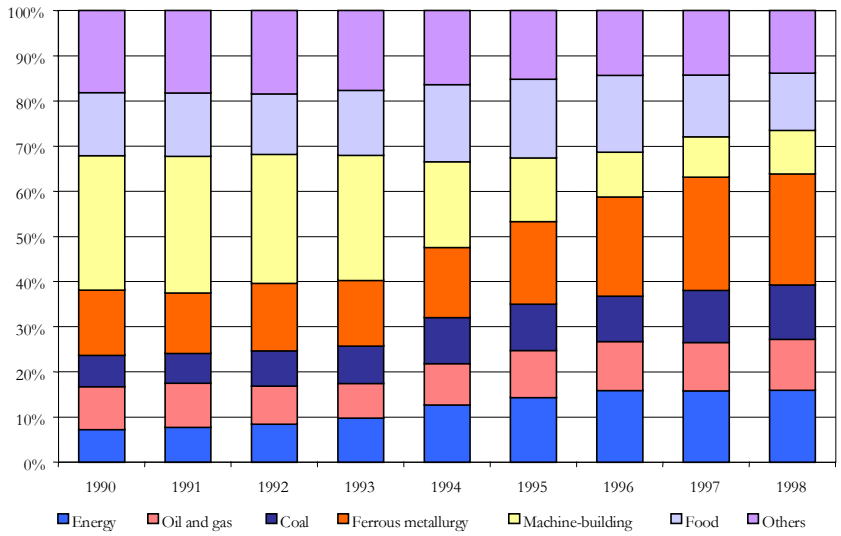
Result discussion

The prediction that this gap between GDP and Adj. GDP should reduce (because of industrial production contraction) would have been proved if the trend constantly declined. The obtained result is unexpected: although the industrial output has fallen since 1990, this gap first increased but since 1995 decreased.

However, there are several explanations for this disagreement in both trends:

- Formula (2) in Chapter 3 helps to make some hypotheses. This difference in trends for the period 1990/94 in notation of this formula could be expressed as follows: the LHS goes down while RHS goes up.

Figure 3. Structure of industries



Source: TASIS estimates.

Hypothesis 0: *holding the relative prices of output and emissions fixed, the change in composition of industries affects* θ. *In other words there has been shift toward more polluting industries.*

Indeed, the Figure 3 shows the increasing proportion of more polluting industries (ferrous metal, coal, oil and gas, energy) in the total industry. It explains why toxic emission has increased, although the total output has fallen.

Hypothesis 1: *data misreporting.*

The main part in environmental cost, operating cost of enterprises on environmental protection, follows the trend of the gap in Figure 2. Operating cost data are self-reported to Derzhcomstat (State Statistical Committee) by enterprise. It is difficult to check them. The bias could arise from incorrect data reporting (whatever the reasons are, for example, to hide profit for taxes avoiding).

Alternatively, there could had been be undervaluing output.

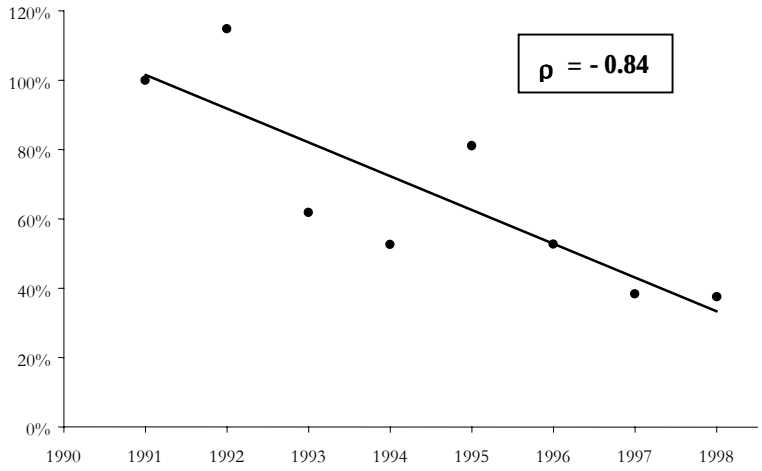
Hypothesis 2: *the relative prices* $\frac{P_I}{P_E}$ *did not adequately reflect the market equilibrium prices.*

Most of Ukrainian industries-pollutants are state owned and energy intensive. Energy resources prices are regulated by the government and undervalued. This creates favorable conditions for change in structure of industrial output toward polluters.

There can be other explanations:

- The effect of hyperinflation was not taken into account while calculating the ecological payments. These payments are determined on rates of levy standards that were set once and were not adjusted for inflation until 1995. Moreover the rules for calculating the environmental royalties were changed in 1995;
- Irregularities in the accounts resulted during the statistical processing of data. Moreover, the system composition of statistics calculation in Ukraine changed in 1994. Therefore, it could serve as explanation for such a surprising result.
- Or there could be a combination of all above factors that leads to anticipated result.

Figure 4. Environmental cost (GDP-Adj.GDP) index trend (1991=100)



Source: my estimates, based on the data of the Ministry of the Economy and State Statistic Committee

Explanatory note:

Index of environmental cost is a measure in real terms. Total environmental cost is calculated in UAH and adjusted for inflation by using CPI. Year 1991 is chosen as the base, its environmental cost is 100%. The indexes for following years are calculated as ratio of cost in given year to cost of base year (in percent). For example, for year 1995 Index $=EC_{1995}/EC_{1991}$, where EC_{1995} and EC_{1991} are the environmental cost measured in real terms.

Figure 4 shows the trend of the environmental cost index. Its calculations are similar to output and toxic emission indexes in Figure 1. The trend of environmental cost as share of GDP does not follow the trend of industrial output to GDP ratio. However, downward direction of environmental cost index supports the hypothesis of the same trend of industrial output and environmental cost indexes. However, the deviation from the trend is observable. The possible explanations are the same as above.

Chapter 4

CONCLUSIONS

Compared with the traditional national income accounts, both the composition and level of Adjusted GDP differ. Thus, the integrated system gives the view of an industrial production that reflects changes in its resource base. It incorporates changes in natural capital as well as in man-made capital. Adjusted GDP reveals the existing environmental situation while performing the functions of conventional GDP.

"Information itself has little intrinsic value. Instead, information acquires value when it facilitates optimizing behavior. That is, better information can lead to changes in actions, changes that themselves create value" (James Boyd, 1998 p.5). In other words, the information has value only if it leads to decisions different from those that would be made in the absence of the information. Integrated economic and environmental accounting aims to provide a picture of interaction between the economy and the environment. Although this picture is complex, it does not cover many interactions. The accounts highlight the fact that economic sustainability relates with environmental sustainability.

From the policy-maker's perspective the information about natural resources and specific industries provides valuable insight about sustainability and the implication of different regulations, and taxes. Do policies with respect to pollution emissions target efficient levels? There are issues for each of the economic and environmental ministries if government commitments to sustainable development are to be met.

Existing market economies cannot deliver efficient outcomes in environmental terms: pollution is an externality to the market process, and therefore is not adequately reflected in private market decisions. It might be not true under

assumption of clearly defined property rights and no transaction costs (perfect information). Government corrections might be needed when negative externalities are present in economic activity. They might be needed, because the ability of government to impose optimal regulation is questionable, since industrial output growth is of higher priority than environment sustainability. An area for further research on the microlevel is whether the royalties are set correctly, to capture resource rents while leaving firms with adequate rates of return. It is important to ensure that royalties on natural resource exploitation are invested in other productive assets but not consumed.

The integrated accounts should go along with conventional ones. Then we would observe more informative picture of the Ukrainian economy. Even given the limited database used in this work, we find that GDP is overvalued. The magnitude of this overvaluation is between 3 and 7 percent of GDP for the period 1991-98. The gap between the conventional GDP and environmentally adjusted GDP reduces over period of economic recession (at least since 1995). I found several reasons for discrepancy in year 1995. Increasing proportion of more polluting industries, data misreporting or irregularities during statistical processing of data, effect of hyperinflation can explain this divergence from downward trend.

Much of what the improved accounts will indicate may also not be completely new, rather, it may provide additional information on already-known problems**.** The primary benefit of environmental accounting is to obtain a more accurate figure of national income. However, even more important than adjusted numbers may be the actual process of collecting the data and analyzing it, and discussing the sectoral result. Environmental accounting helps prioritize the relative importance of environmental issues.

Environmental accounting will not by itself result in improved environmental policies. They could be encouraged only indirectly. Better income accounting

should be seen as one element along with other tools, which include environmental and economic analyses for policy work at the micro- and macro-economic level.

Many issues need to be added to this discussion of integrated environmental economic national accounting. This task is so important that every effort should be made to overcome any obstacles.

BIBLIOGRAPHY

Beder Sharon. 1996. The Environment Goes To Market. *Democracy and nature.* http://www.uow.edu.au/arts/sbeder.D&N.htm.

Boyd James. 1998. The Benefits of Improved Environmental Accounting: An Economic Framework to Identify Priorities. *Resources For Future*. Discussing Paper 98-49.

Cabinet of the Ministries of Ukraine, *Decree # 303, 01.03.1999 'About the Approval of Established the Standard Levies for the Pollution and the Collection of Levies.*' (Кабінет Міністрів України, 1999 р Постанова. N 303, 'Про затвердження Порядку встановлення нормативів збору за забруднення навколишнього природного середовища і стягнення цього збору').

Carson Card S. 1994. Integrated Economic and Environmental Satellite Accounts. http://www.bea.doc.gov/bea/an/0494od/maintext.htm.

Cobb Clifford, Ted Halstead, Jonathan Rowe. 1995a. *The Genuine Progress Indicator: Summary of Data and Methodology*). Redefining Progress, San Francisco.

_____ . 1995b. If the GDP is Up, Why is America Down? *The Atlantic Monthly* (October), Vol.276, no. 4.

Colman Ronald. 1998. *Measuring Sustainable Development: Application of The Genuine Progress Index to Nova Scotia Progress Report and Future Directions.* Background Documentation for Nova Scotia Inter-Departmental Consultation on the proposed Index of Sustainable Development, March 1998, Halifax, Nova Scotia.

Daly, H., and Cobb, J. B. Jr. (1989). *For the Common Good*, Beacon Press, Boston.

Eisner Robert. 1988. Extended Accounts for National Income and Product. *Journal of Economic Literature* 26(4):1611-1684.

El-Serafy, -Salah. 1996. Environmental Accounting For Sustainable Development conceptual and Theoretical Issues Relating to The System of Integrated Environmental and Economic Accounting (SEEA). *Journal of Economic Cooperation Among Islamic Countries* 17, 1-2: 87-107.

Hamilton, Kirk, Ernest Lutz. 1996. Green national Account: Policy Uses and Empirical Experience. *World Bank Environmental Economic Series*, paper NO. 39.

Heal Geoffrey. 1998. *Valuing the Future: Economic Theory and Sustainability*. Columbia University Press, New York.

Ivanov Y. N. 1998. Ed. Economical Statistic: TextBook. Infra-M. Moscow.

Nordhaus William and James Tobin. 1972. Is Growth Obsolete? *Economic Growth*. Columbia University Press, N.Y.

Perman, Roger, Yue Ma and James McGilvary. 1996. *Natural Resource and Environmental Economics*. London and New York: Longman.

Piontkivska Iryna, Nadia Sosonkina , Alisa Syvalnieva. 2000. Ukraine's Environmental Policy. *Policy Studies NO. 10*. ICPS (International Centre For Policy Studies). Kyiv.

Shahmer Carsten. 1996. Environmental Accounting For Sustainable Development: Systems For Integrated and Economic Accounting (SEEA): Conceptual and Theretical Issues. *Journal of Economic Cooperation Among Islamic Countries* 17, 1-2(1996): 133-154.

State Statistical Committee. 2000. *Statistical Bulletin. Environmental Report, 1999*.

UN Development Program. 1996. *Human Development Report,* New York.

UN. 1993. *Handbook of National Accounting: Integrated Environmental and Economic Accounts*. UN Department of Economic and Social Information and Policy Analysis, Statistics Division, New York.