

# 6. WHAT IS ROMANIA'S WEALTH? THE FOUNDATION OF A NATIONAL WEALTH EVALUATION ECONOMETRIC MODEL

---

---

Gheorghe ZAMAN<sup>1</sup>  
Roxana Arabela DUMITRAȘCU<sup>2</sup>  
Vadim DUMITRAȘCU<sup>2</sup>

## Abstract

*The importance of knowing the country's national wealth level and structure is determined by the fact that these factors condition the sense and content of the development of a country on short, medium and long term. A study of the World Bank made in 2006 proves that the sustainable development is generated by a wealth structure in which the dominant role is that of the intangible capital, of the anthropic capital and of the natural capital having rather facilitating functions. This study also presents the situation of Romania's wealth. In 2000, the national wealth of our country was characterized by a non-competitive structure and a low sustainable development generation potential. The current study aims at updating the econometric model (until 2009) of Romania's national wealth estimation presented by the World Bank in its 2006 report.*

**Keywords:** anthropic capital, natural capital, intangible capital, sustainable development, capitalization

**JEL Classification:** C51, C53, E01, E22, O11

## 1. Introduction

The national wealth is a major social-economic category used for evaluating the economic potential and the development level of a country. Depending on the methodological principles adopted (territorial, national, book value, current prices or constants, components classification/grouping criteria, etc.) distinct sizes of the national wealth can be obtained, based on human (social) capital, a primary factor

---

<sup>1</sup> Institute of National Economy. E-mail: gheorghezaman@ien.ro

<sup>2</sup> "Petre Andrei" University of Iasi. E-mail: dumitrascu\_arabela@yahoo.com

whose importance has already been stated by the classics of political economy (Smith, 1992; Ricardo, 1959).

In Romania, many experts were concerned about the volume, dynamics and structure of the national wealth in different historical periods (Axenciuc, 2000) or about the aspects of the interdependence between national wealth and the sustainable development at macroeconomic (Dobrescu, Albu, 2005; Albu, 2008) or regional level (Jula, Albu, 2008).

The approach used by the Romanian specialists to assess national wealth and its components has as feature the completion of results with a system of more or less aggregated social and economic indicators.

In the present study we try to evaluate Romania's national wealth during the 2000-2009 period as a whole and in parts (anthropic, natural and intangible capital) starting from the World Bank methodology, which defined the intangible capital as a difference between the total national wealth determined as "current value" of consumption and the anthropic and natural capital.

## II. The Methodology Used by the World Bank

The World Bank specialists admitted the following basic hypothesis regarding the national wealth estimation method: the wealth represents the current value of future consumptions (World Bank, 2006). Consequently, the following equation was used to calculate the wealth:

$$W_t = \int_t^{\infty} C(s) \times e^{-r(s-t)} ds \quad (1)$$

where:  $W_t$  = the total national wealth in the year  $t$ ;

$C(s)$  = the consumption in the year  $s$ ;

$r$  = investments efficiency social rate;

$e$  = Euler number or Napier's constant ( $e \approx 2.7182818284 \dots$ ).

As far as the anthropic capital is concerned, its stock was derived, usually in historical investments with the help of the perpetual inventory method (Perpetual Inventory Model - PIM), meaning that the stock level at a certain moment is determined by the initial stock where the capital inflows are added (gross investment) and from which outputs are deducted (capital amortizations). The structure of the anthropic capital is as follows: equipment and technological facilities, economic infrastructure and economic quality of the urban environment (Urban Land). The anthropic capital results from the summation of the values of these three constituting elements. In order to estimate the equipment stock, facilities and aggregated value structure, the following relation was used:

$$K_t = \sum_{i=0}^t I_{t-i} (1 - \alpha)^i \quad (2)$$

where:  $K_t$  = aggregate stock of equipment, facilities and infrastructure in the year  $t$ ;

$I$  = investment value in constant prices;

$\alpha$  = anthropic capital constant annual rate of depreciation;

$i$  = the year anterior to the  $t$  calculation year.

The third element of the anthropic capital – the quality of the urban environment - was indirectly evaluated, as a percentage of the value of the equipment, facilities and productive infrastructure elements. World Bank analysts have chosen a 24% percentage. Thus, the estimated value of the economic quality of the urban environment,  $U_t$ , is:

$$U_t = 0.24 K_t \quad (3)$$

The following elements were included in the structure of the natural capital:

1. Protected natural areas (directly estimated at an opportunity cost);
2. Energy resources (directly estimated at the net current value);
3. Mineral resources (directly estimated at the net current value);
4. Forest resources (directly estimated at the net current value);
5. Arable land (directly estimated at the net current value);
6. Pastures (directly estimated at the net current value);
7. Water resources (indirectly measured as % of the aggregated value of the directly estimated elements);
8. The services ensured by ecosystems (indirectly measured as % of the aggregated value of the directly estimated elements).

The following elements of the natural capital were not included in the evaluation: fish stocks and diamond reserves. The determination of the current value of the natural capital elements was based on their physical stock and the rents estimated to be obtained from their exploitation (the rents were calculated as differences between world prices and local costs). The updating rate used was 4%.

The national wealth calculation process involves the following steps:

1. The determination of the value of the anthropic capital;
2. The determination of the value of natural capital;
3. The estimation of the total national wealth;
4. The computation of the value of intangible capital as a residual factor, as difference between the total national wealth and the sum of the anthropic and natural capitals, respectively:

$$\text{Intangible capital} = \text{Total national wealth} - (\text{Anthropic capital} + \text{Natural capital}) \quad (4)$$

Conventionally, the time length considered for the forecasting estimation of the national wealth and of its anthropic and natural elements was 25 years (from 2000 to 2024). These are, roughly, the main technical elements that articulate the World Bank methodology for the national wealth estimation.

### III. Romania's National Wealth in 2000 in the International Context

World Bank experts consider that the national wealth of a country may be divided into the following components:

- a) **anthropic capital** or product represents the wealth that countries create in the production processes, materialized in equipment and technical facilities, economic infrastructure and economic quality of urban environment;

## What Is Romania's Wealth?

- b) **natural capital** consists of elements such as arable land, mineral and energy resources, protected natural areas, etc.
- c) **the intangible capital**, difficult to assess in financial terms, but the most important source of wealth, incorporating the quality of the human resources, the social capital composition, the public confidence in institutions.

According to the study on the assessment of global wealth made in 2006, the World Bank economists have found that, in 2000, 4% of the global wealth was provided for by the natural capital, 18% by the anthropic capital and 78% by the intangible capital (Table 1).

**Table 1**  
**Total World Wealth, 2000**  
- \$ per capita and percentage -

Income group	Natural capital	Anthropic capital	Intangible capital	Total wealth	Natural capital share	Anthropic capital share	Intangible capital share
Low-income countries	1,925	1,174	4,434	7,532	26%	16%	59%
Middle-income countries	3,496	5,347	18,773	27,616	13%	19%	68%
High-income OECD countries	9,531	76,193	353,339	439,063	2%	17%	80%
World	4,011	16,850	74,998	95,860	4%	18%	78%
Romania	4,508	8,495	16,110	29,113	15%	29%	56%

Source: World Bank Report: *Where is the Wealth of Nations? Measuring Capital for the 21st Century*, Washington DC, 2006.

Independently from socio-economic development levels and income in countries included in the World Bank study, the percentage participation of the anthropic capital in the total wealth is almost the same in all countries, ranging between 16% and 19%. Undoubtedly, substantial differences appear in comparing absolute levels of wealth per capita. Situations are much more sophisticated in terms of natural capital. In countries with a lower per capita income, natural resources represent an important share in the total national wealth (26%), revealing a major dependence of the respective countries on this capital. On the other hand, in high-income countries, natural capital represents on average only 2% of the national wealth. In all countries included in the study, the intangible capital has the largest share in national wealth, but in high-income countries this capital provides an average of 80% equity in wealth, while in low and medium-income countries reaches only 68% and 59%, respectively.

Based on data presented by the World Bank, we may conclude that developed countries are richer because of skills and capacities of the population, of the social fabric quality, as well as of the effectiveness of institutions that support the economic activity. In other words, the intangible capital stimulates economic yields and income

generation potential represented by the anthropic capital and the natural capital, having as main effect a higher and more sustainable, viable national wealth. The share of intangible capital is closely correlated with the country income level, feeding them retroactively and functioning as a main vehicle of development. It is, in fact, the main conclusion of the World Bank analysts (World Bank, 2006).

In the context of the World Bank evaluation, Romania is placed between the lower and medium-income countries, an international comparative analysis showing the following conclusions:

- Romania's total national wealth per capita represents 29,113\$ and 105.42%, respectively, as compared to the average level, specific to the medium-income countries (27,616\$). In comparison with the world average, Romania's national wealth is only 30.37% and only 6.63% as compared to high-income countries;
- Romania's natural capital, with \$ 4,508 per capita, and a 15% share in the total national wealth, positions the country slightly above the values recorded by medium-income group (\$ 3,496 per capita and 13% in total);
- The anthropic capital of Romania holds a 29% share in the total national wealth, a level exceeding by far the world average (18%), and that of the medium-income countries (19%) and high-income countries (17%). However, if we compare the values per capita, the anthropic capital accumulated by Romania (\$ 8,495) is only higher than that of the medium-income countries (\$ 5,347), representing only 50.41% of the global level and 11.15% of the average level specific to the high-income countries;
- The figures related to intangible capital draw Romania closer to the low-income countries: Romania's intangible wealth represents only 56% of the total national wealth, a few percentage points less than the average level (59%) observed in low-income countries and well below medium-income countries (68%), the world average (78%) and the high-income countries' level (80%);
- Even more startling is the comparison based on the absolute dollar values, calculated per capita: thus, Romania's intangible capital per capita (\$ 16,110), is only 85.81% of the one observed in medium-income countries (\$ 18,773), 21.48% of the global average (\$ 74,998) and only 4.56% of the typical high-income countries (\$ 353,339).

The results of this comparative analysis show that Romania's national wealth structure is outdated, does not create an optimal support for simultaneously ensuring economic viability, social and ecological development. The sustainability of development is fragile because of a structure with relatively modest effectiveness of the national wealth (World Bank, 2007). The absolutely unsatisfactory level of the accumulation and capitalization of Romania's intangible capital, which currently is by far the main source of national wealth of all countries, is actually the most serious impediment of placing Romania on the path of a sustainable development.

Similar conclusions are also suggested by other studies. Thus, in terms of stages of development of national economies and their influence factors, *The Global Competitiveness Report 2011-2012* published by the World Economic Forum establishes that in stage 3 of the economic development, based on innovation factors and business sophistication, the elements of intangible capital (sub-indices of the

efficiency enhancers and of innovation) have an 80% share (Table 2), while at stage 1 the share is 40%, and 60% in stage 2, respectively. Romania is placed into development stage 2, and the share of its intangible capital in the total national wealth is 56%, according to the World Bank results.

**Table 2**

**Sub-index Weights and Income Thresholds  
for Stages of Development**

Indicators	Stages of Development				
	Stage 1: Factor-driven	Transition from stage 1 to stage 2	Stage 2: Efficiency- driven	Transition from stage 2 to stage 3	Stage 3: Innovation- driven
GDP per capita (US\$)	< 2,000	2,000-2,999	3,000-8,999	9,000-17,000	> 17,000
Weight for basic requirements sub- index	60%	40-60%	40%	20-40%	20%
Weight for efficiency enhancers sub- index	35%	35-50%	50%	50%	50%
Weight for innovation and sophistication factor sub-index	5%	5-10%	10%	10-30%	30%

Source: World Economic Forum 2012, *The Global Competitiveness Report 2011-2012*.

In the same train of ideas, *Innobarometer – EU27* considers that Romania is “a country with a modest capacity of innovation“, the reason being a low level of accumulation of intangible elements of wealth (European Commission, 2010).

How has Romania's national wealth evolved from 2000 until now? How have the processes of accumulation of national wealth been affected by the global economic crisis? Have important changes occurred in the structure of Romania's national wealth structure? What factors had the most important effects on the formation of national wealth and its components? We try to answer these questions by using an econometric model that updates the World Bank's 2006 estimated projections.

**IV. Econometric Model to Update the World Bank  
Assessment**

In order to develop the econometric model, we adopted the following working hypothesis:

- economic growth, reflected in the evolution of GDP, represents the objective support of the total national wealth (TNW);
- it is not the entire GDP that is converted into wealth, but only a fraction of it;

- as GDP is a form of income, to turn it into the capital that generated it, the operation of capitalization is performed;
- the capitalization rate should summarize the main effects of the main factors influencing the elements of wealth; these factors are determined by means of some relative indicators (coefficients, or expressed in percentages).

The capitalization function of the total national wealth (TNW) has the following form:

**Analytical:**

$$TNW_n = AC_{n-1}(1+r_n)^{f_{AC}} + NC_{n-1}(1+r_n)^{f_{NC}} + IC_{n-1}(1+r_n)^{f_{IC}} \quad (5)$$

**Algebraic:**

$$TNW_i = \sum_{j=1}^n C_{i-1,j} (1+r_i)^{f_{ij}} \quad (6)$$

If we consider the evolution of the population (6) it is corrected with the population index  $i_p$ :

$$TNW_i = \frac{\sum_{j=1}^n C_{i-1,j} (1+r_i)^{f_{ij}}}{i_p} \quad (7)$$

where:  $i-1$  = the year previous to the calculating year  $i$ ;

$j$  = capital class, that is anthropic capital AC, natural capital NC and intangible capital IC;

$f_{ij}$  = exponent that expresses the variation of the  $j$  type of capital in the year  $i$ .

$f_{ij}$  calculates AC arithmetic average of a number of indicators of efficiency (relative or percentage), which reflects the action of specific influence factors on each type of capital  $j_n$  in the year  $i$ :

- ✓  $f_{ij}$  calculates AC arithmetic average of a number of indicators of efficiency (relative or percentage), which reflects the action of specific influence factors on each type of capital  $j_n$  in the year  $i$ :

$$f_{ij} = \frac{1}{n} \times \sum_{k=1}^{j_n} f_{kj} \quad (8)$$

- ✓  $f_{kj}$  = indicator of influence factor  $k$  expressing action on item  $j$ .
- ✓  $IC_{i-1,j}$  = the capital element  $j$  in the year  $i-1$ ;
- ✓  $r_i$  = economic growth rate (GDP) in the year  $i$ ;

The  $f_{kj}$  indicators selected for calculations, per components of the national wealth, are:

**Anthropic capital indicators** ( $AC_n$ ):

$AC_1$  = gross fixed capital formation AC % in GDP;

$AC_2$  = net investment rate/gross assets;

$AC_3$  = new works and capital repairs rate/total construction works;

$AC_4$  = fleet percentage increase;

$AC_5$  = percentage increase of housing stock (in  $m^2$ ).

**Intangible capital indicators (IC<sub>n</sub>):**

IC<sub>1</sub> = % graduates of technical sciences, mathematics, physics, chemistry and biology, in total higher education graduates;

IC<sub>2</sub> = high and medium technology export rate/import HMT;

IC<sub>3</sub> = European patent rate/total patents (European + local);

IC<sub>4</sub> = % of innovative enterprises in all enterprises;

IC<sub>5</sub> = % of education and research and development-innovation expenditures in the GDP.

**Natural capital indicators (NC<sub>n</sub>):**

NC<sub>1</sub> = 1 - % extractive industries in total manufacturing industrial production;

NC<sub>2</sub> = % of environment protection expenditures in the GDP;

NC<sub>3</sub> = protected areas rate/land fund;

NC<sub>4</sub> = cultivated surface rate/arable surface;

NC<sub>5</sub> = rate of afforestation/forest.

## V. Econometric Model Testing

Based on the indicators, the exponent  $f_{ij}$  is determined. Table 3 presents the results of calculations.

**Table 3**

**Exponents  $f_{ij}$  for 2001-2009**

	2001	2002	2003	2004	2005	2006	2007	2008	2009
AC <sub>1</sub>	0.2049	0.2129	0.2152	0.2176	0.2371	0.2561	0.3039	0.3191	0.2622
AC <sub>2</sub>	0.0940	0.0951	0.0530	0.0762	0.0766	0.0957	0.0914	0.0739	0.0505
AC <sub>3</sub>	0.7350	0.7347	0.7374	0.7738	0.7500	0.7800	0.8009	0.8197	0.8026
AC <sub>4</sub>	0.0324	0.0541	0.0291	0.0115	0.0272	0.0145	0.0193	0.1304	0.0504
AC <sub>5</sub>	0.1114	0.0056	0.0060	0.0062	0.0067	0.0080	0.0104	0.0137	0.0130
$f_{AC}$	0.2355	0.2224	0.2081	0.2170	0.2195	0.2308	0.2451	0.2713	0.2357
IC <sub>1</sub>	0.2929	0.2669	0.2723	0.2586	0.2669	0.2627	0.2390	0.1216	0.1613
IC <sub>2</sub>	0.5208	0.5835	0.5351	0.5253	0.5234	0.5368	0.5162	0.5801	0.9423
IC <sub>3</sub>	0.1797	0.3782	0.5078	0.5706	0.5087	0.6116	0.7753	0.7889	0.8130
IC <sub>4</sub>	0.0121	0.0157	0.0142	0.0146	0.0127	0.0125	0.0113	0.0107	0.0103
IC <sub>5</sub>	0.0359	0.0388	0.0384	0.0369	0.0393	0.0602	0.0658	0.0647	0.0467
$f_{IC}$	0.1882	0.2566	0.2735	0.2812	0.2702	0.2967	0.3215	0.3152	0.3947
NC <sub>1</sub>	0.6437	0.8171	0.8802	0.8891	0.8415	0.9324	0.8585	0.7872	1.4047
NC <sub>2</sub>	0.0052	0.0059	0.0047	0.0062	0.0082	0.0089	0.0093	0.0095	0.0087
NC <sub>3</sub>	0.0613	0.0607	0.0634	0.0847	0.0852	0.0822	0.3719	0.3911	0.3921
NC <sub>4</sub>	0.9471	0.9577	0.9433	0.9051	0.8989	0.8356	0.8253	0.8282	0.8367
NC <sub>5</sub>	0.0021	0.0025	0.0023	0.0022	0.0022	0.0023	0.0016	0.0017	0.0016
$f_{NC}$	0.3318	0.3687	0.3787	0.3774	0.3672	0.3722	0.4133	0.4035	0.5278

Source: Own calculations, based on data from INSE, Annual Statistics of Romania 2001–2010.

The  $f_{ij}$  exponents ( $f_{AC}$ ,  $f_{IC}$  and  $f_{NC}$ ) cumulate the individual effects of the influence factors over the anthropic components, intangible and natural, of the national wealth, indicating to what extent the economic growth turned into wealth elements growth.



For 2000 (the year of reference or the first year  $i - j$ ), the World Bank presents the following values of Romania's national wealth and its components (in \$ per capita): the total national wealth – 29,113\$; the anthropic capital – 8,495\$; the intangible capital – 16,110\$ and the natural capital – 4,508\$. Starting from these data, the wealth and its elements are calculated for the 2001-2009 period (Table 4).

Table 4

**Romanian National Wealth, 2001 – 2009**

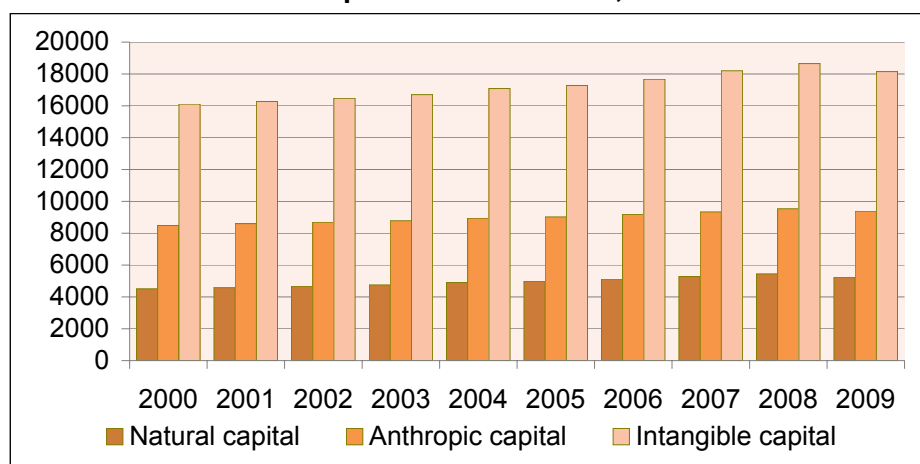
	2001	2002	2003	2004	2005	2006	2007	2008	2009
$r_i, \%$	5.3	5.0	5.2	8.5	4.2	7.9	7.3	8.1	- 6.6
$(1+r_i)^{iac}$	1.0122	1.0109	1.0106	1.0178	1.0090	1.0177	1.0174	1.0213	0.9840
$AC_n$	8,599.0	8,692.7	8,784.8	8,941.1	9,021.5	9,181.1	9,340.8	9,539.7	9,387.0
$(1+r_i)^{inc}$	1.0097	1.0125	1.0139	1.0232	1.0111	1.0228	1.0229	1.0248	0.9734
$IC_n$	16,266.7	16,470.0	16,698.9	17,086.3	17,275.9	17,669.7	18,198.0	18,649.3	18,153.2
$(1+r_i)^{inc}$	1.0172	1.0181	1.0193	1.0312	1.0152	1.0287	1.0295	1.0319	0.9646
$NC_n$	4,585.5	4,668.4	4,758.5	4,906.9	4,981.4	5,124.3	5,275.4	5,443.6	5,250.8
TNW	29,151.2	29,831.1	30,242.2	30,934.3	31,278.8	31,975.1	32,814.2	33,632.6	32,791.0

Source: Own calculations, based on data in Table 3.

The evolution of the updated values of the natural elements, anthropic and intangible, of Romania's total national wealth during the 2000 – 2009 period, presented in Figure 1, provides a basis for future research initiation connected to a series of both theoretical and methodological improvements on how to take into account the anthropic capital of companies with majority foreign capital<sup>3</sup> which expatriate most of their profits, as well as the natural capital that faces depletion for which additional estimates are necessary.

Figure 1

**Wealth Components Evolutions, 2000-2009**



<sup>3</sup> Enterprises with foreign direct investments in Romania expatriated about 2/3 of the total profits (see Zaman et al., 2011).

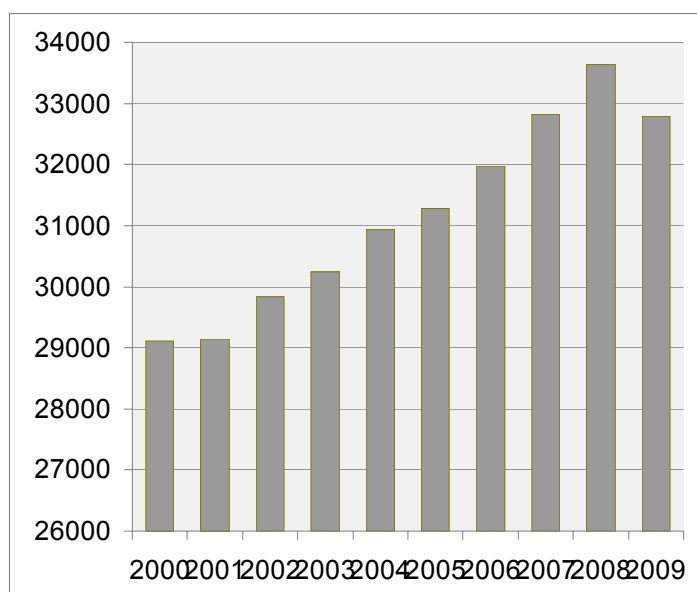
## VI. Result Analysis

The main findings of the econometric model can be summarized as follows:

- a) During 2001-2008, both Romania's total national wealth and its components have been continually increasing, benefiting from a generally upward economic dynamics. The year 2009 marks a turning point, when the upward trend of the total wealth of its components "breaks" under the impact of a negative economic growth (Figure 2).

Figure 2

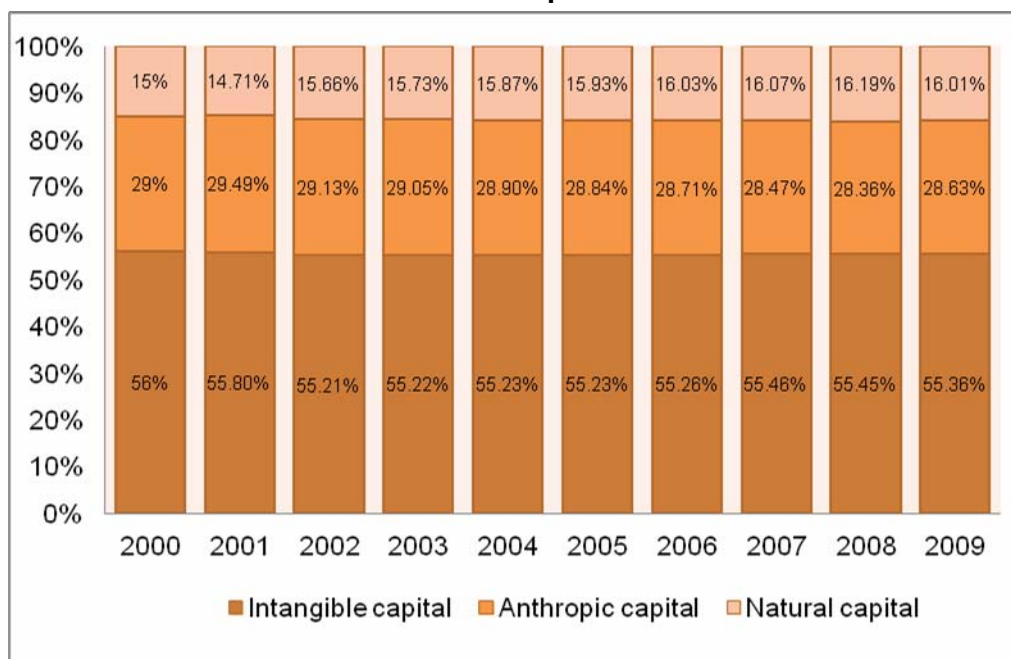
Romania's Total National Wealth Evolution, 2000 - 2009



- b) As compared to 2000, in 2008 the total national wealth increased by 15.52%, at an annual average rate of 1.94%, respectively. In 2009, the total national wealth decreased by 2.5% as compared to 2008, the last year of economic growth. The total wealth is observed both during growth period, but also in recession to show a sensitivity (elasticity) limited (below unit) in relation to relative variations (in %) of GDP. Thus, the average annual GDP increase of 1% determined a total wealth increase of about 0.3%, while the GDP's 1% decrease caused a decrease by 0.38% in the average total wealth. The result is that the total national wealth is, however, more sensitive to the decline in the GDP than to its increase, which means that also in 2010 the downward trend of the national wealth continued, since Romania's GDP continued to decrease.
- c) Developments during the 2001-2009 period have not significantly changed the structure of the national total wealth as compared to 2000. Thus, in 2008, the composition of the national wealth was as follows: anthropic capital - 28.36%, intangible capital - 55.45%, natural capital - 16.19%. Figure 3 shows the shares of various components in the total national wealth for the period 2000 to 2009.

Figure 3

The Structure of Total National Wealth per Anthropogenic, Intangible and Natural Components



- d) As far as the anthropic capital of Romania is concerned, it increased by 12.3% in 2008 as compared to 2000 (a smaller increase than that of the total national wealth - 15.52%), at an average annual rate of 1.53%. During the 2001-2008 period, the drivers of anthropic capital increase were the gross fixed capital formation and new construction works and capital repairs. The recession caused, in 2009, a 1.6% decrease in the anthropic capital as compared to 2008.
- e) As compared to 2000, the Romanian intangible capital grew by 15.76% until 2008 (a little higher growth as compared to the total wealth growth), at an average annual rate of 1.97%. During 2001-2008, the factors that contributed most to the national intangible capital were the share of the graduates from technical domains and sciences, the ratio of HMT exports to imports and the European patents. In 2009, the intangible capital decreased by 2.66% as compared to 2008 (a higher decrease than that suffered by the total wealth).
- f) The natural capital had a 20.75% growth over the 2001-2008 period as compared to 2000 (higher than that of the total national wealth and of the anthropic and intangible components), with an average annual rate of 2.59%. However, this progress was not due to a sustained effort of environmental sanitation and rational use of natural resources, but rather to the industrialization processes which emerged in that period. The natural capital gained not because it was well looked after, but because it was actually less

subject to the unfavourable action of some polluting factors. The decrease in the natural capital was 3.54% in 2009 as compared to 2008 (the highest one among the components of the total national wealth).

Table 5 presents the annual percentage modifications recorded by the total national wealth and its components over the 2001-2009 period.

**Table 5**

**The Annual Percentage Modifications of Total National Wealth and Its Components, 2001-2009**

	2001	2002	2003	2004	2005	2006	2007	2008	2009
AC	+1.22	+1.09	+1.06	+1.78	+0.90	+1.77	+1.74	+2.13	- 1.6
IC	+0.97	+1.25	+1.39	+2.32	+1.11	+2.28	+3.0	+2.48	- 2.66
NC	+1.72	+1.81	+1.93	+3.12	+1.52	+2.87	+2.95	+3.19	- 3.54
TNW	+1.31	+2.33	+1.38	+2.29	+1.11	+2.23	+2.62	+2.49	- 2.5

Source: Own calculations, based on data in Table 4.

The data in Table 5 clearly show that the economic crisis has negatively affected the process of national wealth accumulation. Among the components of total wealth, the natural capital had the highest sensitivity to crisis, although during 2001-2008 it experienced a percentage growth exceeding the relative growth of total wealth. The main cause is **a higher reduction in environmental investments**, as a result of the negative impact of the crisis on the investing process in Romania, as well as due to the decrease in the absorption level of the structural and social cohesion funds of the Environment Sectoral Operational Program. The intangible capital had approximately the same compression as the total wealth. In general, the annual percentage increases in the intangible capital during 2001-2008 were very similar to those recorded by the total wealth. But the anthropic capital proved to be the most "resilient" to the effects of economic recession, although between 2001 and 2008 the annual percentage modifications in the anthropic capital were usually lower than those observed in the case of total wealth.

In this train of ideas, the data in Table 5 show relatively small differences between the intangible capital and the total national wealth, but also between the intangible capital and the anthropic capital, which may be explained by the interference of at least two influence factors: 1) the embodied technical progress; and 2) disembodied technical progress), which, by evolution and share, have a common origin in the intangible capital, whose participation in the national wealth is dominant.

It is worth mentioning the analysis of the correlations between growth rates,  $r_i$ , and the percentage modifications of the wealth elements, on one hand, and the relative variations in the TNW and the relative variations in the AC, IC and NC, on the other hand. To this aim, we calculate the coefficient of simple linear correlation,  $r$ , the determination coefficient,  $r^2$ , and the non-determination degree,  $(1 - r^2)$  (Table 6).

As results from Table 6, it was a highly intense positive correlation during 2001-2009 between the economic growth rates and the annual percentage variations of the total wealth, of Romania's anthropic capital and intangible capital.

Table 6

**The Linear Correlations between Growth Rates and Modifications of Wealth Elements**

Correlations	$r$	$r^2$	$(1 - r^2)$	Observations
$r_i$ / TNW	0.97	0.94	0.06	Highly intense positive correlation
$r_i$ / AC	0.99	0.98	0.02	Highly intense positive correlation
$r_i$ / IC	0.9766	0.9537	0.0463	Highly intense positive correlation
$r_i$ / NC	0.8741	0.764	0.236	Medium intense positive correlation
TNW / AC	0.9721	0.9449	0.0551	Highly intense positive correlation
TNW / IC	0.9842	0.9686	0.0314	Highly intense positive correlation
TNW / NC	0.8609	0.741	0.259	Medium intense positive correlation

Yet, in the same period, we can observe a positive correlation of medium intensity between the economic growth rates and the annual percentage variations in the natural capital. We explain this medium correlation through the fact that, by content, the natural capital is defined by certain characteristics that can only be modified from the anthropic point of view to certain limits. Also, during the mentioned period, a very strong direct correlation between the variations of the total national wealth and the variations of the anthropic and intangible components can be observed. For the already presented reason, the correlation between the total national wealth and the natural capital, although direct, is one of medium intensity. These observations lead to the conclusion that, in order to stimulate the national wealth accumulation processes, priority action must be performed in the area of formation factors of the anthropic and intangible wealth components.

**VII. Conclusions**

The World Bank study *Where is the Wealth of Nations? Measuring the Capital for 21st Century* shows that the modern nations' wealth results, in an absolutely deciding way, **from the endowment with intangible capital**. The influence of the anthropic capital on the wealth accumulation is rather moderate, and the effects of the natural capital may be considered a bit more reduced. In most cases, the value of the intangible capital is a lot higher than the summed values of the anthropic and natural capitals. The more evident this ratio is the higher the development level of the country is. The intangible capital not only stimulates the economic functionality and the efficiency of the tangible capital (anthropic and natural), but also becomes extremely efficient as its substitute. The accumulation of the intangible wealth is a priority with a view to ensure sustainable competitiveness of nations.

The mentioned report finds that in 2000, Romania's national wealth was characterized by a share of 56% of intangible capital (far less than the average in the developed world), an insufficient level to support the sustainable development. This gap exposed the country to numerous structural and functional risks and vulnerabilities, especially on medium and long term. In order to answer the question "How did the total national wealth and its components evolved from 2000 to present?", we built a model for

updating the results presented in the World Bank study, based on the hypothesis that the GDP evolution represents the foundation of wealth accumulation and that GDP transformation into wealth is determined by the effects of some specific factors of intangible and natural anthropic components of the national wealth, expressed through some relative indicators. The operation of completing the time series of national wealth to the time horizon 2009 represents, in essence, the procedure of capitalization. The model has as a central pillar an exponential function, and the exponent is a rate that captures the static and dynamic impact of the factors influencing the wealth components.

The model was tested by data series for the years 2001 to 2009. The outcomes of the model application indicate a very strong link between the overall economic growth, expressed by the GDP growth rate, and the national wealth: practically, the national wealth and its elements follow the trend of the economic growth rate, increasing in 2001 until 2008, with a decrease in 2009 as a result of the economic crisis. The average annual growth of national wealth during the 2001-2008 period was 1.94%, which means that, for maintaining this rate, it would take approximately 51.5 years to double the national wealth value. Very similar dynamics were also experienced by the wealth components.

Testing the model proved that the structure of the national wealth did not suffer significant modifications from 2000 to 2009. Although Romania has recorded almost continuous economic growth, it has not succeeded in its efforts to strengthen the intangible foundations of sustainable development. Romania is still deprived of the most important source of wealth and development. Although Romania registered economic growth almost continuously during the analyzed period, we cannot assert that it managed to determine significant changes in the structure of its national wealth, so as to reduce the difference through *catching-up* (ratrapage) or "leapfrogging", as the opportunities for radical change, like, for instance, functional market economy and European Union membership could not be placed under the expected favourable auspices, also due to the beginning of the international financial and economic crisis in 2008 that directly hit by contagion an open economy like that of Romania.

In connection with the relationship between GDP and the national wealth, our calculations show a bi-univocal relation of inter-empowering or interdependence, so that the national wealth may be considered as a potential basis of the GDP and the latter as a changing factor, extra or less, of the national wealth. We intend in the future to examine in depth the relationship between national wealth and GDP, in the context of the real GDP and of the potential one (GUP gap output), so that we can find a number of comparative and competitive advantages/disadvantages, both of the national wealth of the country, and of its result, reflected in GDP, with its anthropic, intangible and environmental determinations.

The preponderance of the intangible capital, both in developed countries and developing ones, must not be understood as a neglect or reduction in importance, as regards the national wealth creation and dynamics, of the capital-product components (anthropic) or natural capital. On the contrary, these two categories of capital rather represent *sine qua non* elements of the intangible capital with which, otherwise, are in a close bi-univocal connection. The eco-economy and eco-innovation and knowledge-

based society constitute undeniable evidence in this regard. Of course that, in countries where the natural capital has a relatively high share, as in the case of some developing countries, this type of capital must be given special importance.

Considering the role of competitiveness and total productivity of factors, our future research will try to establish a link between the national wealth and GDP in accordance with the structure of the 12 pillars of global competitiveness indicator determined in the *Global Competitiveness Report 2011-2012* and presented at the World Economic Forum in Davos. According to this document, countries are divided into three categories, expressing as many stages of development. Each stage of development is characterized by a mix of factors that generate the competitiveness of the countries. Thus, for the first stage of development – “factor-driven economies” – the competitiveness drivers refer to delivering basic requirements for a functional economy: institutions, infrastructure, macroeconomic environment, health and primary education. In the case of the second stage of development – “efficiency-driven economies” – the sources of competitiveness are to be found in the system of conditions that stimulate the economic efficiency: higher education, goods market efficiency, labour market efficiency, financial market efficiency, technological dynamism and market size. The third stage of the development – “innovation-driven economies” – is dominated by factors that determine business sophistication and innovation dynamics (World Economic Forum, 2012).

Considering both the theoretical and methodological-conceptual frame of the model used for quantification of the national wealth, and its possible uses in forecasting, an interesting direction of development of the model refers to short and medium term forecasts of national wealth, complementarily using the scenario method and fuzzy set theory-derived methods, where result or effect variables (the national wealth and/or GDP) can be placed in functional dependence on different independent sizes or explanatory factors - the intangible capital, the anthropic capital and the natural capital or their subcomponents.

Continuing the research efforts regarding the dynamics and the structure of Romania's national wealth represents no intellectual *per se* exercise, but a scientific approach of certain theoretical-methodological and practical-applied value.

From methodological point of view, this approach involves the use of new categories and concepts related to applying the generational technology patterns (vintage models), the elasticity of the environmental accounts substitution, adjusted net domestic product of the environmental economy, the net current value and the social rate of return on investments, the intergenerational welfare, the sustainable national income, the increase in the intergenerational welfare, the correlation between saving, investment and future changes in consumption and production patterns, the interference and substitutability of the different assets of income generation, the micro management, the macro and world portfolios of natural resources, etc.

From practical point of view, the analysis and quantification of national wealth approach provides multiple prospective assessment tools, as well as benchmarks for founding more consistent policies, coordinated and compatible for sustainable development at national and world level, a better privatization of its economic components, social and environmental. In case the national wealth of a country

registers short, medium and long term growth, there are reasons for stating that a strong sustainable development has taken place. On the contrary, a downward trend of wealth is evidence of non-sustainable development of the economy and society and it is the duty of all stakeholders to contribute to reverse such a trend.

## Acknowledgement

This work was supported by the project "Post-Doctoral Studies in Economics: Training program for elite researchers - SPODE", co-funded from the European Social Fund through the Development of Human Resources Operational Programme 2007-2013, Contract no. POSDRU/89/1.5/S/61755“.

## References

- Albu, L. et al., 2008. *Analiza interdependențelor dintre dezvoltarea durabilă a României și a țărilor membre UE în perioada postaderării*, Editura Expert, CIDE, Academia Română.
- Axenciuc, V., 2000. *Avuția Națională a României. Cercetări istorice comparate 1860-1939*, Editura Expert, București.
- Cooke, P. and Schikstock, L., 2000. Structural Competitiveness and Learning Regions, *Entreprise and Innovation Management Studies*, 1(3), pp. 265-280.
- Dobrescu, Em., Albu, L. (coord.), 2005. *Dezvoltarea durabilă în România – modele și scenarii pe termen mediu și lung*, Editura Expert, INCE, Academia Română.
- European Commission, 2010. *Innobarometer–27. Innovation Union Scoreboard 2010*. Available at: <<http://www.proinnoeurope.eu/page/innobarometer>> [Accessed on December 2011].
- Foray, D., 2004. *The Economics of Knowledge*, MIT Press.
- INSSE, *Anualele Statistice ale României 2001 – 2010*.
- Jula, D., Albu, L. (editors), 2008. *Economics of Sustainable Development Financing Regional Development*, Editura Mustang, Bucharest.
- Lev, B., 2001. *Intangibles. Management, Measurement and Reporting*, Washington, Brooking Institution.
- López Ruiz, R.V. et al, 2011. Measurement of National Non-Visible Wealth through Intellectual Capital, *Romanian Journal of Economic Forecasting*, 3, pp. 201-209.
- Malhotra, Y., 2000. Knowledge Assets in the Global Economy: Assessment of National Intellectual Capital, *Journal of Global Information Management*, 8, pp. 5-15.
- Ricardo, D., 1959. *Opere alese*, vol.I și II, Editura Academiei Republicii Socialiste România, București.



- Shearlock, C., James, P. and Phillips, J., 2000. Regional sustainable development: Are the new regional development agencies armed with the conformation they require?, *Sustainable Development*, 8, pp. 79-88.
- Smith, A., 1992. *Avuția Națiunilor*, vol.I și II, Ed. Universitas, Chișinău.
- United Nations, 2003. *Handbook of National Accounting: Integrated Environmental and Economic Accounting – An Operational Manual*, Organizația Națiunilor Unite, New York.
- World Bank, 2007. *World Development Indicators – 2007*, Washington D.C.
- World Bank, 2006. *Where is the Wealth of Nations? Measuring the Capital for 21st Century*, Washington D. C.
- World Economic Forum, 2012. *The Global Competitiveness Report 2011-2012*. Available at: <<http://www3.weforum.org/docs/GCR2-12/1.GCR2011-2012Contents.pdf>> [Accessed on December 2011].
- Zaman, Gh., *et al.*, 2011. Aspecte ale impactului ISD din România asupra exporturilor și dezvoltării durabile (Some challenging (macro)economic aspects of FDI in Romania), *Romanian Journal of Economics*, 33(2), pp.1-60.