Model Estimates Of Gross Domestic Product In Relation to Export And Import Of Fuels, Focused on the Elasticity and Determination Of Directly and Indirectly Associated Rates

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ABSTRACT

The article is based on several interrogative assumptions related to the positive impact of the crises and the recession on determinations in the econometric models of Romania's GDP as a variable dependent in relation to the export and import of fuels. After a short introductory section, which details, in a relative manner, the overall goal and the objectives of the paper, a first section makes use of elasticity and the modern solutions of building the coefficient of elasticity, proposing an original alternative to existing variants, and afterwards the next section builds on these statistical tools in the econometric modeling of Romania's GDP, starting from the ratios and value indicators and offering a few original models where the export and import of fuels are the key initial explanatory factors. The final remarks reinterpret the role of the energy resources, as well as that of the related flows, in enhancing statistical connections, and especially the role of crises and recessions in validating econometric models, by raising their degree of predictability.

Key words*: gross domestic product (GDP) elasticity coefficient, correlation matrix, econometric model, fuel export / import.*

JEL Classification: *C15, C19, C51, C53.*

INTRODUCTION

Real Business Cycle Theory (or the RBC theory), as a variant of Business Cycle, synthesizes a whole class of macroeconomic models where

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the shocks of the cycle of business fluctuations can be counted as cases of real progress to a large extent (Rothbard, 2000), in contrast to the nominal approach, while acknowledging, and in this way quantifying, the four major economic fluctuations as being the trend (the general tendency), the cyclicality (the business cycle), seasonality (sub-annual variation) and the random tendency (residual variable impact). Recessions and periods of economic growth, in RBC theory, appear as an effective response to the exogenous changes in the actual economic environment, and Ludwig Mises and von Friedrich Hayek were among the few who empirically predicted the Great Depression (Cooley and Hansen, 1995; Diego and Gertler, 2006).

The Austrian Business Cycle Theory Applied in Rothbard's America's Great Depression Business Cycle, as well as the economic cycle, had both fervent advocates, if we merely mention Joseph Schumpeter, and vehement opponents, if we refer to Irving Fisher, who also set up an entire theory of fluctuations in business, called the Theory of Business Fluctuations (TBF).

The topic of Business Cycle has become an important subject of analysis and econophysics, too, although there are significant precedents with Louis Bachelier or Benoit Mandelbrot; the emergence of such outstanding econophysicists as Rosario Mantegna and Eugene Stanley allowed analyzing over one million records of stock market indices to find that the real economic value has a special distribution, which deviates from the classical or Gaussian one, without however being able to identify a standard mathematical model of the business cycle (Mantegna, Stanley, 1999; Săvoiu, 2012). All those approaches have virtually suggested the primary aim of the present paper, which deals with a model of Romania's GDP in keeping with several explanatory factors, or else independently, in connection with the resources, for a period in the country's economy that was affected by crisis or recession.

Recession or crisis are part of the RBC theory, and they generate and augment conflicts. The standard, relatively dominant picture of crisis or recession seems to come near that of a state of conflict, or a disease of the economy, entirely similar to medical approaches, and, practically like any conflict or disease, crisis and recession have a solution, which occurs in two phases or stages. During the first phase (the so-called cold phase) of the active conflict or disease, when physically or materially, there occur specific cellular disorders, and the psyche and the autonomic nervous system are facing unexpected situations, the whole body, switched into a phase of stress, reorients itself in order to be able to cope with the conflict or disease as such. The sufferer's mind becomes increasingly more concerned with the content of the conflict or disease, occurring sleep disturbances and lack of appetite; attention focuses on the conflict or disease, and the additional mental

and physical activity seeks to generate the optimal conditions to resolve the conflict or disease in an optimal manner. This phase is called *cold* because of the presence of actions that are uncertain, unstable and oscillating, tending towards the extremities. During stress period, there occurs the constricting of the blood vessels, and the specific symptoms of conflictuality become the *cold extremities* of the body (especially the hands) and the *instability* that has set in (shivering and cold sweat.). The longer the cold state of the disease, the greater the risk that the consequences are possibly fatal; and, by extension, the longer *the cold phase* of the crisis or recession gets, the more evidently the economy feels it is dependent on vital resources and essential activities, on their continuity.

In the second stage, when treatment and solutions are already present and available, the body or the economy relax and adjust themselves, while everything returns to a higher temperature, and to the stability that is specific to normality. This latter stage may be termed the *hot phase* of the conflict or the disease, when solutions have already been put into practice, and are yielding results (the economy heats up, returning to normality, and the body regains its existential stability).

The life cycle, from hot to cold, and the cycle of creativity, from expansion to contraction, the cycle of activities and products, the geological cycle or the demographic cycle, they are all realities and certainties of the modern world, capable of altering the process of human mind and thinking, the health of the individual, but also the internal conflictive character of the economies. The warm or hot phase and the cold phase, expansion and contraction, prosperity and decline, represent the two sides, reverse and obverse, of the economy, the relaxation and the stress of economic conflict, revealing cyclical fluctuations caused by the gradual accumulation of decisions, solutions, correct or incorrect behaviours, be it financially, monetary, or investment- and management-wise, having major consequences in resource allocation at the national or global economy (Săvoiu, 2013). This means either a natural continuity, if we refer to prosperity, or a system short-circuit, when it comes to recession, changing the mechanism of resource allocation, price dynamics, freedom of competition, which all coordinate the economic activity of billions of people. Everywhere in the world economy, conflict seems to start from the tendency to impose a historical limit on resources. Starting from these already mentioned resources, which are nearly always a challenging issue, the authors felt the need to proactively reshape the macro-aggregates of the economy, both as main outputs, and as key dependent variables, by having recourse to: Gross Domestic Product (GDP), Final Consumption (FC), gross capital investments, or Gross Fixed Capital Formation (GFCF), while

fuels, in their characteristic import and export flows, synthesized the major independent factor.

What preoccupied the thinking of the authors of the present article was an attempt to simplify or reduce modelling in a *caeteris paribus* manner, based on explanatory factors, and going as far as the periodization or length of analysis, as a limit of the profound senses of estimating the mechanism of the economy. *What happens if the cold phase is eliminated from the life cycle of the organism? This was essentially the first interrogative hypothesis, and the quantification of the level of heating needed by the economy was studied with the statistical instrumental simplicity of the elasticity coefficients. Does the cold phase affect modelling itself, as well as the vitality and intensity of the associations in the model? This was the second interrogative hypothesis, and the authors' propensity towards eliminating it, or keeping it in two types of econometric models, is revealing.*

FROM ELASTICITY TO THE COEFFICIENT OF ELASTICITY

Statistical and econometric literature brings together a set of tools, techniques and models, both classic and modern, relating to flows of exports and imports, and also to the increasingly intense factor dependence of macro-aggregates of the GDP, FC or GFCF type in fuels, especially those based on oil. One of the first econometric models, accused of apparent perishability, though in fact an example of development with emphasis on permanent diversification and modelling based on factorial reductionism (as a rule, on a single explanatory factor, which increases its character of a *caeteris paribus* model, and also of a type of modelling successively focused on one single hypothesis of explanatory variable) was, and has remained, the *model of elasticity* and the *elasticity coefficient* (Săvoiu, 2001; 2013a). Elasticity represented a pre-classical econometrics model, as early as 1838, as intuited by A. Cournot, and authenticated by A. Marshall in 1885, through the coefficient of elasticity, prior to the emergence of econometrics as a multidisciplinary science. Conceptualized exhaustively in economics, elasticity, appearing in a famous PhD thesis by Derycke, entitled *Élasticité et analyse économique* (Derycke, 1964), as *a ratio of relative variations which shows the change of a (qualitative) variable as an action concurrent or prior to another (quantitative) variable*, while Jan Tinbergen redefined it, statistically and econometrically, as *a measure of the absolute and relative mobility of a phenomenon, in relation to another one, with which it is in a natural relation*, thus emphasizing the paramount importance of correlating or combining the two variables or the

two factors analysed. Elasticity, generalized at the level of the fabric of the transactions in a national economy, such as that of Romania, and in the space of the modern statistical and econometric thinking, can express the sensitivity and reactivity of a consequential or dependent variable (GDP, FC, GFCF, etc.) to the change in other explanatory variables or independent factor (fuel export, fuel import, etc.), and so macroeconomic behaviour is explained and quantified through variables placed in a complex statistical and econometric causality. In a strictly mathematical manner, the elasticity of demand is quantified via the elasticity coefficient calculated using a point or portion of the elasticity curve function *y = f(x)*. *Elasticity* was considered a standard form of non-proportionality, in the sense of *algebraic non-equivalence* between the relative changes of two variables: *y*, or dependent (GDP, FC, GFCF, etc.) and *x*, or factorial (export or import of fuel, etc.).

Non-equivalence is expressed by the manner of determining a coefficient of elasticity different from |±1|. Hence, the mathematical solution immediately appears of the resulting equation, in a relatively simple manner, namely if:

$$\Delta y / y \neq \Delta x / x \tag{1}$$

This can also be re-written as:

$$\frac{\Delta y}{y} = \lambda_{(y/x)} \times \frac{\Delta x}{x} \tag{2}$$

hence the value of the elasticity coefficient promptly appears:

$$\lambda_{(y/x)} = \frac{\Delta y}{y} : \frac{\Delta x}{x} \tag{3}$$

The elasticity coefficient of variation quantifies, for an illustration, the ratio between the variation of the dependent feature (general result as *demand* or GDP, FC, GFCF, etc.) and the variation of the factor variable, or independent variable (*price* or *income*, export or import of fuel, etc.) which allows to express it, as well, as a function of the elasticity of demand y = f(x) transposed in c = f(p) or c = f(v):

$$\lambda_{(c/p)} = \frac{\Delta c}{c} : \frac{\Delta p}{p} \quad \text{and} \quad \lambda_{(c/v)} = \frac{\Delta c}{c} : \frac{\Delta v}{v} \quad \text{where: } \Delta p \to 0 \text{ and } \Delta v \to 0 \tag{4}$$

The elasticity coefficient can also be determined as the ratio of the marginal value and the mean value:

$$\lambda_{(c/p)} = \frac{dc}{dp} : \frac{c}{p} \text{ and } \lambda_{(c/v)} = \frac{dc}{dv} : \frac{c}{v} \text{ or } \lambda_{(c/p)} = \frac{\Delta c}{\Delta p} : \frac{c}{p} \text{ and } \lambda_{(c/v)} = \frac{\Delta c}{\Delta v} : \frac{c}{v} \text{ where: } \Delta p \to 0 \text{ and } \Delta v \to 0 \tag{5}$$

The elasticity coefficient can also be calculated directly from an elastic function y = f(x), being defined by a ratio between the logarithmic derivative of y and the logarithmic derivative of x:

$$\lambda_{(c/p)}=\frac{d(\log c)}{d(\log p)}=\frac{dc}{c}:\frac{dp}{p}=\frac{dc}{c}\cdot\frac{p}{dp}=\frac{dc}{dp}\cdot\frac{p}{c} \quad \text{where: } dp\to 0 \tag{6}$$

and

$$\lambda_{(c/v)}=\frac{d(\log c)}{d(\log v)}=\frac{dc}{c}:\frac{dv}{v}=\frac{dc}{c}\cdot\frac{v}{dv}=\frac{dc}{dv}\cdot\frac{v}{c} \text{ where: } dv\to 0 \tag{7}$$

In the case presented in formulas 4.5 and 6.7, economic demand represents the dependent variable y, and price and income are the explanatory factors x (complementing the factor name λc/p și λc/v, thus becoming the *coefficients of elasticity-price* or *elasticity-income* of the demand (Pitchford, 1960; Trebici,1985; Săvoiu, 2001; Isaic-Maniu, 2003).

By analogy, one can also build annual coefficients of elasticity for GDP, FC, GFCF, in keeping with the export or import of fuels, one can model and analyse the main macro aggregates (Cooley and Hansen, 1995; Klump and de La Grandville, 2000; Diego and Gertler, 2006; Brett Goldfarband Li, 2013; Assous, Bruno & Legrand, 2014).

Making use of the theory of time series, and its relative indicators, another two simple ways of practical determination are deduced, which are strictly connected with the existence of databases expressed in indexes or rates, $\lambda_{(y/x)}=\frac{\Delta y}{y}:\frac{\Delta x}{x}$ turns into:

$$\lambda_{(y/x)}=R^{y}_{(\%)}/R^{x}_{(\%)} \tag{8}$$

Thus the coefficient of elasticity becomes a *mere ratio of rates* (Demetrescu, 1967) and the coefficient of *elasticity-price* is transcribed as $\lambda_{(c/v)}=R^{c}_{(\%)}/R^{v}_{(\%)}$ and the coefficient of *elasticity-income* as $\lambda_{(c/p)}=R^{c}_{(\%)}/R^{p}_{(\%)}$.

The coefficient of elasticity can also be expressed through indices:

$$\lambda_{C/V}=\frac{\Delta C_{1/0}}{C_0}:\frac{\Delta V_{1/0}}{V_0}=\frac{C_1-C_0}{C_0}:\frac{V_1-V_0}{V_0}=\frac{I^{C}_{1/0}-100}{I^{V}_{1/0}-100} \tag{9}$$

where $I^{C}_{1/0}, I^{V}_{1/0}$ are the indices of demand and income, or

$$\lambda_{C/P}=\frac{\Delta C_{1/0}}{C_0}:\frac{\Delta P_{1/0}}{P_0}=\frac{C_1-C_0}{C_0}:\frac{P_1-P_0}{P_0}=\frac{I^{C}_{1/0}-100}{I^{P}_{1/0}-100} \tag{10}$$

where $I^{C}_{1/0}, I^{P}_{1/0}$ are the indices of demand and prices (Săvoiu, 2013a).

The significance of the coefficients of elasticity-price and elasticity-income describes, in a contrary way, the same economic reality. Thus, the coefficient of *elasticity-price of demand* is an investigative tool that expresses the percentage the demand changes with when there is a 1% variation of the price (the transcription is preceded by the "minus" sign), and the coefficient of *elasticity-income of demand* expresses the percentage of the change in demand when there occurs a 1% variation of the income (the transcription is preceded by the "plus" sign).

THE ELASTICITY OF GDP IN ROMANIA'S ECONOMY IN RELATION TO OVERALL EXPORTS / IMPORTS, AND SPECIFICALLY IN FUELS

Within the context of correctly identifying the rates of the evolution of the macro-aggregates GDP, FC, GFCF compared to the evolution of rates X, Xb, M, Mb, and also the evolution of fuel import and export in the Romanian economy, we can determine the elasticity coefficients based on a database, which is expressed directly in rates, of the economy between 1996 and 2014. At first, it appears that overall, during the 19-year period, the average rate of nominal GDP was 9.09%, reflecting the 11.88% increase in nominal export, that of nominal import was 10.98%, and final consumption in current prices increased by 8.63%, and the gross fixed capital all, again in current prices, by 9.48% (with flawed developments in the crisis and deep recession years 1999 and 2009, yet with a significant economic recovery between 2005 and 2007), while actual increases, or increases in comparable prices, are significantly lower (the average growth value, based on the real GDP growth index in the last 25 years in Romania, was around 1%).

The most visible change (increase or decrease) can be seen in the import and export of mineral fuels, which together lead to an elasticity having deeper modelling implications. In this respect, it proved useful to determine the specific elasticity of GDP (*exemplified here as a calculation relationship by:* λ *(Xfuel/GDP =* R_{Xfuel}/R_{GDP}*)*, and the results are outlined below (Table 1).

The annual elasticity coefficients in Romania's economy quantified as a ratio of rates

Table 1

Coefficients of elasticity of GDP detailed, as compared to:						
Year	Exports of goods and services (FOB)	Exports of goods (FOB)	Imports of goods and services (CIF)	Exports of goods (CIF)	Export of mineral fuels (FOB)	Import of mineral fuels (CIF)
1996	2.99	2.77	8.46	8.88	-1.28	7.68
1997	1.84	2.09	1.25	1.29	-0.47	-0.19
1998	-0.21	-0.08	0.21	0.28	-1.33	-1.80
1999	-1.13	-1.01	0.47	0.57	-1.29	2.48
2000	2.08	2.03	2.07	2.16	5.32	3.65
2001	1.07	1.01	1.65	1.78	-0.16	2.39
2002	2.02	2.16	1.10	1.21	6.34	-0.58
2003	0.75	0.73	1.36	1.46	-1.40	1.18
2004	1.23	1.35	1.45	1.48	1.59	2.17
2005	0.67	0.57	0.85	0.78	2.79	1.50
2006	0.86	0.73	1.12	1.12	0.41	0.94
2007	0.58	0.51	0.94	0.94	-0.50	-0.01
2008	0.36	-0.63	0.37	0.18	2.74	2.15
2009	0.91	0.71	1.87	2.12	2.82	3.16
2010	4.60	6.84	3.76	5.23	2.70	5.71
2011	3.86	4.34	3.10	3.40	5.96	6.01
2012	11.90	23.09	1.39	2.50	-21.10	50.62
2013	1.82	0.71	0.39	0.65	0.39	-2.32
2014	1.93	1.61	1.62	0.61	5.16	-0.02

Source: The data were processed by the authors, based on the calculation relationships above and the Eurostat Database[online] available at: http://ec.europa.eu/eurostat/data/database.

Note:* To calculate the elasticity coefficients of other macro-aggregates, GDP was substituted, for illustration, by FC and GFCF, and the results were detailed in Table 1 in Appendix 1.

A special case is that of *cross-elasticity* or *transverse elasticity*, a case that is underlain by the possibility of calculating a coefficient of elasticity of demand in the situation of an *x* commodity, in keeping with the change in the price of a *y* commodity. The classic calculation formula is:

$$\lambda_{(q_x/p_y)} = \frac{\Delta q_x}{\Delta p_y} : \frac{q_x}{p_y} = \frac{\Delta q_x}{\Delta p_y} \times \frac{p_y}{q_x} = \frac{\Delta q_x}{q_x} : \frac{\Delta p_y}{p_y} \quad \text{or} \quad \lambda_{(q_x/p_y)} = R^{qx} : R^{py} \quad (11)$$

This relationship can be adapted, for example, also for the macroeconomic result (GDP, FC, GFC, etc.) depending on the total export and import of an economy, or depending on the fuel export and import. Interpreting cross-elasticity or transverse elasticity considers five different situations (Case and Fair, 1999):

1. if $\lambda=\infty$, the demand and the macroeconomic result are perfectly elastic, and a minimal change in price or a factor change results in a maximum change in the amount or result;

2. if $\lambda>1$, the demand and the macroeconomic result are elastic, a change in price or a factor change results in a supra-proportional change in the quantity or result, the products or independent factors being in a state of rivalry, or substitutable products (e.g. honey and sugar, import or export of fuels);

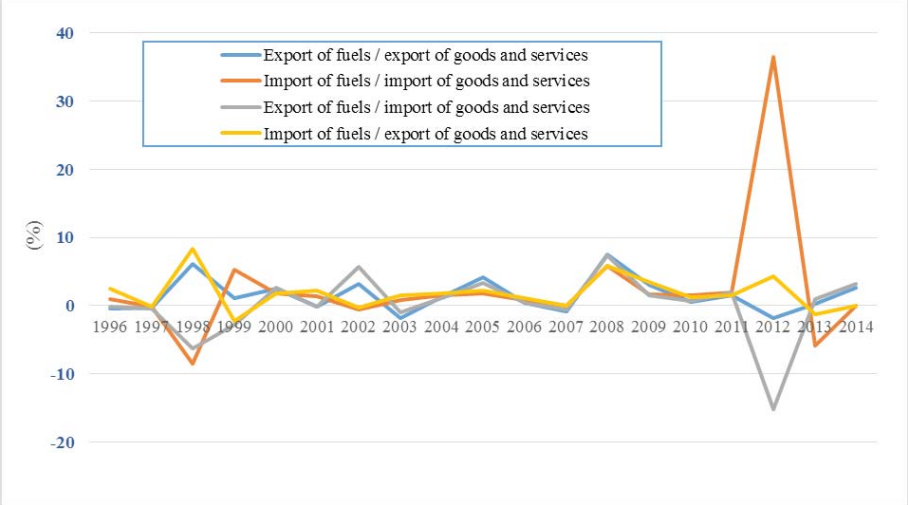
3. if $\lambda=1$, the demand and the macroeconomic result are *unitary-elastic*; a change in price or a factor change by 1% results in an identical change in quantity or result;

4. if $\lambda<1$, the demand and the macroeconomic result are inelastic; a change in price or a factor change results in a sub-proportional change in the quantity or result, the products or factors being in a state of complementarity, or solidary (car and petrol, import or export of fuels).

5. if $\lambda = 0$, the demand and the macroeconomic result are inelastic; a maximum price change or a factorial change do not result in a change in the amount or result, and the products or factors are independent (a situation of inelasticity).

Coefficients of cross-elasticity connected with overall export / import, and export / import of fuels in the Romanian economy between 1996 and 2014

Figure 1



The chart displayed in Figure 1 shows an increase in elasticity after the prolonged crisis and the global recession that followed the Romanian economy after 2008, both in terms of coefficients of cross-elasticity of fuel import / overall import, and in terms of fuel export / import, exceeding the

usual values for two decades in an excessive and compensatory manner (the data from Table 2 in Appendix 1 describe these special developments).

ECONOMETRIC MODELS FOCUSED ON RATES AND ELASTICITIES IN THE ROMANIAN ECONOMY

Econometric modelling based on elasticity coefficients, generating classical models, does not represent a phenomenon ended, which can be illustrated by the mere solution offered in this paper, apt to generate new elasticity coefficients and new models, which the latter can extract or derive from the real world. This paper will provide below a number of high-performance models in point of constructive determination based on a concept of elasticity substantiated by determination or the values of R^2, extracted directly from the correlation matrices (where the value of R is presented). Statistical correlation and regression are essential in the processes of identifying, selecting and modelling the factorial connections in economy, which finally provide the simplest and most efficient indicator through the correlation ratio Ry/x:

$$R_{y/x} = \sqrt{R^2_{y/x}} = \sqrt{1 - \frac{\sum_{i=1}^{n} \left(y_i - Y_{x_i}\right)^2}{\sum_{i=1}^{n} \left(y_i - \bar{y}\right)^2}} \tag{12}$$

or

$$R_{y/x} = \sqrt{D} \tag{13}$$

hence, eventually

$$|R_{y/x}| \in (0,1] \tag{14}$$

Rapid factor identification is achieved through correlation matrices with a single R, the generator of R-squared (R^2) in econometric models. *The interpretation of the determination is that of explanatory variation compared to another variation of the result, and in the context of two distinct variables, defined by ratios, determination conceptualizes in a much deeper manner elasticity as measurable association or correlation of the relationships of characteristic rates*. The correlation matrix of the rates in Romanian economy between 1996 and 2014 contains these types of deep elasticities, and also allows subsequent modellings focused on the statistical tools described and the information drawn from them (Table 2).

Correlation matrix of the rates of the main macroaggregates expressed in nominal rates

Table 2

	GDP	Exports of goods and services (FOB)	Exports of goods (FOB)	Imports of goods and services (CIF)	Imports of goods (CIF)	Exports of fuels (FOB)	Imports of fuels (CIF)	FC	GFCF
	SER01	SER02	SER03	SER 04	SER05	SER06	SER07	SER08	SER09
SER01	1.000000	0.540258	0.381985	0.792680	0.750186	0.458764	0.559063	0.973412	0.885559
SER02	**0.540258**	1.000000	0.923102	0.863208	0.873457	0.759431	**0.787393**	0.434732	0.688476
SER03	0.381985	0.923102	1.000000	0.780558	0.820637	0.607965	**0.691234**	0.326554	0.514521
SER 04	**0.792680**	0.863208	0.780558	1.000000	0.989515	**0.630947**	0.843220	0.746792	0.888216
SER05	**0.750186**	0.873457	0.820637	0.989515	1.000000	**0.590990**	0.825852	0.707810	0.846486
SER06	0.458764	**0.759431**	**0.607965**	0.630947	0.590990	1.000000	0.773560	0.371668	0.530125
SER07	**0.559063**	0.787393	0.691234	**0.843220**	**0.825852**	0.773560	1.000000	0.493279	0.737844
SER08	**0.973412**	0.434732	0.326554	**0.746792**	**0.707810**	0.371668	0.493279	1.000	0.794444
SER09	**0.885559**	0.688476	0.514521	**0.888216**	**0.846486**	0.530125	**0.737844**	0.794444	1.000

Source: Calculations made based on Eurostat data [online] available at: http://ec.europa.eu/eurostat/data/database.
Software used Eviews.

In analysing the interdependencies with potential predictive valences, the first category is represented by the multifactor models derived from the monitoring of the interdependence of GDP rate and import / export along the axis of the dominance of fuels trade. This type of analysis allows retracing and forecasting the values of a variable that can use the information contained in the values of another variable, with which it is related. First, the rates were selected that were derived from the nominal indices specific to the three indicators in the sphere of foreign trade in correlation with the rate of GDP during 1996-2014 (SER04, or the series of the annual rate of imports of goods and services -CIF, SER05, or the series of the annual rate of imports of goods –CIF, and SER06, or the series of the annual rate of exports of mineral fuels FOB). The first two high-efficiency models are focused on the simultaneous elasticity of the GDP rate (SER01) in keeping with the rate of the import of goods and services (CIF) or SER04 and the rate of export of mineral fuels (FOB), or SER06, i.e. in keeping with the rate of the import of goods (CIF), or SER05 and the rate of the export of mineral fuels (FOB), or SER06, models that were slightly improved with coefficients and free terms (Figure 2).

High-efficiency econometric models focused on the simultaneous elasticity of the rate of GDP in keeping with the rates of export and import

Figure 2

Ist model based on SER04 and SER06

Dependent Variable: SER01 Method: Least Squares				
Sample: 1996 2014 Included observations: 19				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.352263	2.202390	1.068050	0.3013
SER04	0.642174	0.150314	4.272216	0.0006
SER06	-0.021958	0.062510	-0.351264	0.7300
R-squared	0.631186	Mean dependent var		9.676316
Adjusted R-squared	0.585084	S.D. dependent var		11.49117
S.E. of regression	7.401918	Akaike info criterion		6.985295
Sum squared resid	876.6143	Schwarz criterion		7.134417
Log likelihood	-63.36030	F-statistic		13.69113
Durbin-Watson stat	1.472716	Prob(F-statistic)		0.000342

IInd model based on SER05 and SER06

Dependent Variable: SER01 Method: Least Squares				
Sample: 1996 2014 Included observations: 19				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.173642	2.339799	1.356374	0.1938
SER05	0.522519	0.145386	3.594025	0.0024
SER06	0.007565	0.065430	0.115622	0.9094
R-squared	0.563144	Mean dependent var		9.676316
Adjusted R-squared	0.508537	S.D. dependent var		11.49117
S.E. of regression	8.055814	Akaike info criterion		7.154605
Sum squared resid	1038.338	Schwarz criterion		7.303726
Log likelihood	-64.96874	F-statistic		10.31267
Durbin-Watson stat	1.284361	Prob(F-statistic)		0.001326

Software used EViews

If the years are extracted the value impact of which was profoundly negative on the growth of GDP (1999 and 2009 in the table of rates – Table 3 in Appendix 1), we find that without these values, the data reveal an evolution that is not influenced in any major way by the crisis or recession, and the new correlation matrix becomes the expression of a significant attenuation, tending to limit of an average intensity of the determination (R^2 moves towards ever smaller values: 0.342 and 0.286, respectively) as rates of GDP elasticity compared to fuel export and import. The trend is very interesting that is revealed by these data for Romania's economy: a positioning in temporal contexts that are not influenced by the crisis or the recession, for a determination that tends to 0.25, which shows R values of the 0.5 type, or at the limit of the average intensity of both fuel exports and fuel imports compared to GDP pace (Table 3).

Correlation matrix of the rates of the main macroaggregates expressed in nominal rates, excluding 1999 and 2009

Table 3

	GDP	Exports of goods and services (FOB)	Exports of goods (FOB)	Imports of goods and services (CIF)	Imports of goods (CIF)	Exports of fuels (FOB)	Imports of fuels (CIF)	FC	GFCF
	SER01	SER02	SER03	SER 04	SER05	SER06	SER07	SER08	SER09
SER01	1.000000	0.358647	0.187366	0.624733	0.538128	0.341723	0.285926	0.951080	0.800243
SER02	0.358647	1.000000	0.910220	0.836459	0.856754	0.705714	***0.727833***	0.190153	0.607877
SER03	0.187366	0.910220	1.000000	0.767746	0.837261	0.527606	***0.622639***	0.106345	0.395635
SER 04	0.624733	0.836459	0.767746	1.000000	0.977754	***0.564210***	0.761939	0.537993	0.834417
SER05	0.538128	0.856754	0.837261	0.977754	1.000000	***0.501603***	0.732879	0.457792	0.757436
SER06	**0.341723**	**0.705714**	**0.527606**	0.564210	0.501603	1.000000	0.754140	0.214177	0.450339
SER07	**0.285926**	0.727833	0.622639	**0.761939**	**0.732879**	0.754140	1.0000	0.180096	0.594846
SER08	0.951080	0.190153	0.106345	0.537993	0.457792	0.214177	0.180096	1.0000	0.640627
SER09	0.800243	0.607877	0.395635	0.834417	0.757436	0.450339	0.594846	0.640627	1.000

Source: Calculations made based on Eurostat data [online] available at: http://ec.europa.eu/eurostat/data/database.
Software used Eviews.

While R values of 0.705714 and 0.761939 stress the dominance of fuels in Romanian exports and imports, the values of 0.341723 and 0.285926 stress that, in the evolving context that excludes crisis or recession (the cold phase), the organism of the economy loses some of the intensity of the correlation imposed by the conflictive character of the resources. In other words, the crisis and the recession in Romanian economy became factors that boost direct and indirect (cross) elasticities between export and import flows, but also the special ones, between fueld export and GDP, respectively between fuel import and GDP. The econometric artificial technique of excluding the years of major impact of the crisis and recession (1999 and 2009) also produces changes signifying diminution, up to the disappearance of the significance of value models of GDP focused on export or import of fuels. The statistical analysis of confrontation of the values of R-squared for the models resulting from databases containing, or on the contrary excluding, *the years of crisis and deep recession (1999 and 2009) becomes an interesting one, having important consequences for the originality of this research focused on the principle of caeteris paribus applied in this specific context not to the factors, but the records made in databases*.

A relevant example exploits bi-factorial models focused on simultaneous elasticity of fuel export and import as explanatory factors of GDP, a model that is easy to improve with coefficients (free terms). In Figure

3 the radical change can be seen of the values of R-squared and the collapse of F-statistic in both models compared (Voineagu et al, 2007; Andrei et al. 2008; Săvoiu, 2009).

Econometric models confronted in a context of crisis or recession, and out of such a context

Figure 3

Dependent Variable: SER01 – GDP rate Method: Least Squares
Sample: 1996 2014 Included observations: 19

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.352263	2.202390	1.068050	0.3013
SER 04	0.642174	0.150314	4.272216	0.0006
SER06	-0.021958	0.062510	-0.351264	0.7300
R-squared	**0.631186**	Mean dependent var		9.676316
Adjusted R-squared	**0.585084**	S.D. dependent var		11.49117
S.E. of regression	7.401918	Akaike info criterion		6.985295
Sum squared resid	876.6143	Schwarz criterion		7.134417
Log likelihood	-63.36030	F-statistic		13.69113
Durbin-Watson stat	1.472716	Prob(F-statistic)		0.000342

Note: SER04 = Import rate of goods and services (CIF)
SER06 = Export rate of Fuels (FOB)

Dependent Variable: SER01 – GDP rate Method: Least Squares
Sample: 1 17 (Included observations: 17 - without 1999 and 2009

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.389671	3.232399	1.358023	0.1959
SER04	0.519721	0.207291	2.507205	0.0251
SER06	-0.004036	0.064641	-0.062442	0.9511
R-squared	**0.390461**	Mean dependent var		12.25412
Adjusted R-squared	**0.303384**	S.D. dependent var		8.955174
S.E. of regression	7.474303	Akaike info criterion		7.019604
Sum squared resid	782.1129	Schwarz criterion		7.166642
Log likelihood	-56.66663	F-statistic		4.484091
Durbin-Watson stat	1.462998	Prob(F-statistic)		0.031262

Note: SER04 = Import rate of goods and services (CIF)
SER06 = Export rate of Fuels (FOB)

Dependent Variable: SER01 – GDP rate Method: Least Squares
Sample: 1996 2014 Included observations: 19

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.173642	2.339799	1.356374	0.1938
SER05	0.522519	0.145386	3.594025	0.0024
SER06	0.007565	0.065430	0.115622	0.9094
R-squared	**0.563144**	Mean dependent var		9.676316
Adjusted R-squared	**0.508537**	S.D. dependent var		11.49117
S.E. of regression	8.055814	Akaike info criterion		7.154605
Sum squared resid	1038.338	Schwarz criterion		7.303726
Log likelihood	-64.96874	F-statistic		10.31267
Durbin-Watson stat	1.284361	Prob(F-statistic)		0.001326

Note: SER05 = Import rate of goods (CIF)
SER06 = Export rate of Fuels (FOB)

Dependent Variable: SER01 – GDP rate Method: Least Squares
Sample: 1 17 (Included observations: 17 - without 1999 and 2009

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.804412	3.378292	1.718150	0.1078
SER05	0.376801	0.199260	1.890997	0.0795
SER06	0.024537	0.066278	0.370220	0.7168
R-squared	**0.296470**	Mean dependent var		12.25412
Adjusted R-squared	**0.195966**	S.D. dependent var		8.955174
S.E. of regression	8.029922	Akaike info criterion		7.163012
Sum squared resid	902.7150	Schwarz criterion		7.310049
Log likelihood	-57.88560	F-statistic		2.949824
Durbin-Watson stat	1.224446	Prob (F-statistic)		0.085306

Note: SER05 = Import rate of goods (CIF)
SER06 = Export rate of Fuels (FOB)

Software used EViews

Crises and economic recession periodically bring into the focus, in the Romanian economy, the importance of fuel export and import, which are necessary for the operation of this complex economic fabric of transactions of great variety.

A correlation matrix for the period 1995-2014, focused on value indicators, simplifies a construction of econometric models and induces some final performances. Within this context, which provides coverage for a period of 20 years, there are a few (one- and two-factor) models that have a reasonable future as forecast tools, and are useful in benchmarking or confrontation analyses. However, their validity is questionable in evolution periods having no significant impact of crises and economic recessions, as was demonstrated above. What was associated and correlated more intensely was the value of the two indicators related to international fuel trade in correlation with the value of GDP (SER01) during 1995-2014 (this time, out of a total of 23 distinct variables, those which were selected as more detailed factorial variables were SER18 or the value of the exports of fuels and mineral oils, including bitumen

materials - FOB and SER19 or the value of imports of mineral fuels, lubricants and related materials - CIF).

It appears that SER01 or GDP, this time in terms of value, can be more efficiently modelled in keeping with SER18 and SER19, whether in uni-factorial or bi-factorial models (Figure 4):

Value econometric models of GDP focused on export and import of fuel

Figure 4

Dependent Variable: SER01 GDP Method: Least Squares				
Sample: 1995 2014Included observations: 20				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.40517	7.313419	2.106425	0.0495
SER18)	0.004290	0.000393	10.92405	0.0000
R-squared	0.868934	Mean dependent var		83.26345
Adjusted R-squared	0.861652	S.D. dependent var		46.41009
S.E. of regression	17.26230	Akaike info criterion		8.629567
Sum squared resid	5363.767	Schwarz criterion		8.729140
Log likelihood	-84.29567	F-statistic		119.3349
Durbin-Watson stat	1.115011	Prob(F-statistic)		0.000000

Dependent Variable: SER01-GDP Method: Least Squares				
Sample: 1995 2014Included observations: 20				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.467032	8.410828	0.412211	0.6851
SER19	0.021543	0.002009	10.72476	0.0000
R-squared	0.864683	Mean dependent var		83.26345
Adjusted R-squared	0.857165	S.D. dependent var		46.41009
S.E. of regression	17.54001	Akaike info criterion		8.661486
Sum squared resid	5537.737	Schwarz criterion		8.761059
Log likelihood	-84.61486	F-statistic		115.0205
Durbin-Watson stat	1.275764	Prob(F-statistic)		0.000000

Dependent Variable: SER01 -GDP Method: Least Squares				
Sample: 1995 2014 Included observations: 20				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.901380	8.199153	0.963682	0.3487
SER18	0.002304	0.001212	1.900249	0.0745
SER19	0.010507	0.006104	1.721466	0.1033
R-squared	0.888390	Mean dependent var		83.26345
Adjusted R-squared	0.875259	S.D. dependent var		46.41009
S.E. of regression	16.39144	Akaike info criterion		8.568877
Sum squared resid	4567.550	Schwarz criterion		8.718237
Log likelihood	-82.68877	F-statistic		67.65772
Durbin-Watson stat	1.245429	Prob(F-statistic)		0.000000

Software used EViews

Final consumption (hereinafter SER20) and gross investments or Gross fixed capital formation (SER21) correlates with import and export of fuels (previously described by SER18, the value of the export of fuels and mineral oils, including bituminous materials - FOB and SER19, or the value of the import of mineral fuels, lubricants and related materials - CIF), generating themselves econometric models in an even more efficient, successful manner than the previous ones, which is a rational thing in view of the axis of elasticity, which is more clearly pronounced in these cases (Figure 5 and Figure 6):

Value econometric models of Final Consumption (FC) focused on export and import of fuel

Figure 5

Dependent Variable: SER20 FC Method: Least Squares				
Sample: 1995 2014 Included observations: 20				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.59421	5.228289	2.982661	0.0080
SER18	0.003265	0.000281	11.63110	0.0000
R-squared	0.882570	Mean dependent var		67.24525
Adjusted R-squared	0.876046	S.D. dependent var		35.05156
S.E. of regression	12.34064	Akaike info criterion		7.958313
Sum squared resid	2741.246	Schwarz criterion		8.057886
Log likelihood	-77.58313	F-statistic		135.2826
Durbin-Watson stat	1.270648	Prob(F-statistic)		0.000000

Dependent Variable: SER20 FC Method: Least Squares				
Sample: 1995 2014 Included observations: 20				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.345754	5.908479	1.074008	0.2970
SER19	0.016442	0.001411	11.65148	0.0000
R-squared	0.882932	Mean dependent var		67.24525
Adjusted R-squared	0.876428	S.D. dependent var		35.05156
S.E. of regression	12.32159	Akaike info criterion		7.955223
Sum squared resid	2732.789	Schwarz criterion		8.054796
Log likelihood	-77.55223	F-statistic		135.7569
Durbin-Watson stat	1.450533	Prob(F-statistic)		0.000000

Dependent Variable: SER20 FC Method: Least Squares				
Sample: 1995 2014 Included observations: 20				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.553196	5.722842	1.669310	0.1134
SER18	0.001667	0.000846	1.969231	0.0654
SER19	0.008459	0.004260	1.985568	0.0635
R-squared	0.904676	Mean dependent var		67.24525
Adjusted R-squared	0.893462	S.D. dependent var		35.05156
S.E. of regression	11.44089	Akaike info criterion		7.849746
Sum squared resid	2225.199	Schwarz criterion		7.999106
Log likelihood	-75.49746	F-statistic		80.66992
Durbin-Watson stat	1.461172	Prob(F-statistic)		0.000000

Software used EViews

Value econometric models of Gross Fixed Capital Formation (GFCF) focused on export and import of fuel

Figure 6

Dependent Variable: SER21 GFCF Method: Least Squares				
Sample: 1995 2014 Included observations: 20				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.035077	2.450264	0.422435	0.6777
SER18	0.001313	0.000132	9.982359	0.0000
R-squared	0.847001	Mean dependent var		21.81025
AdjustedR-squared	0.838501	S.D. dependent var		14.39149
S.E. of regression	5.783504	Akaike info criterion		6.442536
Sum squared resid	602.0806	Schwarz criterion		6.542109
Log likelihood	-62.42536	F-statistic		99.64750
Durbin-Watson stat	0.979090	Prob(F-statistic)		0.000000

Dependent Variable: SER21 GFCF Method: Least Squares				
Sample: 1995 2014 Included observations: 20				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.356877	2.303150	-1.457515	0.1622
SER19	0.006795	0.000550	12.35248	0.0000
R-squared	0.894480	Mean dependent var		21.81025
AdjustedR-squared	0.888618	S.D. dependent var		14.39149
S.E. of regression	4.803010	Akaike info criterion		6.071002
Sum squared resid	415.2402	Schwarz criterion		6.170575
Log likelihood	-58.71002	F-statistic		152.5839
Durbin-Watson stat	1.202083	Prob(F-statistic)		0.000000

Dependent Variable: SER21 GFCF Method: Least Squares				
Sample: 1995 2014 Included observations: 20				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.764551	2.420084	-1.142337	0.2691
SER18	0.000308	0.000358	0.859964	0.4018
SER19	0.005320	0.001802	2.953231	0.0089
R-squared	0.898879	Mean dependent var		21.81025
Adjusted R-squared	0.886982	S.D. dependent var		14.39149
S.E. of regression	4.838141	Akaike info criterion		6.128419
Sum squared resid	397.9294	Schwarz criterion		6.277779
Log likelihood	-58.28419	F-statistic		75.55774
Durbin-Watson stat	1.151099	Prob(F-statistic)		0.000000

Software used EViews

All the above examples underline that the econometric modelling of the major macro-aggregates in the Romanian economy over the last 20 years

has a greater predictability power, given by the very presence of the crises or recessions that basically adjusts and amends the trends.

CONCLUSIONS

The increasingly diverse and accentuated practical use of the classical econometric models augmented, in parallel with the amount and consistency of their criticism by those who sought to capitalize on them as forecast and estimate solutions. According to a number of relatively justified criticisms, the econometric model has essential limitations, ranging from using oversimplified economic methods, and the inability of the quantitative model to fit a theory or another, up to the high error margin of prediction and simulation, and the absence from the final model of explanatory variables related to the response of the authorities and economic policies, which may distort, even in a short term, the behavioural rationality of an economy. The econometric model, in its major sense and acceptation, shows a continuous decline in time of its first form by simple parameterization, which was acknowledged by the existence of the claim "in business few (cor)relations retain, in time, their original mathematical precision" (Săvoiu, 2013). The success of the classic econometric model is not unanimously accepted among economists, either – i.e. among those who ought to enjoy its applicability to the utmost. Thus, Ludwig von Mises and Friedrich von Hayek, major representatives of the neoclassical Austrian school of economics, questioned formalization of economic behaviour through econometric modelling, highlighting the sad balance of the predictions made on the basis of econometric models in recent decades, despite their increasingly modern computing equipment and their ever more sophisticated make-up, with increasingly serious theoretical accents, and practically devoid of the impact of experiment. The originality of the analysis, using coefficient of elasticity, of the macro-aggregates in the Romanian economy (GDP, CF, GFCF, etc.), based on the export and import of fuels, generates relatively efficient, high-performance models, yet posing problems of validation for the calmer periods of economic development. The specific marks of this research focused on the *caeteris paribus* principle, applied to both the factors and the records in databases, relativize the medium-term credibility of econometric models, as it seems they are being regarded as too easily outdated, and even questionable – as is the case of many contemporary econometric models.

These findings bring about the need for multiplication of the modelling economic disciplines, by adding experimental economy, a branch of economics that involves performing laboratory experiments to test micro-

economic models, and also financial economics, which includes probability theory and financial economy in the construction of its models in order to round off econometrics in assessing the theories formulated by economics, while even invalidating, in the medium term, some established econometric models.

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Appendix no. 1

Annual elasticity coefficients of export (X) and import (M) overall, and of export and import of fuels compared to Final Consumption (FC) and Gross Fixed Capital Formation (GFCF) in Romania's economy

Table 1

Year	X/FC	M/FC	X_{fuels}/FC	M_{fuels}/FC	X / FBCF	M/ FBCF	X_{fuels}/ FBCF	M_{fuels}/ FBCF
1996	0.90	2.54	-0.39	2.30	6.86	19.42	-2.95	17.64
1997	1.63	1.11	-0.42	-0.17	-43.58	-29.57	11.09	4.44
1998	-0.16	0.16	-1.01	-1.38	-2.67	2.64	-16.55	-22.49
1999	-1.06	0.44	-1.21	2.32	-0.47	0.19	-0.53	1.02
2000	2.64	2.63	6.77	4.65	0.84	0.83	2.15	1.47
2001	1.14	1.75	-0.17	2.54	0.45	0.70	-0.07	1.01
2002	2.94	1.61	9.26	-0.84	2.26	1.24	7.12	-0.65
2003	0.61	1.10	-1.13	0.95	0.65	1.18	-1.22	1.02
2004	1.23	1.46	1.59	2.18	0.82	0.97	1.06	1.45
2005	0.62	0.79	2.58	1.39	0.73	0.92	3.01	1.62
2006	0.95	1.24	0.45	1.04	0.49	0.64	0.23	0.53
2007	0.64	1.04	-0.56	-0.01	0.34	0.56	-0.30	0.00
2008	0.54	0.55	4.05	3.18	0.23	0.24	1.74	1.36
2009	0.88	1.81	2.72	3.05	0.45	0.92	1.38	1.55
2010	4.59	3.75	2.70	5.69	5.81	4.75	3.41	7.20
2011	6.53	5.24	10.08	10.17	2.18	1.75	3.36	3.39
2012	2.63	0.31	-4.67	11.21	-0.53	-0.06	0.93	-2.24
2013	3.65	0.79	0.79	-4.64	5.07	1.10	1.10	-6.45
2014	2.03	1.71	5.42	-0.02	2.83	2.38	7.55	-0.03

Source: The data were processed by the authors, based on the calculus relations presented above and the Eurostat Database[online] available at: http://ec.europa.eu/eurostat/data/database.

Annual cross-elasticity coefficients of export or import of fuel compared to total import or export, in Romania's economy

Table 2

Year	Cross-elasticity coefficients between 1996 and 2014			
	Export of fuels / export	Import of fuels / import	Export of fuels / import	Import of fuels / export
1996	-0.43	0.91	-0.15	2.57
1997	-0.25	-0.15	-0.38	-0.10
1998	6.19	-8.53	-6.27	8.41
1999	1.14	5.26	-2.73	-2.19
2000	2.56	1.77	2.58	1.76
2001	-0.15	1.45	-0.10	2.23
2002	3.15	-0.52	5.75	-0.29
2003	-1.87	0.87	-1.03	1.57
2004	1.29	1.49	1.09	1.76
2005	4.14	1.77	3.28	2.23
2006	0.47	0.84	0.36	1.09
2007	-0.87	-0.01	-0.54	-0.01
2008	7.52	5.79	7.39	5.90
2009	3.09	1.69	1.50	3.47
2010	0.59	1.52	0.72	1.24
2011	1.54	1.94	1.92	1.56
2012	-1.77	36.43	-15.19	4.25
2013	0.22	-5.87	1.00	-1.27
2014	2.67	-0.01	3.18	-0.01

Source: The data were processed by the authors, based on the calculus relations presented above and the Eurostat Database[online] available at: http://ec.europa.eu/eurostat/data/database.