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FORECASTING METHOD IN ECONOMICS AND FINANCE

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Abstract. The forecasting problem in economics and finance is considered. A classification of economic forecasting methods is given. Necessary (or corresponding) complexity principle is formulated and the possibilities of practical use of forecasting methods applying to Georgian economy on the basis of current computer systems is demonstrated. the base of current computer systems is shown.

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We won't be mistaken if we say, that an ultimate goal of studying any discipline is receiving the most real forecasting estimates. However, unfortunately it is very difficult to do this in economics and finance. The importance of forecasting is well expressed in the words: "My interest is in the future because I am going to spend the rest of my life there" (C. E. Ketering) [1]. But one thing is the interest and wish, another whether it is possible. The difficulty can be well seen from the following definition (belonging to Evan Esar): "An economist is an expert who will know tomorrow why the things he predicted yesterday didn't happen today"([1]).This is certainly a joke. More seriously this question was considered by a well-known macroeconomist Gr. Mankiw in his most famous textbook in economics, where he says: "Unfortunately with the accounting of modern knowledge of economy, processes flowing in it often are unpredictable", or as famous macroeconomist R. Lukas said: "As consultants, we sometimes try to bend down through ourselves". Thus, forecasting in economics and finance is a very actual, complicated and therefore, very interesting thing.

Scientific forecasts are made by applying logical inference to facts and past experience under the assumption that the future tends to replicate the past. In this way, forecast errors made in the past can be systematically studied, to improve forecast accuracy in the future. The principal technique, used in economic and business forecasting, vary from simple methods to complicated econometric model forecasts. Simple methods are mechanical and ignore the structural relationships of economic systems. Sophisticated methods, which can be empirical, statistical or econometric, are derived from economic theories and statistical inference; and these methods, to a greater extent, incorporate economic causality into the forecasting system. The procedure for making forecasts is similar, no matter what technique is used. It involves building a forecasting device, putting inputs into this device and making a forecast. To an econometrician, the mathematical model is the forecasting device, and judgments along with historical data and inputs. Although, before the device is put into use, it must go trough a series of rigorous economic and statistical tests, to assess its forecasting ability.

The building of such forecasting device is not devoid of a builder's judgments. A forecasting model is greatly influenced by the builder's interpretations of data information, views of economic theories, and preferences for statistical inference techniques. In addition, the construction of a forecast device is also subject to the limitations on time, funds, and the availability of data. Given the objective of the forecast and its limitations, it is the forecaster's judgment to decide how to construct the forecasting model.

Forecasting methods are separated into two groups according to their level of sophistication. Noneconometric forecasts include simple extrapolation, judgmental forecasts, economic indicators and survey forecasts. The econometric techniques these methods require do not go beyond simple and multiple regression analyses.

Econometric forecasts involve the use of a number of advanced econometric techniques and can be classified into three categories, each involving an increased level of sophistication. In a single-equation regression model, the dependent variable to be forecast is explained by a number of explanatory variables in a single equation. The second group consists of methods which are oriented to use a multidimensional econometric models, assuming that initial variants of these models has a structural form (are constructed in accordance with economic theory). The third level of complexity is the time-series (stochastic) models, which are usually empirical.

As to the complexity of using models or methods, here everything depends on the complexity of problem to be solved. Actually, as A. Einstein said: "All must be done as simple as it is possible, but no more". In our opinion it is possible to formulate this idea in a form of "necessary (or corresponding) complexity principle". For illustration of this principle, recall some examples from our issues (of course, we can recall many examples from others issues, but as it is said in a Russian proverb: "our own shirt is closer to the body"!).

Let us begin this following increasing of complexity of mathematical apparatus and models.

Consider, for example, very actual for our economy, Georgian consolidated budget revenues forecasting problem (say, for 2013-2015 years), for incomes expected from tax of profit. Using well known computer system Eviews (Econometric views), we can construct a model of dependence of Gcbr from gdp of the country. The corresponding linear logarithmic model (regression equation) has the form:

$$\mathrm{LOG(GCBTP)} = -13.69992633 + 2.136274694 * \mathrm{LOG(GDP)}, \tag{1}$$

where GCBTP denotes Georgian consolidate budget tax of profit volume (in million GELs), GDP is volume of gdp, LOG is natural logarithm.

As it is clear from the corresponding results, the model has rather high level of accuracy: $R^2 = 0.98$, t-statistics of parameters are rather high, DW-statistic is almost 2, F-statistics is equal to 411, etc.

Besides this, it should be noted that, due to the model (1), the elasticity coefficient of tax of profit, with respect to GDP equals 2.14, i.e. 1% increase of GDP shall cause 2.14% increase of the Georgian tax of profit.

The forecasting problem of this index the model (1) it reduces on finding the forecasting estimation of exogenous variable GDP, for forecasting period.

Finally, concerning GDP's forecasting problem, the semilogarithm trend model of this index has the form:

$$\mathrm{LOG(GDP)} = 8.121026344 + 0.1243837372 * \mathrm{@TREND}, \qquad (2)$$

where @TREND denotes artificial time (trend) variable. The accuracy of model (2) is rather high: $R^2 = 0.99$, t-statistics of parameters are very high, F-statistics are equal to 1238, etc.

After all, accounting forecasting estimations from this model, in the model (1) gives forecasting estimations of resulting variable for appropriate period, what's very easy by using Eviews.

Analogously we can forecast the other budget revenues, although sometimes, for achieving appropriate accuracy, one must include trend component in the model.

For example, it can be shown, that Georgian consolidated budget total (own) revenues model (on the base of data of 1995-2011 years) has the form:

$$\mathrm{NSSH} = -902.6632766 + 0.3854412984 * \mathrm{GDP} - 95.58398125 * \mathrm{@TREND},$$

where NSSH denotes the volume of total (own) revenues of Georgian consolidate budget.

However, from the above-considered examples we must not make a conclusion that all forecasting problems can be solved on the basis of such simple models. Consider, for example, Georgian commercial banks total actives forecasting problem basis on dynamics of this index. It can be shown, that based on the months data of 2007.12 − 2010.04, Georgian commercial banks total actives, with rather high accuracy, can be described by following autoregressive and moving average type (ARMA) model (using Eviews):

$$\mathrm{CBA} = 7417816.211 + 69742.51203 * \mathrm{@TREND} + [\mathrm{AR}(2) = 0.502738842, \mathrm{MA}(1)$$
$$= 1.238605111, \mathrm{INITMA} = 2008M02],$$

where $AR(2)$ denotes second order autoregressive term, while $MA(1)$ represents first order moving average (as it is known $MA(1) = u_{t-1}$, where u_{t-1} represents error term of this equation for the previous period).

Although this model is rather accurate, (as it is known) the accuracy of such models will begin to deteriorate as the forecasting period extends. Besides the above, the necessity of use of rather sophisticated models can be caused by technical complexity of problem or specifics of modeling situation or country.

Consider, for example, the capital cost computing problem for investment projects (see [3]). Let us begin again from the very simple example. Consider an investment project which requires initial investment of 100000$ to buy a new special device. By market department's forecasting estimations, the living circle duration of this product is 3 years and the probable incomes from this device at the end of each year will be, correspondingly, 50000, 40000 and 30000$. Within this conditions, net present value (NPV) for this project can be calculated as follows (see [4]):

$$\mathrm{NPV} = -100 + 50/(1+k) + 40/(1+k)^2 + 30/(1+k)^3 \qquad (3)$$

where k (rate of discount) denotes the capital cost for this project.

Clearly for this project there should exist a value of k, say k_0 (internal rate of profitability, IRR), for which NPV of the project equals 0 or project never brings profit nor loss. This means that if $k > k0$, then $NPV < 0$, i.e. project brings loss and if $k < k_0$, then the project brings profit, i.e. $NPV > 0$ or profit is 0. From this it is clear, that if k_0 for project is rather low, the project is not acceptable and it is acceptable for the case when k_0 is sufficiently high. Thus, it is clear, that problem of finding k_0 in this case is reduced to the solution of equation $NPV = 0$, which by (3) means that it is needed to solve a third order equation. On the other hand, to solve such an equation (and more complex ones) is very simple by using modern computer programs, such as Matlab (see, for example [5]). Actually, using this system, the above mentioned problem can be solved by using the single command:

$$fsolve('-100 + 50/(1 + x) + 40/(1 + x)^2 + 30/(1 + x)^{3'}, 0),$$

which gives the value $k_0 = 0.1065$. Thus, if capital cost of this project is lower than 10.65%, the project is profitable, and not otherwise. Now it is clear, that analogously one can find internal value of profitability for projects, which have any living circle duration, i.e. solve the profitability problem for them.

At last a real problem in economics and finance can be so complex, that it will require the application of all above mentioned instruments. For example, consider very actual problem for Georgian economy, optimal tax burden definition problem (see [6-7]). As is known, this problem (in a theory) can be solved using Lafer curve. If we try practical realization this theory for Georgia in the base of data of 1995-2011 years, we receive following classical Lafer's product curve equation

$$X = -34790.71 * q^2 + 48624.40 * q - 942.65, \tag{4}$$

where X denotes value of gdp (in real representation), and q denotes tax burden level on economy. It should be noted that, although statistical characters of coefficients of this equation are not very high, they have "right" signs (i.e. corresponding to the signs of economic theory). Besides this, as a whole, the obtained regression equation is not very unreliable: $R^2 = 0.89$, F-statistics is equal to 52.7, etc. Hence, one can use it for deriving some estimations. If we try to define the optimal tax burden for Georgia on the basis of maximization of (4) we find that from the production point of view optimal tax burden level for Georgia must be near to 70% and such a result is very far from the reality. By this reason (and taking into account the specifics our country!), it may have a sense to create and analyse an alternative (non-classical) variant of product curve(see [7]). One of this non-classical product curve equation for our economy has form:

$$X = (42325.99251 * q - 690.0227668)/(1 + 25.76346016 * q^4). \tag{5}$$

It is remarkable, that this equation has the same level of accuracy as (4), i.e. we can use it instead of the equation (4). However, additional difficulty in this case is that the maximization problem of function (5) is much more complex; however this problem is not very hard to solve using the same Matlab system. In fact, since maximization of X is equivalent to minimization of the function $-X$, by using Matlab we will have:

$$fminbnd('-(42325.99251 * x - 90.0227668)/(1 + 25.76346016 * x^4)', 0, 1)ans = 0.3428$$

Hence, in this case we obtain that the so called Lafer's first type point for Georgian economy tax burden is the 34% and this corresponds much better to the real situation. Besides this, from (5), considering the relation

$$q = T/X,$$

where T denotes Georgian consolidate budget tax revenues (in real representation), one can built fiscal curves following non-classical variant, for our country:

$$T = (42325.99251 * q - 690.0227668) * q/(1 + 25.76346016 * q^4). \qquad (6)$$

From the equation (6) one can find also an estimation of the tax burden level corresponding tax revenues maximum (Lafer's second type point). Actually, in this case, maximization of function T (i.e. minimization of function $-T$) on the basis of Matlab, gives:

$$fminbnd('-x*(42325.99251*x-90.0227668)/(1+25.76346016*x^4)', 0, 1)ans = 0.4481$$

Hence, on the basis of 1996-2011 years data, achieving maximal tax revenues level of Georgian consolidate budget requires 44.8% tax burden. It's obvious that, this is maximal level of tax burden for Georgian economy. Moreover, as we have mentioned this above, real tax burden on our economy must not exceed Lafer's first type point, i.e. 34%. Hence, for the solution of this problem we are forced to use such computer systems as Eviews and Matlab. Note that we did not say anything about more complicated direction in forecasting, which suggests to use models of so called nonlinear dynamics (for example Samuelson-Hicks models, etc.) and which is of course very perspective.

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