THE ACCURACY OF GENERAL GOVERNMENT BALANCE FORECASTS IN ROMANIA

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Abstract: *Economic forecasts are an essential building block for a budgetary anticipation in order to determine the budgetary objectives and to sustain the tax and expenditure plans. In Romania the surveillance process is ensured by the use of budget programs. The aim of this paper is to improve the budgetary planning by recommending the use of the forecasted general budget balance provided by the institution with the highest accuracy during the crisis (2008-2013). More types of projections were analyzed during the recent economic crisis and the IMF forecasts for this indicator outperformed those provided by Dobrescu model and the European Union. Therefore, the recommendation is related to the use of IMF predictions in establishing the next budgetary plan for 2014 and 2015. Moreover, this research also brings improvements in the methodological framework, by proposing some aggregated accuracy indicators (S1, S2, S3 and S measures) for solving the problem of contradictory results of different accuracy indicators.*

Keywords: general government balance, budget deficit, forecasts, accuracy
JEL Classification: C51, C53

Introduction

The budget plans are an essential tool of modern budgeting, since the current budget is analyzed into the medium-term perspective. These budget plans in the European Union countries have another important role. The surveillance process is ensured by the use of budget programs. As an EU member, Romania has to achieve the stability programs or convergence. The programs are evaluated by the European Commission and ECOFIN Council to check for budgetary imbalances that might affect the fiscal sustainability.

During the recent economic crisis fiscal consolidation policies have been implemented in Romania and the entire European Union in order to achieve the planned general government balance or to recovery the decrease in economic growth. One of the causes for this failure is represented by the unrealistic planned budget deficit. Actually, the latest researchers like that of Novy and Taylor (2014, p. 5) showed that the low macroeconomic forecasts accuracy is the real cause for the actual world economic crisis. In this case the planned budget deficit is smaller than the one that would be registered. The policies in many countries of the European Union, including Romania, tended to diminish of budget imbalances following unrealistic targets, fact that affected the demand.

The failure of the Stability and Growth Pact in creating an environment of fiscal prudence during the business cycle, new commitments were taken into account in the Treat of Stability,

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Coordination and Governance from March 2012. This Treaty imposes to Romania a national mechanism to adjust the budget deficit, but it does not suppose a specific policy. From our point of view, the fiscal and budget objectives from this Treaty will be achieved if the forecasts accuracy is improved. The aim of assessing the predictions accuracy is to improve the decisional process and to implement the best government policy by taking into account the anticipated evolution of the macroeconomic indicators.

Trying to diminish the budget deficit, this study proposes a solution to the budget and fiscal problems by taking into account the forecasts of general budget balance provided by different experts. The predictions during the economic crisis are made by European Commission, International Monetary Fund and Center of macro-modeling conducted by Academician Emilian Dobrescu that uses the famous Dobrescu macro-model for the Romanian economy. After this brief introduction, the article presents some solutions from literature to the problem of fiscal planning improvement. Moreover, the general budget balance forecasting for Romania during the crisis (2008-2013) is described. A theoretical part presents the main methods for assessing the predictions accuracy. A new section is dedicated to the assessment of general budget balance forecasts made by national and international forecasters for Romania. The last section concludes, giving recommendations for improving the budget deficit planning.

1. Forecasting budgetary indicators

Economic forecasts are an essential building block for a budgetary anticipation. They are designed to determine the budgetary objectives and to sustain the tax and expenditure plans. Therefore, an *ex-post* evaluation of fiscal policy will reflect the differences between planed and actual economic growth. For example, if the government constructs the national budget upon an optimistic future growth, it will forecast higher structural revenues and it will budget higher discretionary expenditure than it would in the case of a cautious evaluation. In ex-post terms, lower than anticipated growth and shortfall of revenues, will have the same effect as an expansionary fiscal policy, because the discretionary expenditures are in general slowly adjusted.

In the literature some solutions were proposed to improve the forecasting of budget deficit, some of the approaching being oriented to the evaluation of predictions accuracy.

A historical evaluation for previous budget forecasts of Congressional Budget Office (CBO) was made and inaccurate predictions were obtained because of the incorrect technical and economic assumptions (Penner, 2002, p. 3). The forecast errors increases extremely fast if the horizon broadens.

The solution proposed by the author is related to the de-emphasizing of the forecasts for horizon larger than 5 years and to avoid of following strictly a desired target.

Buckle, Kim and Tam (2002, p. 156) proposed a structural VAR model to measure the impact of budget balance on four types of shocks in New Zealand: nominal disturbances, supply, fiscal disturbances and shocks in real private demand. Stochastic simulations are achieved to evaluate the cash budget balance level to have an actual budget balance for a certain forecast horizon.

Strauch, Hallerberg and von Hagen (2004, p. 27) assessed the budget and GDP growth rate forecasts in stability programs and convergence during 1991-2002. The fiscal projections used an accounting framework and are characterized by acceptable biases. There was a pro-cyclical fiscal stance, after 1998 the fiscal forecasts being quite restrictive because of the electoral cycles.

Jonung and Larch (2006, p. 492) showed that the official predictions of GDP growth are essential in the evaluation of budget balances, proving that for euro area the neglected biased predictions had an important impact on high deficits. The bias is explained by political measures and the authors' solution is the use of the budget deficit projections made by an institution that is independent by the Ministry of Finance.

Fiscal forecasting and evaluation are based on government accountability in using public resources. Lately, the budgetary surveillance in EU from Stability and Growth Pact showed a real interest in budgetary predictions (Leal *at al.,* 2008, p. 348). The forecasts might be affected by political and strategic influences, the authors analyzing in detail the fiscal forecasting and its implication in improving the financial sustainability.

Von Hagen (2010, p. 488) explained that the fiscal background in EMU countries is based on fiscal medium-run planning of the EU governments. The author assessed the gaps between the planned indicators (general government balance, spending, revenues, output growth) in the context of Stability and Convergence programs and the registered values. The factors that determined deviations for the planned values of the variables since 1999 are: restrictive fiscal rules and type of financial governance, which are institutional determinants.

The budget deficit in Romania before crisis, in 2007, was 2.5% of GDP, with a slow increase compared to 2006. The social transfers and public wages were higher than the planning, but this situation was compensated by the well performing revenues. The increases in pensions and the second pension pillar from 2008 in the context of economic crisis determined a higher deficit, much more than expected. Even if the public expenditure were well controlled, restrictive fiscal policy was imposed because of the macroeconomic vulnerabilities. Many factors have contributed to the increase of the budget deficit in Romania during 2008-2011: public salary slippages, dismal track record regarding the execution and planning of the budget, the negative impact of reforms on the social

contribution, political cycle characterized by elections during 2008-2009. The convergence program for Romania imposed the decrease of the general government budget deficit that expanded too much in the context of economic contraction from 2009. The low values of nominal GDP and the arrears' payment in health and other areas determined a significant higher deficit compared to the Government target for 2009 of 7.8% of GDP. Therefore, The Parliament has adopted in January 2010 a budget, imposing a set of measures to diminish the public expenditure to 2%. For 2010 the Government commitment established a target of 6.4% of GDP for budget deficit following the objectives of program of fiscal assistance. Some restrictive measures were planned then for expenditure side: freeze in public salaries, pensions and expenditures of services and goods. The excise taxes were grown and the budget took into account the reimbursement of tax arrears. However, even if these measures were proposed for 2010, the Government considered that these are not enough to achieve the desired target, because of the high deficit from 2009, low increase of GDP, shortfall of revenues, expenditure overruns. The policies of fiscal consolidation continued in 2011. However, for 2011 a decline in government deficit was planned in the context of faster real GDP increase. The Government projection has dropped from 8% of GDP in 2010 to 7.4% of GDP in 2011. Additional consolidation measures were required for 2012 to correct the high deficit. It was reduced from 3% of GDP in 2012 to 2.3% in 2013. The process of consolidation was based on expenditure part with planned decreases in expenditures. A slow decrease in deficit is forecasted for 2014 in the context of pensions' indexation, an insignificant increase in public sector wages, resources provided by EU funds. The predictions for 2014 also consider the inflation indexation of excise duties, a slow increase in social security contributions, excise-rate for energy goods, a larger basis for property tax. The main risks of budgetary forecasts are related to the tax collection and to the expenditure control in the context of elections from 2014.

2. The evaluation of forecasts accuracy

There are different methods used in literature to assess the forecasts accuracy. In practice, there are many cases when some indicators suggest the superiority of certain forecasts while other ones indicate that other predictions are more accurate. Therefore, it is proposed a new methodology to solve this contradiction given by the results of accuracy assessment. The method is based on different types of accuracy measures: statistics based on size errors, coefficients for comparisons and directional accuracy measures. These types of indicators were also used by (Melander, Sismanidis and Grenouilleau, 2007, p. 40), but without any aggregation.

The prediction error at time *t* is the simplest indicator based on the comparison of the registered value with the forecasted one and it is denoted by e_t. There are two ways of computing the forecast error if $\hat{y}_t$ is the prediction at time t: $e_t = y_t - \hat{y}_t$ or $e_t = \hat{y}_t - y_t$. Seven out of eleven members from International Institute of Forecasters recommended in a survey the use of the first variant ($e_t = y_t - \hat{y}_t$). This is the most utilized version in literature and it will also be used in this study.

The following summary statistics have been used: root mean squared error, mean squared error, mean error, mean absolute error, mean absolute percentage error. The aggregate statistic for comparisons is based on U1 Theil's statistic, mean relative absolute error, relative RMSE and mean absolute scaled error and they are presented in *Table 2*. $RMSE_b$is the RMSE for the benchmark. e_t^* is the benchmark error. In our case the benchmark is represented by the naïve projection. If the horizon length is h and the length of actual data series is n, the indicators are computed as in the *Table 1*:

Table 1- Measures of absolute and relative forecasts accuracy

Summary statistics for forecasts accuracy	**Indicator**	**Formula**
	Mean error- ME	$ME = \frac{1}{h}\sum_{t=n+1}^{n+h}(y_t - \hat{y}_t)$
	Mean absolute error- MAE	$ME = \frac{1}{h}\sum_{t=n+1}^{n+h}\lvert y_t - \hat{y}_t\rvert$
	Root mean squared error- RMSE	$RMSE = \sqrt{\frac{1}{h}\sum_{t=n+1}^{n+h}(y_t - \hat{y}_t)^2}$
	Mean squared error- MSE	$MSE = \frac{1}{h}\sum_{t=n+1}^{n+h}(y_t - \hat{y}_t)^2$
	Mean absolute percentage error- MAPE	$MAPE = 100 \cdot \frac{1}{h}\sum_{t=n+1}^{n+h}\left\lvert\frac{y_t - \hat{y}_t}{y_t}\right\rvert$
Statistics for comparing the forecasts accuracy	U1 Theil's statistic	$U_1 = \frac{\sqrt{\sum_{t=n+1}^{n+h}(y_t - \hat{y}_t)^2}}{\sqrt{y_t^2} + \sqrt{\hat{y}_t^2}}$
	Mean relative absolute error- MRAE	$MRAE = average(\left\lvert\frac{e_t}{e_t^*}\right\rvert)$
	Relative Root mean squared error- RRMSE	$RRMSE = \frac{RMSE}{RMSE_b}$

	Mean absolute scaled error- MASE	$MASE = average(\frac{e_t}{\frac{1}{n-1}\sum_{t=n+1}^{n+h}\lvert y_t - y_{t-1}\rvert})$

Source: (Hyndman and Koehler, 2006, p. 18-32)

If ME takes a positive value on the mentioned horizon with the proposed definition of the forecast error, the predictions are underestimated. For negative value of ME the forecasts are overestimated. For optimal predictions ME is zero, but this value is also met when the errors offset each other perfectly. RMSE is equal or larger then MAE. A higher difference between these two indicators implies a higher errors variance. The errors have the same magnitude if RMSE equals MAE. The minimum value of those measures is 0, but there is not a superior limit for them. A null value for the MAPE expressed as percentage shows a perfect forecast. If MAPE is smaller than 100% the prediction is better than the naïve one. MAPE has no superior limit.

The percentage of sign correct forecasts (PSC) shows how many percent of time is sign of prediction forecasted correctly. Percentage of directional accuracy correct forecasts (PDA) shows if the expert correctly anticipates the increase or decrease of the variable. The formulae for the two indicators are presented in *Table 3*. It measures the ability to correctly predict the turning points. PDA and PSC are located between 0% and 100%. According to Melander *et al.* (2007) the success rate of the indicators should be greater than 50%.

Table 2 - Measures for directional and sign accuracy

Indicator	Formula	Conditions
Percentage of sign correct forecasts- PSC	$PSC = \frac{100}{h}\sum_{t=n+1}^{n+h} z_t$	$z_t = 1, y_t \cdot \hat{y}_t > 0$ $z_t = 0, otherwise$
Percentage of directional accuracy correct forecasts- PDA	$PDA = \frac{100}{h}\sum_{t=n+1}^{n+h} z_t$	$z_t = 1, (y_t - y_{t-1})(\hat{y}_t - y_{t-1}) > 0$ $z_t = 0, otherwise$

Source: (Melander, Sismanidis and Grenouilleau, 2007, p. 44)

The methodology by us consists in the following steps:

- The computation of sums of summary statistics after the division to each standard deviation (S1);
- The computation of sum of relative accuracy measures (S2);
- The computation of sum of percentage for directional and sign accuracy (S3).

For the first indicator S1, the MSE has been excluded, because it has the same significance as RMSE. S1 and S2 should be as lower as possible, while S3 should be as high as possible. After these measures assessment, the best forecaster is chosen.

$$S_1 = \frac{|ME_t|}{SD_t^{ME_t}} + \frac{MAE_t}{SD_t^{MAE_t}} + \frac{RMSE_t}{SD_t^{RMSE_t}} + MAPE_t \quad (1)$$

$$S_2 = U_1 + MRAE + RRMSE + MASE \quad (2)$$

$$S_3 = PSC_t + PDA_t \quad (3)$$

These aggregated indicators also might show contradictory results. Therefore, another aggregated measure is constructed (S indicator) that considers the values of S1, S2 and S3 and a single decision is made using it.

$$S = \left|\frac{S_1+S_2}{S_3}\right| \quad (4)$$

The forecasts with the lowest S value are the most accurate.

Let us consider the actual values of a variable $\{y_t\}, t = 1,2, \dots, T$ and two predictions for it $\{\hat{y}_{t1}\}, t = 1,2, \dots, T$and $\{\hat{y}_{t2}\}, t = 1,2, \dots, T$. The prediction errors are computed as: $e_{it} = \hat{y}_{it} - y_t$, i=1,2. The loss function in this case is calculated as:

$$g(y_t, \hat{y}_{it}) = g(\hat{y}_{it} - y_t) = g(e_{it}) \quad (5)$$

In most cases this function is a square-error loss or an absolute error loss function.

Two predictions being given, the loss differential is:

$$d_t = g(e_{1t}) - g(e_{2t}) \quad (6)$$

The two predictions have the same degree of accuracy if the expected value of loss differential is 0.

For Diebold-Mariano (DM) test, the null assumption of equal accuracy checks if the expected value of differential loss is zero: $E(d_t) = 0$. The covariance stationary been given, the distribution of differential average follows a normal distribution. The DM statistic, according to (Diebold and Mariano, 2002, p. 38), under null hypothesis is:

$$S_1 = \frac{\bar{d}}{\sqrt{\hat{V}(\bar{d})}} \to N(0,1)$$

$$\bar{d} = \frac{\sum_{t=1}^{n} d_t}{n} \qquad (7)$$

$$\hat{V}(\bar{d}) = \frac{\hat{\gamma}_0 + 2\sum_{k=1}^{n-1}\hat{\gamma}_k}{n}$$

$$\hat{\gamma}_k = \frac{\sum_{t=k+1}^{n}(d_t - \bar{d})(d_{t-k} - \bar{d})}{n}$$

Instead of estimating the variance we can study the prediction error auto-covariances. This test does not suppose restrictions like forecast errors with normal distribution, independent and contemporaneously uncorrelated predictions errors.

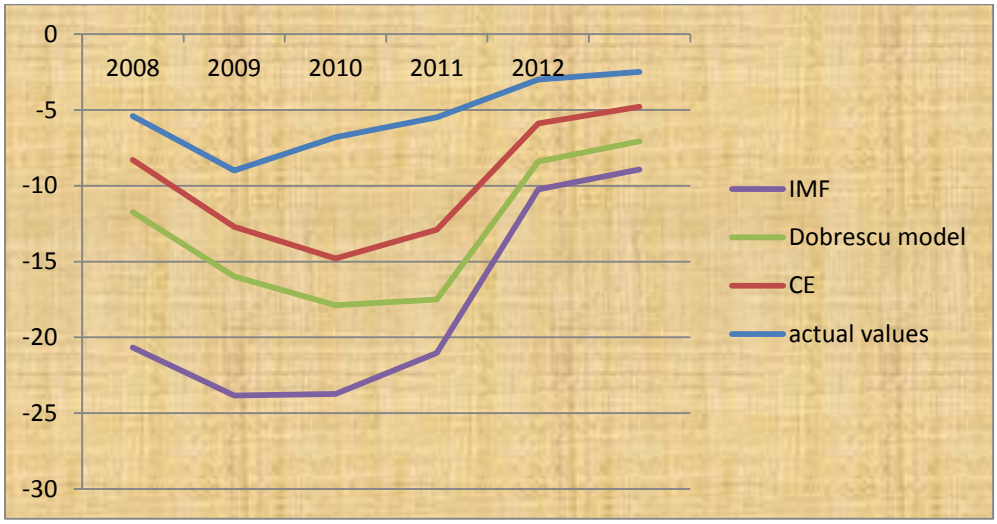
3. The assessment and improvement of forecasts accuracy for general government balance

The forecasts made during the crisis (2008-2013) for general government balance in Romania are provided by Dobrescu macro-model, European Commission and International Monetary Fund. DG ECFIN provides macro-economic predictions on behalf of European Commission. These forecasts represent the basis for different economic surveillance procedures. DG ECFIN's predictions include a large number of territories, from the overall European Union, euro zone, other major economies outside the European territory to each country from EU and candidates to this union. In this study, the spring and winter versions of the forecast for Romania will be used.

The Dobrescu macro-model for the Romanian economy is used mainly for making forecasts regarding the future evolution of the key variables of the national economy (Dobrescu, 2013, p. 3). The author has been constructed different scenarios along the time.

The source of predictions made by IMF is the World Economic Outlook (WEO) database, which is generated during the biannual exercise that begins in January and June for every year.

Figure 1 - The evolution of actual and projected general government balance during 2008-2013



Source: author's graph

According to all accuracy measures, the predictions provided by IMF are the most accurate. The negative values of ME suggest that all the predictions of the forecasters are higher in average than the registered values during the economic crisis (2008-2013). All the predictions are better than the naïve ones, MASE registering low values.

Table 3 - The accuracy evaluation of the forecasts for general government balance (horizon: 2008-2013)

Accuracy measure	CE	Dobrescu model	IMF	Forecasts' average
Mean error- ME	-0.8333	-2.1667	**-0.3942**	-1.1314
Mean absolute error- MAE	2.2000	2.5560	**1.7546**	**1.2859**
Root mean squared error- RMSE	2.5639	2.9246	**1.8437**	**1.7530**
Mean squared error- MSE	6.5733	8.5530	**3.3994**	**3.0729**
Mean absolute percentage error- MAPE	17.9846	20.9074	**20.5721**	**11.4639**
U1 Theil's statistic	0.2357	0.3218	**0.1604**	0.1708
Mean relative absolute error- MRAE	0.7969	0.8801	**0.8782**	**0.4934**
Relative Root mean squared error- RRMSE	1.0708	1.2214	**0.7700**	**0.7321**
Mean absolute scaled error-MASE	0.4420	0.5042	**0.3178**	**0.3022**
Percentage of sign correct forecasts- PSC	100%	100%	**100%**	**100%**

Percentage of directional accuracy correct forecasts-PDA	66.67%	83.33%	**100%**	83.33%
S1	4.3812	14.6547	**2.3735**	3.3563
S2	2.5453	2.9275	**2.1264**	**1.6985**
S3	166.67%	183.33%	**200%**	**183.33%**
S	4.155817	9.590465	**2.24995**	2.757214

Source: own computations

The proposed aggregated accuracy indicators S1, S2, S3 and S confirmed the superiority of IMF forecasts. However, the combined forecasts based on the average of all types of predictions are superior only in terms of relative and directional accuracy. However, this method of improving the forecasts accuracy proved to be good, even if the mean error is quite large.

The use of accuracy measures is not enough if an accuracy test is not used. The Diebold-Mariano test is applied in order to check the differences in accuracy between the institutions' forecasts. The criterion of selection for DM test is represented by the value of MSE. The kernel is uniform and the maximum lag is chosen according to Schwert criterion. This test is applied to check the differences in size errors and the results are displayed in *Table 4*.

Table 4 - The results of DM test

Forecasts to compare belong to:	**DM statistic**	**Decision- better forecasts provided by:**
EC and Dobrescu model	S(1) = -1.33e+08 p-value = 0.0000	EC
EC and IMF	S(1) = 8.99e+07 p-value = 0.0000	IMF
Dobrescu model and IMF	S(1) = 2.08e+08 p-value = 0.0000	IMF

Source: author's computations

The results of DM test put into evidence the superiority of IMF predictions during the economic crisis. The two approaches from literature based on accuracy indicators and based on an accuracy test conduct us to the same conclusion. The hierarchy of institutions according to forecasts accuracy for general budget balance is: IMF, EC and Dobrescu model. The results are consistent with the main findings from literature that imputed to Dobrescu model the fail to anticipate the economic crisis and its' continue.

Conclusions and recommendations

The results of this research conducted us to a very important conclusion for improving the planned general budget balance in Romania for achieving the financial stability or convergence. More types of projections were analyzed during the recent economic crisis and the IMF forecasts for this indicator outperformed those provided by Dobrescu model and the European Union. Therefore, the recommendation is related to the use of IMF predictions in establishing the next budgetary plan for 2014 and 2015. According to the recommendations from literature, the Government should not be too restrictive in terms of targeted budgetary deficit and the use of IMF projections should not be avoided because the forecasts do not correspond to the desired targets.

The novelty of the proposed global accuracy measure (S indicator) is brought by the inclusion of different aspects of forecasts accuracy. In decision making all the dimensions of the accuracy should be taken into account. For example, for policy decisions the neglect of directional accuracy could have large negative consequences. The general public might be interested only in the error size, but for processes where the sign of the error and detail aspects of accuracy evaluation are relevant the use of a global accuracy measure is essential. One type of policy is elaborated when we expect a decrease in inflation and another one when an increase is anticipated.

All in all, this research brings improvement not only in the empirical domain of budgetary planning in Romania, but also proposed some aggregated indicators for assessing forecasts accuracy that represents an improvement on the methodology related to the predictions accuracy evaluation.

References

Buckle, R.A., Kim, K. and Tam, J. (2002), "A structural VAR approach to estimating budget balance targets", *New Zealand Economic Papers*, Vol. 36, Issue 2, pp. 149-175.

Diebold, F. X. and Mariano, R. (2002), "Comparing Predictive Accuracy", *Journal of Business and Economic Statistics*, Vol. 20, Issue 1, pp. 134-144.

Dobrescu, E., (2013), "Updating the Romanian Economic Macromodel", *Romanian Journal of Economic Forecasting*, Vol. 16, Issue 4, pp. 5-31.

Jonung, L. and Larch, M. (2013), "Improving fiscal policy in the EU: the case for independent forecasts", *Economic Policy*, Vol. 21, pp. 491–534.

Leal, T., Pérez, J. J., Tujula, M. and Vidal, J.-P. (2008) "Fiscal Forecasting: Lessons from the Literature and Challenges", *Fiscal Studies*, Vol. 29, pp. 347–386.

Novy, D. and Taylor, A.M., (2014) "Trade and Uncertainty", NBER Working Papers 19941, National Bureau of Economic Research, Inc., pp. 34-48.

Melander, A., Sismanidis, G. and Grenouilleau, D., (2007) "The track record of the Commission's forecasts-an update Directorate General Economic and Monetary Affairs (DG ECFIN)", European Commission, 291, pp. 34-98.

Penner, R. G. (2012), "Dealing with Uncertain Budget Forecasts", Public Budgeting & Finance, 22, pp. 1–18.

Strauch, R., Hallerberg, M. and von Hagen, J. (2004) "Budgetary Forecasts in Europe – The Track Record of Stability and Convergence Programmes", Economic Working Papers at Centro de Estudios Andaluces E2004/42, Centro de Estudios Andaluces, pp. 18-32.

von Hagen J. (2010), "Sticking to fiscal plans: the role of institutions", *Public Choice*, Vol. 144, Issue 3-4, pp. 487-503.