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Accuracy in Forecasting Macroeconomic Variables in India

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ABSTRACT

In this paper we have surveyed the time series models and forecasting methods that could be used as an effective tool to capture the evolving data that is constituted by interlinked documents. Data set of the study was fourth quarter of 1997-1998 to first quarter of 2014-2015. Where regression line is estimated by auto regression model 2 for the period of fourth quarter of 1997-1998 to first quarter of 2012-2013 and used RMSE as benchmark to evaluating an estimated regression model. Test results showed that IIP and Exchange have predictive power in India.

INTRODUCTION

Before 1990, the Indian economy was primarily a closed, regulated and protective economy. As a result, the performance of various sectors and overall growth rate was not remarkable as the economy has many obstacles and constraints. However, by the adoption of liberalization and globalization in the 1990s, the Indian economy became a market based economy. A major structural change allowed the economy's annual growth rate to exceed 7% since 1994. The macro-economic indicators have important significance for decision makers in both public and private sectors. The country's fiscal or monetary policies are based on accurate forecasting of GDP produced by central institutions (i.e. the Ministry of Finance, or the Reserve Bank of India).

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The United Nations, the International Monetary Fund and the World Bank make annual predictions for the global economy in their publications because predicted data provides important information and affects the decisions of the general public, governments and businesses. The purpose of this paper is to study the forecasting performance of India GDP.

The Forecasting methodology depends on the underlying data generating process (DGP) using different time series models. Continuous changes in macro foundations of any macroeconomic variable data generating process make it mandatory to use different time series technologies to forecast adverse accuracy of macroeconomic variables.

Forecasting methods can be used to provide information to support decisions about many aspects of the business including buying, selling, production, and hiring

To determine whether the forecast is provided to users with accurate economic forecasts, it is necessary to have a formal assessment of forecast accuracy. Mincer and Zarnowitz (1969) stated that forecasting accuracy can be divided into two main parts: Accuracy of forecast in absolute terms and accuracy of prediction in relative conditions.

REVIEW OF LITERATURE

Bernanke and Boivin (2003) suggested that very large data of economic information required to economic policy decision making Geweke; Sargent and Sims (1977) explored that Dynamic factor models are well suited where large data required. In these models the joint behavior of a large number of economic time series is jointly modelled by specifying that the series are driven by a small set of persistent common factors and by idiosyncratic shocks.

Same Study modeling approach was used in recent developments in forecasting based study where large panels of macroeconomic variables involved and in dynamic factor analysis. A similar approach is taken by Doz, Giannone, and Reichlin (2011) proposed a dynamic factor model with factor loading, a two-step approximate method is set equal to the eigenvectors associated with a set of major components. In the first part, the main components are calculated and its dynamic properties are estimated through a vector autoregressive model. In the second part, the Kalman filter methods are obtained by factor estimates and forecasts, which apply to a model with the eigenvectors in the form of loading factor, and for the factors the main components with autoregressive coefficient matrix.

Forni M at al.(2005) explored that Dynamic factor model is used in conjunction with the combined behavior of a large number of economic numbers series, continuing by a small set of normal factors and specifying the series, and with the automatic shock.

Marinheiro (2010) A comprehensive study evaluating the forecast accuracy of the real GDP growth forecasts of the EU-15 national government taken from the forecast of SCP and their respective EC countries for the period 1998-2008. EC is chosen as

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a benchmark because it is considered as a relatively independent entity. The study also concluded that supranational forecasting rather than predictions produced by government agencies will reduce optimistic bias.

Tests are conducted to determine the full accuracy of both sets of predictions that are conducted in fairness and weak conditions. Whereas, standard descriptive measures of accuracy are mainly ME, MAE, and RMSE; Formal testing of similar accuracy (revised Diebold-Mariono test); and the estimated tests are used in relative accuracy evaluation. A relevant search is that only France and Portugal display a statistically significant optimist To analyze all four forecasting horizons, bias in their national real GDP growth forecasts, Shows an important bias for three out of four forecasting squares following Italy. Apart from this, a country does not display inability for all forecast skyline, because in some countries, some horizons exhibit inefficiency, but not in other. Apart from this, standard descriptive statistics show that the accuracy of the EC's forecast is not in the entire country or the horizon. Despite this, EC performs significantly better in the one year ahead forecast year, where its forecast is more accurate than the national forecast of EU-15.

Given these diverse conclusions, the study concluded that instead of future forecasts To reduce optimistic bias, supranational institutions must be compelled to justify the countries Important deviation from EC's forecast therefore recommends that the latter should be Used only as a benchmark.

Polak (2011) evaluated the accuracy of the national Czech Republic forecasts for the period 2000 to 2010, he used the EC forecast as a benchmark with the Organization for Economic Cooperation and Development (OECD) and the International Monetary Fund (IMF). This assessment is based on standard, accurate measures, mainly ME, MAE, MSE, RMSE and MAPE. Study shown that the national forecasting of real GDP growth is lower to supernational forecasts, so dislike this fact that the use of local information in the production of local GSP development forecasts is a beneficial effect.

Ashiya (2005) examind the relative accuracy of real GDP growth predictions produced by 25 Japanese economists for the period 1987 to 2001, in which they compiled by comparing them with other benchmark predictions: Japanese government forecasts and four time-series models Two of which was VAR and VECM based on the first vintage data. The study concluded that rather than the predictions of those produced by the Japanese economists or commercial institutions, it is better to rely on the predictions produced by VECM.The main purpose of this study was to Evaluated the complete and relative accuracy of the annual December GDP growth forecast Produced by the Japanese government for the period of 1980-2002. Testing for optimality in Japanese Government's estimated through a rationality tested on study, fairness and efficiency properties. Apart from this, it compares with the five benchmark predictions, which evaluates the relative accuracy of the national forecast, of which there are four timeseries models, including VECM and VAR based on real-time data and one is the mean published forecast of seventy Japanese private institutions. The best forecast had been chosen on the basis of a prediction presented by RMSE and MAE and a forecast encompassing test introduced by Chong and Hendi (1986).

Howrey (1995) revealed that a variation of the actual GNP development, the GNP deflator, the civilian unemployment rate and the 90-day Treasury bill rate, a four-variable VAR (2) model was slightly more accurate than the Michigan Quarterly Econometric Model (MQEM) used by the research seminar in quantitative economics (RSQE) in the forecast of GNP development. Apart from this, it was evidence that by combining the VAR and RSUE predictions, one could get a better forecast because each of the two predictions has information that was not available in the other.

Elbourne et al. (2008) evaluated the relative accuracy of the real GDP growth forecasts formed by SAFFIER, which evaluates a large macro model used by the Central Planning Bureau (CPB), the Netherlands Bureau of Economic Policy Analysis, which uses real time data while comparing the VAR model with the series from 1993 to 2006. Based on the minimum values of ME, RMSE and MAE, it had been shown that for most predictable horizons, VAR based forecast was not better than CPB forecast because some VARs were more accurate whereas others were less accurate.

Pilstorm and Pohl (2009) constructed three variable VAR models with unemployment, GDP and inflation to forecast quarterly GDP growth for the Baltic States using latest available revised data. VAR forecasts accuracy is found to be in line with forecasts produced by several central banks using more complex models.Creating three variable VAR models with unemployment, GDP and inflation, to predicting quarterly GDP growth for Baltic States using the latest available modified data. The accuracy of the VAR forecasts considered to be consistent with the forecast produced by many central banks using a more complex model.

Klein (1984) asserted that the models of time-series only primarily for adjusted macroeconomic models from three months to six months for small forecasted skyline. Supported The small VAR model performs fairly well for the prediction of twelve quarters, it is generally more accurate which is considered to be the horizon of sorter time.

Lupoletti and Webb(1984) retrieved different results because their five variable VAR (6) models perform poorly in one-third of the forecast, but in the United States (USA) three famous commercial establishments, four quarters to six quarter ahead The exact for the period from 1970 to 1983. Further study concluded that VAR model typically provided a useful benchmark for evaluating the long term horizons of macroeconomic forecasts.

OBJECTIVE OF STUDY

- To estimated regression line of GDP through IIP and Exchange Rate
- To forecast the GDP.
- To check the accuracy of forecasted GDP results.

RESEARCH METHODOLOGY

The study was causal in nature. The macroeconomic variables (GDP, IIP and Exchange rate) of India were the population. Sample size of the study was 1998 to 2015 quarterly data. For data collection Non probability purposive sampling technique was used. All study data was collected from official website of RBI. Data sample from 1st January 1998 to 31st March, 2013 was used to estimate regression line of GDP by Auto regression Forecasting regression model-2 that is $Y_t = \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + e_t$ if model is statically correct we further forecast GDP the next 8 quarters from 1April 2013 to 31 march 2015. Root mean squared error measure was applied to check the accuracy of forecasted GDP results.

If F_t is the value of some variable in time t forecasted at some earlier date and A. I the measured value of the variable in time t then the forecast error is $e_t = F_t - A_t$. for assessing the overall performance of forecasting we need some function that aggregates these forecast errors. Root mean squared error measure was applied to check the accuracy of forecasted GDP results.

Table 1: Dependent Variable: GDP1						
Method: Least Squares						
Variable	Coefficient	Std. Error	t-Statistic	Prob.		
С	978.006	698.0434	1.401067	0.1674		
EXR1	-3.149351	15.44257	-0.20394	0.8392		
IIP1	24.55678	3.418882	7.182694	0		
GDP1(-1)	0.116278	0.147762	0.786924	0.435		
GDP1(-2)	-0.115793	0.102085	-1.134289	0.2621		
R-squared	0.963162	Mean dependent var		6982.609		
Adjusted R-squared	0.960215	S.D. dependent var		1819.445		
S.E. of regression	362.908	Akaike info criterion		14.71268		
Sum squared resid	6585110	Schwarz criterion		14.89517		
Log likelihood	-399.5988	F-statistic		326.8273		
Durbin-Watson state	1.82166	Prob(F-statistic)		0		

RESULT AND DISCUSSION

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To estimate forecasting regression lines Autoregression Forecasting model-2 also known as dynamic model have been applied with 2 leg period of GDP. Test result shows that IIP coefficient (24.55) is highly significant at .05% level of significant. R-squared value is .96 shows that independent variables explained dependent variable by 96%. Table 2 result shows the serial correlation LM test result where observed R-squared value is .5278 with probability of .768 means data is not Serially Correlated.

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F-statistic	0.232563	Probability	0.793387		
Obs*R-squared	0.527842	Probability	0.768034		

Table 2: Breusch-Godfrey Serial Correlation LM Test

For assessing the overall performance of forecasting we need some function that aggregates these forecast errors. Ideally the weights of the different forecast errors should reflect the cost of making the mistakes. Root Mean square error = $\sqrt{1/H}\sum(F_t)$

 $(- A_t)^2$) to assess forecasting accuracy where H is the number of observations on the forecast errors.



Figure 1: Results of Root Mean Square Error

Test rest result shows the RMSE value is 608.99, is benchmark to estimated regression model and predictive power of GDP. RMSE shows the gap between actual GDP and forecasted GDP.



Figure 2: Predicted GDP versus Actual GDP for the papers in the data set.

Figure 2 shows the data line of actual GDP and forecast GDP. For The year 2013-14 and 201415, forecasted eight quarters results are very close of actual GDP. In other words IIP and 2 lag difference GDP having the predictive power of GDP.

CONCLUSIONS

It is an interesting problem to predict the GDP a paper would receive. Though forecasting and prediction is accurate but the value of RMSE was higher, it would be more accurate if we could achieve higher percentage of accuracy with low RMSE. Data set of the study was fourth quarter of 1997-1998 to first quarter of 2014-2015. Where regression line is estimated by auto regression model 2 for the period of fourth quarter of 1997-1998 to first quarter of 2012-2013 and used RMSE as benchmark to evaluating an estimated regression model. Test results showed that IIP and Exchange have predictive power of GDP in India.

REFERENCES

- 1. Ashiya, M. (2005). An evaluation of GDP forecasts made by Japanese individual economists. *Kobe University Economic Review*, 51(2005), pp.65-75.
- 2. Bernanke, B., Boivin, J. (2003). Monetary policy in a data-rich environment. *Journal of Monetary Economic.* 50: 525-546.
- 3. Chong, Y. Y. and Hendry, D. F. (1986). Econometric Evaluation of Linear Macroeconomic Models. *Review of Economic Studies*, 53, pp.671-690.
- 4. Doz, C., Giannone, D. and Reichlin, L. (2011). A two-step estimator for large approximate dynamic factor models based on kalman filtering. *Journal of Econometrics* 164 (1), 188–205.
- 5. Elbourne, A., Kranendonk, H., Luginbuhl, R., Smid, B. and Vromans, M. (2008). Evaluating CPB's published GDP growth forecasts; a comparison with individual and pooled VAR based forecasts. CPB Document no. 172.
- 6. Forni, M., Hallin, M., Lippi, M., Reichlin, L. (2005). The generalized dynamic factor model. One-sided estimation and forecasting. *Journal of the American Statistical Association*. 100: 830-840.
- 7. Geweke, J. (1977). The dynamic factor analysis of economic time series models. *In D Aigner and A Goldberger (eds) Latent Variables in Socioeconomic Models*. 365-383 Amsterdam. North-Holland.
- Howrey, E.P. (1995). An analysis of RSQE forecasts: 1971–1992. Atlantic Economic Journal. 23 (3). pp.203-219.
- 9. Klein, L.R. (1984). The importance of the forecast. Journal of forecasting, 3 (1), pp.1-9.
- 10. Lupoletti, W. M. and Webb, R. H. (1984). Defining and Improving the Accuracy of Macroeconomic Forecasts: Contributions from a VAR Model. *The Journal of Business*, 59 (2), pp.263-285.
- 11. Marinheiro, C. F. (2010). Fiscal sustainability and the accuracy of macroeconomic forecasts: do supranational forecasts rather than government forecasts make a difference? *International Journal of Sustainable Economy*, 3 (2), pp.185-209.
- 12. Mincer, J. and Zarnowitz, V. (1969). The Evaluation of Economic Forecasts. *Cambridge: National Bureau of Economic Research*.
- 13. Pilstrom, P. and Pohl, S. (2009). Forecasting GDP Growth: The Case of Baltic States. *Bachelor Thesis in Economics*, Jonkoping University
- 14. Polak, Z. (2011). Evaluation of Macroeconomic Forecasting Accuracy. *Bachelor thesis. Charles University in Prague.*
- 15. Sargent, T., Sims, CA. (1977). Business cycle modeling without pretending to have too much a-priori economic theory, *in: C. Sims et al., eds., New methods in business cycle research.* (Federal Reserve Bank of Minneapolis, Minneapolis).