External Shocks and the Indian Economy: Analyzing through a Small, Structural Quarterly Macroeconometric Model

Bhanumurthy NR and Lokendra Kumawat

National Institute of Public Finance and Policy, New Delhi, India, Ramjas College, Delhi, India

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N R Bhanumurthy & Lokendra Kumawat

Abstract

Though a large number of structural macroeconometric models have been estimated for India, the fact that all these are based on annual data limit their usefulness for short-term policy analysis, particularly in volatile periods of the type seen during last few quarters. Therefore the present paper builds up a short-term macroeconometric model for India using quarterly data. The model has reasonably good in-sample performance. One important feature of the model is use of quadratic relation between government expenditure and credit to private sector, which shows presence of both crowding in and crowding out effects, the latter dominating the former when expenditure is high enough. Some simulations are also carried out to analyse the impact of recent external shocks such as rise in global food and fuel prices and the global financial meltdown, on the Indian economy. The results show that the current slowdown in India's growth predates the global price shock and the global financial crisis, and is more of a regular cyclical downturn. The global developments only further deepen the slowdown and prolong the recovery.

JEL Classification codes: E19, C51, C53

1. Introduction

For an effective macroeconomic policy making, understanding of overall economic behaviour through a macroeconomic model is necessary. A macroeconomic model provides an understanding of structural relationships among various macroeconomic variables. It also provides cause and effect relationships between the policy and target variables; and helps in generating forecasts, which are important for any policy formulation. Among the different types of macromodels, macroeconometric models (of Klein-Goldberger type) are quite popular as they depict the structure as well as the temporal behaviour of the macroeconomy.

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In India, although building of macroeconometric models were built from early 1960s, the construction of large comprehensive economy-wide models started only from late 1980s. There are several such models for India (see Krishnamurthy (2008) for an excellent survey of Indian macroeconometric models) with different theoretical structures and with different foci providing insights into functioning of the economy and potentially useful for policy making. However, there are several limitations with the existing models. As the changes in the behaviour of economic variables following structural changes, the predictive power of these models diminish and call for changes in the model itself (there are many studies on this issue, see for example Rapach & Wohar (2006)). Another important limitation is the strengthening of database over a period of time that helped in providing realistic data. For example, change in the base year for GDP from 1993-94 to 1999-2000 also included shift in the production function by including more commodities that were not relevant in 1993-94. Another limitation with the existing macroeconometric models, which is inherent in the structural modelling, is that these are based on annual data, which creates two types of problems: (1) as it requires long time series data, it might be irrelevant for forecast purpose, given the significant changes in the economic behaviors (for example, in India following economic reforms, the data prior to 1991-92 may not be useful in predicting current economic behaviour); 2) it is difficult to capture the impact of intermittent policy changes due to one year gap between two successive data points. For example, in annual models, it is difficult to forecast when the impact of any cut in policy interest rates be felt on inflation, industrial performance, credit demand, money supply, etc. Another problem with the existing models is that these models generally tend to ignore the time series properties of the underlying time series, which, apart from distorting the inference, tends to affect the forecast performance adversely. Finally, in these models, most of the relations are specified in linear form, which may not capture the actual relations in the economy.

To overcome these limitations, for the first time in India, we have tried to estimate a short term quarterly structural macroeconometric model, with appropriate adjustment for the time series properties and nonlinear relations. There are data limitations for this exercise as the real sector data is available only from the second quarter of 1996. But we feel that these data are sufficient to construct a reasonable model as it takes care of many

of the data issues (such as structural changes and instability) that are specific in the post-reform period and the forecast from this model is expected to be much more robust than that from the annual models. Further, it has been seen that the forecast performance of smaller models (with satellite models) is much better compared to large models.

We find that our model has good in-sample fit and the out-of-sample forecast performance is also good. Further, given adequate number of policy levers, exogenous variables, and linkages, it is also able to capture the effects of different exogenous shocks reasonably well. As in the current context, to understand the impact of global economic crisis and the policy responses to mitigate this adverse impact, annual models may not be of much use compared to quarterly model.

The paper is organized as follows. In the second section the structure of the macroeconometric model is presented, followed by a discussion of the exogenous variables and propagation mechanisms. The third section contains the discussion of data and methodology. The estimated equations are discussed in section 4. In the fifth section, the overall performance of the model in terms of the in-sample root mean square percentage errors (RMSPE) has been discussed. In the following section, we present some simulation results, showing how well the model captures the effects of some of the recent events. In the last section, the limitations and the general conclusions of the study are highlighted.

2. Structure of the model

2.1 Structure

Like any economy-wide macroeconometric model, this model also has broad disaggregations with strong interlinkages among different blocks. The model has five blocks namely real sector, price, monetary, fiscal and trade block. Within each block, based on the availability of data, we have further disaggregated. Unlike in the annual models, this quarterly model lacks disaggregated investment equations as the data on private and public investments are not available at the quarterly level. Hence, the gross fixed capital formation has been used as a proxy for the investments. Similarly, in the trade block, the disaggregation is limited only upto oil and non-oil and in fiscal block the disaggregation is limited at tax and non-tax revenues and total expenditure.

The model follows an eclectic approach with a mix of theoretical underpinnings, but largely Keynesian and neo-classical. The demand side behavior is expected to follow the Keynesian approach while on the supply side it is the neo-classical approach. As we know that the economic behavior is dynamic, to capture this, the model uses sufficient lead-lag relationships. It also includes expectations. As the purpose of this model is to capture the current macroeconomic behavior, in which international factors play a major role, the model sufficiently incorporates open-economy macroeconomic relations. This will help in understanding the international transmission mechanism and also the impact of current global economic developments on the Indian economy. Further, the model is capable of capturing exogenous shocks (both domestic and external) such as world oil prices and rainfall. The estimated model also takes care of time series properties such as stationarity and seasonality issues, which are inherent in the time series data. The structure of different blocks is discussed below.

The real block

In the real block, two types of equations are estimated that reflect both demand side and the value-added side. First three equations are for real GDP in the three sectors, namely, agriculture, industry and services. The other three equations describe the behaviour of the domestic components of aggregate demand, namely, consumption and investment. While for consumption, we estimate separate equations for the private and public sector, for investment, we model the total gross fixed capital formation only, due to non-availability of data at disaggregated level.

The real GDP in agricultural sector (ZYAG) is determined by rainfall (RAIN) and gross fixed capital formation[1] (ZGFCF), as agriculture in India is largely supply-driven. There are some studies that show that price response from Indian agriculture is weak. Thus,

$$ZYAG = F(RAIN, ZGFCF)$$

The real GDP in industry (ZYIN) is determined by (real) net domestic credit (private and public sector combined), non-industrial output (ZYAG+ZYSR), non-oil exports (XNO), and lending rate (RRL). Although output gap (capacity utilization) is one of the

[1] Though a large number of specifications were tried for each relation, only the specification which was finally retained is being given here, for each variable.

important variables, due to non-availability of investment series, this was not used in the estimations. Hence, ZYIN equation is specified as below

ZYIN = F(ZYAG+ZYSR, NDCPR/PY, NDCPU/PY, XNO, RRL)

where NDCPR and NDCPU represent net domestic credit to private sector and public sector respectively, and PY is GDP deflator. Thus, ZYIN depends on monetary policy stance (NDCPR, NDCPU and RRL), domestic demand (ZYAG+ZYSR) as well as external demand (XNO).

The real GDP in services (ZYSR) is determined by demand from the commodity sector (GDP in agriculture and industry (ZYAG and ZYSR respectively)), real gross fixed capital formation (ZGFCF), real World GDP (ZYW) and exchange rate (E), i.e.,

ZYSR = F(ZYAG+ZYIN, ZGFCF, ZYW, E)

Thus, GDP in this sector is affected by both domestic demand (ZYAG and ZYIN) as well as external demand (ZYW and E), and also by total investment (ZGFCF). We have used exchange rate as it is one of the main determinants of some sub-sectors such as the ITES sector.

Real GDP (ZYTO) is calculated simply as the sum of real GDP in the three sectors, viz.,

ZYTO = ZYAG + ZYIN + ZYSR

In the components of aggregate demand, the real consumption in private sector (ZCPR) is determined by real GDP (ZYTO), (real) net domestic credit to private sector (NDCPR/PY), fiscal balance (FB), lending rate (RRL), which appears here as a proxy for deposit rate; and consumer price index (PCPI):

ZCPR = F(ZYTO, NDCPR/PY, FB, RRL, PCPI)

Thus, apart from total income (ZYTO) and prices (PCPI), private consumption is also affected by net credit (NDCPR/PY), fiscal balance (FB) and deposit rate, which is the opportunity cost of consuming now instead of postponing consumption.

The real consumption in public sector (ZCPU) is determined by fiscal balance (FB) alone:

ZCPU = F(FB)

Finally, the investment, captured by real gross fixed capital formation (ZGFCF) is determined by total real GDP (ZYTO), (real) net domestic credit to private and public sector (NDCPR and NDCPU respectively, both deflated by PY), total real expenditure by government (ETO deflated by PY), net FII inflows (FII) and BSE Sensex (BSE):

$$ZGFCF = F(NDCPR/PY, NDCPU/PY, ETO/PY, FII, BSE)$$

This shows that the model captures the role of credit (both private and public sectors, NDCPR and NDCPU respectively), public investment (proxied by total government expenditure, ETO), and business confidence (captured through FII and BSE).

The price block

We model three price variables: GDP deflator (PY), wholesale price index (PWPI) and consumer price index (PCPI).

The GDP deflator is calculated as weighted average of the sectoral deflators, where the weights are given by the share of the sector in GDP in 1999-2000, i.e.,

$$PY = w_{AG}PAG + w_{IN}PIN + w_{SR}PSR$$

The price block equations generally reflect the eclectic theoretical understanding the prices are affected by both demand side (money supply from monetarists), supply side factors (output from the structuralists) and by the input costs (fuel prices). As we also know that in India nearly 30% of the commodity prices are administered, the policy interventions also being considered as one of the determinants.

GDP Deflator for agriculture (PAG) is determined by broad money (M2), price index for fuel (PFUEL) and total output in agriculture, i.e.,

$$PAG = F(M2, PFUEL, ZYAG)$$

where M2 captures the demand impact, while PFUEL and ZYAG capture the supply side effects. We tried with Minimum Support Price (MSP), but it was found to be insignificant.

The deflator for the industrial sector (PIN) is determined by broad money (M2), price index for fuel (PFUEL), non-industrial output (ZYTO-ZYIN) and price index for imports (PM):

PIN = F(M2, PFUEL, ZYTO - ZYIN, PM)

Thus, this deflator is affected by domestic demand factors (ZYTO-ZYIN and M2), fuel prices (PFUEL) and also international prices (PM).

The third component of GDP deflator, the services deflator (PSR) is determined by broad money (M2), fuel prices (PFUEL) and import prices (PM):

PSR = F(M2, PFUEL, PM)

where M2 captures the domestic demand while PFUEL and PM capture the supply side effects.

The wholesale price index (PWPI) is determined by GDP deflator (PY), fuel prices (PWPI) and world food prices (PWF)

PWPI = F(PY, PFUEL, PWF)

Thus, in addition to the overall price situation at home, it also responds to world food prices. GDP deflator (PY) is derived from ZYTO and YTO.

Finally, the consumer price index (PCPI) is determined by the wholesale price index (PWPI) in our model:

PCPI = F(WPI)

This is based on the assumption that changes in wholesale market prices would reflect in the retail market prices with a lag.

Monetary block

In monetary block, we model broad money (M2), its components (net domestic credit and net foreign assets), and lending rate. For net domestic credit, separate treatment was given for credit to private and public sectors.

The net domestic credit to the private sector (NDCPR) is determined by total industrial output (ZYIN), lending rate (RRL) and government expenditure (ETO)

NDCPR = F(ZYIN, RRL, ETO)

where ZYIN captures the demand side while RRL represents the cost of funds. ETO captures the effect of government expenditure. Theoretically, the impact of government

expenditure on the private investments (here credit) could be either positive or negative depending upon the extent of the public expenditure. If the public expenditure is on infrastructure, then it could crowd-in private investments. But if the public expenditure is increased due to increase in unproductive current expenditure, then it might crowd-out after certain threshold level. In other words, it can be argued that there are some limits for public expenditure upto which it would have positive relation and after that it would have negative impact on the private investment and, hence, on growth as well. To capture this (although review of exiting macro models have not addressed this issue), during estimation, we introduce non-linear relation between public expenditure and private credit. This issue is quite pertinent to current situation in India and at global level as well, where the fiscal stimulus packages appears to exceed the threshold level of fiscal deficits for respective countries, which have potential to create macroeconomic instability in the medium term.

The net domestic credit to the public sector (NDCPU) is determined solely by the total government expenditure (ETO) and fiscal balance (FB):

$$NDCPU = F(ETO, FB)$$

Net foreign assets (NFA) is determined by real world output (ZYW) and BSE Sensex (BSE)

$$NFA = F(ZYW, BSE)$$

where ZYW captures the accumulation due to trade and BSE captures the part due to capital flows. This is the channel through which the current global crisis was expected to transmit to India in the first stage.

Broad money (M2) comprises largely of net domestic credit and net foreign assets, and the other components also tend to move together with these components. Apart from these three components one component within M2 is the 'net non-monetary liabilities of the banking sector', which is found to be highly volatile and less behaviourial. Hence, we drop this component and model M2 directly. M2 has been specified in terms of NDCPR, NDCPU and NFA:

$$M2 = F(NDCPR, NDCPU, NFA)$$

Finally, lending rate (RRL), proxied by the prime lending rate of top five commercial banks, is determined by the repo rate of RBI (RRREPO) and the LIBOR (RRLIBOR)

RRL = F(RRREPO, RRLIBOR)

RRREPO is the policy rate of RBI, and has emerged as the most important tool of RBI in recent years. Thus the specification captures the policy impulses. Presence of RRLIBOR allows for propagation of international financial impulses to be transmitted to Indian financial system. Inflation rate is another determinant which is used to explain the changes in interest rate.

Fiscal Block

In fiscal block, we have modeled total government expenditure (ETO), tax revenue (TR) and non-tax revenue (NTR). We have also further disaggregated the expenditures and revenues. But, given the objectives of the present paper, here we are presenting only the broad fiscal block. ETO is determined by total revenue (RTO) and net domestic credit to the public sector (NDCPU):

ETO = F(RTO, NDCPU)

which captures both the ways of financing of government expenditure, namely, its revenue and borrowings.

Tax revenue (TR) is determined by total non-agricultural output, i.e.,

TR = F(YIN+YSR)

Similarly, non-tax revenue is also determined by this variable alone,

NTR =F(ZYIN+ZYSR)

This is due to the fact that agriculture is practically non-taxable in India, and therefore, only non-agricultural production serves as tax base for both types of taxes.

Trade Block

In this block we model exports, imports and exchange rate. Exports and imports are disaggregated into oil and non-oil components.

Non-oil imports (MNO) is determined by total output (ZYTO) and exchange rate (E):

MNO = F(ZYTO, E)

where ZYTO captures domestic demand, while E captures external competitiveness.

Oil imports (MO) depend, apart from the two factors affecting MNO, on world oil prices (OIL),

MO = F(ZYTO, OIL, E)

In exports, the non-oil component (XNO) is determined by real world output (ZYW), World consumer price index (PWC), GDP deflator (PY), non-oil imports (MNO) and E:

XNO = F(ZYW, PWC, PY, MNO, E)

where ZYW captures the demand side, while PWC, PY and E capture relative competitiveness of our exports. MNO is an important factor determining XNO in view of the large share of raw and semi-finished goods in our imports, which are then exported back after processing.

Oil exports (XO), which is a very small component of exports right now, is determined by oil imports and exchange rate

XO = F(E, MO)

Finally, exchange rate is determined by real world output (ZYW), domestic lending rate (RRL), LIBOR (RRLIBOR), net FII inflows (FII) and BSE Sensex (BSE)

E = F(ZYW, RRL, RRLIBOR, FII, BSE)

Here ZYW captures the pressures on E due to trade. RRL and RRLIBOR represent domestic and foreign interest rate respectively, and along with FII and BSE, capture the pressure due to capital flows.

2.2 Inter-sectoral linkages and transmission mechanisms

The model has adequate number of exogenous variables and inter-sectoral linkages, allowing the propagation of various shocks to different sectors of the economy. Specifically, we have four sets of exogenous variables to allow for different types of shocks and policy changes:

(a) agricultural shock: rainfall (RAIN)

(b) fiscal policy : through total government expenditure (ETO)

(c) monetary policy: through repo rate (RRREPO)

(d) external shock: World output (ZYW), world oil prices (OIL), world food prices (PWF), world interest rate (RRLIBOR), FII flows (FII)

The transmission of shocks and policy changes to different sectors of the economy is shown below:

Agricultural shock:

RAIN → ZYAG → ZYTO

Fiscal policy:

ETO → NDCPR → ZGFCF, ZCPR, ZYIN

ETO → NDCPU → ZGFCF, ZYIN

Monetary policy changes:

RRREPO → RRL → ZCPR, NDCPR, ZYIN

External shocks:

ZYW → ZYSR → ZYTO

ZYW → NFA → M2 → PIN → ZGFCF, ZYIN

FII → ZGFCF → ZYAG, ZYSR

OIL → MO → XO

RRLIBOR → E → MNO, MO, XNO, XO, ZYSR

RRLIBOR → RRL → ZCPR, ZYIN, NDCPR

The above mentioned flow reflects only direct transmission mechanism. But the interlinkages among different sectors lead to further effects, which is typical of any structural macroeconometric models. This is also the strength of these type of models.

3. Data and Methodological Issues

The model is based on quarterly data for the period 1996Q2 to 2008Q4, i.e., 50 observations[2]. The data are taken mostly from different agencies of the Government of India and the Reserve Bank of India. For external series, we have looked at other sources also, e.g., IMF's International Financial Statistics, OECD Economics Indicators, etc.

Overall the model has 24 estimated equations. The estimations take care of time series properties and uses ARDL models and log-differences wherever necessary. Though most of the exogenous variable series of the type used here have been found to exhibit non-stationarity in trend as well as seasonality, we do not take into account that possibility here, given the short span of data. Simulation studies have shown that the tests designed to discover non-stationarity have very poor properties for such small samples. However, to take care of dynamic interactions, seasonal as well as non-seasonal, adequate number of lags has been included wherever required. Moreover, whenever the dynamic properties of the underlying (endogenous) series suggest clear signs of non-stationarity, the equations have been estimated using ARDL approach to cointegration. Thus, the estimation takes due care of the time series properties of the variables. Further, as we need to get a robust model to arrive at accurate forecasts, we have adjusted some of the unexplainable data errors with dummy variables. This is a standard way to minimize the forecast errors (both in-sample and out-of-sample).

4. Estimation Results

Real block

As stated in Section 2, we estimated the three sectoral outputs separately and added these to arrive at the total real output. The equation for real output in agriculture (ZYAG) is as follows:

[2] However, there are series for which data are not available for the full period. For instance, for components of GDP, data are available upto 2008Q1 only. Therefore, the sample indicated above is the largest sample available.

$$ZYAG = 436.276 - 0.139ZYAG_{t-1} + 0.165ZYAG_{t-2} - 0.218ZYAG_{t-3} + 0.496ZYAG_{t-4}$$
$$(4.63) \quad (-4.85) \quad (4.27) \quad (-8.22) \quad (13.19)$$
$$+ 0.123ZGFCF + 0.389(RAIN_{t-1} + RAIN_{t-2}) + 1203.634dumZYG1$$
$$(7.26) \quad (11.91) \quad (15.96)$$

$$R^2 = 0.995 \qquad \bar{R}^2 = 0.994 \qquad dw = 1.539 \qquad F = 1145.83 \quad n = 46$$

where figures in parentheses are t-ratios. The results show very clearly the high degree of seasonality in agricultural output. As expected, rainfall exerts a significant positive effect on agricultural output, and it is the rainfall in preceding two quarters that affects the agricultural production. Capital formation too has large effect on this variable. Adjusted R-squared of more than 99% shows that the model captures the movements in the variable reasonably well. In fact, all the equations presented here the adjusted R-squared is more than 0.92, in most cases more than 0.95.

The results for output in industrial sector (ZYIN) show the significant role of external demand (XNO) and monetary impulses (NDCPR and RRL). Further, the second lag of RRL shows that the impact of monetary policy on industrial output is lagged by two quarters. Further, this equation also shows one channel through which the prices affect the GDP, namely, by depleting the flow of real credit, even if the quantum of nominal credit remains constant.

$$ZYIN = 212.41 + 1.074\left(\frac{NDCPR}{PY}\right) + 0.019(ZYSR + ZYAG) + 0.126XNO + 0.292\left(\frac{NDCPU_{t-3}}{PY_{t-3}}\right)$$
$$(4.52) \quad (3.89) \quad (3.06) \quad (8.01) \quad (0.55)$$
$$- 3.019RRL_{t-2} + 0.614ZYIN_{t-4} + 3.747DUMYIN$$
$$(-1.13) \quad (8.02) \quad (7.16)$$

$$R^2 = 0.998 \qquad \bar{R}^2 = 0.998 \qquad DW = 2.05 \qquad F = 4531.024 \qquad n = 46$$

The output in services sector (ZYSR) is, as expected, affected heavily by the output in the industrial sector, as is clear from the following equation.

$$ZYSR = -1674.40 + 0.086\,ZYAG_{t-1} + 3.293\,ZYIN + 0.246\,ZGFCF + 0.0003\,ZYW_{t-2}$$
$$(-4.79) \qquad (2.90) \qquad (12.55) \qquad (2.67) \qquad (0.38)$$
$$+16.78\,E_{t-1} + 185.598\,DUMZYSR$$
$$(5.45) \qquad (8.84)$$
$$R^2 = 0.998 \qquad \bar{R}^2 = 0.998 \qquad DW = 2.05 \qquad F = 4644.661 \qquad n = 46$$

Further, the gross capital formation and external sector variables also have a significant effect on services sector output. The effect of external factors is lagged.

In the components of aggregate demand, the private sector consumption (ZCPR) exhibits high degree of seasonality. Apart from current income (ZYTO), growth in real credit to private sector (NDCPR/PY), interest rate and price have large impact on private consumption. The large positive coefficient on RRL (it may be recalled, RRL appears here as a proxy for deposit rates and hence represents the opportunity cost of current consumption) shows high degree of intertemporal substitutability of current consumption. Finally, the negative coefficient on fiscal balance shows that the fiscal deficit tends to crowd out private consumption.

$$ZCPR = 205.05 + 0.224ZYTO + 10.20\left(\frac{NDCPR_{t-3}}{PY_{t-3}} - \frac{NDCPR_{t-4}}{PY_{t-4}}\right) + 3.81RRL + 0.64ZCPR_{t-4}$$
$$(0.89) \qquad (4.77) \qquad (2.67) \qquad (0.24) \qquad (6.46)$$
$$-0.06FB - 5.15GPCPI$$
$$(-1.08) \qquad (-1.04)$$
$$R^2 = 0.987 \qquad \bar{R}^2 = 0.985 \qquad DW = 2.55 \qquad F = 497.997 \qquad n = 46$$

The public consumption, on the other hand, depends just on fiscal balance. In fact, this relation captures the positive relation between these two variables, arising out of the rise in ZCPU causing FB to rise. The large coefficient on the lagged ZCPU shows very high degree of seasonal persistence in this variable.

$$ZCPU = 89.85 + 0.88ZCPU_{t-4} + 0.04FB + 195.44DUMZCPU$$
$$(3.68) \qquad (21.94) \qquad (1.46) \qquad (7.82)$$
$$R^2 = 0.939 \qquad \bar{R}^2 = 0.936 \qquad DW = 1.77 \qquad F = 218.69 \qquad n = 46$$

Gross fixed capital formation (ZGFCF) depends on, apart from real output (ZYTO),

availability of credit to the private sector (NDCPR), FII flows (FII) and BSE Sensex (BSE). The significant coefficient on FII underlines the role of external factors in investment, while the large coefficient on NDCPR highlights the importance of credit. The government expenditure is shown to facilitate investment (positive coefficient on ETO) but the credit to the public sector is seen to crowd out investment. Significant coefficient on lagged BSE shows importance of business confidence, but also makes it clear that the impact of business confidence is lagged.

$$ZGFCF = 260.80 + 5.5\left(\frac{ETO}{PY}\right) + 0.07\,ZYTO - 4.96\left(\frac{NDCPU}{PY}\right) + 12.36\left(\frac{NDCPR}{PY}\right)$$
$$(3.59) \qquad (1.40) \qquad (2.93) \qquad (-3.98) \qquad (17.34)$$
$$+ 0.003\,FII + 0.007\left(BSE_{t-1} + BSE_{t-2}\right) + 191.13\,DUMZGFCF$$
$$(3.34) \qquad (1.89) \qquad (3.83)$$

$$R^2 = 0.994 \qquad \bar{R}^2 = 0.994 \qquad DW = 1.002 \qquad F = 1013.492 \qquad n = 46$$

Price Block

As discussed in Section 2, the overall GDP deflator is calculated as weighted average of the sectoral deflators. Among the sectoral deflators, the agricultural deflator (PAG) is positively affected by the broad money and fuel prices, as expected. Also, it exhibits high degree of persistence.

$$PAG = 80.03 + 0.001\,M2 + 0.038\,PFUEL - 0.005\,ZYAG_{t-1} + 0.625\,MA(1)$$
$$(28.34) \quad (8.70) \qquad (1.68) \qquad (-6.15) \qquad (5.07)$$

$$R^2 = 0.982 \qquad \bar{R}^2 = 0.981 \qquad DW = 1.49 \qquad F = 607.43 \qquad n = 48$$

The deflator for the industrial sector, on the other hand, is affected by import prices, fuel prices and non-agricultural output. However, the largest impact is seen to come from its own lag, showing high degree of persistence. One point here is that except PFUEL, all the other variables appear in lagged form.

$$PIN = 11.21 + 9.90 \times 10^{-5} M2_{t-1} + 0.007 PM_{t-1} + 0.015 PFUEL + 0.0009\left(ZYTO_{t-1} - ZYIN_{t-1}\right)$$
$$(1.69) \qquad (0.59) \qquad (2.09) \qquad (1.29) \qquad (1.76)$$
$$+ 0.001\left(ZYTO_{t-2} - ZYIN_{t-2}\right) + 0.75 PIN_{t-1}$$
$$(2.35) \qquad (7.94)$$

$$R^2 = 0.997 \qquad \bar{R}^2 = 0.996 \qquad d = 1.69 \qquad F = 1704.569 \qquad n = 42$$

For the deflator for services (ZYSR), the largest impact is from the fuel prices. The other two variables affecting this deflator are broad money and import prices (both lagged).

$$PSR = 72.59 + 0.0009 M2_{t-1} + 0.004 PM_{t-1} + 0.088 PFUEL + 0.81 MA(1)$$
$$(28.71) \quad (5.65) \qquad (1.41) \qquad (4.05) \qquad (9.39)$$
$$+ 0.65 MA(2)$$
$$(6.18)$$

$$R^2 = 0.992 \qquad \bar{R}^2 = 0.992 \qquad DW = 2.08 \qquad F = 964.43 \qquad n = 42$$

The wholesale price index (PWPI) traces closely the GDP deflator, but fuel prices and world food prices too have a significant impact.

$$PWPI = 4.74 + 0.14 PFUEL + 0.105 PWF + 1.08 PY + 2.687 DUMPWPI$$
$$(2.15) \quad (15.03) \qquad (16.24) \qquad (26.38) \qquad (4.42)$$

$$R^2 = 0.999 \qquad \bar{R}^2 = 0.999 \qquad DW = 1.71 \qquad F = 13828.8 \qquad n = 50$$

Finally, the consumer price index is, though significantly affected by the wholesale price index, it has a high degree of persistence.

$$PCPI = 0.138 + 0.157 PWPI + 0.75 PCPI_{t-1}$$
$$(0.13) \quad (4.29) \qquad (12.14)$$

$$R^2 = 0.995 \qquad \bar{R}^2 = 0.995 \qquad DW = 1.59 \qquad F = 4802.97 \qquad n = 50$$

Monetary Block

In monetary block, we model the net domestic credit to private and public sectors, net foreign assets, broad money and lending rate. The net domestic credit to the private sectors is affected heavily by output in the last one year. It is also affected significantly by the lending rate and the government expenditure. However, the most interesting effect here is from ETO (lagged). Here we allow for both linear and quadratic terms, and both are significant. This means that the effect of ETO on NDCPR is nonlinear. While the

linear term has positive coefficient, the quadratic term has negative coefficient., i.e., though higher government expenditure tends to raise NDCPR, the effect declines as ETO increases, and after a threshold level, the rise in government expenditure tends to reduce NDCPR. This happens because the crowding out effect dominates the crowding in effect at higher levels of ETO. This implies that the fiscal stimulus packages such as those being announced in the post-Lehman Brother's collapse around the world may, if pushed too far, have negative effect on the economy later, unless matched by monetary policy response.

$$LOG(NDCPR) = -13.70 - 0.03RRL + 0.687LOG(ZYIN_{t-1} * ZYIN_{t-2} * ZYIN_{t-3} * ZYIN_{t-4})$$
$$(-7.656) \quad (-2.94) \qquad (32.1)$$
$$+ 0.06LOG(ETO) + 1.03LOG(ETO_{t-1}) - 0.07LOG(ETO_{t-1}) * LOG(ETO_{t-1})$$
$$(2.38) \qquad (2.11) \qquad (2.88)$$
$$+ 0.42MA(1)$$
$$(2.71)$$

$$R^2 = 0.997 \qquad \bar{R}^2 = 0.996 \qquad DW = 1.57 \qquad n = 46$$

Net domestic credit to the public sector depends, as expected, on total expenditure by the government. A Rs. 100 rise in government expenditure in any quarter causes the net domestic credit to the public sector to go up by Rs. 73 by the end of next quarter, showing that a substantial portion of the government expenditure is financed by borrowing.

$$NDCPU = 138.48 + 0.41ETO_{t-1} + 0.32ETO + 0.09FB_{t-1} + 0.87NDCPU_{t-1}$$
$$(2.13) \quad (5.75) \qquad (4.58) \qquad (0.91) \qquad (39.86)$$
$$+ 766.20DUMNDCPU1$$
$$(7.35)$$

$$R^2 = 0.997 \qquad \bar{R}^2 = 0.996 \qquad DW = 2.00 \qquad F = 2355.09 \qquad n = 46$$

Net foreign assets (NFA) show a high degree of persistence. It is affected positively by BSE and real world output.

$$NFA = -2848.83 + 0.009ZYW_{t-1} + 0.08BSE + 0.80NFA_{t-1} + 1051.24DUMNFA$$
$$(-5.87) \quad (5.87) \qquad (7.00) \qquad (31.04) \qquad (11.90)$$

$R^2 = 0.998$ $\quad \bar{R}^2 = 0.998$ $\quad DW = 1.45$ $\quad F = 5487.28$ $\quad n = 50$

Total money supply is, as expected, affected positively by the three components discussed above, the effect being larger in case of domestic credit than the net foreign assets.

$$M2 = -151.02 + 0.22NFA + 0.82NDCPU + 0.74NDCPR + 0.28M2_{t-1} + 908.11DUMM2$$
$$(-1.65) \quad (5.29) \qquad (18.27) \qquad (21.19) \qquad (7.91) \qquad (11.07)$$

$R^2 = 0.999$ $\quad \bar{R}^2 = 0.999$ $\quad DW = 1.42$ $\quad F = 65719.78$ $\quad n = 50$

Finally, the lending rate (RRL) is positively affected by the policy rate (RRREPO) and the foreign interest rate (RRLIBOR). The latter shows high sensitivity of the domestic financial market to external shocks. However, this series exhibits a very high degree of persistence.

$$RRL = 0.77 + 0.06RRREPO_{t-1} + 0.897RRL_{t-1} + 0.02RRLIBOR + 1.43DUMRRL$$
$$(2.54) \quad (2.02) \qquad (24.57) \qquad (2.24) \qquad (14.68)$$

$R^2 = 0.985$ $\quad \bar{R}^2 = 0.983$ $\quad DW = 2.68$ $\quad F = 538.41$ $\quad n = 38$

Fiscal Block

Talking about the expenditure variable (ETO) first, it is affected significantly by the total revenue (RTO). However, the largest effect comes from its own value four periods back, which also highlights high degree of seasonality in this variable.

$$ETO1 = -44.62 + 0.14RTO + 0.004NDCPU_{t-1} + 1.05ETO1_{t-4} + 581.11DUMETO$$
$$(-1.02) \quad (3.01) \qquad (0.40) \qquad (18.28) \qquad (15.28)$$

$R^2 = 0.98$ $\quad \bar{R}^2 = 0.98$ $\quad DW = 2.17$ $\quad F = 486.08$ $\quad n = 43$

The behaviour of tax and non-tax revenue is similar: a large part is explained by their own values in the corresponding quarter in the previous year. Also, as expected, the tax-base, namely the non-agricultural output exerts a significant effect.

$$TR = -74.9 + 0.02(YIN + YSR) + 1.02TR_{t-4} + 103.92DUMTR$$
$$(-3.89) \quad (4.64) \qquad\qquad (19.90) \qquad (4.39)$$
$$R^2 = 0.986 \qquad \bar{R}^2 = 0.985 \qquad DW = 1.54 \qquad F = 883.80 \qquad n = 42$$

$$\log(NTR) = -0.63 + 0.11\log(ZYIN * ZYSR) + 0.82\log(NTR_{t-4}) + 2.78DUMNTR$$
$$(-0.50) \quad (1.38) \qquad\qquad (16.88) \qquad (13.59)$$
$$R^2 = 0.92 \qquad \bar{R}^2 = 0.92 \qquad DW = 2.12 \qquad F = 153.59 \qquad n = 42$$

Trade Block

In trade block, we model imports, exports (both disaggregated into oil and non-oil components) and exchange rate.

The non-oil imports are affected by total output and exchange rate, as expected. A rise in national income by Rs. 100 leads to about Rs. 13 rise in non-oil imports, in all.

$$MNO = -34.85 + 0.06ZYTO + 0.07ZYTO_{t-2} - 8.40E + 0.67MNO_{t-1} + 196.28DUMMTO$$
$$(-0.38) \quad (3.51) \qquad (3.82) \qquad (-3.10) \qquad (8.04) \qquad (7.29)$$
$$R^2 = 0.994 \qquad \bar{R}^2 = 0.993 \qquad DW = 2.81 \qquad F = 1211.31 \qquad n = 43$$

Oil imports depend on international oil prices as well, in addition to total output and exchange rate. In fact, the effect of international oil prices is much larger than the other two factors. Even persistence is much smaller here as compared to non-oil imports, showing the large extent to which the fluctuations in international oil prices can affect the trade balance.

$$MO = 5.298 + 6.71OIL + 0.02ZYTO_{t-1} - 2.895E + 0.24MO_{t-2} + 165.21DUMMO$$
$$(0.07) \quad (11.98) \qquad (1.68) \qquad (-1.68) \qquad (3.16) \qquad (7.02)$$
$$R^2 = 0.988 \qquad \bar{R}^2 = 0.987 \qquad DW = 1.93 \qquad F = 601.98 \qquad n = 42$$

In exports, the non-oil exports are affected by world output, world consumer prices and domestic prices. Non-oil imports have a large effect on non-oil exports, and a Rs. 100 rise in non-oil imports leads to more than Rs. 60 rise in non-oil exports, *ceteris paribus*. Effect of exchange rate is lagged.

$$XNO = -654.23 + 2.3E_{t-1} + 0.62MNO_{t-1} + 8.45PWC - 23.76PY + 0.007ZYW + 159.71DUMXNO$$
$$(-4.62) \quad (0.68) \quad (6.96) \quad (1.14) \quad (-5.19) \quad (3.41) \quad (8.27)$$

$$R^2 = 0.989 \qquad \bar{R}^2 = 0.987 \qquad DW = 1.81 \qquad F = 556.12 \qquad n = 44$$

Oil exports are largely determined by oil imports and oil exports in the previous period, with very small effect from exchange rate.

$$XO = 10.96 + 0.64XO_{t-1} - 0.53E_{t-1} + 0.14MO + 69.27DUMXO$$
$$(0.50) \quad (16.57) \quad (-1.12) \quad (10.69) \quad (17.59)$$

$$R^2 = 0.994 \qquad \bar{R}^2 = 0.994 \qquad DW = 2.26 \qquad F = 1624.12 \qquad n = 41$$

Finally, the exchange rate has significant effect from real world output, domestic and foreign interest rates, foreign capital flows, and expectations about domestic economy as captured by (lagged) BSE Sensex.

$$E = 9.82 - 0.0006BSE_{t-1} - 0.68RRL - 0.0002FII + 5 \times 10^{-5} ZYW + 0.71RRLIBOR_{t-1}$$
$$(1.52) \quad (-6.59) \quad (-2.62) \quad (-9.22) \quad (5.21) \quad (5.67)$$
$$+ 0.56E_{t-4} + 4.07DUME$$
$$(7.86) \quad (6.77)$$

$$R^2 = 0.918 \qquad \bar{R}^2 = 0.903 \qquad DW = 1.92 \qquad F = 61.38 \qquad n = 46$$

5. Historical Validation

After estimating each specification, all equations are solved simultaneously using Gauss-Seidel algorithm for the recent period that is 2004Q2 to 2008Q2[3] and examined the in-sample forecasts of the model through root mean square percentage errors (RMSPE) statistics, given by

$$RMSPE = \sqrt{\frac{\sum[(y^s - y^a)/y^a]^2}{n}} * 100$$

Where n is the number of periods, y^s is the simulated value of variable Y, and y^a is the actual value of variable Y.

Results are presented in table 1. It may be noted that except for fiscal variables and imports, all other variables' RMSPE is less than 10%. In fact, for as many as 16

[3] For some series, e.g., price series and monetary variables actual figures are available upto 2008Q4 and for these variables the RMSPE figures are for that period.

variables, the error is less than 5%. This also includes the real output variables and investment. For fiscal variables the error seems to be higher, but below the acceptable level of 15%. As we also know that there is a lot of noise in the quarterly fiscal data, these errors are not unnatural.

Table 1: RMPSE for different variables

Block	**0-5%**	**5-10%**	**10 % and above**
Real	Real agricultural output, real industrial output, real services output, real private consumption, real gross fixed capital formation	Real public consumption	--
Price	Agricultural deflator, industrial deflator, services deflator, consumer price index, wholesale price index	--	--
Monetary	Net domestic credit to private sector, net domestic credit to public sector, net foreign assets, m2, lending rate	--	--
Fiscal	--	Total government expenditure	Tax revenue, non-tax revenue
External	Exchange rate	Oil exports, non-oil exports, oil imports, non-oil imports	--

For the whole model, the average RMSPE is estimated to be less than 5%.

6. Some simulation results

With satisfactory in-sample forecasting performance, the model was used for some simulations for the period upto 2010Q1. As specified earlier, with this model, we try to understand and assess the impact of recent global events on the Indian economy. In particular, we attempt to analyze four scenarios through this model and they are as follows:

1. In first scenario, we assume that there is no global financial crisis and expect the pre-crisis conditions to continue. This would help in analyzing the net impact of crisis on Indian economy. This would be the baseline scenario

2. In Scenario-1, we examine the impact of rise in global food and fuel prices, which has preceded the global economic meltdown
3. In Scenario-2, the impact of global financial crisis on India's economic growth would be examined
4. In Scenario-3, we examine the impact of policy responses such as monetary and fiscal stimulus packages on the growth.

Baseline scenario

For deriving the baseline scenario we assumed the following for the exogenous variables.

Assumptions

1. World oil prices are expected to increase from 45 to 60 dollars per barrel
2. Rain fall assumed to be normal at its long period averages of 44.6, 218.1, 658.8, 121.3 mm for Q1 to Q4
3. It is expected that the policy interest rate to be at the current level of 5%.
4. Based on OECD forecasts, LIBOR is expected to increase to 2.5% by the end of 2010.
5. OECD growth, which is currently at -1.5%, is expected to decline further to -2.5% in 2009 and to -3.2% in 2010 (based on OECD projections)
6. World consumer prices inflation to decline from 6.01% in 2008 to 2.8% in 2009 and to 2.81% in 2010 (based IMF's World Economic Outlook)
7. World food inflation to be at –20.83 in 2009 against 18.47 in 2008 and in 2010 it is expected to be at 1.35% (IMF's World Economic Outlook)

Based on the assumptions that there is no global economic crisis and no fuel and food price shock and the conditions in domestic and international economy remain same at the March 2008 situation, the model estimates a growth of 7.1% for 2008-09 against 9.1% in 2007-08. And for 2009-10, the GDP growth projected to be at 7.3%. This is also based on the assumption that there is no oil and food price shock that was experienced in the middle of 2008. This forecast only shows that India's cyclical slowdown precedes global economic crisis. One of the main sources of this deceleration in the GDP growth cycle is the deceleration of exports growth, which is moving down to single digit (of 5.3%) in 2008-09 after attaining above 15% annual growth since 2002-03

Alternative scenarios

Next, we tried to see the effects of recent events on India's macro economy. As discussed earlier, here, apart from baseline, the model is used to examine three alternative scenarios. In scenario 1, we introduce the commodity price shock, and in scenario 2, we introduce the global financial crisis. In scenario 3, we examine the impact of policy stimulus packages.

Table 2: Annual growth rate of real GDP (%): Different scenarios

Year	Baseline	scenario 1	scenario2	scenario 3
2007-08	9.3	9.3	9.2	9.2
2008-09	7.1	6.6	6.2	6.4
2009-10	7.3	9.2	5.0	5.8

In scenario 1, we have taken the actual global food and fuel prices in 2008, while assuming there is no financial crisis. In scenario 2, we take recessionary conditions in the global economy (in particular in advanced economies) and in scenario 3 we have taken the policy changes such as reduction in policy interest rates and also the rise in public expenditures and also some reduction in the tax revenues, which forms part of fiscal stimulus package. The results of GDP growth for different scenarios are presented in table 2.

The results clearly show the following:

- Even without the two shocks, the growth rate of the Indian economy would have slowed down in 2008-09, as a result of cyclical downturn.
- The two shocks, of course, contributed to the downturn and deepened further.
- The rise in global food and fuel prices in 2008 indeed brings down the GDP growth in 2008-09. But it bounces back to 9.2% in 2009-10, indicating that the impact of sharp rise in global fuel prices on Indian economy is short-lived.
- The global financial meltdown appears to have adverse impact for atleast eight quarters, with maximum impact expected in 2009-10.
- The impact of policy stimulus packages appears to be very minimal in 2008-09, while in 2009-10 it is expected to be around 0.8 percentage points. But this figure also takes care of the impact of bad monsoons that India has experienced in the Kharif period in 2009. Based on the assumption of normal monsoon, the

GDP is expected to be around 6.7%, indicating that with the normal monsoon, the impact of policy stimulus could have helped GDP growth to increase by 1.7 percentage points (compared to 5% in scenario 2).

7. Conclusion

In this study, an attempt has been made to analyse the impact of recent global economic developments such as sharp rise in the global food and fuel prices in 2008 and the meltdown of global financial sector post-Lehman Brothers' collapse in September 2008. These two developments have had adverse impacts on the most countries in the world and has resulted in recession in many advanced countries. Following these two incidents, to mitigate the adverse impacts, countries across the world have adopted expansionary fiscal and monetary policies aggressively, resulting in sharp rise in fiscal deficits.

In India also, although expansionary fiscal policies preceded the global financial crisis, three fiscal stimulus packages have been unveiled. With this, fiscal deficit, which was targeted to be at 2.5% in Union Budget:2008-09, increased to above 6%. For the year 2009-10, the fiscal deficit to GDP ratio is estimated to be at 6.6% for the centre and above 10% of GDP for Centre and State together exceeding 10% of GDP.

With the help of our structural quarterly macroeconometric model, in the baseline scenario, the study finds that Indian economy was already in a slowdown phase even before the global developments. This slowdown particularly emanated from the slowdown in the industrial production, which was largely cyclical and also due to slowdown in the export demand. The study finds that with the rise in global fuel and food prices had adverse impact on the prices, resulting in double-digit inflation for quite some time. But its impact on the economic growth was not found to be very significant compared to the baseline scenario.

The global financial meltdown indeed deepened the slowdown in the India's economic growth. It has transmitted the negative growth in the exports to slowdown in the

industrial output growth (negative in some months) and led to deceleration in the domestic aggregate demand. But the crisis transmission through finance channel is short-lived; both foreign exchange reserve and also the rupee reserves from the market stabilization fund have given a much needed cushion to the domestic financial markets in the short term. Hence, the adverse impact of global crisis would have significant impact in 2009-10 compared to 2008-09.

The policy changes that were followed after September 2008 appears to mitigate the crisis impact to some extent. But the full recovery, to the 9% growth, appears to depend largely on the recovery in the exports growth. Regarding the fiscal stimulus, the model shows that the optimal threshold level of fiscal deficit (Centre alone) is around 5%. As the Budget Deficit estimate for 2009-10 is at 6.6%, this would result in crowding out of private investments in the medium term. In other words, rolling back the fiscal expansion atleast to its threshold level, if not to old FRBM targets, is essential to achieve the medium term target of 9% growth in India.

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Annex-1: Description of variables used in the model
(Sources of the data are specified in the parenthesis)

APE	Average Price Earnings ratio (RBI bulletin)
BSE	BSE SENSEX end-of-the-month average (RBI Handbook)
BSEMC	BSE Mkt capitalisation last month end (RBI handbook)
BSETO	BSE total quarterly turnover (RBI Handbook)
CAB	Current Account Balance Rs. billion (RBI Handbook)
CABD	Current Account Balance $ mn (RBI Handbook)
CII	Change in inventories Rs. Billion (www.mospi.nic.in)
CPR	Private consumption Rs. billion (www.mospi.nic.in)
CPU	Govt. consumption Rs. Billion (www.mospi.nic.in)
CTO	Total consumption expenditure (www.mospi.nic.in)
E	Exchange rate Rs. per US $ quarter end, (RBI handbook)
ETO	Total government expenditure Rs. billion (www.cga.nic.in)
FB	Fiscal balance Rs. billion (www.cga.nic.in)
FC	food credit RBIHB
FER	Foreign Exchange Reserves Rs. bn (RBI Handbook)
FII	FII flows Rs. million (RBI Handbook)
GFCF	Gross Fixed Capital formation Rs. billion (www.mospi.nic.in)
GIIPA	Growth rate of IIPA
GITO	Growth rate of ITO
GM2	Growth rate of M2
GMNO	Growth rate of MNO
GMO	Growth rate of MO
GPAG	growth rate of PAG
GPC	Growth rate of PC
GPCPI	Growth rate of PCPI
GPFUEL	Growth rate of PFUEL
GPI	Growth rate of PI
GPIN	Growth rate of PIN
GPM	Growth rate of PM
GPSR	Growth rate of PSR
GPWC	World inflation (CPI) (IMF)
GPWF	Growth rate of PWF
GPWPI	Growth rate of PWPI
GPX	Growth rate of PX
GXB	Growth rate of XB
GXNO	Growth rate of XNO
GXO	Growth rate of XO

GZYAG	Growth rate of real agriculture output
GZYIN	Growth rate of real industrial output
GZYSR	Growth rate of real service output
GZYTO	Growth rate of real total output
GZYW	OECD GDP growth (OECD site)
H	Reserve Money Rs. billion (RBI Handbook)
IIPA	IIP for agricultural products (20-21 to 26), (www.mospi.nic.in)
IIPAA	IIP Agriculture and allied (20-21 to 29), (www.mospi.nic.in)
M2	Money Supply Rs. Billion (RBI Handbook)
MNO	Non oil imports Rs. Billion (RBI Handbook)
MO	Oil imports Rs. Billion (RBI Handbook)
MTO	Imports total Rs. billion (www.mospi.nic.in)
NCTR	Net current transfers (CSO)
NDCPR	Net bank credit to commercial sector Rs. billion (RBI Handbook)
NDCPU	Net bank credit to government Rs. billion (RBI Handbook)
NFA	Net foreign exchange assets of Banking sector Rs. billion (RBI Handbook)
NFC	non-food credit (RBI Handbook)
NINV	Net invisibles Rs. Billion (RBI Handbook)
NIT	Net indirect taxes Rs. billion (www.mospi.nic.in)
NTR	Non tax revenue Rs. billion (www.cga.nic.in)
PAG	Price deflator for agriculture 1999-00100, (www.mospi.nic.in)
PC	Price deflator for total consumption 1999-00100, (www.mospi.nic.in)
PCII	Price deflator for CII 1999-00100, (www.mospi.nic.in)
PCPI	CPI industrial workers 2001100, (www.laborbureau.nic.in)
PCPR	Price deflator for private consumption 1999-00=100, (www.mospi.nic.in)
PFUEL	Domestic fuel price index (CSO)
PI	Price deflator for GFCF 1999-00100, (www.mospi.nic.in)
PIN	Price deflator for industry 1999-00100, (mospi.nic.in)
PM	Unit value index imports 1978-79100 (indiastat.com)
PSR	Price deflator for services 1999-00100, (www.mospi.nic.in)
PWC	World CPI (IMF, IFS)
PWF	World food price index (IMF, IFS)
PWPI	WPI 1993-94100, (mospi.nic.in)
PX	Unit value index exports 1978-79=100 (indiastat.com)
PY	Price deflator for GDPFC 1999-00=100, (www.mospi.nic.in)
PYMP	Price deflator for GDPMP, 1999-00100, (www.mospi.nic.in)
RAIN	rainfall quarterly total indiastat.com, (CMIE monthly bulletin)
RRCALL	Call money rate (RBI handbook and bulletin)
RRD	Deposit rate (RBI Handbook)

RRL	Prime Lending Rate (RBI Handbook and Bulletin)
RRLIBOR	LIBOR for 3 months (IFS)
RRREPO	Repo rate (RBI, Handbook)
RRUS	United States federal fund rate (IFS)
RTO	Total Receipts Rs billion (www.cga.nic.in)
TB	Trade balance (CSO)
TR	Tax revenue (www.cga.nic.in)
XB	Exports of Basmati rice, Rs. Crore (indiastat.com, APEDA)
XNO	Non oil exports Rs. Billion (RBI Handbook)
XO	Oil exports (RBI)
XTO	Total exports (RBI)
YAG	Nominal Agricultural GDP (www.mospi.nic.in)
YIN	Nominal GDP industry (www.mospi.nic.in)
YSR	Nominal GDP services (www.mospi.nic.in)
YTO	Total Nominal GDP (www.mospi.nic.in)
ZCII	Real change in inventories (www.mospi.nic.in)
ZCPR	Real private consumption (www.mospi.nic.in)
ZCPU	Real public consumption (www.mospi.nic.in)
ZCTO	Real total consumption (www.mospi.nic.in)
ZGFCF	Real GFCF (www.mospi.nic.in)
ZMTO	Real total imports (www.mospi.nic.in)
ZNIT	real net indirect taxes (www.mospi.nic.in)
ZXTO	real total exports (www.mospi.nic.in)
ZYAG	real GDP agricultural (www.mospi.nic.in)
ZYIN	real GDP industry (www.mospi.nic.in)
ZYSR	real GDP services (www.mospi.nic.in)
ZYTO	Real GDP total (www.mospi.nic.in)
ZYW	OECD real GDP (Stats.OECD)