Is Fiscal Policy Contracyclical in India: An Empirical Analysis

Chakraborty, Pinaki and Chakraborty, Lekha S

National Institute of Public Finance and Policy, New Delhi, India;, Centre for Development Studies (JNU), India

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PINAKI CHAKRABORTY[♣]
LEKHA S CHAKRABORTY

Abstract

The paper empirically examines the validity of Keynesian philosophy of contracyclical variation in fiscal policy to the macroeconomic activity in India. The macroeconomic activity is proxied by 'output gap' a concept defined to estimate the index of economic activity. Applying Johansen's Full Information Maximum Likelihood test of cointegration, it was found that there exists a long run, stable relationship between fiscal policy stance and macroeconomic activity. Further, the causality detection in asymmetric vector autoregression model revealed that there exists feedback mechanism between fiscal policy stance and output gap, which reinforces the Keynesian theory that fiscal stance is contracyclical in nature. The policy implication of these results points to the fallacy of *rule-based fiscal policy* to contain fiscal deficit, based on the neo-classical assumption that fiscal deficit has detrimental effects through financial crowding out. The results reinforced the role of fiscal deficit not as an evil but as an instrument of short run demand management and also the significance of *pump priming*.
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Key words: Fiscal stance, Output gap, Contracyclical fiscal policy, Stationarity, Cointegration, Asymmetric vector autoregression.

[♣] Authors are Associate Professors, Centre for Development Studies, Prasanthnagar, Thirivananthapuram, Kerala, India.
Email: pinaki@cds.ac.in

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Keynesian philosophy of contracyclical variation in budget deficit to reduce fluctuations in economic activity gained momentum in developed countries with the publication of Keynes's *The General Theory of Employment, Interest and Money* in 1936[1]. The shifting of fiscal policy stance away from the principle of balanced budget to the compensatory principle of finance viewed budget deficit not as an evil but as an instrument of short run demand management.

Apart from the developed countries, in developing countries also, budget deficit-GDP ratio increased significantly during the post world war period. However, theoretical literature expressed contrasting views on the relationship between budget deficit and economic activity. The Ricardian Equivalence Theorem argued that variation in budget deficit is neutral to economic activity; as in the face of rising budget deficit, farsighted and intertemporally optimising tax payer, taking into account also the interests of future generations, would increase savings so as to provide for the higher tax burden in the future, offsetting the likely impact of budget deficit on macroeconomy. However, neo-classicals argued that budget deficit has detrimental effect on economic growth; that a rise in the budget deficit leads to increase in the rate of interest, which in turn leads to the decline of interest-sensitive components of private spending, in particular, the phenomena of *crowding out* of private investment. Only, the Keynesian theory proposed that budget deficit has a positive effect on the macroeconomic activity, stimulating savings and capital formation by increase in the aggregate demand. One way to looking into the relationship between budget deficit and economic activity is to examine the effect of variation in the deficit on various macro variables like interest rate, rate of inflation, exchange rate, current account deficit and private investment. Other way of looking into it is to examine the relationship between deficit and macroeconomic activity in totality.

This paper examined the relationship between budget deficit and macroeconomic activity in India. This paper is divided into following sections. In section-I, we define the concept of economic activity and measure it. In section II, the appropriate concept of deficit capable of capturing the true relationship between budget deficit and economic activity is defined and estimated. In the section III, the results of cointegration technique applied to examine the long

[1] An evaluation of US fiscal policy in line of Keynesian prescription is narrated in Herbert Stein**'s *The Fiscal Revolution in America***. Similarly, the characterization of British macroeconomic policy as Keynesian in the immediate post war decades has become and unchallenged in standard text books [Congdon: p84, 1998]

run equilibrium relationship between macroeconomic activity and fiscal stance is reported. The section IV detects the direction of causality between the variables and the Section V sums up the findings and draws conclusions.

I. Concept and Measurement of 'Economic Activity'

For the present purpose of the study, the concept of 'economic activity' is synonym to the concept of 'capacity utilisation' of an industry or firm. Like 'capacity utilisation', it is also a measure of the intensity with which national economy makes use of its resources. The economy-wide measure of 'capacity utilisation' or the economic activity index can be defined as

OG=[(Actual GDP-Potential GDP)/Potential GDP] *100

This is also known as the 'output gap' [see Christiano: 1981, Congdon: 1998; Tanzi, 1985]. It can be seen from the above equation that the index of economic activity or 'output gap' is defined as the difference between the actual and trend/potential level of national output as a percentage of trend/potential output.

Definitionally speaking, potential level of output would be higher than the actual as the resource utilisation is maximum at potential level. However, it is argued that cyclical factor such as recession or boom could cause the actual to be below or above the potential output respectively [Tanzi: 1985]. The major problem of estimation of 'output gap' lies on the estimation of potential level of output.

Theoretically, the 'production function method' estimates the trend/potential output by determining the quantity and productivity of inputs, viz., labour and capital[2]. The relative importance of the two inputs are determined by assuming that their return is determined by their marginal products and their share in the national output is equal to their quantity multiplied the return (See Adams and Coe: 1990). Trend output estimation through 'production function method' requires data on labour force and capital stock. If data on one of these series or both are not available, one has to search for other methods of estimation of trend output.

[2] It is called 'production function method,' as production is represented as the functions of inputs.

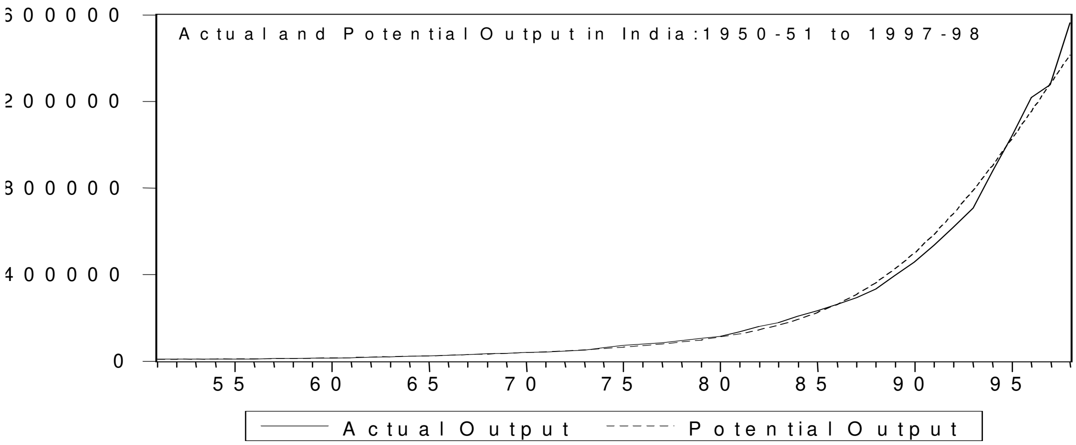
One of the most commonly used methods of estimation of trend output is the moving average method. Another method known as 'trend through peaks' developed by Klein with Wharton Econometric Forecasting Associates (hereafter TTP) [Klein and Summers: 1966]. The steps involved in estimation are delineated below. First step is to plot the data on GDP adjusted for price fluctuations and identify the peaks. Secondly, it is assumed that identified peaks in the series are the points where resources in the economy are used at 100 per cent of their capacity. Third step is to intrapolate between the major peaks including the first and last observation. The strong assumptions beneath the TTP method itself deterred us from using it as a tool for estimating potential output.

The Hodrick-Prescott filter (HP filter) is yet another method for the derivation of the potential output. The idea of this filter is to decompose a non-stationary time series such as actual output into a stationary cyclical component and a smooth trend component (Y_t and Y_t^* denote the logarithms of actual and trend/potential output respectively) by minimising the variance of cyclical component subject to a penalty for the variation in the second difference of the trend component (Hodrick-Prescott: 1981). This results in the following constrained least square problem

$$\text{Min} \quad \sum_{t=1}^{T} (Y_t - Y_t^*)^2 + \lambda \sum_{t=2}^{T-1} [(Y^*_{t+1} - Y_t^*) - (Y_t^* - Y^*_{t-1})]^2$$

The first term in the equation is a measure of fit. The second term is a measure of smoothness. The *Langrange* multiplier λ is associated with the smoothness constraint and must be set apriori. As a weighting factor, it determines how smooth the resulting output series is. The lower the λ, the closer potential output follows actual output. We have used the HP filter method for the calculation of potential level of output.

Chart 1: Movement of Actual and Potential Output in India



The Chart 1 traces the path of actual and potential output in India. The series showed a smooth increasing trend over the period 1950-51 to 1997-98. It should be noted that smoothening the actual data we arrive at this potential series. In turn, the potential series has an estimation bias.

II. Nature of Deficit and Measurement of Fiscal Stance

Having estimated the potential GDP series to arrive at the measure of 'output gap', in this section we examine the nature of fiscal policy and estimate the fiscal policy stance. In case of developing countries, deficit is generally structural in nature. The structural fiscal deficit emanates due to the structural change in the economy and it has got lasting impact on the budget balance. The cyclical deficit has transitory effect on budget balance emanating from the difference between actual and potential output [Congdon: 1998]. If the fiscal deficit is cyclical in nature they would turn into surpluses during boom years due to the greater mobilisation of revenues and consequently there would be no accumulation of debt and no expansion in the debt-GDP ratio over the cycle and vice-versa [Tanzi & Blejer: 1988]. The cyclically neutral fiscal deficit attempts to remove the effect of fluctuations in economic activity on the budget.

For the purpose of our analysis, we construct an indicator, viz., fiscal stance which, is defined as the difference between actual and cyclically neutral fiscal deficit. The fiscal stance (FIS) could be either expansionary or contractionary. A positive FIS implies an expansionary fiscal policy stance and a negative FIS implies a contractionary fiscal policy stance. The objective is to test for long run stable equilibrium relationship between the fiscal stance and macroeconomic activity index -‘output gap’ and detects the direction of causality between them [3].

In order to estimate the cyclically adjusted fiscal deficit or cyclically neutral fiscal deficit [hereafter CNFD], the Heller et al (1986) technique is followed. In order to calculate the CNFD, Heller, et al. (1986) assumed that in the absence of discretionary policy, government revenue is unit elastic with respect to actual nominal GDP, while government expenditure is unit elastic with respect to the trend value of real GDP valued at current prices. The difference between the two will give the CNFD. The difference between the actual fiscal deficit and the CNFD is the fiscal stance (FIS). In equation form CNFD can be written as

$$CNFD=g.\ GDP^{*}-t\ .GDP$$

where g is the expenditure to nominal GDP ratio, t is the revenue-to-nominal GDP ratio, both in a given base period. GDP^{*} is the potential value of GDP, and fiscal stance

$$FIS=X-CNFD$$

where X is the actual deficit.

The movement of the ‘fiscal stance’ and output gap revealed that we had an expansionary fiscal policy stance except for very few years in the early 1950s and early 1970s. The movement of FIS further revealed highly expansionary fiscal policy stance during the early 1980s and in the early 1990s compared to earlier years (see Char 2 and Chart 3).

III. Econometric Estimation: Pre-tests for Order of Integration and Cointegration

In order to examine whether there is any long run equilibrium relationship between the fiscal stance and economic activity represented by the ‘output gap’, we apply the cointegration technique between the two for the period starting from 1950-51 and ending with 1997-98. As cointegration technique involves the testing of stationarity of data series which other- wise, could give rise to econometric problems, we apply Dickey Fuller [augmented] and Phillips Perron test to examine the stationarity. The Table 1 reported the Unit root test result of both fiscal stance and output gap. The result indicates that both fiscal stance and output gap are stationary at I (1).

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[3] If the actual out put were below the trend level of output, the tax revenue also would be below the trend level. However, items of government expenditure may well remain above the trend especially the items of committed revenue expenditures like items of social security, interest payment, etc. which would lead to an increase in the deficit.

Table 1: Unit Root Test Results of Fiscal Stance and Output Gap

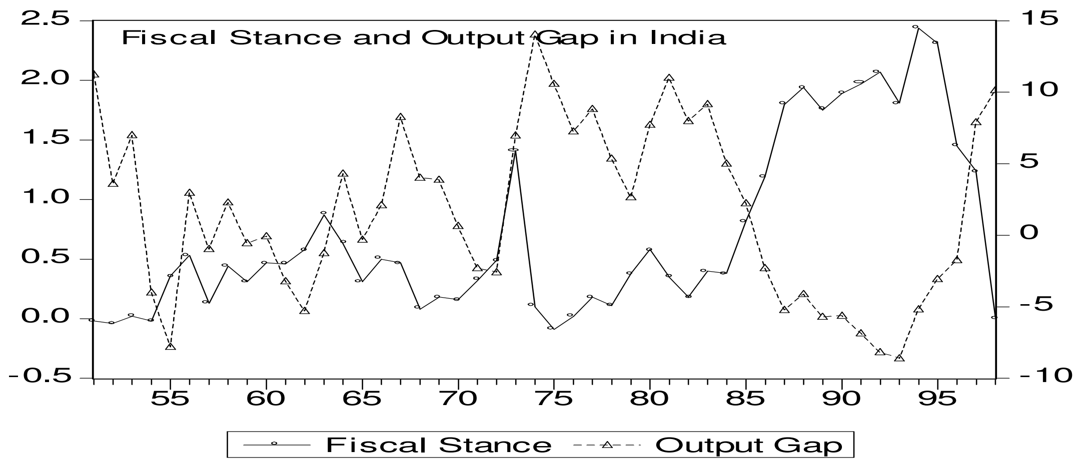
	Fiscal Stance		Output Gap	
ADF Test	-3.960891 (-3.5112)	I(1)**^{c,t}	-5.045857 (-4.1728)	I(1)*^{ct}
PP Test	-6.313484 (-4.1678)	I(1)*^{ct}	-7.110202 (-4.1678)	I(1)*^{ct}

Note: 1. I (1) implies stationary at levels.
2. "c,t" implies with constant and time trend.
3. "*" denotes significance at 1 per cent, "* *" denotes significance at 5 per cent.
4. Figures within brackets are MacKinnon Critical Values

Chart 2: Plots of Fiscal Stance and Output Gap in India

The Chart 2 plots the fiscal stance and output gap. Prima facie, the plots revealed that fiscal policy stance and economic activity are *moving together* over the period 1950-51 to 1997-98. Since 90s, the output gap which is the proxy for economic activity has shown a distinct decline. At the same time, fiscal policy stance has shown an expansionary phase. Does this mean that fiscal policy in India is contracyclical in nature? In other words, when the economy is in recession, government undertakes pump priming and when the economy is in boom, fiscal policy stance takes a contractionary step. The contracyclical variations of fiscal policy stance to reduce the macroeconomic fluctuations in the economy is prima facie captured from these plots. But these indications from the graphical plots have to be statistically proved to examine whether we really had a contracyclical fiscal policy. Econometrically, if we could prove that the fiscal stance and output gap are cointegrated and also causality is established between fiscal stance and output gap, then Keynesian philosophy of contracyclical nature of fiscal policy can be proved in Indian context.

Chart 3: Co-movement of Fiscal Stance and Output Gap in India



As both the variables are integrated of same order, the next step is to establish if there is any cointegrating relation between fiscal stance and output gap. We have used Johansen full information maximum likelihood test of cointegration for this purpose.

Table2: Johansens' Full Information Maximum Likelihood Test for Cointegration: Results of λ-Trace Test.

Null hypothesis	Eigen value	Likelihood Ratio	Critical Value 5 %	Critical Value 1 %	AIC	SBC
.r =0	0.384864	25.79447	25.32	30.45	6.291609	6.530127
.r =1	0.072105	3.442506	12.25	16.26	6.023088	6.460372

The result of the Johansen full information maximum likelihood test of cointegration using k=1 and including a linear deterministic trend is given in the Table 2. According to the Johansen trace test, null hypothesis of no cointegration vector is rejected at 95 per cent confidence interval. The model selection criteria also indicated that there is one cointegrating equation.

IV. Hsiaos' Autoregressive Modelling and Causality Detection

According to the Granger Representation Theorem, if two data series forms a cointegration set, there must be Granger causality between them at least in one direction [Engle and Granger, 1987]. We test for Granger Causality in Hsiao's (1981) autoregressive framework. The point to be noted here is that as the variables under concern are I (1) and they are cointegrated, one should specify vector error correction model (VECM) for the causality tests[4] to avoid misspecification.

The appropriate parameterization of the model manifests the critical part of Granger-causality test, as the results depend on the lag length chosen. Arbitrarily or adhoc parameterization can lead to econometric problems. Under parameterization may lead to estimation bias and over parameterization results in the loss of degrees of freedom and thus the power of the test. On the basis of parameterization, Vector Autoregressive modeling can be of two types. The first type of VAR model is standard Sims-type VAR model in which every variable enters every equations with the same lag length. This is Symmetric VAR model since it employs symmetrical lag specifications. The second type is Asymmetric VAR model. Asymmetric VAR model is defined as VAR where each variable may have a unique number of lags. The advantage of asymmetric VAR over symmetric VARis that the latter employs the same lags length for each variable and consequently often estimates many statistically insignificant coefficients.

Hsiao's [1981] method is one of the alternatives to unconstrained Sims type symmetric VAR[5]. Hsiaos' procedure starts from univariate autoregression and sequentially adds lags and variables using Akaikes' [1969;1970] Final Prediction Error criterion. This Asymmetric VAR model using FPE criterion to select the appropriate lag specification takes care of the "parametric profligacy" of symmetric VAR models[6]. An advantage of Hsiao [1981] Asymmetric VAR is that along with the appropriate parametrisation, we can detect the causality of the variables also in the

[4] If the variables are non-stationary, that is, integrated of a higher order, the conventional asymptotic theory is, in general, not applicable to testing in VAR. If economic variables were I(1) with no cointegration, then one could estimate a VAR in first-differences. Similarly if variables are I(1) and they are cointegrated, one should specify vector error correction (VECM) model (Park and Phillips:1989).

[5] The Bayesian VAR method (Litterman:1986) is another alternative to symmetric VAR. Hsiaos' [1981] Asymmetric VAR has an advantage against Littermans' Bayesian VAR. Litterman imposes Bayesian prior restrictions on VAR coefficients. Since these prior restrictions are almost always based on forecasting performance instead of economic theory, parameter estimates from Bayesian VARs are likely to be biased. Bias may be acceptable in forecasting, but biased structural parameters estimates are undesirable if the goal is to answer questions about macroeconomic structure and the channels of operation of a macrovariable (Keating: 2000).

[6] Hsiaos' method takes care of the practical disadvantage of Symmetric VAR that number of parameters to be established can easily become large and this quickly eats up degrees of freedom in the estimation procedure. Often, however, a substantial number of parameters hardly differ from zero. Moreover, Ahking and Miller [1985] have shown that imposing common lag-lengths has no basis in theory, and can distort the estimates and lead to misleading inferences concerning causality, if lag structure differ across variables. To overcome this problem Hsiao [1981] suggests an approach start from univariate autoregression and sequentially adds lags and variables using FPE.

autoregressive framework. Asymmetric VAR models permit more flexibility in modeling dynamic system. In Asymmetric VAR, each equation has the same explanatory variables, but each variable may have different number of lags. Hsiao further noted that " FPE criteria is appealing since it balances the risk due to the bias when a lower order is selected and the risk due to the increase of variance when a higher order is selected."

Hsiao [1981] noted that by combining this Final Prediction Error criterion and Grangers' [1969] definition of causality, a practical method for identification of the system of equations can be suggested.

Akaikes' definition of Final Prediction Error criteria is expressed as

$$FPE_y(m, n) = \frac{T+m+n+1}{T-m-n-1} * \frac{\sigma^2 y(m,n)}{T}$$

where T is the number of observations, m and n are the order of lags of the variables under the concern , fiscal stance [y] and output gap [x] respectively and

$$\sigma^2\ y(m,n) = \sum_{t=1}^{T} (yt - \hat{\psi}^{m}_{11}(L)\, y_t - \hat{\psi}^{n}_{12}(L)\, x_t - \hat{a})^2$$

where superscripts m and n denote the order of lags in $\psi_{11}(L)$ and $\psi_{12}(L)$. And $\psi^{m}_{11}(L)$, $\psi^{n}_{12}(L)\, x_t$ and a^ are the least square estimates. [for details, see Hsiao: 1981].

The causality can be detected as follows:

1. If FPE y (m,n) < FPE y (m,0) then xt Granger causes yt, denoted by xt $\Rightarrow$ yt.
2. If FPE y (m,n) < FPE y (m,0) and FPE y (n,m) < FPE y (n,0); then the relationship is feedback, denoted by xt $\Leftrightarrow$ yt.

The final prediction error (FPE) of fitting one dimensional autoregressive process for FIS and OG are computed with upper bound of lag length (L^*) assumed equal to 10. Firstly, we have considered FIS as controlled variable, holding the order of its autoregressive operator to one, we sequentially added the lags of the manipulated variable OG upto the L^* of 10 and found that the order which gives the smallest FPE at the lag of 6. In this treatment of OG as the manipulated variable we found that $FPE_{FIS}(m^*,n^*) < FPE_{FIS}(m^*,0)$ which implies FIS Granger-causes OG. To examine whether there is any feedback mechanism that exists between FIS and OG we repeated the experiment in the bi-variate framework keeping OG as the controlled variable and sequentially added the lags of FIS to the set and found the presence of reverse causality between the variables.

Table 3: Results: Hsiao [1981] Detection of Optimal Lags of the Manipulated Variable and FPE of the Controlled Variable

Controlled Variable	Manipulated Variable	Optimum lags of Manipulated Variable	Final Prediction Error	Causality Inference
Fiscal Stance [1]	-	-	0.1591	
Fiscal Stance [1]	Output Gap	6	0.0747	FIS ⇒OG
Output Gap [2]	-	-	0.1836	
Output Gap[2]	Fiscal stance	1	0.1776	OG⇒FIS

Note: The number in the parentheses denotes the order of autoregressive operator in the controlled variable.

V. Conclusion

This study examined the relationship between fiscal policy and macroeconomic activity in India by estimating both 'fiscal policy stance' and the index of economic activity proxied by 'output gap'. The 'output gap' was estimated by estimating the potential output (GDP) through HP filter method. Using the method adopted by Heller et al (1986), the fiscal policy stance was also estimated. We found that fiscal policy was largely expansionary in nature during the last five decades. The standard test procedure applied to test the order of integration revealed that both fiscal policy stance and output gap series are stationary at I~(1). The cointegration test revealed that there existed a long run stable cointegrating relationship between the two. The causality test among them under Hsiao's autoregressive framework also revealed that there existed a feed back mechanism between the two, which implies that fiscal policy, is contracyclical in nature in India.

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