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Private Investment and Economic Growth: Regional Experience in India

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PRIVATE INVESTMENT AND ECONOMIC GROWTH: REGIONAL EXPERIENCE IN INDIA

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ABSTRACT

This paper examines the impact of private investment on income at the state level for the major 15 states in Indian economy over the periods from 1993–94 to 2004–05 by using General Methods of Moments (GMM). The result finds that elasticity of per capita income with respect to private investment is more than that of the public investment, which is due to the higher productivity of private capital than the public capital in developing countries. There is also evidence of the convergence of per capita income among Indian states by conditioning per capita private investment along with other factors of economic growth. This paper is innovative in separating out the significance of private investment from the public investment in explaining variation in income across states. This paper suggests that balanced regional growth can be achieved by the equitable allocation of private investment across states.

JEL Classification: E22, R11, C23

Key words: Private investment, Convergence, Regional growth, Panel data methods

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I. INTRODUCTION

Investment is identified as a crucial factor for economic growth at both the national and state levels in Indian economy. The inflow of investment into a state has the potential to generate state income, output and tax revenue along with providing employment opportunities to local residents. Investment is sourced from both the private sector and public sector. The pattern of flow of private investment differs from that of the public investment. The flow of public investment is discretionarily determined by the decision of central and state governments. In contrast, the flow of private investment is market oriented and determined by the rate of returns on investment. The introduction of various economic reform measures in 1991 aggravates the competition for attracting private investment in a variety of ways. For instance, the abrogation of the Industrial Licensing Act favours the investors to choose their preferred state among other states as the investment destination. Further, liberalization measures reduce the degree of control exercised by the Centre in many areas, leaving much greater scope for state level initiatives in Indian economy. Hence, there has been a stiff competition among the states to attract private investment among Indian states.

The imbalanced economic growth among the Indian states is a persistent issue. The imbalanced regional growth can pose a serious threat to the economic development because even small differences in growth rates, cumulated over a long period of time, would have a substantial impact on the standard of living of the people (Barro and Sala-i-Martin, 1995). Chowdhury (2003) also argued that inequality in any form has a negative effect on subsequent growth and development and creates economic, social and political tension among the states in India.

There is no comprehensive study on the relative significance of private investment and public investment on income across the Indian states. However, there is rich literature on the impact of investment on economic growth at state level and the issue of convergence of per capita income across the Indian states include Baddeley *et al.* (2006), Rao *et al.* (1999), Kurian (2000), Aiyer (2001), Marjit and Mitra (1996), Rao *et al.* (1999), Dasgupta *et al.* (2000), Cashin and Sahay (1996), Krishna (2004), Nayar (2008), Aiyer (2001), Bajpai and Sachs (1996), Sinha and Sinha (2000) and Nagaraj *et al.* (1998). These studies provide mixed results on the issue of convergence of regional growth in India based on different samples of the states over different time spans. For example, Cashin and Sahay (1996) and Aiyer (2001) find evidence of convergence after controlling for differences in initial economic conditions, but Rao *et al*. (1999), Bajpai and Sachs (1996), and Sinha and Sinha (2000) find divergence. Aiyer (2001) finds that education and investment helped to reduce cross-state income divergence, while Cashin and Sahay (1996) found that fiscal transfers were a significant equalizing force. Bhattacharya and Sakthivel (2004) and Kumar (2004) assert that the reforms of the 1990s exacerbated the gap between richer and poorer states, while Ahluwalia (2002) asserts that these reforms helped reduce the gap. However, due to the unavailability of data on private investment and public investment, many states used (i) loans extended by financial institutions as proxy for private investment (Nayar, 2008; Baddeley *et al*., 2006; Rao *et al.*, 1999), (ii) credit from scheduled commercial banks for private investment (Purfield, 2006), and (iii) public expenditure (Rao *et al*., 1999) and developmental expenditure (Nayar, 2008; Baddeley *et al.*, 2006) for public investment. These proxies are poor reflections of the extent of private investment and public investment at the state level because they exclude loans extended by various non-financial institutions to private enterprises and foreign investors in the states and public investment as a part of public expenditure. The use of appropriate measures of private investment may suggest the robust results of the impact of private investment on the income of states and the long-run dynamics of income with private investment in the Indian states.

In light of the above, this paper seeks to shed light on the debate by asking two related questions. First, how do private investment and public investment explain the variation in income in Indian states? Second, what is the role and importance of private investment in the long-run dynamics of states income in the Indian states? The detailed empirical analysis of the study by using the appropriate measurement of private investment and public investment, may suggest the policies to achieve balanced growth, which will ensure regional convergence in terms of per capita income and spread the benefits of the growth processes among the different states of India.

Following this introduction, the measurement issues of investment are described in section II. The association of income with their private investment at the state level is presented in section III. The theoretical background for the impact of private investment on state income is described in section IV. Methodology for the empirical analysis is described in section V. The variables and data sources used in the study are described in section VI. The impact of private investment on income at the state level is analysed in section VII.

The long-run dynamics of income of Indian states is examined in section VIII. The last section concluded the paper.

II. MEASUREMENT OF PRIVATE INVESTMENT IN INDIAN STATES

The central statistical organisation (CSO) is the basic source for data relating to investment and capital stock in India. GOI (2007) defines that investment is the creation of capital or net addition to the stock of capital. Investment is usually measured by the gross capital formation (GCF), which comprises gross fixed capital formation (GFCF) and change in stocks or inventories. CSO estimates capital formation at the national level by three approaches, i.e. production (or commodity flow), saving (or flow of funds approach), and expenditure approach. The GFCF is used as the measurement of investment due to the fluctuating nature of inventories (Khan and Reinhart, 1990; Blejer and Khan 1984; Wai and Wong 1982, Mallick 2013, 2012, 2011, 2008) at the national level. The production and saving approaches are not directly applicable at the state level due to non-availability of data. Further, change in stocks is not conceptually viable or feasible at the state level because of the open state boundaries and due to the non-availability of data on goods and services transacted across the state boundaries. Hence, the Regional Accounts Committee (RAC) in 1972 recommended compilation of estimates of state level GFCF by using the expenditure approach.

Reports by National Statistical Commission headed by Dr C. Rangarajan in August 2001 and High Level Committee (GOI, 2009) have recommended several measures for improvements in the estimation of state level public and private GFCF in India. GOI (2009) comments that the non-availability of details on state level capital expenditures in private corporate and household sectors, limits the compilation of estimates of state level private GFCF. Although data on GFCF with respect to national level private corporate sector is available from the “Studies of Company Finances” conducted by the RBI, such details cannot be worked out as companies do not maintain location-wise capital expenditures in their accounts. As regards the household sector, the All India Debt and Investment Survey (AIDIS) provides data for the benchmark years only. Also, there are problems with respect to AIDIS data, which results in considerable underestimation of investment data as well. However, at present, the benchmark enterprise surveys conducted by the National Sample

Survey (NSS) do not give reliable estimates of GFCF at state level, due to a variety of reasons.

Further, state level capital formation is estimated by the Directorate of Economics and Statistics (DES). DES of Andhra Pradesh (AP), Assam (ASM), Haryana (HA), Madhya Pradesh (MP), Rajasthan (RA), Tamil Nadu (TN) and Uttar Pradesh (UP) estimate both the private GFCF and public GFCF. However, Bihar (BH), Gujarat (GU), Karnataka (KA), Maharashtra (MR), Orissa (OR) and Punjab (PN) only estimate public investment. EPWRF (2003 and 2009) publishes the GFCF at the state level, estimated by DES and others in India. EPWRF (2003) commented that there are limitations to the estimates of capital formation in DES estimates. As per the recommendation of the sub-group on "State Gross Domestic Product and Expenditure Account," all states are supposed to apply the same broad methodology. But, there are variations in methods adopted depending upon the economic structure at a particular point of time and data availability in the individual states. Hence, the estimates of DES are not comparable across the states.

The state level private investment is estimated at current prices by Lakhchaura (2004) from 1993–94 to 1999–00, GOI (2009) for 2004–05 and Rajeswari *et al.* (2009) from 1999–00 to 2005–06. The data length in Lakhchaura (2004) and Rajeswari *et al.* (2009) are too short for a meaningful empirical analysis. The above estimates cannot be combined with each other, as they are based on different methodologies, data sets and assumptions. Mallick (2013) estimates public GFCF, domestic private GFCF and foreign private GFCF for the major 15 states from 1993–94 to 2004–05 at constant prices (i.e. 1999–00=100)[1]. Jharkhand, Chhattisgarh and Uttaranchal were carved out of larger states of Bihar (BH), Madhya Pradesh (MP) and Uttar Pradesh (UP) respectively to form new states in 2000–01. Hence, Mallick (2013) clubs these divided states with their original states from 2000–01 to 2004–05 to make consistent with the previous year estimates. These estimates are also robust, as these are comparable with Lakhchaura (2004) and GOI (2009). Hence the present study analyses the impact of private investment on the income and role of private investment in convergence/divergence of income at the state level by using estimates of GFCF from Mallick (2013). The study includes the major 15 states viz. AP, ASM, BH, GU, HA, KA,

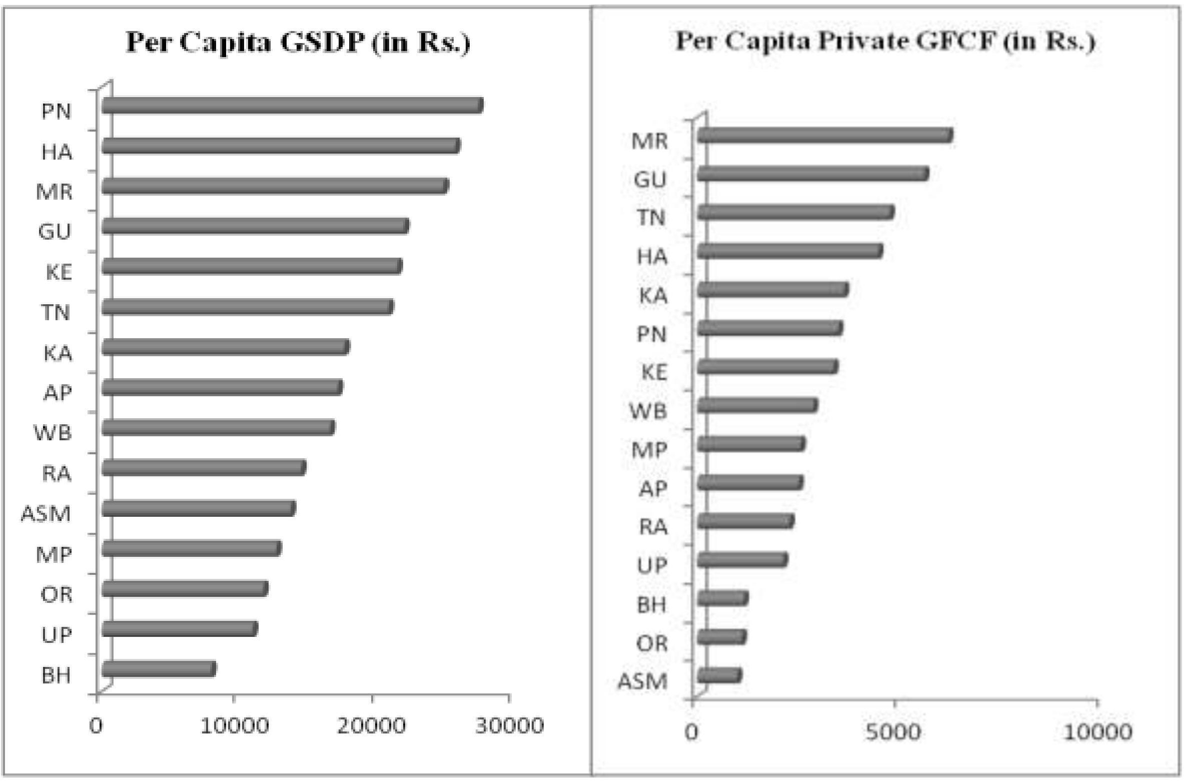
[1]Mallick (2013) uses two steps for the estimation of state level private GFCF in the 15 major states. First, the national level total real GFCF is distributed across states on the basis of their share in gross state domestic product (GSDP). The total GFCF includes both the private and public GFCF. Second, the state-wise combined capital expenditure is constructed and used to distribute the national level public GFCF. The remainder—after netting out of public GFCF from total GFCF—is the state level private GFCF. Further, the total private GFCF is distributed between domestic and foreign owners based on the foreign direct investment data.

KE, MP, MR, OR, PN, RA, TN, UP and West Bengal (WB) over the period from 1993–94 to 2004–05.

III. PRIVATE INVESTMENT AND INCOME IN INDIAN STATES

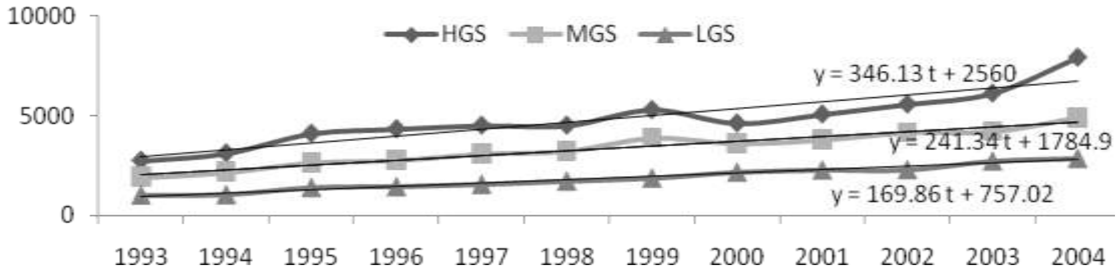
The annual averages of per capita GSDP in 15 major states are presented in Figure 1. The Figure reveals that the top eight states in terms of per capita GSDP are PN, HA, MR, GU, KE, TN, KA and AP. However, five state such as MR, GU, TN, HA and KA, are the top five in terms of per capita private investment. The simple correlation coefficient of per capita GSDP with per capita private investment and public investment is 0.81 and 0.74, respectively. The result indicates a high degree of association between per capita private investment and per capita GSDP. The variation or scatteredness of per capita private GFCF and per capita GSDP across states over the periods 1993–94 to 2004–05 is measured by the standard deviation and plotted in Appendix Figures 1 and 2. The figure indicates some important results on the patterns of development. There is high dispersion of per capita GSDP corresponding to the high dispersion of per capita private GFCF, which have been increasing over the periods, as reflected in the trend line in the figures.

Figure 1: Per Capita Private GFCF and Per Capita GSDP of States



States can be classified into three groups on the basis of economic growth viz. high growth states (HGS): GU, HA, MR and PN; medium growth states (MGS): AP, KA, KE, TN and WB; and, low growth states (LGS): ASM, BH, MP, OR, RA and UP (Adabar**,** 2005). The trend lines of annual averages of per capita private investment for these three groups of states are plotted in Figure 2. The trend lines reveal the positive trend in all the three groups of states. However, it is important to observe that the coefficient of trend line for HGS (= 346.13) is higher than the MGS (= 241.34) and LGS (= 169.86). Further, the coefficient of trend line for MGS is also higher than the LGS. The trend coefficients indicate that the rate of increase in per capita private investment in HGS is higher than the MGS and LGS. The rate of increase in per capita private investment in MGS is also higher than the LGS. Hence, there is the emergence of increasing variation in private investment across these three groups of states in India.

Figure 2: Per Capita Private GFCF (in Rs.) by Income Groups of States



Thus, the picture that emerges is that the increasing variation in total private investment corresponds to the increasing variation in income at state level over the periods. Rao *et al.* (1999) and Bhattacharya *et al.* (2004) provide various reasons for such increasing disparity in income across Indian states. Rao *et al.* (1999) commented that the divergence of per capita income across Indian states has increased, particularly since economic liberalisation measures were initiated, which reduced the degree of control exercised by the Centre in many areas leaving much greater scope for state level initiatives and facilitate states to compete with each other in order to attract the market-determined flow of private investment. Further, the regional pattern of allocation of private investment depends upon resources, institutions and policies. Rao *et al.* (1999) argued that social and economic infrastructures are crucial for the allocation of private investment among the Indian states. Further, Bhattacharya *et al.* (2004) argued that though the growth rate of GSDP has improved marginally in the post-reform period, at the same time, regional disparity in SDP has widened more drastically. Industrial states are growing more rapidly than backward states by attracting investment, due to a variety of reasons, like poor income and infrastructure and poor governance. The liberalisation policies have helped these growing states to make their backward and forward linkages stronger. However, Pal and Ghosh

(2007) argued that this increasing inequality in the distribution of private investment could be due to either a big domestic market or cheap and skilled labour. The large market size involves high demand, which requires high private investment, to fill the gap between demand-supply in the economy. The other reason is that many states have completely ignored the rural sector and concentrated their development expenditures in the urban areas, which aggravated the rural and urban inequality in India.

IV. THEORETICAL BACKGROUND

The present study aims at evaluating the impact of private investment on state income, and its role in the convergence of state income across major states in Indian economy. The neoclassical growth theory has been extensively used to understand the inter-regional and inter-country growth and differences in income due to its theoretical foundation (Baumol, 1986; De Long, 1988; Barro and Sala-i-Martin, 1995; Mankiw *et al.,* 1992; Shioji, 1993; Cashin, 1995; De la Fuente, 1996). Hence, this paper uses the theoretical framework as provided in Mankiw *et al.* (1992) to estimate the impact of private investment on income at state level.

The Cobb-Douglas production function with two units of inputs including labour and capital, which are paid at their marginal productivities, and with decreasing returns in accumulable factors, the production function for state “i” at time “t” can be written as

$$Y_{it} = K_{it}^{\alpha}(A_{it}L_{it})^{1-\alpha} \qquad 0 < \alpha < 1 \qquad (1)$$

Where, Y_{it}, A_{it}, K_{it} and L_{it} represent output, level of technology, stock of capital and quantity of labour respectively. The coefficients α and (1- α) represent the elasticities of output with respect to capital and labour. Whereas, L and A are assumed to grow exogenously at the rates n (i.e. growth of population) and g (i.e. growth of technology). Following Mankiw *et al.* (1992) the natural log of per capita income (y) of states “i” *at a* given time “t” is:

$$\ln y_{it} = a + \frac{\alpha}{1-\alpha}\ln(s_{it}) - \frac{\alpha}{1-\alpha}\ln(n_{it} + g + \delta) + \varepsilon_{it} \qquad (2)$$

The equation predicts that natural log level of output per worker is positively associated with the natural log of investment rate(s) and negatively with the effective depreciation rate

$(n+g+\delta)$[2]. Whereas, ε_{it} is the random disturbance term in the model. The equation predicts not only signs, but also the magnitude of the coefficients on saving rate and population growth, by assuming that factors are paid their marginal products and the states are currently in their steady state. Human capital positively affects to the income. Hence, equation (2) can be modified as below.

$$\ln y_{it} = a + \frac{\alpha}{1-\alpha}\ln s_{it} + \frac{\lambda}{1-\alpha}\ln h_{it} - \frac{\alpha}{1-\alpha}\ln(n_{it} + g + \delta) + \varepsilon_{it} \qquad (3)$$

Where s_{it} and h_{it} are physical investment rate and human capital investment rate respectively, and λ represents the output elasticity of the stock of human capital.

The important determinants of economic growth identified in equations (2) and (3) are the total investment, human capital and population growth. However, the role and importance of private investment in the economy differs from that of public sector investment. The impact of private investment on economic growth significantly different from the public investment in the developing countries (Khan and Reinhart, 1990). In other words, the marginal productivity of private capital differs from that of public capital in developing countries. Private investment plays a much larger role in the growth process than public investment due to the market-based economic reforms. At the same time, public investment also affects economic growth by increasing the productivity of capital (Aschauer, 1989; Otto and Voss, 1994). Hence, in order to separate out the effects of private sector investment from public sector investment, equations (2) and (3) need to be expanded.

The inclusion of private investment and public investment in the regression equations (2) and (3) may pose a theoretical question within the neoclassical growth framework. It is because the capital share components of public capital due to public investment or private capital due to private investment in state income cannot be compatible since the only exponent of aggregate capital is, α in the model. The regression equation (2) derived from Cobb-Douglas' production function uses aggregate factors of production such as capital and labour; augmenting technical progress (Harrod neutral) is indirectly helpful to estimate the share of capital and labour in the income of the state. This estimate of capital share is obtained from the aggregate capital used in the production process of an economy.

[2] The present study uses δ (=0.05) as the constant rate of depreciation of capital. However, g is assumed to be 0.02 following Sivasubramonian (2004).

Therefore, estimation of a separate parameter due to public investment rate in the presence of private investment variable in the regression equations (2) and (3) may be inconsistent with the neoclassical growth model (Solow, 1956) and may result in ambiguity in the determination of the magnitudes of the parametres.

However, the impact of private investment and public investment can be evaluated by using the neoclassical growth model. The matter of interest for this objective of the study is the coefficient of private investment and public investment, which represents the elasticity of income due to private investment and public investment. The larger coefficient of private investment than the public investment indicates the larger marginal product of private investment than the public investment. Hence, equations (2) and (3) can be expanded to include both public investment and private investment. The expanded equation captures the contribution of both private and public sector capital stock to the economic growth due to private investment and public sector investment in an economy (see, Khan and Kumar, 1997; Khan and Reinhart, 1990).

There is long-run impact of investment on economic growth as in the neoclassical growth models. Investment is crucial in the convergence of economic growth. The prediction of convergence is based on diminishing returns to reproducible capital. In the Solow-Swan growth model (Solow, 1956) output per effective worker depends on the initial level of output per effective worker [y(0)], the initial level of technology [A(0)], the rate of technical progress (g), the saving rate (s), the growth rate of labour force (n), the depreciation rate of capital (δ), the share of physical and human capital in output [(α) and (λ)] and the rate of convergence to the steady state (β) during the transitional dynamics. Thus, the model predicts that a high saving (investment) rate is positively related to the growth in output per worker and the growth of labour force is negatively related to the growth in output per worker after being corrected for the rate of technological progress and the rate of depreciation of capital. The specification for conditional convergence (without human capital) is

$$(1/t)\ln(y_{it}) - \ln(y_{i0}) = \tilde{\tilde{a}} - \left(\frac{1-e^{-\beta t}}{t}\right)\frac{\alpha}{1-\alpha}\ln s_{it} - \left(\frac{1-e^{-\beta t}}{t}\right)\frac{\alpha}{1-\alpha}\ln(n_{it}+g+\delta) - \left(\frac{1-e^{-\beta t}}{t}\right)\frac{\alpha}{1-\alpha}\ln y_{i0} \quad (4)$$

where, $\tilde{\tilde{a}} = \left(\frac{1-e^{-\beta t}}{t}\right) + \ln A_0 + gt$. Equation (4) predicts that states with low initial output per effective worker record faster transitional growth rates than the states with higher initial output per effective worker, conditioned upon the values (s, n, g and δ). The transitional equation for the Solow-Swan model augmented with human capital is given by

$$(1/t)\ln(y_{it}) - \ln(y_{i0}) = \tilde{\tilde{a}} - \left(\frac{1-e^{-\beta t}}{t}\right)\frac{\alpha}{1-\alpha}\ln s_{it} - \left(\frac{1-e^{-\beta t}}{t}\right)\frac{\alpha}{1-\alpha}\ln(n_{it} + g + \delta) + \left(\frac{1-e^{-\beta t}}{t}\right)\frac{\lambda}{1-\alpha}\ln s_{it} - \left(\frac{1-e^{-\beta t}}{t}\right)\frac{\alpha}{1-\alpha}\ln y_{i0} \quad (5)$$

where $\beta = (1-\alpha-\lambda)(n+g+\delta)$.

Equations (4) and (5) are used for the estimation in stochastic form under the assumption that production structure is common to all states. This assumption is necessary because it is difficult to observe the efficiency function of $\ln A_t$ and $\tilde{\tilde{a}} = \left(\frac{1-e^{-\beta t}}{t}\right) + \ln A_0 + gt$ is also assumed to be constant across the states. As mentioned earlier, the inclusion of both private investment and public investment into equations (4) and (5) makes it impossible to estimate the rate of convergence within the neoclassical growth models, which is a matter of interest for this particular objective of this study. The inclusion of both the private and public investment rates with growth of population and human capital in the regression equations (4) and (5) calls for an alternative formulation of the production function, which is beyond the scope of neoclassical growth models.

V. EMPIRICAL METHODOLOGY

This study uses panel data of 15 states over the period from 1993–94 to 2004-05 in India. The panel data model is used to control for individual heterogeneity of the states, more degree of freedom and more efficiency (Baltagi, 2001). In the case of panel data model, the error term ε_{it} is a composite residual consisting of time invariant state specific components μ_i, and captures various characteristics of the state, which are not observable but have a significant impact on incomes, and the disturbance term ε_{it}, which is assumed to satisfy the Classical Linear Regression (CLRM) model assumptions.

The empirical analysis of short-run impact of private investment includes 15 major states over the period 1993–94 to 2004–05. The pooling of data of 15 cross-sections with the 12 time periods, provide 180 number of observations. The number of states (n=15) is greater that than the number of time period (T=12). Some of the regressors are expected to be endogenously determined in the system. The lag of per capita income may also explain the variation in private investment across states. Hence, there is the presence of a lagged dependent variable as regressor in the estimation. Further, time-invariant state characteristics (fixed effects) may be correlated with the explanatory variables. Due to these features of the estimation, the analysis on the short-run impact of private investment on income across states uses dynamic Generalized Method of Moments (GMM) panel estimator. Equations (2) and (3) can be represented through the following form of the dynamic GMM panel equation.

$$Y_{it} = \alpha Y_{it-1} + \beta X_{it} + \lambda Z_{it} + \mu_i + \varepsilon_{it} \quad (7)$$

i = 1……………15 and

t = 1993–94, 1994–95,………………, 2004–05.

Y_{it} is per capita income of states, Y_{it-1} is one year lag of per capita income of states, X_{it} is the vector of strictly exogenous variables and Z_{it} is the vector of predetermined and endogenous variables[3]. α, β and λ are the parameters. μ_i is the time invariant state specific effect that captures various characteristics of the state, which are not observable but have a significant role in inflow of private investment. ε_{it} is the error term, with the assumption that μ_i and ε_{it} are independent for each i over all t, and that there is no autocorrelation in the ε_{it}.

The dynamic panel GMM has been widely employed in empirical literature on Development Economics due to its advantages[4]. The methodology of GMM for panel data analysis proposed by Arellano and Bond (1991) and then further developed by Blundell and Bond (1998).[5] Arellano-Bond estimation starts by transforming all regressors, usually by differencing, and uses the Generalized Method of Moments (Hansen 1982), and so is called Differences GMM. The Arellano-Bover/Blundell-Bond estimator augments Arellano-Bond by making an additional assumption that first differences of instrument variables are uncorrelated with the fixed effects. This allows the introduction of more instruments and builds a system of two equations—the original equation as well as the transformed one—which is known as System GMM.

The yearly time spans are too short to be appropriate for studying growth

[3] Predetermined variables and endogenous variables are assumed to be correlated with only past errors, and both the past and present errors, respectively.

[4] The GMM estimator is good in exploiting the time-series variation in the data, accounting for unobserved individual specific effects, and therefore providing better control for endogeneity of all the explanatory variables (Beck *et al*., 2000).

[5] For a detailed explanation on the GMM estimator, see, Green (2000, Chapter 11), Wooldridge (2002, Chapter 8 and Chapter 14), and Roodman (2009).

convergence (Islam, 1995). Short term disturbances may loom large in such brief time spans. Importantly, using annual data on per capita real income has the disadvantage of increasing serial correlation due to business cycle effects and shocks. In contrast, using long-period averages increases the probability of obscuring changes in the steady state that have occurred during the period. Hence, keeping in mind these concerns, we use a panel of four-year spans (i.e. $\tau = 4$). Hence, for the period 1993–94 to 2004–05, we consider three panels. Islam (1995) developed a dynamic panel growth framework as derived from the basic neoclassical growth model. With time span (τ), equations (4) and (5) can be transformed into the following equation.

$$y_{it} = \psi y_{i,t-\tau} + \sum_{j=1}^{3} \theta_j x_{it}^{j} + \eta_t + \mu_i + \varepsilon_{it} \qquad (6)$$

Where y is the per capita income.

$$y_{it} = \ln Y_{it}$$

$$y_{i,t-\tau} = \ln \gamma y_{i,t-\tau}$$

$$\theta_1 = (1 - e^{-\beta\tau}) \frac{\alpha}{1-\alpha}$$

$$\theta_2 = -(1 - e^{-\beta\tau}) \frac{\alpha}{1-\alpha}$$

$$\theta_3 = (1 - e^{-\beta\tau}) \frac{\lambda}{1-\alpha}$$

The implied β, α and λ obtained from the estimates of equation 6 are given as follows.

$$\beta = \frac{-\ln(\psi)}{\tau} \qquad (6.1)$$

$$\alpha = \frac{\theta_1}{1 - e^{-\beta\tau} + \theta_1} \qquad (6.2)$$

$$\lambda = \frac{\theta_1 - \alpha\theta_3}{1 - e^{-\beta\tau}} \qquad (6.3)$$

The inclusion of both the per capita private investment and public investment into equation (6) is beyond the neoclassical growth framework, which makes it impossible to estimate implied α and implied β in the present growth framework. However, the inclusion of two investment variables into the growth equation suggests an alternative framework of analysis. Mankiw *et al.* (1992) argue that an augmented Solow model, which expresses growth as an explicit function of the initial level of income and a set of other variables, included as determinants of the steady state, is an alternative way to analyse convergence. Most empirical growth models are based on the hypothesis of conditional convergence, where countries converge to parallel equilibrium growth paths, the levels of which are a function of certain variables, i.e. an equation for growth (the first difference of log output) contains some dynamics in lagged output (Mankiw *et al.*, 1992; Barro 1991;

Caselli *et al*. 1996). The equation is:

$$\ln y_{it} - \ln y_{i,t-\tau} = \beta \ln y_{i,t-\tau} + \psi x_{it} + \eta_t + \mu_i + \varepsilon_{it} \qquad (7)$$

where y denotes real per capita income, i indexes the state, t indexes the time period, η is a state-specific fixed effect, μ is a year-specific effect, X is a vector of explanatory variables. Equation (7) can be rewritten as a dynamic panel data model in which current output is function of lagged output and a set of explanatory variables.

$$\ln y_{it} = (1+\beta) \ln y_{i,t-\tau} + \psi x_{it} + \eta_t + \mu_i + \varepsilon_{it} \qquad (8)$$

Equation (8) can be used to estimate the speed of convergence by including both private investment and public investment as the explanatory variables. The coefficient of lag of income is $1+\beta$. Where the – (+) sign of β shows the convergence (divergence) of income among states. The speed of convergence among the states is β/τ.

Hence, the study includes 45 numbers of observations by pooling 15 states over three time periods (each spanning a period of 4 years). However, 3 time periods for the estimation of dynamic panel GMM are not sufficient. Hence, the analysis of this objective uses the simple panel data model. There are three types of panel models viz. (a) pooled regression model (PRM), (b) fixed effects model (FEM), and random effects model (REM). Two diagnostic tests are used to choose among panel data models viz. Breusch and Pagan Lagrange Multiplier (LM) test and the Hausman specification test. LM test is used to test the null hypothesis of non-random individual effect. Hausman specification test is used to test null hypothesis of zero correlation between state specific effects and the explanatory variables. The significance of LM test statistics indicates that the model estimated by using REM or FEM give better estimates than PRM. Further, the statistical significance of Hausman specification test suggests preferring estimation by using FEM to REM. The standard statistical frameworks for the estimation of these models are well known (Greene, 2006; Baltagi, 2001). The diagnostic statistics of panel data models suggest using the fixed effect models for the empirical estimation as well.

VI. VARIABLES AND DATA SOURCES

The data for this study is based on secondary sources. This paper focuses on the impact of private investment on income by including 15 major states over the period from 1993–94 to 2004–05, which account for 90% of India's population, 80% of national private investment and 82% income in the country. All the variables included in the analysis are in the form of natural logarithm. Equations (2) and (3) are estimated to evaluate the impact of private investment and public investment on income at the state level by using the annual data from 1993–94 to 2004–05. The data on state public investment and private investment are sourced from Mallick (2013). Data on population and GSDP of states are taken from EPWRF (2009). Human capital is expected to positively influence the income at the state level. Human capital allows the operation of tasks that are more complicated and which produce high-skill products, thereby improving productivity. Further, Lucas (1988) argued that human capital generates positive externalities. The total number of enrolments in education, representing human capital at the state level, is sourced from the Annual reports of University Grant Commissions (UGC). The detailed measurements of variables and data sources are described in Table 1. The descriptive statistics and simple correlation coefficients of the variables included in the analysis are presented in Tables A1 and A2 in Appendices.

Table 1: Variables and Data

Variables	Measurement	Data Sources
Per capita real income (y)	The ratio of real GSDP to the population in each state.	EPWRF (2009)
Annual growth of population ($n+g+\delta$)	The population variable is adjusted with the growth of technology and depreciation ($g+\delta$).	“do"
Human capital (h)	It is measured as the ratio of gross enrolment to the population of respective state.	Annual reports of UGC
Per capita private investment (Ip)	The ratio of real private GFCF at constant prices (1999–2000) to the population of each state.	Mallick (2013)
Per capita public investment (Ig)	The ratio of real public GFCF to the population of each state.	“do"
Per capita total investment (I)	The ratio of real GFCF to the population of each state.	“do"

Note: *The values of all variables are at constant prices 1999–2000.*

The long-run dynamics of income with private investment is examined by using the dynamic fixed effects panel growth equations (6) and (8). The annual time length’s data are very short to study growth convergence and hence the total time period from 1993–94 to 2003–04 is divided into four-year shorter time periods to estimate equations (6), (7) and (8). The four-year periods are 1993-1996, 1997–2000 and 2001–2004. The dependent variable is the natural logarithm of f per capita income [ln(y*)] in the estimation. The independent variables are natural log of per capita income at the beginning of the each four-year period [ln (y0)], the natural log of per capita investment variables, population growth rate [ln (n+g+ δ)*], and human capital [ln (h*)]. The study considers 15 major states and 3 shorter time periods. The detailed measurements of variables and data sources to study the long-run dynamics of income conditioning private investment along with other variables are described in Table 2. The descriptive statistics and simple correlation coefficient of the variables are presented in Tables A3 and A4 in Appendices. The result shows that the correlation coefficients of ln (y*) with per capita private investment [ln (I_p*)] and per capita public investment [ln (I_g*)] are 0.81 and 0.64. The degree of association of per capita income with per capita private investment is higher than per capita public investment. The initial level of income (ln (y_0)), ln (I*), ln (I_p*), ln (I_g*) and ln (h*) are positively correlated with ln (y*), while population growth is negatively correlated with ln (y*).

Table 2: Variables in Long-run Dynamics of Income

Variables	Measurement	Data sources
Per capita real income (y*)	The annual average for each four-year shorter time periods.	EPWRF (2009)
Initial level per capita income (y_0)	This is the real per capita income at the beginning year of the each four-year span.	“do"
Annual growth of population (n+g+ δ)*	The annual average of each four-year shorter time periods after the growth of population adjusted with the growth of technology and depreciation (g+ δ).	“do"
Human capital (h*)	It is measured as the ratio of total enrolment to the population of each state. The annual average of each four-year shorter time periods.	Annual reports of UGC
Per capita private investment (Ip*)	The ratio of real private GFCF to the population of each state. The annual average of each four-year shorter time periods.	Mallick (2013)
Per capita public investment (Ig*)	The ratio of real public GFCF to the population of respective states. The annual average of each four-year shorter time periods.	“do"
Per capita total investment (I*)	The ratio of real GFCF to the population of each state. The annual average of each four-year shorter time periods.	“do"

Note: *All the variables in values are at the constant prices 1999-2000.*

VII. IMPACT OF PRIVATE INVESTMENT ON INCOME

This section presents the estimation results of impact of private investment on income in Indian states by using the theoretical equations (2) and (3), and applying dynamic panel data models. The analysis of the dataset is started by testing the statistical properties of the time series. The stationarity of variables is investigated by applying panel unit root tests viz.

Levin, Lin and Chu (LLC), Breitung, Im, Pesaran and Shin (IPS), Fisher-type tests using ADF and PP tests, and Hadri test. Tests have been computed under two different specifications, represented by the inclusion of individual effects, and individual effects and linear trends as reported in Table 5. LLC, Breitung, and Hadri tests assume that there is a common unit root process. LLC and Breitung tests employ the null hypothesis of common unit root while the Hadri test uses a null of no unit root. The null hypothesis of the individual unit root process is verified by IPS and Fisher tests of ADF and PP. The first part of Table 5 provides the result for the specification of inclusion of both the individual effects and linear trends. The unit root result for ln (y) shows that LLC, PP Breitung, IMS and ADF tests fail to reject the null hypothesis of unit root process. Hadri test rejects the null hypothesis of no unit root in ln (y). Hence, ln (y) is not stationary. Similarly, the unit root result for ln (I) and ln (Ig) shows that LLC, PP Breitung, IMS and ADF tests fail to reject the null hypothesis of unit root process. While Hadri test rejects the null hypothesis of no unit root in ln (I) and ln (Ig). Hence, ln (I) and ln (Ig) are not stationary. However, the majority of panel unit root tests suggest the presence of unit root in ln (h), ln (Ip) and ln (n+g+δ). The second part of Table 5 provides the results of panel unit root for the specification that includes only the individual effect. The results suggest the presence of unit root in all the variables as well.

Table 5: Panel Unit Root Test

Variables	Ln(y)	Ln(I)	Ln(I)p	Ln(Ig)	ln(n+g+δ)	Ln(h)
Unit Root Test (With Trend)						
Levin, Lin & Chu	2.05	4.34	-3.03*	2.97	0.19	15.47
Breitung	2.18	2.12	-0.69	4.93	-2.32*	-0.13
Im, Pesaran and Shin	2.02	1.43	-0.70	3.14	0.95	1.68
ADF - Fisher	12.58	16.25	32.93	12.57	17.73	23.26
PP - Fisher	31.10	10.64	69.02*	19.95	79.63*	164.93*
Hadri	4.89*	5.00*	3.85*	7.90*	4.81*	9.14*
Unit Root Test (Without Trend)						
Levin, Lin & Chu	0.93	5.32	-1.6	4.02	-0.03	2.18
Im, Pesaran and Shin	5.26	6.4	1.88	1.58	0.51	4.10
ADF - Fisher	6.43	1.84	16.88	19.22	21.65	18.63
PP - Fisher	8.25	3.26	27.28	32.39	74.36*	102.03*
Hadri	8.92*	9.1*	8.64*	4.87	4.22*	8.37*

Note: * significant at 1% level, ** significant at 5% level, *** significant at 10% level. Automatic selection of maximum lags. Automatic selection of lags based on SIC. Newey-West bandwidth selection using Bartlett kernel. Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. Probabilities for Hadri test is computed using Z distribution.
Source: Author's calculation using EViews 7.

The result of panel unit root test shows that all the variables included in the analysis are unit root processes. Further, though the number of states (n=15) is larger than the number of years (n=T), but still the number of states is small for the system GMM approach of Blundell and Bond (1998). It may not be appropriate to use System GMM with a dataset with small number of states, because it uses more instruments than the difference GMM (Mileva, 2007). Hence, the empirical analysis preferred to use the Arellano and Bond (1991) difference GMM estimator to system GMM estimator developed by Blundell and Bond (1998). The results are provided in Table 6.

Table 6: Impact of Private Investment on Income

Independent variables	Dependent variable: log of per capita income			
	Regression 1	Regression 2	Regression 3	Regression 4
l.ln (pgsdp)	0.47 *	0.73*	0.50 8*	0.66 *
	(0.12)	(0.09)	(0.13)	(0.10)
ln(I)	0.30 *		0.26*	
	(0.07)		(0.08)	
ln(Ip)		0.11*		0.10 *
		(0.02)		(0.03)
ln(Ig)		0.04*		0.03 **
		(0.02)		(0.01)
ln(n+g+ δ)	-0.25*	-0.28	-0.21*	-0.23*
	(0.05)	(0.08)*	(0.06)	(0.6)
ln(h)			0.04**	0.07***
			(0.02)	(0.05)
Observations	135	135	135	135
States	15	15	15	15
Instruments	87	88	105	107
Wald chi2(5)	287.97	484.4*	491.01	517.19*
AR1	-2.27**	-2.11**	-2.25**	-2.17 **
AR2	1.98	1.95	2.01	1.98
Hansen Test of over ID	12.57	13.42	13.41	13.78

***Notes*:** *, ** and *** indicate statistical significance at 1%, 5% and 10% respectively. Robust standard error estimates are consistent in the presence of any pattern of heteroskedasticity and autocorrelation within panel standard errors and are reported in parenthesis.
***Source*:** Author's calculations using STATA 12.

Table 6 provides four sets of results, which differ from each other with respect to the specification of regression equations. Regression 1 includes log of per capita income [ln(y)] is the function of log of per capita total investment [ln (I)] and log of adjusted population growth rate. The results of difference GMM estimator shows that, per capita investment and population growth rate are statistically significant in explaining the variation in per capita income at the state level in India. The sign of the coefficient of investment and growth of population are positive and negative, respectively, which is expected. Also the results of the first difference GMM of dynamic panel data model shows that, the one year lag of the dependent variable, i.e. the one year lag of log of per capita income [ln(y0)] is statistically significant with a positive sign.

Now the per capita investment is divided into per capita private investment and per capita public investment, and introduced in regression 2. The results of the first difference GMM shows that all the regression coefficients are statistically significant and have the expected signs. Particularly, both the investment variables are found to be statistically significant in explaining the variation in per capita income across Indian states. The one year lag of per capita income is also found to be statistically significant in the regression. The coefficients of per capita private investment and public investment are 0.11 and 0.04 respectively, which indicates that the elasticity of per capita income due to the per capita private investment is higher than the elasticity due to the per capita public investment. In other words, the effect of private investment on income is more influential than that of public investment, which corroborates with the finding of Khan and Reinhart (1990), and Khan and Kumar (1997). Khan and Reinhart (1990) argued that marginal productivity of private capital is more than that of public capital in developing countries, including India, due to the market-based reforms in the economy which leads to higher income elasticity of private investment than public investment.

The augmented Solow growth model suggests that the human capital explains the variation in per capita income. Hence, regression 3 includes log of per capita income as the function of log of per capita investment, log of human capital [ln(h)] and log of growth rate of population. The first difference GMM results shows that all human capital, per capita investment and population growth rate are statistically significant and have the expected signs in explaining the variation in per capita income across the Indian states. However, the coefficient of per capita investment is higher than the coefficient of human capital, which indicates the significance of investment in the variation of income across states. In other words, the elasticity of income due to the per capita investment is higher than the elasticity of income due to human capital as well. Also, the difference GMM result shows that the one year lag of per capita income is statistically significant in explaining the variation in income.

The relative significance of private investment and public investment with the presence of human capital is analysed in regression 4. The regression equation (4) includes per capita private investment, per capita public investment, human capital and population growth rate as the independent variables to explain the per capita income across states. The result of difference GMM shows that the coefficients of all the regressors are statistically significant with the expected signs. Even in the presence of human capital, the coefficient of per capita private investment is larger than the coefficient of per capita public investment and human capital. It indicates that not only is the elasticity of income due to private investment larger than the elasticity of income due to per capita public investment, but also larger than the human capital. In other words, the marginal productivity of private capital is more than the public capital at the state level in Indian economy. Hence, the role and importance of private investment is more important than the role of public investment in the variation in income across Indian states during the period from 1993–94 to 2004–05. Further, the results of first difference GMM suggest that the lag of per capita income is also significant which explains the variation in per capita income across states.

In short, factors such as private investment, public investment and human capital positively explain the variation income across states. The population growth rate negatively influences the income at the state level in India. However, private investment is more significant than the public investment in explaining the variation in income across Indian states. In other words, the marginal productivity of private capital is more than public capital during this study periods because of the market-based reforms in the Indian economy. Also, private investment is more significant than human capital to explain the variation in income across states. The results of difference GMM suggest the positive impact of the one year lag of income on the variation in income across states as well.

VIII. PRIVATE INVESTMENT AND CONVERGENCE OF INCOME

The role and importance of private investment in the long-run dynamics of income at the state level is analysed by using dynamic panel growth model (i.e. equation (6)) as suggested by Islam (1995). The estimation results are presented in Table 7. Table 7 provides six set of results, which differ from each other due to the specifications. Regressions 5, 6, 7 and 8 are estimated within the framework of Islam (1995). However, Islam (1995) has limitations in estimating regressions 9 and 10. Hence, the empirical framework in terms of equation (8) is used to estimate regressions 9 and 10 along with regressions 5, 6, 7 and 8. The speed of convergence by using both the frameworks, i.e. by using the frame work of Islam (1995) and equation (8) are provided in Table 7.

The analysis started with diagnostic tests to choose the appropriate model among the panel data models. The results show that the value of LM statistics and Hausman statistics are statistically significant in all the regressions. Hence, all the regressions are estimated using the fixed effect method. The F-statistic for the state-specific coefficients is significant at 1% in all the models, which indicates the significance of state-specific effects in the long-run dynamics of income across states in Indian economy. Hence, the nature of data is in line with that of Islam's (1995), which suggests the use of the fixed effect model due to the significance of state specific effects on the long-run dynamics of income.

Regression 5 includes per capita income as the function of initial per capita income, per capita investment and population growth. The result shows that all the variables are statistically significant with their expected signs. The coefficient of initial income is found to be 0.63, which indicates the conditional convergence of income among states. Hence the implied β using Islam (1995) [or equation 6] is 0.11. The speed of convergence among the Indian states is 11.6%, conditioning to investment and population growth rate during the period from 1993–94 to 2004–05. Per capita total investment is replaced by per capita private investment in regression 6. The estimation result shows that the initial per capita income, per capita private investment and population growth rate are statically significant with the expected signs. The coefficient of initial per capita income is 0.75, which indicates the conditional convergence of income across the Indian states. The implied β is found to be 0.072, which indicates that the speed of convergence is 7.2 %.

Human capital is introduced in regression 7 and regression 8. Regression 7 includes initial level of per capita income, per capita investment, population growth rate and human capital as the independent variables. The result shows that initial level of per capita income, population growth rate and per capita investment are statistically significant and have their expected signs. However, human capital is statistically significant at the conventional level. The coefficient of initial level of per capita income is 0.61, which shows the evidence of conditional convergence of income among the Indian states. The implied β is found to be 0.124, which indicates that the speed of convergence is 12.42%. The per capita total investment is replaced by the per capita private investment in regression 8. The estimation result shows that all the factors of steady state income are statistically significant except human capital. The coefficient of initial level of per capita income is 0.69, which shows the evidence of conditional convergence. The implied β is found to be 0.093. Hence, the steady state income across states is converging at the speed of 7.2% with conditioning to per capita private investment and population growth rate.

Table 7: Convergence of Income in Indian States

Independent variables	Dependent variable: log of per capita income at the end of each four-year span					
	Regression 5	Regression 6	Regression 7	Regression 8	Regression 9	Regression 10
ln(y0)	0.63 (.08)*	0.75* (0.06)	0.61* (0.08)	0.69* (0.08)	0.74* (0.07)	0.69* (0.08)
ln(I*)	0.19* (0.06)		0.17* (0.06)			
ln(Ip*)		0.07* (0.03)		0.06** (0.03)	0.07** (0.03)	0.05*** (0.04)
ln(ig*)					0.007 (0.03)	-0.01 (0.03)
ln(n+g+ δ)*	-0.38*** (0.20)	-0.41*** (0.23)	-0.33*** (0.22)	-0.32*** (0.28)	-0.42** (0.24)	-0.29 (0.25)
ln(h*)			0.05 (0.06)	0.08 (0.06)		0.09 (0.07)
Implied α	0.339	0.219	0.303	0.162		
Implied β	0.116	0.072	0.124	0.093		
Implied λ			0.397	0.152		
Half Life	5.98	9.63	5.59	7.5		
Implied β @	0.092	0.062	0.097	0.077	0.065	0.077
R^2	0.97	0.96	0.96	0.96	0.96	0.96
F-test(for Ui =0)	253.6*	214.68*	188.11*	166.19*	155.37*	128.45*

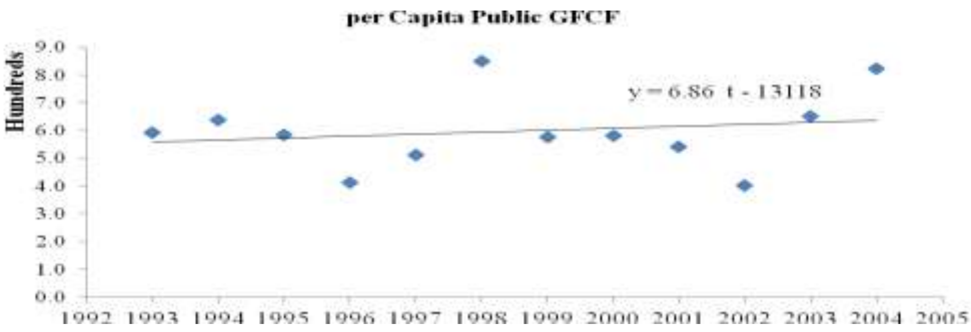
*Note: *, ** and *** refer to, the regression coefficients are statistical significant at 1, 5 and 10 % levels respectively. The figures in parentheses are the standard errors of the coefficients. The @ indicates that, the rate of convergence by using the equation 8.*

The neoclassical growth model is designed to include investment, population growth and human capital as the factors to measure the convergence or divergence of growth. However, it is not possible to estimate the speed convergence, if the investment variable is divided into private investment and public investment within the framework of neoclassical growth model. Hence, this paper provides two estimates of speed of convergence, i.e. by using the measurement of speed convergence by Islam (1995) and by equation (8) as used in Nayar (2008).

The per capita investment is separated by per capita public investment and per capita private investment, which are incorporated in regressions 9 and 10. Regression 9 includes both the investment variables, population growth rate and initial level of per capita income as independent variables to evaluate the long-run dynamics of income across Indian states. The estimation result shows that initial level of per capita income, per capita private investment and population growth rate are statistically significant with their expected signs. But, public investment is not statistically significant at the conventional level. The coefficient of the initial level of income is 0.74, which indicates the evidence of conditional convergence of income across states. The implied β is found to be 0.065, which suggests that the steady state income across states is converging at the speed of 6.5%. There is also evidence of convergence by including per capita private investment, per capita public investment, population growth rate and human capital as factors of steady state income in regression 10. The coefficients of per capita private investment and population growth rate are statistically significant and have the expected signs. But the coefficients of per capita public investment and human capital are significant at the conventional level. The rate of convergence is found to be 7.7%. The using of equation (8) for the estimation of convergence also suggests that the rates of convergence are 9.2 %, 6.2 %, 9.7 % and 7.7 % in regressions 5, 6, 7 and 8, respectively.

There is empirical evidence of conditional convergence of steady state income across Indian states over the period from 1993–94 to 2004–05. It is interesting to observe that though public investment and human capital are the factors for the variation in per capita income, but they do not play any significant role in the convergence of steady state income across Indian states during the period from 1993–94 to 2004–05. Private investment is crucial in the convergence of income among the positive factors of steady state income. Therefore, the equitable allocation of private investment can resolve the problem of imbalance in economic growth among the Indian states. However, the allocation of private investment depends upon factors such as physical infrastructure, state governance (includes law and order, fiscal status and industrial relations), economic uncertainty, labour productivity, including state specific factors (Mallick, 2011). The policy makers should look at these factors to devise policies to achieve balanced regional growth through balanced allocation of private investment in India. Singh *et al.* (2010) and Chakravorty (2004) also argued that spatial income inequality in developing countries is mainly due to spatial inequality in location of industry. Particularly, new private sector industrial investments in India are biased towards existing industrial and coastal districts while state industrial investments (in deep decline after structural reforms) are less biased toward such districts. Structural reforms lead to increased spatial inequality in industrialisation and hence in income in India.

Figure3: Variation in Public Investment at State Level



***Source**: Author's calculation using basic data from* Mallick (2013).

However, polices need to be devised to push public investment and human capital, which will speed up the rate of convergence of steady state income across Indian states. The coefficients of the variation (CV) of per capita public GFCF of the 15 major states during the periods from 1993–94 to 2004–05 are presented in Figure 3. The CV ranges from 44.15 to 77.43, which indicates that the degree of scatteredness of public investment is high. The positive trend in the trend line suggests that the scatteredness has been increasing over the period. Hence, the inequality in per capita private investment has increased, corresponding to the divergent nature of per capita income among the 15 major states over the period from 1993–94 to 2004–05. However, Roy and Raychaudhuri (2007) argued that the availability of public investment in a particular state depends on the state's own spending for the creation of productive capacity and revenue raising policy, and the extent of transfers received from the central government for financing productive expenditure. Nevertheless, the amount transferred by the central government to states for productive purposes is not sufficient, which limits the state's capability to spend on productive purposes and build productive capacity. The increase in productive public investment enhances growth directly as well as indirectly, i.e. by increasing productivity and profitability of the private sector as well. Hence, an equitable distribution of public investment is required to achieve balanced regional growth in India.

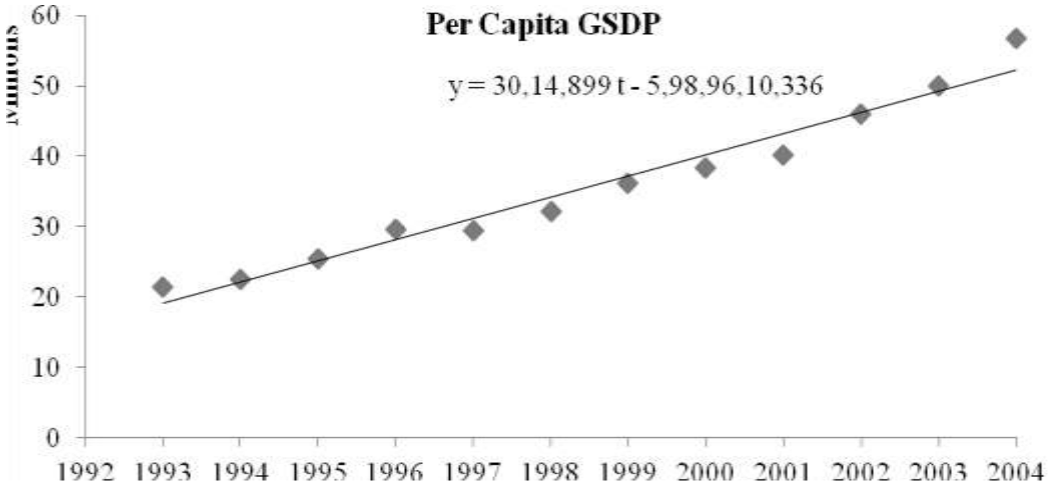
IX. CONCLUSIONS

This paper sought to examine the impact of private investment on the income at the statelevel for the 15 major states during the period from 1993–94 to 2004–05. This paper uses the first difference GMM estimator and finds that private investment is an important factor along with population growth, human capital, public investment and one year lag of per capita income for the variation in per capita income in the Indian states. The elasticity of per capita income due to per capita private investment is more than public investment, population growth and human capital across the 15 major states. Hence, the elasticity coefficient of per capita income due to per capita private investment is higher than the per capita public investment, which is due to the larger marginal productivity of private capital than the public capital of the states in the market-based reforms in the Indian economy. This finding is in line with the findings of Khan and Reinhart (1990) and Khan and Kumar (1997) for developing countries including India.

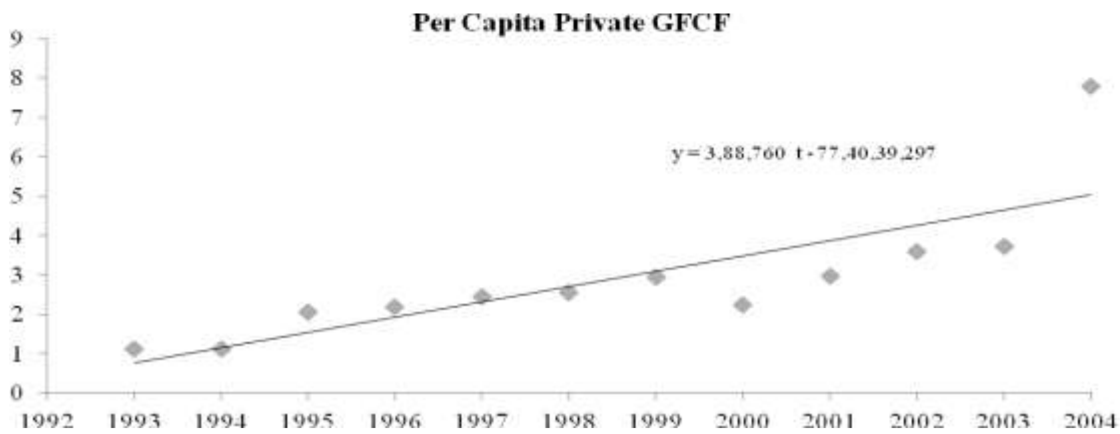
The second part of the study analyses the role and importance of private investment in the long-run dynamics of income in the Indian states by using the fixed effect model of panel data. The result finds that there is evidence of conditional β convergence of per capita income across the 15 major states. Per capita private investment, population growth and state specific factors are significant in the conditional convergence of income at the state level in India. The equitable distribution of private investment may help to mitigate the problem of imbalanced growth among the states in the Indian economy.

The elasticity of per capita income due to public investment is considerably less than private investment. This is where the policy can be designed to raise the marginal productivity of public capital to achieve balanced regional growth. Central government should provide more resources for the purpose of productive use in the Indian states. Public investment in infrastructure and public services, i.e. roads, bridges and water and sewage systems, etc., spur economic growth by increasing the productivity of the overall capital in the state. There is a positive link between social variables and infrastructural variables with growth rates of NSDP (Shand and Bhide., 2000). In fact, the regional policies of the central and state governments and public expenditure policies of the state governments play important roles in ensuring equitable spread of infrastructure. Therefore, this paper offers important lessons for development strategy. The significant affirmative measures should be taken to correct imbalances in the spread of infrastructure through regional policies to reduce the disparity in income across states.

APPENDICES



Graph A.1: Trend of Disparity in Per Capita GSDP.



Graph A.2: Trend of Disparity in Per Capita Private GFCF.

Table A 1: Descriptive Statistics

Variable	Mean	Standard deviation	Minimum	Maximum
ln(y)	9.72	0.36	8.83	10.41
ln(I)	8.32	0.47	7.24	9.33
ln(n+g+ δ)	2.17	0.07	1.99	2.38
ln(h)	3.39	0.45	1.87	4.57
ln(Ip)	7.85	0.69	5.82	9.30
ln(Ig)	7.15	0.44	5.44	8.31

Note: *Number of observation is 180.*

Table A 2: Simple Correlation Coefficient

Variables	Ln(y)	Ln(Ig)	Ln(Ip)	ln(n+g+δ)	Ln(h)	Ln(I)
ln(y)	1					
ln(Ig)	0.51	1				
ln(Ip)	0.78	0.08	1			
ln(n+g+δ)	-0.26	-0.07	-15	1		
ln(h)	0.73	0.26	0.69	-0.29	1	
ln(I)	0.92	0.39	0.918	-0.185	0.76	1

Table A 3: Descriptive statistics of Variables in in Dynamic Panel Fixed Effect Growth Models

Variable	Mean	Standard deviation	Minimum	Maximum
ln(y*)	9.77	0.38	8.92	10.41
ln(y_0)	9.66	0.35	8.87	10.27
ln(I*)	8.32	0.46	7.29	9.08
ln(Ip*)	7.87	0.64	6.22	8.99
ln(Ig*)	7.18	0.37	6.37	7.99
ln(n+g+δ)*	2.17	0.06	2.04	2.28
ln(h*)	3.40	0.43	2.36	3.99

Note: Number of observation is 45.

Table A 4: Simple correlation coefficient of Variables in in Dynamic Panel Fixed Effect Growth Models

Variables	ln(y*)	ln(y_0)	ln(Ip*)	ln(Ig*)	ln(n+g+δ)*	ln(h*)	ln(I*)
ln(y*)	1						
ln(y_0)	0.98	1					
ln(Ip*)	0.81	0.79	1				
ln(Ig*)	0.64	0.65	0.25	1			
ln(n+g+δ)	0.29	-0.25	-0.15	-0.098	1		
ln(h*)	0.78	0.77	0.75	0.4	-0.33	1	
ln(I*)	0.93	0.92	0.95	0.51	-0.19	0.81	1

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