Vidyasagar University Journal of Commerce
Vol. 22, 2017/ISSN 0973-5917

LINKING THE DYNAMICS OF DEMOGRAPHIC AND MACROECONOMIC VARIABLES : THEORY AND EMPIRICS IN INDIA

Sovik Mukherjee*
Tanusree Das**

Abstract

The theory of economic growth is one of the principal branches of macroeconomics that tries to highlight the factors that have influenced the long-run trend of the growth of an economy. One of the leading issues in the literature on India's economic growth has been the manifold effects of inflation and employment among many others. The present paper aims toexamine the relationship between economic growth rates, inflation, employment and population growth in a Simultaneous Equations System (SES) framework, with an exclusive focus on the experience since economic liberalization. The literature on this subject has up till now analyzed the determinants of these endogenous variablesunconnectedly. Not only does this paper endeavour to ascertain the existence of endogeneity among these variables but also highlight a multitude of factors that areconnected in this regard. This paper comes to a close by discussing the possibilities for developing strategies that are overtly concerned with productive employment generation.

Key Words : Macroeconomic variables; Demographic variables; Instrumental Variable (IV) Regression; Simultaneity;

Jel Classification Codes : C3; I15; I25; J64; O47

"*The difficulty lies not so much in developing new ideas as in escaping from old ones.*"
– Keynes

1. Introduction

These words of Keynes are very much significant in the context of our paper. Several theoretical concepts like the Phillips curve had been ruling the charts for almost half of a century. But, the question is to what extent is this model relevant for a country like India, today. Growth theory had its beginning in the years following the World War II when war devastated economies had embarked on the programme of reconstruction and development. This had called for high

*Faculty of Economics & Statistics, Department of Commerce (Evening), Shri Shikshayatan College, Kolkata, West Bengal; E-mail: mailtomesovik@gmail.com
**Faculty of Finance & Management, Department of Commerce (Evening), Shri Shikshayatan College, Kolkata, West Bengal; E-mail: mailmetanusree@gmail.com

savings (reduction in current consumption) so that resources could be employed for investment purposes.But, in an inflationary situation, the general tendency of prices is to go upwards which has been statistically captured by the persistent upward movement of some of the aggregate price indices, *viz.* Consumer Price Index (CPI) or GDP deflator. Studies have shown that inflation has a highly significant negative impact on growth. Apart from causing distress for the poorer sections of the populace, the rising and variable prices also hurt the long term growth prospects by knocking the macro environment off balance.As a result, price stability figures are positioned high among the policy priorities of the Government of India.To all intents and purposes, inflation control is now considered more important than the elimination of the output gap. It is therefore important for the policy makers to know the exact relation between economic growth and inflation.

Coming to the issue of growth-employment linkage,the growth process in India shows evidence ofthe inability of high growth rates of output to stimulate sufficient employment opportunities.This phenomenon has been observed in India post-liberalization, since 1991. This indeed is what emerges from a more detailed consideration of the patterns of growth and employment dynamics in India. This absurdity has indeed haunted India's economy for at least half a century and has threatened the developmental policy of ensuring employment opportunities for the populace as a whole (Ghosh and Chandrasekhar, 2007). The conventional Phillips curve in essence shows the inflation-unemployment tradeoff but the question is whether the negative relation holds good for the Indian economy.Growth is incomplete in an economy where there is not enough generation of employment. Phillips (1958) in his seminal contribution had affirmed that to control inflation in an economy, employment needs to berelinquished.Subsequently, we come to the population-growth linkage and how it affects employment.Instinctively, it can be argued that impacts can be both favourable as well as unfavourable. If a country has larger amount of inoperative resources, the population can supply laborers which when efficiently utilized will result in a rise in the rate of per-capita GDP growth through the generation of employment. On the other hand, an increase in population can also negatively affect the growth rate of GDP through poverty, lack of capital formation as employment generation in the formal sector has beenmiserable.Hence, an increase in population tends to press hard oneconomic resources as well as job opportunities. This paper will be looking into the fact that whether population growth affects GDP positively or negatively in the Indian context. It is also clear that there is enough simultaneity among the focus variables.

The present paper analyzes this crucial issue by building up an empirical model which highlights the liaison between economic growth, inflation rate, employment and population growth in a SES framework. The spotlight then shifts to the theoretical foundations of the analysis. In particular, our objective is to bring out the presence of simultaneity among the focus variables in our model. Section 4 talks about the issues pertaining to the empirical model and the methodologyapplied. The econometric analysis performed in Section 5 helps us topencil in

the comprehensive policy implications of thisresearch. The paper comes to a close by resolving the fusillade of questions.

2. Brief Review of Select Literature

Empirical evidence about the relationship between inflation and growth differs with some studies finding a negligible effect of inflation on growth (for instance Chari *et al.*,2000), some finding a negative effect (Chopra, 2015) and others providing evidence of the existence of a positive effect (Dholakia, 1995). Theoretically, the effect of inflation on growth is largely due to the inefficient use of resources and distorted investment decisions owing to inflation (Mallik and Chowdhury, 2001).Consequently, the relationship between economic growth and inflation may even end up being bi-directional. This ambiguous liaison amid inflation and growth necessitates that though rising inflation may have associated growth costs, policy efforts to suppress inflation could even negatively affect the growth prospects. On the other hand, by tolerating inflation at higher rates could lead to higher growth. In their paper, Singh and Kaliranjan (2005) empirically analyzed the employment-growth nexus and came to a conclusion that there exists an uni-directional causality between employment and growth. Ahmed and Mortaza (2005) have substantiated the existence of a positive relationship between inflation and growth by examining the long term dynamics of this relationship for four South Asian countries *viz.* Bangladesh, Pakistan, Sri Lanka and India. This paper will concentrate completely on the endogenous relation as opposed to the exogenous theoretical arguments that are already existing in the literature. The unemplyment and inflation trade off boasts of a rich literature. Coming to the latest studies in the Indianmilieu, Paul (2009) observed the existence of a short run negatively sloped Phillips curve based on data pertaining to the industrial sector in India. In a different structure, whileinvestigating the relationship between inflationary expectations and monetary policy, Patra and Ray (2010) confirmed the existence of the normal Phillips curve. Also, Ghosh and Chandrasekhar (2007) have theoretically taken up the issue of growth-employment linkage by evaluating the employment performance over the same period, in both aggregate and sectoral terms. The developments unambiguously do not confirm the existence of a negative Phillips curve in the Indian context.India'sgrowth in the last decade has been epitomized by "jobless growth"[1] phenomenon. To provide productive employment for the ongoing escalation in thelabour force forms an indispensable part of the purpose of inclusive growth (Rangarajan, 2006) but studies concerning population growth in an integrated framework are very few in number. This paper takes a modest attempt in this regard.

3. Theoretical Construct

In this context, we will make use of the money market equilibrium condition. Ghosh *et al.* (1997) in their article had used a simple money demand function to illustrate the difference in inflation performance across different exchange rate regimes. But, we will use a slightly modified version of that theoretical construct, in a different context, with the intention of theoretically

establishing a relation among the variables under consideration.

Consider, a simple money demand function and from the money market equilibrium condition–

$$\frac{M_t V_t}{P_t} = y_t^{\alpha} r_t^{-\beta} \qquad \alpha, \beta > 0 \qquad \text{.....(1)}$$

where, M and P denote money supply and price level, y is per-capita real output, r is the nominal interest rate and V measures residual velocity controlling for income and interest rate effects.[2] In constructing this money demand function, we have somewhat differed from the abovementioned paper by incorporating per-capita real output as opposed to real output. This implies that y = Y/L where, Y is the real output and L is the current population in the economy.

Taking log on both sides in equation (1),

$$\log M_t + \log V_t = \log P_t + \alpha \log Y_t + \alpha \log Y_t - \alpha \log L_t - \beta \log r_t$$

Differentiating with respect to time, we get :

$$\frac{1}{M_t}\frac{dM_t}{dt} + \frac{1}{V_t}\frac{dV_t}{dt} = \frac{1}{P_t}\frac{dP_t}{dt} + \frac{\alpha}{Y_t}\frac{dY_t}{dt} - \frac{\alpha}{L_t}\frac{dL_t}{dt} - \frac{\beta}{r_t}\frac{dr_t}{dt}$$

$$\left(\frac{\frac{dM_t}{dt}}{M_t}\right) + \left(\frac{\frac{dV_t}{dt}}{V_t}\right) = \left(\frac{\frac{dP_t}{dt}}{P_t}\right) + \alpha\left(\frac{\frac{dY_t}{dt}}{Y_t}\right) - \alpha\left(\frac{\frac{dL_t}{dt}}{L_t}\right) - \beta\left(\frac{\frac{dr_t}{dt}}{r_t}\right)$$

$$\hat{M} + \hat{V} = \hat{P} + \alpha\hat{Y} - \alpha\hat{L} - \beta\hat{r} \qquad \text{..... (2)}$$

Now, $\hat{M}$ denotes the growth rate of money supply, $\hat{V}$ denotes the growth rate in money velocity, $\hat{P}$ is the inflation rate and $\hat{r}$ is the rate of growth of the nominal interest rate. Coming to $\hat{Y}$ and $\hat{L}$, $\hat{Y}$ denotes the growth rate of output whereas $\hat{L}$ denotes the growth rate of the population. So, it is clear that the focus variables of our analysis are indeed theoretically inter-related (equation 3).

From equation (2), we can write the relation as,

$$\hat{M} + \hat{V} + \beta\hat{r} = \hat{P} + \alpha\hat{Y} - \alpha\hat{L} \qquad \text{..... (3)}$$

4. Empirical Model and Methodology

4.1 The Structural Model

We have started our analysis from 1992 as 1991 is an outlier year and may lead to biased results. The structural form of the model is given below :

A. $$Gdpgrowthrate_t = a_1 + b_1 gdp_{t-1} + c_1 Emprate_t + d_1 Infrate_t + e_1 iip_t + f_1 depratio_t + g_1 poplngrowthrate_t + h_1 nomdeprate_t + i_1 adilrate_{t-1} + u_1$$

B. $$Emprate_t = a_2 + b_2 Gdpgrowthrate_t + c_2 Infrate_t + d_2 iip_2 + e_2 depratio_t + f_2 adilrate_{t-1} + g_2 pop \ln growthrate_t + h_2 Moneysupplygrowthrate_t + u_2$$

C. $$Infrate_t = a_3 + b_3 Gdpgrowthrate_t + c_3 Emprate_t + d_3 Moneysupplygrowthrate_t + e_3 Infrate_{t-1} + f_3 nomdeprate_t + g_3 poplngrowthrate_t + u_3$$

D. $$poplngrowthrate_t = a_4 + b_4 adilrate_{t-1} + c_4 fertlrate_t + d_4 Gdpgrowthrate_t + e_4 Infrate_t + f_4 Emprate_t + u_4$$

The endogenous variables are *Gdpgrowthrate*, *Emprate*, *Infrate, poplngrowthrate* whereas all the other variables in our model are pre-determined variables (lagged endogenous and exogenous). In this model,we have considered the growth rate of the GDP (yearly). The employment rate has been formulated as per the definitions of the ILO.Moreover, the unorganized sector has not been considered because of the unavailabilityof data. Inflation has been calculated by the Consumer Price Index (CPI). The data on the adult literacy rate was available in an interval of ten years so it had to be tabulated accordingly as per ourhandiness. Newton's Forward Interpolation formula for equal intervals has been used. The formula is :

$$U_{a+xh} = U_a + Xc_1 \Delta U_a + Xc_2 \Delta^2 U_a + ... + Xc_r \Delta^r U_a + ...$$

We have derived the adult literacy rates on an annual basis using this formula. The definition of money supply that we have taken into account here is M_3 or 'Broad Money'[3] and the growth rate of money supply is basically the growth of M_3.

In this empirical model, the endogenous variables are highly correlated which point towards the presence of simultaneity. There also exists a high degree of correlation among other independent variables like adult literacy rate and dependency ratio. So, does it necessarily mean that we have multicollinearity in our model? The answer is no because in such a situation where the R^2 value is highand regression coefficients are individually significant as revealed by the higher t-values, then the multicollinearity issue may never cause a very serious problem (Gujarati, 2004).

4.2 Checking Identification and Stationarity as a Prelude to Estimation

- The order condition is : $K^{**} \geq G^{\Delta} - 1$ (where value of one endogenous variable is set at 1 via the invocation of normalization condition; G^{Δ} = Number of endogenous variables included in the i^{th} equation and K^{**} = Number of exogenous variables excluded from the i^{th} equation).
- The rank condition is : Rank (Δ) = G–1 (where, Δ is defined as the matrix consisting of the coefficients of the parameters that are excluded from the i^{th} equation of the model (both the endogenous and exogenous variables) but included in the other equations of the system and G gives the number of endogenous variables.

For Equation A :

$K^{**} = 3$, $G^{\Delta} - 1 = 4 - 1 = 3$; $K^{**} = G^{\Delta} - 1 \Rightarrow$ Order condition is satisfied.

Rank Δ = Min {Row, Column} so accordingly we will be chalking it out :- G = 3

$$\text{Rank of } \Delta = \begin{bmatrix} 0 & -h_2 & 0 \\ -e_3 & -d_3 & 0 \\ 0 & 0 & -c_4 \end{bmatrix} = 3 \text{ ; Also, } G - 1 = 3 \Rightarrow \text{Rank condition satisfied.}$$

Therefore, the first equation is just identified.

For Equation B :

$K^{**} = 4$, $G^{\Delta} - 1 = 4 - 1 = 3$; $K^{**} > G^{\Delta} - 1 \Rightarrow$ Order condition is satisfied.

Rank Δ = Min {Row, Column} so,

$$\text{Rank of } \Delta = \begin{bmatrix} -b_1 & 0 & -h_1 & 0 \\ 0 & -e_3 & -f_3 & 0 \\ 0 & 0 & 0 & -c_4 \end{bmatrix} = 3 \text{ ; Also, } G - 1 = 3 \Rightarrow \text{Rank condition satisfied.}$$

Here, G = number of endogenous variables = 3. Therefore, the second equation is over identified.

For Equation C :

$K^{**} = 5$, $G^{\Delta} - 1 = 4 - 1 = 3$; $K^{**} = G^{\Delta} - 1 \Rightarrow$ Order condition is satisfied.

Rank Δ = Min {Row, Column} so accordingly we will be chalking it out

$$\text{Rank of } \Delta = \begin{bmatrix} -b_1 & -i_1 & -f_1 & 0 & -e_1 \\ 0 & -f_2 & -e_2 & 0 & -d_2 \\ 0 & -b_4 & 0 & -c_4 & 0 \end{bmatrix} = 3 = G - 1$$

$\Rightarrow$ Rank condition satisfied. Therefore, the third equation is over identified.

For Equation D :

$K^{**} = 6$, $G^{\Delta} - 1 = 4 - 1 = 3$; $K^{**} > G^{\Delta} - 1 \Rightarrow$ Order condition is satisfied.

Rank Δ = Min {Row, Column} so, accordingly we will be chalking it out

$$\text{Rank of } \Delta = \begin{bmatrix} -b_1 & -e_1 & -f_1 & -h_1 & 0 & -h_2 \\ 0 & -d_2 & -e_2 & 0 & 0 & -d_3 \\ 0 & 0 & 0 & -f_3 & -e_3 & 0 \end{bmatrix} = 3 = G - 1$$

$\Rightarrow$ Rank condition satisfied. Therefore, the third equation is over identified.

Since, all the equations in the system are identified it means that the model is identified. It should be noted that before we move onto to the estimation of the model, checking the stationarity of the variables becomes necessary.To check for stationarity of the variables, we go for Unit Root Test for every individual series by applying the Augmented Dickey Fuller (ADF) test statistic and the Akaike Information Criterion (AIC), with trend and intercept for knowing whether the series is trend stationary (TS) or difference stationary (DS). After conducting the ADF test we see that all our variables attain stationarity at their level values except for GDP growth rate, money supply growth rate and employment rate. This result is quite obvious given the time period that we have considered in our analysis.

Our next task is to find out the reduced form parameters of the system and henceforth look into the estimation of the structural parameters. During the estimation procedure, we will consider the first differenced values of the three variables that have attained stationarity at the first difference *viz.Gdpgrowthrate*, *Emprate* and *Moneysupplygrowthrate*.Taking into considerationthat this is a simultaneous equation framework, Ordinary Least Square (OLS) technique cannot be applied. Thus, after doing some algebraic manipulations the reduced form estimates can be derived where endogenous variables have become functions of only the pre-determined variables i.e. exogenous plus lagged endogenous variables of the system. So, now OLS can be applied. The reduced form estimates of equation A can be derived by putting equation C in equation B and then again re-substituting equation B into equation A. In this way, one can derive the reduced form estimates which will basically serve as instruments in the process of 2SLS or Instrumental Variable (IV) regression. After deriving the reduced

form estimates of this model we put it back into the original model to obtain the 2SLS estimates in this SES set-up.As a result, the problem of simultaneity has been resolved by using the2SLS procedure.

5. 2SLS and 3SLS Results

Null Hypothesis:(The independent variables cannot explain the dependent variables).

H_0: $b_1 = 0$, $c_1 = 0$, $d_1 = 0$, $e_1 = 0$, $f_1 = 0$, $g_1 = 0$, $h_1 = 0$, $i_1 = 0$

Alternative Hypothesis: (The independent variables can explain the dependent variable).

H_1: $b_1 \neq 0$, $c_1 \neq 0$, $d_1 \neq 0$, $e_1 \neq 0$, $f_1 \neq 0$, $g_1 \neq 0$, $h_1 \neq 0$, $i_1 \neq 0$

Here, by looking at the P > |t| values from the above table it can be inferred that all the variables excepting one can explain the dependent variable which is *Gdpgrowthrate* for the first equation. Therefore, the null hypothesis is rejected for all the variables excepting, *adlitrate_1* which does not seem to play any role in explaining the findings and the constant term is also insignificant. *EEmprate* and *EInfrate* have done a great job in explaining the variation of the *Gdpgrowthrate*. It should also be noted that *EEmprate* and *EInfrate* are the reduced form estimates of the model. From the P > |t| values in Table 2, we see that all the variables can explain the dependent variable which is *EEmprate* in this case. Therefore, the null hypothesis for all variables is rejected so all the explanatory variables have played a part in explaining the variation in *EEmprate*.

For the second equation we have,

Table 1. 2SLS estimates for the GDP growth rate function

Number of observations	Prob>F	R^2
23	0.00	0.99

Gdpgrowthrate	Coefficient	Standard Error	t-statistic	P> |t|
EEmprate	-2.66	1.14	-2.44	0.0*
EInfrate	-2.39	0.69	-3.50	0.0*
Epoplngrowthrate	-81.93	34.09	-2.55	0.0*
gdp_1	-0.39	0.22	-1.81	0.0*
iip	-1.32	0.52	-2.03	0.0*
depratio	2.57	0.55	4.54	0.0*
nomdeprate	0.29	0.09	2.97	0.0*
adilrate_1	-0.13	0.15	-0.78	0.6
_Constant	16.63	36.27	0.46	0.8

Source: Compiled by the authors
Note: denotes significance at 5 per cent level.*

Null Hypothesis: (The independent variables cannot explain the dependent variables).

$H_0 : b_2 = 0, c_2 = 0, d_2 = 0, e_2 = 0, f_2 = 0, g_2 = 0, h_2 = 0$

Alternative Hypothesis:(The independent variables can explain the dependent variable).

$H_1 : b_2 \neq 0, c_2 \neq 0, d_2 \neq 0, e_2 \neq 0, f_2 \neq 0, g_2 \neq 0, h_2 \neq 0$

For the third equation we have,

Null Hypothesis: (The independent variables cannot explain the dependent variables).

$H_0: b_3 = 0, c_3 = 0, d_3 = 0, e_3 = 0, f_3 = 0, g_3 = 0$

Alternative Hypothesis: (The independent variables can explain the dependent variable).

$H_1: b_3 \neq 0, c_3 \neq 0, d_3 \neq 0, e_3 \neq 0, f_3 \neq 0, g_3 \neq 0$

For the fourth equation we have,

Null Hypothesis: (The independent variables cannot explain the dependent variables).

$H_0: b_4 = 0, c_4 = 0, d_4 = 0, e_4 = 0, f_4 = 0$

Alternative Hypothesis: (The independent variables can explain the dependent variable).

$H_1: b_4 \neq 0, c_4 \neq 0, d_4 \neq 0, e_4 \neq 0, f_4 \neq 0$

Hence, by observing the P > |t| values in Table 3, it is clear that all the explanatory variables

Table 2. 2SLS estimates for the Employment rate function

Number of observations	Prob> F	R^2
23	0.00	0.92

Emprate	Coefficient	Standard Error	t-statistic	P>|t|
EGdpgrowthrate	-0.44	0.17	-2.67	0.0*
EInfrate	-0.43	0.12	-3.58	0.0*
Epoplngrowthrate	-30.54	15.91	-1.92	0.0*
iip	-0.33	0.12	-2.75	0.0*
depratio	1.57	0.65	2.42	0.0*
adilrate_1	4.02	1.09	3.66	0.0*
Moneysupplygrowthrate	0.334	0.22	2.81	0. 0*
_Constant	19.51	18.81	1.04	0.3

Source:Compiled by the authors
Note: denotes significance at 5 per cent level.*

Table 3. 2SLS estimates for the Inflation rate function

Number of observations	Prob> F	R^2
23	0.00	0.95

Infrate	Coefficient	Standard Error	t-statistic	P>|t|
EGdpgrowthrate	-0.79	0.69	-5.13	0.0*
EEmprate	-7.53	1.37	-5.20	0.0*
Epoplngrowthrate	0.87	1.33	3.06	0.0*
Moneysupplygrowthrate	0.34	2.22	2.51	0. 0*
Infrate_1	1.56	0.57	5.74	0. 0*
nomdeprate	0.79	0.46	2.08	0.0*
_Constant	-15.34	12.79	-1.93	0.0*

Source:Compiled by the authors
Note: denotes significance at 5 per cent level.*

have explained the dependent variable which is *Infrate*. Therefore, rejection of the null hypothesis for all these variables isbound to happen.

Table 4. 2SLS estimates for the Population growth rate function

Number of observations	Prob> F	R^2
23	0.00	0.97

poplngrowthrate	Coefficient	Standard Error	t-statistic	P>|t|
adilrate_1	-0.67	0.28	-2.39	0.0*
fertlrate	1.89	0.22	8.59	0.0*
EGdpgrowthrate	-0.93	0.37	2.51	0.0*
EEmprate	-0.91	0.35	2.60	0.0*
EInfrate	2.01	2.15	0.94	0.5
_Constant	12.26	15.63	0.78	0.6

Source: Compiled by the authors
Note:* denotes significance at 5 per cent level.

Also, all the variables have turned out to be significant in explaining the variations in population growth rate except inflation rate. The results showthat our model fits the data exceptionally well with R^2estimates of 99 per cent, 92.3 per cent, 95 per cent and 97 per cent for economic growth, employment, inflation rate and population growth equation respectively, in the structural form of the model. Next, we jump onto the 3SLS approach.

The 3SLS approach involves the estimation of all the equations simultaneously. Identification of all the equations is essential in this approach. The 3SLS estimator involves estimation in three stages where firstly one needs to obtain the reduced form of the model. Then, obtain the 2SLS estimates and hence obtain the variance-covariance (Var-Cov) matrix of 2SLS residuals. Finally, using the variance-covariance matrix of 2SLS residuals from the second stage, GLS is applied to the composite model to get the 3SLS estimator. The 2SLS and 3SLS results are consistent with one another.

Table 5.3SLS Results

Equations	Observations	Parameters	RMSE	R^2	χ^2	Probability
1	23	8	1.74	0.980	38.55	0.000
2	23	7	1.03	0.911	71.98	0.000
3	23	6	2.42	0.963	28.19	0.002
4	23	5	1.01	0.954	30.01	0.001

Equation 1 : Gdpgrowthrate	**Coefficient**	**Standard Error**	**t-statistic**	**P > |t|**
Emprate	-2.89	1.02	-2.88	0.0*
Infrate	-1.19	0.55	-2.16	0.0*
poplngrowthrate	-30.72	9.91	-3.10	0.0*
gdp_1	-0.19	0.19	-2.01	0.0*
iip	-0.03	0.01	-2.45	0.0*
depratio	1.30	0.55	2.38	0.0*
nomdeprate	0.15	0.13	1.93	0.0*
adilrate_1	-3.65	1.53	-2.39	0.0*
_Constant	36.68	33.01	23.01	0.0*
Equation 2 : Emprate	**Coefficient**	**Standard Error**	**t-statistic**	**P > |t|**
Gdpgrowthrate	-0.45	0.18	-2.54	0.0*
Infrate	-0.43	0.13	-3.43	0.0*
poplngrowthrate	-51.18	13.16	-3.89	0.0*
iip	-0.31	0.12	-2.61	0.0*
depratio	1.58	0.66	2.39	0.0*
adilrate_1	0.12	0.09	2.22	0.0*
Moneysupplygrowthrate	0.53	0.12	1.81	0.0*
_Constant	19.59	19.37	4.01	0.0*
Equation 3 : Infrate	**Coefficient**	**Standard Error**	**t-statistic**	**P > |t|**
Gdpgrowthrate	-0.79	0.63	-3.25	0.0*
Emprate	-7.12	0.34	-21.12	0.0*
poplngrowthrate	0.87	1.33	3.06	0.0*
Moneysupplygrowthrate	0.33	0.19	2.72	0.0*
Infrate_1	2.75	1.20	2.29	0.0*
nomdeprate	0.95	0.14	6.61	0.0*
_Constant	-15.34	17.82	-15.11	0.0*

Equation 4 : poplngrowthrate	Coefficient	Standard Error	t-statistic	P > |t|
adilrate_1	-1.43	0.41	-3.48	0.0*
fertlrate	2.89	1.04	2.77	0.0*
EGdpgrowthrate	-1.13	0.59	-1.91	0.0*
EEmprate	-1.23	-0.51	-2.41	0.0*
EInfrate	1.34	1.11	1.27	0.2
_Constant	18.26	5.67	3.22	0.0*

Source:Compiled by the authors
Note: denotes significance at 5 per cent level.*

6. Interpretation of the Results

6.1 Examining GDP Growth Rate

We have found a simultaneous relationship among GDP growth rate, employment and inflation rate; significantly affecting each other. The negative sign of the lagged values of the GDP growth rate hints at the fact that the convergence hypothesis holds good for the Indian economy as found out by Khan and Ssnhadji (2001) who obtained the convergence after including a wide range of countries. There exists a negative bi-directional relationship between employment rate and GDP growth rate. During 2004-09, India was achieving a high growth rate of about 9 per cent but if we compare the corresponding employment figures we see that they were staggering at around a meager 13 per cent per thousand. The post economic liberalization period in India has witnessed the service sector becoming the principal contributor to economic growth but its contribution to employment generation has been dismal. Agriculture, still accounts for a major proportion of the employment in India. Going by the latest developments in this sector (the burning issue of farmer suicides) coupled with agriculture still being a gamble during the rainy season, have aggravated the problems. So, this significant negative relationship is quite obvious.

Population Growth rate is negatively related as expected. We can see a positive and a significant relationship with the nominal depreciation rate implying that with increase in the growth rate of exchange rate (i.e. depreciation of the home currency) the economic growth will be boosted and hence the rise. This happens because the depreciating exchange rate leads to higher reward from exports and hence higher GDP. The counter-intuitive (negative) sign of adult literacy rate in the growth equation can make sense when analyzed in conjunction with the result of another study, which articulated that it may take about seven to nine years for the constructive effects of adult literacy to be felt on growth in an economy (Dholakia, 2003). So, adult literacy might positively affect growth, but only with a substantial time-lag.

High significance and the negative sign of the inflation rate parameter shows that there are huge growth costs associated with inflationin terms of income redistribution, tax structure,

losing out on international competitiveness, etc., an evidence supporting the findings by authors like –Heer and Suessmuth (2009). This is the relationship being currently observed in the Indian economy and some other developing countries where higher predictions of inflation have maneuvered the decrease in the future growth forecasts. The dependency ratio parameter shows a positive sign in the growth equation, signifying higher labour productivity in countries with a higher dependency ratio.

6.2 Examining Employment Rate

The GDP growth rate has turned out to be statistically significant and the negative relationship is an implication of jobless growth in India which we have discussed in the previous sections. The population growth rate bears a significant negative relationship asanticipated. The adult literacy rate supports a significant positive relationship with the employment rate and this implies that an increase in adult literacy leads to a rise in the employment growth rate. Due to the Government of India's investment in school education, especially the SarvaShikshaAbhiyan (SSA), there has been an increase in the number of teachers employed by the Government schools throughout the country which may be a cause of the rise in rate of employment. The dependency ratio parameter signifies that a higher dependency ratio in India is an indication of a rise in the employment rate. Phillips curve suggested a tradeoff between the rate of inflation and unemployment which could assist the government to lower unemployment at the expense of higher inflation by pursuing the Keynesian expansionary policies. The liaison between employment and inflation has turned out to be negative significantly, contrary to the Phillips curve. One of the reasons for this may be the presence of a massive informal sector in the Indian economy. The growth of employment in the informal sector is not accounted for in the GDP and the growth rate of employment in the formal sector that we have considered here is not that much. So, a demand-pull inflation coming from the large informal sector is leading to this paradoxical result. This establishes the fact that India follows a Keynesian system of Government expenditure. The Phillips curve relation is a long run phenomenon and data for twenty three years may not be sufficient to claim such a proposition but still the results are in conformity with the vast literature on the "jobless growth" phenomenon which India has been experiencing for the last couple of years (since the US crisis in 2008).

6.3 Examining Inflation Rate and Population Growth Rate

The lagged value of inflation rate has a positive and highly significant relationship with inflation. Thus, the results support the adaptive inflationary expectations hypothesis. Money supply growth rate has turned out to be statistically significant thereby affecting the inflation rate. The sign of the parameter is positive as the growth of the money supply component promotes inflation. This is in agreement with the concept of 'Quantity Theory of Money'. The bi-directional link between employment and the inflation rate has already been talked about in the preceding section. The population growth rate has a positive impact on the inflation rate. Theoretically,

this is justified because a rise in population means a greater amount of consumer demand which in turn fuels up the prices. GDP growth rate has also turned out to be statistically significant in forecasting the inflation rate. The nominal exchange rate (NEER) is highly significant and thus positively related to inflation. The significance of the general fertility rate in the population growth equation has been theoretically justified. The level of Adult literacy has negatively affected population growth in this study. This implies that adult literacy has acted as a catalyst in the process of population control coupled with a strong consortium of Community Health Centres (CHCs), Primary Health Centres (PHCs) and Sub Centres (SCs) active in the execution of family planning programmes. However, the General Fertility Rate (GFR) has been on the high so the achievements of family planning programmes still remain an unresolved mystery. The recent statistics of GFR reported by the Government of India (GOI), being 3.10 per cent advocates that these are disturbing signs which warrant immediate attention as there exists a negative effect of a rise in population growth on the macroeconomic variables *viz.* growth and employment status. Interestingly, an increase in the level of income or employment opportunities reduces poverty (Ahluwalia et al., 1979; Sala-i-Martin, 2005) whichindirectly functions as a catalyst in the reduction of population growth. But, the reverse causality does not hold in the model. This is precisely what we have pointed out.

7. Concluding Remarks and Future Research Possibilities

Every economy prospers on a strategy for faster growth of productive employment together with sustaining a stable position between growth and inflation. Despite the historically unprecedented economic performance, India continues to maintain incongruity between the rate of economic growth and the growth rate of employment. As already mentioned, a major proportion of workers in the non-agricultural economic activities work in the informal sector where they tend to suffer from a massive quality shortfall in the employment conditions, in terms of very low productivity, minimal earnings, pitiable working conditions and lack of social protection measures (NCEUS, 2009). At present, the challenge for the Indian economy is to not only generate new jobs but also improving the quality of existing jobs.In addition to this, India has failed to play satisfactorily in the field of controlling inflation. Presently, India is going through a phase of high inflation which has cast a negative impact on its economic growth. So as to keep a thorough check on the rate of inflation, both the Reserve Bank of India (RBI) and the Government of India (GoI) must be more cautious in their approach. All the aforementioned measures are to be implemented properly for our much coveted dream of an economically prosperous India to come true.

The framework developed in this paper is innovative in the sense that it provides an insight into how a researcher can correlate the effects of demographic variables on macroeconomic variables. Our results have highlighted that population growth has negatively influenced economic growth in India. In the recent years, the size of the working age cohort has increased

given the number of dependents but since India could not orchestrate for productive employment opportunities, the potential acceleration of growthanticipated in due course of time lead to economic deceleration. Though, we have not particularly focused on the topic of 'demographic dividend'[1] but the results clearly bear an indication that during the period considered, India has been unable to realize the benefits stemming from demographic profile changes. Had India been able to take advantage of thecircumstances, the story could have been different altogether.Nevertheless, ten years down the line, the inference could be different given the fact that initiatives taken by the government for generating productive employment opportunities are successful in their mission. Carrying out the Error Correction Mechanism and Granger Causality would have added another dimension. The novelty of this paper also lies in the theoretical justification of the fact that macroeconomic objectives in the Indian economy aremutually dependent. This experiential configuration can be broadened by incorporating variables such as fiscal deficit, savings, the trade-openness ratio and financial inclusion. If the governmentrecommends a policy for achieving the objectives of price stability then objectives like growth and employment must also be considered.

References

Ahluwalia, M. S., Carter, N. G., &Chenery, H. B. (1979). Growth and poverty in developing countries. *Journal of development economics*, *6*(3), 299-341.

Ahmed, S., &Mortaza, G. (2005). Inflation and Economic Growth in Bangladesh.*Working Paper 0604, Policy Analysis* Unit.

Chari, V. V., Kehoe, P. J., &McGrattan, E. R. (2000). Sticky price models of the business cycle — can the contract multiplier solve the persistence problem? *Econometrica*, *68*(5), 1151-1179.

Chopra, S. (2015). Inflation household savings and economic growth.

Patra, M. D. & Ray, P. (2010). Inflation expectations and monetary policy in India : An empirical exploration. *IMF Working Papers*, 1-26.

Dholakia, R. H. (1995). Expected Inflation and Short-Term Forecast of Growth Rate in India. *IASSI Quarterly*, *13*(4), 44-67.

Dholakia, R. H. (2003). Regional disparity in economic and human development in India. *Economic and Political Weekly*, 4166-4172.

Ghosh, A. R., Gulde, A. M., Ostry, J. D., & Wolf, H. C. (1997). Does the nominal exchange rate regime matter? *NBER Working Paper* 5874.

Ghosh, J., & Chandrasekhar, C. P. (2007, January). Economic growth and employment generation in India — Old problems and new paradoxes.In *IDEAs International Conference on Sustainable Employment Generation in the Developing Countries.*

Gujarati, D. (2004). Basic Econometrics.United States Military Academy, West Point.

Heer, B. & Sussmuth, B. (2009).The savings-inflation puzzle. *Applied Economic Letters*, *16*(6), 615-617.

Kalirajan, K. & Singh, K. (2005). Globalization strategies and poverty reduction across Indianstates.In *Foundation for Advanced Studies on International Development (ASID), Hakone Conference, Mimeo*.

Khan, M. S. & Ssnhadji, A. S. (2001). Threshold effects in the relationship between inflation and growth. *IMF Staff Papers*, 1-21.

Mallik, G. & Chowdhury, A. (2001). Inflation and economic growth: evidence from four South Asian countries. *Asia-Pacific Development Journal*, *8*(1), 123-135.

National Commission for Enterprises in the Unorganised Sector (NCEUS) (2008). *Report on the Conditions of Work and Promotion of Livelihoods in the Unorganised sector*. New Delhi :GoI, August.

Paul, B. P. (2009). In search of the Phillips curve for India. *Journal of Asian Economics*, *20*(4), 479-488.

Phillips, A. W. (1958). The Relation between unemployment and the rate of change of money wage rates in the United Kingdom, 1861–19571.*Economica*, *25*(100), 283-299.

Rangarajan, C. (2006). *Employment and Growth*.Madras School of Economics.

Sala-i-Martýn, X. (2005). On the Health-Poverty Trap. In G. L. i Casasnovas, B. Rivera, & L. Currais (Eds.), *Health and economic growth:Findings and policy implications*, 95.