Globalisation, Productivity Growth and Employment- A Cross Country Analysis

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Abstract

This paper rigorously examines the nature of the effects of the total factor productivity, globalization and the relative position of the sample countries, on the level and growth of per capita real GDP and also on the per capita real GDP per unit of employment by considering the role of exogenous components like the financial development, human capital etc as instrumental variables by using the dynamic panel data(dpd) with GMM method. It also examines the cross country differentials in the growth of TFP and the contribution of globalization, the relative position of the countries in relation to the GTF, the weighted R&D on the same by considering the same set of exogenous component weighted by relative TFP and by using the same technique. Further, it also explores the contributions of the endogenous variables coupled with that of the exogenous factors on the cross country variations in the growth of total employment. We find that the globalization, TFP and the relative positions of the countries which are instrumented by the exogenous factors make economically and statistically significant contribution to the level and growth of PCGDP and PCGDPPE. In case TFP growth also the relative position of the countries in relation to the GTFP, globalization and weighted RD are found to be the crucial explanatory factors in explaining the cross country variations and the weighted exogenous factors play positive role to this end. Almost similar results are found in analyzing the cross country variations in growth of total employment. All the results are robust. So for catching up the GPF and GTF the laggard countries should not only emphasize on the innovation and imitation of the modern technology but it must be complimented by greater emphasis on the financial development and the development of their human capital so as to improve their relative positions.

Key Words: Cross country; Growth, TFP, Employment; Globalization, Relative positions of Countries; Exogenous factors and Dynamic panel data with GMM.
JEL Classification Nos: O31;O40;O 33; O30.
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I. Introduction

The process of rapid globalization has led to the tremendous competition amongst the countries for achieving higher rate of growth and productivity so as to catch up the global productivity frontier(GPF). It has not only led to the free movement of corporate capital, the new capital

goods embodied with most advanced technology but also the transfer or diffusion of technology through trade and technological externalities . Alongside the same has generated tremendous competition not only amongst the developed or rich countries for the innovation of new advanced technologies which are basically skill based technologies and but also amongst the technologically laggards countries i.e the poor developing countries for the imitation or the absorption of the most advanced technology so as to reduce the distance from the global technology frontier(GTF) through the achievement of faster rate of growth of productivity. In fact the transfer of advanced technologies may take place through trade, imitation, technological externalities and innovation. It has been found that most of the developing countries use the advanced technologies by the unskilled labour force so that there has been tremendous difference of productivity between the developed and the less developed countries due to tech skill mismatch (Acemoglu and Zilibotti,2001).

As a fall out of this acute global competition , expenditure on innovations (R&D) as proportion of country specific GDP has revealed a conspicuous increasing trend across the countries since liberalization either for the innovation of new advanced technology in the case of rich or developed countries or for the utilization or absorption of advanced technology by the laggards countries. However, the advanced technology cannot be used in a cost less way albeit it is non-rival. Absorption as well as innovation of new advanced technology requires increased investment not only in R&D but also on higher education and infrastructure etc. Interestingly, the studies in this respect have shown that the countries which are close to Global Productivity Frontier(GPF) and spend more on tertiary education have achieved higher growth rates than the countries that are close to GPF but invest more on primary and secondary (Aghion and Howitt(AW,2009). There is also a famous hypothesis developed by Gerschenkron (1962) known as ‘advantage of backwardness’ which states that the further the countries behind the global technology frontier faster it will grow given the frequency of implementation innovations. So distance to the frontier can affect the countries growth performance. In fact the technologically backward countries may catch up the growth rate of productivity of rich country through the implementation of the advance technology innovated by the advanced countries or rich countries. Paralley, there is cross-current of evidences as well as econometric studies on the famous hypothesis of convergence which has given rise to a controversy over the issue of convergence of the countries and finally the hypothesis of club convergence of the rich countries such that if

the laggard countries or poor developing countries has to catch up the productivity growth rate of the developed countries, they need to be the member of the club through the increase in stock of capital, human capital as well as the expenditure on innovation for availing of the benefit of technological externalities (Solow,1956;2000; Swan,1956; Romer,1986; Barro,1992, Barro and Martin,1992;AW,2009; Mankiw,Romer and Weil(MRW),1992; Ghosal,2007, 2009;Mayer and Foulkes,2002;Aghion,Howitt and Mayer,2005 Keller,2004;Howitt Mayer and Faulkes,2005; Quah,1996;Durlauf and Johnson,1995.).

From the paradigms of growth theory what we learn is that the neo-classical and the initial version of the endogenous growth theory (AK Model) emphasize the role of the capital accumulation on long run growth without distinguishing between the capital goods with embodied technology and the same with disembodied technology. Moreover unlike in the neo-classical theory which treats that the technological progress is exogenous and the cross country convergence occurs due to the operation of diminishing returns to capital, the modern endogenous growth theorists argue that the differentials in the per capita income across the countries occur not only because of differences in the per capita stock of capital but also because of the differences in productivities and in this respect there is the role of technological progress. So they argue that the convergence across countries takes place not only because of diminishing returns to capital but also through the transfer of technology through trade and innovation. In fact the new generation of endogenous growth theories both product variety model of Paul Romer (1995) and the Schumpeterian growth model based on the idea of 'Creative destruction' developed by Aghion and Howitt (2009) focus on the role of innovation for raising growth as well as the productivity per worker of the countries. In fact in the Schumpeterian based growth theory the convergence is restricted to the countries performing R&D. Actually as a country approaches its steady state its productivity will be rising at a faster rate relative to the rest of the world such that it will offset the growth dampening effect of the diminishing marginal product of capital. Along with this theoretical evolution of growth there have been several attempts by the economists to account for the growth of the countries centering round the following questions. How much of the growth of the economies is accounted for by the growth of physical and human capital, the technology growth as well as the productivity growth? To this end several studies have been made for estimating the total factor productivity (TFP) and its growth across the countries in the world (Jorgenson, 1995; (AW),2009; (MRW),1992 etc). This

empirical estimates have raised another controversy over the relative contribution of the factors on the growth of the countries.. Despite this controversy, it has been more or less accepted that the capital accumulation and the technological progress contribute a substantial proportion of the productivity growth – somewhere between 30% and 70% each depending on the details of estimation(AW,2009). However question arises regarding the methodological issues of estimation as because most of the modern new capital goods embodies the modern technology. So it becomes difficult to estimate the contribution of capital as such by separating out that of technology. To overcome this problem we, in our study, have tried to determine the relative role of the technological progress on growth as well as productivity per worker in industrial sector in terms of growth of the expenditures on R&D. On other hand the, increased investment for the use as well as the innovation of most sophisticated advanced labour saving technology for the increase in growth and the productivity per worker across the countries have been more or less unaccompanied growth in employment i.e there has been jobless growth. This has happened in most of the developing countries like India.

Another important issue which has received immense attention of the economists and social planner has been the impact of financial development on the cross-country differentials in the growth of per capita income as well as the productivity per effective unit of labourforce. Infact, the efforts towards innovations and imitations for absorption of the frontier technology by the developing countries and also the developed countries lying below the global technology frontier requires the of developed financial institutions and infrastructure. At the micro level also the technologically laggard industries of any economy requires external financing either for the imitation/ absorption of the frontier technology developed by the developed countries so as to achieve the global productivity frontier(GPF) and global technology frontier(GTP) which in turn help increase in the growth rate of the concerned economy. There is vast literature and cross-current of views regarding the effectiveness of financial development on the growth of per capita income across the economies in the world since the first decade of twentieth century when Joseph A. Schumpeter viewed on the positive impact of development of financial sector of a country on the level and growth of its per capita income (Schumpeter,1911; Grossman and Stiglitz, 1980; Aghion and Howitt, 1998; Galor and Zeira,1993; Rajan G. Raghuram and Luigi Zingales,1998; Levine , N. Loayza ane T. Beek, 2000; King. G. Robert and Ross Levine, 1993; Aghion, Howitt, P. and Mayer-Foulkes Devid, 2005). Most of these studies have emphasized the

positive role of the financial market including stock market on the growth of individual countriy and also at the cross-country level. Interestingly, most of these studies on the analysis of the cross-country differentials in the growth rate of per capita income, total factor productivity as well as the cross-country convergence of economies have not incorporated financial development as explanatory factor or as exogenous instrumental variable for TFP vis-à-vis R&D in the cross-country panel regression models. So, we have tried to examine the impact of financial development across the countries in terms of domestic credit to private sector scaled by GDP and market capitalization ratio in a dynamic panel set up with GMM estimator.

Literature and our study

It is well known that growth theories and its empirics have come into vogue since the publication of the neo-classical Solow model of growth and since then a series of growth models as well as their empirics have come out in view of rectifying the limitations of the previous models one alibi others(Solow,1956; Swan, 1956; MRW, 1992). By taking into account the major shortcomings of the neo-classical model in which the technological progress and human capital play the major role behind the growth process and the cross-country convergence occur due to diminishing return to capital, the first version of endogenous growth theory i.e. the AK paradigm of growth advocates that higher growth rate of savings will help financing the technological progress through learning by doing thereby resulting into faster growth without diminishing returns and convergence. On the other hand ,the second paradigm of endogenous growth theory has been the product variety model developed by Romer(1990).It is basically innovation based model such that there will be a continuous flow of innovation of new products and the new products are not necessarily of improved quality . In this type of model technological spill over takes place through trade, so that it will lead to long run growth rate of per capita output of the economies through R&D investment. Since there is no role of creative destruction and that of exit and turnover on the part of the producers in the product variety model, the third phase of endogenous growth theory come into picture in 1990 ,the driving force of which has been the Schumpeterian " creative destruction" (Aghion and Howitt, 1992; Segerstorm, Anant and Dinopoulos, 1990; Howitt, 2000). In such model technological progress has been treated as endogenous and it is the result of R&D such that it could be financed out of savings of the economies. So the cross-country differentials in the productivity, growth of per

capita income have been treated as basically the result of the differentials in total factor productivity, human capital, trade and practicing R&D etc. (Aghion and Howitt, 1992 Howitt,2000; Griffith et al., 2004). On the other hand ,some explains that the structural change in labour market through the reallocation of labour from low productivity sector to high productivity sector plays a major role in an economy's growth process as well as in world growth. In such studies, growth enhancing structural change helps technological improvement as well as transfer through globalization thereby raising the productivity growth (Mcmillan and Rodrik,2011). Further, in the modern endogenous growth paradigm, there is a separate study which emphasizes the role of financial intermediary development and the legal and accounting system on the cross-country differentials of growth (Levine et al., 2000). However, the technological improvement vis-à-vis R&D have not been considered in such study. Some explains the role of technological diffusion through trade in the cross-country differentials in growth and productivity through the differentials in R&D. It is argued that the innovation of new technology developed in the developed countries is basically skill based as the innovation taken place for the efficient utilization of their skilled labour force and so it is not suitable for the developing countries which are overwhelmingly endowed with unskilled labor force. Now, since they use the skill based technology with the help of their unskilled labor force , the productivities of the LDCs are found to be lower and this leads to the cross-country differentials in the productivity and growth (Griffith et al., 2004). Actually, they argue that R&D has two faces i) stimulating innovation and ii) technology transfer (R&D based absorptive capacity). Since the developing countries are basically endowed with unskilled labor force, the technology skill mismatch has led to lower productivity of such countries thereby resulting into cross-country differentials in growth and productivity. However, they have also emphasized the relative positions of the countries in respect of GTF as driving force for technology transfer and absorptive capacity. But in this study the institutional factors like financial development, tacit knowledge, culture etc are not taken into account.

Therefore, we find that there is as such no attempt to explain the cross-country differentials in the growth of per capita GDP (PCGDP), GDP per effective unit of employment (GDPPPE), total factor productivity (TFP), employment by considering both the endogenous component of explanatory variables together with the exogenous components of the explanatory variables as instrumental variable (namely human capital, financial development of the countries etc.). Here

actually lie the basic differences of our study with those of others. So the basic questions which crop up are as follows: What actually explain the large disparities in the level and growth of per capita income (PCGDP) as well as the per capita GDP per effective worker(PCGDPPE) across the countries since globalization? What role the globalization plays in this respect? Why does the technology or the TFP differ across the countries? Is it due to the inappropriateness, or the lack absorptive capacities or the inadequate supply of skilled labour force in the technologically laggard countries? Why do the aggregate level and growth of employment vary across the countries? We will try to cover all these questions in our study in relation to the models of studies of Paul Krugman(1979),W Keller(2004)L.A.Rivera-Batiz and Paul M Romer(1991)and Acemoglu and Zilibotti(2001), Howitt,(2000). Under this backdrop we have examined the Gerashchenkron hypothesis (1952), cross-country differentials in growth, productivity and employment separately by using the dynamic panel data(DPD) with GMM instrumental variable approach.

Our paper is structured as follows. Section - II will be devoted to analyze the econometric specification as well the data base of our study ; Section - III represents the analysis of the cross country differentials of the level and growth of PCGDP and PCDDPPE and the role of globalization, TFP, R&D ,financial development, human capital to this end.; Section -V presents the analysis on the cross country differentials the level of TFP and its growth in dynamic panel framework with GMM by using country specific financial development as exogenous variable instrumenting the endogenous arguments. Section -V highlights on the analysis of the cross country variations in the employment and the role of the endogenous explanatory variables instrumented by some strictly exogenous variables like financial development of the countries etc. and finally Section-VI gives the concluding observations.

Section II: Econometric Specification and the Data Base

Since the LSDV estimator is constituent for the static model irrespective of whether the effects are fixed or random to estimate the cross-country variations in the growth of per capita GDP (PCGDP henceforth) and the productivity per effective employment (PCGDPPPE), the growth of total factor productivity (TFP) and the employment (both for industrial sector and the aggregative level) we have used the dynamic panel regression with GMM estimators. The simplest model introduced by Arellano and Bond (1991) which we used can be expressed as

$Y_{it} - Y_{it-1} = (\alpha-1)\, Y_{it-1} + \beta\, X_{it} + u_i + \varepsilon_{it}$ (1)

Where, i = 1,2,3,……,n (countries)

t= 1,2,……T (time)

Here, Y_{it} represents the dependent variable; X_{it} represents the vector of explanatory variables (other than lag dependent variables) i.e X_{it} is a (K-1)x1 vector of exogenous regressors ; u_i stands for unobserved country specific effect i.e. the fixed effect and ε_{it} is the conventional error term such that $\varepsilon_{it} \sim N(0,\sigma^2)$ i.e. the random disturbance term.

We rewrite the eq(1) as

$Y_{it} = \alpha Y_{it-1} + \beta\, X_{it} + u_i + \varepsilon_{it}$ (2)

Now to eliminate the country specific effect (u_i) we take the first difference of equation (2) such that we have the dynamic panel model with GMM estimator as

$\Delta Y_{it} = \alpha \Delta Y_{it-1} + \beta\, \Delta\, X_{it} + \Delta\varepsilon_{it}$ (3)

Now the fixed effect (i.e. country specific effect) is eliminated. By construction ΔY_{it-1} is correlated with $\Delta\varepsilon_{it}$. Now the use of instrument is required to deal with (1) the likely endogenity of explanatory variables and (2) the problem that the new error term in eq-3 is correlated with the lagged dependent variable (by construction). Under the assumption that there is no serial correlation in ε_{it} and the explanatory variable X are weakly exogenous, the GMM dynamic panel estimator uses the following moment conditions

$E[\, Y_{it-s}\, (\varepsilon_{it} - \varepsilon_{it-1})] = 0$ for $s \geq 2$; t= 3,4,……..T…….(4)

$E[\, X_{it-s}\, (\varepsilon_{it} - \varepsilon_{it-1})] = 0$ for $s \geq 2$; t= 3,4,……..T …….(5)

Now it follows that if the regressors are strictly exogenous, ε_{it} can not affect X_{is} for any s or t. Again if regressors are pre-determined, ε_i may affect for X_{is} for s > t. Strict erogeneity rules out any feedback from the idiosyncratic shock at time t to a regressor at time s > t.

It is worth noting that the consistency of GMM estimators depends on the validity of the instrument which produces their impact on the dependent variable through the regressors . To deal with this issue we need the specification test. In our study we use the Sargan test of over identifying restrictions which actually tests the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process.

Data Base

Our study will exclusively be based on the secondary data which are available from Penn world Table 9.0 version, various issues of World Development Indicators of UNDP, Publications of

ILO, Data base of UNESCO, Gronongen Growth and Development Centre (GGDC) of the Netherlands, Data base of Timmer and de Vries,(2009).We have taken the data on Human capital(HC) and TFP from the Penn World table 9.0 version . HC is measured on basis of the years of schooling and the returns to education. The TFP is measured at constant national prices of the sample countries and then expressed at 2011 constant US dollar. On the other hand, we have taken the data on the PCGDP, PCGDPPE, market capitalization ratio (MKTCAP) , domestic credit to the private sectors provided by the financial institution (DCP), net inflow of FDI (FDINIF), net capital formation (NCF), trade openness(TDOP),imports(IMP) from various issues of World Development Indicators and World Development Reports. It is worth mentioning that the PCGDP of the respective sample countries are expressed at constant 2005 US dollar PPP. Similarly the PCGGDPPE of the respective countries are measured at constant 1990 US dollar PPP. The MKTCAP is the ratio of the total values of stocks of the listed companies enlisted in the stock market to the GDP of the respective sample countries. All these data are scaled by the GDP of the respective sample countries and all are at constant US dollar PPP. The data on R&D are taken from UNESCO data base, World Development Indicator and also from BERD. The data on foreign direct investment (FDI) are taken from UNCTAD data base and then these are expressed as percentages of GDP , the data on which are taken from Penn World Table 9.0 version. The values of NCF of the sample countries have been computed by applying a common and a constant depreciation rate (0.03 %) to the GCF figures(MRW).We have measured the distances of the countries from the GPF (such that the PCGDP of US for base year (1990) is assumed to be the GPF), in terms of ratios of US PCGDP for 1990 to the time series of PCGDP of the sample countries and in our econometric analysis this variable is christened as relative PCGDP i.e. RPCGDP. In the analogous manner we have computed the variable RPCGDPPE which indicates the relative positions of the countries as compared to the GPF(US PCGDPPE for 1990). Similarly for measuring the distance of countries from the GTF (i.e. to judge the relative positions of the countries in comparison to GTF) we have used the highest value of the TFP across the sample countries and over the period under consideration as a measure of GTF. Then we have computed the ratios of GTF to the TFPs of the respective sample countries across time and this has given us the relative total factor productivity of the countries ie the variable RTFP in our study. To test the Gerschenkron hypothesis on the technological and productivity catch-up we have used RTFP,RPCGDP, RPCGDPPE as endogenous variables

which will be instrumented by some exogenous instrumental variables in separate dynamic panel data frame with GMM estimators. On the other hand, we have taken the data on total employment from the Penn World table 9.0 version. However the data on the employment in industrial sector have been computed on the basis of the data available from World Development Indicator and Penn World table. But the time series data on this are not available for all the countries excepting the 20 countries which are mainly the developed countries.

It is worth mentioning that since the data on all the dependent variables (for separate DPD regression), the explanatory variables or the regressors and also on all the exogenous variables which are used as instrumental variables are not available for all the countries and also for the unique period , we have been compelled to selective in choosing the sets of sample countries pertaining to the longitudinal data set .For instance the data on the R&D for all the countries and also for the period before 1990 are not available. Basically the time series data on R&D are available for a few developed and OECD countries since 1995 from World development Report and UNESCO. For some other few countries these are available from 1990 from the data base of BERD. On the other hand the longitudinal data on MKTCAP are not available for all the countries considered in our study before 1990. Consequently, we have chosen our period of analysis from 1990 to 2014. Further since the longitudinal data on R&D and employment are not available for all the countries since 1990 we have got to restrict our sample sizes for the analysis of cross country differentials in the growth of TFP and the employment such the for the former the sample size contains only 22 countries which are mostly develop and for latter the same contains 20 countries in view of making the DPD-GMM analysis. Once again because of the non-availability of the longitudinal data we have excluded the variable R&D from our DPD analysis with GMM approach and chosen additional countries based on data availability such the sample size in this case contains 38 countries of which some are developed and some are developing , the period of analysis remaining the same . However the use of MKTCAP as instrumental variable has resulted into the contraction of the sample size to 35 countries in some cases. On the whole, we have run three AB model from our longitudinal data set one for growth analysis, the other for TFP growth analysis and the rest for the employment analysis. The list of countries are given in Appendix.Before running the DPD regression we have done the Unit Root tests by applying the Levin-Lin-Chu method for judging the stochastic property of longitudinal data. We find that in some cases there are unit roots indicating the non-stationarity of the data

and the first differences make the data stationary. Moreover, it is also worth mentioning that we have used the Arellano- Bond (AB) method (1991) of DPD analysis with GMM estimator using exogenous variable as instruments for each of our regression analysis. Further to test the null hypothesis that whether the models and over identifying conditions are correctly specified ,we have applied the Sargan test for each of the regression analysis. We assume that almost all the countries in the globe have entered into the process of rapid globalization since 1990.So we have chosen the period of our study from 1990 to 2014. It is also worth mentioning that for the DPD analysis we have used the econometric software Stata-11 version.

III. Analysis on Cross Country Growth

This section highlights the average performance of the sample countries of our studies in respect of level and growth of per capita GDP and per capita GDP per persons employed for the period from 1990 to 2014 for 38 countries and also for all the endogenous as well as exogenous variables. It also presents the analysis on the cross country variations of the level and growth of the PCGDP and PCGDPPE on the basis of the results of the DPD analysis based on GMM approach. The summary statistics regarding average performance are reported in table-1 below. The table reveals that there is large difference in the minimum and maximum values of per capita GDP and per capita GDP per persons employed across the countries. Further, the values of the standard deviations also imply significant cross country differentials in the per capita income as well as PCGDPPE over the period of our study. If we look at the annual growth rate then also we find that the average growth rate of per capita GDP of the sample countries ranges from -14.39% to 18.62% and for the PCGDPPE the same ranges from -17.61% to 17.5%. So, the average performance of the economies ,if it is measured in terms of average growth rates, clearly reveals a high degree of variations across the countries such that the average annual growth rate of per capita GDP is 2.16 % and that of PCGDPPE is 1.54 % over the period.

Table -!: summary Statistics on the performance of the sample countries(38) during 1990 to 2014.

Variable	Obs	Mean	Std. Dev.	Min	Max
gdpppe	950	28445.63	16827.37	2458	68374
fdgdppe	912	1.538338	3.393527	-17.76066	17.5902
pcgdp	950	19127.82	17524.11	399.3269	69094.74
fdpcgdp	912	2.15925	3.271447	-14.38515	18.62113
tdop	949	69.10239	57.21661	13.75305	439.6567
dcp	948	100.8296	62.35658	6.69741	373.7896
tfp	950	.9789493	.0964521	.5910667	1.236055
imports	944	34.24833	26.631	4.631322	209.3877
fdinif	948	2.980203	5.303416	-5.647104	88.09634
ncf	950	4576123	8117277	43525.46	6.56e+07
fdi	949	16069.84	32871.23	-28293.89	314007
hc	950	2.730694	.5987706	1.327254	3.734285

The similar picture is found to persist in case of financial development (measured in terms of MKTCAP and DCP), human capita (HC), the net capital formation (NCF) and FDI etc. Surprisingly, the contribution of technology i.e. TFP ranges from the minimum value of 0.59 to 1.24 across the 38 countries over the period which clearly indicates a high degree of variations in technological development across the countries.

Now to account for the cross country variations in the level PCGDP or in other words to capture the dynamics relationship of PCGDP and its growth as well as the PCGDPPE and its growth with the explanatory variables like TDOP,RPCGDP,RPCGDPPE,TFP we have estimated separate dynamic panel regressions for the two with GMM method. For the level analysis we have used PCGDP and PCGDPPE as dependent variable and the first differences of RPCGDP, RPCGDPPE,TFP, TDOP are used as explanatory variables which are instrumented by DCP, MKTCAP, HC, Imports as exogenous variables which are assumed to produce their effect on the level of PCGDP and PCGDPPE of the respective countries . The results of dynamic panel data (DPD) regression with GMM estimators following Arellano and Bond method are reported in table- 2 and 2-A respectively. It follows from the table -2 that the coefficients of RPCGDP and TDOP as well as TFP are highly significant with their desired signs such that the technology,

globalization and the relative positions of the countries in relation to the GPF play economically and statistically significant role in explaining the cross-country and cross-time variations in PCGDP of the sample countries. Further the positive sign of the RPCDP is much more interesting in the sense that the lower the ratio of the countries , the lower the level of PCGDP and so there will inducement on the part laggard countries to catch up the GFP through the increase in their capabilities for imitating or absorbing as well as innovating the modern technology. So the distance of the countries from the GPF matters in respect of the level of productivity and its growth across the countries. To this end the exogenous components of PCGDP viz; the financial development of the countries ,the imports, ncf, the expenditure on R&D are also important . Most of the empirical studies on the cross country growth analysis have not integritated these exogenous component as instrumental variables in their stidies.The same results have been found to persist in case of dynamic panel data (DPD) regression with GMM estimators for the PCGDPPE. In this analysis we have used the financial development as well as human capital as instrumental variables producing their impact on the cross country variables of PCGDP and PCGDPPE through the endogenous variables used in the DPD regression analysis. The Wald Chi 2 value is found to be highly significant indicating the correct specification of the model and the robustness of this is established by corresponding P-value. Further we have applied the Sargan test of the null hypothesis that the model and the over identifying conditions in respect of selection of instrumental variables are correct specified. The value of Sargan test and its p-value clearly indicate that there is the overall validity of the instruments in analyzing the sample analog of the moment conditions used in the estimation process. So the results are robust in all respects. This type estimation has not been done in other studies.

Table -2: GMM estimates of PCGDP (sample period= 1990-2014; sample size=34 countries)

Dependent Variable PCGDP

pcgdp	Coef.	z	P>|z|
pcgdp			
L1.	.8859625	126.28	0.000
tdop	11.72707	5.82	0.000
tfp	9302.775	17.60	0.000
rpcgdp	70.37314	4.98	0.000
_cons	-7835.984	-15.21	0.000

Sargan Test: chi2(279) = 729.1117
Prob > chi2 = 0.0000

Wald chi2(4) = 37499.71
Prob > chi2 = 0.0000

Table -2A: GMM estimates of PCGDPPE (sample period= 1990-2014; sample size=34 countries)

Dependent Variable PCGDPPE

gdpppe	Coef.	z	P>|z|
gdpppe			
L1.	.8124322	61.39	0.000
tdop	21.60443	6.65	0.000
tfp	8448.69	8.65	0.000
rgdppe	-338.2322	-2.92	0.004
_cons	-2693.651	-2.59	0.010

Sargan test of overidentifying restrictions:
chi2(279) = 525.8419
Prob > chi2 = 0.0000

Wald chi2(4) = 11494.17
Prob > chi2 = 0.0000

Now, as far as the cross country differentials in the growth of PCGDP as well as the PCGDPPE are concerned we have used log difference of PCGDP and that of PCGDPPE as dependent variables in separate regression models and LRPCGDP, TDOP and TFP as endogenous or explanatory variables in case of growth analysis of PCGDP and RGDPPE, TDOP and TFP as the explanatory variables in case of growth analysis of PCGDPPE. In both of these cases the endogenous explanatory variables are instrumented by DCP, MKTCAP, HC, imports such that these exogenous variables are assumed to produce their effect on the growth of the two dependent variables via the endogenous variables in which case there is always the use of lagged dependent variables across the countries are likely to make a positive contribution to the growth of per capita income of the countries by helping the producers of the countries to finance the technological innovation and absorption of modern technologies at the global level. We have actually measured the financial development in terms of MKTCAP and DCP. So it is likely that these two will make positive contribution to the growth through the growth of TFP. Actually the cross country variations in the development in the financial intermediaries may also help furthering the process of globalization of the countries which may also help fostering the growth process through import of modern capital goods embodied with new technologies and also the export of the products produced out of the capital good to the developed countries wherefrom the import of the same capital goods were done. This type of approach has been developed in general equilibrium model on innovation, technology transfer and the world distribution of income developed by Paul Krugman(1979). So we have used MKTCAP and DCP as instrumental variables. Further for the absorption of modern technology and also for the innovation of technology the, HC plays that the countries possess ,plays a major role. So we have used the same as an instrumental variable in all the sets of DPD regression model with GMM estimator. Here also we have followed Arellano and Bond method of GMM estimators. The results of the dynamic panel data GMM estimations are represented in table-3 and 3A respectively. Table 3 explains the results of the growth analysis of PCGDP across the countries and table 3A depicts the results of the growth analysis of PCGDPPE across the countries. It is worth noting that we have used the log difference of the endogenous of the explanatory variables.

Table -3: GMM estimates of Growth of PCGDP (period= 1990-2014; sample size=35countries)

Dependent Variable: Log difference of PCGDP

pcgdpld	Coef	z	P>|z/
pcgdpld			
L1.	.1363232	3.65	0.000
lrpcgdp	.0762798	6.29	0.000
ltdop	.0171303	1.77	0.077
ltfp	.3344811	9.58	0.000
_cons	-.1240152	-2.68	0.007

Sargan test of overidentifying restrictions:
chi2(256) = 525.1298
Prob > chi2 = 0.0000

Wald chi2(4) = 143.67
Prob > chi2 = 0.0000

Table -3A: GMM estimates of Growth of PCGDPPE (period= 1990-2014; sample size=35countries)

lgdpppe	Coef.	z	P>|z|
lgdpppe			
L1.	.6798207	43.23	0.000
rgdppe	-.0514322	-11.71	0.000
tfp	.2716964 .	9.56	0.000
tdop	.0007487	7.67	0.000
_cons	3.077404	19.26	0.000

Sargan test of overidentifying restrictions
chi2(281) = 679.6165
Prob > chi2 = 0.0000

Wald chi2(4) = 12989.10
Prob > chi2 = 0.0000

It follows from the table 3 that cross country variations in the extent of globalization (measured in terms of TDOP), distance of the countries from GPF (measured in terms of RPCGDP) and the impact of technology (measured in terms of TFP) produces significant impact on the cross-country variations in the growth in the per capita income across the countries over the period from 1990 to 2014. The signs of the endogenous variables are also at the expected level such that the TFP, globalization and the distance of the countries from the GPF contributes positively on the variations of growth rates. Interestingly, the positive co-efficient of RPCGDP supports the view on convergence hypothesis especially the Gerschenkron hypothesis such that the further the countries from GPF, the faster will be their growth of PCGDP. In other words the laggard countries will be catching up the advanced countries through increase in their productivities via the improvement in technology, financial development etc. On the other hand the results of the DPD analysis on the cross country differentials of growth of PCGDPPE across the sample countries which are reported in 3A give a clear overview of the positive contribution of growth of technological improvement(TFP), globalization (TDOP) and the distance of the countries from the GPFE. Here also we have used the same set of exogenous instrumental variables which have also produced their effect on the growth of the countries through the endogenous variables including the lagged dependent variable. Here also the hypothesis of convergence also holds as the the variable RPCGDPPE contains positive sign.

Interestingly in both of the two DPD regression analysis the Wald Chi 2 values are found to be highly significant indicating the correct specification of the models and the robustness of this is established by their corresponding P-values. Further we have applied the Sargan tests of the null hypothesis that the models and the over identifying conditions in respect of selection of instrumental variables are correct specified. The values of Sargan test and its p-values clearly indicate that there is the overall validity of the instruments in analyzing the sample analog of the moment conditions used in the estimation process. So the results are robust in all respects. Interestingly this type estimation has not been done in other studies.

IV. Total factor productivity and its growth analysis

This section presents an analysis of the growth of total factor productivity across the 22 sample countries for the period 1990 to 2014. In fact, the analysis of growth of PCGDP reveals that the

total factor productivity plays a crucial role in explaining the cross-country variations in the growth of per capita income across the countries in which case the instrumental variables like financial development, human capital etc. also play significant role. Therefore, the fundamental question which crops up now is what explains the cross-country variations in the growth of total factor productivity. To account for the TFP growth we once again use DPD model with GMM method following AB method. Before going to the analysis of DPD results one has to have some idea about the average performance of TFP and its growth as well as some of the instrumental variables across the sample countries. The summary statistics are given in table-4 below. As we have seen in our previous analysis, the table-4 here also clearly indicates that there are wide differences between the minimum and maximum values of TFP across the countries such that the value of average TFP is 0.98. However, since the countries in this sample are mostly developed countries, the degree of cross-country variability in TFP is rather small (sd= 0.08) and mean= 0.98. On the other hand there is wide differences in the growth rates of TFP between minimum and maximum values such that the average growth rate of TFP over the period and across the countries is 0.40 coupled with the value of sd is 1.89. So, the question arises that what explains these variations in TFP across the sample countries. To examine this we have followed the method of Griffith et al. (2004)

. **Table-4:** Summary statistics on TFP and other variables

Variable	Obs	Mean	Std. Dev.	Min	Max
dcp	550	124.185	65.09226	19.66499	373.7896
tfp	550	.976177	.0755994	.7292128	1.218385
tfpgr	528	.3943604	1.889226	-9.148325	8.063705
emp	500	5609782	7318368	464868.7	3.26e+07
mktcap	550	85.20045	57.89485	1.194477	320.9934
hc	550	3.168405	.3653447	2.180864	3.734285
tdop	550	67.9693	35.93772	13.75305	220.4074

In this analysis we have used the log difference of TFP of the sample countries as dependent variable and the log differences of TDOP, RTFP and the RD weighted by LRTFP as endogenous or explanatory variables. Here also we have used Weighted DCP, HC, MKT, Imports with one period lag (such that the log values of RTFP with one period lag being the weight) are used as instrumental variables to the analysis. In fact these weighted instrumental variables represent the interaction of the RTFP with the corresponding variables .Actually it is assumed that these instrumental variables namely the variables representing the financial developments of the countries, the HC and imports will help the transfer of technology as well as the absorptive capacities of the sample countries through the R&D which in turn helps boosting the growth of TFP. The results of DPD analysis with GMM instrumental variable approach which are given in table-5 below also support this argument.

Table-5: GMM estimates of TFP growth (sample period= 1990-2014; sample size=22 countries)

Dependent Variables log difference of TFP

ldtfp	Coef.	z	P>|z|
ldtfp			
L1.	.1809684	4.17	0.000
ltdop	-.0113766	-1.63	0.102
lrtfp	-.0602754	-2.52	0.012
wrd	.0158564	3.35	0.001
_cons	.0539029	1.78	0.075

Sargan test chi2(256) = 394.311 Prob > chi2 = 0.0000

Wald chi2(4) = 35.04 Prob > chi2 = 0.0000

From the results of the DPD regression analysis the Wald Chi 2 value is found to be highly significant which indicates the correct specification of the model and the robustness of this result is established by their corresponding P-value. Further we have applied the Sargan tests of the null hypothesis that the model and the over identifying conditions in respect of selection of instrumental variables are correct specified. The values of Sargan test and its p-value clearly indicates that there is the overall validity of the instruments in analyzing the sample analog of the

moment conditions used in the estimation process. So the results are robust in all respects. It is also evident that the explanatory factors RTFP, WRD have produced significant impact on the cross-country variations of the growth of TFP such that the robustness of this result is reflected in the corresponding p-values of the variables. Moreover, the coefficients of variable RTFP, indicating the relative positions of the countries in relation to the GTF, is found to be negative which supports Garschenkron hypothesis that further the countries from GTF faster will be the growth of the TFP of the countries through the increased contribution of technology so that the laggard countries will catch up the GTF. Interestingly the variable WRD is also found to be highly significant. The instrumental variables (DCP, HC, MKTCAP, Imports) in this respect have played major role towards the growth of TFP of the countries via the endogenous variables. Interestingly there is hardly any study which is based on DPD-GMM method in which the role of the exogenous factor like financial development, HC on the TFP are considered.

V. Employment and its growth

This section focuses on the impact of globalization, R&D, FDI on the growth of total employment across the sample countries (20) under considerations during the period from 1990 to 2014. Once again we have applied the AB method of DPD analysis with GMM method for finding out the relationship between the explanatory factors and the growth of employment such that the presence of lagged dependent variable helps to capture the dynamics of employment growth and the endogenous variables. The results of this DPD analysis are given in table-6 below .Here the log values of explanatory variables have been used in first difference form. Now it is found that the globalizations (TDOP) as well as FDI have played significant positive role on the growth of employment of the sample countries (as the signs of their coefficients are positive and significant).

Table-5: GMM estimates of Employment growth (sample period= 1990-2014; sample size=20 countries)

Dependent Variables log difference of Total employment

ltmpd	Coef.	z	P>|z|
ltmpd			
L1.	.4270899	10.06	0.000
lrd	-.0084215	-1.96	0.050
ltdop	.0286231	4.72	0.000
fdiofgdp	.0009343	2.47	0.014
lgdp	-.0002534	-0.04	0.964

Sargan test : Wald chi2(5) = 185.31

Prob > chi2 = 0.0000

chi2(252) = 324.7424

Prob > chi2 = 0.0013

It is evident from the table that the value of Wald Chi 2 is highly significant and the corresponding p-value indicates that the result is robust. So we can say the model is correctly specified. We have also applied the Sargan test for judging the validity of the model specification and the overidentifying conditions in respect of the selection of the instrumental variables. The chi2 value of Sargan test and its corresponding p-value indicate the robustness of the result such that the model specification and the identification of instrumental variable are correct. The negative sign of the R&D variable is justified on the ground that improvement in technology will have negative effect on the employment of the countries. In fact with development of modern technology most of the producing sectors will be using the frontier technology which is basically labor saving and the the innovation of new technology is likely to reduce employment. The positive sign of the coefficient of TDOP indicates the positive role of globalization of the growth of employment. This is also justified as because globalization has led to the expansion of outsourcing and free cross country movement of resources like labour

etc. On the other hand, in this DPD model also we have used HC, DCP, and MKTCAP as instrumental variable which are likely to produce their positive impact on the growth of employment across the sample countries through the endogenous variables .For instance the growth of HC and the development of the financial intermediaries in a country will , on the one hand help the innovation of new technology and the absorption of the existing developed technology through technology transfer thereby resulting into the higher growth of output and the employment of the countries.

VI: Concluding observation

This paper basically examines (i)the nature of cross country differentials in the level and growth of the PCGDP and the same for the PCGDP per effective unit of employment across the sample countries containing the developed and developing countries over the period from 1990 to 2014 exclusively on the basis of the secondary data available from various sources and explores the role of the exogenous variables on the same ,the endogenous explanatory variables apart through the application of the dynamic panel data technique with GMM estimator following the Arellona –Bond Method.(ii) the nature and growth of the cross country variations in total factor productivity for a set of sample countries(22) which are mainly the developed countries and in this context also the contributions of the exogenous components of TFP are examined through the DPD analysis with GMM method and finally the variations in the growth of total employment across the sample countries(20) by using the same method such that the role of exogenous factors are also taken in to consideration, the explanatory factors. We have also examined the validity of the Gerashchenko hypothesis on convergence in the era of globalization .The review if empirical literature on growth, technology diffusion and convergence reveals that the study on the cross country differentials in level and growth of PCGDP, TFP as well as employment by considering the role of the exogenous components through the application of DPD with GMM instrumental variable technique in a single frame is still scarce. So this study claims its novelty in this respect. The main findings of our study are as follows.

First , the summary statistics reveals that there are wide differences in the average performance across the sample countries pertaining to the level and growth since globalisation and the

technology, globalization and the relative positions of the countries in relation to the GPF play economically and statistically significant role in explaining the cross-country and cross-time variations in PCGDP and pcgdppe of the sample countries .Interestingly the distance of the countries from the GPF matters in respect of the level of productivity and its growth across the countries. To this end the exogenous components of PCGDP viz; the financial development of the countries, the imports, ncf, the expenditure on R&D are also important. Most of the empirical studies on the cross country growth analysis have not integrated these exogenous component as instrumental variables in their studies. We have actually used the financial development as well as human capital as instrumental variables producing their impact on the cross country variables of PCGDP and PCGDPPE through the endogenous variables used in the DPD regression analysis. value is found to be highly significant indicating the correct specification of the model and the robustness of this is established by corresponding P-value. Further we have applied the Sargan test of the null hypothesis that the model and the over identifying conditions in respect of selection of instrumental variables are correct specified. The values of he Wald Chi 2 and Sargan test and its p-values clearly indicate that there is the overall validity of the specification of the model and also of instruments used in analyzing the sample analog of the moment conditions used in the estimation process. So the results are robust in all respects.

Second, we find that the cross country variations in the growth of TFP, globalization and the distance of the countries from the GPF contributes positively on the variations of growth rates of PCGDP across the sample countries and in such case also the exogeneous components or the instrumental variables like financial development, human capital import play a positive role to this end. The DPD analysis of the growth of PCGDPPE also reveals the same story. The positive sign of the the variable RPCGDP establishes the validity of the Gerschenkron type hypothesis that the further the country from the faster will be its growth rate ofproductivity.

Third , we find large differences in the average vlue of TFP and its growth across our sample countries.as far the cross country differentials of the growth rates of TFP is concerned we find that the globalization , the relative position of the countries in relation to the RTFP and the R&d weighted by the RTFP play a significant role in explaining the cross country and cross tome variations in the growth rate of TFP. The instrumental variables (DCP, HC, MKTCAP, Imports) in this respect which are weighted by the RTFP have played major role towards the growth of TFP of the countries via the endogenous variables. Here also we find the validity of the

Gerschenkron hypothesis. Interestingly there is hardly any study which is based on DPD-GMM method in which the role of the exogenous factor like financial development, HC on the TFP are considered.

Finally, we find that the globalization and FdI have made economically and statistically significant contribution to the cross country and cross time differentials of the growth of total employment since liberalization. However the R&D has played a significant negative role to the growth of employment and this is justified in the sense that the improvement in technology may cause fall in employment. Here also we have used HC, DCP, and MKTCAP as instrumental variable which have produced their positive impact on the growth of employment across the sample countries through the endogenous variables. The results are found to be robust.

Now an important policy conclusion which emerges from our study is that the relative positions of the countries (i.e their base levels) in relation to the GPF and GTF are very much crucial for the laggard countries for catching up the GPF and GTF and in this respect the R&D with its two faces (i.e. stimulating innovation and the absorption of modern technology) and the globalization ,coupled with the exogenous components like the financial development ,the human capital make a positive contribution. So for catching up the GPF and GTF the laggard countries should not only emphasize on the innovation and imitation of the modern technology but it must be complimented by greater emphasis on the financial development and the development of their human capital.

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Appendix

List of Sample Countries

set-2	SET-3	SET-!
Argentina	Argentina	Argentina
Australia	Australia	Australia
Austria	Austria	Austria
Canada	Canada	Bolivia
Chili	Chili	Brazil
Denmark	Denmark	Canada
Finland	Finland	Chili
France	France	China
Germany	Germany	Cameroon
Israel	Israel	Colombia
Italy	Italy	Denmark
Japan	Japan	Egypt
Korea Republic	Korea Republic	Finland
Norway	Norway	France
Sweden	Sweden	Grece
United States	United States	India
United Kingdom	United Kingdom	Indonesia
Malaysia	Malaysia	Israel
Switzerland	Switzerland	Italy
Spain	Spain	Japan
Mexico		Kenya
Netherlands		Korea
		Morocco
		Norway
		Portugal
		Sri Lanka
		Sweden
		USA
		UK
		Turkey
		Singapore
		Malaysia
		Philippines
		Switzerland
		Spain
		Mexico
		Netherlands