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Impacts of Healthcare Spending, Labor Force Participation Rate and Human Development on Economic Productivity in Short and Long-Term: A Dynamic Panel Analysis

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Abstract
This paper investigates the multifaceted relationships of the healthcare expenditures, labor force participation rate and human development with per capita gross domestic product across various developing countries. Using a dynamic panel data of 115 developing countries from 2009 to 2021, this research has empirically estimated that economic productivity in the form of real GDP per capita follows a path-dependent trend in short term. It is also evident from a positive and significant coefficient of endogenous lagged variable that our system GMM two step estimations are reliable for further interpretations of the exogenous regressors. It is determined from our findings that human development is a major variable of interest for the heightening of economic productivity particularly in long-term rather than in short-term. This study also has practical implications for policymakers intended for achieving the Sustainable Development Goals (SDGs). In particular these goals are improvements in health, poverty (living standards), skilled education, decent work force and economic growth. Our results recommend that for gaining significant long term benefits policymakers should emphasis on an equitable and efficient allocation of resources in healthcare and human development initiatives. Finally, in developing countries strategies must be planned to enhance the quality of labor force rather than its quantity for achieving greater effects of labor force participation on economic productivity.
Keywords: Human Development Index, Healthcare Expenditures, Labor Force Participation, System Generalized Method of Moments, Economic Productivity

1. Introduction

Understanding and improving human well-being is a complex area of research which has significant implications on the developing regions of the world. Primarily, to achieve societal well-being there is an immediate need for investigating effects of health spending, labor force participation rate and human development on economic productivity in short and long term respectively. Previous researches have strongly emphasized on the impact of these factors for the enhancement of economic productivity and overall sustainable development.

As an investment in human capital, spending on healthcare initiatives and infrastructures plays a vital role in economic growth. Healthy individuals can efficiently and more effectively contribute in the economic productivity (Bagadeem & Ahmad, 2020). Conversely, a lower level of healthcare expenditures originate poor health of workers that increase their absentees from work and also diminish their productivity with lost in the economic output. There are strong empirical evidences that efficient healthcare system can increase the productive capacity and living standard of workers (Beylik et al., 2022). Therefore, it is crucial for economists, public health officials and policy planners to understand effects of healthcare on economic growth. Healthcare expenditures indirectly affects the health status of individuals but it directly influence the quality and availability of health services for the population. A healthier segment of population as labor workforce tends to be more productive and positively contribute to economic productivity (Bloom et al., 2004; Xiong, 2024). Higher healthcare expenditures produces better health outcomes in the form of low infant mortality rate, higher life expectancy and better living standards. This enhances the worth of human capital besides indirectly augment productivity (Nixon & Ulmann, 2006; Karhan, 2019; Audi et al., 2024). Health is not only concerned the economic prosperity but it is also a vital factor of economic productivity due to its dual causal relationship with sustainable growth (Üzümcü & Söğüt, 2021; Muhammad, 2023).

Likewise, human development incorporates health, education and living standards and represents a complete assessment of the well-being and productive capabilities of individuals. Human Development Index[5] (HDI) quantifies mean achievements of the major human development dimensions. These key factors of HDI includes healthy life, education and decent living standards (Hopkins, 1991). This measure implies that a higher achieved score indicates better provisions of education and health facilities which are also important for increase in the capacity of labor productivity, innovation and economic growth (Ranis et al., 2000; Ahmad et al., 2024). HDI performs a vital role in influencing economic productivity and growth mainly in developing countries. For instance, recent researches explores strong relationship between GDP per capita and HDI in many countries (Elistia & Syahzuni, 2018; Ali & Sajid, 2020). Moreover, previous literature has also separately emphasized on the importance of multi-dimensional aspects of HDI including health and education in promoting economic growth (Rahim et al., 2022). One more important factor that effects economic productivity is labor force

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participation rate. Recent studies have indicates that higher levels of labor force participation in economic activities boost productivity (Kargi, 2014; Chen, 2022). A more healthier and educated skilled work force participation in economic productivity is a dire need of developing countries to pace up their sustainable development. Although a young and expanding labor force leads to raise the economic growth but it also cause increasing urbanization issues especially in developing countries (Ngounou et al., 2024; Chen et al., 2023; Jacobs et al., 2023; Kilyachkov & Chaldaeva, 2021). Hence, it is also essential to investigate the short-term role and importance of urbanization in economic productivity.

Primary objective of this study is to explore dynamic effects of healthcare spending, labor force participation rate and human development simultaneously on the economic productivity for short and long terms particularly in developing countries. Secondary, this research will also empirically estimate the real GDP per capita time path trajectory in developing nations. Notably, this study will assess a more robust methodology of system Generalized Method of Moments[6] two step estimations for analyzing the short and long terms impacts of regressors on the real GDP per capita with the issues of endogeneity and heteroscedasticity in our dynamic panel dataset. As a secondary goal this research will also explore the short term impact of urbanization on economic productivity.

Our research will add to existing body of knowledge by empirically investigating the short and long terms impacts of healthcare spending, human development and labor force participation in fostering economic productivity of developing countries. This research will show its potential significance through providing a deeper insight to policymakers for the effective and efficient allocation of resources in health and human development. This research will have practical implications for policy designers intended for achieving the Sustainable Development Goals (SDGs). In particular these goals are improvements in health, poverty (living standards), skilled education, decent work force and economic growth. By understanding the dynamics of the under discussion variables will facilitate the designing of crucial policies and development planning for achieving sustainable economic productivity in both short and long terms. By employing robust econometric technique our study will also contribute in existing literature that will overcome common statistical challenges of heteroscedasticity and endogeneity in the dynamic panel datasets.

In this study after introduction, in section 2 previous literature is reviewed. Methodology is explained in section 3 then empirical results are demonstrated and interpreted in section 4. Lastly, section 5 comprises conclusions and policy implications.

2. Review of Literature

This literature review targets to provide a comprehensive analysis of existing studies on our research topic. It will mainly focus on how these variables influence economic productivity. According to Odhiambo (2021), increased healthcare spending particularly public health expenditures significantly raise the economic growth in Sub-Saharan Africa. Similarly, Bagadeem & Ahmad (2020) have empirically investigate the long-term co-integration between healthcare expenditures and GDP. They found that investment on healthcare can increase the economic growth. They have also highlighted the importance government institutions in the efficient allocation of resources in healthcare sector for enhancing national outcomes. Asongu & Odhiambo (2023) have employed more improved statistical methodology of quartile regression to have a deeper insight in the underlying relationship between economic growth and healthcare. They establish similar predictions as previously mentioned studies. Qehaja et al. (2023) have studied the effect of health expenditures on economic progress in OECD and Western Balkan states. They have concluded a positive relationship between GDP per capita growth and health spending. Celik et al. (2023) have investigated the impact of health expenses convergence to economic progress convergence in OECD countries. They have concluded that health expenditures indirectly drives emerging economy through the human capital development. Ozyilmaz et al. (2022) have empirically examined a bidirectional causal connection between health spending and growth of economy and concluded health spendings as the most important driver of growth in economic productivity. Jiang & Wang (2023) have employed Nonlinear Autoregressive Distributed Lag (NARDL) method to empirically explore the asymmetric effects of health related capital on economy. They have concluded that benefits of healthcare spending are not symmetrical particularly in China but it has a significant impact on economic productivity.

Abdullah et al. (2023) have analyzed the impacts of human development on economy at different Indonesian regions. They have employed panel data estimation methodology and concluded that HDI has a positive mono-directional influence on the economic growth. Elistia & Syahzuni (2018) have studied the association in HDI and GDP per capita of ASEAN member countries. They have determined significant and positive correlation between human development initiatives and GDP per capita trends that indicates a mutual relationship between them. Gulcemal (2020) has explored long run impact of human development index on the economic performance of only 16 UDCs. He has concluded that HDI is a key driver of economic progress that stimulus economy positively in long run. According to Pekarčíková & Prachařová (2023), there is a positive correlation in HDI and growth rate of economy but strength of association defers across countries and regions. Kargi (2014) has investigated a linear effect of labor force participation on growth of economy in Turkey. He concluded that growth in the labor force

[6] See, Blundell & Bond (1998), (Roodman, 2009)

participation positively affect the economic progress subject to increase in the quality of labor force. Similarly, Khan, (2023) has also emphasized on the quality of labor work force in order to reap the positive economic benefits of labor force participation rate. Thus, a skilled labor force could upsurge the outcome of labor force participation rate in the economy. Kitov and Kitov (2009) have empirically investigated the similar impacts of labor force participation. They also inferred similar results about labor force which positively impacts the productivity of economy but under some defined circumstances. Wijaya et al. (2021) have examined simultaneously the effect of labor force participation and human development on economic progress in Romania. They have found that both of these factors positively play vital roles in the economic growth but according to them HDI has comparatively greater influence.

Despite of the extensive literature on the relationship of healthcare expenditures, labor force participation and human development with economic productivity, there exists several research gaps. Firstly, most studies have concentrated to understand the effects of these causes separately rather than conducting a comprehensive combined investigation of their relationship with GDP per capita. Secondly, many studies have used simple correlational analysis and panel data analysis with the issue of heteroscedasticity and endogeneity in panel data. So, their estimated findings may have potential biasedness and inconsistences in their conclusions. Finally, many researches did not evaluate both short and long terms dynamic effects of these variables on economic productivity particularly. This study will fill this gap by employing system GMM two step estimation methodology in order to investigate dynamic effects of healthcare spending, labor force participation rate and human development simultaneously on the economic productivity for short and long terms particularly in developing countries.

3. Methodology

In dynamic panel data analysis, there is a suitable methodology to addresses the econometric challenges of endogeneity and heteroscedasticity which are very common. The System Generalized Method of Moments two step estimation technique is particularly preferred for this purpose as it provides robust and efficient estimates in the presence of these issues (Roodman, 2009).

3.1. Variables Description

On the basis of above discussed literature in section 1 and section2 following are the variables used in this research. Real GDP per capita (RGDpc) Purchasing Power Parity (PPP[7]) is the dependent variable which is representing the economic productivity of a country. In a particular year, a country's per capita gross domestic product (GDP) at purchasing power parity is the value of all final services and manufactured goods produced by individuals of an economy. It is log-transformed to address skewness and facilitate interpretation of the coefficients. Healthcare expenditure per capita (HEpc) Purchasing Power Parity (PPP): is an exogenous[8] variable that captures the volume of funds allocated to provide healthcare and infrastructure for individuals. It is also log-transformed due to its exponential growth tendencies. Human development index (HDI), an exogenous variable representing the major aspects of human development which includes health, education, and living standards. It is not log-transformed because it is a composite index that does not exhibit skewness. Labor force participation rate (Lfpr): is an independent variable that measures the proportion of the working-age population that is actively engaged in the labor market. It is not log-transformed as its data that we used in our study typically follows a normal distribution. Urban population as percentage of total population (UrbanPop): is an exogenous variable representing the percentage of a country's population that resides in urban areas. This measurement is used for understanding the effect of degree of urbanization within a society and its implications for economic productivity.

3.2. Data Sources

This study has used balanced dynamic data[9] comprises a panel of 115 developing countries from 2009 to 2021. It has been obtained from United Nations Development Programme (UNDP) and World Development Indicators (WDI).

3.3. System Generalized Method of Moments (GMM):

System GMM estimation method is used for addressing the potential endogeneity and heteroscedasticity in the dynamic panel data. This methodology is particularly effective in dealing with those empirical models where the lagged dependent variable is included as an endogenous variable. It must have a significant estimated coefficient for the implications of dynamic panel data effects on the regressed. The system GMM estimation improves the efficiency of the estimates by accounting for heteroscedasticity and autocorrelation in the residuals. The presence of non-constant variance in the error term is known as heteroscedasticity which can lead to inefficient estimates. The system GMM two-step estimator accounts for heteroscedasticity by constructing a robust variance-covariance matrix (Roodman, 2009) .

[7] Using purchasing power parity prices which are divided by the aggregate prices calculated real GDP per capita (purchasing Power Parity) is converted to US dollars.

[8] For confirmation as exogenous nature of variables, see Results section 4.

[9] For two step system GMM model estimation there is a condition i.e. N(115 groups) must be greater than time periods T(11) (Arellano & Bond, 1991; Blundell & Bond, 1998)

3.4. Empirical Model

Our empirical model is shown in equation (1) below:

$$\ln RGDpc_{it} = \alpha_0 + \alpha_1 \ln RGDpc_{(it-1)} + \beta_1 \ln HEpc_{it} + \beta_2 \ln HEpc_{(it-1)} + \beta_3 \ln HEpc_{(it-2)} + \beta_4 HDI_{it} + \beta_5 HDI_{(it-1)} + \beta_6 HDI_{(it-2)} + \beta_7 Lfpr_{it} + \beta_8 Lfpr_{(it-1)} + \beta_9 Lfpr_{(it-2)} + \beta_{10} UrbanPop_{it} + \beta_{11} UrbanPop_{(it-1)} + \beta_{12} UrbanPop_{(it-2)} + \varepsilon_{it} \quad (1)$$

In above equation (1), *i* denotes the i^{th} country. Current time period is indicated by *t*. Furthermore, α_0 is the estimated constant and α_1 is coefficient of lagged dependent variable. Similarly, β_1, β_2,....., β_{12} are coefficients of current and lagged exogenous variables. All current period coefficients are indicating the short term immediate effects. Moreover, following equation (2) will be used only for the significant short term coefficients for the computation of long-term effects of exogenous variables on the dependent variables.

$$\frac{Significant\ short-run\ Parameter}{1 - Parameter\ of\ lagged\ dependent\ variable} = \frac{\beta_k}{1-\alpha_1} \quad (2)$$

In equation (1), the inclusion of lagged variables ensures that the model captures the persistence and delayed effects in the relationship between economic productivity and other factors (Edjoukou et al., 2022).

Table 1: Categories of Variables in the Model

Dependent Variable:	Natural Log (Real GDP per capita (RGDpc)
Endogenous Variable:	Lag (1) Natural Log (Real GDP per capita (RGDpc)
Exogenous Variables:	Natural Log (Healthcare Expenditure per capita) (HEpc)
	Human Development Index (HDI)
Current, (Lag-1) and (Lag-2)	Labor force participation rate (Lfpr)
	Natural Log (Urban population, %age of total population) (UrbanPop)

This method helps in understanding how past values influence current outcomes, providing insights into the temporal relationships within the dataset (Li et al., 2021).

4. Results

4.1. Descriptive Statistics

Table 1 provides summary of descriptive statistics which encompasses all the variables used in empirical estimations.

Table 2: Descriptive Statistics

Variables	Obs	Mean	Standard Deviation	Mini	Maxi
lnRGDpc	1521	9.014844	1.020336	6.75809	12.0048
lnHEpc	1521	5.880257	1.112446	3.05502	8.57866
HDI	1521	.6443162	.1322205	.325	.933
Lfpr	1521	60.91291	11.06527	31.402	87.641
lnUrbanPop	1521	3.849481	.4916337	2.33949	4.60517

These statistics are indicating that there are not any outliers in our sample data and it's also showing that variables used in the analysis are not skewed.

4.2. Preliminary tests for the validity of System GMM application

According to Roodman, (2009), there are some initial conditions that must be satisfied before the estimation of System Generalized Methods of Moments model on the dynamic panel data. At First, number of cross sections i.e. countries (N) must be greater than number of time series (t). Secondly, multicollinearity must not be present in the exogenous variables that can be detected through variance inflation factor (VIF) that must be less than 5 (Schroeder et al., 1990). In Table 3, health expenditures per capita and human development index have moderate high VIF values while other variables have low VIF values. Similarly, over all VIF is also under the required threshold level. Hence, our model does not have significant multicollinearity issue.

Table 3: Variance Inflationary Factor (VIF)

Regressors	VIF	1/VIF
lnHEpc	4.46	0.2241
HDI	3.81	0.2625
Lfpr	1.87	0.5357
lnUrbanPop	1.03	0.9724
Mean VIF	2.79	

Thirdly, there must be fixed effects in the panel data for the estimation of GMM model. We have employed Hausman Test Statistic[10] = 113.74*** (Prob=0.0000) for this purpose that is highly significant. Thus, the null hypothesis of a non-systematic difference in the coefficients is rejected. So, it is concluded that there exists fixed effects in our panel data (Hausman & Taylor, 1981). Fourthly, Panel data must have heteroscedasticity in it. For

[10] This statistic is obtained after estimating fixed effect and random effect panel regression models on our dependent and independent variables.

this, we have used modified Wald test for the detection of heteroscedasticity. A significant value of the modified Wald test statistics = 92568.61*** (Prob = 0.0000) is concluding the null hypothesis rejection of homoscedasticity. So, there is presence of heteroscedasticity in our fixed effects panel data regression model (Laskar & King, 1997).

Table 4: Pairwise Correlation Test between SLRM (OLS) residuals and the data variables

Variables	PW Coefficient	Probability
lnRGDPpc	0.3565*	0.0000
L_1lnRGDPpc	0.3491*	0.0000
lnHEpc	-0.000	1.0000
HDI	-0.000	1.0000
Lfpr	-0.000	1.0000
lnUrbanPop	-0.000	1.0000

Finally, for the identification of endogenous and exogenous variables in the model, we have estimated a simple linear OLS regression model on our dependent and independent variables and predicted the residuals to term the pairwise correlation test. A significant pairwise correlations with the residuals shows that the variable is endogenous or otherwise it is serving as exogenous (Ferketich et al., 1984). Hence, Table 4 is showing the pairwise correlations results, showing that only the first lag of the dependent lnRGDPpc is serving as endogenous variable and other are valid exogenous variables for the estimation of two step system GMM model. Hence, all above preliminary conditions are full-filled for the application of two-step system GMM model.

4.3. System GMM Two Step Estimation Results:

The results from the system GMM two-step estimation are demonstrated in Table 5. In the GMM two-step method, estimation of white's heteroscedastic-consistent standard errors ensures that estimated coefficients are not violating the heteroscedasticity assumption and providing reliable results in the presence of heteroscedasticity in the model (Roodman, 2009).

Table 5: Result of Two-step System GMM (Dep. Var =log of RGDPpc)

Variables	Estimated Coefficient	P-Value
L_1lnRGDPpc (α_1)	0.9561***	0.000
lnHEpc	0.0502***	0.001
L_1.lnHEpc	-0.0459**	0.023
L_2.lnHEpc	0.0108	0.317
HDI	4.4069***	0.000
L_1.HDI	-5.0574***	0.000
L_2.HDI	0.8836**	0.027
Lfpr	0.0064***	0.003
L_1.Lfpr	-0.0118***	0.001
L_2.Lfpr	0.0055**	0.011
lnUrbanPop	2.6619	0.327
L_1.lnUrbanPop	-4.666	0.388
L_2.lnUrbanPop	1.785	0.466
Constant (α_0)	0.1284**	0.050
Arellano-Bond AR(2)* **		0.526
Hansen Statistic **		0.05
F Statistic* **		0.000
No of Obs.		1265
Groups/Instruments		115/90

Notes: *,**,*** are statistically significant at 10%, 5% and 1% level respectively. P-values of variable coefficients are calculated from the white heteroscedastic consistent standard errors. For the two-step GMM Model validity and instruments validity p-values of AR(2) and Hansen Statistic must be statistically insignificant. Number of instruments must be less than Number of groups (Roodman, 2009).

Arellano-Bond test has also been applied for the detection of autocorrelation in our dynamic panel dataset(Arellano & Bond, 1991). The p-value of Hansen J-test is also used for the validation of the instruments used in the model (Roodman, 2009). In above Table 5, the coefficient for the lagged dependent variable is highly significant and positive which is showing a strong perseverance in economic productivity of developing countries. One percent increase in real GDP per capita in the previous period leads to a 0.956 percent increase in the current period real GDP per capita. Hence, it is indicating that economic productivity in developing nations follows previous path trajectory in short-term. Higher per capita income increase the aggregate demand for goods and

services, which in turn stimulates economic production (Ranis et al., 2000). On the contrary, all estimated coefficients for healthcare expenditure per capita are illustrating mixed results.

The immediate effect of health expenditures per capita is significant and positive while one year lagged effect is significantly negative. Hence, these results are suggesting that current healthcare spending boosts economic productivity in short-term (Celik et al., 2023; Nixon & Ulmann, 2006; Ozyilmaz et al., 2022; Üzümcü & Söğüt, 2021). Similarly, all estimated coefficients of HDI are significant. The current period short term effect of HDI is highly significant and positive. It is indicating that improvements in human development have a considerable positive impact on economic productivity(Abdullah et al., 2023; Elistia & Syahzuni, 2018; Rodliyah, 2023; Saha, 2023) . However, the first lagged effect is negative which is further adjusted by a positive correction in the longer term. The parameters of the labor force participation rate are indicating a positive relationship in the immediate short term effect with significance. This shows that a higher labor force participation rate contribute to increased economic productivity (Juhn & Potter, 2006; Kargi, 2014; Kitov & Kitov, 2009). The significant negative lagged coefficient that again followed by a significant positive coefficient is explain the similar results as previous studies that the quality of workforce matters more than the quantity of labor force participation. Due to rapid innovations and research in productivity most of the working labor in developing countries are not skilled enough to a required standard in labor market. Hence, our results are also presenting mixed short term effects of labor force participation rate on the economic productivity in the developing countries (Khan, 2023).

Finally all estimated parameters of urban population are statistically insignificant. The diagnostic tests statistics of Arellano-Bond and the Hansen validate the robustness and appropriateness of our estimated two-step system GMM model. Hence, there is no any significant autocorrelation in the first differences and the instruments used in the model estimation are valid.

Table 5: Result of Long-term estimates[11] of Two-step System GMM Model (Dep. Var =log of RGDPpc)

Variables	Estimated Coefficient	P-Value
HEpc	1.146197	0.13
HDI	100.51**	0.05
Lfpr	0.148*	0.10

Notes: *,**,*** are statistically significant at 10%, 5% and 1% level respectively (Roodman, 2009).

All first lagged estimated coefficients are negative and significant, therefore following Table 6 is displaying the long-term estimated coefficients which are derived from the significant current period estimated parameters. Thus, HDI has a significant and very stronger long-term impact on the economic productivity of developing countries (Gulcemal, 2020). Similarly, Labor force participation rate has more effects on economic productivity in long term. Finally, the healthcare expenditures long term coefficient is not significant which is might be indicating an inefficient allocation of funds and under-utilization of resources in healthcare of developing countries.

5. Conclusion and Policy Implications

This research empirically contributes to the debate concerning about the dynamic effects of healthcare spending, labor force participation rate and human development simultaneously on the economic productivity for short and long terms mainly in developing nations. By using a robust two step system Generalized Method of Moment (GMM) estimation methodology, our research findings delivers quite valuable understandings for policymakers to formulate effective strategies for enhancing economic productivity. Recent studies are lacking in the explanation of the short term as well as long term effects of healthcare and human development initiatives on the economic productivity. Similarly, an efficient role of labor force participation rate on the economic output in short and long term was never evaluated for dynamic panel datasets. On the same note of importance, recent literature is also requiring a robust empirical investigation on the time-path trajectory of the economic productivity due to the issue of endogeneity in the data of developing countries. Our results suggested that current real GDP per capita is positively and significantly influenced by its previous lag which explains that economic productivity follows a path-dependent trend in short term. It is also evident from this positive and significant coefficient of endogenous lagged variable that our two step system GMM model estimations are reliable for further interpretations of the exogenous regressors. Our results are also in accordance with the previous literature about the positive impact of current period healthcare spending, human development and labor force participation on the real GDP per capita in short term (Abdullah et al., 2023; Celik et al., 2023; Kargi, 2014; Ozyilmaz et al., 2022; Qehaja et al., 2023). On the contrary, our findings suggest that only human development and labor force participation rate are significantly and positively effecting the economic productivity in the long term. Moreover, human development initiatives have stronger and larger positive impact on the real GDP per capita in the long term. Hence, our research findings has practical implications intended for achieving the Sustainable Development Goals (SDGs). In particular these goals are improvements in health, poverty (living standards), skilled education, decent work force and economic growth. Although an increase in healthcare spending positively improve the economic productivity

[11] See equation (2) above.

in short term. But for gaining its significant long term benefits policy makers should emphasis on an equitable and efficient allocation of resources in healthcare facilities particularly in developing countries. It is evident from the findings of this study that human development is the key factor to boost the economic productivity in developing countries. Therefore, there is a dire need to plan more comprehensive human development policies that could achieve multiple dimensions of human well-beings. Due to its positive impact on economic productivity, introducing more inclusive labor market policies will encourage higher labor force participation which will ultimately enhance sustainable growth and improve economic performance. Primarily, in developing countries strategies must be planned to enhance the quality of labor force rather than its quantity for achieving greater positive impact of labor force participation on economic productivity in long-term.

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