Investigating the Impact of Health Expenditure and Child Mortality on Labor Market Participation: Insights from Pakistan

Amtul Hafeez[1], Naeem Ahmed[2] and Aimen Khalid[3]

Abstract

The main objective of the study is to include health in a well-defined workers' participation function to estimate the effect of health on workers' participation. The study examines the impact of health expenditure and child mortality on the labor market work, based on latest data set available (1980-2022) in Pakistan. The findings suggested that health expenditure has a positive impact on the labor force participation in long run suggesting that higher public sector expenditure can improve labor market participation of the individuals. In contrast, child mortality rate has a negative impact on participation of workers in the labor market work. This shows that increase in child mortality is likely to lower the labor market production in the country. These findings may exert significant policy implications.

✉ Amtul Hafeez ahafeez@nml.edu.pk
[1] [2] [3] Authors are respectively Assistant Professors and Graduate, Department of Economics, National University of Modern Languages, Islamabad.

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1. Introduction

Human beings can shape their production competencies through focusing on health. Investment in human health can enhance human well-being (Raza et al. 2023). Health is a critical component in increasing workers' productivity within the world's economic landscape particularly in the case of developing nations such as Pakistan, where intricate socio-economic considerations collide with the nation's health issues. The relationship between a person's human capital—that is, their skills, knowledge, and abilities—and labor market participation and productivity is positively correlated. The health of the workforce exerts a significant impact on labor market productivity of workers. Moreover, health is important to develop the production abilities and earning prospects of individuals and of the whole nation (Grossman 1972). Focus on the health aspect can enhance the potential of labor market workers. According to Bloom et al. (2004), better health is related with 4% increase in the productivity level. Health indicators like health expenditure and child mortality exert a greater impact on labor market participation in Pakistan. For example one percent increase in infant mortality can lead lower the labor market participation by 0.65 in Pakistan, (WDI 2023). Study by Fogel (2004) examined that poor health status can weaken economic growth in the long run. In addition, individuals with better health status can focus on investment in their education. In turn, educated workers can lead to higher labor market activity (e.g., Hafeez & Ahmad 2002; Gondal 2003; Hafeez 2013). Different studies (e.g., Hafeez, 2015; Gondal & Yasmeen 2007 and Ahmad & Hafeez 2007) have highlighted the relation between education and labor market activity. It has been observed that healthy workers can make considerable contribution in market activities. They play a vital role in personal, family and national development.

The empirical analysis of health indicators on labor market work has always been of great concern to health economists, Mushtaq (2013). In economics, the relationship between workers' productivity and health is well-established. Workers in good health typically perform well because they have little absenteeism, a low rate of disability, and high levels of creativity and cognitive thinking. Poor health status of workers could hamper the level of productivity in developing economies, (Schultz 2005). Healthy people are mentally and physically capable to boost the production and growth (Bloom, Canning and Sevilla 2004). Better health of individuals can improve their productivity (Grossman, 1972). The main causes of low labor productivity in Pakistan are the high rates of absenteeism in workplaces particularly government offices, the

lack of hospital equipment in medical facilities, the high cost of treatments, and the scarcity of qualified physicians. A study by Raza et al. (2023) indicates that people in good health are better able to engage in market activities. They are more productive and less likely to be absent from work (Bloom, Canning and Sevilla 2004).

The review reveals that existing studies mainly highlight the impact of health related indicators on economic growth. That is the previous literature hardly examines the impact of human capital variables including health on the labor market participation of adult labor force. Therefore, in the context of above scenario, it has been found imperative to investigate the impact of health expenditure and child mortality rate on the labor market participation of labor market workers. This study elaborates the impact of health indicators such as expenditure on health and child mortality on labor market participation in Pakistan using the latest data set available.

The main objective of this study is to include health in a well-defined workers' participation function to estimate the existence of effect of health on workers market participation. This study investigates two important health-related factors (such as public expenditure on health and child mortality) which affect labor force participation of individuals in Pakistan. The study is based on latest data set available 1980 to 2022. In sum, the purpose of our research is to examine the separate and combined impact of health expenditure and child mortality on the labor market participation in Pakistan. We have formulated three different models in this respect. Econometric techniques have been used to analyze the data.

2. Conceptual Framework and Literature Review

This section reviews a number of studies on the subject conducted nationally as well as internationally.

Individuals can figure their production capabilities through concentrating on their health. Investment in human health can enrich human well-being (Raza et al. 2023). Healthy people are mentally and physically accomplished to enhance the production and growth (Bloom, Canning and Sevilla 2004). Better health of individuals can improve their productivity (Grossman 1972). Ram and Schultz (1979) asserted that improved health status (reducing individuals' sickness and extending life span) increases hours of market work supplied by labour force. Bloom et al. (2000) hold the view that healthy individuals may be less absent from work. Being more energetic intellectually and physically, they have more incentive to invest in human capital

(education and health). Even debt can be acquired to increase the productivity level, Khan, Subhan & Hafeez (2024). Arora (2001) in his study of human health, productivity and economic growth, explained that improvement in health status raises the working capability of the workforce and causes economic growth to increase by 30-40 percent. (Tampa 2002). According to Schultz (2005) improved health exerts remarkable impact on labor force productivity. Bloom et al. (2004) found that good health significantly boosts aggregate output of workforce.

A number of studies have been reviewed to highlight the impact of health expenditure and child mortality on economic growth. Akram & Padda (2008) analyzed the impact of health on economic growth in Pakistan using co-integration and error correction techniques for the data from 1972 to 2006. The study found a positive long-term association between health indicators and per capita gross domestic product (GDP). It highlighted the need to enhance human health capital for higher per capita income with public health expenditure playing a minor role.

A study by Mustafa and Ansari (2022) explored the impact of health spending on GDP growth in Pakistan using ARDL and co-integration methods with data from 1971 to 2016. Their findings highlighted that investments in health and education significantly boost economic growth. The study also emphasized the need for the government to prioritize health and education to enhance economic activities and long-term growth in Pakistan.

In an empirical study, Raza et al. (2023) analyzed the impact of newborn mortality, life expectancy, and health expenditures on Pakistan's workforce productivity using the ARDL method with time series data. The study found that government healthcare spending significantly enhances labor force participation as healthier individuals are more likely to engage in market activities as compared to unhealthy workers. Education is also identified as a key factor which positively influencing the labor force participation in Pakistan.

Similarly, Raifu (2024) examined the role of institutional quality in the association between health expenditure and labor force participation in Africa for the period 2000 to 2018. The study employed generalize method of moments to analyze the data. It was found that public sector expenditure exerts positive effect on labor force participation in Africa.

The review reveals that existing studies mainly highlight the impact of health related indicators on economic growth. Based on the extensive review of literature, it has been found imperative to investigate the impact of health expenditure and child mortality rate on the labor market participation of labor market workers.

3. Data and Methodology

This analysis uses time series data covering the years 1980–2022 and the variables like labor market participation, health care expenditure, child mortality, government spending on education, GDP growth rate, merchandise trade and gross capital formation. Table 1 shows the trend of some important variables used in the study.

Table 1

Year Wise Statistics of Variables

Years	Labor Force Participation	Health Expenditure	Child Mortality Rate	Literacy Rate (%)
1990	48.62	0.9	60.06	34.8
1995	50.04	0.88	59.87	37.9
2000	50.45	0.55	62.10	45.00
2005	50.12	0.48	62.46	53.00
2010	49.68	0.58	64.43	57.00
2011	50.77	0.67	64.64	58.00
2012	48.62	0.72	64.78	60.00
2013	51.45	0.80	65.15	58.00
2014	50.99	0.84	65.28	60.00
2015	49.11	0.92	65.69	58.00
2016	48.93	1.03	65.88	60.00
2017	64.21	1.20	66.29	62.30
2018	50.99	1.11	66.48	62.30
2019	51.59	1.16	66.75	60.00
2020	51.20	1.21	66.26	60.00
2021	44.87	1.18	66.09	62.80
2022	49.30	1.20	66.10	63.00
2023	47.6	1.00	55.77	60.7

Source: Data is taken from World Development Index (WDI), Economic Survey of Pakistan, State bank of Pakistan

Model: Health Expenditure, Child Mortality and Labor Market Participation
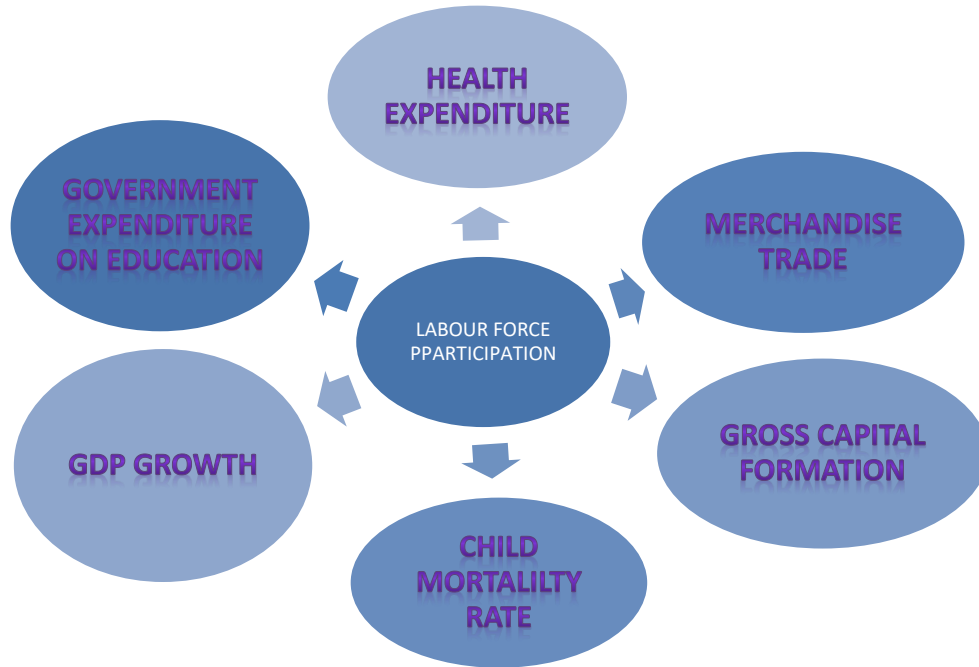
Relationships of Variables

A healthy person can play a significant role in performing daily life activities. Health status of people in a country indicates the health of economic situation prevailing in the country. A model has been formulated to investigate the empirical nexus between the health and workers' productivity in the labor market.

Dependent Variable

Labor Force Participation

Labor force participation (LFP) rate measures the percentage of working age population that is either employed or actively seeking for employment. LFP is a basic indicator of economic health of a society. It shows the availability of labor input for producing goods and services (Hipple 2016). The efficiency with which labor inputs are used to produce products and services is referred to as labor force productivity. According to Mushtaq (2013) and Raza et al. (2023), increased output per unit of time produced by workers is a key component of higher productivity which is essential for competitiveness and economic progress.

Independent Variables

Expenditure on Health

The total sum of money spent on the healthcare services by the individuals, government and the organizations of the country is referred as health expenditure. Higher expenditures on maintaining human health situation indicate more focus on acquiring health services by the society. Therefore, individuals would be likely to contribute more productivity in the aggregate national production. Increase in public sector spending on health leads to improve health outcomes by lowering the intensity of diseases and improving life expectancy. A healthier labor unit may actively participate in economic productive and therefore would be more productive and efficient (Ali et al. 2017). According to Schultz (2005) & Bloom et al. (2004) better health applies outstanding impact on productivity. Moreover, healthier individuals may be more capable of acquiring education and therefore may be more productive. Various studies like Piabuo & Tieguhong (2017) have shown positive relationship between health expenditure and labor force participation and productivity. Preventive health care may lower the need of treatment and therefore save the medical cost. That is the higher health care expenditure assures good quality work force which can be translated by increase in its participation in production process of the country.

Child Mortality Rate

The number of children who passes away before the age of 5 years per 1000 live births in a country in a specific time span is referred as child mortality rate. Mortality rate exerts inverse impact on economic growth, (Afridi 2016). High mortality rate usually indicates poor and inadequate health care system in a country. Lower child mortality rate is associated with higher participation and effective productivity of labor force. Families with lower child mortality rate are likely to bear fewer children and allow parents particular mothers to participate more in the labor force. They would contribute more in the aggregate productivity of labor force. Moreover healthier parents and children can save the medical treatment cost and can contribute more in the economic activity (Roser and Ortiz-Ospina 2016). According to Raza et al. (2023) low newborn mortality significantly enhances labor force participation as healthier individuals.

Government Expenditure on Education

This is the total sum of money set aside by the government for the educational purposes. This includes teacher's salaries, schools infrastructure, government laptop schemes for students and more. Investment in education enhances the knowledge and skills of workers leading to higher participation and productivity of labor force (Roser & Ortiz-ospina 2016; Khan & Hafeez 2017). Educated individuals are more likely to adopt innovative production techniques. It improves the labor market outcomes leading to better job opportunities and higher productivity. It also develops social mobility and reduces poverty. Moreover educated individuals are more likely to undertake better health care choices and therefore lead to more productive healthy population.

GDP Growth Rate

The total value of goods and services produced inside the borders of a country in a given time span is termed as the GDP growth. Growth rate measures the increase in economic production of a country over a certain time period. It reveals the overall health and performance of the economy. Higher growth rate can lead to higher participation of the adult labor force as result of more job creation higher investment and economic activity taking place in the country Martin (2018). This would cause workers to improve their standards of living as a result of having higher earnings.

Merchandise Trade

The trade or exchange of all the physical goods among the countries in a given time span is referred as merchandise trade. This includes exchange of agricultural goods, automobile, raw materials and more. It plays a vital role in global economy. It can positively affect labor force participation by creating jobs and stimulating economic and skill development (UNSD 2011). It can lead to higher productivity through efficient use of resources and specializing the production of goods. It can expand the market and therefore create more job opportunities.

Gross Capital Formation

The gross value of all physical assets like buildings, machinery and infrastructure produced within a country in a given time span is referred as gross capital. Since gross capital formation indicates investment in physical assets, it leads to increase productive capacity of an

economy. These investments create jobs and therefore require labor force. This would enhance the participation and productivity of labor force and reduce the unemployment and intensity of poverty in the country. Continuous investments in capital formation can result in long term economic benefits such as higher employment rate and improved standards of living (Umair, et al. 2024).

> Table 2 contains the construction of all the explanatory variables as well as relevant data sources. The data are obtained from World Bank Indicators (WDI) and the State Bank of Pakistan (SBP).

Table 2

Description of Variables and Data Sources

Variables	Abbreviations	Measurement	Data Sources
Dependent Variable			
Labor Force Participation	LFP	% of total population ages 15+	World Development Index (WDI)
Independent Variables			
Health Expenditure	HE	% of GDP	State Bank Of Pakistan
Child Mortality Rate	CMR	Per 1000 child birth	WDI
Government Expenditure on Education	GEE	% of GDP	WDI
GDP Growth Rate	GDP	Rate	WDI
Merchandise Trade	MT	% of GDP	WDI
Gross Capital Formation	GCF	% of GDP	WDI

The following equations 1, 2 and 3 are formulated to analyze the impact of health indicators on labor force productivity.

Model 1: Health Expenditure and Labor Force Participation

$$LFP_{t} = \beta_0 + \beta_1 HE_t + \beta_2 GEE_t + \beta_3 GDP_t + \beta_4 MT_t + \beta_5 GCF_t + \varepsilon_t \tag{1}$$

Model 2: Child Mortality Rate and Labor Force Participation

$$LFP_{t} = \beta_0 + \beta_1 CMR_t + \beta_2 GEE_t + \beta_3 GDP_t + \beta_4 MT_t + \beta_5 GCF_t + \varepsilon_t \tag{2}$$

Model 3: Health Expenditure, Child Mortality and Labor Force Participation

$$LFP_{t} = \beta_0 + \beta_1 HE_t + \beta_2 CMR_t + \beta_3 GEE_t + \beta_4 GDP_t + \beta_5 MT_t + \beta_6 GCF_t + \varepsilon_t \tag{3}$$

Where, ε : Error term

4. Estimation Results and Discussion

This study analyzes the impact of different health indicators on the LFP in Pakistan by analyzing three distinctive models. Augmented Dickey Fuller (ADF) test was utilized to verify the stationarity of data. The long- term effect of health indicators on labor force participation has been analyzed by using the Auto Regressive Distributive Lag model (ARDL). Table 3 provides the descriptive statistics of the selected data set.

Table 3

Descriptive Statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev
LFP	48.89274	49.72000	52.73000	32.20000	3.826369
HE	0.822093	0.800000	1.250000	0.440000	0.226385
CMR	4.661876	4.656813	5.105945	4.147885	0.296219
GDP	4.767925	4.705803	10.21570	-1.274087	2.221850
GEE	2.335702	2.386440	3.022300	1.687461	0.355059
GCF	17.20829	17.57773	20.68500	14.53469	1.706660
MT	28.51622	28.51622	34.15386	19.99501	3.925503

The findings of Augmented Dickey Fuller (ADF) are displayed in Table 4. The results indicate that LFP, health related variable like health expenditure and child mortality rate and gross capital formation are stationary at first level of integration I(1). The remaining variables which include government expenditure on education, GDP growth rate, and merchandise trade are stationary at level. That is they are integrated of order zero, I(0).

Table 4

Result of Augmented Dickey Fuller Test

Variables	t-statistics	Probability	Integration order
LFP	-6.085115	0.0000	I(1)
HE	-4.855250	0.0000	I(1)
CMR	-2.756083	0.0095	I(1)
GDP	-4.762164	0.0000	I(0)
GEE	-3.237194	0.0025	I(0)
MT	-2.811497	0.0076	I(0)
GCF	-6.275312	0.0000	I(1)

Model 1: Health Expenditure and Labor Force Participation

This section presents the analysis of health expenditure and LFP in Pakistan. Results of ARDL Bound test for health expenditure and labor force participation are given in Table 5. This indicates that value of F - statistics is higher than lower and upper bound. That is, the long run relationship prevails between the variables. On the other hand, no long-term link exists between the variables, if the value of F-statistic is less than the upper bound critical value. This explains that ARDL can be applied to the model.

Table 5

Results of Bound Test for Health Expenditure and LFP

Significance	Bound I(0)	Bound I(0)
10%	2.08	3
5%	2.39	3.38
2.5%	2.7	3.73
1%	3.06	4.15
F- Statistics value	8.371704	

Long run results for the model 1 are given in Table 6.

Table 6

Long Run Results of Health Expenditure and LFP (Model 1)

Variables	Coefficients	t- statistics	Probability
HE	16.57225	2.488038*	0.0209
GEE	-7.013146	-2.151863*	0.0426
GDP	-0.757553	-1.594031	0.1044
MT	-0.163616	-0.816071	0.4232
GCF	2.091918	2.969410*	0.0071
R-squared	0.89	Prob (F-statistics)	0.00
F-statistics	8.77	Log likelihood	-53.69

Note: Coefficients are significant at one, five and ten percent and are shown by (*), (**) and (***) respectively.

The results indicate that health expenditure has a significant and a positive impact on the LFP in Pakistan. This explains that higher level of spending on the health care services and facilities by the government sector result in healthy and more efficient work force in the country. Our results are confirmed by findings of existing studies. For example, a study by Piabuo & Tieguhong (2017) has shown positive relationship between health expenditure and labor force participation and productivity. That is the higher health care expenditure assures good quality work force which can be translated by increase in its participation in production process of the country. Similarly a project report by university of Shefiled in 2017 found that healthier workers tend to be more productive. That is investment in health can reduce absebteeism and improve the workers efficiency. Likewise Raifu (2024) revealed similar result for public sector health expenditure and labor force participation in Africa.

Government expenditure on education has a significant and inverse impact on LFP in Pakistan. This shows that higher educational costs do not always result into higher-quality education and therefore may lower the labor force participation in the country. This may often result in mismatch between the skills that workers possess and the capabilities of workers that employers need and therefore demand. According to Boheim, Horvath and Leoni (2023), if education system does not match with the labor market requirements, the increased spending on

education may not lead to high employment. That is, focus on threotical knowledge rather that practical work can lead to reduce probability of getting job. This explains that poor quality education might not ensure the education quality and can lead to inefficiencies. Thus, it may not improve the labor force participation.

The relationship between gross domestic product and LFP can be complex. While GDP growth generally indicates a healthy economy, its direct impact on labor force participation isn't always straightforward. Sometimes, impact of GDP might be inverse on labor market participation but insignificant. That is, there is a weak association which may not be considered evocative. This could be due to various reasons like structural changes in different industries of the economy driving productivity growth. It has been observed that growth rate of gross domestic product has negative but insignificant impact on labor force participation in the country. That is, rapid GDP growth rate may stress the country's infrastructure and improve inequality. It may mainly widen the creation of jobs in low-labor sectors which also may hinder skill development of workers. This can lead to lower the productivity of workers and therefore their labor force participation.

Similarly, merchandise trade exerts negative and insignificant impact on labor force participation. As with more merchandise trade in Pakistan income disparities and unstable employment could worsen the labor force participation in the country, the association between merchandise trade and labor market participation can be certainly composite. While merchandise trade can affect labor market by generating or eradicating jobs, its straight bearing on labor force participation might not always be substantial. Several factors like technological improvement can lower the demand for labor in certain sectors even as trade grows. Large distraction in global supply chain as those experienced during COVID-19, can lead to increase the cost of trade and lower the labor market activity.

The empirical results indicate that gross capital formation has a strong positive impact on the country's labor force participation. Since gross capital formation indicates investment in physical assets, it leads to increase productive capacity of an economy. These investments create jobs and therefore require labor force. This would enhance the participation and productivity of labor force and reduce the unemployment and intensity of poverty in the country. Findings of a study by Umair, et al. (2024) support the findings of our study. According to Umair, et al.

(2024), continuous investments in capital formation can result in long term economic benefits such as higher employment rate and improved standards of living.

Table 7 shows the results of the model in the short run.

Table 7

Results of Health Expenditure and LFP (Model 1) in Short Run

| Variables	Coefficient	T- statistics	Probability
HE	16.57225	3.173313*	0.0044
GEE	-7.013146	-2.991195*	0.0067
GDP	-0.757553	-2.862288*	0.0091
MT	-0.163616	-0.816071	0.4232
GCF	-2.091918	-3.778696*	0.0010
CointEq(-1)	-0.875347	-8.636219*	0.0000
R-squared	0.94	D.W stat	1.95
Adjusted R-squared	0.92	Log likelihood	-53.69

Note: Coefficients are significant at one, five and ten percent and are shown by (*), (**) and (***) respectively.

As in the long run, health expenditure has a significant and positive impact on labor force participation in short run. Whereas GDP growth, government expenditure on education and gross capital formation has a negative and significant impact. Additionally, merchandise trade has a negative but an insignificant impact on labor force productivity in short run. Co-integration term indicates that if any disequilibrium arises in the short run model it will be adjusted back towards equilibrium at the speed of 0.87 percent.

Stability Test

We have applied Cumulative Sum Control Chart (CUSUM) test to ensure the stability of the model (Figure 1). The calculated lines between the margins of the Cumulative Sum Control Chart (CUSUM) test demonstrate that there is no volatility, ensuring the stability of our findings for Model 1.
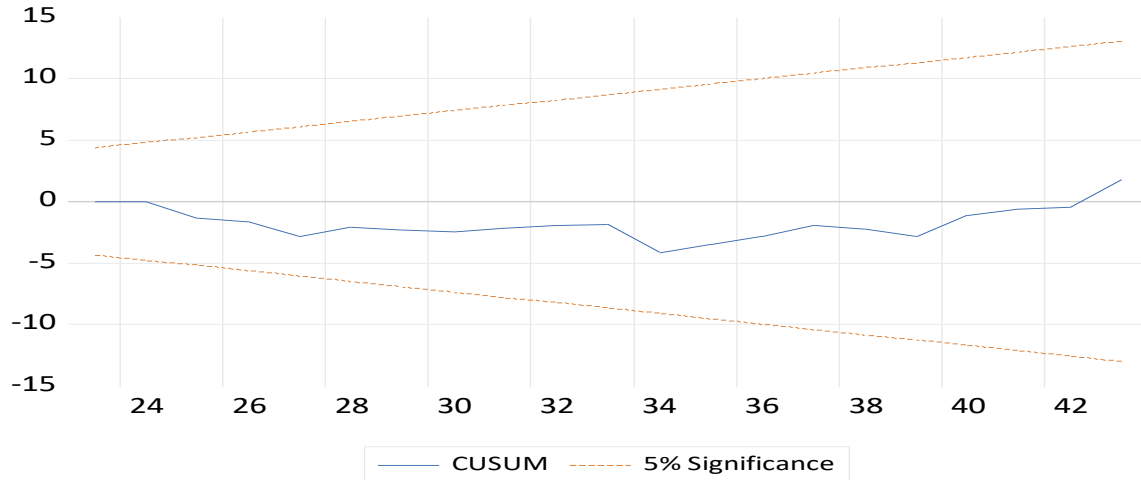
Figure 1: CUSUM Test

Model 2: Child Mortality Rate and Labor Market Participation

This section presents the analysis of child mortality rate and LFP in Pakistan. Results of ARDL
Bound test for health expenditure and labor force Participation are given in Table 8. This
indicates that value of F - statistics is higher than upper bound at the 5% level of significance.
This indicates that long run relationship prevails between the variables. This results verifies that
ARDL can be applied to the model. On the other hand, no long-term link exists if the F-statistic
value is less than the upper bound critical value. Long run results for the model 2 are given in
Table 9.

Table 8

Results of Bound Test for Child Mortality and LFP

Significance	Bound I(0)	Bound I(1)
10%	2.08	3.00
5%	2.39	3.38
2.5%	2.70	3.73
1%	3.06	4.15
F- Statistics value	6.786352	

Table 9

Long run Results for Child Mortality and LFP

Variables	Coefficients	T- statistics	Probability
CMR	-0.166291	-1.625408	0.0999
GEE	-0.348033	-2.351808*	0.0290
GDP	-0.106596	-1.427025	0.0661
MT	-0.362541	-1.010356	0.0781
GCF	1.380862	3.009090*	0.0069
R-squared	0.74	Prob (F-statistics)	0.06
Adjusted R-squared	0.41	D.W stat	1.83
F-statistics	2.21	Log likelihood	-74.18

Note: Coefficients are significant at one, five and ten percent and are shown by (*), (**) and (***) respectively.

The long term results indicate that child mortality rate (CMR) has an insignificant and a negative impact on the labor force participation (LFP) in Pakistan in the long run. This explains that child mortality rate before the age of 5 years lowers the human labor market participation and productivity particularly of the mothers. That is the poor health care results in lower productivity of the women labor force through higher child mortality rate prevailing in the economy. Families with higher child mortality rate are less likely to allow parents particular mothers to participate in the labor market. They would, therefore, contribute less in the aggregate productivity of the active labor force. However, male earners (fathers), being the primary financial supporter of the family have to take part regularly in the market activity. Moreover healthier parents and children can save the medical treatment cost and can contribute more in the economic activity, (Roser and Ortiz-Ospina 2016).

The relationship between child mortality rate and labor market participation is multifaceted and can depend on different factors like economic circumstances, health care infrastructures and social sector policies. Higher child mortality rate can impact labor market productivity in different manners. It can lower the future work force. Parents who lose children may face emotional and psychological misery which can lessen their productivity at work.

Higher child mortality rate also specify poor health system which can also affect the overall health and efficiency of labor force, (Muldoon et al., 2011).

Similarly, GEE has a significant and inverse impact on the LFP in the long run in Pakistan. This may be due to the reason that increase in government expenditure may not be up to the level as required by the significant number of people who require education in the country. Our results are supported by the study by Boheim, Horvath and Leoni (2023). The study found that mismatch between education system and labor market requirements may lead to lower the employment level. That is, focus on threotical knowledge rather that practical work can lead to reduce probability of getting job.

GDP growth has weak negative impact on LFP in the country. That is, rapid GDP growth rate in Pakistan focus on development of the infrastructure that improves inequality and mainly widens the creation of jobs in low production sectors. Our findings are supported by the existing literature. For example, Dubina et al. (2021) found that GDP growth usually places a positive effect on LFP by creating more jobs and stimulating people to enter in the work force. However, other factors like demographic tendencies, educational achievement and social polices play a strong role. Sometimes, impact of GDP might be inverse on labor market participation but insignificant. That is, there may exist a weak association between the two variables which may not be considered evocative. This could be due to various reasons like structural changes in different industries of the economy driving productivity growth.

Similarly, MT exerts negative and insignificant impact on LFP as more merchandise trade in Pakistan. Income disparities and unstable employment could worsen the labor force participation in the country. The association between merchandise trade and labor market participation can be certainly composite. While merchandise trade can affect labor market by generating or eradicating jobs, its straight bearing on labor force participation might not always be substantial. Several factors like technological improvement can lower the demand for labor in certain sectors even as trade grows. Large distraction in global supply chain as those experienced during COVID-19, can lead to increase the cost of trade and lower the labor market activity.

The results show that GCF has significant and positive impact on the productivity of labor force in the country. This indicates that development of physical assets will lead to higher participation and productivity of labor force through improvement in skills necessary for increasing the productivity of workforce in Pakistan. Findings of a study by Umair, et al. (2024)

confirm the findings of our study. Umair, et al. (2024) found that continuous investments in capital formation can result higher employment rate and improved standards of living.

Table 10 shows the results of the model in the short run. Child Mortality has a significant and positive impact on labor force participation in short run. Whereas GEE, GDP growth rate and gross capital formation have negative and significant impact on the dependent variable in short run. Additionally, merchandise trade has a negative but an insignificant impact on LFP in short run. Co-integration term indicates that if any disequilibrium arises in the short run model it will be adjusted back towards equilibrium at the speed of 0.57 percent.

We have applied Cumulative Sum Control Chart (CUSUM) test to ensure the stability of the model (Figure 2).

Table 10

Short run Results of Child Mortality and LFP

Variables	Coefficients	T- statistics	Probability
CMR	4.625753	6.317982*	0.0000
GEE	-0.273532	-2.347095*	0.0293
GDP	-0.106596	-3.802895*	0.0011
MT	-0.124423	0.0998969	0.2232
GCF	-1.723228	0.339027	0.0001
CointEq(-1)	-0.573201	1.714717***	0.0000
R-squared	0.85	D.W stat =	1.83
Adjusted R-squared	-0.76	Log likelihood= -	-74.18

Note: Coefficients are significant at one, five and ten percent and are shown by (*), (**) and (***) respectively.

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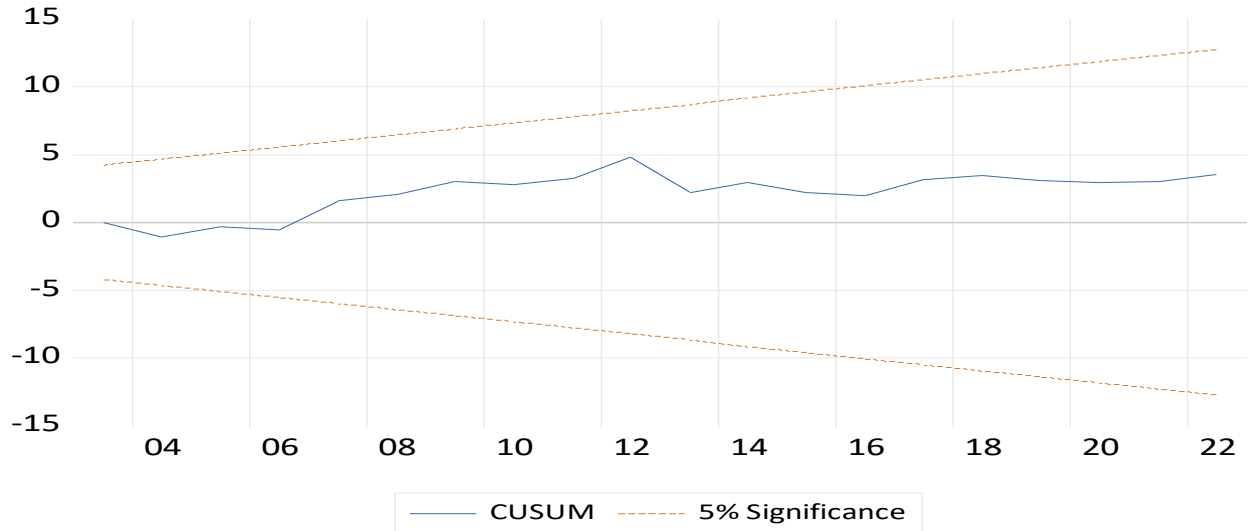
Figure 2: CUSUM Test

Model 3: Health Expenditure, Child Mortality and Labor Force Participation

This section presents the analysis of child mortality rate and labor force participation in Pakistan. Results of ARDL Bound test for model 3 are given in Table 11. This indicates that value of F - statistics is higher than upper bound at the 5% level of significance. This indicates that there exists long run relationship between the variables. This results validates that ARDL can be applied to the model. On the other hand, no long-term association exists if value of F-statistic is less than the upper bound critical value.

Table 11

Results of Bound Test of Health Expenditure, Child Mortality and LFP

Significance	Bound (1)	Bound I(0)
10%	1.99	2.94
5%	2.27	3.28
2.5%	2.55	3.61
1%	2.88	3.99
F- Statistics value	11.60806	

Long run estimates for the Model 3 are given in Table 12. The results can be interpreted in similar manners as those for Model 1 & 2.

Table 12

Long Run Results of Health Expenditure, Child Mortality and LFP

Variables	Coefficients	T values	Probability
HE	0.442714	3.399161*	0.0059
CMR	-19.26713	-1.442940	0.1769
GEE	-0.386162	-2.032262*	0.0470
GDP	-0.207524	-3.097810*	0.0101
MT	0.327143	1.483107	0.0729
GCF	-1.571706	-4.415702*	0.0010
R-squared	0.80	Prob (F-statistics)	0.00
Adjusted R-squared	0.693	D.W stat	2.29
F-statistics	4.257	Log likelihood	-57.64

Note: Coefficients are significant at one, five and ten percent and are shown by (*), (**) and (***) respectively.

The long term results of model 3 indicate that health expenditure has a significant and a positive impact on the labor market participation in the long run in Pakistan. That is, higher the spendings by the government on the health care facilities, more healthy and productive will be the workforce in the country. This result is also supported by Mushtaq, Mohsin & Zaman (2013) which states that health expenditure has a positive effect on labor force productivity.

The long term results indicate that CMR has an insignificant and a negative impact on the LFP in Pakistan in the long run. This explains that child mortality rate before the age of 5 years lowers the human productivity particularly of the mothers. That is the poor health care results in lower participation of the women labor force through child mortality. The insignificant result may be due to the reason that number of married women, who are willing to work, is less in the total sample of the adult labor force in the country.

Government expenditure on education has a significant but a negative impact on the LFP in the long run. This may be because higher educational costs do not always result into higher-quality education. Our results are supported by the study by Boheim, Horvath and Leoni (2023). The study found that mismatch between education system and labor market requirements may lead to lower the labor market participation. That is, focus on threotical knowledge rather that

practical work can lead to reduce probability of getting job.   According to Ahmad & Hafeez (2007) and Hafeez & Ahmad (2002), the decision to enter the workforce is significantly influenced by a person's level of education.

Growth rate of GDP has insignificant but negative impact on labor force participation in the country. That is, rapid GDP growth rate in Pakistan focus on development of the infrastructure that improves inequality and mainly widens the creation of jobs in low production sectors. It also may hinder skill development and therefore may lead to lower labor market participation. However the result is statistically insignificant. Similarly, MT has weak inverse impact on the participation of labor force in Pakistan.

The results show that GCF has inverse and significant impact on the participation of labor force in the country. This indicates that development of physical assets will lead to lower productive LFP in the market. This may be due to the reason that workers may not have access to provision of skills necessary for increasing the productivity of workforce in Pakistan. For example, continuous investments in capital formation leads to long term higher employment rate and higher standards of living (Umair, et al. 2024).

Table 13 shows the results of the model in the short run. Child mortality has a significant and positive impact on LFP in short run. Whereas government expenditure on education, GDP growth rate and gross capital formation have negative and significant impact on the dependent variable in short run. Additionally, merchandise trade has a negative and insignificant impact on labor force participation in short run. Co-integration term indicates that if any disequilibrium arises in the short run model it will be adjusted back towards equilibrium at the speed of 0.575 percent.

Table 13
Short Run Result of Health Expenditure, Child Mortality and LFP in Short Run

Variables	Coefficient	t- statistics	Probability
HE	0.442714	6.107268*	0.0001
CMR	24.61221	3.887195*	0.0025
GDP	0.036035	2.233989*	0.0472
GEE	-0.407350	-3.377771*	0.0062
MT	0.327143	1.600567	0.0035
GCF	-1.571706	-8.039378*	0.0000
CointEq(-1)	-0.575112	-12.327218*	0.0000
R-squared	0.94	Log likelihood	-57.64
Adjusted R-squared	0.89	Durbin-Watson stat	2.29

Note: Coefficients are significant at one, five and ten percent and are shown by (*), (**) and (***) respectively.

Stability Test

We have applied Cumulative Sum Control Chart (CUSUM) test to ensure the stability of the model (Figure 3).
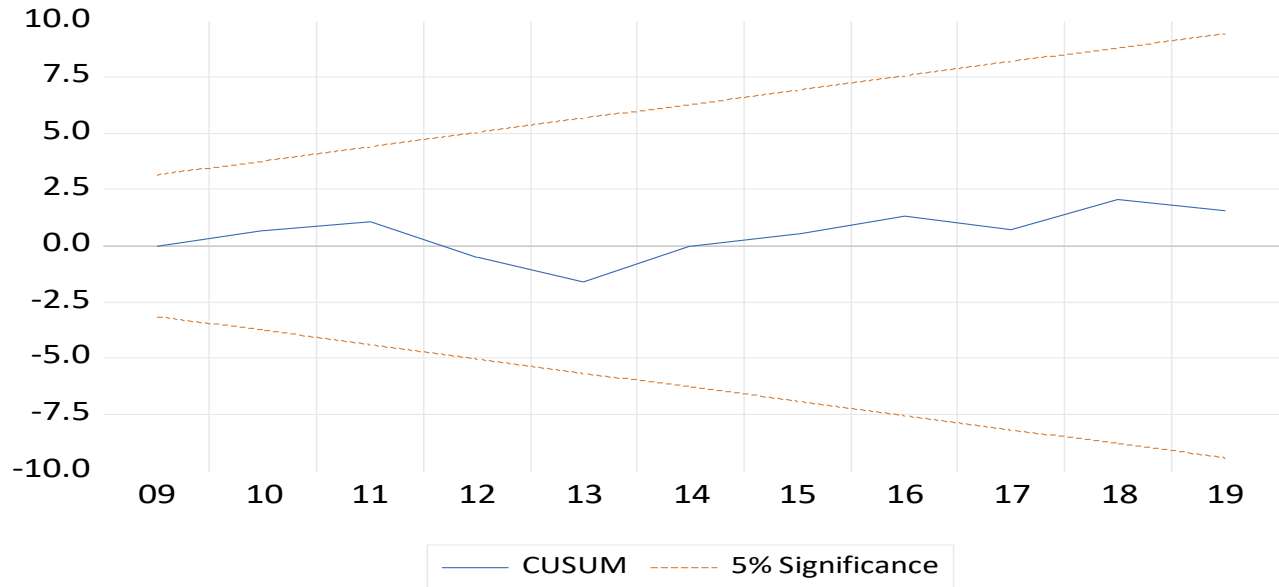

Figure 3: CUSUM Test

5. Conclusion and Plan Implication

This study analysis the impact of different health indicators (public sector expenditure on health and child mortality) on participation of workers in Pakistan between 1980 and 2022. Participation of labor force has been used as a dependent variable. The independent variables include public sector expenditure on health, child mortality rate, government spending on education, GDP growth rate, gross capital formation and merchandise trade. The study formulated three different models to investigate the relationship between the variables. First two models examine separate effect of the public sector expenditure on health, child mortality rate on the dependent variable. However, the combined effect of both health sector indicators has been analyzed in the third model. Computer program E-views-12 has been adopted to analyze the data.

In both the short and long terms, public sector healthcare expenditures and rate of child mortality are found as important determinants of labor market participation of workers in all

three models. These variables play a significant role in influencing workers' participation in the economy. For example, public sector healthcare expenditure has exerted positive and significant effect on the labor participation both in the short and long term. Increase in the health expenditure mainly exerts significant and a positive impact on the labor force participation. This is so because the higher spending on the healthcare facilities results in healthy and efficient workers which increases the overall productivity of the labor market in Pakistan. However, child mortality rate is found to place weak inverse impact on labor force participation in long run. This is so because the deaths of the children under the age of 5 decreases capabilities and working potential of adult human beings in the country which may decrease the overall productivity of the country. The other important factors influencing participation of labor market workers are the government spending on education, GDP growth, gross capital formation and merchandise trade.

The findings of our study indicate that increasing health care spending and declining child mortality rate can boost worker productivity over the long run.

It is suggested that government can focus further to increase spending on health expenditure and to lower child mortality in order to improve the labor market participation in the country.

The researchers are advised to further investigate the issue in order to highlight the role of different health related factors in determining the labor market participation in Pakistan in future.

Limitation of the study: the study has not investigated the other important health related indicators to examine the labor market productivity.

REFERENCES

Ahmad, E., & Hafeez, A. (2007). Labor supply and earning functions of educated married women: A case study of northern Punjab. *Pakistan Development Review*, *46*(1), 45–62.

Afridi, A. H. (2016). Human Capital and Economic Grwoth of Pakistan. Business and Economic Review, 8(177-88). https://www.jstor.org/stable/41260728

Ali, Z., Iqbal, D., Kakakhel, D. J., Nadeem, D., & Saeed, D. (2017). Investment in human capital and economic growth nexus: Evidence from Pakistan. Journal of management research, 3(1). https://www.jstor.org/stable/41260728.

Akram, N., Phadda, I. u., & Khan, M. (2008). The Long Term Impact of Health on Economic Growth in Pakistan. The Pakistan Development Review, 47, 487-500

Arora, S. (2001). Health, human productivity and long term economic growth, The Journal of Economic History, 2001, vol. 61(3), 699-749.

Bloom, D. E., & Canning, D. (2000). The Health and Wealth of Nations. *Science*, *287*(5456), 1207-1209.

Bloom , David E, Canning, David and Sevilla, Jaypee (2004). The Effect of Health on Economic Growth:A Production Function Approach, World Development Vol. 32, No. 1, pp. 1–13, 2004.

Böheim R., Horvath, T. & Leoni, T. (2023). The Impact of Health and Education on Labor Force Participation in Aging Societies: Projections for the United States and Germany from Dynamic Microsimulations, Population Research and Policy Review 42:39. https://doi.org/10.1007/s11113-023-09781-3.

Dubina, K. S., Ice, L., Kim, Janie-L. & Rieley, M. J. (2021). Projections overview and highlights, 2020–30, Monthly Labor Review, Bureau of Labor Statistics, USA.

Fogel, R. W. (2004). Health, Nutrition, and Economic Growth. Economic Journal and Cultural Change, 52. https://www.jstor.org/stable/2565122.

Gondal, A.H. (2003). Women's Involvement In Earning Activities: Evidence From Rural Pakistan. Lahore J. Econ., 8, 123–136. https://doi.org/10.35536/lje.2003.v8.i2.a7.

Gondal, A.H. & Rukhsana Y. (2007). Education And Labor Market Participation Of Wives in District Chakwal,The Economic Journal of Nepal, vol.30(3), Pp 163-119.

Grossman, M. (1972). On the Concept of Health Capital and the Demand for Health," Journal of Political Economy, vol. 80(2), pages 223-255,

Hafeez, A., & Ahmed, E. (2002). Factors determining the labor force participation decision of educated married women in a district of Punjab: *Pakistan Economic and Social Review,*no 1, 75-88.

Hafeez, A. (2015). Factors affecting aggregate work hours of married working couples in Pakistan. In International Journal of Multidisciplinary Research and Development (Vol. 2, Issue 10, pp. 239–241). https://www.allsubjectjournal.com.

Khan M. Z., & Hafeez A. (2017). Economic activities and unmarried labour, Economic Research, Ekonomska Istraživanja, 30(1):985-991.

DOI: 10.1080/1331677X.2017.1305805.

Khan, A. A, Subhan, S. & Hafeez, A. (2024). Effect of External Debt Services on Economic Growth: An Empirical Evidence from Pakistan, International Journal of Social Science Archives, 7(2). PP. 171-188.

Muldoon, K. A., Galway, L. P., Nakajima, P.,   Kanters, S., Hogg, R. S., Bendavid, E. & Edward J Mills. (2011). Health system determinants of infant, child and maternal mortality: A cross-sectional study of UN member countries, *Globalization and Health* volume 7, Number 42.

Martin, Fernando M. (2018) GDP, Labor Force Participation and Economic Growth, Federal Reserve Bank. August 2018, https://www.stlouisfed.org/on-the-economy/2018/august/gdp-labor-force-participation-economic-growth.

Max-Roser and Esteban Ortiz-Ospina (2016) - "Education Spending" Published online at OurWorldInData.org. Retrieved from: https://ourworldindata.org/financing-education' [Online Resource].

Piabuo, S. M. & Tieguhong, J. C. (2017). Health expenditure and economic growth - a review of the literature and an analysis between the economic community for central African states (CEMAC) and selected African countries, *Health Economics Review*, volume 7(23).

Raifu, I. A. (2024). The Role of Institutional Quality in Health Expenditure-Labor Force Participation Nexus in Africa, Journal Of Knowledge Economy, Volume 15, pages 2241–2273.

Ram, R. and Schultz, T. W. (1979). Life Span, Health, Savings, and Productivity Economic Development and Cultural Change, Vol. 27, No. 3, 1979, pp. 399-421. http://dx.doi.org/10.1086/451107.

Raza, A., Shah, S.F.A., Shah, S.U.M. (2023). Analyzing the Effect of Infant Mortality, Life Expectancy and Health Expenses on Labor Force Participation in Pakistan. Global Economic Review, VIII (IV), 40-50

Mustafa, K.A., & Ansari, M.A. (2022). The Impact of Health Expenditure on Economic Growth: A Case Study of Pakistan

Mushtaq, A., Mohsin, A., & Zaman, K. (2013). Effects of health on changing labor force participation in Pakistan. Springer Plus, 2, 1-10

Schultz, T. P. (2005). *Productive Benefits of Health: Evidence from Low-Income Countries* (IZA Discussion Papers, No. 1482). Institute for the Study of Labour (IZA), Bonn.

Ullah, I., Ullah, A., Ali, S., Poulova, P., Akbar, A., Haroon Shah, M., ... & Afridi, F. E. A. (2021). Public health expenditures and health outcomes in Pakistan: evidence from quantile autoregressive distributed lag model. Risk Management and Healthcare Policy, 3893-390

Umair. M. et al. (2024). The Role of Labor Force, Physical Capital, and Energy Consumption in Shaping Agricultural and Industrial Output in Pakistan, *Sustainability* **2024**, *16*(17), 7425; https://doi.org/10.3390/su16177425.