

Assessing the Symmetric and Asymmetric Impacts of Fiscal Decentralization on Living Standards in Pakistan. An ARDL and NARDL Approach

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ABSTRACT

This research focuses on investigating the symmetric and asymmetric effects of fiscal decentralization on living standards in Pakistan. It examines how living standards are affected by the multiple dimensions of fiscal autonomy nationwide. This study uses the Autoregressive Distributed Lag (ARDL) and Non-linear Autoregressive Distributed Lag (NARDL) models to examine fiscal decentralization and living standards, focusing on symmetries and asymmetries, using time-series data at annual intervals. The study shows that fiscal decentralization has both positive and negative long-run and short-run effects on living standards in Pakistan. However, the positive effect improves living standards more strongly than the negative impact affects it. By highlighting the importance of strong fiscal reforms, significant policy insights are provided by the research, which suggests increasing the financial capacity, enhancing accountability and transparency mechanisms, and ensuring equal allocation of resources among provincial governments. It can result in efficient and sustainable outcomes of living standards in Pakistan.

Keywords: Fiscal Decentralization, Life Expectancy, Living Standards, Institutional Quality Index, Urbanization

INTRODUCTION

Fiscal decentralization demonstrates the transfer of expenditure responsibilities and revenue-raising influence from central to subnational governments, intending to improve efficiency, accountability, and responsiveness of public service allocation (Riaz & Khan, 2024). In living standards, decentralization is discussed to take decision-making closer to local populations, by this means modifying services to particular regional needs and enhancing access and outcomes. In Pakistan, milestone reforms such as the 18th Amendment (2010) and the 7th NFC Award expressly raised provincial fiscal autonomy, devolving health management and prepared health a provincial subject (Ahmed & Qayyum, 2023).

Living standards, particularly as life expectancy, play an important role in evaluating the performance of public institutions in many developing countries. Living quality in many countries is influenced by decentralization as devolution can enhance the efficiency of health outcomes by assessing the needs of the local community easily, as local governments are better aware of the needs, so they can distribute resources in a well-managed way, improving efficiency, effectiveness, responsiveness, infrastructure,

institutional quality, and other areas of the public institutions. Therefore, evaluating the relationship between fiscal decentralization and living stan

dards is important to have an idea of whether these reforms are contributing meaningfully to the living sector standards or not.

In the perspective of Pakistan, fiscal decentralization had evolved after the 18th Constitutional Amendment of 2010, which transferred the powers of specific sectors such as health, education, and social services from the center to provincial governments. Despite these reforms, the understanding of fiscal decentralization and living standards remains unclear, with mixed progress across local governments. Existing studies have not discussed much in the area of how fiscal decentralization affects health status in the region; the study aims to bridge the gap by assessing the asymmetric effect of fiscal decentralization on living standards in Pakistan by using the NARDL framework. This study provides a clear path for policymakers seeking to increase health governance and promote equal resource allocation and advancement in population health as the research analyzes both the positive and negative effect of fiscal decentralization.

Although Pakistan has adopted determined decentralization developments, the confirmation of living standards outcomes still compounds. While fiscal transfer to provinces increased, provincial health departments frequently have weak institutional capacity, leading to slight improvement in key living indicators such as life expectancy, infant and maternal mortality (Ahmed & Qayum, 2023). Further, existing studies have inclined to focus on provinces separately, particularly Baluchistan or Punjab, and used limited indicators like infant mortality or health expenditure individually. There rests a gap in using life expectancy as a high outcome and investigating the uneven impact of decentralization above a longer period (1997-2025) across Pakistan as a whole.

Therefore, the essential research problem is: Despite policy reliance on fiscal decentralization to enhance social outcomes in developing country like Pakistan, its real impact remain uncertain on the living standards. Previous studies largely assume a province based or a linear relationship, avoiding possible symmetric and asymmetric effects of positive and negative trends in fiscal decentralization.

Fiscal decentralization has asymmetric impact on health outcomes, where positive shocks improve health conditions more strongly than negative shocks reduce them, shown in the recent studies of Pakistan, Barech et al. (2025). This research fills a gap in Pakistan's decentralization literature by employing advanced econometric techniques (ARDL/NARDL) and evaluating the uneven impact of fiscal decentralization on living standards across 1997-2025. Yet, many studies have used linear models or a view on wider health variables, except for life expectancy. While this study has fulfilled this gap by applying both the ARDL and NARDL models to examine the symmetric and asymmetric effects of fiscal decentralization in both the long-run and short-run, and the positive and negative shocks of fiscal decentralization on living standards in Pakistan.

FISCAL DECENTRALIZATION AND LIVING STANDARDS IN PAKISTAN

Fiscal decentralization is a policy approach that transfers fiscal authority and resources from the central government to sub-national governments. It is expected to improve efficiency, accountability and responsiveness in the provision of public services, thereby enhancing living standards. However, its impact in Pakistan may differ across time and economic conditions, suggesting possible symmetric and asymmetric effects.

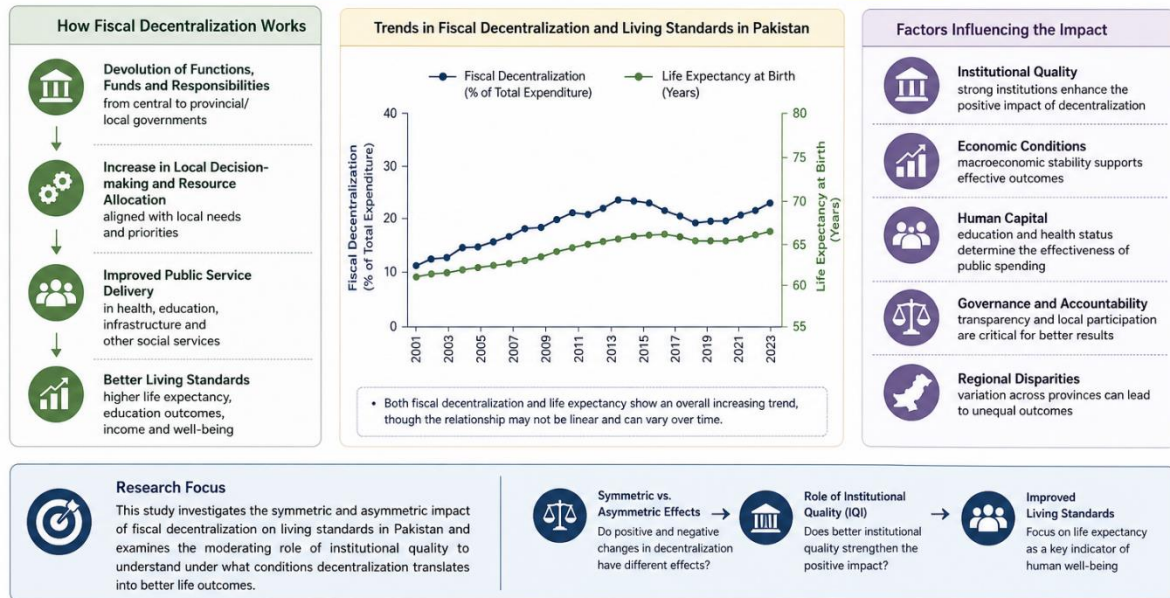


Figure 1

The purpose of this research is to assess the impact of fiscal decentralization on life expectancy, a proxy for living standards in Pakistan. The study further investigates the roles of socioeconomic, demographic, and infrastructure elements as determinants of health outcomes.

Consequently, the study is guided by the following questions: Does Fiscal Decentralization have a significant symmetric and asymmetric impact on life expectancy as a proxy of living standards in Pakistan? How do control indicators-such as IQI, health expenditure, education, population, urbanization, and GDP per capita-impact life expectancy in Pakistan? And how does institutional quality influence the impact of fiscal decentralization on living standards in Pakistan?

The significance of the study is that it takes life expectancy as a proxy for living standards, and this study demonstrates a comprehensive view of population health rather than concentrating exclusively on mortality or expenditure metrics. Life expectancy captures the collective impact of compound features, making it a valuable living outcomes measure (Iqbal, 2013). Secondly, the study has practical significance: it delivers to provincial and federal policymakers associated whether fiscal devolution individually is appropriate to improve living outcomes, or whether complementary variations, boosted governance, and further urban access, investment in education and maternal health are required. By viewing potential bottlenecks, the study contributed to the execution of Sustainable Development Goal (good health and wellness). And thirdly, this research fills a gap in Pakistan's decentralization literature by employing advanced econometric techniques (ARDL/NARDL) and evaluating the uneven impact of fiscal decentralization on living standards, 1997-2025. The time-based extent offers stronger insights for policy than many extant cross-sectional or provincial-level analyses (Riaz et al. 2024).

The scope of this research is limited to assessing the symmetric and asymmetric impact of fiscal decentralization on living standards in Pakistan. The research uses annual time series data from 1997 to 2025, and it includes life expectancy as the dependent variable, which plays the role of the proxy of living standards, while the key independent variable is Fiscal Decentralization. Additionally, several

control indicators have been mentioned as Institutional Quality Index (IQI), Health Expenditure (CHEZ), Population Growth (POP), Urbanization (URB), and GDP per Capita (GDPCUS). The data for this study have been taken from multiple platforms that include the Pakistan Bureau of Statistics, World Bank, and World Health Organization. This study mainly focuses on fiscal decentralization and living disparities and does not examine district-level or individual-level living status.

This research fills a gap in Pakistan's decentralization literature by employing advanced econometric techniques (ARDL/NARDL) and evaluating the uneven impact of fiscal decentralization on health across 1997-2025. The time-based extent offers stronger insights for policy than many extant cross-sectional or provincial-level analyses. Even though multiple studies have been done in this field, there is a gap in empirical research in elaborating the symmetric and asymmetric impact of fiscal decentralization on living standards in Pakistan, which needs to be filled. Yet, many studies have used linear models or view on wider living variables except life expectancy, to know the asymmetric effect of the NARDL model, and the variable of life expectancy is necessary to understand the effect of fiscal decentralization on the living standards in Pakistan. While this study has fulfilled this gap by applying the ARDL and NARDL model to examine both the symmetric and asymmetric effect of fiscal decentralization in both the long-run and short-run, and the positive and negative shocks of fiscal decentralization on living standards in Pakistan. This approach has provided a stronger and more effective reason for policymakers to work in a certain area to find the relationship between the key indicators for future enhancement and development in the area of living standards.

The order of study begins with the literature review of earlier studies on the effects of fiscal decentralization on the living status which serves as a foundation for this study along with Institutional Quality Index (IQI), Health Expenditure (CHEZ), Population Growth (POP), Urbanization (URB), and GDP per Capita (GDPCUS), followed by the research methodology which outlines both theoretical and conceptual frameworks along with model estimations and empirical findings. After that, econometric findings are analyzed and discussed. The research is then finally concluded, and potential policy recommendations have been suggested.

LITERATURE REVIEW

The previous studies acknowledged that a shift in the expenditure and revenue authority to the provincial governments can enhance public service delivery by enhancing efficiency, responsiveness, and effectiveness. Oates (1999) debated on the phenomenon that provincial governments are well aware of the needs of society, which allows them to distribute resources productively. Faguet (2014) elaborates on the cross-nation evidences that fiscal decentralization can enhance living standards in a country by providing equal allocation of services to the local governments according to their needs. However, Mehmood and Sadiq (2022) highlighted that positive outcome in a country come from the capacity of institutions and the level of financial self-rule. The mentioned theoretical studies help us by providing direction to know how fiscal structures effects social sectors, including health and other key areas.

An increase in the empirical studies assesses the effect of fiscal decentralization on health status in developing countries. Many studies have found that decentralization has the ability to improve service provision, child mortality, and life expectancy by enabling equal distribution of resources and empowering local governments (Farooq, 2023; Qiao et al, 2008). Although some studies suggested that fiscal decentralization may worsen disparities when local governments are inefficient or if fiscal decentralization is not well-structured (Arzaghi & Henderson, 2005). Barech et al. (2025) used a nonlinear ARDL approach and found evidence of asymmetry in the relationship between fiscal decentralization and health outcomes in Pakistan, indicating that positive fiscal reforms generate stronger health improvements compared to negative fiscal shocks. These compound results of many studies suggested that fiscal decentralization can have positive and negative effects on living status, depending on the economic and policy structure of a country.

Fiscal decentralization has enhanced the structural determinants of health outcomes, specifically in developing countries where resource allocation and governance are inconsistent. Empirical evidence shows that when provincial governments provide adequate fiscal support, health services delivery becomes more accessible, efficient, and community-oriented (Picazo et al., 2001; Aslam & Yilmaz, 2011). Over the countries prove that the decentralized fiscal mechanism shows wider immunization exposure, weaker child mortality, and encourages life expectancy depending on the skilled institutions and transparent expenditure instruction (Khaleghian, 2004). In Pakistan, the effect is still complex because of the uncertain local situation, political differentiation, and the legacy of centralized control, in which the limitation of the capability of decentralized units is transformed into fiscal capacity into health gains (Aslam & Yilmaz, 2011). This demonstrates that decentralization is not enough individually unless accompanied by a governance system and accountability structures.

Furthermore, the literature overview of the enhancement in life expectancy is all designed by socioeconomic, demographic, and health-system indicators. Research shows that enhancing education helps to reduce mortality and improve long-term population health, specifically among women (Gakidou et al., 2010). Health expenditures, both public and private, play an important role, with higher per-capita expenditures consistently linked with better living standards when together with clear and effective resource allocation (Farag et al., 2013). Urbanization becomes positive by expanding access to health infrastructure but may develop disparities, even with the growth of service space (Vlahov & Galea, 2002). Likewise, institutional quality and governance determine how efficiently public funds translate into enhancing life expectancy. Altogether, these studies recommend that in Pakistan, fiscal decentralization's impact on living standards is mediated by wider structural situations, such as institutional quality, human development, and health as well. It shows the need for contributed policy frameworks to improve living standards in the long run.

In the perspective of Pakistan, evidence remains limited depending on context, but are informative. Studies argue that fiscal decentralization in Pakistan gained momentum after the 18th Constitutional Amendment, which has produced a variety of results among the provinces. Some researchers have examined the improvement in living standards of provinces by an increase in funds that enhanced living standards and improved local management sectors, as they are well aware of the needs of local communities (Mehmood & Sadiq 2022). While the others have argued that weak institutions are directly responsible for limitations in the living standards, even after decentralization, resulting in weak progress in life expectancy and overall in each area of the health sector. These results have suggested that economists use advanced econometric techniques to validate both linear and non-linear relationships.

Contemporary researchers have argued for advanced-level techniques to understand asymmetric linear and non-linear relationships that show effects in decentralization. Shin, Yu, and Greenwood-Nimmo (2014) suggested that different policy variables might have different positive and negative effects, which makes Non-linear ARDL suitable to be used. In the time series data, the advantage of using NARDL modelling is also highlighted by Peseran, Shin, and Smith (2001). There is much need for such techniques in Pakistan due to different levels of disparities, governance inefficiencies, and bias in the institutions.

Fiscal decentralization refers to the degree to which spending and revenue-increasing authority are transmitted from central to subnational governments (Riaz, Khan, & Khan, 2022). The rationale is that subnational governments, being closer to local populations, can allocate resources more efficiently, tailor public services to local needs, and thus potentially yield improved social outcomes (Hoque, Mallik, & Alam, 2021). In Pakistan, major fiscal decentralization reforms contributed to the 18th Amendment (2010), which established living standards for provinces, and the 7th National Finance Commission (NFC) Award, which raises the share of resources for provincial governments (Ahmed & Qayyum). The empirical studies demonstrate that compound results: for instance, in the Punjab district-level analysis, fiscal decentralization enhances living standards (Nisa, Khalil, & Irshad, 2024). While

fiscal decentralization presents promise as a policy instrument, its current effect is based on institutional capacities, service delivery system and contextual factors.

In the study, Life expectancy (LE) is used as a dependent variable that is a crucial and globally adopted indicator of living standards and social growth in all over the world. Life expectancy measures the average number of years an individual is going to live. This indicator captures the standard of healthcare resources along with the social, economic, and environmental factors that affect life. However, in this study, life expectancy (LLE) is used as an alternative indicator of living standards, portraying the overall influence of the living standards framework, fiscal governance, education, and standards of living. Analysts such as O'Hare et al. (2013) and Bloom and Canning (2019) explain that life expectancy is a justified measure of societal health because it takes information from mortality, morbidity, and healthcare approaches into individual, understandable results. In the same way, Preston (2017) clarifies that an increase in life expectancy is strongly associated with efficient governance and fiscal adoptability, showing that policies encouraging decentralization and public liability do not directly enhance population living outcomes.

In the context of fiscal policy and life expectancy that represents the efficiency of government institutions and the distribution of resources in improving living conditions. Research from developing countries has shown that higher fiscal decentralization, where decision-making and control of resources are given to local authorities. It leads to increasing health outcomes, initially by increasing responsiveness to local requirements (Jimenez-Rubio & Garcia-Gomez, 2017). While in Pakistan, evidence recommended that local disparities in healthcare accessibility and spending efficiency significantly affect existence: it suggests the role of devolution institutions in balancing living possibilities (Mehmood & Sadiq, 2022). And additionally, life expectancy correlates with broader economic and social indicators, such as education, institutional quality, and urbanization, which either support or weaken the fiscal-living connection (Lutz & Kebede, 2018). However, LE in Pakistan is not only a population-based but also an alternative for public health performance, showing how fiscal designs, institutional quality, and local accountability are engaged to long-term well-being.

There is a growing body of empirical work on fiscal decentralization and social outcomes in Pakistan. According to Javed & Qadri (2013) analyze the period 1990-2010 and found a positive correlation between fiscal decentralization and life expectancy. Ahmed & Qayyum (2023) use provincial time-series data for Baluchistan (1975-2020) and find no improvement in life expectancy despite raising fiscal autonomy. Analyze district-level data from Punjab (20023-2015) and highlighted that greater fiscal decentralization is associated with improved maternal and child health outcomes (Nisa et al, 2024). Further studies have evaluated decentralization's link to public services and discovered that spending decentralization is more effective than revenue decentralization to improve public service delivery. Despite this involvement, most studies either focus on provincial case studies, limited health indicators, for instance, infant mortality, or exclude asymmetric and long-run dynamics. This develops a gap for a comprehensive national-level time-series data study from 1997-2025 using life expectancy as the evaluation of outcome.

Theoretical Background

The major theory that supported my study is the Fiscal Federalism Theory, which was introduced by Wallace E. Oates (1972) Decentralization Theorem, which derives from the Fiscal Federalism Theory. It argues that local governments are better positioned as central authorities to allocate resources efficiently because of their proximity to citizen demands and preferences. In the case of living standards, this implies that provinces can customize expenditures on services such as maternal health, education, and institutional quality more effectively than a centralized system (Faridi, Karim & Arif, 2022; Munir, Mehmood & Nawaz, 2022).

The Public Choice Theory, established by James Buchanan and Gordon Tullock (1965) in “The Calculus of Consent”. Help as a foundational background for accepting the dynamics of decentralization. It debates that governments, like individuals, respond to incentives and constraints, and that decentralizing fiscal power decreases bureaucratic inefficiencies by taking decision-making closer to the people. While in the perspective of fiscal decentralization, this theory recommends that when local governments distribute budget distribution and expenditure distribution as their duty, they can increase the sharing of resources of living standards based on local needs, as they are required to implement higher efficiency and adaptability (Oates, 1972; Buchanan & Tullock, 1965). Therefore, in Pakistan’s case, the fiscal federalism background discussed the rationale behind the 18th Amendment, which conveyed key accountabilities for health, education, and social services from the federal to the provincial governments. Consequently, the theory underpins the actual study’s argument that fiscal decentralization can significantly affect life expectancy (LE) by enhancing the allocation of public-related spending and an efficient governance system. In contrast, the Public Choice or Local Governance Theory allows absorbing rationality to investigate whether Pakistan’s fiscal decentralization has productively reshaped into better life expectancy (LE) in order to help as a measurable indicator of public wellness and health outcomes.

The sensitizing area of this research focuses on governance quality as a clear view to get outcomes in the real world. As the Fiscal Federalism Theory, along with the Public Choice Theory, elaborate how decentralization works, this area helps us to understand the reality. The factors like weak accountability, limitation of administrative capacity, and political polarization often have a role in the results of the policies of decentralization. Therefore, every province has different outcomes in terms of living standards. Because of this, this approach helps out to elaborate on how fiscal decentralization depends on the efficiency of local governance and institutional quality.

Overall, this chapter analyzes the theoretical and empirical literature on fiscal decentralization and living standards, particularly life expectancy (LE), and positions the existing study within the Pakistani context. It continues with an overview of fiscal decentralization and then investigates literature on life expectancy as a wider living indicator.

METHODOLOGY

Model Specification

The purpose of this research is to assess the impact of fiscal decentralization on life expectancy, a proxy for living outcomes in Pakistan. The study further investigates the roles of socioeconomic, demographic, and infrastructure elements as determinants of living outcomes.

The functional form of the model is demonstrated as follows:

$$LLE = f(FDE, IQI, LCHEZ, LURB, LGPCUS, LPOP) \dots \dots \dots (1)$$

The baseline econometric model is stated as follows:

$$LLE_t = \beta_0 + \beta_1 FDE_t + \beta_2 IQI_t + \beta_3 LCHEZ_t + \beta_4 LURB_t + \beta_5 LGDPCUS_t + \beta_6 LPOP_t \dots \dots \dots (2)$$

Where LE is the dependent variable, FDE, IQI, LCHEZ, LURB, LPOP, and LGDPCUS are the various independent variables.

Definition and Description of Variables

A detailed description of the variables, their assigned abbreviations, and their data source are mentioned in Table 1 below.

Table 1: Variable Definition and Sources

Constructs	Operational Definitions	Sources
Fiscal Decentralization (FDE)	Subnational revenue–expenditure share	State Bank of Pakistan
Life Expectancy at Birth (LE)	Average expected lifespan	World Bank (WDI)
Institutional Quality Index (IQI)	Governance quality composite index	Worldwide Governance Indicators (WGI)
Health Expenditure (LCHEZ)	Per capita health spending	World Bank (WDI)
Population Growth (LPOP)	Annual population growth rate	World Bank (WDI)
Urbanization (LURB)	Urban population share	World Bank (WDI)
GDP per Capita (LGDPCUS)	Real income per capita	World Bank (WDI)

Estimation Techniques

The study uses ARDL and NARDL statistical techniques together, in order to control small sample sizes and neutral integration orders I (0) and I (1). In this study, ARDL and NARDL models are used to understand the short-run and long-run relationship between fiscal decentralization and life expectancy. Such as, in the context of Pakistan, these models have used time series variables that are made up of the above-mentioned mixed orders. These models provide flexibility between variables that result in efficient results even with a smaller sample size (Pesaran, Shin, & Smith, 2001).

The general ARDL framework can be represented as:

$$LLE_t = n_\theta + \sum_{i=1}^p n_1 LLE_{t-i} + \sum_{i=0}^q n_2 FDE_{t-i} + \sum_{i=0}^q n_3 IQI_{t-i} + \sum_{i=0}^q n_4 LCHEZ_{t-i} \\ + \sum_{i=0}^q n_5 LURB_{t-i} + \sum_{i=0}^q n_6 LGDPCUS_{t-i} + \sum_{i=0}^q n_7 LPOP_{t-i}$$

The following ARDL integration (long-run) equation is:

$$LLE_t = n_\theta + \sum_{i=1}^p n_1 LLE_{t-i} + \sum_{i=0}^q n_2 FDE_{t-i} + \sum_{i=0}^q n_3 IQI_{t-i} + \sum_{i=0}^q n_4 LCHEZ_{t-i} \\ + \sum_{i=0}^q n_5 LURB_{t-i} + \sum_{i=0}^q n_6 LGDPCUS_{t-i} + \sum_{i=0}^q n_7 LPOP_{t-i} + \lambda_1 LLE_t + \lambda_2 FDE_t \\ + \lambda_3 IQI_t + \lambda_4 LCHEZ_t + \lambda_5 LURB_t + \lambda_6 LGDPCUS_t + \lambda_7 LPOP_t u_t$$

Where:

- n = short-run coefficients

- λ = long-run coefficients
- p = lag length of dependent variables
- q = lag length of independent variables
- p_t = error term

While the above equations cover symmetric (linear) impacts, likely, positive and negative differences in fiscal decentralization (FDE) or GDP per capita may have an effect on life expectancy differently. So, by using the NARDL technique, the independent indicators of interest are merged into positive and negative restrictive sums.

Fiscal Decentralization:

$$FDE_t^+ = \sum_{j=1}^t \max(\Delta FDE_j, 0), FDE_t^- = \sum_{j=1}^t \min(\Delta FDE_j, 0)$$

The final NARDL specification of life expectancy can be written as:

$$\begin{aligned} LLE_t = n_\theta &+ \sum_{i=1}^p n_1 LLE_{t-i} + \sum_{i=0}^q n_2 FDE_{t-i}^+ + \sum_{i=0}^q n_3 FDE_{t-i}^- + \sum_{i=0}^q n_4 LGDPCUS_{t-i}^+ \\ &+ \sum_{i=0}^q n_5 LGDPCUS_{t-i}^- + \sum_{i=0}^q n_6 IQI_{t-i}^+ + \sum_{i=0}^q n_7 IQI_{t-i}^- + \sum_{i=0}^q n_8 LCHEZ_{t-1} \\ &+ \sum_{i=0}^q n_9 LURB_{t-1} + \sum_{i=0}^q n_{10} LPOP_{t-1} u_t \end{aligned}$$

This NARDL model allows the understanding of both short-run and long-run asymmetric impacts of fiscal decentralization and other elements on life expectancy, highlighting whether positive and negative changes in main indicators have diverse effects on life expectancy in Pakistan.

RESULTS AND DISCUSSION

Descriptive Statistics

Significant variation is indicated by the descriptive statistics between the variables from the period 1997 to 2025. 64.290 is the mean value of the LE, which shows constant advancement in the population's living status in Pakistan. Standard deviation is low (2.127), which suggest relatively steady fluctuations over the time period. While skewness is negative (-0.115) indicates that most of the values are above the given average. However, 0.121 is the average of fiscal decentralization, and 0.020 is its standard deviation, because it fluctuation is reflected moderately over the years by the changes in variations in intergovernmental fiscal shifts and spending decentralization. IQI shows low variability, due to which it indicates that changes and progress in development became stable over time. However, CHEZ have average values of 2.55% of GDP approximately from estimation, which shows the moderate variation and supports Pakistan's rapid population change, also enhancing investments in development sectors (Khalil & Asif, 2024).

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis	Variance
LE	29	64.290	2.127	60.466	67.982	-0.115	2.048	4.522
FD	29	0.121	0.020	0.061	0.153	-0.768	4.466	0.000
IQI	29	0.244	0.030	0.186	0.304	0.127	2.574	0.001
GDP	29	1100.213	445.787	454.276	1850.662	-0.013	1.655	198725.9
CHE	29	2.549	0.276	2.037	2.990	-0.146	2.145	0.076
URB	29	1.547	0.022	1.510	1.585	0.045	1.854	0.000
POP	29	2.153	0.532	1.302	2.911	-0.138	1.486	0.283

Correlation Matrix

Table 2 presents the pairwise correlation matrix along with p-values. Life expectancy (LE) exhibits a positive correlation with fiscal decentralization, current health expenditure, and urbanization (Oates, 1999; Akai et al., 2007; Arzaghi & Henderson, 2005; Mehmood & Nawaz, 2022). A significant negative correlation has been observed between institutional quality and life expectancy, which calls for further investigation in the regressive framework (Farag et al., 2013; Karim et al., 2023). Population growth is highly negatively correlated with LE, as a higher population reduces per capita welfare. (Pesaran et al., 2001; Shin et al., 2014), the issue of multicollinearity is addressed through the ARDL and NARDL frameworks.

Table 3: Pairwise Correlation Matrix

Variable	LE	FD	IQI	GDP	CHE	URB	POP
LE	1.000						
FD	0.408** [0.028]	1.000					
IQI	-0.514*** [0.004]	0.165 [0.393]	1.000				
GDP	0.967*** [0.000]	0.409** [0.028]	-0.422** [0.023]	1.000			
CHE	0.614***	0.551***	-0.046	0.610***	1.000		

	[0.000]	[0.002]	[0.812]	[0.000]			
URB	0.982***	0.399**	-0.418**	0.973***	0.670***	1.000	
	[0.000]	[0.032]	[0.024]	[0.000]	[0.000]		
POP	-0.882***	-0.527***	0.252	-0.915***	-0.468**	-0.870***	1.000
	[0.000]	[0.003]	[0.187]	[0.000]	[0.011]	[0.000]	

Stationarity Test

Unit root tests, especially the results of PP and ADF, show a mixed order of integration between the variables, indicating the existence of both stationary I (0) and non-stationary I (1) trend altogether in the dataset (Pesaran et al., 2001; Shin et al., 2014). In sum, the coexistence of I (0) and I (1) variables justifies the suitability of the ARDL and NARDL modelling technique.

Table 4: ADF Unit Root Test Results

Variable	Level	t-Statistic	1% CV	5% CV	10% CV	p-value	Decision
LE	Level	-0.826	-3.736	-2.994	-2.628	0.8114	Non-stationary
FD	Level	-2.142	-3.736	-2.994	-2.628	0.2280	Non-stationary
IQI	Level	-2.387	-3.736	-2.994	-2.628	0.1455	Non-stationary
GDP	Level	-0.350	-3.736	-2.994	-2.628	0.9181	Non-stationary
CHE	Level	-2.010	-3.736	-2.994	-2.628	0.2823	Non-stationary
URB	Level	3.303	-3.736	-2.994	-2.628	1.0000	Non-stationary
POP	Level	-1.514	-3.736	-2.994	-2.628	0.5265	Non-stationary
D(LE)	1st Diff.	-5.223	-3.743	-2.997	-2.629	0.0000***	Stationary I(1)
D(FD)	1st Diff.	-4.214	-3.743	-2.997	-2.629	0.0006***	Stationary I(1)

D(IQI)	1st Diff.	-3.272	-3.743	-2.997	-2.629	0.0162***	Stationary I(1)
D(GDP)	1st Diff.	-4.128	-3.743	-2.997	-2.629	0.0009***	Stationary I(1)
D(CHE)	1st Diff.	-5.453	-3.743	-2.997	-2.629	0.0000***	Stationary I(1)
D(URB)	1st Diff.	-1.112	-3.743	-2.997	-2.629	0.0432*	Stationary I(1)
D(POP)	1st Diff.	-3.342	-3.743	-2.997	-2.629	0.0131**	Stationary I(1)

Note: In the unit root test, the null hypothesis is not accepted at 1%, 5%, or 10% significance levels. Indicators added at order one are represented as I (1).

Bounds Test Results

The findings of F-bounds tests show a strong long-run relationship between the variables, with the value of F-statistic 35.36962 that is surpassing the upper critical bound (I (1)) at all the conventional significance levels mentioned as (10%, 5%, 2.5%, 1%). In the same way, the t-Bounds test shows a t-statistic value of -11.47002, which is found above the critical levels at all conventional levels (Pesaran et al., 2001; Shin et al., 2014; O'Reilly et al., 2020).. Although these results robustly reject the null hypotheses of no level relationship in the test, thus validating the means of ARDL modelling and error correction mechanisms for the remaining analysis.

Table 5: Bounds Test Results

- F-Bounds Test – Null Hypothesis: No level relationship

Test Statistic	Value	Significance Level	I(0)	I(1)
F-statistic	35.36962	10%	1.6	2.72
K	11	5%	1.82	2.99
		2.5%	2.02	3.27
		1%	2.26	3.6

- t-Bounds Test – Null Hypothesis: No level relationship

Test Statistic	Value	Significance Level	I(0)	I(1)
t-statistic	-11.47002	10%	-1.62	-4.42
		5%	-1.95	-4.76
		2.5%	-2.24	-5.06

		1%	-2.58	-5.44
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Empirical Results

In the context of ECM results, the estimated error-correction model coefficient is -0.6485***, which is negative and statistically significant at the 1% level of significance, which lies within the expected range of $(-1 < ECM < 0)$. Although the short-run results show mixed dynamics between living standards and fiscal decentralization (Pesaran et al., 2001; Shin et al., 2014). ARDL shows that fiscal decentralization reveals a weak and statistically insignificant effect, indicating that sudden changes in fiscal decentralization do not improve living standards. (Vlahov & Galea, 2002; Faguet, 2014; Kyriacou & Roca-Sagalés, 2019), other variables such as urbanization have a strong short-run effect, suggesting that socioeconomic variables can improve living standards immediately. While the NARDL result shows important short-run asymmetric effects. Positive shocks of fiscal decentralization have a significant positive effect on living standards. However, negative shocks are weaker and mostly insignificant. This indicates that fiscal autonomy at the local level can improve living standards immediately, assuring the presence of asymmetric short-run adjustments (Shin et al., 2014; Barech et al., 2025; Ahmed & Qayyum, 2023).

Table 6: ARDL/NARDL Short-Run Results

Variable	ARDL Coefficient	NARDL Coefficient
ECM / LLE(-1)	-0.6485***	-1.0129***
FDE	-0.0033	—
FDE_POS	—	0.0253***
FDE_NEG	—	0.0027
IQI	-0.150**	-0.0031
LCHEZ	-0.014	-0.0609***
LPOP	-0.2280***	11.7193**
LURB	0.2217	1.6611
LGDPUS	0.0178	-0.0912**

Model Summary

$R^2 = 0.99964$ | $Adj. R^2 = 0.998129$ | $S.E \text{ of Regression} = 0.001292$

Akaike Info Criterion = 10.522 | Schwarz Criterion = -9.466 | Log Likelihood = 164.05

Durbin-Watson = 2.376 | Observations = 29

In the long-run fiscal decentralization and living standards have more stable relationship. ARDL model shows that fiscal decentralization has a positive and statistically significant long-run effect, revealing that in the long run, fiscal autonomy improves living standards more robustly over time (Oates, 1999; Arzaghi & Henderson, 2005; Akai et al., 2007; Faguet, 2014; Mehmood & Nawaz, 2022). However, urbanization remains a dominant positive driver of long-term welfare. (Vlahov & Galea, 2002; Kyriacou & Roca-Sagalés, 2019), the NARDL model shows that fiscal decentralization has a more robust and statistically significant effect on the living standards in the long-run are, and statistically significant as its negative effects are also statistically significant, but it has comparatively weak effects. This asymmetry reveals that long-term benefits from fiscal decentralization are primarily supported by consistent positive fiscal reforms, while decrease in decentralization have a less but still adverse effect. The findings suggest that fiscal decentralization is a major long-run part of living standards, with stronger benefits arising from expansionary policies rather than contractionary policies of fiscal adjustments (Shah, 2006; Martinez-Vazquez et al., 2017).

Table 7: ARDL/NARDL Long-Run Estimation Results

Variables	ARDL Coefficients	NARDL Coefficients
FDE / FDE_POS	0.027**	0.039***
FDE_NEG	—	0.015***
IQI	-0.150**	-0.150***
LCHEZ	-0.014	-0.075***
LPOP	-0.228***	-0.310***
LURB	2.796***	4.441***
LGDPCUS	-0.035	-0.167***

Long-Run Equation

$$EC = LLE - (0.0392 \cdot FDE_POS + 0.0150 \cdot FDE_NEG + -0.1503$$

$$*IQI + 0.0554 \cdot LCHEZ + 0.0160 \cdot LEDUUS - 0.0014$$

$$*LPOP + 4.4410 \cdot LURB - 0.1674 \cdot LGDPCUS)$$

Stability tests

The CUSUM stability test of (Brown, Durbin & Evans, 1975), gives strong evidence that the coefficients of the estimated regression model stay stable throughout the period of the sample from 2018 to 2025. The CUSUM line stays within the 5% significance limits, suggesting parameter stability over time. No significant shocks or instabilities are affecting the model parameters. The CUSUM of Squares (CUSUMSQ) test in Figure 6 shows the stability of the framework's variance across the sample period. The blue line in it remains within the 5% significance boundaries (red dashed lines), which shows model stability across the time period. Hence, there is no evidence of structural breaks; the model's variance is consistent throughout the period of time.

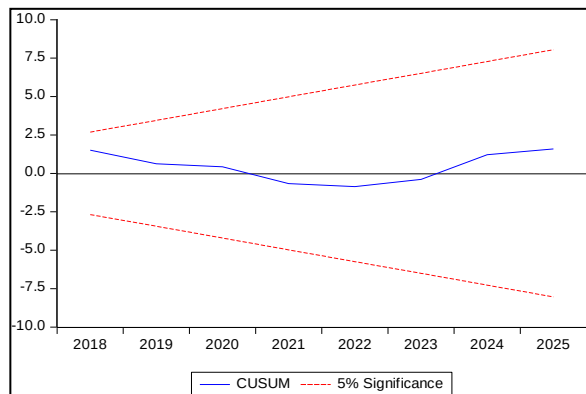


Figure 2

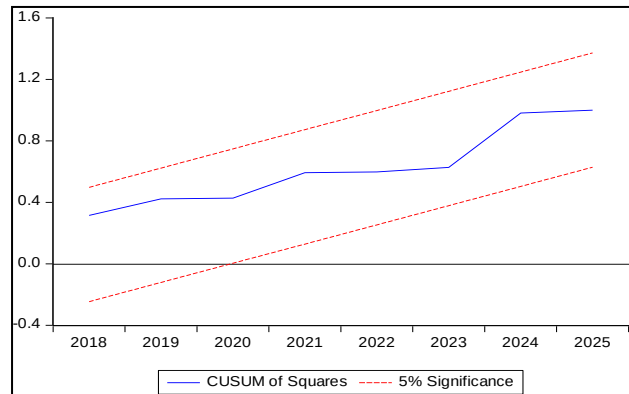


Figure 3

Diagnostic Tests

The key diagnostic findings of our data are in the table below, it shows the robustness, reliability, and validity of the estimated NARDL model, the diagnostic findings show that the

model is statistically well-specified and free from core econometric issues which disturb the framework. Therefore, the Breusch-Godfrey Test of (Breusch, 1978; Godfrey, 1978), shows no evidence of serial correlation as ($p < 0.05$), showing that the residuals are independent. However, it further suggests the lack of heteroscedasticity as ($p < 0.05$), indicating that the variance of residuals is still consistent, justifying effective parameter estimates over the sample. Moreover, (Ramsey, 1969). the Ramsey RESET Test shows a p-value (0.6508), which shows that the functional form of the framework is correctly specified and free from misplaced variable bias and the model is fit.

Table 8: Diagnostic Test Results

Test	Statistic	Value	p-value
Breusch-Godfrey LM Test (Autocorrelation, lag=1)	chi2(1)	6.536	0.0106**
Breusch-Pagan / Cook-Weisberg Test (Heteroskedasticity)	chi2(1)	3.990	0.0457**
Specification bias (Ramsey Reset Test)	adj chi2(1)	0.02	0.6508

CONCLUSION AND POLICY RECOMMENDATION

This study examined the symmetric and asymmetric impacts of fiscal decentralization on living standards in Pakistan by using both ARDL and NARDL approaches. The findings show that linear ARDL reveals a positive but statistically weak relationship, while the non-linear NARDL provides robust evidence of asymmetry. As positive changes in fiscal decentralization significantly improve living standards, while negative one have relatively weaker impacts as compared. This indicates that the relation is asymmetric, and relying only on the asymmetry may lead to an inappropriate conclusion. Moreover, variables such as economic growth and urbanization contribute positively to living standards, while population growth exerts a negative impact, highlighting the need for equal allocation of

resources. However, the significant error correction model assures a stable long-term relationship between fiscal decentralization and living standards.

Both the favorable and unfavorable impacts of Fiscal decentralization (FDEPOS and FDENEG) were found to increase living standards. The positive impact of both fiscal decentralization parts suggests that even under core alignment of fiscal reforms, productivity benefits are acknowledged. These results support (Martinez-Vazquez & McNab, 2017) who elaborated that decentralization, rapid adoptability and responsibility motivating public service provision in the health and education sector. Plus, it supports (Kyriacou & Roca-Sagalés, 2019), who found almost the same findings for enhancing economies, suggesting that fiscal self-rule involved improving living standards by enhancing expenditure supervision. The Institutional Quality Index (IQI), therefore, shadows a negative coefficient, indicating that weak institutions and administrative incapability obstruct the productive implementation of decentralization policies. This is relevant to (Rodríguez-Pose & Ezcurra, 2010), who found that in developing countries, a weak institutional background can erode the potential gains of decentralization.

Similarly, urbanization (URB) had a positive impact on life expectancy, suggesting that human capital development and urban infrastructure play important roles in increasing access to healthcare services. While health expenditure (CHEZ) stresses a negative long-run coefficient, suggesting mismanagement of the distribution of funds in Pakistan's public health department, alignment in the evaluation of public health financing. Moreover, population growth (LPOP) showed a negative relationship with life expectancy, which shows resource burden because of population pressure. Unexpectedly, GDP per capita (LGDPUS) had a negative parameter, denoting that economic growth itself does not guarantee equitable living enhancement, mainly because of inequality or ecological destruction.

The study findings provide possible empirical support to Fiscal Federalism Theory (Oates, 1972) and Public Choice Theory (Tiebout, 1956). Fiscal federalism suggests the efficiency benefits from decentralized decision-making, while public choice theory recommends the significance of provincial feasibility and citizen opinion satisfaction. The positive effect of fiscal decentralization on life expectancy backs up these theories by indicating how localized fiscal power can encourage living-supporting public expenditure. Furthermore, the findings of this study are consistent with Barech et al. (2025), who showed asymmetric effects of fiscal decentralization on health outcomes in Pakistan, confirming that positive fiscal decentralization shocks have a stronger welfare-enhancing impact as compared to negative shocks of fiscal decentralization on health status in Pakistan.

The diagnostic and stability tests made the estimation frameworks free from autocorrelation and heteroscedasticity, and the coefficient stayed stable across time. These results emphasize the transparency of the findings and support that the relationship between fiscal decentralization and life expectancy in Pakistan is both empirically and economically significant.

In a policy perspective, this research provides a clear direction for improving Pakistan's fiscal and living status. Although the positive long-term relationship between fiscal decentralization and life expectancy suggests policies that could increase the intergovernmental fiscal framework and confirm that local governments have both financial capability and institutional efficiency to control living-related spending effectively in Pakistan (Qiao, Martinez-Vazquez, & Xu, 2011; Asfaw, Frobberg, & James, 2007). Therefore, Researchers must provide preference to the National Finance Commission (NFC) Award to interlink fiscal shifts with observable living outcomes, incentivizing local governments to provide resources efficiently in the region. However, increasing institutional quality and making transparent monitoring systems will help to ensure that decentralized spending is used equitably and effectively among different regions of the state (Martinez-Vazquez & McNab, 2017). While policies can motivate provincial governments to use evidence-based budgeting, societal contributions can enhance control, effectiveness, and sustainability in public health sectors within the requirements. But in the long term, fiscal decentralization, enhanced by a robust institutional framework, can ensure that

financial shifts translate into tangible health benefits and contribute to Pakistan's broader goal of achieving sustainable human growth, equitable for all. Moreover, as there is asymmetry, fiscal reforms should be made flexible, enabling policymakers to maximize the benefits of positive trends while avoiding the adverse impact of negative shocks.

Supported by current studies, future studies should employ a more disaggregated, local-level approach to capture the diverse impact of fiscal decentralization all over Pakistan. Therefore, policymakers should examine the mediating role of institutional quality, efficiency, and intergovernmental fiscal transfers in shaping living outcomes (Farooq, 2023; Arzaghi & Henderson, 2005). However, merging micro-level datasets, mentioned as household health expenditure and healthcare inclusiveness, would help future research and provide greater analytical strength. Moreover, non-linear econometric frameworks, such as household interactions, Panel threshold Models, or Spatial Durbin Models, could help identify local impacts of fiscal decentralization on health outcomes. In contrast, countrywide analyses among South Asian nations could also examine Pakistan's performance in achieving Sustainable Development Goal 3 (Good Health and Well-Being). In the end, future studies may reflect on the role of political devolution and participatory bodies to evaluate how provincial autonomy and accountability mechanisms affect public health sustainability growth (Faguet, 2014; Qiao et al, 2019).

In conclusion, this research ends with the fact that fiscal decentralization plays an important role in enhancing life expectancy and living standards across Pakistan, validating the innovative ability of encouraging provincial governments through fiscal autonomy. The long-term and short-run results from ARDL and NARDL techniques indicated that both positive and negative fiscal shocks strongly affect life expectancy, emphasizing the significance of efficient and equal service distribution. However, the findings prove that when fiscal authority is given to efficient provincial institutions, living outcomes are enhanced by an improved adaptation of public expenditure to provincial needs (Oates, 1999; Faguet, 2014). So, there are benefits of decentralization that depend upon robust and efficient institutional quality, regulatory models, and transparency in fiscal central administration. Therefore, this research stresses the need for reliable fiscal reforms, institutional efficiency, and policy transparency among federal and provincial administrations in the region. Hence, in conclusion, a well-managed fiscal decentralization framework can be a major systematic tool for attaining long-term impacts on living standards and efficient human growth all over Pakistan.

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