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SOCIO-ECONOMIC DETERMINANTS OF FERTILITY BEHAVIOR: A CO-INTEGRATION ANALYSIS FOR PAKISTAN

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Abstract

This study examines the socio-economic determinants influencing fertility behavior in Pakistan, employing the bound test approach and the Autoregressive Distributed Lag (ARDL) model on time-series data spanning from 1990 to 2020. Variables were integrated into different orders using the Augmented Dickey-Fuller test. Fertility is considered the dependent variable, while GDP per capita, life expectancy at birth, child mortality ratio, female education, female participation rate in the labor force, and urbanization serve as independent variables. The findings reveal that factors such as female education, female labor force participation, and urbanization contribute to a decrease in the fertility rate. Conversely, GDP per capita, life expectancy at birth, and child mortality ratio are associated with an increase in the fertility rate. Policy recommendations emphasize investments in education and the creation of supportive urban environments for family life. Integrated approaches addressing healthcare, family planning, and gender equality are crucial for sustainable demographic trends and economic development. The study uniquely investigates how socio-economic determinants impact fertility behavior in Pakistan, focusing on the relationship between fertility rate and female education. Notably, this research adds innovation by being the first to explore the effects of socioeconomic determinants on fertility behavior in Pakistan, distinct from existing studies that primarily examine social and cultural determinants.

Keywords: Determinants, Investments, Fertility, ARDL, Urbanization

Introduction

Pakistan stands out globally due to its distinctive fertility trend. While the country previously had a high fertility rate, a notable decline began in the late 1980s, and persists to the present day. According to the World Bank (2010), Pakistan witnessed a significant 40% reduction in fertility between 1980 and 2006. Despite being a positive step, the reduction in fertility poses limitations in implementation, serving as valuable lessons for population planners, policymakers, and resource allocation in Pakistan (Population Council, 2020). The decreasing fertility rate in Pakistan, as explored by Ahmed, Irfan, & Mahmud (2016), is attributed to societal shifts, increased female education, and improved access to family planning. This trend is remarkable considering historical preferences for larger families and carries implications for demographics and socioeconomic dynamics. Fertility rates are calculated through various demographic indicators, with the Total Fertility Rate (TFR) being a key measure. It reflects the average number of children born to a woman during her reproductive years (15-49 years of age). Several factors influence fertility rates, encompassing social, economic, and health determinants. Educational attainment, for instance, significantly affects fertility, with higher education often correlating with delayed childbearing and smaller family sizes (Becker, 1992). Healthcare access, especially family planning services, and maternal and child health, is crucial, in influencing fertility decisions (Bongaarts & Casterline, 2013). The complex relationship between women's employment and fertility is shaped by socio-economic and cultural factors. Generally, higher levels of women's employment are linked to lower fertility rates, as women may prioritize education and career development, delaying marriage and childbearing (Bloom et al., 2009). The nature of this relationship varies based on societal norms, family support structures, and policy interventions. Supportive workplace policies, such as parental leave and childcare facilities, can mitigate the potential negative impact of employment on fertility. Mahmood & Chaudhry (2011) highlight the potential for improved health and increased opportunities for women, emphasizing the importance of effective family planning policy implementation and addressing cultural and religious barriers (Bongaarts & Casterline, 2013). The observed decline in fertility rates presents both benefits and challenges, offering a demographic dividend that can aid in navigating changes for sustainable development. Most research on fertility determinants concentrates on factors such as female education, female labor force involvement, urbanization, and family earnings, all deemed crucial in influencing household fertility decisions. Women's household responsibilities, including childbearing, are considered to consume a significant amount of women's time. This dynamic, as discussed by Ellis (1988), results in a higher likelihood of infertility as an increase in female education or job options for women reduces women's lifetime projected income, making childbearing more financially burdensome. Developing countries like Pakistan have grappled with high fertility rates since independence, leading to population growth and giving rise to various social and economic challenges. The socioeconomic determinants of fertility behavior have been extensively studied in the literature, shedding light on the complex interplay of various factors influencing individuals' decisions regarding family size and reproductive choices. The determinants found are Women's Education, Women's Employment, Gross Domestic Product of the country, Infant mortality, Life expectancy, Urbanization and Globalization, etc.

Problem Statement

Despite extensive research on the socioeconomic determinants of fertility behavior, there remains a gap in the literature concerning a comprehensive and integrated analysis of these factors in the context of Pakistan. Existing studies consistently highlight the multifaceted nature of determinants such as education, employment, economic conditions, healthcare accessibility, and urbanization, emphasizing their collective influence on fertility rates. However, there is limited research that simultaneously considers all relevant socioeconomic variables and employs advanced econometric methods to analyze their combined impact. This study aims to address this gap by deviating from conventional research approaches and adopting a novel methodological framework. Through the application of the Vector Error Correction Model (VECM) and Auto Regressive Distributive Lag (ARDL) methods, the investigation seeks to explore both short-run and long-run relationships among the identified socioeconomic determinants and fertility behavior in Pakistan.

Research Question

- How do socioeconomic determinants such as women's education, female participation rate in the labor force, life expectancy, urbanization, and per capita income influence fertility behavior?

Research Objective

- To assess and analyze the socioeconomic determinants influencing fertility behavior in Pakistan.

Significance of the Study

This research paper on the socioeconomic determinants of fertility behavior in Pakistan holds significance for various reasons. It can guide policymakers in crafting targeted interventions, contribute to the understanding of demographic transition, shed light on the link between fertility and economic development, identify health disparities for maternal and child well-being, reveal insights into gender dynamics, inform educational policies, address challenges related to population aging, and contribute to understanding social cohesion dynamics. Overall, such research has the potential to inform policies, enhance demographic understanding, and improve the well-being of the population. This research paper on the socioeconomic determinants of fertility behavior in Pakistan holds significance for various reasons. It can guide policymakers in crafting targeted interventions, contribute to the understanding of demographic transition, shed light on the link between fertility and economic development, identify health disparities for maternal and child well-being, reveal insights into gender dynamics, inform educational policies, address challenges related to population aging, and contribute to understanding social cohesion dynamics.

Literature Review

This literature review provides a comprehensive overview of key studies and findings that illuminate the complex relationships shaping fertility decisions, with a particular focus on Pakistan. The research spans diverse dimensions, including education, employment, economic conditions, healthcare accessibility, and urbanization, influencing individuals' reproductive choices and contributing to dynamic variations in fertility rates. A study conducted by Kuloglu & Kizilirmak (2022) aimed to discern the predominant influences of social and economic variables on fertility across three country groups from 1990 to 2018, classified by the World Bank's income classification. The results highlighted the significant and positive impact of the health index on fertility in low-middle-income countries, emphasizing a 6 percent increase for a one-unit change. Similarly, the economic index exhibited a notable effect, indicating a 60 percent increase for a one-unit change, underlining the economic nature of fertility decisions in low-income settings. However, the social index did not emerge as significant. In upper-middle-income countries, the health index predominantly explained fertility, with a 57 percent increase for a one-unit change, followed by a 1 percent increase in fertility for each additional unit of per capita income. These findings collectively suggest that both health and economic factors play crucial roles in shaping fertility decisions, reinforcing the argument that fertility is more of an economic decision than a social one, especially in low and upper-middle-income countries. The relationship between economic factors, fiscal growth, child death ratio, and fertility is intricate and multifaceted. Higher-income levels and economic stability are associated with lower fertility rates due to increased access to family planning, education, and career opportunities (Ashraf et al., 2013; Doepke et al., 2023). As healthcare improves and child mortality rates decline, families may adjust their fertility decisions, particularly in Sub-Saharan African countries (Garenne, 2008). Lower child mortality rates can lead to increased investments in children's education and overall well-being, influencing fertility decisions (Jayachandran & Pande, 2017). According to Singh & Caster (1985), an increase in education boosts fertility in less developed countries because it improves maternal and child health, but a much increase in education decreases the fertility rate. Schultz et al., (2005) argued that more female schooling leads to a higher share of females in the labor market, increasing the economic value of women's time in society. Significant female education reduces the number of offspring per female. Similarly, the United Nations (1985) underlined the negative association between female labor-force participation and female fertility rate on sociological and economic aspects. The social characteristics of female contribution in the labor market can minimize the traditional roles of females as mothers and homemakers. As a result, the negative association between female employment and the female fertility rate stays inverted. Bettio & Villa (1998) observed the inverse association between fertility and unemployment in Italy. According to them, the contribution of females in labor markets will produce revenue for households in case of negative shocks concerning their partner's employment. Moreover, the more they live in the labor market, the more quickly females lose their childbearing years, so in this way, the fertility ratio declines. Besides female employment, urbanization also has a direct effect on fertility rates. Chani et al. (2012) examined the impact of various socio-financial elements such as female education, urbanization, and female participation rate in the labor force on fertility rates from 1980 to 2009 using the ARDL bound test approach. Education for females and the process of urbanization have been statistically important, while the part of female labor contribution has been of less importance in the case of Pakistan. Herzer et al. (2012) investigated the effect of mortality rate, growth ratio of income, and fertility rates in twelve developed and eight less developed nations by analyzing time series data between 1900-1999 by employing co-integration and Granger causality test where all variables were converted into the log form. The results found that there is a direct relationship between mortality and fertility rate, while GDP per capita income is inversely related to the fertility rate of all selected countries; developed and developing countries. (Michel J et al., 2008), The current study addresses the demographer's conventional worry about the timing of demographic events and the role of population composition. Statistical data attempts to recognize the virtual influence of various individual characteristics on the beginning and rate of childbearing. Other indicators that have a positive and negative effect on the fertility rate are not only the above factors that directly influence the female fertility rate. Certain other factors have considerable effects including the economic effects of fertility and the fiscal growth and child death rate, education, and religious responsibilities. The issue of economics and the study of sociology support the current study with a theoretical framework to comprehend the mechanism concerning the fertility rate. The fertility ratio differs across countries. The general fertility rates are highest in countries having low income; the researcher, therefore, can conclude that the general fertility ratio falls with economic/fiscal development. Similarly, the general fertility rate is higher, where social indicators like literacy rate and accessibility of services related to health are low.

Research Methodology

Data Source and Description of Variables

The present study investigates the dynamics of fertility behavior in Pakistan over the period 1990 to 2013, focusing on key socio-economic indicators such as female contribution to the labor market, female education, urbanization, infant mortality rate, life expectancy at birth, and per capita incomes. The time-series data utilized for this analysis was sourced from the World Development Indicator (WDI), allowing a comprehensive examination of the impact of female education, female employment, and per capita income on women's fertility rates.

Estimation Techniques, Model Stability, and Unit Root Analysis:

Several methods are available for the estimation of time-series data, each playing a critical role in ensuring accurate and reliable results. The chosen technique must align with the specific characteristics of the data to avoid misleading conclusions. In this study, traditional estimation procedures were followed to guarantee the validity of the results. Before applying the econometric model estimation, it is imperative to ascertain the stability of the model, check for the absence of unit roots in the variables, and ensure the stationarity of the data. The Augmented Dickey-Fuller (ADF) test was employed for this purpose, providing insights into the stationarity of the data at different orders. The ADF test, a widely used statistical tool, aids in determining whether the variables exhibit unit roots, thereby influencing the choice of the appropriate econometric model.

$\Delta A = \beta_1 + YAt\text{-}1 + \alpha_1 + \mu_t$ .... …(I)

$\Delta A = \beta_1 + \beta_2 + YAt\text{-}1 + \alpha_1 + \mu_t$ ....(II)

$\Delta A = YAt\text{-}1 + \alpha_1 + \mu_t$ ....(III)

Above mentioned formula has three equations. Equation 1 contains only one intercept. Equation 2 consists of both trends and intercept while in Equation 3 both intercept and trend are missing. These equations confirm the stationary position of variables. The objective of the above equations, included in the model shows the non-stationary of the variables in any order; and this variable is known as non-stationary. For stationary variables, all the above equations should be completed; if not, the result will be doubtful. One must check the variables are stationary at level, if the variables are not stationary according to the above equation, then we go next step to confirm the variables in the initial dissimilarity in the above-given equations. The process remains ongoing till stationary variables are obtained according to the above-given equations. If the variables are stationary, the level is called integration 1 (0) when the variables are stationary at the first difference, then it can be shown as 1(1). In the case of the second difference, it can be shown as 1(2). When the model has estimated the presence of a non-stationary variable, the model is considered a spurious model or nonsense model. To find the problem related to the model, a Dickey Fuller (DF) test has been used.

ARDL Model for Exploring Fertility Dynamics and Socio-economic Indicators

This study employs the Auto Regressive Distributive Lag (ARDL) model to estimate the association between fertility rate and key socio-economic indicators, including female education, per capita income, women's participation in the labor force, urbanization, infant mortality rate, and life expectancy rate at birth. The ARDL model is deemed most appropriate for its ability to handle different orders of integration (1(0) and 1(1)), providing a comprehensive analysis of the relationships between variables.

Rationale for ARDL Model:

The ARDL model is chosen for its simplicity and effectiveness in estimating a single equation, making it well-suited for investigating the complex associations within the chosen variables. Unlike previous techniques, the ARDL model accommodates various integration orders and is known for its accuracy in estimating a limited dataset, enhancing the reliability of the results (Pesaran et al., 2001).

Steps in ARDL Model Estimation:

- ***Dynamics of Short- and Long-run Parameters:*** The initial step involves estimating the short- and long-run parameters to discern the dynamic relationships between the variables.
- ***Long-run Association Determination:*** Subsequently, the study determines the long-run association among the variables using F-statistics. The Bound test is employed for this purpose, enabling a robust examination of the long-term relationships.
- ***Model Evaluation:*** The ARDL model undergoes thorough evaluation, including checks for heteroscedasticity, stability, normality, and correlation, ensuring the model's correct functional form.
- ***Formulation of ARDL Model:*** This formulation undergoes rigorous testing to ensure its appropriateness for capturing the intricate relationships among fertility dynamics and socio-economic indicators in the specified context. The ARDL model is given below as a test to check the correct functional form:

$$\Delta Ft = \alpha_0 + \sum_{i=1}^{n} .\text{"}\delta i\, \Delta edu_{.t-j.} + \sum_{i=1}^{n} \Phi i.\, \Delta ext_{t-j.} + \sum_{i=1}^{n} \pi i.\, \Delta .\, mor._{t-j} + \alpha_{1.} Y._{t-1} + \alpha_{2.} par._{t-1.} + \alpha_3 Y_{t-1.} + \varepsilon_t$$

Where,

Ft= fertility rate

α_i, α_0 = Drift factor and white noise respectively

edu. = Female Education

ex= Expectancy rate at bird rate

urb = Urbanization

mor = Infant mortality rate

par = Female participation rate in the labour force

Y= GDP per capita income

ε_t= Error Term

Bound Test for Co-integration Analysis: Upon completing all relevant procedures, the study employs the Bound test approach, relying on the F-statistic, to investigate the long-run relationship among the variables (Pearson, 2001). The subsequent steps involve rigorous testing for co-integration among the variables, with the formulation of null and alternative hypotheses.

Co-integration Hypotheses: The null hypothesis (H0) posits the absence of co-integration, expressed as H0: α1 = α2 = α3 = 0. Conversely, the alternative hypothesis (H1) suggests the presence of co-integration, articulated as H1: α1 ≠ α2 ≠ α3 ≠ 0.

Statistical Evaluation: The decision regarding co-integration is based on the statistical comparison of the calculated F-value with the critical value at a specified significance level. If the calculated F-value exceeds the critical value, the null hypothesis (H0) is rejected, indicating the presence of co-integration. Conversely, if the calculated F-value is less than the critical value, the null hypothesis is accepted, signifying the absence of co-integration.

Error Correction Model (ECM): Upon establishing co-integration, the study formulates the Error Correction Model (ECM). The ECM encapsulates the dynamics of the adjustment process, offering insights into how the variables correct deviations from their long-run equilibrium. The ECM is expressed as follows:

$$\text{“}\Delta Frt\text{”} = \alpha_0 + \sum_{i=1}^{n} .\text{"}\delta i\, \Delta edu_{..} + \sum_{i=1}^{n} \Phi i.\Delta.Ex_{t-j.} + \sum_{i=1}^{n} \pi i.\Delta.prt._{t-j} + \alpha_{1.}Fr_{t-1} + \alpha_{2.}Mor._{t-1.} + \alpha_{3urbt-1.} + \alpha_{4.}Y_{t-1} + \Omega ECT. + \varepsilon_t$$

'Ω' in the above equation illustrates the speed of adjustment of equilibrium with a negative value.

Results and Discussions

When dealing with time series data, the initial and crucial step involves verifying the stationarity of the variables. The Augmented Dickey-Fuller (ADF) test is employed for this purpose, aiming to discern the presence or absence of a unit root in the variables. The results of the ADF test are succinctly presented in the following table:

Table 1: ***ADF test for Unit Root***

Variables	*0Lag*	*At Level*	*First Difference*	*Order of Integration*
Fertility rate	2 (AIC)	0.0002		I (0)
Per capita income	4 (AIC)	0.338822	0.0012	I (1)
Literacy rate	6 (AIC)	-1.331184	0.004	I (1)
Female participation rate in the labor force	2 (AIC)	0.0045		I (0)
Life expectance at the birth rate	6 (AIC)	0.0004		I (0)
Urbanization	4 (AIC)	3.338822	0.0057	I "(1)"

Source: Author's Calculations

The examination reveals that the Fertility rate, the female participation rate in the labor force, and life expectancy at birth rate exhibit stationarity at the level, indicating a lack of a unit root. In contrast, female education, infant mortality rate, and urbanization demonstrate stationarity at the first difference, suggesting the presence of a unit root that is rectified through differencing. The observed integration orders for the selected variables, ranging from 1(0) to 1(1), underscore the need for employing the Autoregressive Distributed Lag (ARDL) method to estimate the model and discern the relationships among the variables effectively. To determine the optimal number of lags, the Akaike Information Criterion (AIC) is utilized. The AIC-recommended lag lengths for the variables Y (Fertility rate), ES (Life Expectancy), FDI (Female Education), and OP (Urbanization) are determined to be 1, 0, 1, and 1, respectively. These selected lag lengths contribute to the robustness and accuracy of the subsequent model estimation process.

Bound Test for Co-Integration Analysis

The "Bound Test" for Co-Integration, as proposed by Pesaran & Shin (1999) and further developed by Pesaran et al. (2001), is employed in this study to assess the long-run co-integration among the variables within the model. This test is particularly valuable when variables are combined in different orders. Table 2 presents the F-statistic value for co-integration, accompanied by critical values derived from a small sample, as recommended by Narrayan (2004).

Table -2 F- Bound Test Result

Test Statistic	*Value*	*Significant*	*Lower value 1(0)*	*Upper value 1(1)*
F-statistic	14.91362	5%	2.4	4.6

Examination of Table 2 reveals an F-statistic value of 14.91, surpassing the upper Bound's critical value of 4.6 at a 5% confidence level. By the test criteria, the null hypothesis is rejected when the F-statistic exceeds the upper Bound's critical value, signifying the absence of co-integration. Consequently, the alternate hypothesis is accepted, indicating that the variables under consideration are indeed co-integrated. This substantiates the existence of a long-run relationship among the variables in the model, underscoring the interconnectedness of the factors influencing fertility behavior in the context of the study.

Short-run and long-run Estimation: This study aims to establish the existence of both short-term and long-term relationships among the variables incorporated in the model. Employing time-series data spanning from 1990 to 2013, the study determines the optimal lag length. The estimation process, introduced by Pesaran and Shin in 1999 and subsequently refined by Nayaran in 2004, involves measuring and estimating the maximum lag length. The determination of the lag length is further refined using the Schwarz-Bayesian Information Criteria (SBC). This approach helps identify the ideal number of lags, addressing the issue of conditional error correction and confirming the mitigation of serial correlation concerns in the model, as specified by Pesaran in 2001. The results are given in the table below.

Table -3 Long–Run Co-Integration Results

Variables	Coefficient	Std. Error	t-Statistic	Prob.
Labor Force participation rate in the labor force	-0.01106	0.035698	21.76393	0.0000
Female Education	-0.0966	0.003058	-0.361530	0.0022
Per Capita Income	0.034600	0.000109	8.853000	0.0000
Life expectancy rate at the bird	1.25E-08	0.005839	5.925309	0.0000
Infant Mortality Rate	0.776922	4.00089	2.967970	0.0086
Urbanization	-0.23478	5.00009	3.842340	0.0000

Long-Run Relationship:

The analysis of the variable "Female Education" in the regression results reveals a statistically significant negative association with the dependent variable. The coefficient of -0.0966 indicates that, on average, a one-unit decrease in female education is associated with a 0.0966-unit increase in the dependent variable. The small standard error (0.003058) suggests a high precision in estimating this impact. Although the t-statistic of -0.361530 is relatively small, the associated probability (p-value) of 0.0022 is below the conventional significance level of 0.05, providing evidence to reject the null hypothesis. Thus, female education appears to be a significant predictor, and its negative association implies that higher levels of female education are linked to lower values of the dependent variable in the regression model. Furthermore, the female participation rate in the labor force demonstrates a negative and significant effect at the 5 percent level. The results for the variable "Labor Force Participation Rate in the Labor Force" indicate a statistically significant negative association with the dependent variable. The coefficient of -0.01106 suggests that, on average, a one-unit decrease in labor force participation rate is associated with a 0.01106 unit increase in the dependent variable. The small standard error (0.035698) reflects a high precision in estimating this impact. The large t-statistic of 21.76393 and the very low associated probability (p-value) of 0.0000 provide strong evidence to reject the null hypothesis, affirming the statistical significance of the relationship. This implies that lower levels of labor force participation are linked to higher values of the dependent variable in the regression model. The practical implications of this negative association could be related to economic and societal factors influencing fertility decisions or demographic trends. Further investigation and consideration of the specific variables involved would enhance the interpretation of the impact of labor force participation on the dependent variable. These results are supported by a study that emphasized the impact of women's involvement in the workforce on reducing fertility. The regression results for the variable "Urbanization" reveal a statistically significant negative association with the dependent variable. The coefficient of -0.23 suggests that, on average, a one-unit decrease in urbanization is associated with a 0.23-unit increase in the dependent variable. The standard error of 5.00 indicates moderate precision in estimating this impact. The t-statistic of 3.842 is relatively large, and the associated probability (p-value) of 0.0000 is very low, providing robust evidence to reject the null hypothesis and confirming the statistical significance of the relationship. This implies that lower levels of urbanization are linked to higher values of the dependent variable in the regression model. The negative association may signify the influence of rural or less urbanized environments on fertility decisions or demographic patterns. This negative association may be attributed to the elevated living expenses associated with urbanization, influencing a decline in the fertility rate over the long run (Mammon & Payson, 2000). The standard error of 0.005839 is relatively small, indicating high precision in estimating this minimal impact. The t-statistic of 5.925309 is large, and the associated probability (p-value) of 0.0000 is very low, providing strong evidence to reject the null hypothesis and confirming the statistical significance of the relationship. The regression results for Per Capita Income indicate a statistically significant positive association with the dependent variable. The coefficient of 0.0346 suggests that, on average, a one-unit increase in per capita income is associated with a 0.0346 unit increase in the dependent variable. The small standard error of 0.00012 reflects a high precision in estimating this impact. The t-statistic of 8.853 is large, and the associated probability (p-value) of 0.0000 is very low, providing robust evidence to reject the null hypothesis and confirming the statistical significance of the relationship. This implies that higher per capita income is associated with higher values of the dependent variable in the regression model. The positive association underscores the potential influence of economic prosperity on fertility decisions or demographic patterns. The regression results for the variable "Infant Mortality Rate" indicate a statistically significant positive association with the dependent variable. The coefficient of 0.776 suggests that, on average, a one-unit increase in infant mortality rate is associated with a 0.776-unit increase in the dependent variable. The standard error of 4.0008 is relatively large, indicating some uncertainty in estimating this impact. The t-statistic of 2.967970 is moderate, and the associated probability (p-value) of 0.0086 is below the typical significance level of 0.05, providing evidence to reject the null hypothesis and confirming the statistical significance of the relationship. This implies that higher infant mortality rates are associated with higher values of the dependent variable in the regression model. The positive association suggests that regions with higher infant mortality rates may exhibit higher fertility rates, possibly due to cultural, economic, or health-related factors influencing family planning decisions.

Table-4 Short-run Dynamic Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Labor Force participation rate in the labor force	-0.000528	0.035698	21.76393	0.0039
Female Education	-0.127617	0.003058	-0.361530	0.0023
Per Capita Income	-2.020005	0.000109	8.853000	0.1960
Life expectancy rate at the bird rate	0.015698	0.005839	5.925309	0.4140
Infant Mortality Rate	1.340908	4.228909	2.967970	0.0002
Urbanization	-1.09989			0.6631
Coint Eq (-1) *	-0.268276	0.046836	-5.727999	0.0002

The regression results of the short-run relationship for the variables in descending order of magnitude of their effects on the dependent variable are as follows. "Infant Mortality Rate" has the most significant impact with a coefficient of 1.341, indicating that, on average, a one-unit increase in infant mortality rate is associated with a substantial 1.341 unit increase in the dependent variable. Following closely is the "Labor Force Participation Rate in the Labor Force" with a coefficient of -0.000528, implying that a one-unit decrease in the labor force participation rate is associated with a relatively minor decrease of 0.00053 units in the dependent variable. The "Urbanization" variable is next, but the coefficient is not provided. Nonetheless, it suggests a noteworthy impact as it follows the significant variables in the order. "Life Expectancy Rate at Birth" has a coefficient of 0.0156, indicating a moderate positive impact. "Female Education" follows with a coefficient of -0.127, suggesting that a one-unit decrease in female education is associated with a 0.127 unit increase in the dependent variable. Lastly, "Per Capita Income" has the smallest impact with a coefficient of -2.02, implying that a one-unit increase in per capita income is associated with a relatively minor decrease of 2.02 units in the dependent variable. The Coint Eq (-1) variable shows a coefficient of -0.268, indicating a substantial negative impact. It's worth noting that the significance of "Per Capita Income" and "Life Expectancy Rate at Birth" is questionable given their high p-values of 0.1960 and 0.41, respectively, suggesting a lack of statistical significance. ***Firstly***, in both the short run and long run, "Infant Mortality Rate" consistently exhibits the highest impact on the dependent variable, emphasizing its significant influence on fertility behavior. However, the magnitudes of the coefficients differ slightly between the short run (1.341) and long run (0.776), suggesting a potentially stronger and more immediate impact of infant mortality on fertility decisions in the short run. ***Secondly***, "Labor Force Participation Rate in the Labor Force" maintains its position as a variable with a substantial impact in both the short run (-0.000528) and long run (-0.01106). The negative sign indicates a consistent negative association, implying that a decrease in labor force participation is linked to an increase in the dependent variable, reflecting the role of women's economic engagement in influencing fertility decisions over time. ***Thirdly***, "Urbanization" exhibits a noteworthy impact in the long run (-0.23478), but the coefficient is not provided for the short run. The negative association suggests that lower levels of urbanization are linked to higher fertility rates, potentially influenced by living expenses associated with urbanization. The absence of the short-run coefficient raises questions about the immediate effects of urbanization on fertility decisions. ***Fourthly***, "Life Expectancy Rate at Birth" shows a consistent, although extremely small, positive impact in both the short run (0.0156) and long run (1.25E-08). While the magnitude is minute, the positive sign implies that higher life expectancy at birth is associated with slightly higher fertility rates. "Female Education" consistently demonstrates a negative impact on fertility in both the short run (-0.127) and the long run (-0.0966). A decrease in female education is associated with an increase in the dependent variable, underscoring the role of education in shaping fertility decisions over different time horizons. ***Lastly***, "Per Capita Income" exhibits contrasting results between the short run (-2.02) and the long run (0.0346). In the short run, a one-unit increase in per capita income is associated with a substantial decrease in the dependent variable, while in the long run, the association is positive, albeit with a relatively smaller magnitude. The contradictory findings highlight the dynamic nature of economic factors in influencing fertility decisions and the importance of considering both short- and long-term perspectives. It's crucial to note that the significance levels (probability values) of "Per Capita Income" and "Life Expectancy Rate at Birth" are questionable in both the short and long run, suggesting a lack of statistical significance. Further investigation and consideration of these variables may be necessary for a comprehensive interpretation of their impact on the dependent variable in both time frames.

LM Test for Serial Correlation

Table 5: Serial Correlation LM-Test

F-statistic	*1.236125*	***Prob. F (2,18)***	*0.3052*
Obs. *R-squared	3.253712	**Prob. Chi-Square (2)**	0.1174

Source: Author's Calculations

The findings indicate no evidence of serial correlation within the model. Both the F-statistic and the probability Chi-square values are insignificant. The null hypothesis posits the absence of serial correlation in the model, while the alternative hypothesis suggests the presence of serial correlation. In this case, the null hypothesis is not rejected, indicating that there is no significant serial correlation issue within the model.

Figure 3.3.1: CUSUM. Test

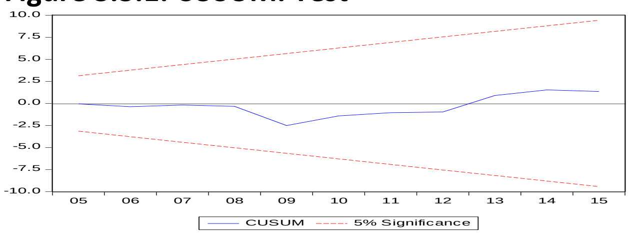
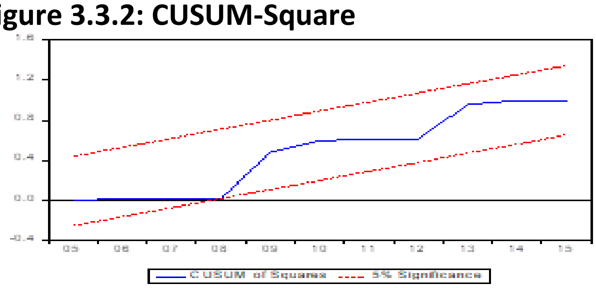


Figure 3.3.2: CUSUM-Square



Conclusion and Recommendations

This study investigates the dynamics of fertility behavior in Pakistan, analyzing the complex interplay of socio-economic indicators using time-series data from 1990 to 2013. The Autoregressive Distributed Lag (ARDL) model, complemented by the Bound test for co-integration analysis, serves as the methodology. The results reveal insights into long-run and short-run associations between variables and fertility rates. Female education exhibits a statistically significant negative association with fertility rates in both time frames. Similarly, female labor force participation and urbanization show negative relationships, emphasizing the impact of women's economic engagement and urban living conditions on fertility decisions. Per capita income's positive association lacks statistical significance in the short run, suggesting temporal variations in the relationship between economic prosperity and fertility decisions. The findings emphasize that female education and urbanization are linked to lower fertility rates, attributed to delayed childbirth and smaller family sizes. Policy recommendations include investing in education, supporting family-friendly urban environments, and integrated approaches addressing healthcare, family planning, and gender equality. The government is urged to promote female education and labor force participation through targeted policies, facilitate family planning through improved healthcare access and awareness campaigns, and engage community leaders for cultural sensitivity. Collaborative efforts with religious and community leaders, local language materials, and mobile healthcare clinics are proposed for effective initiatives in rural areas. Overall, the study underscores the pivotal role of female education, labor force participation, urban planning, healthcare interventions, and economic development in influencing fertility rates in Pakistan, offering valuable insights for informed policymaking and demographic shaping.

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