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# Exploring the Impact of Socio-Economic Factors on Fertility Trends: Evidence from Lebanon

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**Abstract**

The primary objective of this study is to explore the influence of various socio-economic factors on the fertility rate in Lebanon spanning from 1971 to 2016. To begin with, the stationarity of the variables under consideration is assessed using the Philips Perron unit root test. Subsequently, the Autoregressive Distributed Lag (ARDL) approach to co-integration is employed to investigate the presence of co-integration among the variables within the model. Finally, the study delves into the causal relationships among the variables through the application of Variance Decomposition and Impulse Response Function analyses. Through these methodological approaches, the study aims to gain deeper insights into the complex interplay between socio-economic factors and fertility rates in Lebanon over the specified time period. The findings of the estimation indicate that the selected variables within the model exhibit a mixed order of integration. In the long run, the study reveals significant negative associations between female education and urbanization with the fertility rate in Lebanon. This suggests that as female education levels increase and urbanization progresses, there is a notable decrease in the fertility rate within the country. Such results underscore the importance of socio-economic factors in shaping demographic trends and highlight the potential of educational attainment and urban development in influencing fertility behavior. The findings suggest that life expectancy and per capita income demonstrate a positive and significant association with fertility in Lebanon. Moreover, the estimated Error Correction Term (ECT) suggests that short-term deviations take more than 5 years to converge to the long-run equilibrium. This underscores the importance of sustained socio-economic improvements in influencing the fertility rate in Lebanon. By focusing on enhancing life expectancy and increasing per capita income levels, policymakers can potentially contribute to lowering fertility rates in the country over the long term.

**Keywords:** Fertility rate, Socio-economic factors, Lebanon, ARDL approach, Demographic trends
**JEL Codes:** J13, O15, C32

## 1. INTRODUCTION

Throughout the 20th century, advancements in healthcare, sanitation, and technology led to significant declines in mortality rates worldwide. These improvements, coupled with increased access to healthcare and better living conditions, resulted in longer life expectancies for many populations. As a result, the number of people surviving into adulthood and old age increased, contributing to overall population growth. However, alongside declining mortality rates, fertility rates have remained a crucial determinant of population dynamics, especially in developing countries. Despite improvements in healthcare and education, many regions continue to experience high fertility rates due to factors such as cultural norms, limited access to family planning resources, and economic insecurity. As a result, population growth in these areas has been driven primarily by high birth rates rather than declining death rates. Understanding the interplay between mortality and fertility rates is essential for addressing population growth and its associated challenges, including strains on resources, environmental degradation, and socioeconomic disparities. By examining the factors influencing fertility rates and implementing effective policies and interventions, societies can work towards achieving sustainable population growth and promoting the well-being of future generations. Indeed, targeted fertility management can play a crucial role in moderating population growth, particularly in light of shifting demographic trends. Historically, both mortality and fertility rates were elevated, resulting in relatively slow population growth over extended periods. However, significant changes occurred as advancements in industrialization and healthcare led to substantial increases in life expectancy. The advent of modern healthcare, improved sanitation, and access to essential services drastically reduced mortality rates, allowing more individuals to survive into adulthood and beyond. This demographic shift, combined with persistently high fertility rates in many regions, contributed to a rapid expansion of the global population. As societies continue to evolve, there has been growing recognition of the importance of targeted fertility management in addressing population growth. By providing access to comprehensive reproductive healthcare, family planning services, and education, individuals and communities can make informed choices about family size and spacing of children. Additionally, initiatives aimed at empowering women, promoting gender equality, and addressing socioeconomic disparities can further support efforts to manage fertility rates effectively. By adopting

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evidence-based strategies and investing in reproductive health programs, societies can navigate the complexities of population dynamics while promoting sustainable development and improving the quality of life for current and future generations.

The decline in fertility rates represents a significant and multifaceted socioeconomic phenomenon, particularly in developing countries. Within the existing literature, demographers and researchers have proposed various theories and hypotheses to elucidate this complex trend. The Millennium Development Goals outlined by the United Nations also underscore several socioeconomic factors implicated in reducing fertility rates across developing nations. Empirical evidence suggests that urbanization, women's education, and the economic status of families are among the key socioeconomic factors influencing fertility rates (Ellis, 1988). As populations undergo urbanization, with increasing proportions residing in urban centers, various demographic shifts occur, including changes in family structure, access to healthcare, and employment opportunities. Furthermore, investments in women's education have been shown to correlate with lower fertility rates, as educated women often delay marriage and childbearing, pursue career opportunities, and possess greater knowledge about family planning and reproductive health. Additionally, the economic status of families plays a pivotal role, with higher-income households often exhibiting lower fertility rates due to increased access to resources, including healthcare services and contraceptives. By understanding and addressing these socioeconomic determinants, policymakers and stakeholders can develop targeted interventions aimed at promoting reproductive health, expanding educational opportunities for women, and fostering economic empowerment. Such efforts are essential for facilitating fertility decline and advancing sustainable development goals in developing countries. The socioeconomic and demand theories of fertility propose that various socioeconomic factors influence the incentives for fertility decline. Individual decisions regarding family size and childbearing are shaped by a range of economic and social considerations, including income levels, life expectancy of children, educational attainment, and social status.

Research by Galloway, Hammel, and Lee (1994) and Potter, Schmertmann, and Cavenaghi (2002) has highlighted the significance of these factors in shaping fertility behaviors. Higher income levels often provide families with greater resources and opportunities for childcare, education, and healthcare, leading to lower fertility rates as couples may opt for smaller family sizes to maintain their standard of living. Moreover, improvements in life expectancy and healthcare contribute to lower child mortality rates, reducing the need for larger family sizes to ensure offspring survival. Education, particularly of women, plays a crucial role in fertility decline by empowering individuals with knowledge about family planning methods, reproductive health, and the benefits of smaller family sizes in terms of economic and social outcomes. Additionally, social status and cultural norms influence fertility decisions, with societal expectations and aspirations often shaping individuals' desires regarding family size and childbearing. As societies undergo socioeconomic development and urbanization, traditional norms regarding family size may evolve, leading to shifts towards smaller family sizes and lower fertility rates. According to the classical demographic transition theory proposed by Notestein (1953), fertility rates are initially high in traditional agricultural societies to compensate for high mortality rates and ensure population survival. In such societies, having many children serves as a form of insurance against the risk of child mortality and other threats to family well-being. As societies undergo development and experience changes in socioeconomic structure, including rising levels of education, urbanization, industrialization, increased investment in public healthcare, and shifts in the costs and benefits associated with having children, fertility patterns begin to change. The transition from high to low fertility rates is driven by several key factors. Firstly, improvements in child survival rates, resulting from advancements in healthcare and sanitation, reduce the need for families to have many children as a form of insurance against mortality. Additionally, the economic value of children tends to decline as societies industrialize and urbanize, leading to a shift in attitudes towards smaller family sizes. Rising costs associated with raising and educating children, coupled with increasing opportunities for women in the workforce, contribute to a desire for smaller families. As a result, there is a growing demand for birth control and family planning services, which enable individuals and couples to make informed decisions about reproduction and contraception. This increased access to contraception and the desire for smaller families ultimately lead to a decline in actual fertility rates.

The empirical evidence from both developed and developing countries consistently demonstrates a strong association between women's education and lower fertility rates (Schultz, 1973; Ainsworth et al., 1996; Vavrus and Larsen, 2003; Sackey, 2005). As women's educational attainment increases, there is a corresponding increase in their participation in the labor market, which enhances the economic value of their time within society. Numerous studies have shown that higher levels of women's education are associated with a reduction in the number of children per woman (Schultz, 1973; Singh, 1994). This study aims to investigate the impact of selected socio-economic factors on fertility in Lebanon from 1971 to 2014. Such comprehensive analyses are rare for Lebanon, making this study a valuable contribution to the existing literature on the subject. By examining the interplay between socio-economic variables and fertility patterns in Lebanon, this study seeks to enhance our understanding of the determinants of fertility in the country and provide insights that can inform policy interventions and programs aimed at managing population dynamics.

## 2. LITERATURE REVIEW

It is common for researchers to make broad statements regarding developmental indicators such as non-agricultural development and gross domestic product (GDP). However, changes in these indicators may not always accurately reflect changes in the incentives to limit fertility. Neoclassical economists argue that increased human capital formation, which includes factors such as education and skill development, can lead to greater participation of women in the labor market. This

increased participation can, in turn, influence fertility rates, as women may opt for smaller family sizes due to their enhanced economic opportunities (Singh, 1994). It is widely acknowledged that women's education is associated with smaller desired family sizes worldwide. Coale's observations, articulated in "The Decline of Fertility in Europe from the French Revolution to World War II" (1967), underscore the multifaceted nature of fertility control mechanisms in modern societies. Beyond education and literacy, the widespread availability of communication networks and the transformation of employment sectors play pivotal roles in shaping fertility preferences. In modern societies, access to education empowers women by providing them with knowledge and skills, leading to greater autonomy in decision-making, including family planning choices. Additionally, the transition from agrarian to industrial economies alters societal structures and norms, influencing attitudes towards family size and child-rearing practices. Moreover, the decline in child mortality rates due to advancements in healthcare and sanitation means that families no longer need to have as many children to ensure that some survive into adulthood. This demographic shift, coupled with urbanization and the rise of nuclear families, contributes to smaller desired family sizes. Legislation and policies further reinforce the trend towards smaller families by prohibiting child labor and mandating children's education. These measures not only reflect societal values but also contribute to the overall reduction in fertility rates by altering the economic and social dynamics surrounding childbearing. Coale's insights, as outlined in "The Decline of Fertility in Europe from the French Revolution to World War II," highlight the intricate interplay between socio-economic factors, cultural norms, and policy interventions in shaping fertility patterns in modern societies.

Empirical tests of socio-economic theories provide valuable insights into how different institutional and policy frameworks shape fertility preferences, even among countries with similar levels of development. For instance, two countries may exhibit comparable scores of development, yet their approaches to family size limitations can vary significantly due to divergent welfare state structures and policy objectives. In one country, a robust welfare state may provide extensive support and benefits to parents, effectively offsetting the financial burdens associated with raising children. This can lead to smaller desired family sizes as parents feel less pressure to have more children for economic security. Conversely, another country with equivalent development scores may lack such comprehensive welfare provisions, resulting in different fertility patterns driven by financial considerations. However, assessing these dynamics can be challenging due to the inherent limitations of international development data. Issues such as data accuracy, comparability across countries, and consistency over time pose significant challenges for researchers. As highlighted by Srinivasan (1994) and Lloyd et al. (2000), international development data are often subject to discrepancies and inconsistencies, making it difficult to draw robust conclusions from cross-country comparisons. Despite these challenges, empirical studies play a crucial role in elucidating the complex interplay between socio-economic factors, institutional arrangements, and policy interventions in shaping fertility behaviors across diverse contexts. By carefully analyzing available data and accounting for methodological limitations, researchers can enhance our understanding of the determinants of family size and contribute to informed policymaking in the realm of population and development.

Indeed, a cursory examination of fertility data from sources like the United Nations Population Division reveals the inherent complexities and uncertainties surrounding fertility estimates, particularly in countries such as Angola or Cambodia (United Nations Population Division, 2004). These challenges underscore the need for cautious interpretation and handling of fertility data in empirical analyses. Moreover, the presence of noise and inconsistencies in the data further complicates efforts to discern the relationship between fertility patterns and socioeconomic changes. While development indicators serve as useful proxies for understanding underlying social phenomena that influence fertility, they are inherently imperfect and subject to limitations. Socioeconomic theories of fertility anticipate an association between development indicators and fertility rates, yet this relationship is marked by numerous exceptions and variations across different contexts. Consequently, drawing definitive conclusions about the validity of socioeconomic theories based solely on the strength of the cross-country relationship between fertility and development is inherently challenging. The United Nations (1985) conducted an investigation into the relationship between fertility rates and women's labor force participation across a panel of countries. The findings of this study revealed that when sociological factors are considered, increased women's labor force participation tends to diminish the traditional roles of women as homemakers and mothers. Consequently, there emerges a negative correlation between women's employment and their fertility rates. Conversely, when the economic value of women's labor is taken into account, a different dynamic emerges. In this scenario, women may opt to have fewer children in order to maintain their active participation in the labor force. This suggests that women face challenges in balancing maternity and employment, leading to a negative relationship between fertility rates and women's work. Overall, these findings highlight the complex interplay between women's employment, societal roles, and fertility decisions. While sociological factors may influence the traditional roles of women, economic considerations also play a significant role in shaping fertility preferences and labor force participation among women.

Ellis (1988) underscores that the process of infant nutrition demands considerable energy and time from women, thereby suggesting that having more children could disrupt women's socio-economic activities. In regions where education levels, urbanization, and modernization are high, the opportunity cost associated with women not participating in the workforce tends to be greater compared to areas lacking such advancements. The findings of the study suggest that women's education and urbanization exert an inverse influence on fertility rates. In other words, as education levels rise and urbanization increases, there tends to be a corresponding decrease in fertility rates. This highlights the importance of socio-economic factors in shaping fertility decisions and underscores the role of education and urbanization in facilitating lower fertility rates. Bettio

and Villa's (1998) investigation sheds light on the intricate interplay between unemployment dynamics and fertility behaviors in Italy. Their findings underscore a nuanced relationship wherein variations in unemployment rates exert discernible effects on fertility patterns among women. The study reveals a noteworthy negative correlation between unemployment levels and the propensity for childbirth. Delving deeper, the study elucidates how the labor force participation of women serves as a pivotal factor in shaping household income dynamics. In instances where one partner experiences unemployment, increased participation of women in the workforce helps mitigate the financial strain, thereby cushioning the impact of economic downturns on family finances. Consequently, fewer women opt to allocate their prime childbearing years to the pursuit of career opportunities, resulting in a discernible decline in overall fertility rates across the population. Bettio and Villa's research underscores the complex interplay between economic factors and fertility decisions, highlighting how shifts in unemployment dynamics can intricately influence family planning behaviors and demographic trends within a society.

Mammen and Paxson's (2000) study builds upon the theoretical framework established by Goldin (1995), delving into the nuanced relationship between women's income per capita and their labor force participation rates. Their research aims to unravel the complexities of this association, particularly focusing on the impact of economic structures and urbanization on fertility dynamics. Their findings reveal a U-shaped relationship between income per capita and women's labor force participation rates. In agrarian economies characterized by poverty, women often engage in agricultural activities alongside their family members, contributing to higher employment rates. However, the demands of childcare within these traditional family structures can lead to elevated fertility rates. Conversely, in economies dominated by manufacturing sectors and characterized by low to moderate urbanization, women may struggle to balance employment obligations with familial responsibilities. As urbanization levels increase, women are more likely to participate in the labor market, but fertility rates tend to decline as the demands of urban life necessitate smaller family sizes and greater emphasis on career pursuits. Kravdal's (2002) investigation delves into the intricate relationship between fertility rates and community education across a spectrum of developed and developing nations. Through empirical analysis, the study unveils a robust negative correlation between fertility rates and levels of community education. The findings bolster the tenets of neoclassical theory, which underscore the pivotal role of human capital investment in altering demographic behaviors. Specifically, the study aligns with the theory's proposition that heightened investments in education lead to increased female labor force participation. Over the long term, this phenomenon tends to reshape household fertility preferences, with women opting for smaller family sizes. By shedding light on the transformative impact of education on fertility dynamics, Kravdal's study contributes valuable insights to our understanding of demographic transitions in diverse socio-economic contexts. It underscores the pivotal role of educational attainment in shaping not only individual life trajectories but also broader demographic trends within communities and nations.

Kreider et al. (2009) embark on an extensive examination of the factors contributing to fertility decline across 47 countries spanning Sub-Saharan Africa, the Caribbean, Asia, Latin America, and North Africa. Leveraging data from Demographic and Health Surveys (DHS), the study sets out to unravel the intricate interplay between the pace of socio-economic advancement and the corresponding stage of fertility transition. Employing multivariate analysis, the study meticulously probes the relationships among various variables encapsulating socio-economic progress and fertility dynamics. The findings of the study unveil compelling associations, particularly highlighting the influential roles of women's educational attainment, infant and child mortality rates, and per capita income growth. In elucidating the nuanced relationship between socio-economic development and fertility trends, the study underscores the pivotal role of economic growth trajectories. Specifically, it reveals that more rapid GDP growth tends to yield smaller magnitudes of fertility reduction over time. This nuanced insight offers valuable implications for policymakers and stakeholders engaged in addressing demographic challenges and fostering sustainable development strategies across diverse global contexts. Adhikari (2010) delves into the nuanced dynamics of fertility differentials among married women of reproductive age in Nepal, a country that has witnessed a decline in birth rates since 1981. Drawing upon data from the Demographic and Health Surveys (DHS) conducted in 2006, the study meticulously analyzes the multifaceted interplay of demographic, socio-economic, and cultural factors shaping fertility patterns. Employing a comprehensive analytical approach, Adhikari applies bivariate analysis, including one-way ANOVA, and multiple linear regressions to disentangle the intricate relationships between various predictors and fertility outcomes. Through rigorous statistical analysis, the study sheds light on the impact of each independent variable on fertility, while controlling for the influence of other relevant factors. A notable finding emerges regarding the influence of literacy status on fertility, with literate women exhibiting, on average, a significantly lower number of children ever born compared to their illiterate counterparts. Moreover, the study uncovers intriguing dynamics related to cultural factors, indicating that among Muslim women without exposure to mass media, the likelihood of having more children compared to Hindu women without similar media exposure is notably higher. In synthesizing these findings, Adhikari underscores the pivotal role of socio-economic factors in shaping fertility dynamics within the Nepalese context. This nuanced understanding of the determinants of fertility underscores the importance of targeted interventions and policy initiatives aimed at addressing socio-economic disparities and fostering sustainable demographic outcomes in Nepal. Abdullah et al. (2013) undertake a comprehensive investigation into the intricate relationship between human development indicators and fertility decline in Pakistan spanning the period from 1971 to 2010. Employing sophisticated econometric techniques such as the Bound Testing approach (ARDL) and Vector Error Correction Model (VECM), the study rigorously analyzes the empirical dynamics of the selected variables within the model. The results of the empirical analysis unveil compelling insights into the long-run co-integration and short-run dynamics between total

fertility rate and various human development indicators. Specifically, the study identifies significant negative associations between fertility and indicators such as secondary school enrollment and life expectancy at birth. These findings underscore the pivotal role of education and healthcare in driving fertility decline, highlighting the importance of investing in human capital formation as a means to curb population growth. Moreover, the study reveals nuanced insights regarding the impact of GDP per capita on fertility, indicating a positive but statistically insignificant relationship. While the precise influence of economic factors on fertility remains nuanced, the findings suggest that solely focusing on economic growth may not suffice to drive fertility decline in Pakistan. In light of these findings, the study advocates for targeted interventions aimed at bolstering human development indicators, particularly through the provision of enhanced education and healthcare services. By prioritizing investments in human capital formation, policymakers can effectively contribute to the sustained decline in fertility rates, thereby fostering sustainable demographic outcomes in Pakistan.

## 3. METHODOLOGICAL FRAMEWORK

Thompson's seminal work in "Population Problems" (1947) sparked the enduring debate surrounding fertility transition. He astutely noted the significant shifts in population growth rates, particularly the rapid decline in birth rates, which have profound implications for both national economies and international relations. Despite decades of research, fertility and its determinants remain a complex and multifaceted subject, influenced by a myriad of societal and individual factors. The existing literature on fertility determinants reflects this complexity, offering a diverse array of perspectives and analyses. While it is widely acknowledged that fertility decisions are deeply personal, shaped by individual circumstances and preferences, understanding the broader societal context is crucial. Researchers have predominantly focused on exploring the array of choices available to women and the factors that influence their reproductive decisions. Against this backdrop, the primary objective of this study is to identify socioeconomic factors that exhibit significant correlations with fertility in Lebanon. By delving into these factors, policymakers can gain valuable insights into potential avenues for intervention. By shaping public policy decisions to address these key determinants, stakeholders can work towards effectively reducing fertility rates in Lebanon, thereby fostering sustainable demographic outcomes and socio-economic development. Following the previous literature review and keeping work of Ainsworth et al., (1996), Bloom et al. (2007) and Abdullah et al., (2013) in view this study propose the functional form of the model:

$$\mathrm{LFRIR}_t = +\beta_0 + \beta_1 \mathrm{LFSS}_t + \beta_2 \mathrm{LLIF}_t + \beta_3 \mathrm{LURB}_t + \beta_2 \mathrm{LGDPP}_t + \beta_2 \mathrm{LINF}_t + \mu_t \qquad (1)$$

Here
FRIR=Fertility Rate
FSS=Women Secondary School Enrollment Rate
LIF=Life Expectancy
URB=Urbanization
GDPP=Per Capita Income
INF=Inflation Rate
t=Time Period
u=Error Term

## 4. FINDINGS AND DISCUSSIONS

Table 1 provides the descriptive statistics for six variables: LFIR (Labor Force Participation Rate), LFSSE (Life Satisfaction Score), LLIFE (Life Expectancy), LURB (Urbanization Rate), LGDPP (Gross Domestic Product per Capita), and LINF (Inflation Rate). The mean values for these variables are 1.194813, 3.697530, 4.209178, 4.048760, 7.993074, and 1.657178, respectively. The median values are slightly lower, indicating a slight skewness towards the lower end of the distribution. The range of values varies across variables, with LFIR ranging from 0.693147 to 1.839279, LFSSE from 2.557670 to 4.553068, LLIFE from 3.956949 to 4.312173, LURB from 3.791098 to 4.196540, LGDPP from 7.365562 to 8.549281, and LINF from 0.635737 to 3.194367. Standard deviations reveal the extent of dispersion around the mean, with LFIR having a standard deviation of 0.428748, LFSSE 0.715461, LLIFE 0.104165, LURB 0.127676, LGDPP 0.324620, and LINF 0.588489. Skewness measures the asymmetry of the distribution. Positive skewness is observed for LFIR and LGDPP, indicating a slight right skew, while negative skewness is observed for LFSSE, LLIFE, LURB, and LINF, indicating a slight left skew. Kurtosis measures the peakedness of the distribution. LLIFE and LURB exhibit relatively higher kurtosis values, indicating a more peaked distribution compared to the other variables. The Jarque-Bera test statistic assesses the normality of the data. While most variables have probabilities greater than 0.05, indicating normality, LLIFE and LINF have probabilities slightly below 0.05, suggesting departure from normality. However, caution should be exercised in interpretation given the small sample size. Overall, these descriptive statistics provide insights into the central tendency, variability, and distributional characteristics of the variables under consideration.

Table 3 displays the lag order selection criteria results for the Vector Autoregression (VAR) model with endogenous variables including LFIR (Labor Force Participation Rate), LFSSE (Life Satisfaction Score), LLIFE (Life Expectancy), LURB (Urbanization Rate), LGDPP (Gross Domestic Product per Capita), and LINF (Inflation Rate). The table presents the log-likelihood (LogL) for each lag order, along with the sequential modified likelihood ratio (LR) test statistic, the final prediction

error (FPE), and information criteria such as the Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ). Upon examination of the criteria, it is observed that for lag orders 1, 2, and 3, the LR statistic exceeds the critical value, indicating significance at the 5% level. Additionally, the FPE is minimized at lag order 2, indicating improved predictive accuracy. The information criteria AIC, SC, and HQ also support selecting lag order 2 as they are minimized or close to the minimum at this lag. Therefore, lag order 2 is selected as the optimal lag order based on these criteria. This selection process ensures the VAR model's effectiveness in capturing the dynamic relationships among the endogenous variables while avoiding overfitting or underfitting.

**Table 1: Descriptive Statistics**

| | LFIR | LFSSE | LLIFE | LURB | LGDPP | LINF |
|---|---|---|---|---|---|---|
| Mean | 1.194813 | 3.697530 | 4.209178 | 4.048760 | 7.993074 | 1.657178 |
| Median | 1.184790 | 3.726329 | 4.259204 | 4.087018 | 7.951005 | 1.602265 |
| Maximum | 1.839279 | 4.553068 | 4.312173 | 4.196540 | 8.549281 | 3.194367 |
| Minimum | 0.693147 | 2.557670 | 3.956949 | 3.791098 | 7.365562 | 0.635737 |
| Std. Dev. | 0.428748 | 0.715461 | 0.104165 | 0.127676 | 0.324620 | 0.588489 |
| Skewness | 0.168727 | -0.291729 | -0.973710 | -0.505734 | 0.192531 | 0.521824 |
| Kurtosis | 1.397105 | 1.630753 | 2.731963 | 1.874219 | 2.028919 | 2.794490 |
| Jarque-Bera | 4.807304 | 3.969007 | 6.923522 | 4.103724 | 1.955193 | 2.027157 |
| Probability | 0.090387 | 0.137449 | 0.031374 | 0.128495 | 0.376214 | 0.362918 |
| Sum | 51.37698 | 158.9938 | 180.9946 | 174.0967 | 343.7022 | 71.25866 |
| Sum Sq. Dev. | 7.720633 | 21.49912 | 0.455714 | 0.684650 | 4.425873 | 14.54542 |

Table 2 presents the results of the Phillips-Perron (PP) unit root test for the variables LFIR (Labor Force Participation Rate), LFSSE (Life Satisfaction Score), LLIFE (Life Expectancy), LGDPP (Gross Domestic Product per Capita), and LINF (Inflation Rate). The PP test is conducted both at the level and after differencing the series once (at first difference) to check for stationarity. At the level, LFIR, LFSSE, and LINF show t-statistics that are not statistically significant at conventional levels, with probabilities greater than 0.05. This suggests that these variables are non-stationary at the level. In contrast, LLIFE and LGDPP exhibit highly significant t-statistics at the level, with probabilities close to zero. This indicates that LLIFE and LGDPP are stationary at the level. After differencing the series once, LFIR, LFSSE, and LINF still do not show statistically significant t-statistics, with probabilities greater than 0.05. This implies that differencing the series once did not achieve stationarity for these variables. However, LLIFE and LGDPP continue to display statistically significant t-statistics after differencing, with probabilities close to zero. This suggests that LLIFE and LGDPP are integrated of order one, or I(1), indicating stationarity after differencing. Overall, these results provide insights into the stationarity properties of the variables and are crucial for subsequent time series analysis and modeling.

**Table 2: PP Unit Root Test**

| | At level | | At First Difference | |
|---|---|---|---|---|
| Variable | t-Stat | Prob. | t-Stat | Prob. |
| LFIR | -1.320969 | 0.6110 | -1.732988 | 0.0787 |
| LFSSE | -1.441787 | 0.5528 | -3.390163 | 0.0171 |
| LLIFE | -9.641981 | 0.0000 | -2.088421 | 0.0367 |
| LGDPP | -5.212136 | 0.0001 | -2.285735 | 0.0232 |
| LINF | -1.027650 | 0.7347 | -9.096377 | 0.0000 |

**Table 3: VAR Lag Order Selection Criteria**

Endogenous variables: LFIR LFSSE LLIFE LURB LGDPP LINF

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 0 | 267.8451 | NA | 8.30e-14 | -13.09226 | -12.83892 | -13.00066 |
| 1 | 654.7960 | 638.4689 | 2.03e-21 | -30.63980 | -28.86648* | -29.99862 |
| 2 | 703.2010 | 65.34667* | 1.24e-21* | -31.26005* | -27.96673 | -30.06929* |
| 3 | 732.4349 | 30.69562 | 2.47e-21 | -30.92174 | -26.10844 | -29.18140 |

Table 4 presents the results of the ARDL Bounds Testing Approach for the dependent variable LFIR (Labor Force Participation Rate) with the specified lag structure ARDL(1,0,1,1,0,1). The critical values for the F-statistics and the W-statistic are provided, with values of 12.2442 and 73.4650, respectively. For both the 95% and 90% confidence levels, the lower and upper bounds are presented. At the 95% confidence level, the lower bound ranges from 2.9591 to 4.3020, while the upper bound ranges from 17.7547 to 25.8121. Similarly, at the 90% confidence level, the lower bound ranges from 2.4575 to

3.6766, and the upper bound ranges from 14.7448 to 22.0598. These bounds provide a range within which the estimated coefficients in the ARDL model must fall to be considered statistically significant at the specified confidence levels. The F-statistics and W-statistic are utilized to test the significance of the coefficients in the ARDL model.

**Table 4: ARDL Bounds Testing Approach**

| Dependent Variable LFIR | | | | |
|---|---|---|---|---|
| | F-Statistics 12.2442 | | W-statistic 73.4650 | |
| Critical Value | Lower Bound | Upper Bound | Lower Bound | Upper Bound |
| 95% | 2.9591 | 4.3020 | 17.7547 | 25.8121 |
| 90% | 2.4575 | 3.6766 | 14.7448 | 22.0598 |

Table 5 provides the estimated long-run coefficients derived using the ARDL approach, with the labor force participation rate (LFIR) designated as the dependent variable. The table includes several regressors: LFSSE (Labor Force Supply Elasticity), LLIFE (Average Life Expectancy), LURB (Urbanization Rate), LGDPP (Gross Domestic Product per Capita), and LFIN (Financial Development Index), along with a constant term (C). Each regressor is accompanied by its respective coefficient, standard error, t-ratio, and probability, denoted within brackets. The coefficient for LFSSE stands at -0.61284, with a standard error of 0.18689, yielding a t-ratio of -3.2792, indicating statistical significance at the 0.003 level. For LLIFE, the coefficient is 1.7932, with a standard error of 0.86163, resulting in a t-ratio of 2.0811, significant at the 0.046 level. The coefficient for LURB is -4.5532, with a standard error of 1.3701, leading to a t-ratio of -3.3232, which is significant at the 0.002 level. LGDPP has a coefficient of 1.5222, with a standard error of 0.36055, resulting in a t-ratio of 4.2218, significant at the 0.000 level. In contrast, LFIN's coefficient is -0.042604, with a standard error of 0.039629, yielding a t-ratio of -1.0751, indicating no statistical significance at the 0.290 level. Similarly, the constant term C has a coefficient of 2.0059, with a standard error of 3.4802, resulting in a t-ratio of 0.57637, which is not statistically significant at the 0.568 level. These coefficients represent the long-term associations between the LFIR and the specified regressors, elucidating their respective impacts on labor force participation rates over the long run.

**Table 5: Estimated Long Run Results**

| Dependent variable is LFIR | | | |
|---|---|---|---|
| Regressor | Co-efficients | Standard-Error | T-Ratio (Prob) |
| LFSSE | -.61284 | .18689 | -3.2792[.003] |
| LLIFE | 1.7932 | .86163 | 2.0811[.046] |
| LURB | -4.5532 | 1.3701 | -3.3232[.002] |
| LGDPP | 1.5222 | .36055 | 4.2218[.000] |
| LFIN | -.042604 | .039629 | -1.0751[.290] |
| C | 2.0059 | 3.4802 | .57637[.568] |

**Table 6: Vector Error-Correction Model Results**

| Regressor | Co-efficients | Standard-Error | T-Ratio (Prob) |
|---|---|---|---|
| dLFSSE | -.11498 | .041364 | -2.7796[.009] |
| dLLIFE | -1.4575 | .54052 | -2.6964[.011] |
| dLURB | 3.2887 | 1.3531 | 2.4306[.020] |
| dLGDPP | .28558 | .036170 | 7.8955[.000] |
| dLINF | .0035595 | .0048560 | .73301[.468] |
| ecm(-1) | -.18761 | .050831 | -3.6909[.001] |

Table 6 presents the results of the Vector Error-Correction Model (VECM), where the dependent variable is the first difference of LFIR (dLFIR), indicating changes in the labor force participation rate. The table includes several regressors: dLFSSE (Change in Labor Force Supply Elasticity), dLLIFE (Change in Average Life Expectancy), dLURB (Change in Urbanization Rate), dLGDPP (Change in Gross Domestic Product per Capita), and dLINF (Change in Financial Development Index), along with the error correction term ecm(-1). For each regressor, the table provides the coefficient, standard error, t-ratio, and probability (in brackets) associated with its estimated coefficient. The coefficient for dLFSSE is -0.11498, with a standard error of 0.041364, resulting in a t-ratio of -2.7796, significant at the 0.009 level. Similarly, for dLLIFE, the coefficient is -1.4575, with a standard error of 0.54052, yielding a t-ratio of -2.6964, significant at the 0.011 level. The coefficient for dLURB is 3.2887, with a standard error of 1.3531, resulting in a t-ratio of 2.4306, significant at the 0.020 level. dLGDPP has a coefficient of 0.28558, with a standard error of 0.036170, leading to a t-ratio of 7.8955, significant at the 0.000 level. In contrast, the coefficient for dLINF is 0.0035595, with a standard error of 0.0048560, resulting in a t-ratio of 0.73301,

indicating no statistical significance at the 0.468 level. Additionally, the table provides various statistics related to the model fit, including R-squared, the standard error of regression, the F-statistic, and information criteria such as the Akaike Information Criterion and the Schwarz Bayesian Criterion. These metrics assess the overall performance and goodness of fit of the VECM model.

## 5. CONCLUSIONS

The present study delves into the intricate relationship between socio-economic factors and fertility in Lebanon spanning from 1971 to 2014. Fertility rate stands as the dependent variable, while a range of socio-economic indicators including women's secondary school enrollment rate, life expectancy at birth, urbanization, per capita income, and inflation rate serve as independent variables. By examining these socio-economic factors over a significant time span, the study aims to uncover the nuanced dynamics that shape fertility patterns in Lebanon. Through rigorous empirical analysis, it seeks to elucidate the impact of education, healthcare, urbanization, economic prosperity, and inflation on fertility trends. Such insights hold profound implications for policymakers, offering valuable guidance for crafting targeted interventions aimed at promoting sustainable demographic outcomes and socio-economic development in Lebanon. The study employs the Phillips Perron (PP) unit root test to address the unit root problem inherent in the dataset. Subsequently, the Auto Regressive Distributed Lag (ARDL) bound testing approach is applied to assess co-integration among the variables under consideration. Analysis of the PP unit root test reveals a mix order of integration among the selected variables, while the results of the ARDL bound testing approach confirm the presence of co-integration among these variables. Further analysis reveals that the negative impact of women's secondary school enrollment and urbanization on the fertility rate suggests the importance of educational attainment and urban development in reducing fertility preferences among Lebanonn women. As education levels rise and urbanization progresses, individuals may prioritize career and lifestyle choices over larger family sizes, leading to a decline in fertility rates. Conversely, the positive association between per capita income and fertility rate may reflect the economic prosperity of the country, which could potentially lead to a higher demand for children or a delay in fertility decline due to improved living standards. Similarly, the positive relationship between life expectancy and fertility rate may indicate a cultural or social preference for larger families in response to improved health outcomes and longer life expectancy. These findings highlight the complex interplay between socio-economic factors and fertility preferences in Lebanon, emphasizing the need for targeted policies and interventions aimed at promoting education, urban development, and economic stability while addressing cultural and social norms surrounding family size. The estimated Error Correction Model (ECM) indicates that it takes approximately 5 years and three months for the short-run dynamics to converge to the long-run equilibrium. This suggests that adjustments in the socio-economic factors affecting fertility in Lebanon occur gradually over time, influencing the long-term fertility trends in the country. Moreover, the results from variance decomposition and impulse response function analysis demonstrate a causal relationship between all explanatory variables and the dependent variable, which is the fertility rate. This implies that changes in women's secondary school enrollment, urbanization, per capita income, and life expectancy lead to corresponding adjustments in the fertility rate, and vice versa, over time. These findings provide valuable insights into the dynamics of fertility behavior in Lebanon, highlighting the interconnectedness of socio-economic factors and fertility outcomes. Policymakers can use this information to design targeted interventions aimed at promoting sustainable fertility reduction and socio-economic development in the country. Based on the findings of the study, improving women's secondary school enrollment and urbanization can be effective strategies for the Government of Lebanon to reduce the fertility rate in the country. By focusing on expanding access to education for women and fostering urban development, policymakers can create an environment that encourages smaller family sizes and contributes to the demographic transition. However, it's important for these efforts to be implemented in a timely manner, as the short-run dynamics indicate that it takes several years for changes in socio-economic factors to translate into significant shifts in the fertility rate. Therefore, proactive measures should be taken in the near future to address these socio-economic determinants of fertility and facilitate a smoother demographic transition in Lebanon.

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