

Development Deficit and Fertility Persistence in Bangladesh: Revisiting Malthusian Explanations

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ABSTRACT

This paper critically examines the dominant Malthusian perspective in the context of Bangladesh, which attributes population growth as the root of the nation's poverty and underdevelopment. Conversely, this study seeks to explore how the diverse socio-economic underdevelopment dynamics across Bangladesh serve as the crucial factors shaping the country's fertility and demographic landscape. By employing a quantitative analysis, assisted by secondary socioeconomic and demographic data from 1991 to 2024, this study redefines conventional views on population-development nexus. The findings of this study convincingly demonstrate that the deep-rooted underdevelopment standpoint in Bangladesh, marked by sluggish industrialization, enduring poverty, and institutional weakness, shapes traditional societal meanings and perceptions, that define gender roles and expectations, which subsequently influence people's fertility behavior. These forces, in turn, worsen imbalanced population momentum and intensify the nation's demographic stress. The standing of this research emerges from exploring the credible association between development insufficiency and population upsurge, prioritizing for a development-first approach to achieve demographic stability in countries like Bangladesh. Furthermore, the study advocates for strong socioeconomic enrichment and emphasizes the transformative impact of these actions to ensure population stabilization. All of which may lead to a prosperous future and inspire hope through stable population dynamics in Bangladesh and beyond.

Keywords: Bangladesh, Fertility Behavior, Demographic Challenges, Structural Underdevelopment, Gender Role.

1. INTRODUCTION

Since the dawn of humanity, the human species has grown from a hypothetical origin of two individuals about a hundred thousand years ago to about 8.2 billion people today [1], [2]. Projections suggest this number will continue to climb over the next 50 or 60 years, reaching a peak of around 10.3 billion people in the world by the mid 2080s [2]. Almost all this population growth is concentrated in the least developed countries (LDCs)¹, where the population is growing at 2.4% annually, more than twice as fast as that of the developed world, is experiencing a decline of 0.2% per year [3]. LDCs have the lowest socio-economic development, with their combined gross domestic product (GDP) accounting for just 1.4 per cent of global GDP in 2022. Despite the economic growth of LDCs remaining slow, their populations are expanding rapidly, expected to increase

from 1.2 billion in 2023 to nearly 1.9 billion by 2050[4]. Three LDCs are among the 15 most populous countries in the world, including Bangladesh (173 million), followed by Ethiopia (127 million) and the Democratic Republic of the Congo (102 million). By 2050, Bangladesh will be the 8th most populous nation in the world, accounting for a 2.4% share of the world population [5]. These figures have fueled considerable scholarly debate over the past decades about the insight into such demographic trends. Prevailing research knowledge, rooted in classical Malthusian interpretations and later echoed by numerous scholars and development planners, often positions fertility rates and uneven population growth as constraints on development and causes of poverty, underdevelopment, and resource depletion [6-10]. This viewpoint has profoundly influenced decades of policies, especially in least developed countries including Bangladesh, resulting in the adoption of highly restrictive measure to control population growth, often sacrificing the reproductive rights of their citizens [11], [12]. Moreover, contemporary scholarly knowledge also reliably underscores demographic factors or population-

¹ More-developed, less-developed, and least-developed regions follow the UN classification (<https://www.un.org/ohrlls/content/least-developed-countries>)

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first narratives as dominant in determining socio-economic well-being and shaping economic advancement in different regions of the world [13], [14].

Recent studies on Bangladesh show that, despite low gross domestic product, pervasive poverty, and the persistent income inequality, Bangladesh has achieved substantial fertility decline [15]. Some attribute this to women's empowerment and widespread education [16]. However, this remarkable achievement is offset by the alongside country's ongoing demographic burden, including unwanted fertility and socioeconomic disparities, often described as the "Bangladesh Paradox" [15]. Recognizing all these inconsistencies highlights the need for more comprehensive research to obtain fundamental insights into the factors that conclusively shape demographic patterns in LDC countries such as Bangladesh.

Relying on these deterministic interpretations consistently fails to identify the deeper structural roots of demographic trends, particularly where various socio-economic development constraints play a significant role in determining the demographic outcomes in Bangladesh. However, to the author's best knowledge, there remains limited empirical research to identify the association between these underdevelopment factors and the demographic realities in Bangladesh. Given this complexity, further study is essential to examine the association between the country's diverse socioeconomic underdevelopment context with fertility trends and demographic outcomes. Based on all these considerations, this research aims to address this gap by focusing on the following research question:

How might Bangladesh's deeply entrenched socioeconomic underdevelopment burden contribute to and possibly be associated with people's fertility behavior and existing demographic challenges in Bangladesh, rather than serving as a cause of this burden?

To address this inquiry, the objective of the study is to explore this viewpoint within the context of historical and structural underdevelopment and to provide a broad understanding of the association between numerous socioeconomic underdevelopment factors and population outcomes in Bangladesh. By highlighting this, the study contributes to resolving the population-development debate in Bangladesh by emphasizing a development first approach to achieve population equilibrium. This provides new insight into the intersection of structural underdevelopment, fertility behavior and demographic outcomes, which argues that only comprehensive

structural improvements can enable the country to unlock its untapped demographic potential.

This paper proceeds as follows: Section 2 comprises an extensive literature review for this research. Section 3 builds the conceptual framework, and Section 4 highlights the methodology of the study. Section 5 presents the historical origin of development constraints in Bangladesh, Section 6 presents result and discussion, limitations and future research prospect of the study, and Section 7 concludes the paper with policy recommendations.

2. RETHINKING THE POPULATION DEVELOPMENT DISCOURSE IN BANGLADESH

The interaction between development and population growth remains an issue of considerable dispute within the development paradigm. At its core, the prominent perspectives termed as the "Alarmist" or "Pessimistic" view, ingrained in Malthusian and Neo-Malthusian scholarly writings, argues that unchecked population growth will outstrip the means of subsistence, exhaust human well-being, create enduring poverty, and diminish happiness [6-8]. The US National Academy of Sciences report [17], Brown [9] further influenced popular perceptions, arguing demographic challenges as a major obstacle to sustainable development, and recommended to limit population growth. These dominant insights tend to oversimplify or overlook the multifaceted socioeconomic realities of a country's demographic outcome [12], [18], [19].

Despite its policy influence, the Malthusian paradigm has increasingly been challenged by scholars such as Marx. Thompson, Kuznets, Simon. They argue that distributive justice of wealth and power, modernized arrangement, industrialization and reshaping economic roles and social institutions are prerequisite for balanced population trends-particularly fertility decline [20], [21-23]. Yet, these analyses often assume linear modernization pathways that may not reflect the experiences in least-developed economies like Bangladesh.

The contemporary empirical literature relevant to population and development further contribute to this enduring debate. Bayant [24] reframes socioeconomic theory, explaining that fertility behavior in poor and less developed countries determined by incentives to have fewer children rather than driven by development indicators. While Tang and Tey [25] focused on the Malaysian context and demonstrated that the fertility

rate is cointegrated with its structural determinants, such as, female employment, female education, and quality of health care and per capita income. Drawing on econometric evidence, Zakaria et al [26] and Sethi et al [27] disclose the effect of financial sector development on fertility in selected South Asian countries over a specific time. Similarly, research by Lerch [28] has highlighted the fertility differentiation between rural and urban areas in developing countries while Yeung & Abalos [29] investigate the comparative trends of fertility behaviors across Asia, stressing the influence of the interplay of structural, cultural, and policy factors. Moreover, while different literature on Bangladesh demographic perspectives have underlined influence of various socio-cultural and economic factors on fertility outcomes, [30], [31], [32], their studies remain insufficient to establish a definitive association between underdevelopment factors and population burden in Bangladesh. While these studies provide valuable insights, their scope remains confined to analyzing only the interaction between demographic changes and either specific financial or social indicators or broad regional aggregates. Furthermore, several of these studies largely focused on other national contexts, provided little in-depth country specific analysis, particularly for Bangladesh, and often stressed on population growth as the principal cause of underdevelopment. Drawing on these consensuses, the present study emphasizes the Bangladesh context and introduces an alternative analytical perspective through prioritizing macro-structural and micro-social perspective to uncovers how enduring key socio-economic underdevelopment factors continue to shape demographic behavior over time.

3. CONCEPTUAL FRAMEWORK

This study draws on dependency, structuralist [33], [34], and sociological perspectives [35] to explore the deeper systematic underdevelopment in Bangladesh that arises from both internal and external structural constraints which influence population dynamics. Adding these multidimensional frameworks is crucial for understanding how colonial legacies continue to siphon resources from the country, produce a dependent economic structure [33], intertwine with various domestic development constraints [34]. All of these create a fragile industrial base, which hindering sustained socio-economic growth for a peripheral nation like Bangladesh. This macro-level analysis is further supplemented by micro-level scrutiny of Blummer's symbolic interactionism [35], which validated the idea is that individual and community

actions are guided by the meanings they create in daily social interactions and thus humans' interactions act as active agents in constructing social reality. This insight conjectures that, individual and community conduct associated with family size, gender roles, and reproductive decisions are thereby profoundly influenced by the socially constructed interpretation of meaning. We utilize Baran's [33] view to clarify the structural origin of underdevelopment in Bangladesh through surplus extraction and external dependencies. While Myrdal's [34] conceptualized underdevelopment through his cumulative causation model which shows how weakly articulated modes of production, diminished productivity, poor living standards, fragile institutions, inadequate policy and low literacy level interact to perpetuate cycle of poverty and inequality shaping long trajectories of underdevelopment over time [34]. These internal socio-economic fragilities further construct the collective social perception [35] about family size, and gender norms and roles.

Building on these perspectives, in this study, socio-economic underdevelopment aspects of Bangladesh can be conceptualized as a web of structural, institutional and social constraints arising from historical inability to channel economic surplus toward productive sectors, which impedes the transition from an agrarian peasant economy to a more industrialized one. This stagnation results in increased unemployment, poverty and low income, while it also restricts investment in education, health, and the social security system. These fundamental structural constraints impede the rise of progressive norms, values, and culture within both families and the communities. Such socially embedded customary perception undermines collective well-being and shape socio-cultural perception expressed through large family norms, son preference, early marriage, and persistence of patriarchal values. Altogether, these socio-economic realities halts modernization efforts, dimming the prospect of a more enlightened worldview—a conversion from traditional ways of thinking and behaving [36]. In the end, these restrict women's empowerment, equality and autonomy in fertility choice which set the stage for an imbalanced population dimension in Bangladesh.

When these transformative social and economic elements are effectively aligned, they create such a reasonable social environment that reduces poverty, raises living standards, and fosters more equitable social and economic conditions for all. These progressions contribute to demographic equalization across the country [12], [18]. The study therefore generates hypotheses that deep-

rooted socio-economic development constraints such as weak industrialization, poverty, low education and health attainment, fragile social security system determine that socially embedded gender perspectives have a positive association with the country's demographic challenges.

This contrast disrupts the simplistic Malthusian view, by highlighting the fundamental structural development deficit that caused to demographic challenges (fig. 1) and inviting us to rethink the argument that population pressure in Bangladesh is an indication of its historically entrenched socio-economic underdevelopment perspectives.

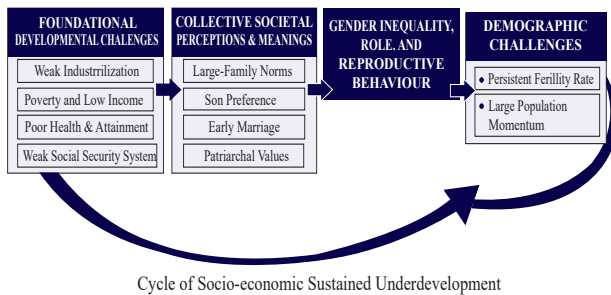


Fig. 1: Conceptual framework

This framework illustrates how, foundational development constraints, shape collective societal perceptions and meanings, which generate gender inequality, determine gender roles, and shape reproductive behavior. These dynamics sustain demographic challenges, ultimately again perpetuating the same cycle of socio-economic constraint and reinforcing underdevelopment.

4. MATERIAL AND METHODS

4.1. Sources of Information

This study employs a quantitative analysis to examine association between socioeconomic underdevelopment indicators and fertility outcomes that intensify demographic challenges in Bangladesh. The data set for each variable is used in this study obtained from rich array of national and international recognized sources including regular social and economic survey of Bangladesh Bureau of Statistics, relevant UN and World Bank estimates [15]. Moreover, additional references, such as books, journals, research reports, and working papers, were also reviewed and analyzed, precisely focusing on literature relevant to Bangladesh. Integration of data from multiple sources minimizes bias and links demographic behavior with socio-economic and institutional patterns, reinforcing the methodological rationale and assessing consistency between observed outcomes and theoretical expectations through pattern matching.

4.2: Data Overview and Analysis

This study utilizes data spanning from 1991 to 2024. The year 1991 was chosen as the starting point because Bangladesh initiated accelerated reforms under the structural development adjustment program during this decade, which substantially influenced the country's demographic dynamics. The data period ended in 2024 since the availability of complete datasets for all variables considered in this study. However, only health expenditure analysis uses data from the year 2000 onwards due to data unavailability and to maintain consistency across sources. In the conceptual framework (Fig. 1), demographic challenges were represented by the persistence fertility rate and large population momentum. However, for the statistical analysis, only fertility rate was considered as dependent variable, since population growth is viewed as the direct outcome of fertility behavior. Moreover, this study considered socioeconomic determinants, including core developmental challenges and gender roles as independent variables, since these factors outline a person's reproductive behavior and contribute to demographic stress in Bangladesh. However, within the analytical framework alongside socioeconomic determinants, gender role was considered the key variable for measurement, recognizing the view that, it is shaped not only by the collective societal meanings and norms but also closely tied to women's agency in reproductive behavior. By capturing this, the study quantified how structural barriers and socio-cultural expectations relate to demographic outcomes in Bangladesh.

Table I: summarize and describe representation all the variables analyze in this study.

Variable Description	Proxied By
Fertility rate	Total births per woman,
Industrialization	Industry value added (% of GDP)
Poverty rate	Poverty headcount ratio (% of population)
Income per capita	GNI per capita, PPP (current US\$)
Education Attainment	Literacy rate, adult total (% of people ages 15 and above)
Health Attainment	Health expenditure (% of GDP).
Gender Roles	Female labour force participation (% of total labor force).

Note: All data are sourced from World Development Indicators (World Bank), ILO, UNFPA, WHO, BBS

In this study, gender role is proxied by female labour force participation, as it unveils the depth of structural constraints and socio-cultural attitudes that impact female economic empowerment. This demonstrates the behavioral

dimension of gender inequity which links social meanings to women's fertility behavior and demographic outcomes.

Characteristics of all the study variables were summarized using descriptive statistics, which helps us to understand the further analysis. The descriptive statistics of this study examine the direction and strength of possible association between socio-economic underdevelopment factors and fertility trends shaping demographic stress. Pairwise correlation analysis was used to find the direction and strength of relationships among the study variables. Furthermore, to find the individual effect of explanatory variables on Total Fertility rate (TFR), univariate regression analysis was done. Subsequently, a multiple regression model including all predictors was fitted. To detect the problem of multicollinearity, the variance inflation factor (VIF) was calculated. Usually, VIFs are greater than 10 for many independent variables, indicating severe multicollinearity. When multicollinearity exists, regression results are unreliable, and as a result, misleading inferences are drawn. To overcome the disturbance of multicollinearity, Principal Component Analysis (PCA) is a reliable tool, thus ensuring stable and accurate assessments [37], [38]. That's why by using Principal Component Analysis, a socio-economic development index is created by combining six socio-economic independent variables, i.e., industry, poverty, GNI per capita, literacy rate, health expenditure and female labor force. The first principal component, which explained most of the total variance, was used as the index for subsequent regression analyses. Finally, the constructed socio-development index was used in a regression model to estimate its effect on TFR. So, the final model is

$$TFR_i = \beta_0 + \beta_1 \text{Socio-development index} + \epsilon_i$$

Where, ϵ_i is the error term.

The overall analysis offering a possible pathway that may link underdevelopment aspects and fertility as well as population outcomes in Bangladesh.

5. EXAMINING BANGLADESH: HISTORICAL ROOTS, DEVELOPMENT CONSTRAINTS AND ONGOING DEMOGRAPHIC CHALLENGES

Addressing the relationship between underdevelopment and demographic challenges requires a sound understanding of the country's historical root of unprivileged situation. The demographic experiment in Bangladesh has intense structural roots that can be traced back to a long-standing pattern of underdevelopment shaped by 215 years of

colonial and post-colonial rule and exploitation, which continues to shape its contemporary development and population paradigms [18]. After the Battle of Plassey (1757), the victory of British power facilitated primitive capital accumulation through the colonial 'structured plunder' where surplus was siphoned out of the Bengali region [39]. William Digby's (1901) evidenced this extraction and stated that, in just 58 years, from Plassey (1757) to Waterloo (1815), approximately five billion pounds worth of capital was transferred from India to the English Bank (as cited in [19]), the bulk of this capital unquestionably came from the British-occupied richest structure of the data and detect potential inconsistencies in province, Bengal. The intensive extraction of economic surplus stalled capital formation and consequently industrial self-reliance, thereby creating a dependent economic structure that contributed to enduring economic fragility in colonial Bengal [18], [19], [39].

In 1947, the two-nation theory resulted in the creation of India and Pakistan. Following partition, Pakistan's state power was used to extract surplus from East Pakistan's (now Bangladesh) agrarian economy while systematically underinvesting in its infrastructure and social welfare.

Following independence in 1971, the newly implemented economic policies of the young nation were further weakened by the powerful interests of the political elite and the state's inability to invest in establishing articulation between agriculture and industry, as well as education and health, thereby weakening the building of human capital [18].

These factors added a layer of complexity to the country's development, reinforced external dependencies, and stalled the rise of self-sustaining industrialization, resulting in a mismatch between development strategies and demographic policies that Bangladesh would face for decades to come.

The result is evident: despite a substantial decline in the fertility rate in Bangladesh from 6.1 children per woman in the 1980s to 2.2 in 2024 [3], Bangladesh is still experiencing a relentless demographic burden. This ongoing challenge stems from economic and institutional fragile conditions, that remains insufficient to ensure the social progress necessary to absorb demographic burden. Kuznets [21] demonstrated that population trends, particularly fertility decline—follow patterns of industrialization, urbanization, and income growth, reshaping both economic roles and social institutions. The origin of this structural root of underdevelopment provides an important insight for understanding fertility

pattern and its association with underdevelopment factors in Bangladesh. To examine these relations empirically, the following graph and statistical analysis are shown in the results and discussion section which are consistency with analytical expectations.

6. EMPIRICAL RESULT AND DISCUSSION

This section presents empirical results and analyzes how different contemporary socio-economic underdevelopment forces impede the achievement of demographic equilibrium in Bangladesh.

6.1 Foundational Developmental Challenges and Demographic Pattern

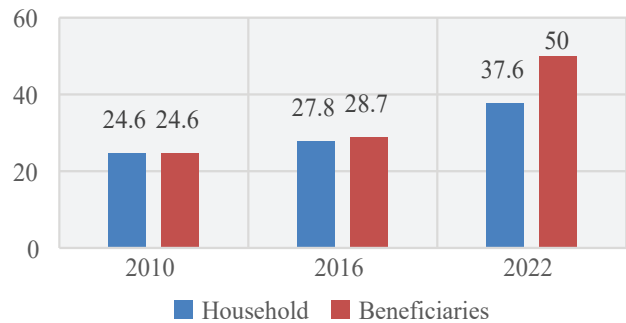
Colonial and post-colonial Bengal plundering and post-independence government inability to establish the wave of industrialization in the nation increase dependence on agriculture that failed to increase employment and per capita income. Additionally, persistence of informal labor market and limited technological innovation and diversification, have also resulted in restricted job opportunities. So high levels of Poverty and youth underemployment are inevitable, which can lead to economic instability.

In Bangladesh's workforce is mostly engaged in agriculture, (44.70%), compared to just 17.4% in the industrial sector [40]. Between 2016 and 2022, most are jobs are created in the agriculture sector, where a large number are low-paying and informal positions. During the same period, employment in urban areas grew by only 0.7 million [41]. Limited industrialization, subsequent unemployment and poverty have also led to the hampers access to essential services such as healthcare, education and social security system in which also population pressures manifest. In Bangladesh, only 59% of the population has access to basic sanitation services [42]. Additionally, the literacy rate stands at only 74%, with significant disparities in urban and rural areas [43]. Weak industrialization and limited opportunity for access to education, health care and the social security system confine economic opportunities. Which alternatively boosts the quality of life, increases the cost of raising children and lessens their economic value. This also increases awareness of family planning reducing demographic stress.

Fragile social security system is also another key indicator fueling demographic challenges in Bangladesh. Social security programmes stand as evidence-based intervention to reduce vulnerability and economic

insecurity by providing financial aid and essential services to those most in need. The Government of Bangladesh (GOB) introduced the National Social Security Strategy (NSSS) in 2015 to strengthen and consolidate its existing social security programmes [44].

Fig. 2: Percentages of household and beneficiaries enrolled in social security programme from 2010-2022.



Source-HIES 2022, Cabinet Division, 2023

However, due to limited financial space, weak administrative capacity, and flaws in beneficiary selection mechanisms, restrict the truly inclusive social protection system for all deserving people (Fig. 2) [45]. As a result, increases the economic reliance on children, especially son for old age financial security, contributes to higher birth rates. Only the provision of alternative forms of insurance may reduce the perceive economic value of children, subsequently decrease the people's need for more children [46].

Figures, (3-7), provide the graphical presentation between fertility and its association with development factors in Bangladesh. It is evident from these graphs that

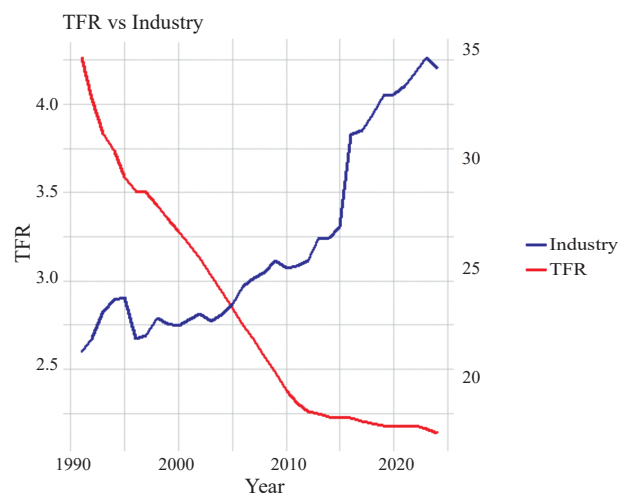


Fig. 3: Fertility and Industrialization

fertility is negatively associated with all variables except, poverty, which has affirmative involvement with fertility. These graphical records again support our hypothesis that demographic outcomes are the consequences of development deficit—not act as its cause.

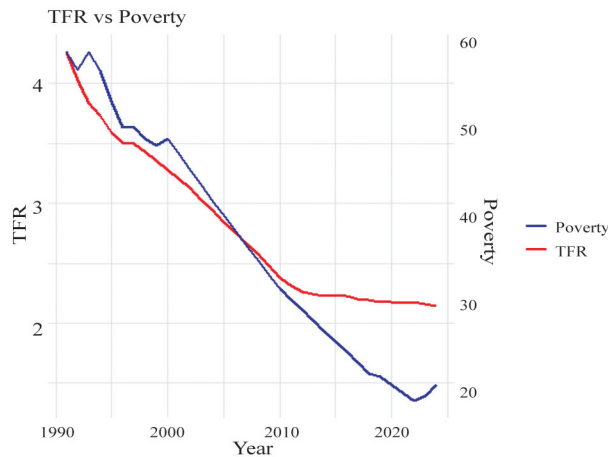


Fig. 4: Fertility and Poverty

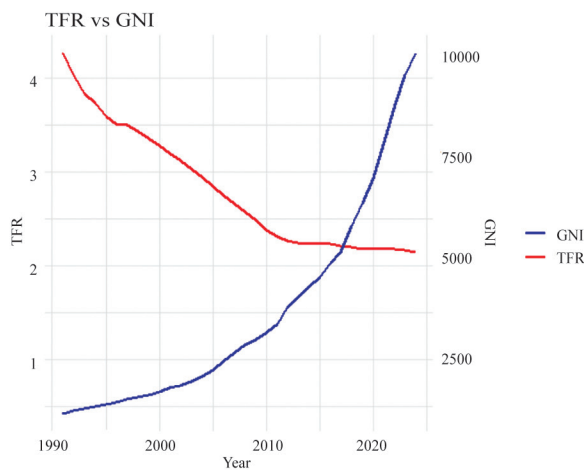


Fig. 5: Fertility and Income (GNI per capita)

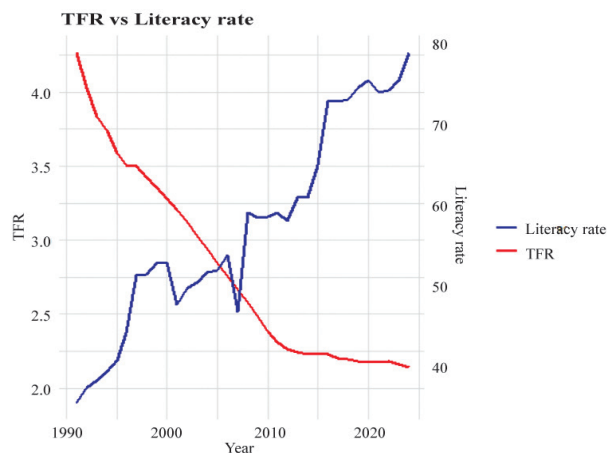


Fig. 6: Fertility and Educational (literacy) Attainment

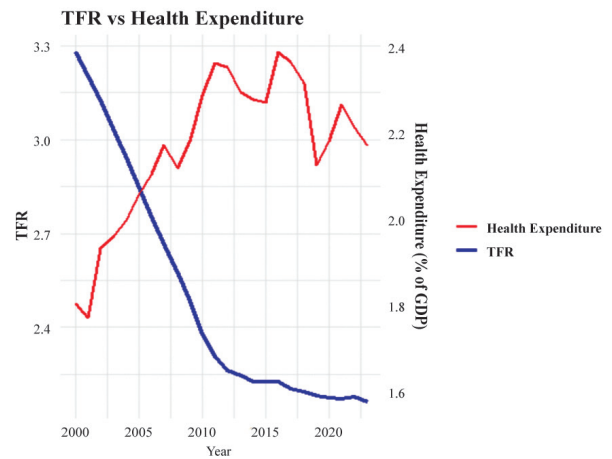


Fig. 7: Fertility and Health Attainment (expenditure)

6.2 Traditional Norms, Gender Roles, and Demographic Outcomes

Gender inequality, traditional norms remain a critical factor in shaping Bangladesh's population dynamics. "Fertility—the number of children a woman has—is not just a barometer for predicting population growth or decline. It can also be a measure of the quality of women's lives, whether they have no children, a few, or many". [47], p-43). In many LDCs like Bangladesh, the last (but not least) cause of high birth rates is the systematic exclusion of women from the development process. Moreover, patriarchal social norms, economic and social subordination of women, absence of a social security system, and inability to participate in the skilled labor force combine to force many women into having more children than they want. For example, in Bangladesh, child marriage by age 18 is about 51% and decision-making on reproductive health and reproductive rights by women is only 64% [48]. As argued by Kathleen Newland [49] in her extensive study of women, within the socio-cultural system, women's positive images are allied to their reproductive role, which seen as the only way for women to attain a sense of purpose and accomplishment. For instance, Children are often seen here as the main sources of a woman's pride, self-respect, and economic security. In the absence of inclusive social security system and faced with the very real possibility of widowhood, divorce, or abandonment, many women need children, especially sons, both for old-age support and to protect their rights to land and other property[12]. A team of demographers studied a village in Bangladesh and concluded: "The risk and insecurity that patriarchy imposes on women represent a powerful systemic incentive for high fertility.

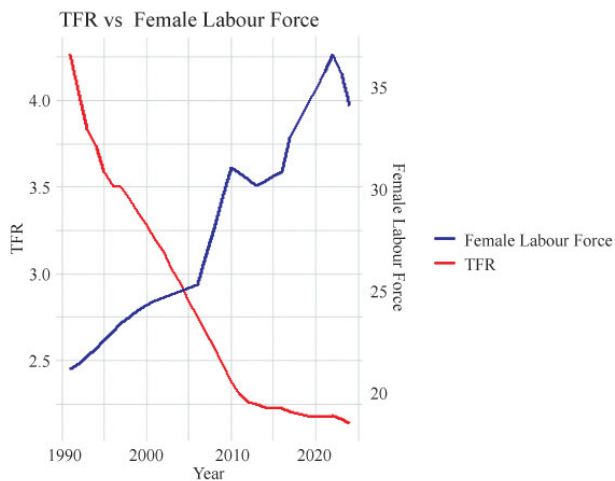
Table II: Correlation Matrix

	Fertility	Poverty	Industry	GNI per Capita	Literacy rate	Health expenditure	Female Labor force
Fertility	1						
Poverty	0.975*	1					
Industrialization	-0.776*	-0.878*	1				
Income per Capita	-0.775*	-0.875*	0.962*	1			
Education Attainment	-0.899*	-0.951*	0.911*	0.900*	1		
Health expenditure	-0.892*	-0.788*	0.527*	0.481*	0.594*	1	
Gender Role	-0.924*	-0.975*	0.924*	0.923*	0.949*	0.673*	1

* Indicates that the correlation coefficient is significant at 5 % level of significance

The best risk insurance for women ...is to produce sons, as many and as soon as possible.” ([50], p.432).

Female literacy and employment are also associated with high birth rates and infant mortality. Although female literacy rates have been rising here, they still fall considerably short those of men. Household income and Expenditure Survey [43], shows that, males have a higher literacy rate (75.8%) than females (72.3%) in Bangladesh. Beyond literacy, women’s employment in the skilled labor force is also linked to fertility decline (fig. 8), not only because of competition with motherhood, but because the availability of such jobs serves as an incentive to families to educate girls [12], [51]

**Fig. 8:** Fertility and Gender Roles

The Bangladesh Labour Force Survey [40] estimates that 71.71 million people were participated in the labour force. However, momentous gender disparities are observed here: the male labour force accounted for 67%, while the female represented for only 33% [40].

An educated woman is usually less closely confined, physically and psychologically, and has a broader

worldview. So, discrimination and socioeconomic barriers, traditional norms and cultural aspect often prevent women and adolescents from making autonomous decisions about their reproductive health [2]. Consequently, such conditions tend to prevent or postpone the reduction of fertility in populations that are growing rapidly, in countries like Bangladesh. In a traditional agricultural society like Bangladesh, high fertility rates persist, largely because social standing is determined mainly by family membership; children contribute a lot but do not cost much, religious and cultural support for having more children, which consequently exacerbates demographic stress. According to G. Carlson, “Birth control behavior is contagious, and the fertility behavior of a population is not the simple aggregate of isolated individual decisions, but the end product of complex social interactions.” (as cited [52] p.374).

The statistical analysis of this study again supports our hypothesis pathway and conceptual expectations about the outcomes of the control variables. Table-II provides correlation matrix between the variables. All variables have statistically significant negative correlation with fertility except poverty, which is significantly positively correlated with fertility. These results corroborate theoretical and analytical justification

Table III displays the univariate regression analysis, which revealed that all the explanatory variables are statistically significantly associated with the total fertility rate at 5% level of significance.

Table III: Results of Univariate Regression Analysis

Independent Variable	Co-efficients	Standard Error	p-value
Poverty	0.048	0.002	0.00
Industrialization	-0.114	0.016	0.00
Income per capita	-0.000192	0.000028	0.00
Education attainment	-0.047	0.004	0.00
Health expenditure	-1.957	0.212	0.00
Female Labor force	-0.123	0.009	0.00

Here, poverty showed a strong positive association with TFR, whereas all other variables exhibited significant negative associations with TFR. Higher poverty levels are associated with higher fertility rates. Specifically, a 1 unit increase in poverty is associated with an increase of 0.048 children per woman. In contrast, Industrialization is negatively associated with TFR, indicating that a 1 unit increase in industrialization results in a 0.114 decrease in children per woman. Similarly, income (GNI) per capita is associated negatively with TFR, with a 1 unit increase corresponding to a decrease of 0.000192 children per woman. Education (Literacy) shows the same pattern, where an increase in literacy (1 unit) is associated with a decrease of 0.047 children per woman. Furthermore, A strong negative association is found between health expenditure and TFR, indicating that a one unit increase in health expenditure corresponds to a decrease of 1.957 children per woman.

Gender role as proxied by female labor force participation also shows an adverse relationship, indicating that a 1-unit increase in female labor force participation is associated with a decrease of 0.123 children per woman. However, socio-economic variables are generally connected; therefore, this relationship may be affected by multicollinearity. A multivariate analysis is subsequently done to assess this.

Table IV presents the results of the multivariate analysis, indicating that only a subset of the variables is statistically significant after controlling for other factors. Moreover, VIF is greater than 10 for all the variables except health expenditure, which indicates that the data is suffering from severe multicollinearity. These high VIF values suggest that the regression coefficient may be unstable and difficult to interpret due to strong correlations among the explanatory variables. So, to solve this problem, a socio-economic development index is computed from those explanatory variables by using Principal Component Analysis (PCA).

Table IV: Results of Multivariate Regression Analysis

Independent Variable	Co-efficients	Standard Error	p-value	VIF
Poverty	0.0502	0.00523	0.000	56.31
Industrialization	0.0306	0.00913	0.004	33.90
Income per capita	0.000029	0.00001	0.063	26.43
Education attainment	0.0008	0.00291	0.775	19.49
Health expenditure	-0.1764	0.12055	0.162	9.64
Female Labor force	-0.0127	0.00806	0.133	23.83

The results of PCA are shown in Table V, which revealed that the first principal component explained 86.31% of total variance and is interpreted as a socio-economic development index.

Table V: Results of Principal Component Analysis

Component	Eigen value	Variance Explained (%)	Cumulative (%)
Component-1	5.178	86.31	86.31
Component-2	0.654	10.91	97.22
Component-3	0.095	1.59	98.81
Component-4	0.043	0.69	99.49
Component-5	0.017	0.28	99.77
Component-6	0.014	0.23	100

The PCA-based regression results presented in Table-VI indicate that the socio-economic development index ($\beta = -0.153$, $p = 0.014$) is strongly and significantly negatively associated with TFR. Specifically, one unit increase in the socio-development index is associated with a decrease of 0.153 children per woman, which is consistent with the methodological rigor, where this study becomes operationalized and allow us to identify the underlying configurations, that contest the conventional Malthusian diagnosis regarding the population-development paradigm.

Table VI: Results of Regression Analysis After PCA

Independent Variable	Co-efficients	Standard Error	p-value
Constant	2.503	0.030	0.000
Socio economic development index	-0.153	0.014	0.000

Across all the dimensions, evidence the Bangladesh's population pressures closely associate with its historical and structural underdevelopment root. As such, population stabilization requires deep institutional reform, industrial diversification, and inclusive human development.

The developmental and demographic landscape of Bangladesh also resonates with the experiences of key Southeast, East Asian and Western nations perspectives. During the nineteen-century massive industrial boom in Western world, fueled an enormous shift from agriculture to industry as a chief source of employment, income, thereby renovating livelihoods and social prosperity

[20], [53]. To sustain and further elevate this prosperity along with maintaining standards of livelihood, European societies also began to favor small family norms, leading to a decline in population growth in the early twentieth century [18].

The experience of key Southeast and East Asian nations such as Japan, South Korea, Taiwan, Singapore, Thailand and Indonesia stand out as notable cases. Back in 1960s these countries were poor, largely agrarian, traditional. However, within 1960 to 1990, these nations underwent remarkable socioeconomic enrichment through the adoption of comprehensive trade and industrialization process, greater access to education, health care, and social support system, as well as improvements in women's status, including increased occupation opportunities outside the home [54]. This structural transformation can absorb the growing youth population and raise income per capita while also bringing meaningful shifts in behavioral changes. Furthermore, narrowing the gap between male and female education has made it rational for parents to invest in daughters, so long as the parents can recoup their investment before a daughter marries and leaves home [55]. This has raised the average age at marriage and age at first birth, leading to women's complete fertility decline and rate of population growth has slowed throughout the region. The area that the Bangladesh state covers today, during the Mughal period, its population was much less than one million [18]. Today, it has increased seventeen times to more than approximately 170 million, the country has one of the highest population densities in the world with approximately 1,300 people per square kilometer [56]. Frank W. Notestein contended that the decline in fertility is closely associated with changes in ways of living and thinking, which are, in turn, products of industrialization (as cited in [19]). Together, these findings link dependency, structuralist and sociological perspectives [33], [34], [35], where country's failed industrialization and modernization effort, reproducing dependency, cycle of poverty and subsequent underdevelopment, shape the societal norms, values and institutions and gender role, contributing to demographic stress. These overall outcomes reflect a development failure that perpetuates demographic challenges in Bangladesh.

6.3. Limitations and Future Research Prospects

Reliance on secondary correlation data and the absence of field-level interviews are the main constraints of this study. The objective of the study is to examine the possible association between underdevelopment indicators and demographic challenges, rather than to investigate

dynamic time-series relationships or to provide forecasting. Principal Component Analysis (PCA) was employed to reduce dimensionality and address multicollinearity among socio-economic indicators. Therefore, our analysis focused on the potential structural relationships among the variables rather than on time-series modeling. Future research focusing on dynamic relationships should use appropriate time-series methods. Additionally, longitudinal or experimental research is essential to establish causality between underdevelopment and demographic outcomes as suggested for future work. Despite these limitations, this study analyzes data with a theoretically grounded interpretation to ensure the credibility of its findings.

7. CONCLUSION AND POLICY RECOMMENDATIONS

This study contests the long-held Malthusian prognosis that population growth will slow and ultimately stabilize, not because of "natural" forces of famine and pandemic, but rather because of improvements in living standards and other socio-economic changes that alter the need for many children [12].

This paper contributes to resolving debates by reframing population pressures as products of institutional and structural stagnation, rather than autonomous drivers of poverty and underdevelopment in Bangladesh. The approach of the study is significant due to its potential value for diverse Global South contexts, such as Sub-Saharan Africa or Latin America, which are experiencing the same kinds of demographic challenges and facing similar underdevelopment experiences. In brief, this study proves that societal transformation from a traditional to a modernized way of living where fertility restriction is always prevalent, which supports the conceptual model of a development-first approach to population stabilization. From both a practical and ethical standpoint, the most sustainable population policy approach is to prioritize human substantive freedom across multiple dimensions.

As Teitelbaum [57] concludes, "Take care of the population, and population growth will come down"

This study carries few policy recommendations, including first, promote decentralized industrial development to absorb the growing working-age population including women aiming to reduce poverty and gender inequality to ensure equal opportunity for

women in formal sector employment. Second: expansion of inclusive secondary and higher education policy to enhance enrollment ratio, especially female enrollment to ensure women agency on reproductive behavior. Third: reforming traditional norms, values, gender roles as well as strengthen policies to provide access to all desired people to social security systems and pension system so that households' incentives to produce more children may decrease. Fourth: Policy formulation and interventions such as family planning service, reproductive education, maternal health care service are essential and prioritize the improving the quality of life which is necessary for low fertility. The government of Bangladesh had stepped up its population stabilization efforts considerably in collaboration with various non-government organizations and development initiatives. Among these initiatives mostly include promoting women's education, restricting early marriage, ensuring women's participation in economic activity where export-oriented apparel industry standing out as prime example. These changes reflect the women's autonomy and improve the lives of women which has alter the country's fertility situation positively—and not for the better, simply due to government resources hardly focusing on controlling the “quantity of births” rather than improving the “quality of people's lives” [12]. The positive association between development and fertility reduction is thus often summarized by the universally used phrase

“Development is the best contraceptive.” [57].

By showcasing Bangladesh as a successful example, the population consensus must offer a fresh perspective on development, which lies not in focusing on policy priorities but in comprehensive economic well-being, social justice that is conducive to the fulfillment of basic human desires and holds the key to a more equitable and demographically stable conditions for Bangladesh.

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