

# **Declining Fertility Rates in Korea: Exploring Further Mechanisms and Policy Implications**

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Previous studies analyzed the determinants of fertility primarily through empirical models that incorporate (i) opportunity costs and (ii) labor market conditions and drew policy conclusions within such frameworks. This study extends the conventional approach in an international comparison context to explain Korea's extremely low fertility rates by using multiple databases and a set of variables expected to be relevant in the Korean context. The empirical analyses on the new factors, such as expectations about future economic conditions, evolving social norms, political orientations, social conflicts, and fertility-related policies, show that (i) the traditional factors and new variables have a statistically significant effect on fertility, and (ii) the impact of the policy variables is generally substantial across the examined countries. Nevertheless, (iii) such factors cannot fully explain the sharp fertility decline in Korea, which indicates that conventional policy measures based on large-scale fiscal spending may be ineffective. By building on a theoretical explanation of policy ineffectiveness through the lens of social norm models, we suggest redesigning fiscal policy combinations tailored to Korea's unique frictions (e.g., structural and sociocultural characteristics), as a promising strategy.

Keywords: fertility rate; opportunity cost; culture; social norms;

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## **I. Introduction**

Following the widespread recognition of low fertility as a pressing social issue around the world, an extensive body of research emerged to investigate the determinants of childbearing decisions. A key message from recent surveys is that several classic empirical regularities, such as the robust negative relationship between income and fertility and the negative relationship between female labor force participation and fertility at the late stages of development, no longer characterize the data of many high-income economies, where compatibility between career and family has become central (Doepke et al., 2022). Most of the existing studies based on traditional frameworks focused on opportunity costs, labor market conditions, and broad social environments, and policy discussions centered mainly around fiscal policy measures, such as local government subsidies for childbirth, as the primary means of response in the Korean context.

This policy paper seeks to extend such discussions in several directions and propose renewed policy perspectives. Specifically, (i) this study incorporates factors that are typically inadequately controlled in prior studies, that is, expectations about the future, the influence of social norms, shifting political orientations and social conflicts, and fertility-related policy measures, in an international comparison analysis to determine whether determinants have been overlooked. By building on the analysis, this study seeks to examine Korea's low fertility problem from a comparative international perspective to identify its distinctive features and determine the appropriate policy approaches for such characteristics. (ii) This study discusses how the factors cannot fully explain the sharp fertility decline in Korea, which indicates that conventional policy measures based on massive fiscal spending may be ineffective. (iii) Furthermore, this study offers a sketch of an explanation for why policy interventions tend to be ineffective under social norms by demonstrating a theoretical mechanism in which norms essentially increase the overall cost of fertility.

Childbirth has been viewed as a blessing for families and an essential element of household decision making. At the macroeconomic level, childbirth is central to population and labor economics and can determine the size of the labor force. Doepke and Tertilt (2016) presented a macroeconomic perspective that emphasized that household decisions on the labor supply, human capital, and related outcomes are made within families. According to the framework developed by Becker (1995), which treats fertility as part of economic activity, couples decide the number of children they will have based on not only children's utility but also the expected income and wealth of the next generation. Within the framework, fertility can determine not only the quantity but also the quality of the labor supply. As wages rise, the value of parental labor increases, which will increase the opportunity cost of childbearing and make having children difficult for households. At the same time, rising income may strengthen the human desire to have numerous children, as a scarce and valued "resource," through income effects, which suggests that income growth may have a positive effect on fertility. Thus, when viewed through a framework that incorporates altruism between parents and children, in which families jointly determine the number and quality of offspring, fertility decisions can be understood in a manner that can offer rich and meaningful economic insights.

Endogenous growth models that view fertility as being part of the macroeconomy seek to explain interrelations among fertility, human capital investment, and income distribution. Within such frameworks, the trade-off between the quantity and quality of children remains central to the discussion (e.g., Becker and Tomes, 1976; Becker and Barro, 1989; Becker, Murphy, and Tamura, 1990; Galor and Weil, 1996; Dahan and Tsiddon, 1998; Morand, 1999). Such studies attempted to account for the stylized fact that the accumulation of human capital and economic growth are typically accompanied by declining fertility rates to offer important insights into the long-term dynamics of demographic change.

However, recent evidence suggests that fertility trajectories exhibit substantial cross-country heterogeneity and may not converge to a single global path, which reinforces the need for comparative analyses that allow for divergent dynamics across groups of countries (Papagni, 2023). The Korean fertility episode is particularly drastic and complex to be explained solely by changing economic conditions, as typically done in the literature. Unlike most standard macroeconomic indicators,

Korea's total fertility rate (TFR) has fallen precipitously from above 6 in the 1960s to around 0.73 in recent years, which is well below the OECD average and the lowest among the member countries. The other countries at the bottom of the ranking, such as Spain, Italy, Greece, Portugal, Luxembourg, and Japan, tend to share certain characteristics, such as having high public debts and experiencing long stagnation (particularly those in Southern Europe), whereas the others are small yet extraordinarily affluent. Although generalizations should be made cautiously, such cases largely represent societies that have lost their economic dynamism after achieving prosperity. From this perspective, we argue that the typically cited conventional factors are not likely the drivers of low fertility, and Korea's situation appears to be distinct, which suggests the presence of unique factors beyond conventional economic explanations.

Women are the principal agents of childbirth; thus, fertility should be analyzed through women's economic activity (e.g., Angrist and Evans, 1998). In decentralized and advanced economies, where economic participation is free and income opportunities are expansive, the opportunity cost of nonemployment is increasing. Thus, female labor force participation tends to increase, despite the existence of labor market penalties for women. The phenomenon is further reinforced by firms' profit-maximizing behavior, that is, as economies develop and the capital-labor ratio rises (e.g., Galor and Weil, 1999), labor costs increase, which encourages firms to use female labor to alleviate wage pressures.

The growing participation of women in the labor market can facilitate profound socioeconomic transformation. From a woman's standpoint, such participation implies the availability of an independent life outside of marriage and thus may reduce the probability of marriage. At the same time, as women's earning capacity improves, gender relations may evolve toward an equal structure. Fiscal spending to boost fertility tends to rise alongside such shifts, at least in Korea. However, asserting that opportunity costs associated with childbirth increase upon marriage would be difficult.<sup>1</sup> Although rising income may, in theory, increase

<sup>1</sup> Recent research stressed that fertility outcomes may reflect agreement within couples, and the distribution of childcare burden between mothers and fathers can be a key determinant of fertility and the effectiveness of family policies (Doepke and Kindermann, 2019).

fertility, most advanced economies have exhibited a trend toward reduced willingness to have children, which eventually converges to low long-term equilibrium.

In general, as market economies develop, women's labor force participation tends to rise, marriage rates decline, and the age at marriage increases. The structural shift can lead to persistently low fertility, which is a pattern widely observed across many countries (e.g., Goldin, 1995). Furthermore, consistent with the broad pattern, recent empirical studies argued that the "new era" of fertility is characterized by the coexistence of active female labor force participation and relatively high fertility, when family and career are easy to combine, supported by childcare availability, supportive policies, paternal inputs, and social norms (Doepke et al., 2022). Identifying such trends is not difficult. However, two notable exceptions stand out. (i) A growing number of economies have recently experienced fertility reversals, in which birth rates rebound, despite rising income levels, and (ii) most important, the pace of Korea's fertility decline has been extraordinarily rapid and cannot be easily explained by existing cross-country evidence. Some scholars argued that, in Korea, social norms regarding childrearing have remained unchanged, despite the high-income growth, which has discouraged women's childbearing (e.g., Hwang et al., 2019; Myong et al., 2021). This view is partly assertive and empirically supported; however, the data do not show a dramatic decline in fertility in most of the advanced countries with comparable conflicts between social norms and economic realities.<sup>2</sup>

Against this background, our study examines the determinants of fertility within the framework of prior research and identifies new factors that may be relevant from Korea's policy perspective. Our study does not focus on estimating exact structural equations for fertility behavior but seeks to uncover actual fertility behavior parameters by characterizing the uniqueness of fertility in Korea and proposing an alternative policy perspective to address the low fertility issue. Based on the results, our study seeks to draw policy conclusions and implications

<sup>2</sup> The recent fertility peak in the United States was 3.65 in 1960, which plummeted to 1.74 in 1976. The period may be comparable to Korea in recent decades, when female labor force participation, along with educational investment, increased. Nonetheless, fertility rates fell excessively in Korea, which suggests the role of noneconomic factors.

for fertility from a fiscal perspective.

By building on traditional factors that may influence fertility, our study reveals several novel findings. (i) The marriage rate is a key underlying factor that can determine fertility. (ii) Expectations about future prosperity serve as a notable mechanism in our analysis. Specifically, we found that, across the OECD countries, high expected future income is associated with low fertility, even after we controlled for marriage and standard economic fundamentals. The finding suggests that, in affluent settings, optimism may accompany preference shifts away from childbearing. However, long-term income prospects do not seem to be markedly better in Korea compared with the other major OECD countries. Thus, expectations *alone* will not likely be able to explain the magnitude of Korea's fertility collapse, and the results point instead to amplifying channels, such as norm-driven quality standards and education-related status competition, that can increase the perceived cost of having children. (iii) Income inequality (e.g., rising Gini coefficients) has a smaller negative impact on fertility than typically presumed. This finding may reflect the mitigating role of redistributive fiscal policies, as well as the empirical regularity of observing high fertility rates in low-income countries. The pattern is consistent with that observed by de la Croix and Doepke (2003), who showed that inequality can generate heterogeneous fertility choices across income strata. (iv) Declining traditional conservative values are moderately associated with low fertility. Although changing such attitudes through policies would be challenging, they can provide valuable insights into the broad social context related to fertility. (v) Religiosity seems to have little statistically significant impact on fertility. (vi) Educational expenditures, which represent an additional opportunity cost beyond market income, can negatively influence fertility. (vii) Fiscal policies related to childbirth have a positive effect, which is consistent with previous findings (e.g., Kalwij, 2010; Luci-Greulich and Thévenon, 2013; БрБшИ иБ, 2019). Such measures may offset some of the adverse effects of income inequality. (viii) Increased polarization could weaken social stability and lower people's chances of finding a spouse, which can impact fertility, albeit weakly. Unlike income inequality, which can be addressed through fiscal redistribution or human capital investment subsidies, social division represents a more fundamental form of instability. Persistent gender-based conflicts and distrust, which can be worsened or amplified by social media, may create new social trends

that function as normative constraints (e.g., Fernández and Fogli, 2009; Fernández et al., 2004), which can discourage fertility among the young working-age population. Moreover, recent theories posit that, in deeply divided societies, fertility may interact with group-level conflicts and norms, which suggests the existence of additional channels through which social division can shape fertility behavior (Bezin et al., 2025). Such findings call for further empirical research.

The synthesis of the findings yielded several key policy implications. (i) Given the difficulty of addressing such challenges within a short period and the effectiveness of fiscal policies, the current fiscal stance to boost fertility rates by raising fiscal subsidies needs to undergo drastic transformation. This is especially true if childrearing costs are incurred in the context of a social “rat race” (e.g., educational expenditures for status competition). (ii) Rather than broad welfare expansion, targeted family-oriented policies, such as child or family allowances linked directly with the timing of childbirth and/or the number of children, should be prioritized to address low fertility rates. Such measures can enhance the efficiency of fiscal spending and maximize its marginal effect on fertility.<sup>3</sup> (iii) Policy frameworks should place considerable emphasis on marriage incentives. Although public support for households has increased through various welfare programs, in certain cases, assistance for married-couple or multiperson households has declined compared with that for single-person households. Redesigning fiscal policies to address such imbalance could improve marriage formation and increase fertility. (iv) Fertility policies and female labor force participation should be balanced from the perspective of efficient resource utilization. Increasing female labor force participation and educational investment in the next generation can contribute to the creation of a highly productive workforce and thus help the economy secure scarce human capital. Therefore, policies for fertility, female

<sup>3</sup> This is relevant in ultra-low-fertility settings, in which childbearing can be effectively understood as a set of discrete margins, that is, whether to have a child and whether to have a second (or third) child and when. Thus, parity- and timing-contingent transfers can target the most policy-relevant decisions. Doepke et al. (2022) emphasized that fertility is not a continuous choice but a combination of discrete decisions (childlessness, parity progression, and timing), which implies that well-targeted incentives can be highly effective when they directly address such margins.

employment, and educational investment should be coordinated, rather than implemented in isolation. (v) Given that social norms related to child education can suppress fertility (e.g., Kim et al., 2024), educational system reforms should be considered. An educational system that fosters self-determination and intrinsic motivation, rather than relative comparison, can help reduce excessive opportunity costs that can deter family formation. (vi) Our theoretical analysis showed that fertility policy incentives decrease when people are concerned about children's quality, which can essentially raise childrearing costs. This result suggests caution in addressing low fertility through fiscal policies.

The rest of this paper is organized as follows: Section II reviews the relevant literature and explains how our study differs from existing approaches, and Section III describes the empirical model. Section IV presents the main results, Section V discusses the policy implications and presents a simple theoretical model that supports the implications, and Section VI concludes the paper

## II. Previous Studies

### A. Theoretical Background

**Quantity-Quality Trade-off Model of Fertility.** According to the theoretical framework developed by Becker (1992), women's labor market participation is a key determinant of fertility. As societies advance and women's educational attainment rises, women's market wages tend to increase. The phenomenon will raise the opportunity costs associated with childrearing and lead to a substitution effect, in which households reduce the number of children but invest substantially in each child. The rising cost of private education can further increase opportunity costs, particularly when such expenditures increase alongside income. At the same time, high female earnings can increase the total household income and generate a countervailing income effect, which can increase demand for children. Therefore, determining which of the opposing forces will dominate ex ante would be difficult. Quantitative analyses based on overlapping generation models generally predicted that an increase in the per capita income, human capital, physical capital, and female labor force participation will lead to low fertility. Yet, such conclusions should be interpreted with caution for at least two reasons.

First, an endogeneity issue exists between fertility and labor force participation in empirical studies. Although high female labor force participation may exert a negative effect on fertility, childbirth can also reduce women's labor supply. Empirical studies that used OECD panel data showed that female labor force participation does not necessarily exert a statistically significant negative impact on TFRs. Such ambiguity in recent research has drawn increasing attention (e.g., Hwang et al., 2018).

Aaronson et al. (2017) addressed the endogeneity issue by treating twin births as an exogenous shock, that is, an unintended increase in fertility, to estimate the causal effect of childbearing on the labor supply. The results indicated that, over the last two centuries, declining fertility was associated (causally) with rising female labor force participation in advanced economies, whereas fertility exerted only a minor effect on women's labor market involvement in developing countries. The authors argued that their findings are consistent with those of Goldin (1995), who documented a U-shaped pattern in U.S. female labor force participation during the 20th century. That is, an initial decline as the economy transitioned from agricultural and household production to factory-based industrial work, followed by a post-World War II increase as fertility fell.

Second, under the hypothesis, early 20th-century United States can be viewed as being analogous to current developing economies, in which declining fertility does not necessarily translate into high female labor force participation. From this perspective, Korea's current situation closely resembles that of advanced economies, which implies continued growth in the female labor supply. However, recent data suggest that such changes are gradual, rather than rapid.

**Relative Income Hypothesis.** Alongside Becker's traditional economic model, which views fertility as an outcome of individual choice, a sociological perspective emerged to explain the determinants of fertility. The relative income hypothesis, which was notably advanced by Easterlin, posits that fertility will decline when younger generations face deteriorating labor market conditions and lower relative income compared with that of their parents' generation. In the framework, whether one's income allows for a standard of living comparable to that during their upbringing matters, instead of an individual's absolute income level. When younger cohorts perceive their standard of living to

be difficult to attain or surpass that of their parents, they will be less inclined to have children.

Empirical tests of Easterlin's hypothesis, such as that conducted by Macunovich (2011), typically analyzed cohort-level variations in fertility and wage patterns to assess the link between income prospects and birth behavior. Although the theoretical foundation of the hypothesis is relatively weak, it has considerable explanatory power in practice. However, its limitation lies in the absence of a clear policy transmission channel. One plausible implication is that fertility may not decline sharply if intergenerational redistribution can effectively reduce economic disparities among generations.

**Social Norms.** In addition to absolute and relative economic factors, such as the opportunity costs and childrearing benefits emphasized in the models of Becker and Easterlin, sociocultural influences function as powerful norms that can shape fertility behavior (e.g., Fernández and Fogli, 2009; Sleebos, 2003). Fernández and Fogli (2009) analyzed how parental behavior regarding work and fertility can affect children's choices. The authors interpreted parental behavior as an external cultural variable, that is, a transmitted norm, and found that parental work and fertility patterns have a statistically significant intergenerational effect. That is, the parental labor supply can positively affect children's labor force participation but negatively affect their fertility, whereas parental fertility will display the opposite pattern. The findings highlighted the important role of cultural transmission in shaping economic behavior across generations.

Broadening the perspective, studies found that changes in social norms, such as declining enthusiasm for marriage, shifting gender-based division of labor, and evolving workplace arrangements facilitating childcare, can influence fertility. Therefore, empirical studies that will adequately incorporate such factors are essential.

Although prior studies typically emphasized the persistence of social norms, our study hypothesizes that such norms evolve rapidly in Korea. When economic and social developments are tightly interlinked, rapid economic growth can accelerate changes in fertility-related norms. For instance, though educational attainment initially enabled individuals to meet the minimal industrialization requirements, it has evolved into a highly competitive pursuit that requires substantial private investment. Rather than moderating their educational spending by relying on public

education, most households have increased their private tutoring expenditures and view such costs as unavoidable social expectations. Excessive “education competition” has become normalized to the point that it is rarely questioned; yet, from an economic standpoint, it represents a socially reinforced distortion. Such behavior suggests that Korea’s fertility-related social norms have endogenously adjusted to high-income levels and thus redefined the minimum standard of child investment. Thus, relative-status competition and the acceptance of high education costs as being “normal” have raised the opportunity cost of childbearing and further discouraged fertility.

***Policy Perspectives.*** Beyond theoretical and empirical frameworks, fertility can be analyzed from a policy design perspective. First, the economic incentives of childbearing can be increased by increasing its benefits or reducing its cost (e.g., Kalwij, 2010; Luci-Greulich and Thévenon, 2013), such as by linking family allowances with the number of children or reducing housing and education expenses for families with multiple children. However, this study emphasizes that such effects will likely be temporary if long-term trends, such as rising housing or education costs, are not addressed.

Second, fiscal policies could be restructured to align closely with fertility by targeting households, rather than individuals, as recipients of welfare benefits. Although the principle is rarely implemented, it is consistent with early arguments that childcare support should target working mothers to maximize labor market effects. Although political considerations typically favor the expansion of benefits for the numerically large group of single-person households, a family-based expenditure framework could enhance the effectiveness of family policies. Despite low fertility being a global trend, Korea’s position at the forefront of this decline leaves considerable room for policy innovation.

Third, though many fertility-related policies target rational cost-benefit decisions, how to respond to behavioral and normative factors should also be considered. For example, wealth redistribution from older to younger generations through taxation may not meaningfully address fertility if the younger cohorts’ reluctance to marry and have children stems from their perceived economic insecurity. Similarly, the heavy subsidization of education and housing costs may fail to resolve the underlying social norm of status-driven competition. Therefore, rather than focusing solely on material incentives, policy efforts should focus

on reshaping the content and purpose of education away from secular success and toward ethical value improvement, self-determination, and a sustainable sense of life purpose.

### *B. Fertility Literature in Korea*

Fertility policies in Korea have been discussed in the Becker and Tomes (1976) tradition, which posits that parents value the quantity and quality of their children. Becker (1992) offered a basis for the economic understanding of fertility and population determinants. Subsequent studies that explored the relationship between fertility and labor force participation focused primarily on the endogeneity between the two variables and examined how fertility can influence women's participation in the labor market. Recently, researchers began to incorporate behavioral and sociocultural dimensions, particularly the role of social norms, into fertility decision economic analyses and move beyond purely rational-choice frameworks. For instance, social norms that reinforce unequal gendered division are prevalent in East Asian societies (Hwang et al., 2019; Myong et al., 2021), which may help explain the low fertility in Korea.

Some social and cultural factors in the Korean context, such as the traditional preference for sons and the tendency of parents to allocate substantial resources to the first child, and the intergenerational transmission of fertility preferences among those raised in a large family are difficult to explain solely through the use of a cost-benefit framework. For instance, the weakening of preference for sons has led to a reduction in births in households that previously continued childbearing until a male child was begot, which has marginally contributed to the decreasing fertility. However, the factor cannot be considered as a structural determinant of low fertility. Conversely, individuals raised in a large family typically display a high propensity to have multiple children, which suggests that personal experiences can shape psychological comfort with large families and thus play a normative role (e.g., Fernandez et al., 2004). This line of research underscores the importance of preferences and social norms in fertility decisions. Nevertheless, the classic trade-off between the quantity and quality of children remains key to understanding fertility behavior, alongside economic growth.

Another significant development in the literature is the integration

of theoretical and empirical factors, such as female labor force participation, technological progress in household production, and demographic dynamics, into macro-level models that can simulate and quantify fertility outcomes. Kitao and Nakakuni (2024) noted that technological advancement and women's family preferences, along with policy changes, can account for the recent changes in Japanese fertility, which may have crucial implications for Korea. Although some economic factors are crucial to fertility decisions, social norms or preferences should be addressed.

Studies primarily examined the causes and characteristics of Korea's rapid aging and fertility decline. By using OECD panel data, Park (2017) attributed the fall in fertility to socioeconomic factors that can constrain work-family balance, such as declining marriage rates, rising childrearing costs, and labor market conditions, as well as sociocultural factors, including changes in educational attainment and gender equality norms. The study further identified the persistent impact of past antinatalist policies, the high cost of marriage and childrearing, unequal household labor division, instability in the housing market, and heavy private education expenses as major structural causes, which call for a comprehensive policy response. Such intuitively plausible factors underlie Korea's massive fiscal commitment, which reportedly totals approximately 380 trillion won, to address the issue of low fertility.

Jung et al. (2019) extended the discussion by empirically testing the Becker and Easterlin hypotheses on fertility trends in OECD countries, paying particular attention to the effectiveness of family policies and their implications for Korea. The authors argued that improving young adults' economic conditions and enhancing flexibility in women's labor market participation are effective means for raising fertility but emphasized the importance of the performance-based evaluation of family policy programs. The research provided valuable policy-oriented insights from a labor market perspective. Despite the usefulness of such parametric approaches, the literature lacks a structural understanding of why Korea's fertility rate declined to such an extreme level.

From the perspective of this research, the findings suggest that the decline in fertility is deeply structural and persistent; thus, a substantial rebound would be highly unlikely. This interpretation is consistent with this study. Recent analyses, such as those conducted by the National Assembly Budget Office (2020), treated low fertility as an

exogenous condition, rather than a reversible phenomenon, and focused on strategies for socioeconomic adaptation, rather than reversal.

Kim et al. (2024) presented evidence showing that social norms related to child education can suppress fertility through parents' use of children's educational achievement as a means for status competition and drawing of utility from children's social status. Such externality mechanism in education investment implies that educational system reforms should be considered. Park (2024) examined the importance of fertility infrastructure expenditures, rather than conventional transfers, by using regional fiscal expenditure data and identified possible inefficiencies in existing fiscal stances toward low fertility.

### *C. Additional Factors Considered in this Study*

Despite the above explanations, this study argues that current theories have failed to fully explain the rapid and profound decline in Korea's fertility rate. Although Korea shows patterns similar to those of other high-income countries, the scale of the change in the country has been considerably large. Therefore, this study extends the analytical framework by incorporating additional variables that may capture Korea's distinctive dynamics, that is, expectations about future economic conditions, evolving social norms, political orientations, and social conflicts, and fertility-related policy measures.<sup>4</sup> By integrating the trend-based factors into the empirical model, this study seeks to effectively understand the previously overlooked determinants of fertility and determine how Korea's fertility drivers differ qualitatively and quantitatively from those observed in other OECD economies.

## **III. Empirical Specifications**

### *A. Two Model Specifications*

In this study, two complementary econometric frameworks were employed to analyze the determinants of fertility. First, a panel fixed-

<sup>4</sup> This extension is motivated by recent evidence showing that fertility dynamics can be highly heterogeneous across countries and may cluster into distinct paths, rather than converge globally, which suggests that country-specific combinations of economic and institutional factors may matter for fertility outcomes (Papagni, 2023).

effects model was used as the baseline specification. Given that fertility behavior is shaped by each country's unique social and cultural characteristics, unobserved country-specific heterogeneity may be correlated with observable explanatory variables and may bias the estimates under a standard OLS framework. The fixed-effects specification controlled for such unobserved time-invariant characteristics by allowing each country to have its own intercept. In addition, given that OECD economies tend to share broadly similar long-term time trends, a linear time trend was used to capture common temporal dynamics.

Second, though the use of panel data can mitigate concerns about spurious correlations, macroaggregated variables typically exhibit comovement across countries, which reflects shared shocks or persistent dynamics. To address the issue and effectively isolate country-specific variations, the analysis supplemented the baseline specification with a dynamic panel model, with reference to the Arellano and Bond (1991) framework. According to their econometric formulation, many behavioral processes evolve gradually, rather than abruptly, which implies substantial autocorrelation in the dependent variable. Fertility is influenced by slowly changing sociocultural factors; thus, modeling it as a first-order autoregressive process, AR(1), including a one-period lag of fertility as a regressor, would be appropriate.

Formally, the composite error term consisted of two components: (i) a country-specific disturbance (fixed effect) with a mean of zero and constant variance and (ii) an idiosyncratic error term that varied over time and across the countries. However, the inclusion of a lagged dependent variable will introduce endogeneity, because the lag is mechanically correlated with the error term. Instrumental variables based on the Arellano–Bond moment conditions were employed to address the issue, and lagged levels and the differences in the endogenous regressors were used as instruments.

The dynamic specification enabled the model to control for the persistence of fertility trends while extracting the cross-country variation attributable to the explanatory factors and thus improved the robustness and causal interpretability of the results.

**Empirical Models.** As the first empirical specification, a panel fixed-effects model was used in this study, expressed as the following linear

formulation:<sup>5</sup>

$$y_{i,t} = \mu_i + x_{i,t}\beta + u_{i,t} \quad (1)$$

where  $y_{i,t}$  represents the TFR of country  $i$  at time  $t$ ;  $\mu_i$  denotes the unobserved country-specific fixed effects;  $x_{i,t}$  and  $\beta$  are the vector of the explanatory variables and their corresponding coefficient, respectively; and the error term  $u_{i,t}$  follows standard properties, that is,  $u_{i,t} \sim iid(0, \sigma_u^2)$ . The model exploited the within-country time-series variations and cross-country differences in the panel dataset. The estimation proceeded with the elimination of the fixed effects through first differencing to address the potential bias from the unobserved heterogeneity, correlated with the regressors. Thus, the approach can mitigate the estimation bias, which can emerge under OLS when the unobserved characteristics are correlated with the observed covariates.

Next, the dynamic panel model was considered, as follows:

$$y_{i,t} = \delta y_{i,t-1} + x_{i,t}\beta + u_{i,t}, \quad i = 1, 2, \dots, N; \quad t = 1, 2, \dots, T, \quad (2)$$

where  $y_{i,t}$  and  $x_{i,t}$  are defined as those above, and  $\delta$  represents the coefficient of the AR(1) process. The error term  $u_{i,t}$  was assumed to consist of the following components:

$$u_{i,t} = \mu_i + v_{i,t} \quad (3)$$

where  $\mu_i \sim iid(0, \sigma_\mu^2)$  represents the country-specific fixed effects, which can capture the unobserved heterogeneity across the countries, and the latter component  $v_{i,t} \sim iid(0, \sigma_v^2)$  follows the standard properties of an idiosyncratic error term. The persistence of fertility arises from two sources: unobserved country-specific fixed effects  $\mu_i$  and the AR(1) process of the lagged fertility rate. Even though the model was estimated within a fixed-effects framework through first differencing to eliminate individual heterogeneity, endogeneity remained between the differenced error term and the lagged dependent variable. Generalized method of moments estimation, which was proposed by Arellano and Bond (1991),

<sup>5</sup> The vector of the explanatory variables may include

$x_{i,t} = [\text{marriage}_{i,t}, \text{child-bearing and-raising cost}_{i,t}, \text{income}_{i,t}, \text{labor market condition}_{i,t}, \text{fertility policy}_{i,t}, E(\text{future income})_{i,t}, \text{belief}_{i,t}]$

was conducted in this study to address the issue. With reference to standard practice, the dependent variable was included, with a first-order lag, and an autocorrelation test (AR test) was conducted up to the second order of correlation to ensure the validity of the model.

### *B. Data*

The macroeconomic data of the OECD member countries were used in this study, along with country-specific information on fertility trends and related policies, which were collected individually, then integrated into other datasets. Furthermore, the variables related to religion and political orientation were drawn from the World Values Survey (WVS) and merged with the data of the OECD countries, which allowed the partial incorporation of noneconomic factors, such as cultural, social, political, and religious influences on fertility. In addition, the data on income inequality, which has become a topic of increasing policy relevance, were obtained from the Standardized World Income Inequality Database (SWIID) for use in the sensitivity analyses.

Although the data of major OECD countries are available as far back as 1970, many of the countries reported complete and consistent statistics only in recent decades. Substantial differences remain in the data coverage and quality, particularly in the labor market indicators and measures of the opportunity cost of education, which resulted in a highly unbalanced panel dataset. The fertility-related policy data of the Western European countries were generally comprehensive, whereas the other nations typically suffered from data gaps or limited reporting periods.

When the variables related to social norms and expectations about the future were integrated into the data from the WVS, the resulting sample became an unbalanced panel that included the childbearing opportunity cost, labor market condition, fertility policy measure, future expectation, and religious/social norm indicators. However, only a small subset of the countries provided complete data across all the dimensions.

The analysis proceeded in stages to maximize the sample size, beginning with the baseline model, which included the opportunity cost and labor market variables. Then, the new group of variables, namely, fertility policy measures, expectations about the future, and religious/social norms, were added either incrementally or jointly, in line with the approach adopted in prior research.

**Variables Used.** Several factors were considered as the explanatory variables. (i) The marriage rate was included as a fundamental precondition for fertility. Most births occur within, rather than outside, marriage; thus, fertility is viewed as being largely induced by marriage. Moreover, though reverse causality from fertility to marriage may be inconsequential, marriage and fertility may be jointly influenced by common shocks and unobserved preferences.

(ii) Average wages were used to capture the influence of women's earnings on their labor market participation and fertility decisions. Labor force participation is endogenous to fertility; thus, directly controlling for it would bias the estimation. Hence, average wages, instead of labor force participation, were used. The variable embodies the price effect, because high wages can raise the opportunity cost of childbearing, and the income effect, because high earnings can increase the household resources available for children. Therefore, the net effect required careful interpretation.

(iii) The unemployment rate, average working hours, proportion of the working-age population, and employment rate were used as variables to reflect the extent to which the current labor market environment supported or hindered the economic activity of the younger generations. The indicators can collectively capture the structural labor market conditions that may directly or indirectly influence fertility behavior.

(iv) The cost dimension of childbearing was explicitly considered through the inclusion of education expenditures per child. The variable proxied for the rising cost of raising and educating children, which is a major determinant of fertility decisions in high-income economies.

(v) Several fiscal policy variables were incorporated to account for government intervention measures to reduce the opportunity cost of childbearing, such as family allowances, childcare subsidies, and other fiscal transfers related to fertility. By controlling for such fiscal instruments within the data availability limits, the analysis sought to capture how government policies can influence the perceived costs and benefits of having children.

(vi) Beyond the economic variables discussed above, changes in social preferences that may affect fertility behavior were considered in the analysis. Religious beliefs, in terms of affiliation and the intensity of faith, can influence fertility decisions, particularly in modern societies that are experiencing increasing secularization. Variables that can capture the extent to which individuals believe in and rely on religion

were included in the model to account for religious beliefs and control for social and cultural factors that may indirectly shape fertility outcomes.

(vii) Political orientation is typically shaped by broad social processes beyond individual control; thus, it was treated as an environmental factor that can influence personal attitudes toward life and decisions on childbearing. Accordingly, controls for a society's prevailing political stance, which can serve as a proxy for underlying value systems that can affect fertility preferences, were included in the model.

(viii) Demographic externalities were controlled in the model by considering the cohort size. When a generation is unusually large, intensified competition in education and labor markets can increase the perceived survival pressure, which may lead individuals to postpone or avoid childbirth. Thus, the generational "crowding effect" was incorporated in the model as a potential indirect fertility constraint.

(ix) Expectations about future economic conditions were also included. Having an optimistic outlook, that is, believing that economic conditions will improve, may encourage fertility, regardless of the difficult times. However, in high-income societies, where welfare and living standards are elevated, expectations about further income growth could shift preferences toward leisure and self-fulfillment and thus discourage fertility. Conversely, rising uncertainty about the future, such as expectations about widening income inequality, may lead to precautionary behavior and cause individuals to delay or forgo childbearing until economic conditions stabilize.

In this context, the analysis distinguished between (i) expectations about future economic conditions and (ii) expectations about the uncertainty of such conditions. Both were controlled in this study to isolate their distinct effect on fertility decisions. A summary of all the variables used in this study is presented in Table 1.

Although most of the variable definitions are self-explanatory, the conflict variable, which represents the social conflict index, requires clarification. By definition, when the size difference between the left- and right-leaning groups is small, a situation of intense ideological confrontation will emerge. Moreover, the smaller the middle group, the higher the significance of the polarization. Accordingly, the degree of political conflict was defined as the product of the two inverse ratios, as follows:

**TABLE 1**  
VARIABLE DEFINITION

	Variable Name	Definition
Dependent Variable	fertility_rate	TFR - average number of children born per woman of childbearing age
First-lag explanatory variable	fertility_rate(t-1)	First-lag TFR (per woman)
Marriage rate	marriage_rate	Number of marriages per 1,000 people
Substitution and income effects	avg_wage	Average wage (log wage, 2016 USD)
Labor market conditions and culture	male_cohort	Ratio of males aged 20–34 years to males aged 35–64 years (high ratio indicates intensified competition among younger generations)
	hours_worked	Working hours
	participation	Labor force participation rate
	labor_force	Proportion of working-age population
	LT_unemp	Long-term unemployment rate
	temp_emp	Temporary employment
	part_emp	Part-time employment
	emp_rate	Employment rate
Policy variables	family_benefit	Family allowance (as a percentage of GDP)
	maternal_leave	Maternity leave duration (weeks)
	paternal_leave	Parental leave duration (weeks)
	public_spending	Public expenditures on childcare and early education (as a percentage of GDP)
Expectations about the future	income_exp	Expected income (long-term real GDP forecast, 2016 USD)
	elderly_pop_rate	Proportion of elderly population (expectations about rising future old-age dependency costs)
	Gini	Gini coefficient (reflecting persistence of inequality)

	Variable Name	Definition
Opportunity cost	private_education1	Private education expenditures for infants (as a percentage of GDP)
	private_education2	Private education expenditures at elementary level (as a percentage of GDP)
	private_education3	Private education expenditures at middle school level (as a percentage of GDP)
	private_education4	Private education expenditures at high school level (as a percentage of GDP)
Income distribution	poverty_rate	Poverty rate (proportion of population below the poverty line, defined as 50% of the median income)
	poverty_gap	Ratio of average income of the population below the poverty line to the poverty threshold (as a share of mean income)
	Gini	Pretax Gini coefficient
Sociocultural and political values	P(no_religion)	Proportion of nonreligious population (derived from WVS religious denomination time-series data)
	political_stance	Proportion of population identifying as left, right, or center (based on WVS political denomination data: 1–4 = left, 5–6 = center, 7–10 = right)
	political	Proportion of respondents identifying with liberal (left leaning) values among all political categories
	conflict	Social conflict index (measured as degree of polarization; narrow gap between left and right groups indicates high conflict)

Note: All the monetary values are expressed in 2016 USD and adjusted for purchasing power parity.

$conflict = f(gap)$  with  $f' > 0$ , and  $gap =$  ideological distance among individuals

$$= \frac{1}{|\text{left} - \text{right}|} \cdot \frac{1}{\text{middle}} \quad (4)$$

If increased conflict leads to decreased fertility, then the conflict variable is expected to yield a negative coefficient. Likewise, for the political variable, which represents the proportion of the respondents with liberal (left leaning) values among those who identify as left, right, or center, a high value indicates a departure from traditional or conservative norms. Therefore, the variable was also expected to show a negative estimated coefficient.

#### **IV. Empirical Results**

##### *A. Descriptive Statistics*

Online Appendix Tables A1–A4, which are excluded from the text for brevity, present the descriptive statistics of the variables used in the analysis, starting with the basic fertility-related variables, then the policy-related variables, social and cultural factors, expectations about the future, and income inequality measures.

The sample size decreased as additional control variables were added, which reflected the inherent data availability limitations across the countries and variables. Moreover, compared with the standard panel data model, the dynamic panel specification required the use of lagged variables as the instruments, which further reduced the number of available observations. The general correlations between the fertility and key explanatory variables were examined before the detailed econometric estimation was conducted to gain preliminary insights.

As shown in Figure 1, the variables that exhibited a positive correlation with fertility are the marriage rate, log income, and employment rate, whereas the variables with a negative correlation are the unemployment rate, proportion of the elderly population, proportion of the nonreligious population, liberal political orientation, and degree of political polarization.

Overall, the correlations aligned well with common intuition and our theoretical expectations. For the other variables, namely, the cohort size, expected future log income, and Gini coefficient, the relationships were less definitive, which suggested the existence of complex interdependencies or compounding third-variable effects. The preliminary findings provided an empirical backdrop for the subsequent rigorous regression analyses, presented in the next sections.

### *B. Estimation Results*

#### a) Baseline Model

Tables 2–10 present the results of the regression analyses examining the determinants of the TFR. The analysis began with the baseline model, then gradually incorporated the other factors, including the social variables, expectations about the future, income inequality, and the policy-related variables.

Tables 2 and 3 report the results of the basic model, which included the fundamental determinants identified in prior studies, namely, the variables that captured opportunity costs and labor market conditions. Specifically, the model controlled for the average wage (*lnwage*) to capture the substitution and income effects, private education expenditures (*private\_spending*) to represent the opportunity cost of childrearing, and the unemployment rate and employment rate to reflect labor market conditions. In addition, the model included a time trend variable (*time*) and the marriage rate (*marriage\_rate*), which are key prerequisites for fertility.

Table 2 reports the estimates of the panel fixed-effects model, and Table 3 presents the results of the Arellano–Bond dynamic panel model. As expected, high private education costs were associated with low fertility, which confirmed the negative relationship between childrearing costs and birth rates. Among the education-related variables, *private\_spending1* represented pre-primary education costs, *private\_spending2* represented primary education costs, *private\_spending3* represented secondary education costs, and *private\_spending4* represented tertiary (high school) education costs.

Although the effects varied somewhat across the levels, high school education costs consistently showed a significant negative impact in both models. Moreover, the aggregate measure, *private\_spending*, which summed all the education-related expenditures, exhibited the strongest negative effect on fertility.

The unemployment rate and employment rate were included together, because though they were inversely related, they were not perfectly collinear. Both variables indicated that improving labor market conditions, that is, reducing unemployment and increasing employment, tended to increase fertility, which is consistent with economic intuition.

Interestingly, the wage variable (*lnwage*) was positively correlated

with fertility across the two estimation methods. The finding suggested that, within the sample of OECD countries, rising income levels, though traditionally believed to discourage fertility through high opportunity costs, were associated with high fertility rates. The finding aligned with recent empirical evidence indicating that, as female labor force participation increases and childcare infrastructure develops, high income will no longer suppress fertility, which will signal a structural shift from past patterns.

#### b) Social Factors

Tables 4 and 5 show how social norms, cultural characteristics, and broad societal factors can influence fertility through a fixed-effects panel model and an Arellano–Bond dynamic panel model. The specifications extended the baseline model by incorporating the social variables to allow the analysis to focus on the effects of the noneconomic determinants. The variables represented societal attributes, rather than individual choices; thus, they were treated as being exogenous to fertility decisions to minimize the reverse causality concerns. The shaded areas in the tables highlight the key results.

First, regardless of the estimation method, the male cohort variable (*male\_cohort*), which captured the relative size of the younger male cohorts relative to the other male cohorts, had a negative and statistically significant effect on fertility. The finding suggested that, as the number of individuals within the same age group increases, competition intensifies, which will lead to decreased fertility rates. The finding is consistent with the Easterlin hypothesis, which posits that large cohorts face economic and social pressures that can discourage family formation. The robustness of the result across the model specifications and sample compositions underscored its importance. Specifically, the members of the present young generation, who are the descendants of the baby boomers, may appear to live in relative prosperity, but in fact, face substantial social and economic pressures, as implied by the outcome.

Second, the effect of religion, which reflected value systems and moral norms, exhibited an interesting contrast between the simple correlations and multivariate results. Although the bivariate correlation between religiosity and fertility was positive, controlling for the other covariates rendered the effect statistically insignificant or slightly negative, which implied that fertility tended to rise as the proportion of the nonreligious

population increased. The result likely reflected the secularization trend observed in many Western European societies, in which religion loses its traditional influence on family behavior as economic and political stability increases.

Third, the effects of having a progressive ideology (political) and the presence of political conflict (conflict) were unclear. The results differed somewhat across the models, but under the Arellano–Bond dynamic panel, which provided a highly reliable specification, a weak negative association was observed between having a liberal political orientation and fertility. The finding may reflect broad social trends, such as shifting gender norms and delayed marriage, that are also relevant in the Korean context. However, given the relatively low statistical significance of the variables, the findings should be interpreted with caution, and further empirical investigation is warranted.

#### c) Expectations about the Future

Tables 6 and 7 present the estimation results of the models that incorporated expectations about future economic conditions in the baseline specification. In addition to the previously discussed variables, the analysis introduced three key forward-looking indicators: expected future income, income distribution (Gini coefficient), and the elderly dependency ratio. The variables captured anticipated socioeconomic conditions, which were assumed to be exogenous to current fertility decisions, to minimize the concerns about reverse causality.

First, one may expect high expected income to improve economic prospects and thus increase fertility. Conversely, worsening income inequality could undermine the fertility intentions of the younger cohorts, whose socioeconomic positions are uncertain, whereas an increase in the elderly dependency ratio would signal heavy future burdens on the working-age generations and thus discourage childbearing. The relationships reflected the effect of the stock variables (expectations and structural factors) on the flow outcomes (fertility decisions); thus, reverse causality was expected to be minimal, and the regression framework was appropriate for the analysis.

However, contrary to our initial expectations, the estimated coefficient of expected future income,  $\ln(\text{income\_exp})$ , was negative and statistically significant, which indicated that high anticipated income levels were associated with low fertility rates. The result may reflect the reality that, within the sample of OECD countries, in which

income and social security systems are well developed, expectations about increased future affluence may shift individuals' focus away from family formation toward leisure-oriented or self-fulfillment activities.<sup>6</sup> Although childrearing may bring psychological satisfaction and increase household stability, in affluent and secure societies, individuals may increasingly seek values beyond family life. Although Korea's level of affluence may be debated in real terms (adjusted for purchasing power), its income level is sufficiently high to lend some relevance to this interpretation.

Second, the Gini coefficient (Gini), which represented persistent income inequality, showed a slightly negative but statistically insignificant effect on fertility. The result suggested that considerable inequality may exert some downward pressure on fertility, though the evidence is weak. The finding partially contrasts with that of de la Croix and Doepke (2003), who found that inequality can shape long-term fertility through heterogeneity in family decisions. However, as demonstrated by further analysis, the potential negative effect largely disappeared when the fertility-related policy variables were incorporated, which indicated the mitigating role of fiscal interventions.

Third, consistent with income inequality, the poverty gap (`poverty_gap_tot`) showed a weak and insignificant negative association with fertility. By contrast, the proportion of the elderly population (`elderly_pop_rate`) showed a strong and statistically significant negative effect, which implied that, as the burden of the supporting older generations increases, the younger cohorts face rising economic and psychological constraints, which can discourage childbearing. The result highlights the growing intergenerational tension between demographic aging and fertility decline.

<sup>6</sup> At high income levels, marginal gains in expected prosperity can increase the relative attractiveness of leisure- and lifestyle-related consumption, which can substitute for childbearing and decrease fertility, conditional on marriage. A formal account of this intuition treated children and leisure-related goods as substitutes and implied that rising income (and/or declining effective prices of leisure goods) can reduce fertility through reallocation toward leisure/lifestyle consumption (Galindev, 2011). Related discussions in the fertility survey literature emphasized that technological and market changes can expand leisure consumption and reshape the work-family trade-offs faced by households (Doepke et al., 2022).

## d) Policy Factors

Tables 8 and 9 present the effects of policy interventions employed traditionally to encourage fertility. Specifically, the model examined the direct measures, such as family allowance and the duration of maternity leave, and the indirect measures, such as parental leave and public expenditures on childcare and early education (family\_benefit, length\_of\_maternal\_leave, length\_of\_paternal\_leave, and public\_spending). The policy variables were largely determined through institutional and budgetary processes and typically adjusted with delays, which can reduce the concerns about contemporaneous reverse causality at an annual frequency. Nevertheless, the estimated policy coefficients should be interpreted cautiously, because policy reforms may respond to underlying demographic trends and political economy considerations.

First, the results showed that the direct policy instruments, such as family allowance, maternity leave, and public childcare subsidies, tended to increase fertility rates significantly when few covariates were controlled. The finding implied that, contrary to the Korean experience, in which policy effectiveness was typically viewed as being limited, such measures may have a substantive impact on fertility in cross-country settings.

Second, the parental leave duration, which is a broad policy that encompasses both parents, showed a weaker and less consistent effect on fertility compared with maternity leave. The result may partly reflect multicollinearity among the policy variables and the relatively small sample but also suggest differences in policy effectiveness across the instruments. Maternity leave, which can directly reduce the opportunity cost of childbirth for women, seemed to exert a strong and immediate impact on fertility decisions. The asymmetry is consistent with bargaining-based views of fertility policies: Interventions that can directly reduce mothers' short-term childbearing and childcare burden tend to elicit a more salient fertility response than broad parental-leave expansions, whose effect on within-household incentives and labor-market attachment may be ambiguous.<sup>7</sup>

<sup>7</sup> Doepke and Kindermann (2019) emphasized that, when births require mutual agreement within couples, policy effectiveness will depend crucially on whether an intervention can reduce the childcare burden borne by women. In the authors' quantitative bargaining framework, policies that can effectively

Third, in terms of statistical significance, family allowance and maternity leave displayed a more robust and direct influence on fertility than childcare-related public spending, which suggested that direct income support and maternal protection measures may be highly effective in shaping short-term fertility behavior. Although not reported in this paper, alternative model specifications confirmed that family allowance and childcare subsidies consistently emerged as the most effective policy tools for reducing the opportunity costs associated with childbearing. Given the cross-country heterogeneity in welfare systems, fertility-related fiscal policies must be tailored to each country's institutional context.

Finally, an interesting finding was that the Gini coefficient became statistically insignificant when the different policy variables were included. Moreover, the sign of the Gini coefficient was reversed, which indicated that high inequality was associated with high fertility, which was consistent across the model specifications. The finding aligned partly with that of de la Croix and Doepke (2001), who argued that high inequality can induce a divergence in fertility behavior: Low-income households ("Malthusian agents") respond to inequality by having multiple children but investing less per child, whereas high-income households have few, but highly educated, children. The dynamic raises the overall fertility but reduces the average human capital and thus slows long-term growth.

In this study's context, the results were interpreted as evidence that fertility-related fiscal policies can mitigate the negative impact of income inequality on fertility, that is, effective policy interventions may offset inequality-driven demographic imbalance to a certain extent by reducing the opportunity cost of childbearing.

#### e) Discussion of Results

The empirical results of the international comparison analysis are summarized in this section, with some interpretation. First, the analysis confirmed that increasing marriage rates remain the most fundamental

target mothers (e.g., childcare support) are substantially more cost effective than instruments that cannot effectively target such groups. Doepke et al. (2022) also stressed that the empirical fertility effects of parental leave policies are mixed, and paternal leave extension can delay or reduce subsequent births in some settings.

determinant of fertility. Although out-of-wedlock births have become increasingly common in modern societies, the majority of childbirths occurs within marriage. Thus, promoting family formation, primarily through family allowance-centered policies, remains a statistically significant and effective approach for increasing fertility. In the Korean context, the estimates suggested that the decline of roughly 0.2 births per woman can be attributed to the reduction in marriages.

Second, expectations about future income growth were found to discourage fertility. In economies with high income levels, anticipation of prosperity may shift household preferences away from childbearing toward alternative high-value activities. The finding implied that, when younger generations lack confidence in sustained future income growth, traditional choices, such as marriage and childbirth, may be highly appealing. In Korea's case, given that long-term income prospects are not substantially worse or better than those in major OECD countries, attributing the low fertility primarily to pessimistic income expectations would be difficult.

Third, contrary to superficial assumptions, income inequality (e.g., Gini coefficient) did not exert a strong or consistent effect on fertility, perhaps because the fiscal redistribution mechanisms of most of the OECD countries can mitigate the impact of pretax inequality. Moreover, in low-income households, fertility was relatively high partly because of child benefits and transfer programs and partly because of the behavioral patterns noted by Becker (1995), that is, in wealthy households, high opportunity costs can reduce fertility.

Fourth, educational expenditures, as a proxy for childrearing opportunity costs, exerted a negative influence on fertility. Although high educational spending places strong societal emphasis on human capital, the cross-country differences suggested that the practice was not purely rational in a cost-benefit sense. For instance, in Korea, the exceptionally high private education costs do not correspond to the proportionately high educational returns, which implies the presence of a cultural or an aspirational driver. Thus, in contexts in which education is perceived to be a costly but unavoidable investment, fertility tends to decline.

Fifth, religious affiliation was not statistically significantly associated with fertility. Although most religions emphasize the sanctity of life, in modern societies, secularization can weaken the institutional and moral influences of religion. As a result, the decline in religious adherence

and diminishing societal weight of religion can neutralize its effect on fertility.

Sixth, the results indicated that traditional or conservative values weaken over time, which was associated with low fertility. As political orientations shift toward progressive and egalitarian views, gender equality norms intensify, which can heighten intergender conflicts during the transition. From a sociological perspective, in such contexts, women may be less inclined to seek traditionally oriented partners or marriage, which will lead to delayed marriages or reduced marriage rates. Although such trends are primarily cultural and structural and thus difficult to modify directly through policies, they should be recognized as macro-level contextual factors when designing fertility policies.

Seventh, the evidence indicated that increased social conflicts can typically suppress fertility. Societal polarization, which was measured as the extent to which the left- and right-wing political groups were evenly divided, with a weakened centrist core, can create instability, which individuals find difficult to navigate or avoid. Such macro-level uncertainty can heighten the perceived long-term risks associated with family formation and childbearing. In extreme ideological deadlocks (e.g., a 51-to-49 split in a deeply divided society), political division can hinder constructive dialogue and heighten social anxiety and thus deter marriage and reduce fertility.

By contrast, income inequality functions differently. Although high inequality can create tension, it can be addressed through fiscal policies or investment in human capital. In addition, according to de la Croix and Doepke (2003), low-income households may respond to inequality by having multiple children but investing less per child. Therefore, in the relatively wealthy and moderately unequal OECD economies, the impact of income inequality on fertility may be weak or statistically indistinct.

Overall, the empirical results implied that, though economic incentives and opportunity costs are important, social cohesion, cultural norms, and perceived future stability play an increasingly central role in shaping fertility behavior in advanced economies.

### *C. Simple Quantitative Assessment*

A simple quantitative exercise was conducted in this study to determine how each explanatory factor category contributed to the overall variation in the fertility rates, based on the estimated coefficients and sample averages. In the baseline model, the marriage rate and income level explained approximately 0.22 and 0.5 births per woman, respectively. Meanwhile, education costs, the unemployment rate, and the employment rate contributed  $-0.06$ ,  $-0.09$ , and  $+0.15$  births, respectively. Among the social factors, the male cohort size (proxy for generational competition) had a strong negative contribution of about  $-0.92$  births, whereas religion, political ideology, and social conflict contributed around  $+0.08$ ,  $+0.04$ , and  $+0.02$  births, respectively.

Regarding the expectation variables, future income expectations exhibited a large negative impact of roughly  $-7.59$  births, whereas income inequality and population aging (elderly dependency ratio) exerted an additional negative effect of  $-0.16$  and  $-0.55$ , respectively. The magnitudes highlighted expectations about future economic conditions as one of the most influential determinants of fertility.

For the policy variables, the estimated contributions of family allowance, maternity leave, parental leave, and childcare support were relatively small, that is, approximately  $+0.04$ ,  $+0.11$ ,  $+0.01$ , and  $+0.01$ , respectively. The results implied that, though the policy effects were statistically significant, their absolute magnitudes were modest and inadequate to alter long-term fertility trends on their own.

Overall, the results suggested that, in addition to the well-known economic and demographic factors, the expectation-related variables, particularly perceptions of future income and aging, played a more critical (negative) role than previously assumed. In the Korean context, expectations about future income growth have stabilized relative to those during the high-growth era, making fully accounting for the substantial fertility decline difficult. Likewise, though accelerating population aging has become a growing concern, Korea has yet to reach the aging intensity level observed in several advanced economies, making it unlikely to be the decisive factor behind low fertility.

Therefore, the perceived lack of policy effectiveness in Korea may stem not from statistical insignificance but from the small magnitude of the policy coefficients. Taken together, the findings align with the results of previous analyses, which indicated that, though economic

and policy drivers matter, the macro-psychological and expectation-driven dimensions of fertility behavior deserve increased attention in future research and policy design.

#### *D. Sensitivity Analysis*

##### a) Exclusion of Marriage Rate Variable

In the baseline specification, the marriage rate was assumed to exert a causal influence on fertility primarily to account for the role of out-of-wedlock births. However, because marriage and fertility may share similar behavioral determinants, the marriage rate variable was excluded, and reestimation was performed. The results showed no significant differences relative to those of the baseline model; therefore, they were not included in the paper for brevity.

##### b) Control of Lagged Explanatory Variables

The empirical analysis assumed that fertility decisions were made annually, given the sufficient information available each year. However, if individuals form expectations adaptively, relying only on contemporaneous or prior-period information (excluding forward-looking expectations), then the relevant determinants of fertility should be lagged by at least one year to account for the gestation period. For brevity, the regression results under the alternative specification were not reported; however, they were largely consistent with the baseline findings.

##### c) Aggregation of Maternity and Parental Leave Variables

Although separate variables were used to represent maternity leave and parental leave in the main analysis, the policies were expected to have similar effects. Therefore, the two variables were combined into a single aggregated leave variable for the robustness testing. The results showed no meaningful difference from the baseline analysis results.

##### d) Use of Alternative Gini Coefficient Data (SWIID)

The OECD Gini coefficient dataset was relatively limited; thus, additional data were drawn from the SWIID, and Gini coefficients based on disposable income were used to reassess the effect of income inequality on fertility. When the other explanatory variables were excluded, the sample was extended beyond the OECD countries to

include several emerging economies. Under the broad specification, the results aligned with those of the literature: Fertility increased with high inequality, and in low-income groups, fertility became a dominant driver of the aggregate fertility (consistent with the findings of de la Croix and Doepke, 2003).

However, when the additional controls were introduced, such as the opportunity cost variables, the Easterlin hypothesis-motivated cohort measures, and the social and policy-related factors, the significance of inequality diminished. The reason for the decrease in significance was that the sample was restricted to OECD countries, where after-tax (disposable income) inequality is relatively moderate. The findings support the conventional conclusion that income inequality may positively affect fertility in unequal or developing economies but will have limited explanatory power in advanced economies with robust redistributive.

The coefficient estimates were interpreted cautiously. Although the panel fixed effects and dynamic specifications mitigated the bias from time-invariant heterogeneity and persistence, some of the regressors, such as the marriage rate, policy variables, and forward-looking indicators, may be correlated with unobserved shocks or respond to long-term demographic trends. Accordingly, the estimates were viewed as policy-relevant conditional associations in an international comparison setting.

## **V. Policy Implications**

### *A. Implications based on Empirical Results*

The synthesis of the above findings yielded several key insights and policy implications. First, Korea is faced with structural and socioeconomic factors that make a dramatic recovery in fertility virtually impossible. Given the country's consistent material wealth, shifting political preferences, rising gender and social tensions, stagnant growth expectations, declining marriage rates, and rising divorce rates, a spontaneous fertility rebound would be unrealistic. Instead, policy efforts should seek to prevent further decline by carefully selecting policy instruments with lasting effects.

Second, instead of relying on broad welfare expansion to boost the low fertility rates, Korea should focus on providing direct targeted family-

based transfers, such as parental leaves, in-work childcare facilities, family allowances, or benefits explicitly linked with in-work childcare and the number of children. Although the creation of an improved overall childbearing environment remains challenging, fertility decisions continue to be influenced by economic factors, particularly the trade-off between opportunity costs and benefits. Therefore, policy measures that can directly reduce the cost of raising children or increase perceived benefits are crucial and can offer a new direction for policy stances. We can expect medium-term fertility recovery by aligning childcare needs with the proper development of childcare infrastructure.

Third, though men and women have become less motivated to marry, policies that encourage marriage remain relevant. Well-designed marriage incentives could help restore pathways to family formation. Although welfare programs have increasingly expanded support for single-person households, the shift has indirectly reduced the relative benefits for family units. Thus, a reassessment of fiscal policies is warranted to ensure that families with children are not disadvantaged in the allocation of public support.

Fourth, though the concern about Korea's persistently low fertility rate is justified, the social benefits of the issue should be recognized. The increasing female labor force participation is expanding the economy's effective labor supply, improving household income stability, and strengthening the overall resilience of the economy. Therefore, policies should take a balanced approach, that is, acknowledge that the decline in fertility also reflects women's independent choices in a society that is experiencing rapid income growth, rising income inequality, and high income risks. Caution is needed to avoid framing low fertility solely as a "problem," without considering the gains in individual well-being and economic efficiency, which come with increased gender equality.

#### *B. Further Implications based on the Insights*

Beyond the above implications, this section discusses the unprecedented pace of the fertility decline in Korea, which cannot be fully explained by conventional models. Although major advanced economies have experienced declines in fertility, alongside income growth, Korea's decline has been considerable. Two potential explanations have been proposed: (i) the sharp deterioration in expectations about the future economy owing to fears of low economic

growth, population aging, and heavy tax burdens and (ii) rapid preference shifts beyond those predicted by rising income levels.

The empirical analysis provided only partial support for the first mechanism, because the estimated effect of future income expectations on fertility was negative. At the OECD average, pessimistic expectations about future income may boost fertility, which is at odds with the data from Korea. Therefore, we did not regard pessimistic income expectations as the sole explanation.

After Korea experienced rapid income growth, driven by its technological catch-up, the country experienced a prolonged period of economic stagnation owing to its limited innovation capacity. However, a sudden collapse in income levels was unlikely. Although income inequality increased, Korea's pretax income distribution remains more equal than that of the United States and is not dramatically worse than that of Western Europe. Youth unemployment is also a legitimate concern. However, its relative rate, which is approximately three times that of adult unemployment, remains comparable to the OECD average. Thus, the objective structural factors alone cannot explain the magnitude of the fertility collapse.

Social norms and political structures may affect fertility, but because of Korea's dynamic nature, some social norms, such as work cultures and gender relations, have changed rapidly. Hence, viewing social norms and political structures as long-term decisive factors in the low fertility would be difficult. We believe that a subset of social norms is highly culturally rooted, which can lead people to perceive childrearing costs as being excessive and thus to low fertility. For instance, if educational achievement mirrors social status, then excessive investment in education can significantly reduce family fertility. High social status is fixed in nature and thus can generate economic rents, which exemplifies a rat race in the context of social status. Having many successful children can be considered as a blessing, but the inability to have intelligent children cannot be considered as a curse. Not all married couples can afford to live in a luxurious Manhattan condominium in New York. One may wish to live in such a place, but not living in such a place will not harm one's well-being. If children are treated solely as a reflection of their parents' social status, then actual educational costs may exceed the pecuniary costs of having children and thus deter childbearing.

In line with this interpretation, education expenditures can be

interpreted as an economic manifestation of a norm-driven “rat race,” in which child investment functions as a positional good. In many high-income societies, particularly Korea, private education spending reflects not only pecuniary costs but also a socially enforced standard of child quality, akin to the implicit benchmark that governs status competition in other domains. When parents perceive high-quality investment to be the norm, rather than a discretionary choice, the cost of having another child will be high, because households may feel compelled to make further investments to avoid falling behind the prevailing standard. This perspective links our reduced-form evidence for education costs with the social norm mechanism, which is discussed in the next section.

The traditional approach used to address low fertility, that is, offering households increased financial resources and incentives to have children, requires large-scale government spending on families. However, such fiscal policies has proven nearly ineffective in Korea. We must stop using resources this way and examine whether the root cause lies in specific social preferences and deep societal conflicts, which would require major reforms in education and social institutions, rather than the allocation of increased funds to fertility programs.

We believe that a convincing interpretation of the data centers around political and cultural changes: the decline of optimism about future prosperity, rising conflicts between generations and genders, and a widespread feeling among younger groups that the social contract can no longer ensure fairness or stability. For the individuals born to baby boomers, the psychological stress of navigating a “post-growth society” can be substantial; however, it is omitted in traditional econometric models.

Institutional reforms are necessary to address the challenges to rebalance risks and opportunities between younger and older generations, particularly labor-market reforms and strong social safety nets. However, such measures may be inadequate to reverse fertility trends if the root cause lies in deep shifts in preferences, specifically how individuals value marriage, family, and personal fulfillment. Therefore, future research and policy development must emphasize the cultural and attitudinal dimensions of fertility behavior, rather than economic factors alone. This intuition was formalized in this study with a simple model.

C. Theoretical Model

In this study, a simple intuitive explanation was provided for the ineffectiveness of fertility policies through the lens of social norm models, with the details available in Jeong and Lee (2025). The representative household's utility is given by

$$U(c, n, q; \sigma, s) = \ln c + \alpha \ln n + \beta \ln q - \gamma \mathbb{1}\{q < \sigma\} \ln \left( \frac{\sigma}{q} \right), \tag{5}$$

which is subject to budget constraint

$$c = y - (1 - s)n(f + q) > 0, 0 \leq s < 1,$$

where  $c$  denotes nonchild consumption,  $n$  is the (continuous) number of children, and  $q$  is the quality (per-child investment) of each child. Moreover,  $q$  encompasses any child quality dimension, such as educational attainment, skills, general knowledge, or character traits, that is socially regarded as a virtue. The parameter  $\sigma \geq 0$  represents an exogenous child quality social norm, and when the chosen quality  $q$  falls short of  $\sigma$ , the household will suffer a utility loss proportional to  $\ln(\sigma/q)$ , scaled by the “norm sensitivity,” or equivalently, the sanction strength  $\gamma > 0$ . The indicator  $\mathbb{1}\{q < \sigma\}$  ensures that the penalty is active only when the norm is violated. Therefore, the term  $\beta \ln q - \gamma \mathbb{1}\{q < \sigma\} \ln(\sigma/q)$  can be interpreted as a reduced-form measure of children's expected future utility (or income), and the parents care about the expected well-being. In this interpretation, the social norm parameter  $\sigma$  can be understood broadly as a socially enforced benchmark for an “acceptable” child quality, which encompasses education-related standards and the perceived necessity of costly private investment. The utility depends on whether  $q$  meets the relative threshold  $\sigma$ . Thus, the norm effectively introduces a positional component to child quality: What matters is not only the absolute level of investment  $q$  but also how it compares with the prevailing benchmark in a society. As  $\sigma$  rises, such as through intensified status competition in education, the household must raise  $q$  to avoid sanctions, which will increase the effective marginal cost of having another child and mechanically attenuate the marginal impact of pecuniary subsidies  $s$  on fertility, as demonstrated below. The household has an exogenous income  $y > 0$ . Subsidy  $s \in [0, 1]$  reduces

the effective price of childrearing; thus, the household pays only  $(1 - s)$  times the sum of the fixed cost  $f > 0$  and the quality-dependent cost  $q$  per child.

If the norm penalty is shut down by setting  $\gamma = 0$ , the problem will be reduced to a standard Becker-type quantity–quality choice, with utility  $\ln c + \alpha \ln n + \beta \ln q$ . The unique unconstrained solution  $(q_U^*, n_U^*, c_U^*)$  is

$$n_U^* = \frac{y(\alpha - \beta)}{(1 - s)(1 + \alpha)f}, \quad q_U^* = \frac{\beta f}{\alpha - \beta}, \quad c_U^* = \frac{y}{1 + \alpha}. \quad (6)$$

The benchmark is independent of the social norm  $\sigma$ : When  $\gamma = 0$ , the norm will play no role in the household's decision.<sup>8</sup>

When  $\gamma > 0$ , the norm penalty will be relevant only if the unconstrained quality  $q_U^*$  lies below the norm, that is,  $\sigma > q_U^*$ . In this case, a regime exists in which the optimal quality satisfies  $q^* < \sigma$ ; thus, the penalty is active. Then, the following unique *interior* solution can be derived easily in the penalty-active regime:

$$n^* = \frac{y(\alpha - \beta - \gamma)}{(1 - s)(1 + \alpha)f}, \quad q^* = \frac{(\beta + \gamma)f}{\alpha - (\beta + \gamma)}, \quad c^* = \frac{y}{1 + \alpha}, \quad (7)$$

provided that  $\alpha > \beta + \gamma$ , and  $q^* < \sigma$  (to make the penalty active).<sup>9</sup>

Among the many interesting features, it can be clearly seen that fertility  $n^*$  is strictly decreasing in  $\gamma$ . From equilibrium  $q^*$ , it can be seen that child quality  $q^*$  is strictly increasing in  $\gamma$ . Strong social sanctions can make parents highly “quality oriented” and reduce the optimal

<sup>8</sup> We require  $\alpha > \beta$ ; thus,  $q_U^* > 0$ , and  $n_U^* > 0$ . Economically, the marginal utility of an additional child must exceed the marginal utility of increasing the child quality at the margin to induce positive fertility. As in the standard Becker model,  $n_U^*$  decreases, and  $q_U^*$  increases with the fixed cost  $f$ , thereby generating a quantity–quality trade-off. Jeong et al. (2025) presented a rich model in which fertility choice is subject to social norms, and the quantity–quality trade-off arises from changes in gender wage gaps and human capital differences between “husband and spouse.”

<sup>9</sup> The condition  $\alpha > \beta + \gamma$  ensures that  $q^* > 0$ , and  $n^* > 0$ . The requirement  $q^* < \sigma$  pins down a lower bound on the norm:  $\sigma > (\beta + \gamma)f / [\alpha - (\beta + \gamma)]$ . When this fails, the penalty will become irrelevant, and the unconstrained solution will apply.

number of children, as hypothesized above. Subsidies can help address low fertility, but social norms can dwarf policy effects.

The simple model provided some intuition about why the estimated effects of fiscal instruments can be statistically significant but quantitatively small. Pronatalist subsidies and related transfers operate on the margin by lowering the pecuniary price of having another child, that is, they reduce  $(1 - s)$  from the budget constraint, but other dimensions of fertility decisions cannot be explained by benefits and costs associated with policy incentives. Naturally, the scope of the effect of the policy on fertility will decline. Although a deep discussion of the policy and normative mechanisms lies beyond the scope of this study (to be addressed in another study), the theoretical discussion suggests that examining noneconomic factors that can affect fertility would be useful.

## VI. Summary and Conclusion

Previous studies on the determinants of fertility focused on economic factors, particularly opportunity costs and labor-market conditions, and provided corresponding policy implications. By contrast, our study incorporated new structural variables relevant in the Korean context: expectations about future economic conditions, changing social norms, political orientations, and the escalation of social conflict. The empirical results showed that, beyond the traditional economic drivers, the variables were typically statistically significant and had nonnegligible effects on the fertility outcomes.

Among the factors, expectations about future prosperity stood out as a notable mechanism: Across the OECD panel, high expected future income was robustly associated with low fertility, even after marriage and the standard economic and policy variables were controlled. However, in Korea, long-term income prospects are neither clearly stronger nor worse than those in the other major OECD countries. Thus, expectations alone will not likely be able to explain the magnitude of Korea's fertility collapse. Instead, complementary mechanisms, such as norm-driven quality standards and education-related status competition, which can amplify the perceived cost of having children, should be considered.

In this context, it is not surprising that pronatalist fiscal interventions, despite substantial budgetary expansions, have delivered only limited aggregate changes in fertility. Such interventions primarily

reduce pecuniary costs at the margin, whereas expectation- and norm-related mechanisms continue to amplify the perceived total cost of childbearing. Despite the existence of additional childcare subsidies, parental leaves, housing support, and welfare benefits, offsetting the opportunity costs associated with social comparison and competitive expectations remains challenging. Improved social infrastructure for childcare can exert a positive impact on fertility, but conventional policy measures based on large-scale fiscal spending may be less effective when social norms are the decisive factor behind fertility decisions. We provided a theoretical explanation for policy ineffectiveness through the lens of social norm models. Based on the findings and analyses, we suggest redesigning fiscal policy combinations tailored to Korea's unique market frictions (e.g., structural and sociocultural characteristics), as a promising strategy.

In the short term, rather than further scaling up broad pronatalist transfers, the policy mix should be rebalanced toward childcare infrastructure and the efficient management of scarce labor resources. As Korea's female labor force participation continues to rise, particularly among young women of childbearing age, developing social infrastructure that can support working conditions related to marriage and childbirth (e.g., parental leaves) would be practical and necessary.

We hypothesized that reversing the declining fertility trend would be achievable through the evolution of social values and norms, shifting away from positional status competition and relative-comparison pressures toward forms of well-being that are less dependent on costly investment in positional goods, such as credential-driven educational competition. Educational reforms have been considered in the context of fiscal consolidation in Korea; however, we may wish to shift the focus on developing skills and reducing unnecessary status competition. Rising social expenditures should be realigned to foster a work-friendly environment, rather than simply increasing universal welfare spending. Education reforms should include drastic measures, such as limiting private tutoring to students with learning difficulties and placing considerable emphasis on core values and support for low-performing students. This policy direction may not be well received in Western societies; however, it would be highly relevant in Korea.

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FIGURE 1.1

SIMPLE CORRELATIONS BETWEEN FERTILITY RATE AND KEY VARIABLES

**TABLE 2**  
DETERMINANTS OF FERTILITY RATE: FIXED-EFFECTS PANEL REGRESSION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
marriage_ rate	0.165*** (0.00499)	0.0750*** (0.00565)	0.0976*** (0.00741)	0.0979*** (0.0113)	0.0901*** (0.0111)	0.0847*** (0.0116)	0.0688*** (0.0146)	0.0678*** (0.0145)
lnwage		0.140*** (0.0277)	-0.0310 (0.0460)	0.0975 (0.108)	0.315** (0.123)	0.345*** (0.125)	0.334*** (0.124)	0.297** (0.125)
hours_ worked			0.00473*** (0.00102)	0.00734*** (0.00182)	0.00616*** (0.00230)	0.00397* (0.00234)	0.00296 (0.00238)	-0.000994 (0.00338)
private_ spending_1				-3.593 (9.943)	-14.13 (10.25)			
private_ spending_2					-84.61** (41.20)			
private_ spending_3					61.38*** (20.06)			
private_ spending_4					-13.69** (5.218)			
private_ spending						-8.769** (3.754)	-8.489** (3.714)	-6.360 (3.904)
unemp. rate							-0.530* (0.300)	0.327 (0.602)
emp. rate								1.188 (0.726)
Constant	0.811*** (0.0313)	-0.180 (0.294)	-7.987*** (1.713)	-14.55*** (3.114)	-14.50*** (3.843)	-10.33*** (3.854)	-8.073** (4.018)	-0.600 (6.059)
Observation	1,799	888	888	154	120	120	120	120

TABLE 3

DETERMINANTS OF FERTILITY RATE: DYNAMIC PANEL (ARELLANO–BOND) REGRESSION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
L.fertility_rate	0.898*** (0.00581)	0.843*** (0.0116)	0.846*** (0.0113)	0.560*** (0.0538)	0.402*** (0.0773)	0.380*** (0.0678)	0.444*** (0.0711)	0.439*** (0.0733)
marriage_rate	0.0125*** (0.00159)	0.0248*** (0.00204)	0.0310*** (0.00274)	0.0751*** (0.00866)	0.0731*** (0.00903)	0.0721*** (0.00844)	0.0510*** (0.0106)	0.0522*** (0.0113)
lnwage		0.0854*** (0.00914)	0.0334** (0.0154)	0.0266 (0.123)	0.267* (0.145)	0.322** (0.135)	0.0476 (0.159)	0.0390 (0.162)
hours_worked			0.00150*** (0.000359)	0.00101 (0.00199)	-0.00349 (0.00258)	-0.00270 (0.00241)	-0.00141 (0.00247)	-0.00200 (0.00309)
private_ spending_1				-3.425 (6.947)	-7.604 (7.352)			
private_ spending_2					30.97 (32.58)			
private_ spending_3					-27.53 (17.55)			
private_ spending_4					-11.63*** (3.806)			
private_ spending						-10.27*** (2.606)	-7.533*** (2.754)	-7.404*** (2.795)
unemployment_ rate							-0.992*** (0.298)	-0.797 (0.684)
employment_ rate								0.226 (0.711)
Constant	0.0908*** (0.00787)	-0.758*** (0.0963)	-3.255*** (0.605)	-1.907 (3.354)	4.932 (4.464)	2.789 (4.021)	3.138 (4.057)	4.239 (5.346)
Observations	1,710	848	848	109	85	85	85	85

**TABLE 4**  
SOCIAL FACTORS AFFECTING FERTILITY RATE: FIXED-EFFECTS PANEL REGRESSION

	(1)	(2)	(3)	(4)
hours_worked	-0.00206 (0.00342)	-0.00716** (0.00305)	-0.00733** (0.00301)	-0.00594 (0.00633)
marriage_rate	0.0691*** (0.0144)	0.191*** (0.0206)	0.197*** (0.0204)	0.183*** (0.0434)
lnwage	0.356*** (0.129)	0.260* (0.149)	0.220 (0.148)	0.278 (0.273)
private_spending	-5.210 (3.936)			
unemployment_rate	0.149 (0.607)			
employment_rate	0.854 (0.749)			
male_cohort	-2.812 (1.754)	-8.409*** (2.223)	-7.620*** (2.217)	-9.214** (4.106)
P(no_religion)		0.440** (0.215)	0.444** (0.211)	0.267 (0.380)
political			0.695** (0.315)	0.146 (0.620)
conflict				0.0000383 (0.000243)
Constant	1.435 (6.139)	13.13** (5.460)	13.56** (5.377)	10.63 (11.22)
Observations	120	152	151	66

Note: Social factors: The analysis supports the finding that a large cohort size (i.e., a high proportion of individuals within the same age group) is associated with low fertility, which reflects intensified intragenerational competition. Meanwhile, variables such as proportion of the nonreligious population, liberal political orientation, and political polarization do not have a significant negative effect on the fertility rate.

**TABLE 5**  
SOCIAL FACTORS AFFECTING FERTILITY RATE: DYNAMIC PANEL REGRESSION

	(1)	(2)	(3)	(4)
L.fertility_rate	0.426*** (0.0730)	0.875*** (0.0354)	0.881*** (0.0314)	0.932*** (0.0366)
hours_worked	-0.00361 (0.00315)	0.00310** (0.00140)	0.00319** (0.00136)	0.00480*** (0.00150)
marriage_rate	0.0565*** (0.0114)	0.0421*** (0.00935)	0.0404*** (0.00784)	0.0291*** (0.00892)
lnwage	0.130 (0.166)	-0.0375 (0.0745)	-0.0330 (0.0730)	-0.0294 (0.0745)
private_spending	-6.538** (2.804)			
unemployment_rate	-0.630 (0.683)			
employment_rate	0.0418 (0.711)			
male_cohort	-3.718** (1.704)	-0.409 (1.237)		
P(no_religion)		0.220** (0.0938)	0.230*** (0.0887)	0.228** (0.0905)
political				-0.404*** (0.140)
Constant	7.010 (5.460)	-5.865** (2.717)	-6.155** (2.562)	-9.325*** (2.837)
Observations	85	102	102	102

Note: Social factors: In the dynamic panel specification, the cohort-size proxy (male\_cohort) is negative and statistically significant in Column (1) but becomes statistically insignificant when additional social controls are added. The proportion of the nonreligious population P(no\_religion) is positive and statistically significant in Columns (2)–(4). Liberal political orientation (political) is negative and statistically significant in Column (4). The results suggest that the estimated effects of the social and political variables vary across specifications and should be interpreted cautiously.

**TABLE 6**  
 EXPECTATION-RELATED FACTORS AFFECTING FERTILITY RATE: FIXED-EFFECTS PANEL  
 REGRESSION

	(1)	(2)	(3)	(4)
hours_worked	0.00119 (0.00377)	-0.00427 (0.00374)	0.00373 (0.00557)	0.00469 (0.00570)
marriage_rate	0.0580*** (0.0153)	0.0541*** (0.0137)	0.0529*** (0.0134)	0.0517*** (0.0135)
lnwage	0.468*** (0.140)	0.682*** (0.158)	0.634*** (0.157)	0.635*** (0.157)
private_spending	-3.518 (3.975)	-4.237 (4.316)	-5.106 (4.247)	-4.329 (4.357)
unemployment_rate	-0.344 (0.650)	-0.715 (0.682)	-0.330 (0.697)	-0.230 (0.709)
employment_rate	0.764 (0.740)	0.773 (0.933)	1.275 (0.950)	1.346 (0.957)
male_cohort	-2.559 (1.733)	-1.881 (2.071)	-3.938* (2.296)	-4.137* (2.314)
ln(income_exp)	-0.270* (0.140)	-0.478*** (0.145)	-0.531*** (0.144)	-0.547*** (0.146)
Gini		-0.731 (0.444)	-0.639 (0.437)	-0.525 (0.459)
elderly_pop_rate			-3.212* (1.686)	-3.490** (1.722)
poverty_gap_total				-0.203 (0.242)
Constant	-2.699 (6.417)	8.939 (7.061)	-5.594 (10.29)	-7.310 (10.52)
Observations	120	93	93	93

Note: Expectation-related factors: An increase in expected future income negatively affects fertility; the negative relationship between worsening income distribution (i.e., high Gini coefficient) and fertility is not strongly supported; the rising proportion of the elderly population, which implies substantial future dependency burdens, appears to exert a negative effect on fertility.

**TABLE 7**  
EXPECTATION-RELATED FACTORS AFFECTING FERTILITY RATE: DYNAMIC PANEL  
REGRESSION

	(1)	(2)	(3)	(4)
L.fertility_rate	0.373*** (0.0714)	0.361*** (0.0848)	0.305*** (0.0901)	0.299*** (0.0911)
hours_worked	-0.000197 (0.00315)	0.00211 (0.00385)	0.00958 (0.00583)	0.0101* (0.00593)
marriage_rate	0.0433*** (0.0114)	0.0453*** (0.0121)	0.0439*** (0.0120)	0.0438*** (0.0120)
lnwage	0.267 (0.163)	0.311 (0.192)	0.361* (0.192)	0.377* (0.195)
private_spending	-5.198* (2.712)	-7.012* (3.857)	-7.531** (3.823)	-7.182* (3.892)
unemployment_rate	-0.974 (0.661)	-0.841 (0.755)	-0.699 (0.751)	-0.601 (0.775)
employment_rate	0.425 (0.689)	0.527 (0.867)	0.748 (0.867)	0.808 (0.877)
male_cohort	-3.444** (1.636)	-0.592 (1.861)	-1.825 (1.978)	-2.007 (2.015)
ln(income_exp)	-0.407*** (0.106)	-0.357*** (0.117)	-0.415*** (0.120)	-0.426*** (0.123)
Gini		-0.674* (0.400)	-0.645 (0.395)	-0.585 (0.412)
elderly_popul_rate			-2.940* (1.741)	-3.156* (1.793)
poverty_gap_tot				-0.104 (0.192)
Constant	3.831 (5.301)	-2.075 (6.998)	-16.33 (10.91)	-17.36 (11.12)
Observations	85	61	61	61

Note: Expectation-related factors: An increase in expected future income is associated with a negative impact on fertility; the tendency of fertility to decline with worsening income inequality (i.e., high Gini coefficient) is not strongly supported; a large proportion of the elderly population, which reflects considerable anticipated dependency burdens, appears to negatively influence the fertility rate.

**TABLE 8**  
POLICY-RELATED FACTORS AFFECTING FERTILITY RATE: FIXED-EFFECTS PANEL  
REGRESSION

	(1)	(2)	(3)	(4)	(5)	(6)
hours_worked	0.0103*** (0.00258)	0.00548 (0.00433)	0.00572 (0.00432)	-0.00650 (0.00606)	-0.00511 (0.00603)	0.00425 (0.00911)
marriage_rate	0.0983*** (0.0159)	0.0825*** (0.0210)	0.0966*** (0.0216)	0.0932*** (0.0255)	0.0896*** (0.0252)	0.0882*** (0.0250)
lnwage	0.0162 (0.167)	0.0793 (0.168)	0.0338 (0.174)	0.402 (0.426)	0.630 (0.444)	0.477 (0.453)
private_spend.	-13.33*** (3.751)	-10.17** (4.095)	-13.21*** (4.339)	-13.80** (5.998)	-11.65* (6.059)	-11.41* (5.998)
family_benefits	11.19*** (3.202)	10.39*** (3.271)	8.239** (3.326)	9.350** (3.916)	4.224 (5.071)	3.891 (5.024)
maternity_leave	0.0111*** (0.00356)	0.0114*** (0.00399)	0.0116*** (0.00393)	0.00773 (0.00625)	0.0102 (0.00634)	0.00762 (0.00655)
parental_leave	-0.00198 (0.00124)	-0.00261** (0.00126)	-0.00254** (0.00126)	-0.000489 (0.00155)	-0.000167 (0.00154)	0.000115 (0.00154)
unemp_rate		-0.196 (0.646)	0.205 (0.655)	0.0439 (0.837)	-0.0897 (0.828)	0.154 (0.838)
emp_rate		0.232 (0.781)	0.349 (0.781)	0.913 (1.139)	1.131 (1.129)	1.416 (1.137)
male_cohort		-3.033* (1.723)	-2.286 (1.722)	-0.372 (2.304)	-0.904 (2.291)	-2.486 (2.548)
public_spend.			8.544 (6.397)	2.149 (7.968)	-1.843 (8.246)	-3.492 (8.250)
Gini				0.632 (0.909)	0.352 (0.912)	0.0981 (0.922)
lnincome_exp					-0.337 (0.217)	-0.385* (0.218)
elderly_pop.						-2.711 (1.995)
Constant	-19.74*** (4.243)	-10.51 (7.561)	-10.75 (7.571)	9.126 (9.867)	8.384 (9.714)	-7.661 (15.23)
Observations	103	103	99	75	75	75

Note: Policy-related factors: Most of the policy variables influence fertility in the expected positive direction; when the policy variables are controlled for, the effect of the Gini coefficient becomes statistically insignificant, which suggests that policy interventions may mitigate the adverse impact of income inequality on fertility.

**TABLE 9**  
POLICY-RELATED FACTORS AFFECTING FERTILITY RATE: DYNAMIC PANEL REGRESSION

	(1)	(2)	(3)	(4)	(5)	(6)
L.fertility_rate	0.324*** (0.0787)	0.402*** (0.0815)	0.374*** (0.0868)	0.339*** (0.104)	0.336*** (0.101)	0.259** (0.115)
hours_worked	0.000600 (0.00321)	0.00117 (0.00408)	0.0000107 (0.00442)	0.00101 (0.00522)	0.00171 (0.00506)	0.0107 (0.00825)
marriage_rate	0.0942*** (0.0146)	0.0605*** (0.0173)	0.0687*** (0.0193)	0.0615*** (0.0198)	0.0554*** (0.0193)	0.0579*** (0.0192)
lnwage	0.0753 (0.230)	0.0190 (0.229)	0.165 (0.280)	0.207 (0.350)	0.512 (0.359)	0.544 (0.356)
private_spending	-9.847*** (2.983)	-7.386** (3.112)	-8.548** (3.420)	-9.144* (4.669)	-7.286 (4.582)	-7.853* (4.556)
family_benefits	7.131*** (2.299)	7.702*** (2.336)	6.832*** (2.476)	3.040 (3.164)	-4.066 (4.113)	-5.015 (4.131)
maternity_leave	0.00950** (0.00441)	0.00860* (0.00487)	0.00810 (0.00517)	0.00672 (0.00557)	0.00841 (0.00544)	0.00492 (0.00596)
parental_leave	0.0000813 (0.00105)	-0.0000341 (0.00104)	0.0000132 (0.00108)	-0.000762 (0.00122)	-0.000427 (0.00119)	-0.0000361 (0.00121)
unemployment_rate		-1.747** (0.805)	-1.231 (0.885)	-1.104 (0.940)	-0.971 (0.913)	-0.392 (0.998)
employment_rate		-0.665 (0.833)	-0.239 (0.908)	0.590 (1.151)	1.356 (1.155)	1.932 (1.218)
male_cohort		-0.875 (2.006)	-0.379 (2.092)	2.660 (2.515)	2.524 (2.439)	1.110 (2.625)
public_spending			-1.053 (5.585)	6.411 (6.482)	1.712 (6.539)	-1.312 (6.839)
Gini				1.574** (0.754)	1.309* (0.738)	1.029 (0.758)
lnincome_exp					-0.427*** (0.165)	-0.523*** (0.177)
elderly_pop_rate						-3.146 (2.290)
Constant	-1.539 (5.321)	-1.386 (6.992)	-0.927 (7.310)	-4.546 (8.765)	-3.873 (8.500)	-20.56 (14.78)
Observations	71	71	68	48	48	48

Note: Policy-related factors: Most of the policy variables affect fertility in the expected positive direction. When the policy variables are controlled for, the negative effect of the Gini coefficient disappears, and its sign becomes positive, which yielded results that are consistent with those in previous studies.