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The Relationship Between Couples' Educational Pairings and Fertility: Evidence from Türkiye

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Çiftlerin Eğitimsel Eşleşmeleri ve Doğurganlık Arasındaki İlişki: Türkiye Örneğinden Bulgular

Abstract

This study aims to examine the relationship between couples' educational pairings and fertility outcomes by using 2018 Türkiye Demographic and Health Survey (TDHS) data and the GPRM model. Our findings show that couples' educational pairings are closely associated with fertility outcomes. The fertility outcomes differ significantly across the subcategories of educational homogamy, hypergamy, and hypogamy. For homogamous couples, we find that those with medium-medium and high-high educational pairings are less likely to have children than those with low-low educational pairings. Additionally, it is revealed that hypergamous and hypogamous couples with high-medium educational pairings have lower fertility outcomes compared to homogamous couples with low-low educational pairings.

Keywords : Educational Pairings, Family Type, Fertility.

JEL Classification Codes : J12, J13.

Öz

Bu çalışmada 2018 Türkiye Nüfus ve Sağlık Araştırması (TNSA) verileri ve GPRM modeli kullanılarak Türkiye'de çiftlerin eğitimsel eşleşmeleri ile doğurganlık sonuçları arasındaki ilişkinin incelenmesi amaçlanmaktadır. Bulgular, çiftlerin eğitimsel eşleşmelerinin doğurganlık sonuçlarıyla yakından ilişkili olduğunu göstermektedir. Eğitimsel homogami, hipergami ve hipogami alt kategorilerinde doğurganlık sonuçları önemli ölçüde değişkenlik göstermektedir. Homogamik çiftler içinde orta-orta ve yüksek-yüksek eğitimsel eşleşmeye sahip çiftlerin, düşük-düşük eğitimsel eşleşmeye sahip çiftlerden daha az çocuk sahibi olmaya meyilli olduğu bulunmuştur. Buna ilaveten, düşük-düşük eğitimsel eşleşmesine sahip homogamik çiftlere kıyasla yüksek-orta eğitimsel eşleşmesine sahip hipergamik ve hipogamik çiftlerin daha düşük doğurganlık sonuçlarına sahip olduğu ortaya çıkmıştır.

Anahtar Sözcükler : Eğitim Eşleşmesi, Aile Tipi, Doğurganlık.

1. Introduction

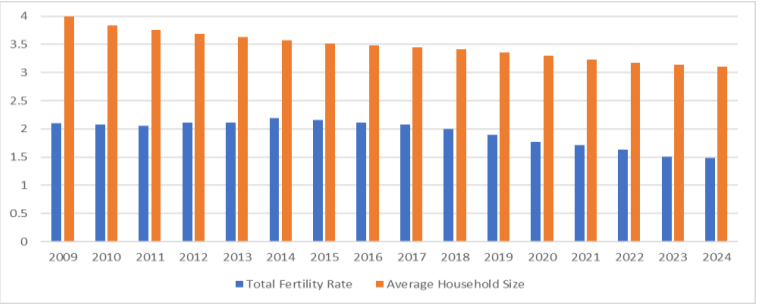
The rapid ageing of the population is a global challenge that has reduced economic performance and led to an expansion of social policies in most countries. However, some developing countries still benefit from a favourable demographic window of opportunity, a consequence of their historically high fertility rates. The demographic window of opportunity is a special case of a country's population pyramid in which a country has an advantageous period during which it can leapfrog in economic development. Developing countries experience an unusual period when the proportion of working-age adults reaches a maximum, thereby facilitating economic and social investment (Bloom et al., 2003). This period is called a demographic window of opportunity for two reasons. First, it provides significant economic advantages, and second, it is available for only a short period. The population pyramid and the concept of a demographic window of opportunity, which imply a relationship between population growth and age distribution driven by changes in economic behaviour and labour force participation that vary with age, highlight the economic importance of fertility and mortality rates.

Türkiye has a relatively young and crowded population at Europe's elbow. The Turkish economy, a typical developing country, has experienced a demographic window of opportunity for a few decades. While Türkiye experienced a slight increase in the fertility rate until the 1950s, it has been steadily declining since the second half of the 20th century. The fertility rate dropped from a record high of 6.8 in 1950 to 4.1 in 1980 (Gökburun, 2020). A look at the situation in Türkiye over the last 40 years reveals that fertility rates have been on a downward trend. Türkiye's fertility rate, which halved between the early 1960s and the mid-1980s, stagnated in the 1990s. However, fertility then entered another period of decline, with a 15% decrease over the five years between 1998 and 2003. Figure 1 shows that total fertility rates started to decrease sharply after 2014. The dramatic decline over the last decade led to the fertility rate reaching 1.48 in 2024, down from 2.2 in 2014, a 0.72-point drop. Very low fertility rates characterise this period in Türkiye. Rindfuss et al. (2016) argue that there are two groups in advanced economies: one with a relatively higher fertility rate (1.9) and the other with a lower rate (1.3). The trend in the fertility rate of the Turkish population suggests that Türkiye will gradually join the lower-fertility group.

In the last decade, family formation has changed greatly in Turkish society. Acar's (2022) measurements show that the age of marriage increased to 25.1 for women and 27 for men in 2020. According to TURKSTAT Marriage and Divorce Statistics, the average ages of marriage for women and men are 25.8 and 28.3, respectively (TURKSTAT, 2025). Also, Acar (2022) states that the total fertility rate fell to 1.77 in 2020, well below the replacement level. This trend led to the closure of the demographic window of opportunity in Türkiye, and the population pyramid began to resemble that of a country with a stable population. With rapid decreases in fertility rates in the last decade, the population pyramid of Türkiye takes the form of a tower that has steep sides from the bottom to the top (Gökburun, 2020). Figure 1 also presents the average household size from 2009 in Türkiye. Household size

decreases from 4 people to 3.1 people on average during this period. In a nutshell, households become one-child families in this period.

Figure: 1
Total Fertility Rates and Average Household Size in Türkiye



Source: TURKSTAT Birth Statistics, 2025.

Moreover, average educational attainment and duration have gradually increased in Türkiye. The proportion of higher education graduates for the population aged 25 and over increased from approximately 10% in 2008 to 25.3% in 2024 (TURKSTAT, 2025). The average duration of education increased from 8.3 to 10.2 years for men, and from 6.4 to 8.8 years for women (TURKSTAT, 2025). It is well known that increasing duration and level of education are among the reasons why people delay marriage and having children. However, in recent years, some studies have focused on the effect of couples' educational pairings on fertility rather than the effect of education on fertility. The literature demonstrates that educational pairings of couples act as intermediaries in the relationship between fertility and education. This role of educational pairings becomes more evident as the level of education increases. Broadly speaking, there are three theoretical approaches to exploring the relationship between decision-making of fertility and educational pairings. The first of these is the New Home Economics Theory of Becker, which began with Becker's work in 1960. It is proposed that sophisticated gender roles in the family increase fertility. If men play the breadwinner role while women specialise in unpaid work and childcare, fertility rises. According to this approach, hypergamous couples in which men have a high level of education have the highest number of children. The second theoretical approach to fertility and education focuses on the family's joint resources. Because educated partners can gain more resources in the labour market, the family's joint resources expand. This approach shows a positive relationship between the partner's educational level and fertility. The third one is about the opportunity cost of having a child. According to Craig & Mullan (2011), childbearing puts mothers at risk of job loss, employment breaks, reduced earnings, and wage penalties. Precarious employment and unemployment delay childbearing (Busetta et al., 2019). In this approach, educational pairings have complex effects on fertility, depending on the labour market conditions of the partner. Micro-level economic uncertainties discourage individuals from starting a family and having children. Economic uncertainty is an individual risk factor, but it is mainly determined by the individual's labour market

conditions and past work experience. Factors such as job-loss risk, short-term contracts, and insecure employment contribute to economic uncertainty for individuals (Mills & Blossfeld, 2012). Economic uncertainty and its primary determinant, unemployment, have income and substitution effects on fertility, and which of these is dominant depends on the individual's likelihood of returning to the labour force and the conditions they will face upon return (Busetta et al., 2019). This study is not only based on New Home Economics theory but also draws on explanatory factors from other theoretical perspectives, such as economic welfare, employment status, and literacy.

This study aims to comprehensively analyse the relationship between couples' educational pairings and fertility outcomes using the 2018 Türkiye Demographic and Health Survey (TDHS) with the Generalised Poisson Regression Model (GPRM). Furthermore, we aim to present policy recommendations grounded in the relationship between couples' educational pairings and fertility to prevent the closure of the demographic opportunity window in Türkiye. The difference between this study and the relevant literature, which includes Bagavos (2017), Nitsche et al. (2021), Da Silva et al. (2022), and Tian et al. (2023), is that it examines whether fertility outcomes are linked to couples' educational pairings within specific subgroups of such pairings. Acar (2022) is the most recent study on the relationship between fertility and education in Türkiye and is the closest to this study. It reports that educational matching among couples influences fertility and that the most significant difference is observed when both the woman and the couple have a university education. However, Acar (2022) examines educational matching using only descriptive methods. This study, unlike Acar (2022), uses microeconometric methods and repeats the analysis across broader demographic subgroups to examine how the effects vary across these subgroups. To achieve this aim, couples were divided into nine educational pairing categories and examined for their association with fertility. This study contributes to the literature by analysing the relationship between couples' educational pairings and fertility outcomes within subcategories of educational pairings. This topic has received limited attention in previous Turkish studies.

The remainder of this study is formed as follows: the next section presents a brief review of the literature. The third section describes the methodology and data used in the study. The fourth section provides the findings. The last section discusses the results and offers policy recommendations.

2. Theoretical Background

There is extensive literature on the relationship between fertility and education, as well as other determinants, stemming from Becker's (1960) seminal work. Becker (1960) provides an economic framework for analysing fertility and family-size decisions. Becker (1960) and Becker (1993) reveal that childbearing is directly related to income. According to them, forgone earnings from motherhood and lower specialisation in paid work are important factors in the effects of income on family-size decisions. In the final step, Becker (1993) and subsequent literature highlight that when parenthood results in temporary or

permanent leave from the workforce, the opportunity costs of income and job loss increase as women's educational levels rise. The theoretical framework of Becker's works links income and family size through education. In sum, it is possible to say that women's education level is an important factor in shaping fertility and has been characterised as a main determinant of economic well-being (Thomas et al., 2017).

Many factors affect childbearing, including cultural, demographic, socioeconomic, ecological, and health and psychological factors (Piotrowski & Tong, 2016; Hashemzadeh et al., 2021). At the same time, fertility depends on restrictions on family size and labour-market compliance (Goldscheider et al., 2015). In the last decades of the twentieth century, the changing social structure of societies strengthened the substitutability of labour-market roles and motherhood for women. It weakened the relationship between marriage and parenthood (Rindfuss et al., 2003). Macro policies and labour market conditions determine the decision to have children (Matysiak & Weziak-Bialowska, 2016). More specifically, labour market conditions such as precarious employment or unemployment, and low wages, are important determinants (Modena & Sabatini, 2012; Goldstein et al., 2013), as are motherhood wage penalties (Budig & Hodges, 2010). Economic insecurity is associated with the possibility of being childless and not realising fertility intentions (Berrington & Pattaro, 2014). The findings on the relation between the individual's unemployment experience and fertility behaviour are inconclusive by gender. While unemployment has causal effects on women's first births, it has no statistical effects on men's (Andersen & Özcan, 2021). The mechanism that creates a negative relationship between labour market tightness and parenthood stems from the effects of education on women's labour market positions. The relevant literature has found that the coefficient for unemployment often changes sign across different education groups (Andersen & Özcan, 2021) and across individuals' well-being (Vignoli et al., 2020). Only when subjective well-being is low do uncertain conditions reduce fertility. At the same time, Kreyenfeld & Andersson (2014) find that fertility tends to be lower during periods of unemployment among highly educated women and men, but not among their less educated counterparts.

An empirical literature on fertility that focuses on the effects of education provides a wide range of evidence. Sobotka (2015) demonstrates the negative effects of higher education on fertility in Austria and the Czech Republic. So, Wood et al. (2014) find that childlessness is more common among highly educated women in 14 low-fertility countries, although the relationship differs strongly across countries and over time. Also, the fertility tempo is negatively associated with women's education in most countries. In Central and Eastern European countries, a negative relationship between fertility and women's education is observed in the second and third births. So, Winkler-Dworak & Toulemon (2007) report, based on a nonlinear analysis, that this relation is U-shaped in France. Consequently, higher levels of education are associated with higher rates of childlessness, lower fertility rates, and smaller family sizes (Martin, 2000; Miettinen et al., 2015).

On the other hand, Nitsche et al. (2021) state that relevant literature on the relationship between fertility and education has focused much less on low-educated parents.

These parents may find fewer opportunities in the labour market, and they mostly take low-skilled positions in manufacturing. Women with low education or migrant backgrounds are more likely to adopt childbearing strategies as an alternative to labour market participation (Wood & Neels, 2017). Also, it is interesting that, as a result of labour market conditions, low-educated people tend to drift towards extremes, such as remaining childless or having many children (Jalovaara et al., 2022). Finally, it must be noted that the effects of education are asymmetric in developed countries. When women's education has a negative effect on fertility, the effects of men's education are positive or negligible (Osiewalska, 2015).

The relevant literature suggests a strong relationship between fertility and women's and men's education, but this relationship is complex in detail. Another important question is whether parents' educational levels are more important or whether the difference in educational levels between couples matters. Education has a negative effect on the likelihood of achieving the desired number of children; however, when analysed in more detail, this relationship between education and fertility is mediated by educational pairings (Berrington & Pattaro, 2014). The educational pairing of couples is a powerful factor in fertility. Theoretically, couples can be classified based on differences in their parents' educational levels. Firstly, families can be divided into symmetrical and asymmetrical types (Young & Wilmott, 2013). Another modern classification consists of three classes: educational homogamy, hypergamy, and hypogamy. If couples have the same education level or the educational levels of couples are different, the families are classified as educational homogamy or heterogamy, respectively. In addition, if the educational level of women is higher than that of men in educational heterogamy, the family are classified as educational hypergamy; otherwise, as educational hypogamy. In this regard, throughout the 20th century, there has been a noticeable increase in the prevalence of both educational homogamy and women who "partner down" in terms of their education (Schwartz & Mare, 2005; Blossfeld, 2009).

Theoretically, expectations are that homogamous couples could have higher fertility rates because they share similar values and goals (Thomson, 1990; Corijn et al., 1996). For example, Huber & Fieder (2011) show that childlessness is lower in educational homogamy than in other educational pairings. However, homogamous couples do not necessarily exhibit higher fertility levels across all educational levels. The interaction between educational pairings and the number of children has different functions at each education level. Becker (1993) theoretically explains this by using the labour market approach. If income loss caused by motherhood is important for the family, the income of women in highly educated homogamous couples is higher than the income of women in less educated homogamous couples, and this leads to a decrease in fertility. Some empirical studies provide support for the labour market approach. Bagavos (2017) provides strong insights into the mediating role of education level in the Greek case. According to the results, the possibility of having a child before 30 is highest for low-educated homogamous couples and lowest for highly educated homogamous couples. Moreover, the duration between the first and second child is longest in highly educated homogamous couples.

On the other hand, the idea is that labour market conditions that women need to cope with improve with higher education. Compliance with the labour market conditions is better for highly educated and career women. Thus, it is possible to say that highly educated couples could have higher fertility (Dribe & Stanfors, 2010). Homogamous couples with low education levels postponed becoming parents in Europe. Consequently, the total number of children remains low in low-educated homogamous families in Europe (Osiewalska, 2015). In addition, Nitsche et al. (2021) find that highly educated homogamous couples delay the first, second, and third child compared to hypogamous and hypergamous couples.

If we need to review the fertility studies in Türkiye, there is limited literature on the relationship between fertility and education. There are some common facts in Turkish literature. The primary data source is the Türkiye Demographic and Health Survey conducted by the Hacettepe University Institute of Population Studies (HUIPS). Second, the studies present trends of fertility in time and across some groups of society. The studies in Turkish literature calculate fertility rates and the number of children at different educational levels. However, none of them extends the analysis to examine the mediating roles of income or cohort in the fertility-education relationship, or investigates the effects of educational pairings on fertility in detail.

Finally, the literature shows that women's educational attainment is negatively associated with fertility in Türkiye, where the total fertility rate has been declining over the long term. In an early study, Selim & Üçdoğruk (2005) found that both the educational levels of women and men in couples are negatively associated with the total number of children. It also claims that the main determinant of a child's education is the educational level of parents. In a detailed study examining parental education and child demand, Eryurt & Akadlı-Ergöçmen (2016) found that the father's education is more important for the first child, whereas the mother's family's educational level is more important for the second and subsequent children. Also, Akça & Ela (2012), in a study presenting descriptive statistics on fertility in Türkiye using the TDHS datasets from 2008 and 2013, show that fertility rates across all groups have declined. Some studies show a strong relationship between employment and fertility in Türkiye. For instance, Abbasoğlu-Özgören et al. (2018) found that when there is a two-way negative association between fertility and employment, the risk of entering employment is reduced by fertility. Gemicioğlu et al. (2019) confirm the robust finding of a negative relationship between fertility and education. Acar (2022) provides statistics on having children and the educational pairing of couples from the 2018 TDHS data. According to the results, as women's educational level increases, the number of children decreases, and among homogamous couples, more educated women have fewer children. It shows that hypergamous couples, in which men are more educated, but those with secondary education or less have the highest fertility rate.

3. Data and Methodology

3.1. Data

This study utilises data from TDHS collected by the Hacettepe University Institute of Population Studies for 2018. TDHS is conducted every 5 years. It includes information on topics such as women's basic characteristics, marriage, fertility and fertility preferences, family planning, maternal health and care, child health, nutritional status of children and women, miscarriages and stillbirths, early childhood development, and women's empowerment. It is based on a representative sample of women aged 15-49. 7,346 women were interviewed in 2018. In TDHS, women currently in a union or living with a man were asked to report the total number of children ever born to them and the education level of their partners. Also, in 2018, TDHS included a question about the respondent's ex-husband's education level. Thus, the TDHS dataset allows us to investigate the relationship between couples' educational pairings and fertility outcomes.

We exclude women and their husbands under 25 from the sample, as they may not have completed their education. In addition, women and men with more than one spouse are also excluded from the sample. Therefore, our sample comprises 3,860 married couples aged 25-49.

Table 1 shows the distributions of married couples aged 25-49 by the educational pairings.

Table: 1
Distributions of Married Couples Aged 25-49 by the Educational Pairings

Educational pairings	(% of total)
Homogamy	61.6%
Heterogamy	38.4%
Hypergamy	26.4%
Hypogamy	12.0%

Source: Authors' own calculation based on 2018 TDHS.

Couples in which both partners have the same level of education are referred to as educational homogamy. Conversely, couples in which the partners have different levels of education are known as educational heterogamy. Therefore, there are two logically distinct subtypes of educational heterogamy: educational hypergamy and hypogamy. The phenomenon of educational hypergamy occurs when men are more highly educated than women, whereas educational hypogamy occurs when men are less educated than women. As shown in Table 1, 62% of women have the same educational attainment as their husbands, and 38% have either lower or higher educational attainment. Furthermore, compared to their husbands, 26% of women have lower levels of education, while 12% have higher levels. In this regard, educational homogamy is more common than educational heterogamy among married couples aged 25-49 in Türkiye.

Table 2 indicates the distributions of married couples aged 25-49 by subcategories of educational pairings. This study categorises individuals by educational attainment as

follows: those with no education or primary education are classified as having low educational attainment, those with secondary education are classified as having medium educational attainment, and those with tertiary education are classified as having high educational attainment. We divide each homogamous, hypergamous, and hypogamous couple into three subcategories. As illustrated in Table 2, homogamous couples comprise low-low, medium-medium, and high-high educational pairings. Hypergamous and hypogamous couples include medium-low, high-low, and high-medium educational pairings.

Table: 2
Distributions of Married Couples Aged 25-49 by Subcategories of Educational Pairings

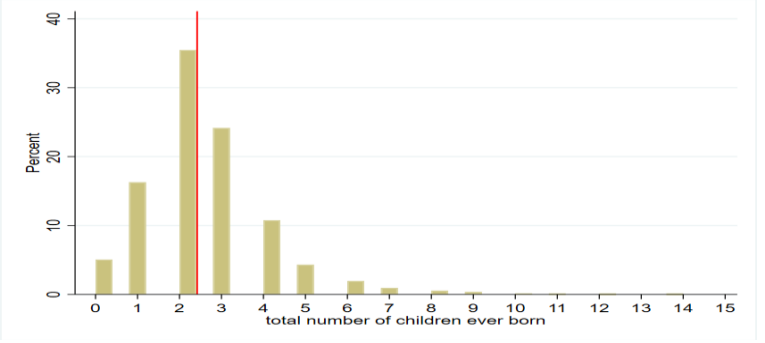
Couples' educational levels			
	Homogamy		
	Woman	Man	(% of total)
	Low	Low	44.6%
	Medium	Medium	33.1%
	High	High	22.3%
	Heterogamy		
	Hypergamy		
	Man	Woman	(% of total)
	Medium	Low	70.5%
	High	Low	7.6%
	High	Medium	21.9%
	Hypogamy		
	Woman	Man	(% of total)
	Medium	Low	57.5%
	High	Low	5.3%
	High	Medium	37.2%

Source: Authors' own calculation based on 2018 TDHS.

Table 2 shows that homogamous couples with low, medium, and high educational levels are 45%, 33%, and 22%, respectively. The majority of hypergamous and hypogamous couples, around 71% and 58%, are medium-low educational pairings, respectively. For these two types of couples, the shares in high-medium educational pairings are about 22% and 37%, while the shares in high-low educational pairings are only 8% and 5%, respectively. In this regard, high-low educational pairings are rare in both types of couples, whereas medium-low educational pairings are quite common, especially among hypergamous couples. In addition, high- and medium-level educational pairings are more prevalent among hypogamous couples than among hypergamous couples.

Figure 2 indicates the total number of children ever born for married couples aged 25-49 in 2018 in Türkiye. The mean total number of children ever born is 2.42 for married couples aged 25-49, indicated by the red vertical line. Furthermore, among these couples, about 35% have 2 children, and 25% have 3 children.

Figure: 2
Total Number of Children Ever Born for Married Couples Aged 25-49



Source: Authors' own calculation based on 2018 TDHS.

Table 3 presents the mean number of children ever born by educational pairings for married couples aged 25-49.

Table: 3
Mean Number of Children Ever Born by Educational Pairings

Educational Pairings	Mean number of children ever born
Homogamy	2.41
Low-Low	3.24
Medium-Medium	2.00
High-High	1.35
Heterogamy	2.46
Hypergamy	2.44
Medium-Low	2.85
High-Low	2.77
High-Medium	1.97
Hypogamy	2.00
Medium-Low	2.28
High-Low	2.29
High-Medium	1.52

Source: Authors' own calculation based on 2018 TDHS.

As can be seen in Table 3, the mean number of children ever born for homogamous couples is 2.41. However, the mean number of children ever born has substantial heterogeneity across subcategories of educational homogamy. The mean number of children ever born of low-low, medium-medium, and high-high educational pairings is 3.24, 2.00, and 1.35, respectively. Accordingly, the mean number of children ever born decreases markedly (to about 2) as educational level increases for couples with the same level of education. In addition, in all subcategories of educational pairings, high-high and low-low educational pairings for homogamous couples have the lowest and highest fertility outcomes.

The mean number of children ever born for heterogamous couples is 2.46, almost the same as that of homogamous couples. However, the fertility outcomes vary for hypergamous and hypogamous couples. The mean number of children ever born by hypergamous and

hypogamous couples is 2.44 and 2.00, respectively. In this respect, fertility outcomes of hypergamous couples are higher than those of homogamous couples. Conversely, fertility outcomes of hypogamous couples remain below those of homogamous couples.

Furthermore, fertility outcomes exhibit considerable variability between and within hypergamous and hypogamous couples. Within hypergamous couples, fertility outcomes for medium-low and high-low educational pairings are comparable at 2.85 and 2.77, respectively, whereas those for high-medium educational pairings are notably lower at 1.97. A similar trend was observed within hypogamous couples in terms of fertility outcomes. For hypogamous couples, the fertility outcomes of medium-low and high-low educational pairings are nearly identical, with values of 2.28 and 2.29, respectively. However, in these types of couples, high-medium educational pairings have a much lower fertility outcomes with a value of 1.52.

Table 3 also indicates that in all the same subcategories of educational pairings, the mean number of children ever born to hypergamous couples exceeds that of hypogamous couples. More specifically, in comparison to hypogamous couples, hypergamous couples had higher fertility outcomes in medium-low, high-low, and high-medium educational pairings by 0.57, 0.48, and 0.45, respectively. In other words, in all the subcategories of educational pairings, fertility outcomes in couples where men are more educated than women are always higher than in couples where women are more educated than men.

3.2. Methodology

Count data models are used for fertility analysis when the dependent variable takes non-negative integer values, such as the number of children ever born. One of these models is the Poisson regression model (PRM), which assumes equidispersion, meaning the conditional mean and variance are equal or nearly equal (Hilbe, 2014). However, the assumption of equidispersion is rarely met in fertility analysis. If the assumption is not met in fertility analyses, PRM estimations indicate that only the standard errors are affected, and the coefficients remain unaffected (Harris et al., 2012). Put simply, while the model produces reliable coefficients, inferences based on the estimated standard errors are no longer accurate. To overcome this problem, Winkelmann & Zimmermann (1994) developed GPRM. GPRM adjusts to account for overdispersion, in which the variance of the model is greater than the conditional mean, and underdispersion, in which the variance of the model is less than the conditional mean, as well as equidispersion. Therefore, we prefer to use GPRM in fertility analysis, recognising the possibility of encountering equidispersion, overdispersion, or underdispersion.

Harris et al. (2012) parametrise the generalised Poisson probability function based on Consul (1989) and Famoye (1993) as follows:

$$f(y_i, \theta_i, \delta) = \frac{\theta_i[\theta_i+\delta y_i]^{y_i-1} e^{-\theta_i-\delta y_i]}}{y_i!}, y_i = 0,1,2, \ldots\ldots \quad (1)$$

The mean and variance of the generalised Poisson random variable Y_i are given

$$\mu_i = E(y_i) = \frac{\theta_i}{1-\delta}, \qquad Var(y_i) = \frac{\theta_i}{(1-\delta)^3} = \frac{1}{(1-\delta)^2} E(y_i) = \varphi E(y_i)$$

The role of a dispersion factor is played by the term $\varphi = \frac{1}{(1-\delta)^2}$. If $\delta = 0$, then there is equidispersion and the generalised Poisson distribution is reduced to the usual Poisson distribution with parameter θ_i. In addition, if $\delta > 0$ the model has an overdispersion, and if $\delta < 0$ the model has an underdispersion.

To reveal the relationship between educational pairings of couples and fertility outcomes, we estimated the following equation with GPRM:

$$ln(numtotchild_i) = \beta_0 + \beta_1 educational\ pairings_i + X_i'\beta_2 \tag{2}$$

In equation 2, $ln(numtotchild_i)$ is the dependent variable that defines the natural logarithm of the number of children ever born of a couple i. β_0 is a constant term. $Educational\ pairings_i$ is our main independent variable that indicates the pairings of the educational levels of a couple i. We use a broad definition of the educational pairings variable to clarify the relationship between couples' educational pairings and fertility. We divide each educational homogamy, hypergamy, and hypogamy, which are three basic educational pairings, into three subcategories, so that the educational pairing variable consists of nine subcategories. More precisely, the subcategories of educational homogamy are low-low, medium-medium, and high-high, while the subcategories of educational hypergamy and hypogamy are medium-low, high-low, and high-medium. In addition, β_1 is the coefficient of the educational pairing's variable, X_i' is a vector that includes control variables, and β_2 is the coefficient of the control variables.

Interpretation of GPRM coefficients is generally not favoured because it indicates the change in the natural logarithm of the response for a one-unit change in the predictor. We therefore prefer to interpret the GPRM coefficients in terms of the incidence rate ratio (IRR), which is the ratio of the count rates between two adjacent ascending response levels. To get IRRs for each predictor, we exponentiate GPRM coefficients. In this context, if we exponentiate both sides of equation 2, we get equation 3.

$$e^{ln(numtotchild_i)} = e^{\beta_0 + \beta_1 educational\ pairings_i + X_i'\beta_2}$$

$$numtotchild_i = e^{\beta_0 + \beta_1 educational\ pairings_i + X_i'\beta_2} \tag{3}$$

For example, the IRR for β_1 is obtained with equation 4.

$$IRR_{\beta_1} = \frac{e^{\beta_0 + \beta_1(=1) + X_i'\beta_2}}{e^{\beta_0 + \beta_1(=0) + X_i'\beta_2}} = e^{\beta_1(=1)} \tag{4}$$

For the reference category, IRR equals 1. IRR<1 indicates that the other category has lower fertility outcomes than the reference category, while IRR>1 shows that the other category has higher fertility outcomes than the reference category.

For the IRR for β_1, we can also interpret it in percentage terms, as in equation 5.

$$IRR_{\beta_1}(\%) = [IRR_{\beta_1} - 1] \times 100 \quad (5)$$

Table 4 gives the summary statistics of the control variables used in the fertility analysis.

Table: 4
Summary Statistics of Control Variables

Control variables	Type	Mean	Std. Dev.
Women's Characteristics			
Age	Continuous	35.613	6.148
Age square	Continuous	1306.083	443.751
Employment status	Dichotomous		
No (ref)		0.692	
Yes		0.308	
Native language	Categorical		
Turkish (ref)		0.790	
Kurdish		0.160	
Arabic		0.024	
Others		0.026	
Women's Parental Characteristics			
Mother literate	Categorical		
No (ref)		0.451	
Yes		0.545	
Don't know		0.004	
Father literate	Categorical		
No (ref)		0.116	
Yes		0.873	
Don't know		0.011	
Couples' Characteristics			
Age difference	Continuous	3.411	3.571
Wealth index	Categorical		
Poorest (ref)		0.143	
Poorer		0.185	
Middle		0.206	
Richer		0.224	
Richest		0.242	
Type of residential place	Dichotomous		
Urban (ref)		0.786	
Rural		0.214	
Region	Categorical		
West (ref)		0.439	
South		0.121	
Central		0.220	
North		0.052	
East		0.168	
Total sample size	3860		

Source: Authors' own calculations based on 2018 TDHS.

In this study, we categorise the control variables into three groups: characteristics of women and couples and women's parental characteristics. Women's characteristics include age and its square, employment status, and native language variables. A substantial body of research indicates that there is a considerable relationship between a woman's age and fertility, and as a woman's age increases, her fertility tends to decline (ESHRE, 2005; Chua

et al., 2020; Delbaere et al., 2020; Beaujouan & Toulemon, 2021). In addition, women are more likely to have children at younger ages (HUIPS, 2018). Thus, an inverted U-shaped relationship is expected between a woman's age and fertility. The existence of the relationship is evidenced by the coefficients of the age and age-square variables being positive and negative, respectively, and being statistically significant.

The general view on the relationship between women's employment and fertility is that women's employment is associated negatively with fertility outcomes. However, in recent years, the emergence of complementary factors between fertility and women's work careers, such as family policy (e.g., increased accessibility of institutionalised childcare), cooperative fathers, favourable social norms, and flexible labour markets (e.g., growth in part-time work), has weakened the negative relationship between fertility and employment (Doepke et al., 2023). From a feminist perspective, the adverse effect of women's employment on fertility may be primarily attributed to existing gender structures within society and the resultant power dynamics within marital relationships (Bernhardt, 1993).

The native language of women is classified into four categories: Turkish, Kurdish, Arabic, and others. Arabs and Kurds have social norms that favour higher fertility, such as pressurising women to have children, the desire of husbands and family elders for male children, and the legal and religious prohibition of abortion (Karakaya et al., 2017). Thus, we expect that women whose native languages are Kurdish and Arabic will have higher fertility outcomes than those whose native language is Turkish.

Women's parental characteristics include the mother's and father's educational levels. The educational status of parents is one of the determinants of the number of children, and parental education is crucial in reducing fertility (Josipovic, 2007; Chen, 2022). Furthermore, Chen (2022) asserts that maternal education is a stronger determinant of fertility than paternal education. In this regard, we expect women whose fathers, especially mothers, are literate to have lower fertility than women whose fathers and mothers are illiterate.

Characteristics of couples include age difference, wealth index, type of residence place, and region variables. Some studies argue that the age of a male partner also affects fertility (Jimbo et al., 2022). In addition, among married couples, the age difference between men and women is generally small. For example, women are on average 2-3 years younger than their partners in most Western countries (Poppel et al., 2001; Dribe & Nystedt, 2017). When couples are close in age, using both women's and men's ages as independent variables simultaneously in econometric analysis can lead to multicollinearity. We therefore use the age difference variable, which represents the difference in age between men and women. In addition, in patriarchal societies such as Türkiye, as the age gap widens in favour of the male partner, it is expected that fertility will be higher due to the bargaining power of the male partner within the household.

The wealth index is constructed from household durable goods, such as televisions and cars, and from their living conditions. This index, which can also serve as a proxy for household income, comprises 5 categories: poorest, poorer, middle, richer, and richest. As income levels rise, individuals tend to invest more in their children's education rather than increase the number of children; in other words, they make a trade-off between the quantity and quality of children (Becker & Lewis, 1973). In this regard, fertility is expected to be negatively affected by higher welfare levels among couples.

The place of residence is considered rural or urban. Fertility outcomes are high in rural areas and low in urban areas (Akça & Ela, 2012; Fiori et al., 2014). The disparity in fertility outcomes between rural and urban areas can be attributed to environmental, economic, and social factors, as well as the demographic composition of specific population segments (Adhikari et al., 2024). From an economic perspective, 84.1% of households living in rural areas of Türkiye are among the poorest in terms of wealth (HUIPS, 2018). Moreover, in rural areas, where women work as unpaid family workers, there is less conflict between fertility and employment (Akça & Ela, 2012). As rural people work mainly in agriculture, households tend to meet their labour needs through their children. From a social point of view, households in rural areas are more likely to have a patriarchal family structure that attaches more importance to fertility than households in urban areas. In addition, the educational attainment of individuals residing in rural areas is lower than that of those residing in urban areas (HUIPS, 2018). All of these lead to higher fertility among couples in rural areas than among those in urban areas.

We have divided Türkiye into 5 main regions: west, east, north, south, and central. Compared with the rest of Türkiye, the eastern and southern regions exhibit higher fertility rates (Selim & Üçdoğruk, 2005; Akça & Ela, 2012; HUIPS, 2018). This phenomenon can be attributed to the comparatively lower level of socio-economic development observed in these regions.

4. Findings

Table 5 presents GPRM estimates of the relationship between couples' educational pairings and fertility outcomes.

Table: 5
GRPM Estimation Results

Variables	Coefficients	IRRs
Educational pairings (ref: homogamy: low-low)		
medium-medium	-0.125***	0.883***
	(0.025)	(0.022)
high-high	-0.435***	0.647***
	(0.035)	(0.023)
hypergamy		
medium-low	-0.043	0.958
	(0.023)	(0.022)
high-low	-0.052	0.950
	(0.043)	(0.041)
high-medium	-0.202***	0.817***
	(0.036)	(0.030)

hypogamy		
medium-low	-0.148***	0.862***
	(0.031)	(0.027)
high-low	-0.045	0.956
	(0.142)	(0.136)
high-medium	-0.300***	0.741***
	(0.051)	(0.038)
Women's Characteristics		
Age	0.132***	1.141***
	(0.015)	(0.017)
Age square	-0.001***	0.999***
	(0.000)	(0.000)
Employed (ref: no)		
yes	-0.083***	0.920***
	(0.019)	(0.017)
Native Language (ref: Turkish)		
Kurdish	0.253***	1.288***
	(0.025)	(0.032)
Arabic	0.424***	1.529***
	(0.055)	(0.084)
Others	0.115**	1.121**
	(0.051)	(0.057)
Women's Parental Characteristics		
Mother literate (ref: no)		
yes	-0.046***	0.955***
	(0.018)	(0.017)
don't know	-0.003	0.997
	(0.106)	(0.106)
Father literate (ref: no)		
yes	-0.023	0.978
	(0.025)	(0.024)
don't know	-0.055	0.946
	(0.072)	(0.068)
Couples Characteristics		
Age difference	0.022***	1.022***
	(0.002)	(0.002)
Wealth index (ref: poorest)		
poorer	-0.077***	0.926***
	(0.028)	(0.025)
middle	-0.154***	0.857***
	(0.031)	(0.026)
richer	-0.188***	0.829***
	(0.033)	(0.027)
richest	-0.265***	0.767***
	(0.037)	(0.029)
Residence place (ref: urban)		
rural	0.001	1.001
	(0.023)	(0.023)
Region (ref: west)		
south	0.088***	1.092***
	(0.028)	(0.031)
central	0.132***	1.141***
	(0.022)	(0.025)
north	0.052**	1.053**
	(0.026)	(0.028)
east	0.260***	1.297***
	(0.028)	(0.036)
Constant	-1.967***	0.140
	(0.276)	0.039
δ	-0.386***	
	(0.017)	
LR test (δ = 0)	816.78***	
	(0.000)	
Log pseudolikelihood	-5707.196	
Pseudo R^2	0.161	
N	3860	

*Notes: ** p < 0.05, *** p < 0.01. Standard errors in the second row. For the LR test only, the second row gives the p-value.*

As shown in Table 5, the LR test statistic is 816.78, and the null hypothesis ($\delta = 0$) is rejected at the 1% significance level. Accordingly, the dispersion parameter is found to be significantly different from zero. In addition, the dispersion parameter is -0.386, indicating that the model is underdispersed. Thus, the preference for GPRM over PRM is supported by the findings.

The findings show that couples' educational pairings are closely associated with fertility outcomes. The fertility outcomes differ significantly across some subcategories of educational homogamy, hypergamy, and hypogamy. For homogamous couples, we find that couples with medium-medium and high-high educational pairings are less likely to have children than those with low-low educational pairings. More specifically, the fertility outcomes of medium and highly educated homogamous couples are lower at 11.7% and 35.3% compared to those of low-educated homogamous couples. These findings are consistent with Bagavos (2017), who found that higher education levels are associated with lower fertility in homogamous couples. Conversely, the findings contradict several studies (Dribe & Stanford, 2010; Osiewalska, 2015).

When fertility outcomes are considered for heterogamous couples, findings show that hypergamous and hypogamous couples with high-medium educational pairings and hypogamous couples with medium-low educational pairings have lower fertility outcomes in comparison to homogamous couples with low-low educational pairings. Compared to homogamous couples with low-low educational pairings, fertility outcomes are lower: 18.3% and 25.9% for hypergamous and hypogamous couples, respectively, and 13.8% for hypogamous couples with medium-low educational pairings. These findings support the notion that hypogamous couples have lower fertility than homogamous couples, in line with empirical studies in the relevant literature (Thomson, 1990; Corijn et al., 1996; Bueno & Garcia-Roman, 2021; Nitche et al., 2021).

The relationship between control variables and fertility is theoretically as expected. The coefficient signs for women's age and its square are significantly positive and negative, respectively, indicating an inverted U-shaped relationship between fertility and women's age. Fertility outcomes of employed women are found to be 8% lower than those of non-employed women. Women's native language is also associated with fertility. The fertility outcomes of women whose native language is Arabic, Kurdish, or other languages are 1.53, 1.29, and 1.21 times those of women whose native language is Turkish, respectively.

Maternal literacy, rather than paternal literacy, is associated with fertility, and women whose mothers are literate have approximately 5% lower fertility outcomes. For each year the age difference between men and women increases in favour of men, fertility outcomes increase by 2.2%. Couples' wealth level plays a key role in fertility outcomes, and as wealth rises, fertility outcomes decline. Fertility outcomes are 23.3% lower among the richest couples than among the poorest. We also find that the geographical region is associated with fertility outcomes, whereas the couples' residence place is not. Fertility outcomes in the east,

centre, south, and north of Türkiye are approximately 1.30, 1.14, 1.09, and 1.05 times more than in the west of Türkiye, respectively.

5. Discussion and Conclusions

In this study, we focus on the relationship between couples' educational pairings and fertility outcomes in Türkiye. The rationale for this focus is that homogamous couples, where both partners have the same level of education, and heterogamous couples, where the partners have different levels of education, exhibit mostly heterogeneity in fertility trends. We offer a comprehensive fertility analysis with nine subcategories, dividing each of the three main educational pairings, homogamy, hypergamy, and hypogamy, into three subcategories. This study contributes to the existing Turkish literature by being among the pioneering studies on the relationship between couples' educational pairings and fertility outcomes. Our findings show that couples' educational pairings play a significant role in fertility outcomes. More specifically, fertility outcomes for couples with the same and different levels of education vary dramatically in subcategories. The top three subcategories with the highest fertility outcomes are the low-low subcategory among homogamous couples and the medium-low subcategory among hypergamous and hypogamous couples, respectively. In addition, the first three subcategories with the lowest fertility outcomes are the high-high subcategory among homogamous couples and the high-medium subcategory among hypogamous and hypergamous couples, respectively. The high-high subcategory of homogamy has the lowest fertility compared to the low-low subcategory, which serves as the reference group. Furthermore, our results indicate that our model satisfies the underdispersion assumption. This suggests that the GPRM, which considers all three assumptions of equidispersion, overdispersion, and underdispersion, is more appropriate than the standard Poisson and Negative Binomial Regression models, which are used under the assumptions of equidispersion and overdispersion, respectively.

Türkiye is a country in which gender roles are dominant. In Türkiye, men spend more time in the labour market as they assume the role of the breadwinner, while women spend more time on household chores, such as housework and caring for children and the elderly. While this situation limits women's participation in education and the labour force, it leads to a decrease in the age at which women marry and have their first child, thus raising their fertility. From this point of view, it is expected that low-educated couples with the same level of education are relatively more likely to have children. Higher educational attainment among women increases the probability of labour force participation and employment. In Türkiye, the employment of highly educated women leads them to devote a significant portion of their time to the labour market, resulting in relatively low fertility. The fact that highly educated working women have highly educated husbands may lead to greater consensus between couples and further reduce the number of children. At the same time, because highly educated working women will have bargaining power over their partners with lower levels of education, the number of children may also be relatively low. In a situation where the male partner is more educated, the opposite effect is observed.

To combat rapidly declining fertility rates worldwide, almost all countries are implementing fertility-promotion policies. Pronatalist policies include legal arrangements to protect the position of women who give birth in the labour market, cash and in-kind benefits to reduce the financial burden of having a child, and labour market support. One of the oldest of these is paid parental leave. Among these leaves, referred to as family-related leave in the literature, maternity leave is the leave taken by working women after the birth of their child, while paternity leave is the leave taken by working men immediately after the birth of their child. Parental leave is leave taken by working parents in addition to maternity and paternity leave to fulfil care responsibilities in the first years of their children's lives (Hofman et al., 2020). In Türkiye, numerous regulations have been in place for many years to ensure that women maintain their position in the labour market during childbearing. In general, 16 weeks of maternity leave are granted to working women. After this period, hourly breastfeeding leave (and allowance) is provided for one year for women returning to work, and up to two years of unpaid leave is provided for women working in the public sector who wish to take it. In the private sector, this period is six months. To increase fertility and improve the disadvantaged position of private-sector employees, this period should be equalised. There are legal provisions that prevent mothers from losing their current jobs after exercising these rights.

In addition to these, numerous incentive mechanisms are implemented to encourage parents' fertility. Among the benefits presented in Dağlıoğlu & Bektaş (2022), Multiple Birth Assistance, Family Assistance Allowance for civil servants, and child benefits provided by employers under collective labour agreements are included. Accordingly, the Ministry of Family and Social Services provides a lump-sum cash support (increasing with the number of children) in the form of a maternity allowance to insured women in Türkiye upon having a child. Although the scope of this support is broad enough to cover all citizens, the amount of support is currently only 1.7% of the minimum wage for the first child. The Turkish government announced a new program to subsidise marriage and fertility at the beginning of 2025. With this new program, total support will reach 29.4% of the minimum wage with three (four) children beginning this year. On the other hand, working women can also receive maternity benefits from their organisations. In the private sector, the amount and scope of support vary, but, for example, for civil servants, the maternity allowance is 5% of the minimum wage. In addition, there are other supports, such as maternity expense reimbursement and a breastfeeding allowance. To summarise, the low level of cash benefits related to childbirth is far from encouraging fertility. Moreover, it can be argued that social policies such as maternity and breastfeeding leave and nursery allowances may be more important for educated women in the labour market, which may be related to the fertility outcomes of couples in educational matches with high levels of education.

More specifically, policymakers aiming to increase fertility should develop policies targeting couples with the lowest fertility outcomes in educational pairings. Couples with the fewest children are those in the high-high subcategory, where both partners have the same educational level, and in the high-medium subcategory, where the female partner is much more educated than the male partner. The main traits of these couples are high levels

of education, with the female partner's education higher than the male's. From the perspective of increasing the likelihood that highly educated couples enter the labour market, it is crucial to recognise flexible working opportunities, provide childcare support for dual-earner families, and extend maternity and breastfeeding leave periods to boost the fertility rates of couples with low fertility. Moreover, given that low education levels are often associated with low income, to improve fertility outcomes for couples with relatively high fertility levels in other educational pairings, cash child benefits should be increased significantly to offset the rising costs of raising children in recent years. These payments should also rise substantially in proportion to the number of children.

The dataset used in the study covers only one year of fertility outcomes. In fact, some women have not yet completed their fertility process. For instance, a woman who gave birth to her first child at the age of 30 in 2018 could still have more children in subsequent years. Consequently, our data provides a snapshot of the relationship between couples' educational pairings and fertility outcomes. If a dataset were available that tracked the same women from the start to the end of their fertility process, it would be possible to make more comprehensive inferences about the relationship between couples' educational pairing and fertility outcomes. This is the study's most significant limitation.

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