The International Journal of Education and Allied Sciences, pp. 17-27
ISSN: 0975-8380, July 2024, Volume 16, No. 1

ARTICLE

Effects of Educational Assortative Matching on Women's Fertility in India

Sugata Bag*

Abstract

Fertility rates in India have fallen significantly during the last few decades. Existing literature has overtly focused on and established the negative association between women's education and fertility but mostly overlooks husbands' position. However, fertility decisions are increasingly jointly made by the spouses, and the Indian marriage market is highly assortative over education. Existing literature categorises educational assortative matching into three types – *hypergamy* (where wife less educated than husband), *homogamy* (equally educated spouses) and *hypogamy* (wife more educated). This study investigates the effect of these three marriage types on fertility. Using data from the NFHS-5 database, we focus on a reduced-form analysis and employ the Poisson regression technique to demonstrate that women in homo- and hypogamy exhibit significantly lower fertility compared to those in hypergamy. These negative effects persist across education levels of husbands but are stronger among older generations of women. Our findings complement existing literature on the negative association between women's education and fertility.

Keywords: Educational assortative mating, Hypergamy, Homogamy, Hypogamy, Fertility, India.

* Associate Professor, Department of Economics, Delhi School of Economics, University of Delhi.

1. Introduction

India has experienced significant demographic shifts within the last several decades. Fertility rates have dropped dramatically over much of India since the 1980s. The most recent National Family Health Survey (NFHS-5) shows that the total fertility rate (TFR) fell from 3.4 to 2.0 children between 1992–1993 and 2019–2021, falling below the replacement rate of 2.1. The existing literature identifies several determinants of fertility levels and their decline. The most important determinant of fertility levels and fertility decline identified in the current literature is the systematic negative association between female education and fertility in India (Drèze & Murthi, 2001; Bhat, 2002; Arokiasamy et al., 2004; Imai & Sato, 2013), as well as globally (Lutz & Samir, 2011). This negative association for women arises due to increased opportunity costs when childbearing negatively impacts labour market activity (Kravdal & Rindfuss, 2008). Additional factors that contribute to decreased fertility rates include the usage of modern contraceptives, particularly by women with lower levels of education (Arokiasamy, 2009), low rates of child death, and the desire for sons. However, Drèze and Murthi (2001) note that urbanisation, poverty reduction, and rising male literacy, which are broad measures of progress and modernisation, do not correlate significantly with fertility.

However, in principle, there are two possibilities. Male education may be more important than female education in a patriarchal system, where men govern reproduction decisions. However, Doepke and Kindermann (2019) observe that fertility decisions are more influenced by mutual agreement and desire between husband and wife, given their costs and benefits, rather than by an individual's preference. Singley and Hynes (2005) emphasise the necessity of a 'couple-level' approach. Some studies, e.g. Imai & Sato (2013) and Bhat (2002), consider the educational levels of both spouses rather than focusing only on women's education. They note ignoring the spouse's education will introduce an omitted variable bias. We propose a different approach and introduce women's relative educational position compared to their partners. This approach thus categorises the marriage type within the positive assortative matches a woman has: hypergamy, homogamy, or hypogamy – which respectively refer to marriages, according to literature, where the husband is more educated, equally educated, or less educated than the wife.

The observed negative association between women's education and fertility in the Indian context may be influenced by the fact that they are in hyper-, homo- or hypogamous marriage types. In this paper, we thus propose a new link: it is not just the rising education of women, but rather their educational attainment 'relative' to their spouses, i.e., the type of educationally sorted marriage they had that affects women's fertility. In India, with the expansion of education facilities over time, matching patterns have undergone a massive transformation – both hyper- and homogamous marriages are on the decline, while hypogamous marriages register a considerable compensatory increase;

hypergamous marriages still hold the dominant share, though (see Panel A in Figure 1). Hypergamous marriages are more aligned with the patriarchal norms of 'male breadwinner' in the households. The other two types can be seen as deviant to those norms. However, women in homo- and hypogamous marriages, being educationally equal or superior, may have higher relative bargaining power of women over men in specific dimensions of the conjugal life of the couples (particularly on family planning) compared to women in hypergamy for each level of husbands' education. Our preliminary assessment shows a systematic difference in fertility among three types of marriages: – the fertility rates are highest among hypergamous marriages, followed by homogamous ones, and lowest for hypogamous marriages (see Panel B in Figure 1). Contemporary literature has not addressed the impact of three marriage types on fertility behaviour. We aim to fill this gap.

Using the recently conducted nationally representative NFHS-5 (2019-21) cross-sectional household survey for women aged 15-49, we empirically intend to establish the negative effects of homo- and hypogamous marriage types on the fertility of Indian women compared to hypergamous marriages. Given that fertility is a count variable, i.e., a type of limited dependent variable, we deploy a simple Poisson regression technique, the most common count-data regression framework. However, we acknowledge that the choice of marriage type is likely endogenous due to correlated-omitted variables, and thereby, the simple Poisson regression estimates may be rendered biased and inconsistent. An unbiased estimate (e.g., two-stage approaches) is possible, but as the valid 'instruments' for the endogenous variable are hard to come by, we leave this as a future research agenda. Instead, following the literature, we use a comprehensive set of controls and fixed effects, and through a reduced-form sequential model-building process, we show the consistency of our results. Thus, our results here are associative and not causation. Our regression shows that fertility rates are about 10 percentage points lower for women in homogamous marriages and about 16 percentage points lower for hypogamous marriages compared to women in hypergamous marriages. We further show that for every successive level of spouses' education (from illiterate to college-educated), the women's fertility levels gradually fall irrespective of marriage type. Moreover, there are significant and consistent differences in fertility between hyper-, homo- and hypogamous marriages. These findings are new to the literature.

The subsequent sections of the paper are structured as follows. Section 2 describes the data, key variables and some illustrative facts. In section 3, we present the empirical model and estimation methodology. Section 4 presents the regression results. Finally, section 5 concludes.

2. Data and Variables

Data: In this study, we use data from the fifth National Family Health Survey

(NFHS-5, 2019-21), part of the worldwide Demographic Health Survey (DHS) program. The NFHS-5 was conducted between June 2019 and April 2021 and surveyed 636,669 households across India. It uses a two-stage stratified random sampling technique to generate a nationally representative sample covering 30,456 Primary Sampling Units (PSUs) drawn from 707 districts, 28 states, and 8 union territories. It has four survey questionnaires—Household, Woman, Man, and Biomarker. For our analysis, we mainly focus on the Women's module, which has information from all women aged 15-49 from all sampled households, that has a sample size of roughly 81 thousand. We have the relevant information on fertility, infant and child mortality, practice of family planning, maternal and child health, reproductive health, nutrition, anaemia, utilisation and quality of health and family planning services, age, year of marriage, educational achievements, and socioeconomic characteristics. Our analytical sample consists of roughly 75 thousand couples, for whom we have non-missing and valid information for the outcome and main explanatory variables and covariates of interest.

Key Variables: We now define the outcome and explanatory variables for this analysis. From the information on birth history, we construct our outcome variable, the fertility rate of a woman; *FER* denotes the fertility proxied by the number of children ever born to a woman aged 15-49, after excluding any miscarriage but including any children who have died. Our key explanatory variable of interest, following Dribe and Nystedt (2013), Hu and Qian (2015), and Lin et al. (2020), is *MarType.* It is a three-category variable based on the educational attainment gap between the husband and wife at the time of the survey: hypergamy, homogamy, and hypogamy, which respectively refer to marriages in which the husband is more educated, equally educated, or less educated than the wife.

<u>Panel A</u>: Matching transitions   <u>Panel B</u>: Fertility rates over women's age

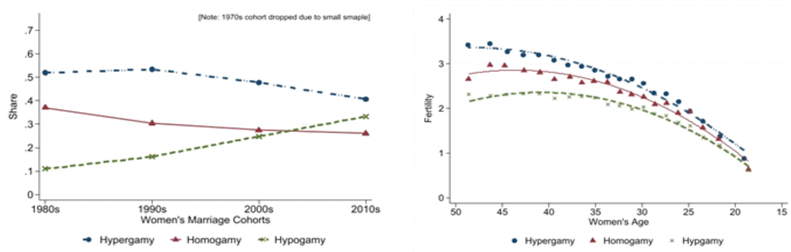

Figure 1: Illustrative facts about assortative marriages, women's fertility and transitions

Notes: Author's computations based on NFHS-5 data. In Panel A, shares of each marriage type are computed from all marriages that took place in each decade. Panel B plot is generated using the STATA –binscatter– package.

We now present some descriptive graphs related to marriage and fertility for Indian women using the NFHS-5 sample data. In Panel A of Figure 1, we show the changing patterns (shares) of three marriage types over the last four decades. Hypergamous marriages continue to hold a dominant position in Indian society, followed by homogamy. However, both have slowly declined over the decades, and there is a compensatory increase in hypogamous marriages. In Panel B, we use a bin-scattered plot to demonstrate how fertility rates declined for each marital type across generations of women. Even raw trends demonstrate that there exist major differences in fertility rates among women in hypergamy, homogamy, or hypogamy; however, the differences were substantially wider for the older cohorts but are steadily narrowing for the younger cohorts. Regardless of age, women in hypogamy had the lowest fertility, followed by women in homogamy. The observation from panel B supports our conjecture, and we validate it through an econometric analysis in the ensuing section.

3. Empirical Model, Methodology

We are interested in measuring the effects of marriage type that a woman had on her fertility, specifically, whether there is a negative impact of homogamy and hypogamy marriages on women's fertility relative to hypergamy and what the magnitude of such an impact is. We specify our baseline model using the following reduced-form equation –

$$FER_{isr} = \alpha + MarType_i\beta + SpouseEdu_i\delta + X_i\gamma + \Theta_s + \psi_r + \epsilon_i \quad (1)$$

The dependent variable is the fertility rate (FER) of married woman *i* residing in subsector *s* of some state *r; MarType* is the three-category marriage type (e.g. hypergamy, homogamy and hypogamy); *SpouseEdu* is the schooling level of the woman's husband. Two fixed effects for the residing location of women are used to deal with local, state-wide unobservable characteristics and cultural patterns or state policies that affect everyone uniformly: Θ for rural/urban sub-sector and ψ for region/state. Further, *X* stands for the vector of the other households and individual factors that correlate with fertility and marriage type, and we describe below. Lastly, α is the intercept and ϵ is the error term.

It is to be noted that considering the positive assortative matching over education, spouse education and *MarType* together serve as a proxy for a wife's education, as well as bring out the bargaining position of women vis-à-vis their husbands. For instance, in the case of homogamy *MarType*, where husband and wife are equally educated, the husband's education is a direct proxy for the wife's education. In the case of hypergamy, women, for every level of husbands' education, are less educated and hence expected to have less bargaining power, but a reverse bargaining situation is expected for women in hypogamous marriages. Moreover, a highly educated husband, irrespective of *MarType*, is likely to cooperate with the wife in family planning and using contraceptives. This possibility has been relatively neglected in the literature, with a few exceptions, such as Bhat (2002) and Imai and Sato (2014). We expect our regression to demonstrate all these effects.

Controlled covariates: To avoid difficulties related to endogenous variables, we in this paper focus mainly on reduced forms, in which we consider the effects of variables that can reasonably be expected to be exogenous. In our regression models, following the literature, we explicitly control a few exogenous factors, such as caste and religious affiliations of the households. Caste is a five-category variable (SC, ST, OBC, none of them, and do not know/ did not reveal). Religion is a five-category variable (Hindu, Muslim, Christian, Sikh, and others). These two will address the social-cultural effects of households belonging to different social groups and religions. Besides these, we control for – women's age and its square to deal with time-varying life-cycle factors, a dummy for cases when twins or triplets were born (a small number of women had twins or triplets and these were mostly exogenous), and a dummy for consanguineous marriage (i.e. if spouses were blood-relatives before marriage). Both spouses' main occupations (each is a seven-category variable), and the household's economic status in the country-wide distribution (poorest, poorer, middle, richer, richest) are also controlled. Lastly, As the survey was interrupted by the arrival of COVID-19, a dummy for pre-COVID-19 lockdown is used.

First caveat: Existing literature often considers various other factors such as contraceptive uses, age of marriage, age of first birth, use of public awareness campaigns, etc. Nevertheless, we explicitly avoid controlling information on these factors as they might be highly correlated with *MarType* or higher education of couples or both, or subsector/state of residence, or changes over time. Several fixed effects used in our model should take care of these factors' spatial or time variation.

Second caveat: We are particularly interested in estimating the vector of coefficients β of the marriage type variable (i.e. the effect of homo- and hypogamy vis-à-vis hypergamy). However, we acknowledge that the choice of marital type is potentially endogenous as it is not chosen randomly but a self-selected decision by the couple. Factors influencing this decision are not observable in the data; this may render our regression estimates biased and inconsistent due to omitted-variable bias. Unbiased estimation (e.g. using two-stage techniques) is possible if valid 'instruments' can be found for the endogenous variable. However, credible instruments are hard to find in this context, and this aspect is left as a future research agenda. However, we try to demonstrate the consistency of our results through sequential model building.

Thus, our results should be considered as associations rather than causal effects.

Regression method: We note that the outcome variable, *FER*, assumes only nonnegative integer values and is thereby constrained as count data. A linear regression is unsuitable for count data, as it neglects the limited number of potential values for the response variable. Without dealing with the endogeneity, we employ the most common count data modelling technique, a Poisson regression, which assumes the error process follows a Poisson distribution with equal mean and variance. However, as the analytical data may not guarantee mean-variance equivalence, alternatively, the Negative Binomial regression is often employed to allow variance to diverge from the mean. We checked both methods, and a likelihood ratio test of overdispersion shows that the dispersion parameter is zero. Therefore, we fit a Poisson regression for our baseline model using STATA.

4. Estimation Results

We now present the Poisson regression results of the effects of three types of educational assortative mating on fertility among Indian women while controlling for other correlates and fixed effects. We use a sequential modelling strategy to demonstrate the consistency of our results. In Table 1 below, regression models in Columns (1) to (2) use different sets of controls and fixed effects. In Columns (2)-(5), we introduce fixed effects related to Urban location, State, household wealth index and pre-lockdown. In column (1), we use only two regressors of our focus – the *MarType* and spouses' education, but no fixed effect. In Columns (2) and (5), we additionally control for religion, caste and occupation categories, whereas in Columns (3), (4) and (5), we have women-specific controls such as their age, age squared, absolute age gap between spouse, twins/triplet born dummy. Column-5 is our final model that includes all controls and fixed effects.

Table 1: Results from Poisson regression models

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Dep var: Fertility	**Model-1**	**Model-2**	**Model-3**	**Model-4**	**Model-5**
MarType (Ref: Hypergamy)					
…Homogamy	-0.227***	-0.218***	-0.181***	-0.131***	-0.119***
	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
…Hypogamy	-0.432***	-0.395***	-0.282***	-0.179***	-0.162***
	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
Spouse' Edu levels	-0.053***	-0.050***	-0.040***	-0.029***	-0.025***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Caste (Ref: GEN)					

Caste (Ref: GEN)					
…OBC		0.003			0.043^{***}
		(0.007)			(0.006)
…SC		0.027^{***}			0.097^{***}
		(0.007)			(0.006)
…ST		-0.015			0.066^{***}
		(0.009)			(0.008)
…DK		0.028^{**}			0.076^{***}
		(0.012)			(0.011)
Religion (Ref: Hindu)					
…Muslim		0.109^{***}			0.180^{***}
		(0.008)			(0.007)
…Christian		0.118^{***}			0.092^{***}
		(0.015)			(0.015)
…Sikh		-0.058^{***}			-0.062^{***}
		(0.019)			(0.016)
…Others		0.050^{***}			0.014
		(0.016)			(0.015)
Urban Dummy		0.020^{***}		-0.004	-0.020^{***}
		(0.007)		(0.006)	(0.006)
Pre-lockdown dummy		0.022^{***}		0.025^{***}	0.031^{***}
		(0.007)		(0.006)	(0.006)
Women related controls					
Age			0.180^{***}	0.189^{***}	0.191^{***}
			(0.002)	(0.002)	(0.002)
Age squared			-0.002^{***}	-0.002^{***}	-0.002^{***}
			(0.000)	(0.000)	(0.000)
Spouses' Absolute age gap			-0.005^{***}	0.002^{***}	0.003^{***}
			(0.001)	(0.001)	(0.001)
Spouses blood related			-0.020^{***}	0.025^{***}	0.008
			(0.007)	(0.006)	(0.006)
Twins/Triplet_birth_dm			0.456^{***}	0.432^{***}	0.429^{***}
			(0.011)	(0.010)	(0.010)
Constant	1.418^{***}	1.236^{***}	-2.302^{***}	-2.659^{***}	-2.930^{***}
	(0.006)	(0.021)	(0.040)	(0.041)	(0.043)
Observations	75160	75160	75160	75160	75160
State FE		Y	Y	Y	Y
HH wealth cat FE		Y	Y	Y	Y

Note: Women and their spouses' occupations are controlled for regression models in Columns (2) and (5).

Clustered (at PSU level) robust standard errors in parenthesis. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Across the different models, one consistent result appears: women in homogamy and hypogamy have consistently lower fertility than women in hypergamous marriages, given their spouses' education level and other controls and fixed effects. We now interpret the results from the model-5. Women in homogamy have about 12 percentage points less fertility compared to women who had hypergamous marriages, *ceteris paribus*. The negative effect is even stronger for women in hypogamy and stands at 16 percentage points lower. The coefficient for spouses' education levels is negative and significant, implying that women married to higher-educated husbands have lower fertility. The caste and religious affiliations of women's families also have a significant bearing on fertility. Compared to the general caste, women from other caste categories have significantly higher fertility; women from scheduled-caste households have the highest fertility (about 10 percentage points higher). Similarly, compared to Hindu families, women from Muslim households have the highest positive fertility gap (about 18 percentage points higher), followed by Christian and Sikh women. The coefficient of Urban dummy also has a small but significant negative effect on fertility. Finally, most of our women-specific controls, except for blood-relationship among spouses, significantly affect fertility. We particularly highlight the inter-generational effect on fertility. The coefficients related to women's age and their square are significant but opposite in signs, implying that over successive generations, fertility rates are decreasing at an increasing rate (rather than a linear fall), as evident from panel B in Figure 1.

Next, let us unpack the above result further to show how the negative effects of homo- and hypogamy vis-à-vis hypergamy for the different educational levels of husbands. To facilitate that we introduce the interactions of marriage type (3-category) with spouses' education (7-category) in the model-5 above, all other controls and fixed effects remain the same. We re-run the model and present results in graphical form in Figure 2 below. We plot predicted fertility from the Poisson model on the vertical axis, and the horizontal axis has husband's education categories. Each line corresponds to one of three marriage types, and each node on a line measures the linear prediction corresponding to one category in the horizontal axes.

Figure 2 shows that the predicted fertility level gradually falls for every successive higher educational category of husbands, irrespective of marriage type. Let us elaborate on this a bit. For instance, consider the women who are married to husbands with 10^{th} standard of schooling; those who are in hypergamy (i.e. have lower education than their husbands) have about 2.5 births, but the women in homogamy (equally educated as husbands) have much lower birth rates (about 2.10) and women in hypogamy (more educated than husbands) have even lower birth rate (about 2). The confidence intervals show that these gaps in birth rates amongst any two marriage types are significant. Results are similar for other education categories of husbands. Given the positive assortative matching, this observation supports the systematic negative association between female education and fertility, a central stylized fact across the globe that more educated mothers tend to have smaller families. However, it is also evident that for every education level of spouses, women in hypergamous marriages have higher fertility than those in non-hypergamous marriages. The significant gap between hyper-, homo- and hypogamy is maintained throughout the spouse's education distribution.

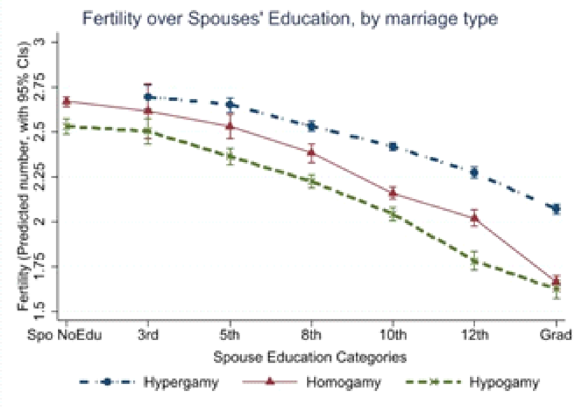

Figure 2: Fertility over women's marriage type and spouses' education

Notes: Author's computation, based on NFHS-5 data

5. Conclusion

This paper investigates the role of different types of education assortative matching–specifically hypergamy, homogamy and hypogamy– on women's fertility in India. To the best of our knowledge, this is the first study in the Indian context to establish this link using the nationwide household survey data. The results in this paper provide several key insights. Our findings complement previous research on the negative relationship between female education and fertility in India. However, we find an even more robust link: it is not just the women's education level, but rather their educational attainment 'relative' to their spouses, i.e., the type of educationally sorted marriage they had, that affects their fertility. First, we demonstrate that women in homo- and hypogamy have significantly and consistently lower fertility than women in hypergamy. Further, we show an even stronger result: given the prevalence of positive assortative matching in India, women's fertility gradually declines for their husbands' successive higher education levels. There exists a significant and consistent fertility gap throughout between women in hyper-, homo- and hypogamous marriages. More interestingly, we show that the fertility gap between the three marriage types is gradually narrowing. However, econometric analysis also identifies other factors influencing fertility, including social (caste), economic backwardness, and religious-cultural customs.

Insights from this paper suggest that policymakers should focus on expanding education among both men and women equally and continue to extend the sensitisation programmes on family planning and related services among the masses, with particular attention to the less-privileged sections of the population.

References

Akem, F. A., Wirba, E. L., & Oumbe Tekam, H. (2024). Educational assortative mating in the Cameroon marriage market: Role of marriage timing. African Development Review.

Allendorf, K. (2013). Going nuclear? Family structure and young women's health in India, 1992–2006. Demography, 50, 853-880.

Arokiasamy, P. (2009). Fertility Decline in India: Contributions by Uneducated Women Using Contraception. Economic and Political Weekly, 44(30), 55–64.

Arokiasamy, P., Kirsty McNay, and Robert H. Cassen. (2004). Female Education and Fertility Decline: Recent Developments in the Relationship. Economic and Political Weekly 39, no. 41 (2004): 4503–7.

Bhat, P. M. (2002). Returning a favour: Reciprocity between female education and fertility in India. World Development, 30(10), 1791-1803.

Doepke, M., & Kindermann, F. (2019). Bargaining over babies: Theory, evidence, and policy implications. American Economic Review, 109(9), 3264-3306.

Drèze, J., & Murthi, M. (2001). Fertility, education, and development: evidence from India. Population and Development Review, 27(1), 33-63.

Dribe, M., & Nystedt, P. (2013). Educational homogamy and gender-specific earnings: Sweden, 1990–2009. Demography, 50, 1197-1216.

Hu, A., & Qian, Z. (2015). Educational homogamy and earnings inequality of married couples: Urban China, 1988–2007. Research in Social Stratification and Mobility, 40, 1-15.

Imai, K. S., & Sato, T. (2013). Recent Changes in Micro-Level Determinants of Fertility in India: Evidence from National Family Health Survey Data. Oxford Development Studies, 42(1), 65–85.

International Institute for Population Sciences - IIPS/India and ICF. 2022. India National Family Health Survey NFHS-5 2019-21. Mumbai, India. Available at https://www.dhsprogram.com/pubs/pdf/FR375/FR375.pdf

Lin, Z., Desai, S., & Chen, F. (2020). The emergence of educational hypogamy in India. Demography, 57(4), 1215-1240.

Lutz, W., & Samir, K. C. (2011). Global Human Capital: Integrating Education and Population. Journal of Mental Economics, Science, 333, 587-592.

Singley, S. G., & Hynes, K. (2005). Transitions to parenthood: Work-family policies, gender, and the couple context. Gender & Society, 19(3), 376-397.