The Causal Impact of College Expansion on Marriage and Fertility

: A Quasi-Experimental Analysis of the South Korean Experience

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Abstract

I examine how educational expansion affects fertility, using data from South Korea, where the college system expanded dramatically and the fertility rate dropped rapidly during 1990s and 2000s. I utilize the college expansion policy as a quasi-experiment in the difference-in-difference model to estimate the changes in fertility for groups defined by their responsiveness to the policy based on propensities for college: those who were drawn into higher education through the expansion (compliers) and those whose college-going decisions are not affected by the expansion because, in any case, they either attend (always-takers) or do not (never-takers). The results show that the effect of college expansion among compliers was modest and mostly due to their delay of leaving education. The declines in marriage and childbirth are most striking among always-takers. The main driving force is fertility-related value changes among traditionally college-educated women. Their decoupling between marriage and fertility is also a contributor.

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Research Question

The relationship between education and fertility has been a central topic among demographers. Research on how expanding education contributes to lowered fertility has been relatively less addressed. Even in the body of studies on educational expansion and fertility, researchers have paid most attention to the contexts of expanding primary or secondary education, especially among less developed societies. The relationship between higher education and low fertility in developed societies has been understudied. There are several studies exploring how educational expansion contributed to fertility outcomes among the advanced countries (Blossfeld and Huinink 1991; Neels et al. 2014; Neels and Wachter 2010; Ní Bhrolcháin and Beaujouan 2012; Rindfuss, Morgan, and Offutt 1996), and theoretical explanations supporting the causal effect of educational expansion on a decline in fertility have been developed (Mills et al. 2011). However, empirical evidence is slim and often inconclusive. More importantly, studies taking a counterfactual framework in order to address the causal inference have been rare.

In this study, I contribute to the literature by estimating the causal effect of an expansion policy of higher education on marriage and fertility, using data from the Korean Longitudinal Survey of Women and Families (KLoWF). The South Korean case is relevant for exploring this question, given its dramatic expansion of higher education and its rapid decline in fertility during 1990s; the college enrollment rate jumped from around 30 percent in the early 1990s to higher than 75 percent in early 2000s, while total fertility rate dropped from about 1.7 to 1.2 during the same period of time. In this paper, my primary focus is on those who were drawn into higher education through the policy change (compliers), because educational expansion affects only a group of the population. Without identifying the effect for this group relative to other control groups – those whose college-going decisions are not changed in spite of the policy change, because they either attend college anyway (always-takers) or do not attend college in any case (never-takers), we are not sure whether the correlation between women's increasing participation in higher education and lowered fertility is due to the expansion policy or due to a change in the influence of education on fertility outcomes.

How College Expansion Affects Marriage and Fertility

It is a well-established idea that more education delays fertility (Mills et al. 2011). There are largely three possible causal mechanisms explaining this correlation. First, more education makes women stay longer in school and, therefore, postpones the timing of their joining the labor force and the marriage market. This tempo effect is considered as responsible for the postponement of the first childbirth (Blossfeld and Huinink 1991). Second, more education increases women's human capital and, consequently, increases the likelihood of pursuing occupational career with higher market rewards. This increases the opportunity costs of family formation including childbearing and lowers fertility (Becker 1991; Blossfeld and Huinink 1991). Third, education induces value changes. More educated women are less likely than less educated women to be attached to the ideas valuing family and traditional gender roles. More education enhances more individualistic attitudes toward their life and career. This dampens the incentive to marry and have children, especially during their early adulthood (Lesthaeghe and Meekers 1987; Liefbroer 2005; Mills et al. 2011). The negative correlation between education and fertility might be the product of the combination of these three mechanisms.

Unlike the negative association at the individual level, educational expansion has another dimension to be considered with regard to its effect on the fertility decline. The effect of educational expansion can be disentangled into two components. First, the increased quantity of education due to the expansion can contribute to the change in fertility. Only compliers undergo this *quantity effect* because they are the group who experience the upgrade of education by definition. Second, during the period of educational expansion, the economic and non-economic value of education in the labor market and in the marriage market can change. This change may be induced by the social, economic factors working differentially across educational gradient, which have nothing to do with educational expansion. For example, skill-biased technological changes in the labor market favoring the more educated can shift demand for higher education and, consequently, raise the opportunity costs of highly educated women in their fertility decision. Certain cultural or attitudinal changes trigged by social changes other than educational expansion also can shift the preference for family formation among highly educated women more than among less educated counterparts. I call this *price effect*. The price effect affects both compliers and always-takers.

The tempo effect is only for compliers because it can only be included in the quantity effect of educational expansion. The effect of opportunity costs can be affected both by the changing quantity of education and by the changing price of education, because opportunity costs are responsive to both supply of and demand for the educated labor in the market. The value effect also can be driven both by the increased quantity of education and by its effect on women's values, norms and attitudes. Table 1 elaborates on how these mechanisms explaining the correlation between education and fertility are understood in the context of educational expansion. In the empirical analysis, I address how these mechanisms contribute to the changes in marriage and fertility.

Table 1 about here

Data and Method

I use data from the Korean Longitudinal Survey of Women and Family (KLoWF), which provides a nationally representative sample of South Korean women. I construct the sample from two seven-year wide cohorts, which represent those who graduated from high school and became eligible to go to college before the college expansion (born between 1965 and 1971) and after the expansion (born between 1976 and 1982). The pre-expansion cohort completed high school between 1984 and 1990. The post-expansion cohort completed high school between 1995 and 2001. The final sample size is 3,219 (1,932 for pre-expansion and 1,287 for post-expansion).

The centerpiece of this paper is my novel approach to identify never-takers, compliers, and always-takers from the sample. Since these three groups only can be defined counterfactually, the observed data suffers from the traditional problem of missing observations; we can observe only one between the pre-expansion college decision and the post-expansion college decision. To solve this problem, I invoke two assumptions. First, I assume a monotonic college expansion; no one changes her decision from college attendance to non-college attendance during the expansion. This is a standard assumption in research examining this type of topic (Imbens and Angrist 1994). Under this monotonicity assumption, all the college graduates in the pre-expansion period are assumed to be also college graduates in the post-expansion period (always-takers), and, in the similar manner, all the non-college graduates in the post-expansion years are assumed to be non-college graduates in the pre-expansion period (never-takers). Second, I assume the ignorability, which states that college-going can be perfectly predicted by the observed covariates, in order to get counterfactual college decisions for those who were non-college graduates in the pre-expansion period and who were college graduates in the post-expansion period. The former is the combination of never-takers and compliers and the latter is the combination of compliers and always-takers. Relying on this assumption, I estimate the propensity scores for college education for the pre- and the post-cohort respectively and predict their counterfactual propensity scores using the estimated function of the other cohort. Then, I simulate the counterfactual college outcome by randomly drawing a binary variable (0 or 1) using the estimated counterfactual propensity score as a Bernoulli parameter. This procedure of simulation is analogous to the multiple imputation methods. From the resulting actual and counterfactual college outcomes, I classify three groups: never-takers (0, 0), compliers (0, 1) and always-takers (1, 1). Table 2 summarizes this procedure.

Table 2 about here

I estimate the pre-post difference in the fertility outcome across these three groups using the difference-in-differences model. Since the procedure involves simulation of random drawing, I repeated the entire steps many times (e.g., 500 times) and averaged the estimated coefficients and standard errors as done in the procedure of multiple imputation. The difference-in-differences model is expressed as follows:

$$y_i = \alpha + \beta_1 t_i^{CP} + \beta_2 t_i^{AT} + \theta T_i + \delta_1 \left(t_i^{CP} \cdot T_i\right) + \delta_2 \left(t_i^{AT} \cdot T_i\right) + \beta' X_i + \varepsilon_i$$

where t_i^{CP} and t_i^{AT} represent compliers and always-takers respectively, T denotes the post-expansion period (or cohort), and X is a vector of control variables that are likely to affect fertility outcomes between the pre- and post-expansion cohorts differentially for reasons other than the college expansion. β_1 and β_2 show the pre-expansion levels of a fertility outcome among compliers and always-takers relative to the reference group, never-takers, and θ captures the change in the fertility outcome for never-takers during the period of college expansion.

For the college decisions, I consider two variables: whether or not to attend any college, including both 2-year and 4-year institutions, and whether or not to attend 4-year college. To predict college attendance, I include several precollege covariates that are commonly used in the literature such as parental education, parental occupation at age 15, self-reported economic situation at age 15, family structure at age 15, number of siblings, urban/rural residence at age 15, high school track, and birth year dummies.

For the fertility outcomes, I examine two binary variables: ever married by age 30 and ever delivered a child by age 30. Limiting age range to 30 is due to data availability; youngest women in the post-expansion cohort became age 30 in the most recent wave (2012) of the KLoWF data. I use the linear probability model (LPM) for the difference-in-difference analysis instead of more conventional nonlinear probability models (e.g., logit, probit) because the LPM yields more straightforward estimates of probability and especially estimates that are directly comparable across nested models. I design the models by adding additional mediating variables capturing the mechanisms of the tempo effect and the opportunity costs effect and consider how the key estimates of our interest changes. Table 3 shows the summary statistics of the variables of college and fertility.

Table 3 about here

Results

The likelihood of first marriage by age 30

Table 4 shows the result from the difference-in-differences model predicting the likelihood of first marriage by age 30. As Model 1 shows, the probability of experiencing marriage by age 30 dropped for all educational groups significantly (17 to 19 percent points). Compliers underwent an additional decline in marriage by 9 (any college) to 12 percent points (4-year college), but their estimates are only marginally significant at the .1 level. Surprisingly, the group that experienced the marriage decline with most magnitude and certainty is always-takers, whose decline amounts to 12 percent points and is statistically significant.

Table 4 about here

Model 2 shows the estimates after controlling for the years of postsecondary schooling after age 18. This means that the prolonged period of higher education among compliers are accounted for. Since always-takers do not have any additional schooling, we expect that their estimates are unchanged. The resulting estimates show that most of the modest decline in marriage among compliers are due to the tempo effect. The decline in the probability dropped sharply from 9 to 2 percent points (any college) or from 12 to 8 percent points (4-year college). Neither of them reaches statistical significance. As expected, there is little change in the estimated decline among always-takers.

In Model 3, the indicators measuring the characteristics of respondents' first job, such as occupation and whether the job is regular or contingent, are included. I expect that these job characteristics capture women's labor market status, which can be a proxy to the magnitude of the opportunity costs of marriage. When these measures are controlled for, there are only slight changes in the estimated coefficients among compliers and always-takers. This suggests that, on the one hand, growing opportunity costs induced by their upgraded labor market status of compliers contributed to a declining likelihood of marriage at early ages of adulthood only minimally, and, on the other hand, there is little change in the opportunity costs of marriage that are induced by the changing price of skilled labor.[1]

What remains unexplained – a significant decline in marriage among always-takers as large as about 10 percent points, then, can be considered attributable to value changes. This effect of value change does not apply to compliers, implying that the upgraded higher education for compliers did not change their family-related values. The value change occurred only to always-takers because of social changes other than college expansion. One possible source of this value change particularly among always-takers is the increasing relative cost of marriage for families from traditionally educated class or middle class families. South Korea underwent the financial crisis in the late 1990s with the economic recession followed for years. Given the fact that a parental subsidiary support has been a major financial source for new married couples' housing in South Korea, the growing economic insecurity of middle class after the crisis and ever rising housing costs increased the relative cost of marriage for many middle class families. I speculate that this economic condition, combined with the persistent standard of the expected quality of marriage, induced a change in the norm about the marriage timing, especially for middle class families.

The likelihood of first childbirth by age 30

[1] Note that I do not measure directly the economic rewards (e.g., wages, earnings) of the respondent's first job due to data unavailability in the KLoWF. The effects of opportunity costs may not be captured fully because of this omission. There might be another concern that the information about the first job may not be a perfect measure for women's potential economic status. I will address these concerns in a later version of this study.

Table 5 shows the result from the difference-in-differences model predicting the likelihood of first childbirth by age 30. The resulting pattern is largely consistent with the pattern found in the result from the marriage analysis, shown in Table 4. The declines in the probability, however, are more pronounced. Model 1 shows that the probability of childbirth dropped by 36 to 39 percent points (never-takers), 48 to 52 percent points (compliers), 55 to 58 percent points (always-takers). The additional decline in probability of childbirth among compliers is statistically significant (for the compliers of 4-year college expansion, only marginally), showing that about a 13 percent point decrease in the rate of childbirth is attributable to the expansion of college education. More dramatic decline among always-takers (19 percent points), however, suggests that the college expansion is not the primary factor driving the decline in the rate of childbirth.

Table 5 about here

Model 2 reports the estimated probabilities after the differences in the years of education away are explained away. Again, the decline among compliers relative to never-takers reduces down to 5 to 7 percent points and falls short of statistical significance. Not surprisingly, the estimates of always-takers are largely unchanged. Like the rate of marriage, the effect of college expansion on the rate of childbirth is primarily through the mechanism of the tempo effect.

As in the marriage analysis, Model 3 shows a limited role of opportunity costs among new and existing college-educated women in the decline in childbirth. That is, the increased human capital and the changing price of skilled labor did not contribute to the fertility decline, at least by age 30. In Model 4, I additionally control for the other outcome, whether ever married by age 30, in order to see how much of the decline in childbirth and the roles of mediating factors is through the decline in marriage and how large part is left independent of marriage. The decoupling between marriage and childbearing among the more educated couples has been an important source of the educational gap in fertility (Brand and Davis 2011). The resulting changes, mostly decreases, in the estimated coefficients suggest that the decline in childbirth is largely due to the declining rate of marriage. In most cases, the declining marriage explains more than 50 percent of the decline in childbirth. However, a substantial amount of the decrease in childbirth among always-takers, about a 9 to 10 percent point decrease, is a delay or a decline among married women, regardless of late entry into or reduction in marriage.

This finding requires an extra explanation of a fertility-related value change among high-SES women (always-takers) that happened during the period of college expansion but had nothing to do with the expansion. A possible explanation is the rising perceived cost of childrearing and education among women with traditionally college-educated or middle class backgrounds. South Korea is notorious for a very high level of prevalence in private tutoring even from a very early stage of childhood and a highly competitive educational environment. Given these conditions, the expected standard for the quality of childcare and education was steadily rising or persistent particularly among middle class families. On the other hand, the childcare system in South Korea is largely privatized and the low-cost public childcare facilities are either insufficient in quantity or unsatisfactory in quality for many of middle class parents. Moreover, as mentioned earlier, the economic security of middle class was undercut by the economic crisis and the subsequent recession. Considering all of these institutional and structural conditions and the gap between expectation and those conditions, one of major coping strategies among middle class married couples (or always-takers) might be to postpone their childbirth or even to keep childless permanently. The result suggests that this kind of change in strategy shifts their value or attitude about fertility and is responsible for the decline of childbirth by about 9 to 10 percent points.

Robustness: Unobserved Heterogeneity and Other Alternative Explanations

There are two major alternative mechanisms explaining the educational differentials in the fertility decline. On the one hand, there is always a concern about unobserved heterogeneity. This is especially true for this study considering that my method relies on the assumption of ignorability in the process of simulations. Some confounders affecting both education and fertility behaviors could be omitted. This omission suggests that at least part of the correlation between education and fertility is driven by unobserved ability and motivation influencing both educational attainment and fertility behaviors. In my study, a notable concern with regard to this omitted variable bias is that we do not include a measure capturing respondent's ability. In a later version of this paper, I will address this concern using a simulation-based robustness analysis, in which I take advantage of external information about how an ability measure is correlated with college attendance and with marriage and fertility outcomes.

Another possible explanation that my analysis does take into consideration is that the decisions of marriage and fertility are made in the consideration of spouse's economic status. This mechanism may be an important contributor especially given the increasing trend of educational homogamy (Park and Smits 2005; Schwartz and Mare 2005). The couple perspective on this issue is not considered in the current version of my analysis. Since the information of husband's education and partial occupational career is available from the KLoWF data, I will address this alternative possibility in my main analysis.

Concluding Remarks

The major contribution of this paper is its new attempt to estimate the effect of college expansion on fertility by disentangling the group of women who are drawn into college education due to the expansion (compliers) and other control groups (always-takers and never-takers). The major findings can be summarized as threefold. First, the effect of college expansion on the rates of marriage and childbirth among compliers is relatively modest and mostly due to their delayed timing of leaving education rather than increased opportunity costs or value and attitude changes. Second, the observed declines in marriage and childbirth are manifest most and significantly among always-takers. The main driving force is value changes that make women who belong to traditionally educated class postpone or avoid marriage and fertility. Lastly, the decoupling between marriage and fertility among the traditionally college-educated is also responsible for the fertility decline.

An implication of this study is that it addresses the issue of the heterogeneous effect of education on fertility outcomes. The finding that the decline in fertility is more striking among the group of always-takers suggests that the effect of education might reflect a positive self-selection. In other words, those who expect more benefits from college education are more likely to go to college. This pattern is consistent with the theory of comparative advantage (Willis and Rosen 1979). A recent study addressing this issue using the US data, however, reports an opposite direction of effect heterogeneity (Brand and Davis 2011). I believe that this study also contributes to this debate as well.

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Table 1: The Mechanisms Explaining Educational Expansion and Fertility

	Quantity effect	Price effect
Compliers	o Tempo effect (e.g., prolonged years of education) o Increasing opportunity costs (e.g., due to the upgraded education) o Value effect (e.g., have less family-attached, more individualistic attitudes obtained in college)	o Changing opportunity costs (e.g., rising skill price; lowering skill price due to a large influx of compliers) o Value effect (e.g., weakened family values, strengthened individualism among college graduates due to class-sensitive norm changes)
Always-takers		o Changing opportunity costs (e.g., rising skill price; lowering skill price due to a large influx of compliers) o Value effect (e.g., weakened family values, strengthened individualism among college graduates due to class-sensitive norm changes)

Table 2: Identification of Never-takers, Compliers, and Always-takers

	Pre-expansion Cohort			Post-expansion cohort		
	Pre-expansion decision (actual)		Post-expansion decision (counterfactual)	Pre-expansion decision (counterfactual)		Post-expansion decision (actual)
Never-takers (NT)	0		0	0	monotonicity	0
Compliers (CP)		simulation (ignorability)	1	0		1
Always-takers (AT)	1	monotonicity	1	1	simulation (ignorability)	

Table 3: The Summary Statistics of Treatment and Outcome Variables

	Pre-expansion cohort (1965-1971)	Post-expansion cohort (1976-1982)
College education:		
no college	58.7 %	34.1 %
junior (2-year) college	11.2 %	25.2 %
4-year college	30.1 %	40.7 %
Experienced marriage by age 30	89.8 %	82.2 %
Experienced childbirth by age 30	82.8 %	51.8 %
Sample size	1,932	1,287

Note: The sampling weight provided by KLoWF is applied.

Table 4: The Difference-in-Differences Estimates of the Rate of First Marriage by Age 30

	Model 1		Model 2		Model 3	
	Any college	4-yr college	Any college	4-yr college	Any college	4-yr college
Compliers (vs. never-takers)	-.007 (.031)	-.008 (.028)	-.003 (.031)	-.004 (.029)	-.006 (.033)	-.006 (.030)
Always-Takers (vs. never-takers)	.005 (.029)	-.017 (.029)	.073 (.035)*	.029 (.034)	.058 (.038)	.004 (.036)
Post-expansion (vs. pre-expansion)	-.172 (.068)*	-.188 (.067)**	-.153 (.071)*	-.166 (.069)*	-.122 (.074)†	-.138 (.072)†
Post-expansion x compliers	-.089 (.052)†	-.123 (.067)†	-.019 (.055)	-.076 (.071)	-.026 (.058)	-.104 (.075)
Post-expansion x always-takers	-.117 (.042)**	-.122 (.047)*	-.110 (.042)**	-.122 (.048)*	-.103 (.045)*	-.102 (.051)*
Mediating variables			o years of postsecondary schooling since 18		o years of postsecondary schooling since 18 o characteristics of the first job (occupation and job security)	
N	3,183		3,183		3,183	

Note: All the models include the covariates of family backgrounds to control for the likely influence of the different distributions of family covariates between pre and post expansion cohorts. Their coefficients are omitted; the estimates result from 500 times of simulations; ***: <.001, **: <.01, *: <.05, †: <.1.

Table 5: The Difference-in-Differences Estimates of the Rate of First Childbirth by Age 30

	Model 1		Model 2		Model 3		Model 4	
	Any col	4-yr col	Any col	4-yr col	Any col	4-yr col	Any col	4-yr col
Compliers	.002	.011	.004	.013	-.006	.008	.001	.015
(vs. never-takers)	(.039)	(.037)	(.040)	(.037)	(.041)	(.039)	(.030)	(.029)
Always-Takers	.040	.028	.110*	.090*	.102*	.097*	.053	.083*
(vs. never-takers)	(.036)	(.037)	(.043)	(.042)	(.047)	(.045)	(.036)	(.034)
Post-expansion	-.355***	-.386***	-.341***	-.359***	-.328***	-.347***	-.090†	-.094†
(vs. pre-expansion)	(.061)	(.058)	(.065)	(.063)	(.070)	(.068)	(.052)	(.052)
Post-expansion	-.127*	-.131†	-.050	-.074	-.050	-.065	-.027	.003
x compliers	(.060)	(.069)	(.064)	(.074)	(.068)	(.078)	(.052)	(.064)
Post-expansion	-.191***	-.194***	-.178***	-.197***	-.184***	-.193***	-.093*	-.097*
x always-takers	(.048)	(.048)	(.049)	(.050)	(.051)	(.053)	(.042)	(.046)
Mediating variables			o years of postsecondary schooling since 18		o years of postsecondary schooling since 18 o characteristics of the first job (occupation and job security)		o years of postsecondary schooling since 18 o characteristics of the first job (occupation and job security) o ever married by age 30	
N	3,183		3,183		3,183		3,183	

Note: All the models include the covariates of family backgrounds to control for the likely influence of the different distributions of family covariates between pre and post expansion cohorts. Their coefficients are omitted; the estimates result from 500 times of simulations; ***: <.001, **: <.01, *: <.05, †: <.1.