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ABSTRACT

'Bachelors' and Babies: The Effect of Tertiary Education Expansion on Fertility

We draw attention to two identification issues with previous studies that utilized tertiary education expansion to estimate the causal effect of education on fertility: (i) the mis-categorization of women past the usual college-entry age as "unexposed" to the expansion, and (ii) a possible violation of the exclusion restriction when using the expansion as an instrument for female education. We exploit the tertiary education expansion in Taiwan starting in 1996, with a novel focus on women past college-entry age, to document significant negative effects on the fertility of women as old as 30 at the onset of the expansion. We also show that the expansion lowered the fertility of women both with and without tertiary education, suggesting that the effect did not operate through education alone.

JEL Classification: I23, J13

Keywords: college expansion, marriage market, fertility, Taiwan

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1 Introduction

With the rapid decline in fertility coinciding with the global massification of higher education, researchers have become increasingly interested in the relationship between tertiary education and fertility (Figure 1).[1] Currie and Moretti (2003) use the expansion in the number of two-year and four-year colleges in the United States between 1940 and 1996 to document a plausible causal negative effect of the education of women on fertility. Tequame and Tirivayi (2015) show that women with tertiary education in Ethiopia were 25% less likely to ever give birth than those without. Choi (2018) argues that the expansion of tertiary education had a negative effect on the fertility of college-educated women in South Korea. James and Vujić (2019) show that post-compulsory education expansion in England and Wales delayed childbearing because of a combination of human capital and signalling effects. Kamhöfer and Westphal (2019) use the increase in the number of colleges in Germany between the 1960s and the 1980s to show that while college education reduced the likelihood of becoming a mother, college-educated mothers had more children than mothers without a college education. They claim that the family-friendliness of jobs for graduate women was an important driver. Kountouris (2020) finds that an increase in the supply of higher education and a concurrent schooling reform in Greece jointly had a large negative effect on fertility by age 30, driven by the increasing opportunity cost of children.[2] Table 1 lists these studies with the samples and methods they use as well as the outcomes they examine.

In this article, we draw attention to two identification issues of these previous studies that might bias the estimates they report. First, these studies typically use some exogenous variation in access to tertiary education around college-entry age, comparing college-aged cohorts with older cohorts, to instrument for tertiary educational attainment. For example, Currie and Moretti (2003) use the number of four-year and two-year colleges in a woman's county in her 17th year. Tequame and Tirivayi (2015) compare women aged

[1] Vollset et al. (2020), who predict that 183 out of the 195 countries in their data will have below-replacement total fertility rate by 2100, suggest the continued rise in female educational attainment and contraceptive use, which is partly influenced by education, could accelerate the global fertility decline further.

[2] In comparison to school education, returns to a tertiary degree are higher, increasing the opportunity cost of bearing children (Autor, 2014). University education may also decrease search costs and increase the quality of the spouse, speeding up or delaying marriage and fertility (Lavy and Zablotsky, 2015). Women in universities may be better able to process the knowledge about family planning and contraception they learn (Thomas et al., 1991). Since university education also overlaps with the major child-bearing years of a woman's life, it might also have a larger incapacitation effect: reduced time for child bearing and rearing (James and Vujić, 2019). Moreover, the sub-population most affected by compulsory schooling laws are typically women from low socioeconomic groups at the risk of dropping out, while women most affected by the expansion of tertiary education are likely to be better off. Therefore, predicting the effect of college education on fertility on the basis of the evidence on the effect of high school education on fertility is unwise.

18 to 19 at the time of tertiary education expansion in Ethiopia in 2000 to those aged 20 to 21. Choi (2018) examines the effect of the increased supply of tertiary education for South Korean high school graduates at age 19. James and Vujić (2019) examine the change in fertility of English and Welsh women exposed to the increased supply of tertiary education at age 18. Kamhöfer and Westphal (2019) study the change in the fertility of German women exposed to an increased supply of tertiary education institutions at age 19. Kountouris (2020) uses the tertiary education expansion in Greece that affected women at age 17. However, tertiary education institutions rarely have entry age limits. It is not uncommon for women of college-entry age to delay enrollment or for those past the college-entry age to return to college. As we describe below, women past the usual college-entry age may also be affected through channels other than a return to college. Categorizing older women who might still respond to such tertiary education expansions as unaffected individuals (control group) is likely to bias the estimates reported in these studies.

Second, the above-mentioned studies use the instrumental variable technique to estimate the effect of tertiary educational attainment of women on fertility.[3] Their instrument for tertiary educational attainment is a woman's exposure to the tertiary education expansion during the "college-age" years. The validity of the causal estimates depends crucially on the assumption that the expansion in tertiary education in these countries affected fertility through no other channels except tertiary educational attainment. The assumption is unlikely to hold for a variety of reasons. For example, tertiary education expansions, at least the ones considered in these studies, were not gender-specific. They affected men too. The expansions, as a result, are likely to have affected the marriage market for all marriage-age women, exposed or otherwise, changing the pool of potential husbands a woman chooses from, in terms of both quantity and quality. Men who went back for tertiary education might have been unavailable. While any changes in the fertility preference of women who went back to colleges as a result of the expansions is a pathway accounted for by the instrument variable approach, such expansions could have also affected the marriage and fertility preferences of exposed males. Since realized fertility is a function of the fertility preferences of both partners, women whose decisions to obtain tertiary education were unaffected by the expansion could have also changed their fertility if they matched with men with preferences different from those of the men they would have otherwise matched with in the absence of the expansion. Similarly, there might have been labor market effects. If a significant number of men and women went back to colleges because of the expansion, it could have

[3] Admittedly, this alleviates the bias in the reduced-form estimates.

affected the labor supply and wages for even those who did not go back to college. This could have changed the opportunity cost of bearing and rearing children, affecting realized fertility.

We elucidate these concerns with empirical evidence from Taiwan. We use a 1996 law that allowed junior colleges to upgrade to bachelor's granting institutions (BGIs) to examine the effect of the increase in tertiary education supply on fertility. The number of junior colleges that were eligible to apply for this upgrade differed across counties and years, allowing us to use a difference-in-differences strategy.[4] In Taiwan, the usual college entry age is 18. If we were to follow the method in the studies cited above, we would compare women who were 18 to 21 years old at the onset of the expansion with women who were 22 or older. Instead, we compare women aged 21 to 30 at the onset of the expansion with women aged 36 to 50 in regions with varying level of upgraded BGIs. We purposely examine the effect of the expansion on the fertility (and marriage) outcomes at ages 30 to 35. In contrast to the existing studies, since the control cohorts in our study were already past these ages in 1996, their outcomes cannot be affected by the expansion.

We show that the increase in BGIs positively affected the educational attainment of 21- to 30-year-old women. Exposed women were also less likely to be married or have children by ages 30 to 35. Four more BGIs, the sample average, in a county results in six fewer children by age 35 per 100 women. In other words, women who are usually considered to be unaffected by such expansions saw a large, significant reduction in fertility and marriages. The expansion had larger short-run effects on women aged 21 to 25 compared to women aged 26 to 30 in 1996. This is expected as younger women had a greater scope for intertemporal reallocation of fertility. Consistent with this, the effects on the fertility of women aged 21 to 25 and 26 to 30 in 1996 were comparable by the time they reached 35 years of age. The short-term decline in the fertility of younger women was, to some extent, compensated with increased fertility in later years. This observation indicates no guarantee that women closer to the usual college-entry age during the expansion will be affected more by such an expansion than women who are slightly older. We also show that the expansion had no effect on teenage fertility (ages 15 to 20), indicating that such tertiary education expansion might affect fertility through mechanisms other a than reduction in teenage fertility as a result of the "incapacitation" effect (Currie and Moretti, 2003; Black et al., 2008; Silles, 2011; Cygan-Rehm and

[4] As we explain in detail ahead, whether a junior college qualified to be upgraded depended on a host of pre-determined variables.

Maeder, 2013; Fort et al., 2016).

Next, to demonstrate the validity of our second concern, we show that the expansion had comparable effects on the fertility of women with and without bachelor's or higher degrees. This is direct evidence that the expansion affected fertility through channels others than educational attainment. Using such tertiary education expansions as instruments, therefore, might violate the exclusion restriction/unconfoundedness assumption biasing the estimates in previous studies. We show that women exposed to the expansion who did not get tertiary degrees were also less likely to be married by ages 30 to 35, suggesting that changes in the demand and supply factors in the marriage market could be one such alternative pathway through which the expansion affected fertility. It is therefore wise to approach the predictions and claims about the large negative effect of female education on fertility with a grain of salt (Vollset et al., 2020) and to reconsider our identification strategy when examining the question.

More broadly, we make some additional observations about the effect of the tertiary education expansion in Taiwan. The fertility effect we find is driven by changes at the extensive margin, i.e. the probability of having any child. This is not surprising since the total fertility rate in Taiwan was already below the replacement rate at the time. While the impact of the tertiary education expansion on fertility we find is consistent with findings from other countries, the effects for Taiwan operate mainly through a reduction in marriages and not teenage pregnancies or assortative mating. We also find significant heterogeneity in the effect of the BGI expansion. Public and older BGIs, which were more reputed and able to attract more students, have larger impacts than private and newer ones. A higher increase in BGIs closer to county administrative centres has a stronger effect than those farther away. The fact that the effect varies by the BGI characteristics adds further evidence that the estimates capture the causal effect of the expansion but not necessarily that of educational attainment.

The rest of this paper is organized as follows. Section 2 provides the institutional background and documents the fertility trend in Taiwan. Section 3 describes our data sources. We describe our identification strategy and the empirical model in Section 4 and report the results in Section 5. Section 6 concludes.

2 Institutional Background and Fertility Trends in Taiwan

2.1 Educational System in Taiwan

After completing nine years of compulsory education, students in Taiwan must choose a track if they wish to continue their education (Appendix Table A1). Students can go for three years of senior high school or five years of junior college after junior high. The first three years in a five-year junior college are equivalent to senior high school, and the last two years are equivalent to the first two years in a university. Five-year junior college tracks award students diplomas if they graduated before 2004 or associate bachelor (AB) degrees if they graduated afterwards. Regardless of the track chosen, students finishing compulsory education generally have to pass an entrance exam to advance to the next level of education.

Graduates from senior high can pursue bachelor's degrees by attending a university or an institute of technology, which typically takes four years.[5] If they attend a two-year junior college, they earn AB degrees (diplomas, if graduated before 2004), unless they continue on to a two-year track institute of technology, which award them bachelor's degrees at graduation. After bachelor's degrees, students can pursue higher degrees at the graduate school level. The major distinctions between junior college and other tertiary education institutions such as universities and institutes of technology are the academic degrees they award and the time required to complete the education. The AB degree (or a diploma if graduating before 2004), which takes only two more years after senior high, is one level below the bachelor's degree, which takes four years to complete. Even the five-year junior college track is equivalent to three years of senior high plus two years of junior college. Therefore, students typically earn their AB at age 20 and bachelor at age 22.

One salient feature of the higher education expansion in the mid-1990s is that a large number of junior colleges were upgraded to bachelor's degree-granting institutions (BGIs). The following subsection describes the tertiary expansion policy in more details.

2.2 The Higher Education Expansion Policy in 1996

Taiwan is a Confucian society that puts a high value on education. However, the establishment of higher education institutions had been strictly controlled by the government until the early 1990s (Lin and Lin,

[5] Some majors, like law and medicine, take longer.

2012). On April 10, 1994, thousands of parents, education advocates, and non governmental organizations took the street in the capital city, Taipei, demanding more universities to be set up. In response, the government introduced a new policy in 1996 that allowed junior colleges, mostly private institutions, to apply to be upgraded to BGIs if they met certain requirements.[6] Specifically, to be upgraded to a BGI, a junior college needed to meet various requirements around the number of staff, infrastructural facilities, number of buildings, and land size. The policy also required the junior college to have had outstanding records in the five years prior to their application, actively engaged in practical research, collaborated with the industry, and possessed sound management and administration. The Ministry of Education (MOE) was responsible for reviewing the applications. The review took place once a year and consisted of two stages. The first stage reviewed the paperwork, and the second stage involved an on-site visit and interviews.

A vast majority of junior colleges that existed before 1996 were upgraded to BGIs within a decade. As shown in Figure 2a, the number of junior colleges had remained stable until 1996, after which it plummeted sharply. Meanwhile, the slow upward trend of BGIs accelerated after 1996. Specifically, 70 junior colleges were upgraded to BGIs between 1996 and 2010, while another 15 new junior colleges were established over this period. The number of BGIs increased by 91 (from 66 to 157), of which 70 were upgraded from junior colleges and 21 were newly established.[7] Figure 3 shows the geographic distribution of the BGIs in 1995 and 2010. The increase in BGIs was along the western plains and, to a lesser extent, along the eastern coastal line. The area between the western plains and the eastern coastal line is the Central Mountain Range with few inhabitants. The major distinction between junior colleges and BGIs, as mentioned before, is that BGIs can confer bachelor's degrees or higher, but junior colleges cannot.

The share of population enrolled in BGIs increased significantly. Figure 2b shows the share of men and women of ages 17 to 22 who enrolled in BGIs increased from about 10% in 1995 to nearly 50% in 2010. Strikingly, there was also a substantial increase in students of more mature ages. The share of men aged 23 to 29 who were enrolled in BGIs increased from 4% to 9%, while the enrollment of women of the same age increased from 2% to nearly 7%. This indicates that the BGI expansion affected not only those of college-entry age but also those of more mature age. The composition of graduates from higher education

[6] BGIs include both universities or institutes of technology.

[7] Appendix Table A6 lists all BGIs in Taiwan.

institutions also changed accordingly, albeit with a predictable lag of the numbers of years required to complete the degree. As reported in Figure 2c, graduates with AB degrees dropped precipitously, while graduates with bachelor's degrees increased. Since BGIs also granted postgraduate degrees, we see a rise in master's and PhD degrees.

2.3 Fertility Trend in Taiwan

Taiwan was one of the first countries outside the OECD to experience a sharp and sustained decline in fertility (Schultz, 1997). This was a result of a combination of factors, including one of the first and immensely effective national family planning programs in the world (Hermalin et al., 1968; Freedman et al., 1972; Schultz, 1973, 1974) and rapid economic growth that increased female labor force participation and the opportunity cost of children (Lin and Yang, 2009). Figure 4 reports two fertility indicators, the crude birth rate (CBR) and the total fertility rate (TFR), from 1974 to 2018. The two indicators, by and large, move in tandem.

Fertility fell throughout the 1970s and the first half of the 1980s, before stabilizing for a decade. Noting that its objective of controlling the rapid increase in population was achieved, the government terminated the family planning program in 1990 (Lin and Yang, 2009). By this time, the TFR had already dropped below replacement level. After remaining stable for about a decade, the TFR started to drop again around the time when the higher education expansion started in 1996. By 2010, it had fallen below 1.[8] We examine the extent to which the 1996 education expansion policy contributed to this decline.

3 Data

3.1 Bachelor-Granting Institutions Data

We obtained the information on all higher education institutions, including AB-granting institutions (junior college) and BGIs (university or institute of technology), from the official registers of Taiwan's Ministry of Education. The registers provide detailed information about each institution, including their names, addresses, phone numbers, website addresses, and institution types. From each institution's website, we

[8]Both the CBR and the TFR are period fertility rates, while our estimations focus on the effect on the cohort fertility rate up to age 35. Unfortunately, official cohort fertility data are not available.

then found out whether and when it had been upgraded from an AB-granting institution to a BGI. This allows us to calculate the annual change in the number of BGIs in each county from 1996 to 2010.

3.2 Woman's Marriage, Fertility and Employment Survey

The fertility data comes from the Woman's Marriage, Fertility, and Employment Survey (WMFES), a supplementary survey to the Manpower Survey (MS), conducted by the Directorate-General of Budget, Accounting, and Statistics, Executive Yuan of Taiwan. The MS started in 1963 as a quarterly employment survey and has been conducted monthly since 1978. Each year, the MS draws a nationally representative sample, via a stratified two-stage sampling method, of the Taiwanese population aged 15 and older to produce official statistics such as unemployment and labor force participation rates. Started in 1979, the WMFES interviews all women in the MS sample. It was conducted every year in June alongside the MS until 1988 and in 1990, 1993, 2000, 2003, 2006, 2010, 2013, and 2016. In addition to the basic demographic information, the WMFES collects detailed information on the participants' fertility, such as the sex and the birth month and year of the first three children and the latest child. Based on the birth years of the mothers and their children, we calculate the age-specific fertility for each woman up to the point of the survey. A caveat is that fertility information is only available for women under 65.[9] The WMFES also allows us to link the respondents to their partners' information if the respondents are married and live with their partners in the same household.

Women eventually exposed to the expansion are relatively too young to be married and bearing children in waves before 2003. Further, a re-delimitation of administrative boundaries at the end of 2010 render the 2013 and 2016 waves incomparable with the previous waves. As a result, we use the 2003, 2006, and 2010 waves of the survey. These waves best fit the study period. We pool the three waves for our analysis. The two main age-specific fertility outcomes of interest are the probability that a woman had any children and the total number of children born to her by that age.[10] To understand the potential mechanisms through which the tertiary education expansion affected fertility, we also examine the educational attainment and marriage status of the women in the sample.

[9]The 1979-1983 survey waves do not contain information about the year of birth of a woman's children. Waves in 1984 to 1990 did not survey women aged 50 and above.

[10]Since the survey collects birth year information for the first three children and the last child born to women, we cannot construct retrospective age-specific fertility for women with more than four children. As a result, we exclude them from our sample. They form 3% of the 35,731 observations in the pooled sample.

Women born between 1966 and 1975, 21 to 30 years old in 1996, form the exposed group. These women were young enough to benefit from the BGI expansion that started in 1996. To verify that our findings are not sensitive to this definition of the exposed cohorts, we run robustness tests with different ages in 1996 as cut-offs. The control group consists of women born between 1946 and 1960, 36 to 50 years old in 1996. We compare the age-specific fertility and marriage outcomes at ages 30 to 35 for exposed and control groups in regions with differing levels of change in BGIs. The outcome for women aged 30 to 35 at the time the expansion started could still be partially affected by the expansion. To keep the comparison clear, we exclude these cohorts from the analysis.[11] Since the control group population is already past the age thresholds we measure the outcomes at, the control group mean is unaffected by the expansion. The Enrolment data from the MOE shows only 3% of college students were of ages 30 or older in 1995.

Table 2 summarizes the outcomes of interest. Overall, about 10% of the women in our sample have bachelor's or higher degrees: 17% in the exposed group and 6% in the control group. The average education gap between the women's education and their husbands' education, if they are married, is much smaller for the exposed cohorts. In terms of fertility, 93% of the women in the control cohorts and 78% of the women in the exposed cohorts had at least one child by age 35. On average, women in the control and exposed groups had 2.4 and 1.7 children by age 35, respectively. We observe a similar pattern for marital status. About 95% of the women in the control cohort had married by age 35, while only 84% of the women in the exposed cohort had done so.

4 Empirical Strategy

4.1 Identification

Our identification strategy uses the variation in the number of BGIs across counties and time generated by the 1996 expansion policy that allowed junior colleges to be upgraded to BGIs. The change in the number of BGIs through upgrades in different counties was driven neither by county fertility trends nor by the fertility decision of women residing in the counties. Women born in different years and living in different counties

[11]This is similar to Duflo (2001), who excludes from the analysis children partially exposed to the primary school construction program in Indonesia.

witnessed different levels of BGI expansion depending on the number of junior colleges in their counties that fulfilled the requirements for an upgrade. Their fertility outcomes would be affected down the road. Our identification strategy, therefore, is a difference-in-differences method that compares women young enough to benefit from the expansion with older women across counties with different levels of BGI expansion. The strategy is similar to the method used, for example, by Duflo (2001) to study the effect of primary school constructions in Indonesia and in numerous education studies since then.

We estimate the following equation:

$$M^a_{ijcy} = \beta^a_0 + \beta^a_1 \Delta BGI_{cy} \times Treat_j + \gamma^a_j + \delta^a_c + \delta^a_c \times time + wave^a_y + \varepsilon_{ijcy} \tag{1}$$

where M^a_{ijcy} is the fertility, marriage, or education outcome of a woman i born in year j in county c measured in survey wave y when she was a years of age. ΔBGI_{cy} is the change in the number of BGIs in county c between 1996 and year y. $Treat_j$ is an indicator variable that takes the value '1' for women born between 1966 and 1975, '0' otherwise. Birth cohort fixed effects, γ^a_j, capture time-invariant differences across women born in different years that could affect the outcomes of interest independently. County fixed effects, δ^a_c, account for time-invariant differences across counties. We also include county-specific linear time trends, $time_c$, to allow for differential trends in the outcomes in different counties. This is to capture the unobserved county-specific trend (e.g. economic growth) that could drive fertility and BGI expansion simultaneously. Survey wave fixed effects, $wave^a_y$, account for aggregate changes in the variables of interest across time. Note that the waves we use are not equally spaced in time. Throughout our analysis, unless otherwise noted, we report robust standard errors clustered at the county-cohort level. β^a_1 captures the effect of the BGI expansion. More specifically, the estimate coefficient measures the effect of one additional upgraded BGI on the outcomes for women exposed to the expansion relative to women not exposed after controlling for birth cohort, county, and survey wave fixed effects as well as county-specific linear time trends.

4.2 Trend Analysis

We begin by investigating the trend in the fertility of women in counties with different levels of $\Delta BGIs$. For visual clarity, we group the counties in Taiwan into two: high-$\Delta BGIs$ counties with higher than median ΔBGI, and the others as low-$\Delta BGIs$ counties. We pool waves from 1979 to 1988, 1990, 1993, 1996, 2000, 2003, 2006, and 2010 to maximize the time span.[12] Figure 5 reports the fertility trend for women in high- and low-$\Delta BGIs$ counties before and after the expansion.

For the trend figures, we first filter out any time-invariant county-level differences by regressing the outcome on a full set of county dummies. We then plot the average of residuals from the previous regression for the two groups for each year in Figure 5. Sub-figures 5a and 5b report the trends in women having any children by ages 30 and 35, respectively. For the figure, we limit our sample to women aged 30 to 50 because (i) the outcomes of interest are available for women 30 or older (ii) survey waves in before 1990 did not have fertility information for women aged 50 and older. The fertility of women in high- and low-$\Delta BGIs$ counties moved in tandem before 1996. If anything, the fertility of women in high-$\Delta BGIs$ counties was slightly higher than the fertility of women in low-$\Delta BGIs$ counties. The trends clearly diverged after 1996. The probability of having any child for high-$\Delta BGIs$ counties was significantly lower than in the low-$\Delta BGIs$ counties once the expansion started. The trends suggest the divergence in the outcomes is less likely to be driven by unobserved factors that are common across regions.

5 Results

5.1 Main Results

Table 3 reports the estimated impact of the expansion on the age-specific probability of having any children between ages 30 and 35. The estimates reported in Panel A suggest the BGI expansion was associated with a significantly lower probability of exposed women having any children by the relevant ages. The coefficient hovers around 0.009, implying that one more BGI in the county lowered a woman's probability of having any child by these ages by nearly one percentage points. Given that the sample average of $\Delta BGIs$ is about four, the expansion reduced the probability of having any children nearly four percentage points ($0.009 \times 4 = 0.036$). This translates to almost 4% fewer women having any children. As Appendix Table A2 shows, the estimated effect is not sensitive to the age cutoff we choose to define the exposed and control cohorts. The estimated effect on the probability of having any children by the younger ages of 26 to 30 are similar to the main estimates in Table 3 (see Appendix Table A4). The effect on the number of children,

[12] Recall, we only use waves 2003, 2006, and 2010 in our main analysis.

since many of them have still not started having children, is predictably muted. In comparison, the expansion did not affect teenage fertility, which was already quite low in Taiwan (Appendix Table A3).

The effect of the expansion is unlikely to be the same for all women exposed to it. Women exposed to the expansion in their late twenties faced a tougher trade-off than younger women who had more time to plan. Students in Taiwan typically start their tertiary education at 17 years of age. The probability that someone who did not start tertiary education at the end of high school will enrol for a tertiary degree later is likely to decline with age. Older women exposed to the expansion are less likely to have enrolled for a bachelor's degree as a result of the expansion than younger women exposed to the expansion. The average age of women at marriage in Taiwan around the time was 26 years. As a result, the possibility of adjusting the timing of marriage and fertility to accommodate tertiary education was also smaller for older women. To examine these dynamics, we divide the treatment group into two groups: those born between 1971 and 1975 (Treat 1, ages 21-25 in 1996) and those born between 1966 and1970 (Treat 2, ages 26-30 in 1996). The control group remains the same.

The results in Panel B confirm our conjecture. While the effect of the expansion on the probability of women having any children by the age of 30 is higher for the younger cohorts, the effect size fell considerably as they grew older. That is, younger women recovered from their fertility slump over time. In comparison, even though the effect of the expansion starts out as small for the older women, they do not recover from the decline in fertility the expansion generates.[13] The older and younger women who enrolled for tertiary degrees received the same kind of education. Any effect that education might have had on their fertility preference is likely to be comparable. The difference in the estimated effects suggests that a part of the effect of the expansion operated through tightening the time constraint for women rather than changing their preferences around fertility. Although most of these women are not past their reproductive ages, bearing the first child after 35 is extremely rare in Taiwan.[14] The impact of the expansion in tertiary education appears to have had a permanent effect on the fertility of the exposed women.

Note that women in both the younger and the older exposed cohorts are past the usual "college-entry

[13]Later, when we examine the mechanisms, we show that the smaller reduced-form effect of the expansion on older women is because a smaller number of them enrolled for a tertiary degree as a result of the program.

[14]Out of 29,193 women in our sample, only 374 had their first child after 35.

age" of 18 but there are strong effects on their fertility. This is not surprising. As mentioned before, tertiary education institutes rarely have any entry-age requirements. Although the effect of such an expansion is likely to be smaller for older women, it might still be substantial. Using these older cohorts as the control group, as done in most prior studies examining the impact of tertiary education on fertility, is likely to bias estimates.

From a methodological viewpoint, a graver problem is the possibility that educational attainment might not be the only channel through which such tertiary education expansions may affect women's fertility. As discussed before, the studies listed in Table 1 use tertiary education expansions as instruments for female educational attainment. The validity of their causal estimates of tertiary educational attainment on fertility depends crucially on the fulfilment of the exclusion restriction/unconfoundedness requirement. In other words, the tertiary education expansion should affect fertility only via tertiary educational attainment of women. To test whether the requirement is satisfied, we estimate the reduced-form effect of the BGI expansion in Taiwan on the fertility of women with and without tertiary education (Table 4). The estimates suggest the effect of expansion on the fertility of women who did not complete their degrees in response to the expansion (Panel B) was almost as large as for women who completed tertiary degrees (Panel A). If educational attainment had been the only channel through which the expansion affected fertility, this would have not been the case. The findings raise the possibility that tertiary education expansions as instruments for female educational attainment might not satisfy the exclusion restriction/unconfoundedness requirement in the studies listed in Table 1, biasing their reported estimates.

We also estimate the effect of the expansion on the number of total children at these ages. We report the results in Panels C and D of Table 3. The sample includes women with no children. In Panel C, the coefficients range from -0.0122 to -0.0145, implying that four more additional BGIs reduced the number of children by about 0.06 for an average woman or about six children per 100 women. Comparing these with the estimates in Panel A, it appears that most of the effect was at the extensive margin: the probability of having any child. The results in Panel D confirm the findings in Panel B. The effect started out larger for the younger cohorts (Treat 1) but declined as they aged. For the older cohorts, the negative impact of the expansion on the number of children increased with age.

Different BGIs varied in their student intake. An upgraded BGI with a higher enrolment is likely to have a larger impact in comparison to another BGI with a smaller capacity. Unfortunately, we do not have information on the exact capacity of the BGIs in each year. To consider the size effect, we replace $\Delta BGIs$ with the change in enrolment in the first year of undergraduate studies at the BGIs in each county since 1996. The results, reported in Appendix Table A5, are qualitatively consistent. However, since enrolment is jointly determined by both supply and demand for tertiary education, we prefer using $\Delta BGIs$ for our main analysis.

Finally, it is useful to benchmark our estimates against those reported in these previous studies. While the above-mentioned studies typically focus on local average treatment effect, many also report the reduced-form effects of the expansion. Unfortunately, since each expansion differs from others, the estimates are not directly comparable. Nonetheless, the comparison may still be useful in providing a sense of the likelihood of bias in the estimated coefficients. Compared to our estimates of a close to 1% decrease in fertility due to the expansion, Currie and Moretti (2003) report an 8 to 9% reduction in fertility caused by the expansion. Tequame and Tirivayi (2015) also find an 8% reduction in fertility as a result of the education expansion in Ethiopia. Choi (2018) reports an extraordinary 45% reduction in fertility caused by the college expansion in South Korea. Closest to our estimates are those reported by Kountouris (2020): a 2.2 percentage point decrease in fertility as a result of the education reforms in Greece.[15] The effect of the expansion in Taiwan may have been smaller because fertility was already below replacement, leaving little room for adjustment. However, as we discussed above, a bias in the estimated fertility effect of education in these studies is also a possibility.

5.2 Mechanisms

The expansion of BGIs could have affected women's fertility through education, marriage, or labor market participation and income. Next, we investigate the effect of the expansion on women's highest educational attainment, their marital status, and their husbands' highest educational attainment if they were married.

We do not have information on when the surveyed women completed their highest educational attain-

[15] Kamhöfer and Westphal (2019) do not report reduced-form estimates. James and Vujić (2019)'s outcomes are not comparable. They find exposure to the tertiary education expansion in England and Wales increased the probability of first birth aged 30 or above for exposed women by 13.3%.

ment. Since the youngest cohort in our sample was 28 years old or older at the time of the first survey wave, the women's highest educational attainment could still provide us with useful information on the mechanism through which expansion affected fertility. Panel A of Table 5 reports the estimated effects of the expansion on women's probability of completing a bachelor's (column (1)) and a master's degree or above (column (2)). Relative to the control group, four more BGIs increase the probability of having a bachelor's degree by about 1.2 percentage points (0.0033×4.2041). Considering that only 15% of the women in the sample have ever obtain a bachelor's degree, the effect of the BGI expansion on education was predictably substantial. It also increased the women's likelihood of obtaining a master's or a higher degree by about 0.7 percentage points (0.0017×4.2041). With only 3% of women ever obtaining a master's or higher degree, the BGI effect on postgraduate degrees was even greater. Panel B shows the expansion affected female education, and therefore fertility through this channel, only for women who were relatively young at the time of the expansion. For older women, there was no significant change in educational attainment as a result of the expansion. The results suggest that, as expected, the expansion affected women's propensity to get tertiary degrees, which is bound to have reduced the time available to bear and rear children. But this was true only for relatively younger women. For older women, the expansion affected fertility through channels other than educational attainment.

Another possibility is that women with higher degrees married men with similar or higher education. These men with higher education might have had a preference for lower fertility (James and Vujić, 2019). However, the results in Panel C and D show that the education levels of the husbands of exposed women were no different than the education levels of the husbands in the control group. This is true for both younger and older exposed women. Mechanisms related to the husbands' characteristics did not drive the fertility effect.

In terms of the marital outcome, the BGI expansion reduced marriages. Table 6 reports the estimated effect of the BGI expansion on the probability of being married by ages 30 to 35. The estimates in Panel A stay at about -0.007. This implies that four more BGIs lowered the probability of women getting married by these ages by nearly three percentage points (0.007×4.1687). Consistent with Table 4, in Panel C, we find exposed women without tertiary degrees were also significantly less likely to be married. In light of these findings, using tertiary education expansions as instruments for the tertiary educational attainment of women, as stated before, violates the exclusion restriction/unconfoundedness requirement. In each panel, we also report the heterogeneity in the effect for younger and older exposed women.

General equilibrium effects, such as the labor market changes resulting from a sudden increase in college enrollments, are potential mechanisms through which the expansion might have affected the marriage propensity of women without tertiary degrees. Labor market effects could have also affected fertility directly regardless of marital status by changing the opportunity cost of children. Unfortunately, we do not have information on the labor force participation of the exposed women. The information we use was collected at a time when many women might not have entered the labor market yet. Since labor market outcomes evolve continuously, our empirical model is unsuitable for examining employment outcomes.

5.3 Heterogeneity

BGIs differ in their attributes, and that affects their ability to attract students. It is possible that upgraded BGIs that did not have the same reputation, legacy, or accessibility as others affected fertility to a lower extent. We study three attributes of the upgraded BGIs: ownership, tenure, and travel time. We define ownership based on whether a BGI is a public or private institution. Tenure is the years since the establishment of the institution. All the institutions in our sample were established before 1996. Travel time is measured in terms of the time it takes to travel from a county administrative center to a BGI in a car under normal traffic conditions. We present the results in Table 7.

Public BGIs in Taiwan are generally better ranked than private ones. Older institutions are better known than relatively newer ones. We expect public and older BGIs would have had larger effects on fertility than private and newer ones. Panels A and B of Table 7 confirm this. The effect of an upgraded public BGI on fertility was one and a half to three times larger than that of a private BGI. This was despite the fact that the number of private BGIs was almost five times larger. We group the BGIs into new and old based on whether they have a tenure greater than the average tenure of upgraded BGIs in the sample. We find the effect of upgrading older BGIs was about three to six times larger that that of newer BGIs.

In principle, students from anywhere in Taiwan could have applied to any of the upgraded BGIs but potential students are likely to have factored in travel time when choosing BGIs. To investigate this possibility, we calculate the travel time by car from a county administrative center to each BGI. Then we group the BGIs into within or outside the half-hour zone. The BGIs outside each zone include all BGIs in Taiwan other than those inside the travel zone of each county administrative center. The zone may not perfectly overlap with the country. Panel C reports the effect of an extra upgraded BGI within the half-hour travel zone on fertility relative to BGIs outside the travel zone. A higher number of BGIs within a shorter travel distance tends to have larger effect than those farther away.

The fact that the heterogeneous effect of BGI expansion on fertility is in line with the expected heterogeneity of BGI expansion on enrolment and graduation further suggests that the decline in fertility was due to the tertiary education expansion. However, as we pointed out before, it might not all have been due to the increase in tertiary educational attainment of women.

6 Conclusion

The threat of depopulation in most advanced economies has experts rattled and governments seeking ways to boost fertility. Planning the right policy response to this crisis requires an understanding of the factors driving this decline in fertility. Previous studies from across multiple countries show that tertiary education of women have large negative effects on their fertility. Yet, we draw attention to two identification issues that may have biased the previous estimates.

First, we argue that treating women past the usual college-entry age as unexposed to the tertiary education expansions might be problematic. Unlike lower levels of education, tertiary education rarely has entry-age restrictions. Some women past the college-entry age might return to college in response to expansions in tertiary education. Similarly, some college-entry age women may choose to delay their college education. Second, large expansions in the tertiary education sector are likely to affect fertility of women through channels other than their increased enrollment in colleges. For example, such expansions may change the quality and quantity of potential partners in the marriage market. This, in turn, may affect the prospects of marriage and fertility for women. Therefore, using tertiary education expansions as an instrument for educational attainment possibly violates the exclusion restriction.

To illustrate these concerns, we study the case of Taiwan with a focus on women past the usual college-entry age. We find significant negative effects on the fertility of women as old as 30 at the onset of the expansion. In addition, we find that the expansion lowered the fertility of women both with and without tertiary education, suggesting that the effect did not operate through education alone. Taken together, our findings point out that the relationship between tertiary education expansion and fertility is more complicated than what it might appear to be at first glance. Future research is required to examine the potential biases in the results from previous studies because of the two identification issues.

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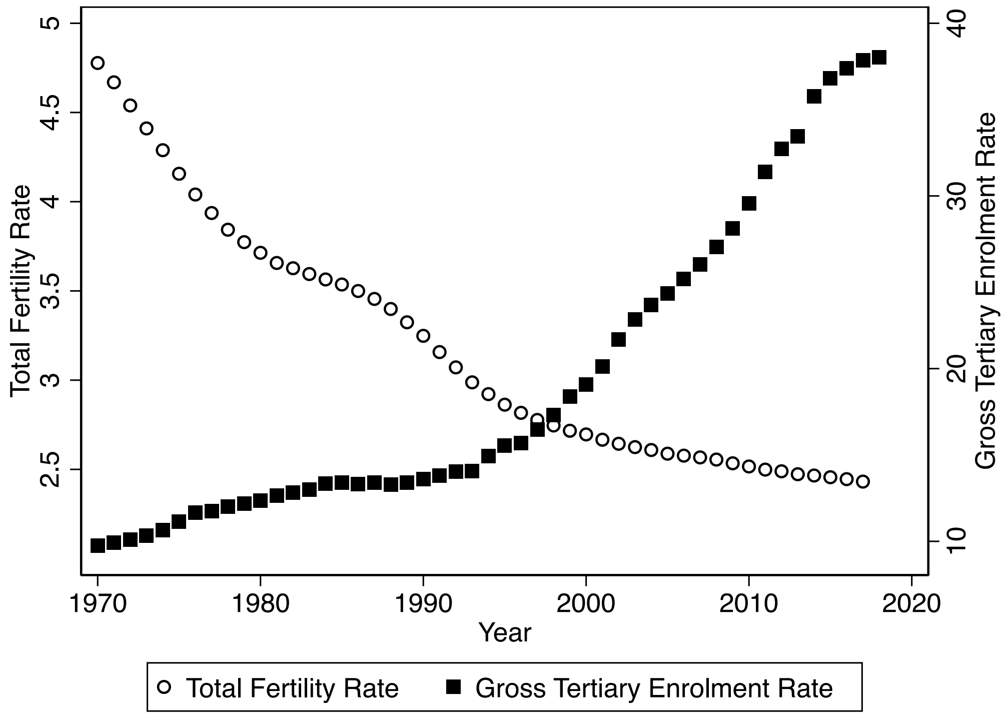
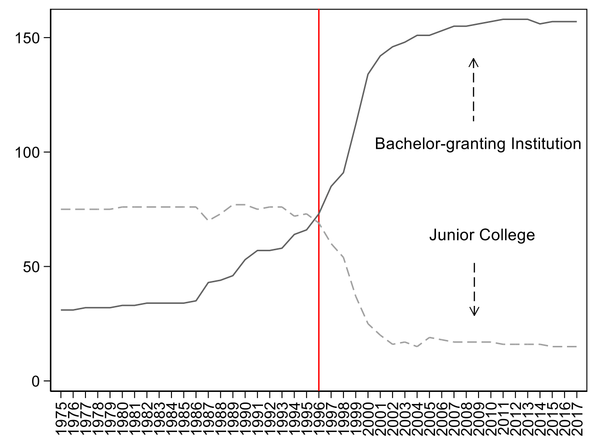
Figure 1: Worldwide total fertility rate and gross tertiary enrollment rate

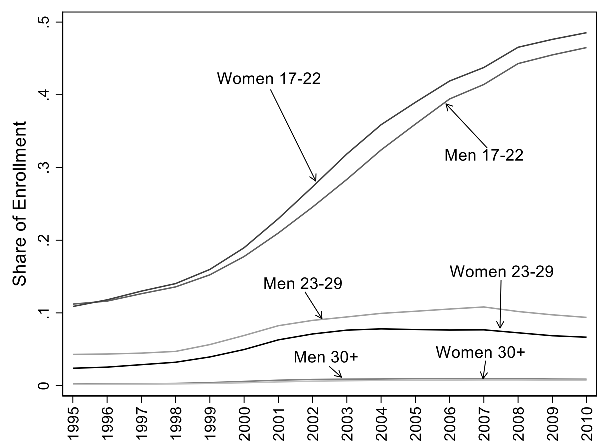


Source: World Development Indicators, 2019.

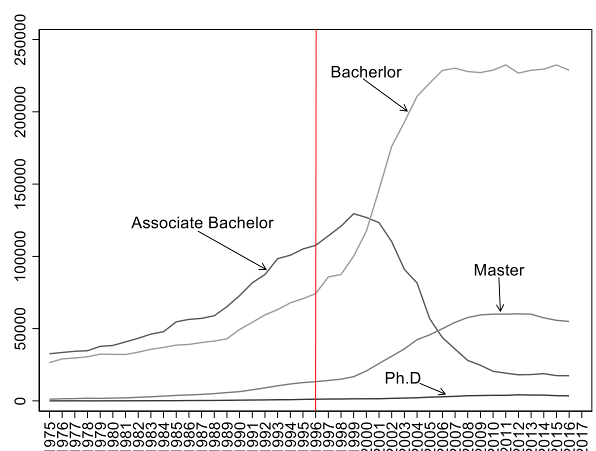
Figure 2: Trends in higher education in Taiwan.



(a) BGIs and Junior Colleges



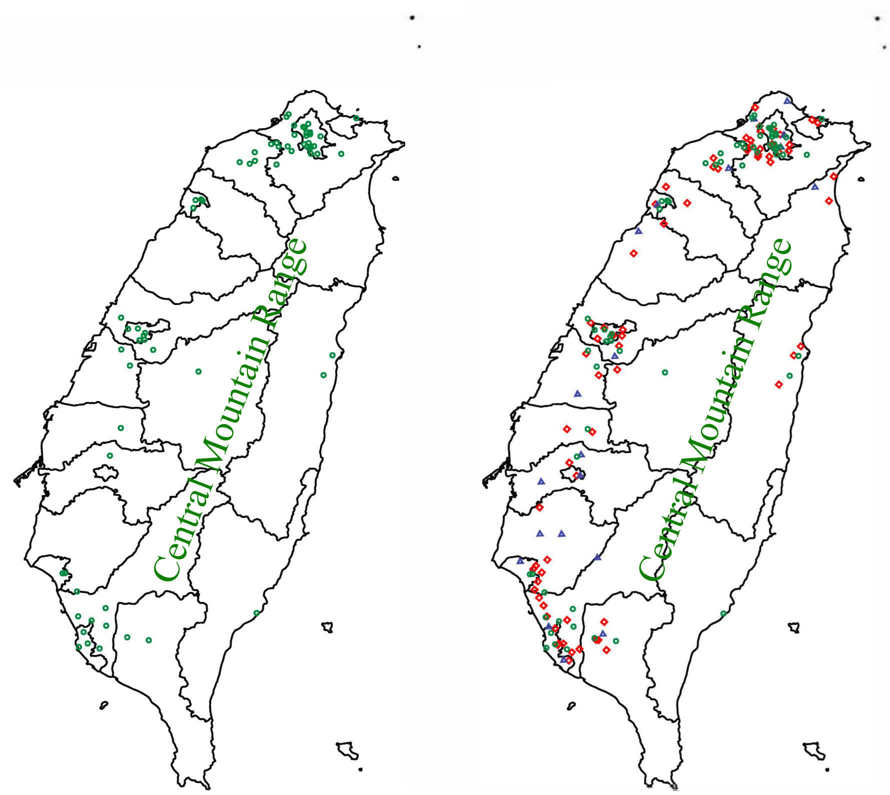
(b) BGI Enrollment Share by Age and Sex



(c) Graduates by Degrees

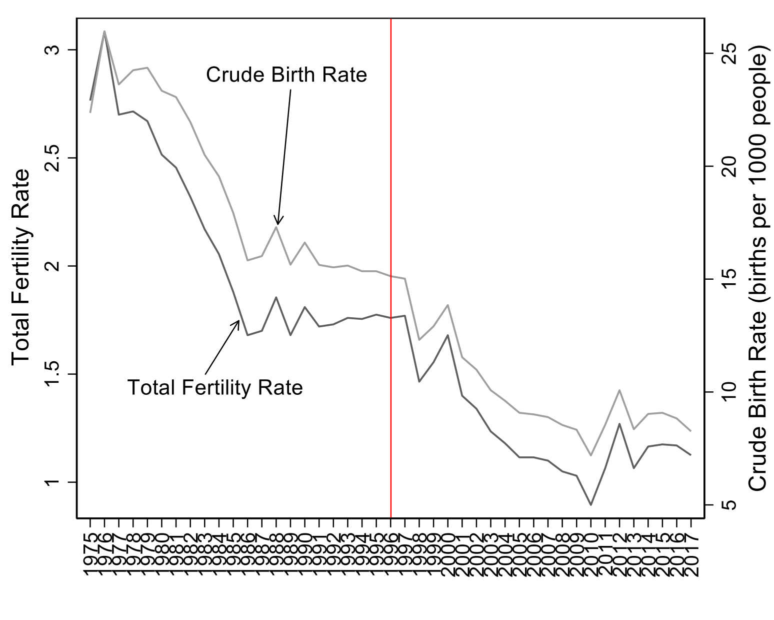
Sources: Higher education data from the Ministry of Education, Taiwan. Population data from the Department of Household Registration, Ministry of Interior, Taiwan.
Notes: Enrollment in Figure 2b includes both undergraduate and postgraduate students. The share is defined as the share of population in each age group enrolled in universities.

Figure 3: BGI distribution in 1995 versus 2010



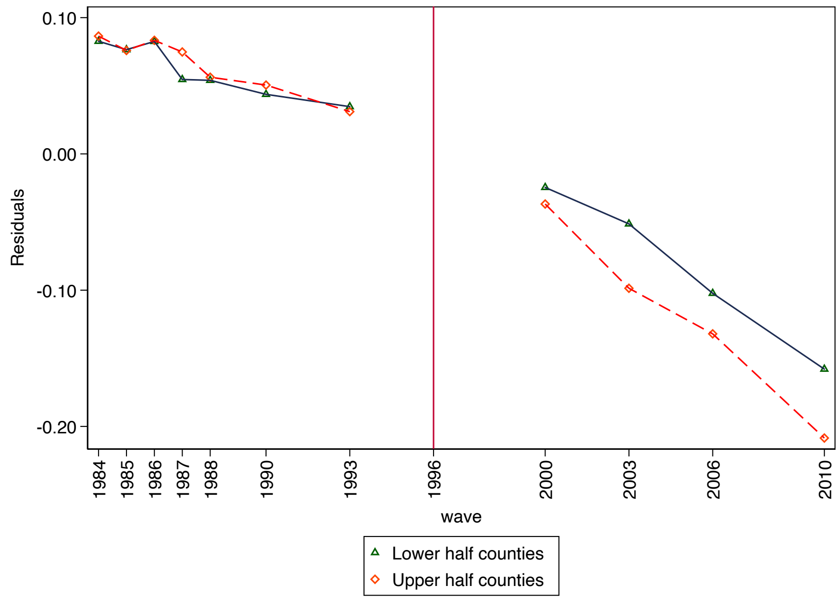
Sources: Authors' own mapping based on BGI data from the Ministry of Education.
Notes: The green circles indicate 66 BGIs that already existed in 1995 before the expansion. The red squares indicate 136 upgraded BGIs, and the blue triangles indicate 21 newly set-up BGIs. Institutions in two small islands, Penghu and Quemoy, are excluded.

Figure 4: Fertility trend in Taiwan.

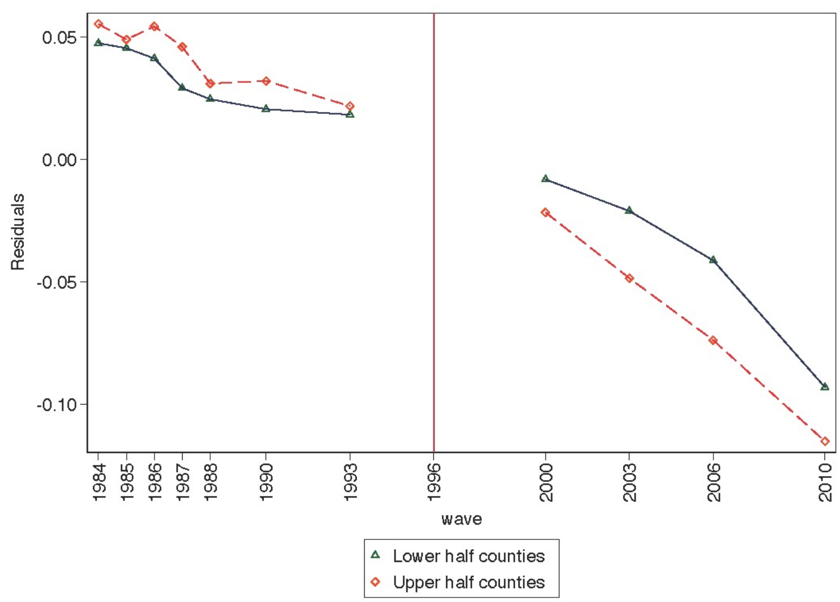


Source: Department of Household Registration, Ministry of Interior, Taiwan.

Figure 5: Pre-trends in fertility outcomes



(a) Any Children by Age 30



(b) Having Any Child by Age 35

Sources: Woman's Marriage, Fertility and Employment Survey 1979-1988, 1990, 1993, 2000, 2003, 2006, and 2010, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.
Notes: The outcome is a dummy variable indicating whether a woman had any child at ages 30 (Sub-figure 5a) and 35 (Sub-figure 5a). The sample consists of women aged 30-50 from surveys in 1979-1988, 1990, 1993, 1996, 2000, 2003, 2006, and 2010. The pooled sample is used to regress the outcome variables on a full set of county dummies and then predict the residuals from the regressions that filter out the county fixed effect. The next step calculates the average of the residuals for individual women in each survey year from high- and low-increase counties defined by changes in BGIs above or below the median change during 1996-2010.

Table 1: The Effect of Tertiary Education on Fertility

Study	Country	Method	Sample	Treatment	Age at treatment	Surveyed in	Outcomes	Conclusions	Mechanism
Currie and Moretti (2003)	US	2SLS	White mothers with first birth b/w ages 24-45	# of 2- and 4-year colleges in the county when women was 17	17	1970-1999	parity by age 45	IV effects: ↓parity by 10-12% Reduced-form: ↓ parity by 8-9%	NA
Tequame and Tirivayi (2015)	Ethiopia	RDD	Exposed: born 1981-1982 (aged 18-19 in 2000) Unexposed: born 1979-1980 (aged 20-21 in 2000)	Abrupt ↑ in supply in 2000	19	2005, 2011	parity, preferred # of children	IV: ↓ parity by 0.21(8%), ↓desired # by 0.43 (9%) Reduced-form: ↓ parity by 0.26 (8%), ↓ desired # by 0.55 (9%)	↑ assortative mating, postponed marriage and motherhood
Choi (2018)	South Korea	DID	Exposed: born 1976-1982 Unexposed: born 1965-1971	Expansion in the 1990's	19	2012	ever married, child by ages 30-36	↓ first marriage ↓ child by 45%	↑ returns from education
James and Vujić (2019)	England & Wales	2SLS	Exposed: born 1972-1979 (below 18) Unexposed: born 1962-1971	Expansion in the late 1980's to early 1990's	18	1975-2013	age at first pregnancy, teenage motherhood, delayed motherhood	IV: ↑ prob. of births after ages 24, 27, and 30 by5.3%, 9.4%, and 13.3%, respectively Reduced-form: ↑ prob. of a birth after ages 24 by 2.4 p.p for those born in 1975	Human capital effects, ↑ labor market opportunities
Kamhöfer and Westphal (2019)	Germany	2SLS	All cohorts born 1956-1986 excluding teenage pregnancies	Expansion during 1958-1990	19	2007-2015	any child, # children by age 40	IV: 0.3 ↓ children per woman with college degree, 25% ↓ prob. of children, College-educated had 0.268 ↑ children than peers without college education	career-oriented & family-friendly occupations .
Kountouris (2020)	Greece	2SLS, RDD	Exposed: born in (April 1982+30 mnths) Unexposed: born in (April 1982-30 mnths)	↑supply of higher education, schooling reform in 2000	17	2011	any children	IV: ↓ prob. of any births by 20 p.p. Reduced form: ↓ prob. of any births by 2.7 p.p.	↑ labor market opportunities ↑ opportunity cost of children

Notes: OLS = Ordinary Least Squares; 2SLS = Two-Stage Least Squared; RDD = Regression Discontinuity Design; DID = Difference-in-Differences. NE = No effect

Table 2: Summary Statistics

	(1) Full Sample	(2) Exposed Cohorts (1966-1975)	(3) Control Cohorts (1946-1960)
		Fertility	
Have any children by age			
30	0.8202	0.6884	0.8806
31	0.8407	0.7205	0.8957
32	0.8552	0.7433	0.9065
33	0.8677	0.7629	0.9157
34	0.8768	0.7757	0.9230
35	0.8831	0.7847	0.9281
Number of children by age			
30	1.9098	1.3443	2.1686
31	1.9945	1.4388	2.2489
32	2.0593	1.5163	2.3080
33	2.1094	1.5785	2.3525
34	2.1459	1.6230	2.3853
35	2.1752	1.6563	2.4127
Ever married by age			
30	0.8787	0.7783	0.9247
31	0.8892	0.7957	0.9320
32	0.8999	0.8132	0.9396
33	0.9061	0.8224	0.9444
34	0.9106	0.8301	0.9475
35	0.9151	0.8364	0.9511
		Own educational attainment	
No bachelor's or higher degree	0.8995	0.8231	0.9344
Bachelor	0.0850	0.1437	0.0581
Master's or Ph.D.	0.0156	0.0333	0.0075
		Husband's educational attainment	
No bachelor's or higher degree	0.8535	0.8027	0.8753
Bachelor	0.1132	0.1370	0.1031
Master's or Ph.D.	0.0333	0.0603	0.0217
N (all women)	29193	9168	20025
N (known husband's education)	22024	6615	15409

Sources: Woman's Marriage, Fertility and Employment Survey 2003, 2006, and 2010, Directorate-General of Budget, Accounting, and Statistics, Executive Yuan, Taiwan.
Notes: The women's own and their husbands' educational attainment were evaluated at the time of the survey. The husbands' education information is missing for women who are single or did not respond.

Table 3: The Effect of BGI Expansion on Fertility at Different Ages

	(1)	(2)	(3)	(4)	(5)	(6)
	Probability of having any children by age [...]					
	30	31	32	33	34	35
	Panel A: Treat=1966-1975; Control=1946-1960					
$\Delta BGIs \times Treat$	-0.0092***	-0.0082***	-0.0093***	-0.0089***	-0.0093***	-0.0093***
	(0.0018)	(0.0018)	(0.0018)	(0.0016)	(0.0016)	(0.0015)
	Panel B: Treat1= 1971-1975; Treat2=1966-1970; Control=1946-1960					
$\Delta BGIs \times Treat1$	-0.0128***	-0.0118***	-0.0126***	-0.0103***	-0.0101***	-0.0089***
	(0.0036)	(0.0034)	(0.0033)	(0.0030)	(0.0031)	(0.0027)
$\Delta BGIs \times Treat2$	-0.0076***	-0.0067***	-0.0079***	-0.0084***	-0.0089***	-0.0095***
	(0.0019)	(0.0019)	(0.0018)	(0.0018)	(0.0018)	(0.0017)
Mean prob. of any child	0.8202	0.8407	0.8552	0.8677	0.8768	0.8831
Mean of $\Delta BGIs$	4.2017	4.2017	4.2017	4.2017	4.2017	4.2017
Observations	29193	29193	29193	29193	29193	29193
	(7)	(8)	(9)	(10)	(11)	(12)
	Total number of children by age [...]					
	30	31	32	33	34	35
	Panel C: Treat=1966-1975; Control=1946-1960					
$\Delta BGIs \times Treat$	-0.0122***	-0.0114***	-0.0132***	-0.0133***	-0.0140***	-0.0145***
	(0.0046)	(0.0044)	(0.0046)	(0.0044)	(0.0043)	(0.0042)
	Panel D: Treat1= 1971-1975; Treat2=1966-1970; Control=1946-1960					
$\Delta BGIs \times Treat1$	-0.0212***	-0.0181**	-0.0208***	-0.0210***	-0.0220***	-0.0196***
	(0.0070)	(0.0072)	(0.0074)	(0.0071)	(0.0071)	(0.0071)
$\Delta BGIs \times Treat2$	-0.0084	-0.0087*	-0.0099*	-0.0100**	-0.0107**	-0.0123***
	(0.0053)	(0.0050)	(0.0052)	(0.0049)	(0.0047)	(0.0047)
Mean # of children	1.9098	1.9945	2.0593	2.1094	2.1459	2.1752
Mean of $\Delta BGIs$	4.2017	4.2017	4.2017	4.2017	4.2017	4.2017
Observations	29193	29193	29193	29193	29193	29193

Sources: Woman's Marriage, Fertility, and Employment Survey 2003, 2006, and 2010, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.
Notes: ***, **, and * indicate significantly at 1%, 5%, and 10%, respectively. Robust standard errors are clustered at the county-cohort level. The dependent variable in Panel A and B is a dummy variable indicating whether the respondent has any children by a specific age in each column. The dependent variable in Panels C and D is the number of children that the respondent has by specific age. $\Delta BGIs$ is the change in the BGIs between 1996 and the survey year. All regressions additionally control for a full set of birth cohort dummies, county and wave dummies, and county-specific time trends.

Table 4: Heterogeneous Effect of BGI Expansion on Fertility by Women's Education

	(1) Any Children by age 35	(2) # of children by age 35
	Panel A: Women with bachelor's or higher degrees	
$\Delta BGIs \times Treat$	-0.0092*	-0.0162
	(0.0050)	(0.0129)
Mean of	4.4971	4.4971
Mean of dep. var.	0.7135	1.3509
Observations	2935	2935
	Panel B: Women without bachelor's or higher degrees	
$\Delta BGIs \times Treat$	-0.0084***	-0.0133***
	(0.0017)	(0.0047)
Mean of	4.1687	4.1687
Mean of dep. var.	0.9020	2.2673
Observations	26258	26258

Sources: Woman's Marriage, Fertility and Employment Survey 2003, 2006, and 2010, Directorate-General of Budget, Accounting, and Statistics, Executive Yuan, Taiwan.
Notes: ***, **, and * indicate significantly at 1%, 5%, and 10%, respectively. Robust standard errors are clustered at the county-cohort level. The dependent variable in column (1) is a dummy variable indicating whether the respondent has any children by specific ages. The dependent variable in column (2) is the number of children that the respondent has by a specific age. $\Delta BGIs$ is the change in the BGIs between 1996 and the survey year. The treatment group is the cohort born between 1966 and 1975 (age 30 or below in 1996). The control group is the cohort born between 1946 and 1960 (age above 30 in 1996). Panels A and B include women with and without bachelor's or higher degrees, respectively. All regressions additionally control for a full set of birth cohort dummies, county and wave dummies, and county-specific time trends.

Table 5: The Effect of BGI Expansion on Women's and Their Husbands' Educational Attainment

	(1) Bachelor or above	(2) Master or above
	Panel A: Women's Own Education	
$\Delta BGIs \times Treat$	0.0033**	0.0017**
	(0.0015)	(0.0007)
	Panel B: Women's Own Education	
$\Delta BGIs \times Treat1$	0.0080**	0.0030***
	(0.0031)	(0.0010)
$\Delta BGIs \times Treat2$	0.0014	0.0012
	(0.0015)	(0.0009)
Mean of $\Delta BGIs$	4.2017	4.2017
Mean of DV	0.1005	0.0156
Observations	29193	29193
	Panel C: Husband's Education	
$\Delta BGIs \times Treat$	0.0019	0.0004
	(0.0020)	(0.0011)
	Panel D: Husband's Education	
$\Delta BGIs \times Treat1$	0.0035	0.0003
	(0.0034)	(0.0019)
$\Delta BGIs \times Treat2$	0.0012	0.0005
	(0.0023)	(0.0013)
Mean of $\Delta BGIs$	4.2041	4.2041
Mean of DV	0.1465	0.0333
Observations	22024	22024

Sources: Woman's Marriage, Fertility, and Employment Survey 2003, 2006, and 2010, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.
Notes: ***, **, and * indicate significantly at 1%, 5%, and 10%, respectively. Robust standard errors are clustered at the county-cohort level. The dependent variables in column (1) of Panels A and B (C and D) are dummy variables indicating that the respondent (respondent's husband) has a bachelor's degree or above by the time of the survey, and those in column (2) are dummy variables indicating whether the respondent (respondent's husband) has a master's degree or above by the time of the survey. $Treat$, $Treat1$, and $Treat2$ denote the cohorts born in 1966-1975 (ages 21-30 in 1996), 1971-1975 (ages 21-25 in 1996), and 1966-1970 (ages 26-30 in 1996), respectively. In all the panels, the control group comprises the cohorts born in 1946-1960 (ages 36-50 in 1996). $\Delta BGIs$ is the change in the BGIs between 1996 and the survey year. All the regressions additionally control for a full set of birth cohort dummies, county dummies, and wave dummies.

Table 6: The Effect of BGI Expansion on Marital Outcome at Different Ages

	(1)	(2)	(3)	(4)	(5)	(6)
	Married by					
	Age 30	Age 31	Age 32	Age 33	Age 34	Age 35
	Panel A: All Women					
$\Delta BGIs \times Treat$	-0.0079***	-0.0070***	-0.0075***	-0.0074***	-0.0071***	-0.0069***
	(0.0017)	(0.0017)	(0.0015)	(4100.0014)	(0.0014)	(0.0013)
$\Delta BGIs \times Treat1$	-0.0114***	-0.0108***	-0.0106***	-0.0098***	-0.0090***	-0.0085***
	(0.0030)	(0.0030)	(0.0028)	(0.0026)	(0.0024)	(0.0022)
$\Delta BGIs \times Treat2$	-0.0064***	-0.0054***	-0.0062***	-0.0064***	-0.0064***	-0.0062***
	(0.0018)	(0.0017)	(0.0016)	(0.0015)	(0.0015)	(0.0015)
Mean of $\Delta BGIs$	4.2017	4.2017	4.2017	4.2017	4.2017	4.2017
Mean of DV	0.8787	0.8892	0.8999	0.9061	0.9106	0.9151
Observations	29193	29193	29193	29193	29193	29193
	Panel B: Women with bachelor's or higher degrees					
$\Delta BGIs \times Treat$	-0.0088*	-0.0103**	-0.0080	-0.0085*	-0.0070	-0.0061
	(0.0051)	(0.0050)	(0.0051)	(0.0051)	(0.0049)	(0.0049)
$\Delta BGIs \times Treat1$	-0.0080	-0.0139**	-0.0113*	-0.0112*	-0.0100	-0.0092
	(0.0064)	(0.0068)	(0.0065)	(0.0067)	(0.0061)	(0.0057)
$\Delta BGIs \times Treat2$	-0.0093	-0.0084	-0.0064	-0.0071	-0.0054	-0.0045
	(0.0060)	(0.0057)	(0.0058)	(0.0058)	(0.0057)	(0.0057)
Mean of $\Delta BGIs$	4.4971	4.4971	4.4971	4.4971	4.4971	4.4971
Mean of DV	0.6944	0.7223	0.7486	0.7629	0.7731	0.7809
Observations	2935	2935	2935	2935	2935	2935
	Panel C: Women without bachelor's or higher degrees					
$\Delta BGIs \times Treat$	-0.0066***	-0.0055***	-0.0063***	-0.0061***	-0.0062***	-0.0058***
	(0.0020)	(0.0018)	(0.0017)	(0.0015)	(0.0014)	(0.0014)
$\Delta BGIs \times Treat1$	-0.0098***	-0.0079**	-0.0083**	-0.0073**	-0.0068**	-0.0061**
	(0.0037)	(0.0035)	(0.0033)	(0.0030)	(0.0029)	(0.0027)
$\Delta BGIs \times Treat2$	-0.0053***	-0.0045**	-0.0056***	-0.0057***	-0.0059***	-0.0057***
	(0.0021)	(0.0019)	(0.0018)	(0.0017)	(0.0016)	(0.0016)
Mean of $\Delta BGIs$	4.1687	4.1687	4.1687	4.1687	4.1687	4.1687
Mean of DV	0.8993	0.9079	0.9168	0.9221	0.9260	0.9301
Observations	26258	26258	26258	26258	26258	26258

Sources: Woman's Marriage, Fertility, and Employment Survey 2003, 2006, and 2010, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.
Notes: ***, **, and * indicate significantly at 1%, 5%, and 10%, respectively. Robust standard errors are clustered at the county-cohort level. The dependent variable is a dummy variable indicating whether the respondent has ever been married by specific ages. $\Delta BGIs$ is the change in the BGIs between 1996 and the survey year. $Treat$, $Treat1$, and $Treat2$ denote cohorts born in 1966-1975 (ages 21-30 in 1996), 1971-1975 (ages 21-25 in 1996), and 1966-1970 (ages 26-30 in 1996), respectively. In all panels, the control group comprises the cohorts born in 1946-1960 (ages 36-50 in 1996). Panel A includes all women. Panels B and C include women with and without bachelor's or higher degrees. All regressions additionally control for a full set of birth cohort dummies, county and wave dummies, and county-specific time trends.

Table 7: Heterogeneous Effect of BGI Expansion BGI Characteristics

	(1) Any Children by age 35	(2) # of children by age 35
	Panel A: Public vs Private BGIs	
$\Delta BGIs^{pub} \times Treat$	-0.0278***	-0.0218
	(0.0059)	(0.0146)
$\Delta BGIs^{priv} \times Treat$	-0.0091***	-0.0144***
	(0.0015)	(0.0042)
Mean of public $\Delta BGIs^{pub}$	0.7792	0.7792
Mean of private $\Delta BGIs^{priv}$	3.4225	3.4225
	Panel B: Old vs New BGIs	
$\Delta BGIs^{old} \times Treat$	-0.0142***	-0.0258***
	(0.0029)	(0.0081)
$\Delta BGIs^{new} \times Treat$	-0.0048*	-0.0040
	(0.0026)	(0.0075)
Mean of old $\Delta BGIs^{old}$	2.0055	2.0055
Mean of new $\Delta BGIs^{new}$	2.1962	2.1962
Mean of DV	0.8831	2.1752
	Panel C: BGIs $\leq$ 0.5 hours vs BGIs $>$ 0.5 hours	
$\Delta BGIs^{\leq 0.5\ hrs} \times Treat$	-0.0072***	-0.0112***
	(0.0009)	(0.0024)
Mean of $\Delta BGIs^{\leq 0.5\ hrs}$	6.9346	6.9346
Mean of DV	0.8831	2.1752
Observations	29193	29193

Sources: Woman's Marriage, Fertilitys and Employment Survey 2003, 2006s and 2010, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.
Notes: ***, **, and * indicate significantly at 1%, 5%s and 10%, respectively. Robust standard errors are clustered at the county-cohort level. The dependent variable in column (1) is a dummy variable indicating whether the respondent has any children by specific ages. The dependent variable in column (2) is the number of children that the respondent has by a specific age. The treatment group is the cohort born in 1966-1975 (age 30 or below in 1996), and the control group is the cohort born in 1946-1960 (ages above 30 in 1996). Panel A divides the BGIs into the public and private ones. Panel B groups BGIs into old and new ones according to the mean tenure since establishment. Panel C separates the BGIs within 30-minute commute zones (starting from the county administrative centers) from those outside the zones. All the regressions additionally control for a full set of birth cohort dummies, county and wave dummies, and county-specific time trends.

A1 Appendix

Table A1: Education System in Taiwan

<table>
<tr><th>Age</th><th colspan="3">Education Level</th></tr>
<tr><td>23+</td><td colspan="3">Graduate School
(Master’s or Doctorate)</td></tr>
<tr><td>22
21</td><td rowspan="2">4-year Track University
or
Institute of Technology
(Bachelor’s)</td><td colspan="2">2-year Track Institute of Technology
(Bachelor’s)</td></tr>
<tr><td>20
19</td><td>2-year Track Junior College
(Associate Bachelor’s)</td><td rowspan="2">5-year Track
Junior College
(Associate Bachelor’s)</td></tr>
<tr><td>18
17
16</td><td colspan="2">Senior High School</td></tr>
<tr><td>13-15</td><td colspan="3">Junior High School [compulsory]</td></tr>
<tr><td>6-12</td><td colspan="3">Elementary School [compulsory]</td></tr>
</table>

Notes: The degrees awarded by each type of higher education institutions are in parentheses. Some undergraduate majors such as law and medicine take more than four years to complete.

Table A2: Robustness to Using Alternative Cutoffs to Define Exposed and Control Cohorts

	(1) Any children by 35	(2) # of children by 35	(3) Bachelor or above	(4) Master or above
	Panel A: $\leq$ 26 in 1996 as exposed			
$\Delta BGIs \times Treat$	-0.0075***	-0.0159**	0.0061**	0.0030***
	(0.0025)	(0.0067)	(0.0027)	(0.0008)
Mean of $\Delta BGIs$	4.2144	4.2144	4.2144	4.2144
Mean of DV	0.8988	2.2673	0.0894	0.0126
Exposed Cohorts	1970-1975	1970-1975	1970-1975	1970-1975
Control Cohorts	1946-1960	1946-1960	1946-1960	1946-1960
Observations	23717	23717	23717	23717
	Panel B: $\leq$ 28 in 1996 as exposed			
$\Delta BGIs \times Treat$	-0.0084***	-0.0130***	0.0051***	0.0026***
	(0.0018)	(0.0047)	(0.0019)	(0.0009)
Mean of $\Delta BGIs$	4.2176	4.2176	4.2176	4.2176
Mean of DV	0.8889	2.2123	0.0973	0.0148
Exposed Cohorts	1968-1975	1968-1975	1968-1975	1968-1975
Control Cohorts	1946-1960	1946-1960	1946-1960	1946-1960
Observations	26243	26243	26243	26243
	Panel C: $\leq$ 30 in 1996 as exposed			
$\Delta BGIs \times Treat$	-0.0093***	-0.0145***	0.0033**	0.0017**
	(0.0015)	(0.0042)	(0.0015)	(0.0007)
Mean of $\Delta BGIs$	4.2017	4.2017	4.2017	4.2017
Mean of DV	0.8831	2.1752	0.1005	0.0156
Exposed Cohorts	1966-1975	1966-1975	1966-1975	1966-1975
Control Cohorts	1946-1960	1946-1960	1946-1960	1946-1960
Observations	29193	29193	29193	29193
	Panel C: $\leq$ 32 in 1996 as exposed			
$\Delta BGIs \times Treat$	-0.0085***	-0.0130***	0.0027**	0.0013**
	(0.0015)	(0.0040)	(0.0013)	(0.0006)
Mean of $\Delta BGIs$	4.2029	4.2029	4.2029	4.2029
Mean of dep. var.	0.8800	2.1513	0.1032	0.0168
Exposed Cohorts	1964-1975	1964-1975	1964-1975	1964-1975
Control Cohorts	1946-1960	1946-1960	1946-1960	1946-1960
Observations	32468	32468	32468	32468
	Panel C: $\leq$ 34 in 1996 as exposed			
$\Delta BGIs \times Treat$	-0.0067***	-0.0096**	0.0020*	0.0012**
	(0.0014)	(0.0039)	(0.0012)	(0.0005)
Mean of $\Delta BGIs$	4.2080	4.2080	4.2080	4.2080
Mean of DV	0.8800	2.1405	0.1025	0.0165
Exposed Cohorts	1962-1975	1962-1975	1962-1975	1962-1975
Control Cohorts	1946-1960	1946-1960	1946-1960	1946-1960
Observations	35784	35784	35784	35784

Sources: Woman's Marriage, Fertility, and Employment Survey 2003, 2006, and 2010, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.
Notes: ***, **, and * indicate significantly at 1%, 5%, and 10%, respectively. Robust standard errors are clustered at the county-cohort level. Panels A to E uses different cutoff ages in 1996 to define the treatment and control groups. The dependent variable in column (1) is a dummy variable indicating whether the respondent has her first child by age 35, column (2) number of children by age 35, column (3) is a dummy variable indicating a bachelor's degree or above at the time of the survey, and column (4) is a dummy variable indicating whether the respondent has a master's or higher degrees at the time of the survey. All the regressions additionally control for a full set of birth cohort dummies, county and wave dummies, and county-specific time trends.

Table A3: The Effect of BGI Expansion on Teenage Fertility

	(1) Age 15	(2) Age 16	(3) Age 17	(4) Age 18	(5) Age 19	(6) Age 20
	Panel A: Any children					
$\Delta BGIs \times Treat$	0.0001	-0.0005	0.0001	0.0008	-0.0001	-0.0000
	(0.0002)	(0.0004)	(0.0006)	(0.0009)	(0.0012)	(0.0013)
Mean of $\Delta BGIs$	4.1978	4.1978	4.1978	4.1978	4.1978	4.1978
Mean of DV	0.0033	0.0095	0.0250	0.0505	0.0899	0.1432
Observations	29430	29430	29430	29430	29430	29430
	Panel B: Number of children by age					
$\Delta BGIs \times Treat$	0.0001	-0.0005	0.0003	0.0004	0.0003	0.0004
	(0.0002)	(0.0005)	(0.0007)	(0.0012)	(0.0016)	(0.0022)
Mean of $\Delta BGIs$	4.1978	4.1978	4.1978	4.1978	4.1978	4.1978
Mean of DV	0.0034	0.0105	0.0282	0.0608	0.1171	0.1997
Observations	29430	29430	29430	29430	29430	29430
Exposed cohorts	1981-1990	1981-1990	1981-1990	1981-1990	1981-1990	1981-1990
Control cohorts	1946-1960	1946-1960	1946-1960	1946-1960	1946-1960	1946-1960

Sources: Woman's Marriage, Fertility, and Employment Survey 2003, 2006, and 2010, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.
Notes: ***, **, and * indicate significantly at 1%, 5%, and 10%, respectively. Robust standard errors are clustered at the county-cohort level. $\Delta BGIs$ is the change in the BGIs between 1996 and the survey year. All the regressions additionally control for a full set of birth cohort dummies, county and wave dummies, and county-specific time trends.

Table A4: The Effect of BGI Expansion on Fertility Outcomes at Younger Ages

	(1) Age 26	(2) Age 27	(3) Age 28	(4) Age 29	(5) Age 30
			Panel A: Any children		
$\Delta BGIs \times Treat$	-0.0074***	-0.0077***	-0.0072***	-0.0087***	-0.0086***
	(0.0018)	(0.0018)	(0.0019)	(0.0020)	(0.0020)
Meaa of $\Delta BGIs$	4.1907	4.1907	4.1907	4.1907	4.1907
Mean of DV	0.6144	0.6703	0.7135	0.7473	0.7752
Observations	30636	30636	30636	30636	30636
			Panel B: Number of Children		
$\Delta BGIs \times Treat$	-0.0031	-0.0043	-0.0024	-0.0043	-0.0050
	(0.0044)	(0.0044)	(0.0042)	(0.0043)	(0.0044)
Mean of $\Delta BGIs$	4.1907	4.1907	4.1907	4.1907	4.1907
Mean of DV	1.2471	1.4191	1.5653	1.6860	1.7832
Observations	30636	30636	30636	30636	30636
Exposed Cohorts	1970-1980	1970-1980	1970-1980	1970-1980	1970-1980
Control Cohorts	1946-1960	1946-1960	1946-1960	1946-1960	1946-1960

Sources: Woman's Marriage, Fertility, and Employment Survey 2003, 2006, and 2010, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.
Notes: ***, **, and * indicate significantly at 1%, 5%, and 10%, respectively. Robust standard errors are clustered at the county-cohort level. $\Delta BGIs$ is the change in the BGIs between 1996 and the survey year. All the regressions additionally control for a full set of birth cohort dummies, county and wave dummies, and county-specific time trenda.

Table A5: The Effect of BGI Expansion using Enrolment as Alternative Measure of Expansion

	(1) Any children by age 35	(2) # of children by age 35
BGI enrolment × Treat	-0.0588***	-0.0532***
	(0.0079)	(0.0185)
Mean of BGI enrolment	0.7259	0.7259
Mean of DV	0.8831	2.1752
Observations	29193	29193

Sources: Woman's Marriage, Fertility, and Employment Survey 2003, 2006, and 2010, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.
Notes: ***, **, and * indicate significantly at 1%, 5%, and 10%, respectively. Robust standard errors are clustered at the county-cohort level. The dependent variable in column (1) is a dummy variable indicating whether the respondent has her first child by age 35, and column (2) is the number of children the respondent has had by age 35. *BGI enrolment* is the change in enrolment of first-year undergraduate students (in 10,000 students) since 1996 in the county in the survey year. All the regressions additionally control for a full set of birth cohort dummies, county and wave dummies, and county-specific time trends.

Table A6: Full List of Bachelor's-Granting Institutions

	BGI	Location	Existing	Upgraded	New	Public or Private
1	National Chengchi University	Taipei City	P			Public
2	National Tsing Hua University	Hsinchu City	P			Public
3	National Taiwan University	Taipei City	P			Public
4	National Taiwan Normal University	Taipei City	P			Public
5	National Cheng Kung University	Tainan City	P			Public
6	National Chung Hsing University	Taichung City	P			Public
7	National Chiao Tung University	Hsinchu City	P			Public
8	National Central University	Taoyuan County	P			Public
9	National Sun Yat-sen University	Kaohsiung City	P			Public
10	National Taiwan Ocean University	Keelung City	P			Public
11	National Chung Cheng University	Chiayi County	P			Public
12	National Kaohsiung Normal University	Kaohsiung City	P			Public
13	National Changhua University of Education	Changhua County	P			Public
14	National Yang-Ming University	Taipei City	P			Public
15	National Taipei University	Taipei County	P			Public
16	National Chiayi University	Chiayi City		P		Public
17	National University of Kaohsiung	Kaohsiung City			P	Public
18	National Dong Hwa University	Hualien County	P			Public
19	National Chi Nan University	Nantou County	P			Public
20	National Taiwan University of Science and Technology	Taipei City	P			Public
21	National Yunlin University of Science and Technology	Yunlin County	P			Public
22	National Pingtung University of Science and Technology	Pingtung County	P			Public
23	National Taipei University of Technology	Taipei City	P			Public
24	National Kaohsiung First University of Science and Technology	Kaohsiung County	P			Public
25	National Kaohsiung University of Applied Sciences	Kaohsiung City		P		Public
26	Taipei National University of the Arts	Taipei City	P			Public
27	National Taiwan University of Arts	Taipei County	P			Public
28	National Taitung University	Taitung County	P			Public
29	National Ilan University	Yilan County		P		Public
30	National United University	Miaoli County		P		Public
31	National Formosa University	Yunlin County		P		Public
32	National Kaohsiung Marine University	Kaohsiung City		P		Public
33	Tainan National University of the Arts	Tainan County			P	Public
34	National University of Tainan	Tainan City	P			Public
35	National Taipei University of Education	Taipei City	P			Public
36	National Hsinchu University of Education	Hsinchu City	P			Public
37	National Taichung University of Education	Taichung City	P			Public
38	National Pingtung University of Education	Pingtung County	P			Public
39	National Chin-Yi University of Technology	Taichung County		P		Public

40	National Taiwan Sport University	Taoyuan County	P			Public
41	National Taipei University of Nursing and Health Science	Taipei City	P			Public
42	National Kaohsiung University of Hospitality and Tourism	Kaohsiung City		P		Public
43	National Open University	Taipei County	P			Public
44	Taipei Municipal University of Education	Taipei City	P			Public
45	The Open University of Kaohsiung	Kaohsiung City			P	Public
46	R.O.C. Military Academy	Kaohsiung County	P			Public
47	R.O.C. Naval Academy	Kaohsiung City	P			Public
48	R.O.C. Air Force Academy	Kaohsiung County	P			Public
49	National Defence University	Taoyuan County			P	Public
50	Central Police University	Taoyuan County	P			Public
51	Tunghai University	Taichung City	P			Private
52	Fu Jen Catholic University	Taipei County	P			Private
53	Soochow University	Taipei City	P			Private
54	Chung Yuan Christian University	Taoyuan County	P			Private
55	Tamkang University	Taipei County	P			Private
56	Chinese Culture University	Taipei City	P			Private
57	Feng Chia University	Taichung City	P			Private
58	Providence University	Taichung County	P			Private
59	Chang Gung University	Taoyuan County	P			Private
60	Yuan Ze University	Taoyuan County	P			Private
61	Chung Hua University	Hsinchu City	P			Private
62	Dayeh University	Changhua County	P			Private
63	Huafan University	Taipei County	P			Private
64	I-Shou University	Kaohsiung County	P			Private
65	Shih Hsin University	Taipei City	P			Private
66	Ming Chuan University	Taipei City	P			Private
67	Shih Chien University	Taipei City	P			Private
68	Chaoyang University of Technology	Taichung County	P			Private
69	Kaohsiung Medical University	Kaohsiung City	P			Private
70	Nanhua University	Chiayi County			P	Private
71	Aletheia University	Taipei County	P			Private
72	Tatung University	Taipei City	P			Private
73	Southern Taiwan University	Tainan County		P		Private
74	Kun Shan University	Tainan County		P		Private
75	Chia Nan University of Pharmacy & Science	Tainan County		P		Private
76	Shu-Te University	Kaohsiung County			P	Private
77	Tzu Chi University	Hualien County	P			Private
78	Taipei Medical University	Taipei City	P			Private
79	Chung Shan Medical University	Taichung City	P			Private
80	Lunghwa University of Science and Technology	Taoyuan County		P		Private

81	Fooyin University	Kaohsiung County		P		Private
82	Minghsin University of Science and Technology	Hsinchu County		P		Private
83	Chang Jung Christian University	Tainan County	P			Private
84	Hungkuang University	Taichung County		P		Private
85	China Medical University	Taichung City	P			Private
86	Ching Yun University	Taoyuan County		P		Private
87	Cheng Shiu University	Kaohsiung County		P		Private
88	Vanung University	Taoyuan County		P		Private
89	Hsuan Chuang University	Hsinchu City			P	Private
90	Chienkuo Technology University	Changhua County		P		Private
91	Ming Chi University of Technology	Taipei County		P		Private
92	Kao Yuan University	Kaohsiung County		P		Private
93	Tajen University	Pingtung County		P		Private
94	St. John's University	Taipei County		P		Private
95	Ling Tung University	Taichung City		P		Private
96	China University of Technology	Taipei City		P		Private
97	Central Taiwan University of Science and Technology	Taichung City		P		Private
98	Asia University	Taichung County			P	Private
99	Kainan University	Taoyuan County	P			Private
100	Fo Guang University	Yilan County			P	Private
101	Tainan University of Technology	Tainan County		P		Private
102	Far East University	Tainan County		P		Private
103	Yuanpei University	Hsinchu City		P		Private
104	Jinwen University of Science and Technology	Taipei County		P		Private
105	Chung Hwa University of Medical Technology	Tainan County		P		Private
106	Tungnan University	Taipei County		P		Private
107	Takming University of Science and Technology	Taipei City		P		Private
108	Mingdao University	Changhua County			P	Private
109	Leader University	Tainan City			P	Private
110	Nan Kai Institute of Technology	Nantou County		P		Private
111	China University of Science and Technology	Taipei City		P		Private
112	Overseas Chinese University	Taichung City		P		Private
113	Yu Da University	Miaoli County			P	Private
114	Meiho University	Pingtung County		P		Private
115	Wufeng University	Chiayi County		P		Private
116	Transworld University	Yunlin County		P		Private
117	Taiwan Shoufu University	Tainan County			P	Private
118	National Taiwan College of Physical Education	Taichung City		P		Public
119	National Pingtung Institute of Commerce	Pingtung County		P		Public
120	National Taichung Institute of Technology	Taichung City		P		Public
121	National Taipei College of Business	Taipei City		P		Public

122	National Taiwan College of Performing Arts	Taipei City			P	Public
123	Taipei Physical Education College	Taipei City		P		Public
124	National Defence Medical Center	Taipei City	P			Public
125	Air Force Institute of Technology	Kaohsiung County		P		Public
126	Hsing Kuo Unervisity of Management	Tainan City			P	Public
127	Ta Hwa Institute of Technology	Hsinchu County		P		Private
128	Wenzao Ursuline College of Languages	Kaohsiung City		P		Private
129	Dahan Institute of Technology	Hualien County		P		Private
130	Tzu Chi College of Technology	Hualien County		P		Private
131	Yung Ta Institute of Technology and Commerce	Pingtung County		P		Private
132	Fortune Institute of Technology	Kaohsiung County		P		Private
133	Technology and Science Institute of Northern Taiwan	Taipei City		P		Private
134	Chihlee Institute of Technology	Taipei County		P		Private
135	Hsing Wu College	Taipei County		P		Private
136	Oriental Institute of Technology	Taipei County		P		Private
137	Nanya Institute of Technology	Taoyuan County		P		Private
138	Chung Chou Institute of Technology	Changhua County		P		Private
139	Hsiuping Institute of Technology	Taichung County		P		Private
140	Toko University	Chiayi County			P	Private
141	De Lin Institute of Technology	Taipei County		P		Private
142	Nan Jeon Institute of Technology	Tainan County		P		Private
143	Lan Yang Institute of Technology	Yilan County		P		Private
144	Lee-Ming Institute of Technology	Taipei County		P		Private
145	Tung Fang Institute of Technology	Kaohsiung County		P		Private
146	Ching Kuo Institute of Management and Health	Keelung City		P		Private
147	Chang Gung Institute of Technology	Taoyuan County		P		Private
148	Chungyu Institute of Technology	Keelung City		P		Private
149	Tatung Institute of Commerce and Technology	Chiayi City		P		Private
150	Asia - Pacific Institute of Creativity	Miaoli County		P		Private
151	Kao Fong College of Digital Contents	Pingtung County			P	Private
152	Hwa Hsia Institute of Technology	Taipei County		P		Private
153	Taiwan Hospitality and Tourism College	Hualien County		P		Private
154	Taipei College of Maritime Technology	Taipei County		P		Private
155	Mackay Medical College	Taipei County			P	Private
156	Dharma Drum Buddhist College	Taipei County			P	Private
157	Taiwan Baptist Theological Seminary	Taipei City			P	Private