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ECON 8740-Final Project

Analysis about education and other factors that effect fertility

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1. Introduction

My research question is about the factors that affect fertility, and the main factor I focus on is mothers' education (I will use education instead of mothers' education in the following content). People with higher education may be less willing to give birth, resulting in lower fertility.

Many factors may affect fertility, including education, religion, marriage age, and so on. With the development of society, life is better than ever before, and the rate of infant mortality has declined to a low level, however, fertility is decreasing in most countries. On the other hand, more and more articles arouse women's freedom, equality, and right through the internet, which let women realize that they are human first, women second, and mothers' roles at last. As a result, women may pay more attention to themselves, like purchasing further education, having more career opportunities, and exploring the probability of different living patterns, meanwhile giving birth and taking care of children are less taken into consideration. In my research, I used women's education as one of the main factors which affect fertility.

Many countries are facing low fertility, some of which have fallen into the 'Low Fertility Trap'. The 'Low Fertility Trap Hypothesis' suggests that if fertility stays low for a prolonged period, a series of mutually-reinforcing demographic, economic and sociological mechanisms serve to make the future increase of birth rates harder. (Lutz, Skirbekk, Testa, Vienna Yearb Popul Res 4:167-192) To increase the fertility, it is important to find the factors that influence the willingness and ability of people to give birth.

Higher education for women means later marriage age and later first give birth age, which has a negative influence on fertility, as well as the age at first birth. In other words, the older people give birth, the fewer children they will raise. As I predicted, the ideal number of children and the age at first marriage do play a positive effect on fertility, however, the factor of media facilities, including television and radio, has a positive effect on the fertility rate, which is reverse to my prediction. Moreover, people who live in urban have a lower fertility rate than those who live in the countryside or remote areas. And interaction term educ*urban in model children 2 tests the hypothesis that the return to education is the same for people who live in the urban area and it turned out to be not. Last but not least, the other dummy variables knowing birth control and using birth control method do play a positive role in regression, which means people who know or use contraception methods has a higher number of children.

2. Literature Review

I have read several papers, including Robert Jensen and Emily Oster “The Power Of TV: Cable Television And Women’s Status In India”; Gary S. Becker “An Economic Analysis of Fertility”; Stuart Basten and Baochang Gu “Childbearing preferences, reform of family planning restrictions and the Low Fertility Trap in China”. Besides, I view the data from the public data website of the Shanghai government.

In the paper of Robert Jensen and Emily Oster, the introduction of cable television was found to be associated with significant decreases in the reported acceptability of domestic violence toward women and son preference, as well as increases in women’s autonomy and decreases in fertility. (Robert Jensen and Emily Oster) As far as I saw, cable television is the main method for people to be able to know more information about the outside world, including women’s freedom, equality, right, etc. To some extent, women get knowledge from TV as another way of receiving education, wilder view and realizing the inner self, instead of scarifying themselves as baby sitter or housewives. It is powerful evidence that education does decrease fertility.

Gary S. Becker analyzes fertility within an economic framework in his paper. The relationship between income and quality and quantity of children was proved that as income increases, quality expenditures per child do—and in a large measure must—increase to such an extent that parents tend to reduce their demand for children. (Gray S. Becker) However, the paper just mentioned the knowledge of birth control little and made the conclusion that the lack of knowledge of modern birth-control techniques is not an obstacle in the path of declining family size.

What I am really interested in is the analysis of ” Childbearing preferences, reform of family planning restrictions and the Low Fertility Trap in China” by Stuart Basten and Baochang Gu. Since I come from Shanghai, China, and I’m quite familiar with the “One-Child Policy” which started in 1980. Although the policy was abolished and the government is working hard to encourage couples to give birth as they introduced the two-child policy in 2016 and then the three-child policy last year to alleviate the problem of an aging population. Unfortunately, the fertility rate raised a little after the policy was activated and then still fell and maintains low after a while. The authors found that important factor-Fertility preferences, as measured through an ideal or intended number of children, should be considered when analyzing the fertility and it is influenced by the government propaganda at the individual level in China, especially in some urban areas.

Last but not least, the report of the investigation of giving birth after the two-child policy on the Shanghai government public website showed that the economic burden of raising children is the main obstacle to having more children, which coincides with Gray S. Becker’s view of some extent. The second factor is that people lack of time and effort to take care of more children. From my perspective of view, the declining family size causes parents to feel stressed to raise children by themselves because it is harder to get help

from other relatives, like grandparents. So the fertility rate may also be related to the expenditure on kids and the family size.

3. Data Description

I used data set from Wooldridge_ fertil2 to run the regression, and then I also used some data from the investigation report from the Public Data source of the Shanghai government's official website (http://wsjkw.sh.gov.cn/)

The Number of children is the dependent variable, the independent variable education has a negative effect on fertility, which means the more education people received, the fewer children they will have. The age at first marriage and the age at first birth also play an important role on fertility, which may be related to the variable education. For instance, higher education may delay the age of marry and the age of giving birth. An ideal number of children reflects the willingness of women to give birth, and plays a vital role in fertility research. Besides, to some extent, life in urban and whether they have media facilities are also related to education and influence the fertility rate. In other words, people who live in urban or have media facilities may have more opportunities to gain an education. Last but not least, variables of "know birth control" and the "use birth control" affect the fertility rate for certain and may be related to education, since higher education may lead to more knowledge about birth control. The error term u contains other factors like religion, government policy, etc.

Table 1 shows the mean, standard deviation, min, and max of all variables except four dummy variables, urban, nomedia, knowmeth and usemeth. The mean value of husband education is around 5, which is used for subsample regression. Table 2 gets summary statistics by living area, that is people who live in urban (urban=1) have almost one child fewer and 2.5 years of education more than those who do not live in urban (urban=0) on average. Table 3 gets summary statistics on whether having media facilities, and the difference in children number is tiny between the two groups, with media (nomedia=0) and without media (nomedia=1), however, the gap in education is almost 3 years on average. Table 4 shows that people who know the method of birth control (knowmeth=1) have 0.4 children less than those who do not know (knowmeth=0) and the mean of education is 4 years more than birth-control ignorance. Table 5 presents that the difference in children number is tiny between the two groups but the gap in education is almost 3 years, which means people who use contraception methods (usemeth=1) have higher education than those who do not use (usemeth=0). Graph 1 is the density of education from the data set, which reveals that amount of people with 0-year education is the largest and the second population is with 7 years of education. Graph 2 shows the average number of children for different education years, and it seems that people with higher education have fewer children. Graph 3 is a plot of the regression coefficients.

4. Empirical Strategy

Simple regression model 1: children=β 0+β 1 educ+ u

Multiple regression model 2: children=β 0+β 1 educ+β 2 agefm + β 3 agefbrth + β 4 idlnchld+ δ1 urban+ δ2 nomedia+ δ3 knowmeth+ δ4usemeth+ u

Multiple regression model 3: children=β 0+β 1 educ+β 2 agefm + β 3 agefbrth + β 4 idlnchld+ β 5 educ^2+ δ1 urban+ δ2 nomedia+ δ3 knowmeth+ δ4 usemeth+ u

Multiple regression model 4: children=β 0+β 1 educ+β 2 agefm + β 3 agefbrth + β 4 idlnchld+β 5 educ*urban+ δ1 urban+ δ2 nomedia+ δ3 knowmeth+ δ4 usemeth + u

Subsample regression is based on husband's education level, which is divided by higher than mean(heduc>5) and lower than mean(heduc⩽5)

My analysis is focused on how education affects fertility, so the dependent variable, number of children, and independent variable education are the most vital variables of interest. Meanwhile, I need to add factors that also have an impact on fertility and may be related to education to the regression model. The second interesting thing is the dummy variables, whether has media facilities, whether know or use birth control, do have a positive relationship with education according to the analysis of Tables 2 to 5 in the part of Data Description, however, their coefficients have the same direction on fertility rate in the model despite education has a negative effect on fertility. For example, the coefficient of independent knowmeth in the model is 0.174, which means people who know birth control method have 0.174 more children than those who do not know about contraception under the same circumstance, which is opposite to what I expected.

What I expect to find is how education affects the number of children, both the ideal and actual number. In other words, higher education should have a consequence of lower fertility and higher quality children, which is the cost per child. The age at first marriage and the age at first birth also play a negative impact on fertility, which means the younger people marry and give birth, the higher possibility to have more children. An ideal number of children, reveals women's willingness of giving birth, which should play a positive effect on fertility. Meanwhile, people who live in urban and live with social media can acquire more information about the outside world, another way to gain knowledge except go to school, especially for women, upgrading their hierarchy of needs from physiological needs to self-actualization. As a result, the fertility rate should be lower under these circumstances. Last but not least, I think that higher education should have a positive effect on the spread of knowledge and usage of birth control, which may lower the fertility as a result.

5. Results and Interpretation

Model Children1 is the simple regression model, and model Children2 is a multiple regression model with all the factors that may affect fertility. Model Children3 adds the quadratic term educ^2 on the basic of Children2, and model Children4 adds an interaction term educ*urban on the basic of Children2. My subsample of data use models Children5 and Children6, divided the dataset by husband education (over the mean or lower than the mean). The estimated equations are as follows: (Table 7)

Children1= -0.16educ+4.43

Children 2= -0.118educ+0.052agefm-0.093agefbrth+0.169idlnchld-0.623urban-0.095 nomedia+0.059knowmeth+0.53usemeth+3.99

Children 3= -0.132educ+0.052agefm-0.095agefbrth+0.17idlnchld+0.0012educ^2-0.623 urban-0.096nomedia+0.07knowmeth+0.532usemeth+4.03

Children 4= -0.155educ+0.052agefm-0.097agefbrth+0.172idlnchld+0.061educ*urban-0.917urban-0.111nomedia+0.174knometh+0.532usemeth+4.08

Children 5= -0.109educ+0.046agefm-0.07agefbrth+0.207idlnchld+0.044educ*urban-0.572urban-0.066nomedia-0.267knowmeth+0.667usemeth+3.14 (husband education>5)

Children 6= -0.135educ+0.059 agefm-0.132agefbrth+0.134idlnchld+0.015educ*urban-0.797urban-0.249nomedia+0.291knowmeth+0.497usebrth+4.98 (husband education$\leqslant$5)

Because testing hypotheses is such an important component of any econometric analysis and the usual OLS inference is generally faulty in the presence of heteroskedasticity. The Breusch-Pagan Test is a linear test for heteroskedasticity where I regress squared residuals on all explanatory variables and test whether this regression has explanatory power. And the White Test is a nonlinear heteroskedasticity test where I regress squared residuals on all explanatory variables, their squares, and interactions. The heteroskedasticity-robust standard errors provide a simple method for computing t statistics that are asymptotically t distributed whether or not heteroskedasticity is present. So I apply Breusch-Pagan Test and White test in Stata and evaluate the p-value, where a small p-value will indicate we reject the null of homoskedasticity in favor of the alternative (heteroskedasticity). The P-values are all very small as shown above, so I can keep all these models for further analysis.

In the model Children3, I use educ^2 as a quadratic to capture decreasing or increasing marginal effects of education. However, the turning point is around 55, which is meaningless. Besides, the effect is not statistically significant even at the 20% level, and the adjusted R-squared decreased from 0.1810 to 0.1807. So I can drop the variable educ^2 and pay most attention to models Children2 and 4.

T- statistic: coefficient/standard error and get all the results are statistically significant at 1% level except nomedia and knowmeth, which are not statistically significant even at the 20% level. In order to make it clear, I tested the joint significance of knowmeth and usemeth and the result showed that I can reject the hypothesis that none of the two factors affect children's number at the 1% level. Then I compare the adjusted R-square and maintain the variable nomedia in the model. However, the practically significant of the factors agefm and idlnchld is low. Take equation Children4 as an example, if the age at first marriage is 20 years later, it will lead to 1 more children, holding other factors fixed. And the ideal number of children should increase by 6, while the real number of children will rise one, holding other factors fixed. So the real significance becomes smaller when we calculate by reality figures.

According to the estimated equation of model Children2, we can get:

- Holding other factors fixed, another year of education is predicted to decrease the number of children by 0.118 ;
- The number of children will increase by 0.052 if the age at first marriage is 1 year older, keeping other factors fixed;
- One year later for giving the first birth will lower the number of children by 0.093, holding other factors fixed;
- One more ideal child may rise the real number of children by 0.169, holding other factors fixed;
- People who live in urban are predicted to have 0.623 fewer children than those who do not live in urban;
- People who have television or radio are predicted to have 0.095 more children than those who do not own any media facilities;
- People who know birth control will have 0.06 more children than those who have no idea about contraception methods;
- People who use birth control methods will have 0.53 more children than those who do not use any contraception methods;

When it comes to model Children4, which contains interaction educ*urban, the estimated return to education for people who do not live in urban is -0.155. For people living in urban, it is -0.155 + 0.061= -0.094. The difference, 0.061 higher for the urbanite, is not economically large but statistically significant: the t statistic is 0.061/0.0236=2.57, statistically significant at the 1% level. Thus, we deny the hypothesis that the return to education is the same for urbanites and country dwellers. Moreover, the coefficient on urban, while remaining statistically significant at the 1% level, becomes economically larger, so I prefer model Children4. Then, I use the heteroskedasticity-robust standard errors to provide a simple method for computing t statistics that are asymptotically t distributed whether or not heteroskedasticity is present.

Based on model Childeren4, standardized beta coefficients are used to weight the impact of the independent variables, which was shown in Table 6. Using Beta Coefficient allows us to interpret coefficients by the standard deviation adjustments instead of units. This is helpful in cases where units are difficult to understand or have little meaning. In my regression model, although most variables educ(education), agefm(age at first marriage) and agefbirth(age at first birth) are measured by years, idlnchild(ideal number of children) is measured by the number of children. So after standard deviation adjustment, one unit increase in agefm will raise the number of children by 0.12, and one unit increase in agefbrth will decrease the children amount by 0.15, compared with 0.19 increases in children number if ideal children add one unit, holding other factors fixed respectively.

Last but not least, husband education level was used for subsamples, which is divided by education higher or lower than average standard. Equation Children 5 is the regression model for husband education over 5 years, and Children 6 is for husband education less than 5 years (See Table7). The coefficient of age at first birth in Children 6 is twice that in Children 5, and nomedia is nearly four times that in Children 5, which means these factors have more influence on fertility if the husband's education is lower. On the other hand, the coefficient of urban*education in Children 5 is three times higher than that in Children 6, which means, the gap of estimated return to education for people who live in urban is larger in Children 5 than that in Children 6.

The limitation of the analysis is the lack of religions effect on fertility. Some region may encourage people to have as many children as possible and forbid the usage of birth control, which may have a profound and lasting effect on fertility.

The data set has many limitations, as well. For example, the data of whether owns television or radio is behind the times. As a result, I would add "whether has internet" to the data set, since people spend more time on the network, including some social media, which effect peoples' notion and broaden their horizon. Women's ideas about freedom, equality, and right will be aroused through the internet, which let women realize that they are human first, women second, and a mother role at last. Therefore, women may pay more attention to themselves, like purchasing further education, having more career opportunities and exploring the probability of different living patterns, giving birth, and taking care of children are less taken into consideration. Another factor I may add to a designed data set is family annual income. Family annual income is probably related to fertility and education level because wealthy people have more resources for gaining education and pay more attention to the quality of children, which means people will spend more on children. So, family income does have an effect on fertility.

6. Conclusions

From the discussion above, we can draw a conclusion that education does have a negative effect on fertility, however, the model with quadratic "educ^2" may not applicable. The variable agefm(age at first marriage) has a positive effect, which means the later people get married, the more children they will have, totally adverse to my prediction. The age at first give birth has a negative direction, ten years later becoming parents, one less child will they have. The number of ideal children, presenting women's willingness to give birth, increases by 1, and the number of kids will increase by 0.17. Talking about people with the same level of education, if we use mean education year and get the result that urbanites may have 0.61 fewer kids than country dwellers, which is consistent with my prediction. Besides, contrary to popular belief, people who know birth control or use birth control tend to have more children than those who do not know or do not use contraception according to the regression result.

Compared with the paper of Gary S. Becker, who analyzed fertility within an economic framework, my analysis is lack economic data. The data set does contain the statistic about whether people have electricity and whether owning a bicycle, which is binary variables and may reflect the standard of living, however, it cannot represent the annual income, which is a continuous variable and related to the education level and fertility. Thus, I prefer to add family annual income as a new variable in future research.

To some extent, my analysis is consistent with the paper of Robert Jensen and Emily Oster, who also found that education decreases fertility, however, the introduction of cable television was found to be associated with significant decreases in fertility, which is opposite to my regression result. People with media facilities (television or radio) are predicted to have more children than those who do not. This result may have limitations because the coverage of media appliances is only television and radio, which may not reflect the true impact on fertility.

The analysis of "Childbearing preferences, reform of family planning restrictions and the Low Fertility Trap in China" by Stuart Basten and Baochang Gu plays an important role in my research, which contains an ideal number of children in the multiple regression model. The relationship between education and the ideal number of children has been shown in Graph4. Higher educated people tend to have a less ideal number of children, and the ideal number of children does have a positive effect on fertility. As a result, the ideal number of children also proves the negative impact of education on fertility.

As I mentioned in the first part of my paper, many countries are facing low fertility and trying to encourage people to give birth, however, the fertility rate is destined to decrease since people have more ways to acquire knowledge and gain more education than ever before. From my regression result, the government may pay more attention to the factors that have a positive effect on fertility, like the ideal number of children, which reflects the willingness to give birth. The government can do some investigations into people's

worries about having more children and launch some policies that clear those barriers. For example, giving some support to women who have babies, including longer maternity leave with higher maternity pay, offering baby sitters from neighborhood and financial aid. Graph5 is an investigation of what hinders people to have a second child after China government has launched the “second-child policy” in Shanghai. As we all know, the “one-child policy” was launched in 1980 in China, the fertility has been totally changed by the political policy. In 2015, the Chinese government renewed the policy that allows people to have two children, and recently, the newest policy came out to encourage people to have three children. Unfortunately, the fertility rate increased a little but maintained a very low rate at last. The expenditure of raising a child is too heavy, which ranks as the No.1 reason, and the factor that parents have no more time to take care of the second child ranks No.2. Further supporting policies can be acted to clear these barriers.

Actually, what I am worried about recently is the anti-abortion law has been launched in many states, the effect on the fertility may show in the future, which can be analyzed within time series regression. Although anti-abortion law should have the function of increasing the fertility because it bans abortion, the law violates the women’s rights and the notion of freedom, which may lower their willingness to give birth at the moment because they have to think twice before pregnant and take the responsibility and burden stress even if they regret to pregnant. That’s why we can read some news about more women traveling to other states to have abortion surgeries. What I feel worried about is the methods of increasing fertility, banning abortion instead of encouraging people to have more children may arouse more resistance.

For future research, I would pay more attention to the policy’s effect on fertility within time series regression. The data set may contain family annual income to test the effect and more time-series data as well.

7. Figures and Tables

Table 1

Variable	Obs	Mean	Std. dev.	Min	Max
children	1,825	3.616438	2.134911	0	13
educ	1,825	5.087123	4.215361	0	20
agefbrth	1,825	19.16548	3.273534	10	38
idlnchld	1,825	5.244384	2.331493	0	20
agefm	1,825	20.70356	5.001569	10	46
heduc	1,721	5.263219	4.834455	0	20

Table 2

-> urban = 0

Variable	Obs	Mean	Std. dev.	Min	Max
children	845	4.134911	2.230928	0	13
educ	845	3.727811	3.713271	0	17

-> urban = 1

Variable	Obs	Mean	Std. dev.	Min	Max
children	980	3.169388	1.941399	0	10
educ	980	6.259184	4.271932	0	20

Table 3

-> nomedia = 0

Variable	Obs	Mean	Std. dev.	Min	Max
children	1,298	3.507704	2.092027	0	12
educ	1,298	5.946071	4.257175	0	20

-> nomedia = 1

Variable	Obs	Mean	Std. dev.	Min	Max
children	527	3.88425	2.216401	0	13
educ	527	2.971537	3.25955	0	14

Table 4

-> knowmeth = 0

Variable	Obs	Mean	Std. dev.	Min	Max
children	58	4.017241	2.274893	1	11
educ	58	1.051724	2.557565	0	10

-> knowmeth = 1

Variable	Obs	Mean	Std. dev.	Min	Max
children	1,767	3.603282	2.129566	0	13
educ	1,767	5.219581	4.193967	0	20

Table 5

-> usemeth = 0

Variable	Obs	Mean	Std. dev.	Min	Max
children	576	3.630208	2.436046	0	13
educ	576	3.090278	3.483952	0	16

-> usemeth = 1

Variable	Obs	Mean	Std. dev.	Min	Max
children	1,249	3.610088	1.98171	0	11
educ	1,249	6.008006	4.205834	0	20

Table 6

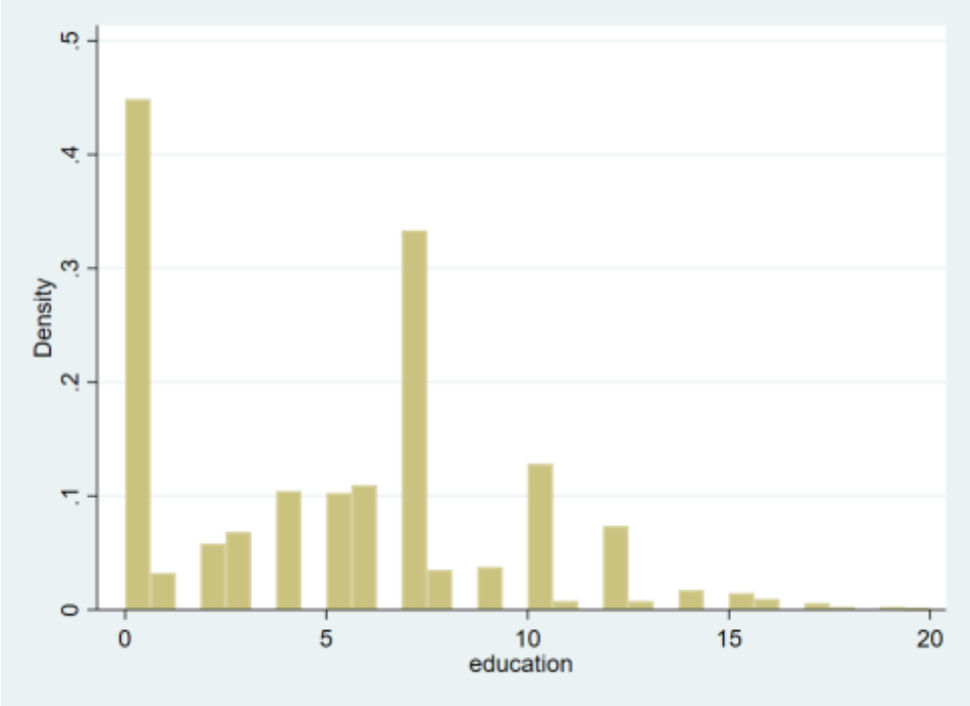
children	Coefficient	Std. err.	t	P>|t|	Beta
educ	-.1551784	.0193046	-8.04	0.000	-.3063983
agefm	.051795	.0099263	5.22	0.000	.1213429
agefbrth	-.0971713	.0157495	-6.17	0.000	-.1489962
idlnchld	.1716639	.0207104	8.29	0.000	.1874707
urbeduc	.0607348	.0235715	2.58	0.010	.1257572
urban	-.916658	.1493251	-6.14	0.000	-.2141535
nomedia	-.1109614	.1060518	-1.05	0.296	-.0235609
knowmeth	.1744126	.2754058	0.63	0.527	.0143346
usemeth	.531584	.1060514	5.01	0.000	.1157553
_cons	4.083035	.430341	9.49	0.000	.

Tabel 7

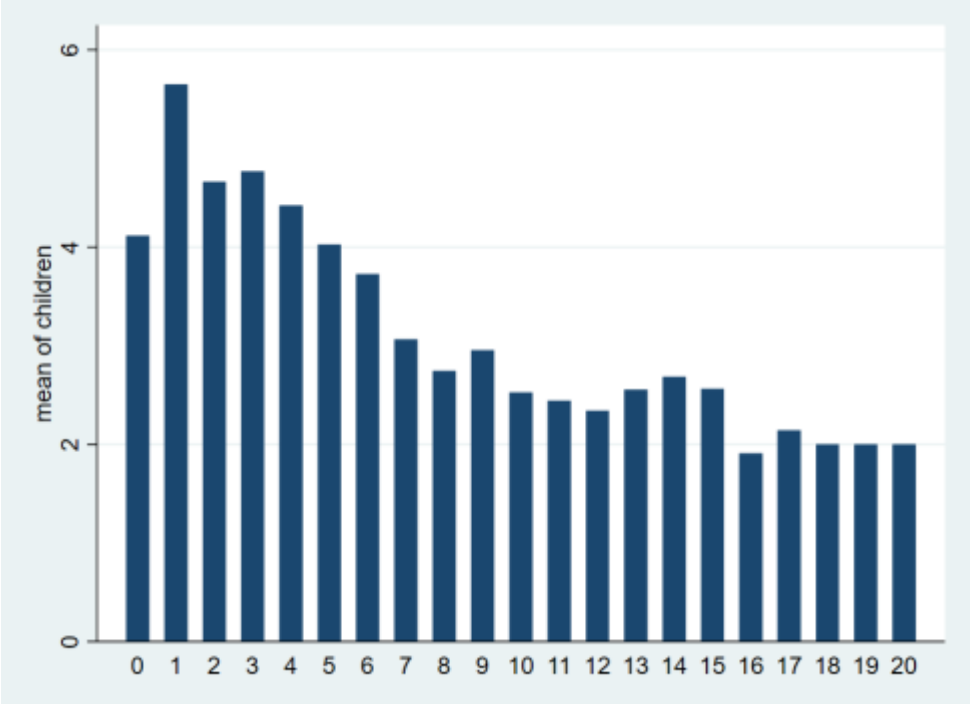
	(1) Children SLR	(2) Children MLR	(3) Children quadratic	(4) Children interaction	(5) Children husband e-ducation>5	(6) Children husband e-ducation≤5
education	-0.160	-0.118	-0.132	-0.155	-0.109	-0.135
	(0.0113)	(0.0130)	(0.0291)	(0.0193)	(0.0245)	(0.0336)
age at first marrige		0.0518	0.0518	0.0518	0.0463	0.0586
		(0.00994)	(0.00994)	(0.00993)	(0.0125)	(0.0154)
age at first birth		-0.0934	-0.0951	-0.0972	-0.0695	-0.132
		(0.0157)	(0.0160)	(0.0157)	(0.0190)	(0.0257)
idlnchld		0.169	0.170	0.172	0.207	0.134
		(0.0207)	(0.0207)	(0.0207)	(0.0265)	(0.0316)
urban		-0.623	-0.623	-0.917	-0.572	-0.797
		(0.0966)	(0.0966)	(0.149)	(0.212)	(0.231)
nomedia		-0.0945	-0.0960	-0.111	-0.0664	-0.249
		(0.106)	(0.106)	(0.106)	(0.143)	(0.157)
know birth control		0.0594	0.0700	0.174	-0.267	0.291
		(0.272)	(0.273)	(0.275)	(0.582)	(0.342)
use birth control		0.530	0.532	0.532	0.667	0.497
		(0.106)	(0.106)	(0.106)	(0.136)	(0.162)
education # educat~n			0.00120			
			(0.00220)			
urban*education				0.0607	0.0439	0.0154
				(0.0236)	(0.0284)	(0.0502)
Constant	4.42	3.988	4.029	4.083	3.140	4.982
	(0.0744)	(0.429)	(0.436)	(0.430)	(0.704)	(0.627)
Observations	1825	1825	1825	1825	996	829
R-squared	0.0995	0.1846	0.1848	0.1876	0.1695	0.1261
Adjusted R-squared	0.0990	0.1810	0.1807	0.1836	0.1619	0.1165
Breusch-Pagan Test P-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0202
White Test P-value	0.0000	0.000 0	0.0000	0.0000	0.0000	0.0000

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

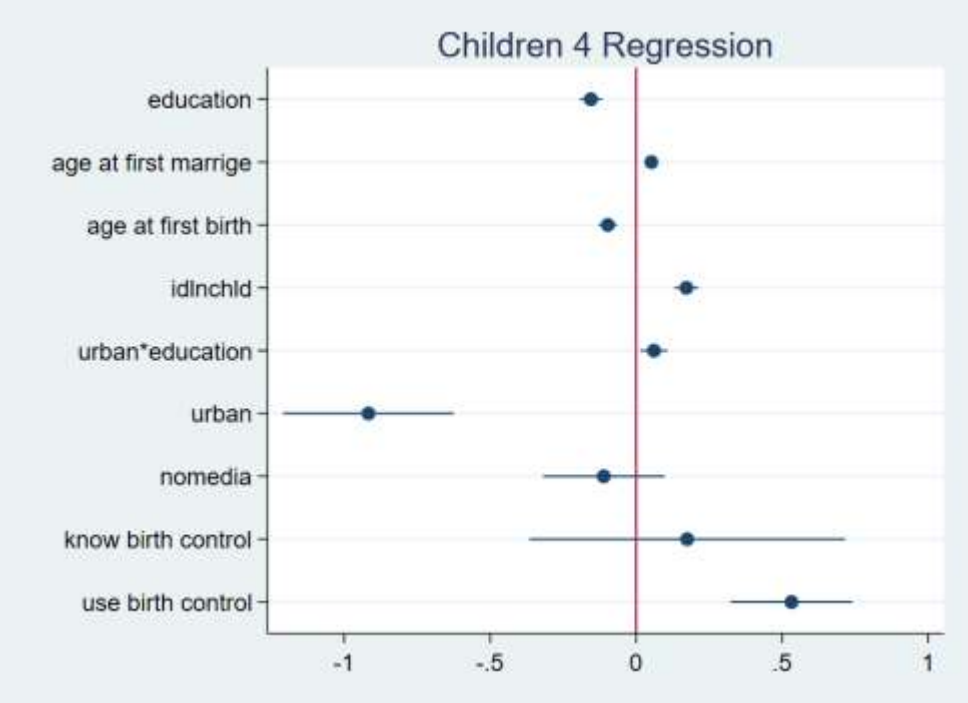
Graph1



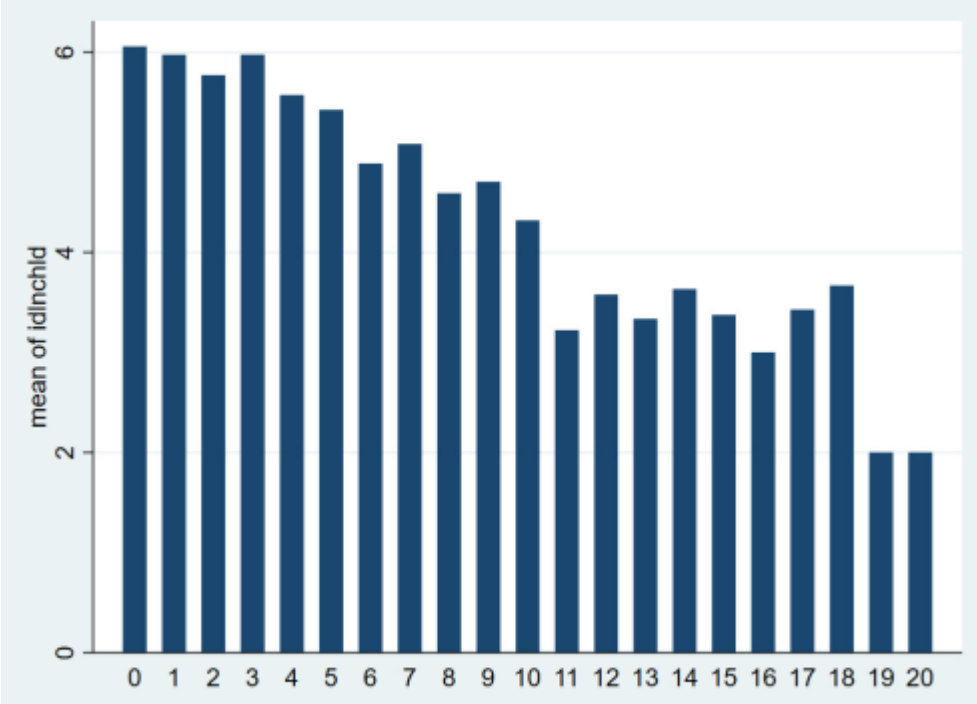
Graph2



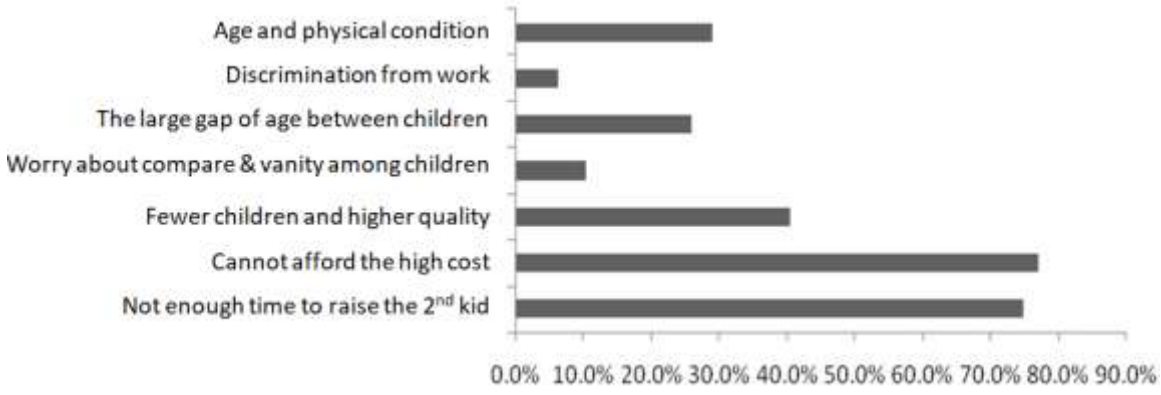
Graph3



Graph4



Graph5



8. Reference

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