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The Impact of Family Planning Program in Lowering Fertility

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Since the end of the World War II, the population explosion of developing countries has been a global concern. However, the impact of family planning program effort to reduce fertility is difficult to measure, as the effort level is endogenously determined. This paper studies if the family planning program impact is substantial and statistically significant in fertility reduction using fixed effect analysis. The fixed effect estimate shows that there is little impact of family planning program effort on fertility. Only the higher income countries showed significant negative impact.

Keywords: fertility, family planning program

I . Introduction

The world population exponentially grew after it reached 1 billion in the mid-19th century (Weeks, 2012). By the end of the 19th century, the population of the part of the world referred to as “developing” alone has already reached a billion. By the late 1950 it

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surpassed 2 billion, it reached 3 billion by 1975, and it exceeded 4 billion in the early 1990s (Bongaarts et al., 1990). In the early 21st century, the number has reached 5 billion. 1) Consequently, rising concern about rapidly increasing population led to a concerted government-level effort to reduce fertility rate. In 1952, the first government family planning program was established in India. In addition the International Planned Parenthood Federation (IPPF) was established that year. After that, the scope and the number of such programs dramatically increased. By 1985, 70 countries had either national family planning programs or significant nongovernmental family planning programs that are at least indirectly supported by government (Brown, 1987; World Bank, 1984).

However, the impact of family planning programs on fertility reduction is difficult to estimate, as the family planning program effort is endogenously determined by each government. For example, countries with greater need for contraceptives may decide to invest more in family planning programs. As well, selection into a greater family planning program effort may be driven by unobservable country specific characteristics that are also correlated with total fertility level. For these reasons, the causal inference between family planning program effort and fertility level is difficult to make.

This paper estimates family planning program impact on fertility, using country fixed effects. We use Ross and Mauldin's (1996) cross-country estimate of family planning program effort, measured in four different time periods between 1972 and 1994, as the policy variable. The fixed effect estimate allows us to estimate the impact of family planning programs, controlling time invariant country specific unobservable characteristics that may drive the endogenous selections. We also estimate heterogeneous impact of family planning programs on fertility by region, religion and income level.

The rest of the paper is organized as it follows. In the next section, we will introduce related literatures about the impact of family planning programs on fertility. In the following section, we will describe the dataset and highlight factors that may affect fertility decision of households, such as income per capita, education level, urbanization, and family planning

1) The long run population projection of the developing nations from World Bank indicates that the population of the region will level off at about 10 billion by the end of the next century (Demeny 1990).

program efforts. After that, we will present the empirical strategy. In the next section, we will present and discuss the implications of the results. Then, we will conclude the paper in the final section.

II. Literature Review

The first rapid decline in fertility level occurred in Europe in the 19th century, without family planning programs or modern contraceptives (Freedman, 1990). Friedlander (1973) similarly showed that the decrease in fertility of Israel was independent of state run family planning program, hence concluding that such programs were not necessary for the decline in fertility. The economic development that improves the value of human capital, indicated by education level, per capita income and urbanization consequently lowers the desired level of fertility and lack of contraceptives would be made up through private channels (Demeny, 1990).

The ongoing debate is whether the fertility transition for the developing countries in the 20th century would have been delayed had it not been for the family planning programs, because the reduction in desired fertility may not have been achieved or at least delayed due to lack of knowledge or resources to practice contraception.²⁾ Freedman (1990) argues that the impact of increasing availability of birthcontrol methods is not negligible in declining fertility rate of less developed region in the 20th century because the main aspect of family planning programs is to increase the availability of contraceptives among general population. Theoretical research that connects economic factors such as technological advancement with fertility reduction also illustrates that expensive birth control method is a factor that limits human capital investment (Rosenzweig, 1990).

Application of methodology used by Preston (1975) yields that non-economic factors

2) Bongaarts et al. (1990) reports that the developing region would have had 4.6 billion more people by the year 2100, under the assumption that the fertility transition of the developing countries would have been delayed without family planning programs.

contribute to reduction of population size in less developed region of the world by roughly 10% in 2000 (Heuveline, 2001). Watkins (1987) compares the fertility decline in Europe and in the third world, using the European Fertility Project and the World Fertility Survey and finds the case where fertility decline is initiated in a relatively rural or poorer region of the world (e.g. France, China, Sri Lanka, and Thailand), or it occurs later than suggested by macroeconomic variables (e.g. England and Mexico). He argues that institutional change can explain these exceptions. Family planning programs, first began in Asian countries, are a major example of such institutional changes and it accords well with fertility decline of the region. The decline in fertility seemingly independent from economic development may be evidence that family planning program impact is significant.

However, there are sources of endogeneity in estimating family planning program impact on fertility. Endogeneity may be generated by regional unobserved characteristics that affect the endogenous determination of the program effort (Rosenzweig and Wolpin, 1986; Rosenzweig and Wolpin, 1988). Some studies use experiments to make causal inferences. Using the Taichung City (Taiwan) experiment of 1963, Freedman and Takeshita (1969) show that the family planning programs significantly raise acceptance to contraceptive usage. Sinha (2005) finds that the impact of family planning program is significant in lowering fertility using experiments conducted in Matlab sub-district of Bangladesh in 1978.³⁾

This paper is in line with a small number of literatures that use fixed effects to estimate causal impact of family planning programs. Studies that use within-country regional fixed effects of Indonesia find that the impact is either small or statistically insignificant (Gertler and Molyneaux, 1994 and Pitt et al., 1993) but similar study of India shows that the impact is statistically significant (Duraismy and Malathy, 1991). Schultz (1994) and Miller (2010) also use fixed effect methods to show that the program effort is not significant in fertility reduction.

3) Sinha (2005) finds that family planning program reduces fertility mainly through increased birth spacing. Kim (2010) also finds that family planning programs in Indonesia has positive impact on birth spacing.

III. Data

Measuring family program effort for different countries is not easy, nor is it possible to treat the 'existence' of such programs as a dummy variable because almost all less developed countries of the world have family planning program nowadays. Therefore, we need a dataset that compiles the degree of family planning program efforts. The widely accepted dataset that assesses the family planning program efforts is the one composed by Ross and Mauldin (1996). The Ross and Mauldin dataset keeps track of the family planning program effort of 93 developing nations.

They report scores based on detailed questionnaire answered by officials directly involved in family planning programs in each country, citizens familiar with such programs, donor personnel in various agencies, and knowledgeable foreigners in the year 1972, 1982, 1989, and 1994. The maximum score is 120, and scores are grouped into 4 categories for classification conveniences: policies and stage-setting activities, service and service-related activities, record-keeping and evaluation, and availability of contraceptive methods.⁴⁾

The dataset from 1982, 1989, and 1994 are the same in design and procedure. They used 30-item scale, improved from 15-item scale of 1972 (Lapham and Mauldin, 1972), with 8 items in policy stage-setting activities, 13 items in service and service-related activities, 3 items in record-keeping and evaluation, and 6 items in availability of contraceptive methods (Lapham and Mauldin, 1985). The score ranges from 0 to 4 for each item, 4 indicating the strongest program. Thus, the maximum possible scores are 32 for policy stage-setting activities, 52 for service and service-related activities, 12 for record-keeping and evaluation, and 24 for availability of contraceptive methods. They did not merely take the average of

4) Family programming effort sharply increased from 1972 to 1982, and again from 1982 to 1989 overall. However it did not change much from 1989 to 1994, when some countries that reached desirably low enough fertility rates purposely decreased their family planning effort. The regions that had the lowest score in 1989 survey were the ones that increased their score most between 1989 and 1994, mostly in policies and stage-setting activities category.

the scores reported by all participants. Rather, they discounted responses that were very different from others, and for each item, tried to extract the answer from the correspondent who is most knowledgeable about the program in each country. Although 1972 survey was a little different in design, Ross and Mauldin (1996) concluded that it was sufficiently similar to later surveys to allow reasonable comparisons.

We construct a year-by-country panel as specified in Ross and Mauldin.⁵⁾ Measures for education, urbanization, per capita income and total fertility rate are all attained from the United Nations country database. Total fertility is available from the United Nations national data of 1973, 1983, 1988, and 1993. For education measure, we divide the total number of education enrolment at secondary level by total population of each country for years 1970, 1980, 1990, 1996, the closest available years from Ross and Mauldin measure. The percentage of urban population is available for years 1970, 1980, 1990, and 1995. ⁶⁾ Summary statistics in Table 1 show that the program effort varies widely from 0 to 92 from country to country.

Some nations, mostly from Africa, report that their total fertility is exactly the same to three decimal places in all four sample periods in 1972, 1982, 1989, and 1994. It is highly likely that the countries are reporting identical self-reported fertility rate for over two decades due to errors in data collection.⁷⁾ Therefore, countries that self-report the same fertility rate from 1972 to 1994 are dropped out from the sample.⁸⁾

Countries are categorized into 7 religion groups: Buddhism, Roman Catholic, Christianity, Hindu, Muslim, Other indigenous, and none. If more than 50 percent of population in a country is indicated as having one specific religion,⁹⁾ the country is classified under the

5) We use the actual value provided by Ross and Mauldin.

6) Dataset reference numbers for UN website are: 14920 for total fertility, 13660 for total population, 13710 for urbanization, and 19510 for GDP/capita. The secondary enrolment data is from UNESCO Institute for Statistics (http://stats.uis.unesco.org/unesco/TableViewer/document.aspx?ReportId=136&IF_Language=eng&BR_Topic=0).

7) There was a total fertility rate dataset directly gathered by UN, not self-reported, also available, but the dataset was too limited in duration and in the number of countries.

8) Those countries were Benin, Bhutan, Burundi, Burkina Faso, Central African Republic, Chad, Congo, Cote d'Ivoire, Laos, Liberia, Mali, Mozambique, Nigeria, Oman, Sierra Leone, Somalia and Togo.

9) Source: CIA World Factbook

〈Table 1〉 Summary Statistics

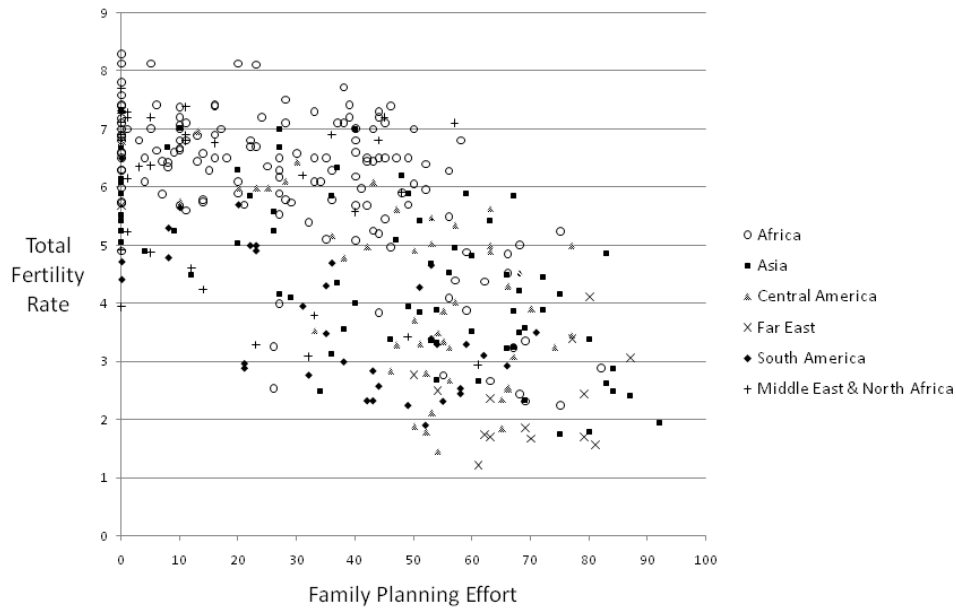
	Sample Mean	Minimum	Maximum
Total fertility rate	5.18 [1.66]	1.46	8.12
Program effort	35.67 [24.66]	0	92
Male secondary school enrollment ratio	0.40 [0.22]	0.02	0.87
Female secondary school enrollment ratio	0.34 [0.24]	0.006	0.93
Per capita income (in'000sUSD)	1.61 [3.07]	0.07	24.82
Urbanization	41.96 [23.16]	2.4	95.5
Number of observations	169		

Note: Standard errors are reported in squared brackets. The male and female enrollment ration is the proportion of secondary school age population enrolled in secondary education..

religion. Otherwise, the country is categorized under 'none', indicating that there is no major religion in that country. Finally, to control for the non-religious cultural aspect of each country, countries are divided into the following 5 regional categories, based on the location: Asia, Middle East and North Africa, Africa, Central America, and South America.

The plot of family program effort measure against total fertility rates reveals that there seems to be a weak negative correlation between them (See Figure 1). There are regional variations in the two variables. Countries in Africa tend to have relatively lower level of family planning effort with greater total fertility level while countries in the Far East tend to have relatively greater level of family planning effort with smaller total fertility level. Middle Eastern and Northern African countries tend to have total fertility rates greater than 5 while most Asian countries display total fertility rate of less than 5.

(Figure 1) Family Planning Program Effort and Total Fertility Rate of Developing Countries 1972-1994



IV. Empirical Strategy

The fixed effect model is used to analyze the impact of family planning programs. The dependent variable is total fertility level of a country. The equation to be estimated takes the following form:

$$TFR_{it} = \alpha PE_{it} + \beta X_{it} + \tau_t + D_i + e_{it} \quad (1)$$

where i indexes countries and t indexes time. PE_{it} is the Ross and Mauldin (1996) measure of family planning program effort and X_{it} represents time variant country specific

characteristics such as proportion of population enrolled in tertiary education, per capita income and urbanization.¹⁰⁾ The country fixed effect (and region and religion fixed

effect) is represented by D_i and τ_t represents year fixed effect.

The time variant country specific characteristics represent the determinants of desired fertility. Industrialization and urbanization are defining factors for the onset and the progress of decreasing fertility rates and a numerous empirical works confirms the connection (Mosk, 1977). According to Axinn and Barber (2001), education level of the husband and the proximity to school of wife when young affects fertility rate negatively, indicating that education is a determining factor of fertility. In addition, Rosenzweig (1990) reaffirms the theory that the increasing wage rate is related to decreasing fertility. In addition, we add country specific regional and religious variables to measure the impact of religion and other behavioral/cultural aspects specific to geography on fertility. We use similar set of control variables as in other empirical literatures that use the fixed effects such as Schultz (1994) and Gertler and Molyneaux (1994).

The PE_{it} variable is endogenously determined by other economic variables and the desired fertility level. However, it is difficult to find a proper instrumental variable for cross-country studies, as it was done in Molyneaux and Gertler (2000) that exploit the within country variation in family planning program budget. Therefore, in this study, we use the country fixed effects to control for country specific unobservable characteristics that may affect program effort and fertility.

V. Results and Discussions

The result of the empirical analysis in regression model (1) is presented in Table 2. The first three columns report the regression results without using country fixed effects. Column

10) To control for heteroskedasticity in the error term, we used clustered standard error on year of observation.

〈Table 2〉 Estimation Results

	Without FE			With FE
	(1)	(2)	(3)	(4)
Program effort	-0.034*** (0.006)	-0.026*** (0.005)	-0.027** (0.006)	-0.002 (0.006)
Male secondary school enrollment ratio	1.437 (0.743)	0.989 (1.049)	0.969 (1.214)	-0.239 (0.800)
Female secondary school enrollment ratio	-3.828*** (0.830)	-2.913** (1.049)	-2.893* (1.170)	-2.240** (0.505)
Per capita income (in'000sUSD)	0.012 (0.015)	-0.017 (0.015)	-0.017 (0.017)	-0.056 (0.078)
Urbanization	-0.016** (0.005)	-0.024*** (0.004)	-0.024*** (0.004)	-0.015 (0.012)
Regional Fixed Effects: (Control Group: Far East)				
Africa		0.984*** (0.071)	0.972*** (0.076)	
Central America		0.292 (0.276)	0.309 (0.281)	
South America		-0.279 (0.458)	-0.263 (0.474)	
Middle East		1.522** (0.399)	1.505** (0.410)	
Religion Fixed Effects: (Control Group: No Major Religion)				
Buddhism		-0.073 (0.178)	-0.081 (0.276)	-0.946*** (0.181)
Roman Catholic		1.292*** (0.266)	1.268** (0.287)	1.336 (0.702)
Christianity		0.385** (0.098)	0.377** (0.111)	0.670 (0.529)
Hindu		0.641*** (0.070)	0.652*** (0.091)	-1.204* (0.528)
Muslim		0.563*** (0.089)	0.564*** (0.095)	0.506 (0.275)
Other		0.346 (0.504)	0.308 (0.489)	0.451 (0.477)
Time Fixed Effects	No	No	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Observations	169	169	169	169
Adjusted R2	0.709	0.798	0.800	0.956

Note: Dependent variable used is total fertility rate. The analysis is identical to the model specified in equation (1). Standard errors are reported in parenthesis. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level. The male and female enrollment ratio is the proportion of secondary school age population enrolled in secondary education. The standard errors are clustered by the year of observation.

(1) only includes time variant economic variables, column (2) additionally includes regional and religious time invariant controls and on top of that, column (3) includes the time fixed effects. Column (4) is the results of fixed effect estimate, where all independent variables from model (3) are included except for region fixed effects, replaced by country fixed effect. The coefficient of primary interest α is reported in the top row.

The fully specified model (3) shows that the improvement of score from 0 to the average of 36 would increase the total fertility rate by 0.97, or 19%, which is quite significant. The female secondary school enrollment ratio and urbanization also have strong effect on fertility level. Compared to the Far East, Africa and the Middle East have higher total fertility rate. Compared to the no major religion group, all other religious groups except for Buddhist countries have greater fertility. However, the impact of family planning program disappears when country fixed effect is included, as it shows in column (4). This implies that the significant correlation between the program effort and fertility is mainly driven by endogenous selection. This result is consistent with Schultz (1994) and Miller (2010) that both find little impact of family planning program on fertility.

The impact of family planning effort on fertility varies by region, religion and income level (See Table 3). Table 3 reports the coefficient of interest α for regression models (1) to (4) as specified in Table 1, for subgroups by region, religion and income level. Panel A divides the whole sample by regional subgroups. In the fixed effect model, countries in all regions show little impact of program effort on fertility. The magnitude of the estimated impact also precipitously drops when the fixed effect is included.

In Panel B, the program impact is reported by religion subgroups. In the fully specified model without country fixed effect, the family planning program effort has significant effect on fertility. For example, in Muslim countries, the increase in family planning effort from 0 to the average of 36 is correlated with the fertility reduction of 1.3, or 24% of the average total fertility rate among Muslim countries, 5.4. However, the strong correlation disappears under fixed effect model and the magnitude of the effect also precipitously decreases.

We divided developing countries into three categories in Panel C: low income countries whose per capita income is less than \$1,000, middle income countries whose per capita income is between \$1,000 and \$2,000 and high income countries whose per capita income

〈Table 3〉 Family Planning Program Impact Coefficient for Subgroups by Regional, Religious and Income Level

Independent Variable	Without FE			With FE
	(1)	(2)	(3)	(4)
Panel A: Program Effort by Region				
Asia	-0.029** (0.008)	-0.031 (0.014)	-0.035 (0.019)	0.002 (0.006)
Africa	-0.014** (0.003)	-0.015** (0.004)	-0.023** (0.004)	0.005 (0.007)
Central and Latin America	-0.013 (0.008)	-0.013 (0.007)	-0.013 (0.009)	-0.0004 (0.009)
Middle East	-0.044** (0.013)	-0.044* (0.013)	-0.041 (0.019)	0.0003 (0.014)
Panel B: Program Effort by Religion				
Roman Catholic	-0.010* (0.005)	-0.015** (0.005)	-0.014** (0.004)	-0.001 (0.005)
Christianity	-0.001 (0.004)	-0.006** (0.002)	-0.019** (0.005)	-0.007 (0.003)
Muslim	-0.047*** (0.003)	-0.037*** (0.004)	-0.036*** (0.003)	-0.003 (0.010)
No Major Religion	-0.042*** (0.007)	-0.019** (0.005)	-0.033*** (0.006)	-0.017 (0.013)
Panel C: Program Effort by Income Level				
Low Income (percapitaincomelessthan\$1,000)	-0.026*** (0.004)	-0.019** (0.004)	-0.023** (0.005)	0.004 (0.003)
Middle Income (percapitaincomebetween\$1,000and\$2,000)	-0.055*** (0.003)	-0.043*** (0.005)	-0.041*** (0.004)	-0.002 (0.013)
High Income (percapitaincomegreaterthan\$2,000)	-0.034** (0.010)	-0.023 (0.012)	-0.015 (0.008)	-0.027** (0.007)

Note: Dependent variable used is total fertility rate. This table reports coefficient from regression model (1) for specified model and subgroup. Model (1)-(3) were identified by running the regression model (1) on each respective subgroup. Model (4) was identified by including country fixed effects, and in case of panel B and C, excluding region fixed effects from model (3). The religious subgroups Buddhism, Hindu and Other were omitted due to limited number observations. Standard errors are reported in parenthesis. *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level.

is greater than \$2,000. As it is the case for all countries grouped by region and religion, the fixed effect estimates imply that there is little impact of program effort on fertility, except for the high income countries. For the high income countries, the increase in the program effort from 0 to the average of 36 implies a drop of fertility by 1.0, or 24% of the average total fertility rate of these countries, 4.2.

Impact of family planning effort may vary by income level due to the level of unwanted fertility and measurement error. Level of unwanted fertility and the need for contraceptives may vary across income levels. Economic structure, proximity to industrialized regions of the world, cultural openness and acceptance to contraceptive use and climate characteristics that affect the use of contraceptives are contributing factors of unwanted fertility. In extremely low income countries, the level of unwanted fertility may be smaller or even negligible because the economic, social and cultural motivations to reduce fertility may be small. Then, in those regions economic variables and time trends may be enough to explain the fertility trend. In addition, as the family planning effort is a survey data, degree of leniency of respondents may lead to overstatement of family planning effort. If the respondents are systematically more lenient when the fertility level of the country is low because of perceived successfulness of the program, then the impact of family planning program effort would be overstated in countries with low fertility. Therefore, higher income countries with suitable economic and social structure may have greater level of unwanted fertility and/or the family planning program effort survey respondents may be systematically more lenient in self-assessment than the respondents in relatively poor countries.

VI. Conclusion

Consensus exists among scientists that desired fertility level is strongly affected by economic variables, as illustrated by fertility transitions of both the developed and developing countries. However, whether the family planning programs introduced in the mid-20th century among the developing countries shorten the time for the onset of fertility

transition is still much debated. Only a few past literatures studying the correlations of family planning program and fertility level using cross-country data rigorously examined the endogenously determined family planning program effort, by using fixed effects. We use the fixed effects to control for the selection and find that the impact of family planning program is negligible. We also introduce regional and religious variables and find that they are also important determinants in fertility. Finally, we find that sensitivity of fertility level to program effort varies by income level. Results of this paper suggest that family planning effort would have significant impact on fertility in higher income countries. Policy makers may consider income subgroup variation of planning program effort to optimize the effectiveness of family planning program effort on fertility reduction.

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요 약

가족계획 사업이 출산율 저하에 미치는 영향

김 영 일

제2차 세계대전 이후, 후진국의 폭발적인 인구 증가는 세계적인 근심을 야기했다. 하지만 출산율을 낮추려는 가족계획 사업의 효과는 이러한 정부 계획이 내생적으로 결정되기 때문에 측정하기 힘들다. 이 논문은 고정효과 모형을 써서 가족계획 사업의 출산율 저하에 대한 영향이 통계적으로 유의한지 밝혀내고자 한다. 고정효과 추정에 따르면 가족계획 사업이 출산율에 미치는 영향은 극히 미미하다. 그 중 1인당 소득이 높은 편인 국가들만이 유의한 음의 효과를 보여준다.

주제어: 출산율, 가족계획 사업