The Effect of Contraceptive Knowledge on Fertility: the Roles of Mass Media and Social Networks

This study examines the effect of contraceptive knowledge on fertility using an instrumental variables approach. It draws upon the "Knowledge, Attitudes, and Practice of Contraception in Taiwan" (KAP) dataset and focuses on the period when Taiwan's family planning programs were in effect. The results indicate that mass media and social networks play important roles in disseminating contraceptive knowledge. Women who are regularly exposed to mass media, or who have a wider social network, have more knowledge about contraceptives than their counterparts. This study finds that women transform their knowledge into behavior--that is, contraceptive knowledge reduces fertility, no matter which fertility metric is measured (life-time fertility or probability of giving birth). This study adds to the existing literatures on the relationship between knowledge and behaviors.

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Long Abstract

This study explores the effect of contraceptive knowledge on fertility using an instrumental variables approach. It draws upon the "Knowledge, Attitudes, and Practice of Contraception in Taiwan" (KAP) dataset and focuses on the period when Taiwanese family planning programs were in effect. This study differs from previous studies examining the effectiveness of family planning programs on fertility by focusing on individuals' obtained contraceptive knowledge and fertility. The results indicate that mass media and social networks play important roles in disseminating contraceptive knowledge. Women who are regularly exposed to mass media, or who have a wider social network, have more knowledge about contraceptives than their counterparts. This study finds that women transform their knowledge into behavior--that is, contraceptive knowledge reduces fertility, no matter which fertility metric is measured (life-time fertility or probability of giving birth). Since very few studies focus on the relationship between contraceptive knowledge and fertility, by exploring this relationship, this paper contributes to an improved understanding of how the individuals obtain the disseminated knowledge; how socioeconomic characteristics, mass media exposure, and social network influence the forming of knowledge; and whether the obtained knowledge is transformed into new behaviors.

1. Introduction

Many advertising campaigns sponsored by private or public agencies disseminate health, nutrition, and product information aimed at changing people's behaviors. Such information about issues reaches its goal only if individuals obtain the disseminated information and transform the acquired information into new behaviors. This study focuses on the period when Taiwan's family planning programs were in effect and examines the relationship between contraceptive knowledge and fertility. It examines how the individuals build their contraceptive knowledge from the programs; how socioeconomic characteristics, mass media exposure, and social network influence the forming of that contraceptive knowledge; and whether the obtained contraceptive knowledge *reduces* fertility.

The implementation of family planning programs is an example of providing information intended to change behaviors: information about contraceptive techniques is provided to women of childbearing age so that they will increase the practice of contraception and thus control fertility. The ultimate aim is to couple low birth rates with a consistently low mortality rate to reduce population growth. For developing countries where the population transitions from a combination of high mortality rate and high birth rate to a combination of low mortality rate and high birth rate, the resulting rapid population growth may create pressures on housing, education, and social patterns. Such a situation often dramatically increases the financial burden of the nation as a whole. In order to control population growth by reducing fertility rates, governments may opt to implement family planning programs which provide married couples with information about modern contraceptive techniques, contraceptive access, and the benefits of having

fewer children. In some societies, such programs may also aim to overcome entrenched gender preference toward sons.

Several studies have focused on investigating whether such family planning programs play any role in decreasing fertility, or whether the decrease is actually driven by economic and social changes; for example, improved educational and economic opportunities for women might cause them to desire fewer children.[1] However, the endogenous characteristics of the input-allocation of family planning programs – high fertility villages tend to be the target of family planning programs and hence receive more family planning inputs than other areas – make the evaluation of the causal effect of family planning programs challenging[2].

This study differs from previous studies examining the effectiveness of family planning programs on fertility by focusing on individuals' obtained contraceptive knowledge and fertility. This study examines the factors related to the acquisition of contraceptive knowledge, and the relationship between an individual's contraceptive knowledge and their fertility during the period when family planning programs were enacted. Since dissemination of information relating to modern contraceptive techniques is one of the main ways for family planning programs to control fertility, examining the ways married women obtain contraceptive knowledge from the programs; the differences in knowledge acquisition across different demographic, social, and economic clines; and the subsequent effects on fertility sheds new light on the effectiveness of family planning programs, as well as the relationship between contraceptive knowledge and fertility.

[1] A few studies address this issue. For example, Pritchett (1994) and Gertler and Molyneaux (1994).
[2] There are a few of randomly designed family planning programs, such as the Taichung city experiment conducted in 1963, the Matlab family planning program, and the family planning programs PROFAMILIA of Colombia (Sinha, 2005).

Taiwan's family planning programs, enacted nationwide in 1964, aimed to decrease the fertility rate in order to control population growth. To reach this goal, the programs educated citizens about population growth issues, extolled the benefits of smaller families and valuing daughters as highly as sons, and provided information about accessing and using contraceptive techniques. In Taiwan in the 1960s, primary education was not universal and both public transportation and communication technologies were limited;[3] the family planning program therefore used a variety of information dispersal techniques, including visiting families, placing advertisements/announcements in mass media, and encouraging word-of-mouth communication via friends, relatives, or neighbors to disseminate the information on family planning programs. For example, the information about modern contraceptive techniques, modern contraceptive access, and the benefits of having fewer children. Previous literature (for example, Kan and Tsai, 2004; Aggarwal and Rous, 2006; Barber and Axinn, 2004; Montgomery and Casterline, 1993; Behrman et al., 2002) have found that mass media exposure and word-of-mouth communication play important roles in obtaining the disseminated information in developing countries such as Taiwan, Nepal, India, and Kenya.

The detailed information on women's contraceptive knowledge, fertility history, mass media exposure, women's organization participation, and household and demographic characteristics in the "Knowledge, Attitude and Practice of Contraception in Taiwan" data sets allow researchers to measure directly women's contraceptive knowledge; contraceptive knowledge across socioeconomic characteristics, mass media exposure, and social networks; and the outcomes on fertility.

[3] In 1964, around 22% of the population did not have primary education, 3.9 per thousand households had the motor transportations, and 11.6 per thousand households had a telephone set in Taiwan. (Source: Taiwan Statistical Data Book)

However, the obtained contraceptive knowledge is jointly determined by factors related to the demand- and supply-side of contraceptive knowledge. Unobserved factors, such as a couple's modernization and their sex/ parity/ quantity preference toward children, determine the levels of demand for both fertility and contraceptive knowledge. The existence of unobserved factors makes identification of causality challenging. This study uses an instrumental variables approach to resolve the endogeneity issue. Mass media exposure and connection to social networks are treated as instrumental variables of contraceptive knowledge to examine the causal effect of contraceptive knowledge on fertility.

There have been several studies investigating the relationship between knowledge and behaviors applied to different fields of interest, such as product consumption, risky behaviors, and health outcomes. Very few studies, however, focus on the relationship between contraceptive knowledge and fertility[4]. By exploring this relationship, this paper contributes to an improved understanding of the relationship between knowledge and behavior.

This paper is structured as follows: Section 2 presents the background of Taiwan's family planning programs. Section 3 contains the literature review. Section 4 introduces the data that this paper uses and basic summary statistics. Section 5 contains the identification strategy. Section 6 presents the results. Section 7 evaluates instrumental variables. Section 8 concludes the study.

2. Taiwan's Family Planning Programs:

[4] Goldin and Katz (2002), Bailey(2006), Ananat et al (2007) use access to, rather than knowledge of, contraceptive techniques to analyze its effect on age of first marriage, professional career, and life-time fertility.

Taiwan's death rate fell from about 14 to 5 per thousand between 1948 and 1962, while the fertility rate remained unchanged. High fertility rates and low death rates led to an annual rate of population growth that reached 3.5% in the years between 1951 and 1956. The 3.5% growth rate caused the population to double in only 20 years (Freedman and Takeshita, 1969). Although it is possible for social and economic development to change the role of the traditional family and decrease the demand for children, it usually takes years to complete the transition from high mortality and fertility to low mortality and fertility. Therefore, Taiwan's family planning programs were implemented nationwide to slow down population growth and shorten the period of demographic transition to prevent a large population growth that might impede economic development.

Taiwan's family planning programs were enacted nationwide in 1964. Before 1964, there were some voluntary and quasi-governmental activities advocating family planning. For example, in 1950 the Joint Commission for Rural Reconstruction (JCRR) issued one million copies of the pamphlet, "The Happy Family," advocating family planning by the rhythm method. In 1954, the China Family Planning Association, a voluntary organization subsidized by the JCRR, organized a training program emphasizing birth control and child spacing for women living in the dependent villages (Freedman et al., 1994).

Around 1963 and 1964, there was an experimental study in the city of Taichung to test the effectiveness of a more intensive family planning program. This study established that many families were interested in family planning and that couples in all social strata would accept contraceptive techniques when they were offered. The success of the program provided support for a later nationwide family intervention. In 1964, the

government started a nationwide five-year plan, with a grant of US $24 million, to reduce the fertility rate by persuading 600,000 women to use contraceptives for their family planning needs.

The program involved 300 female health workers who made motivational and educational visits to women of childbearing age in their homes to offer subsidized contraceptives (Freedman et al., 1994). Since the number of pre-pregnancy health workers was limited, they concentrated first on visiting families with more than three children, those with sons, those living in high-fertility counties, the poor, and those living in remote villages. The reason was that these women had a stronger motivation to accept contraception, and their higher acceptance rates would most effectively lower the overall fertility rate.

The family planning program also used public media, such as radio, TV, newspapers, and slides at Taiwan's movie houses to explain contraceptive techniques and how to obtain contraceptives. Articles on family planning were clipped out every month from 15 of Taiwan's 22 newspapers. In 1965 there were a total of 319 articles related to family planning (Chu, 1966). In addition, around 50,000 posters were printed and placed in villages around the island. Mass media and word-of-mouth communication are the main ways to disseminate the contraceptive information. Over 60% of married women indicate they obtained the information about family planning from mass media or friends/ relatives/neighbors[5].

The government also used financial incentives to encourage women to use contraception. When new kinds of contraceptive techniques were introduced, the government updated their method of subsidizing contraceptives. The government first

[5] From KAP data sets.

encouraged using loop and subsidized half of the cost; then they started to encourage using contraceptive pills and condoms and subsidized part of the cost. In addition to the government's subsidization of sterilization surgery for the poor, each city government also used welfare funding to subsidize sterilization surgery for the general population (Freedman et al., 1994). The number of people undergoing surgical sterilization rose rapidly. The family planning programs were officially ended in 1985.

3. Literature Review:

There have been several studies investigating the relationship between knowledge and behaviors that have focused on different fields of interest, such as consumption and health-related behaviors. Some studies measure an individual's information acquisition about issues and examine the individual's subsequent behavior according to different information acquisition (for example, Kenkel, 1991; Kan and Tsai, 2004; Nayga, 2000); others focus on an event shock, such as the removal of the ban on nutrition claims on product and advertising style campaigns, to identify the information effect to examine different reactions among different subgroups toward the new information (for example, de Walque, 2004; Ippolito and Mathios, 1999).

Regarding the literature about factors related to fertility, there is a large body of literature, covering several different countries, investigating the relationship between contraception and fertility. Most of this literature focuses on contraceptive access rather than knowledge. Several studies focus on family planning programs in the developing countries. They use the time and location variation among family planning programs as inputs to investigate the effect of contraception access on fertility (for example, Miller,

2008). A few studies focus on fertility in the U.S.; they use abortion legalization and pharmaceutical regulations, which vary states and over time, to examine the effect of contraception accessibility on fertility related outcomes (Goldin and Katz, 2002; Bailey 2006, Ananat et al, 2007)). These studies demonstrate that women who have access to contraception at an early age have fewer births and better career achievement than those without such access.

In addition, a large body of literature has focused on the individual's decision to use (or not to use) contraception and their choice of contraception types focusing on institutional and social factors influencing the decisions. Institutional factors shape the accessibility and availability of contraceptives which directly influence the use and choice of contraception (Braunder-Otto et al. 2007). Social effects, on the other hand, influence contraceptive adoption through defining it as a social acceptable behavior, and by spreading the information and adoption of new behaviors (Montgomery and Casterline, 1993; Behrman et al., 2002; Edmeades, 2008). Institutional effects and social effects may jointly influence the adoption of new behaviors. Institutional effects may indirectly influence the new behavior by establishing a social and economic environment which relates to the diffusion and adoption of new behaviors (Edmeades, 2008).

This study argues that the process of establishing contraceptive knowledge is similar to the process of decision making about contraceptives. The institutional effects and social effects influence the dissemination of contraceptive knowledge in the same way that they influence contraceptive practice and choice. The mass media campaigns/ advertisements sponsored by family planning programs could be seen as an institutional effect because they indirectly influence women’s awareness of modern contraceptives,

not only by spreading information about contraceptive methods, but also by identifying locations for obtaining contraceptives. These campaigns can also be seen as social effects, as they shape contraception as a social acceptable behavior. Social networks, through which the contraceptive knowledge spread, are another method by which a social effect influences the establishment of contraceptive knowledge and multiplies the effect of mass media on the build of contraceptive knowledge. Several studies focus on factors such as mass media and social networks, associating them with the establishment of health-related information (Kan and Tsai (2004); Aggarwal and Rous (2006); Barber and Axinn (2004); Montgomery and Casterline (1993); Behrman et al. (2002)).

This study adds to the existing literature by examining the effect of contraceptive knowledge obtained from several mechanisms, such as mass media and social networks, on fertility.

4. Data:

This research is primarily based on data from five island-wide surveys, "Knowledge, Attitudes, and Practice of Contraception in Taiwan" (KAP). They are repeated cross-sectional data conducted respectively in 1965, 1967, 1976, 1980, and 1985.[6] These surveys interviewed married women of reproductive age (18-44). The data set includes information about women's fertility history, desired number of children, and attitudes toward, knowledge of, and use of contraception. In addition, measures of socio-economic status and demographic information such as age, education, employment, and family history for both wives and husbands are covered.

[6] I do not include KAP 3 data collected in 1970, because the nature of KAP 3 is different from the other sets of KAP. KAP 3 re-interviewed half of the respondents interviewed in 1967, while the other half of the data is from an independent sample in the 22-39 age group.

Table 1 presents the summary statistics for each survey year. In 1965, the year after the nation wide implementation of family planning programs, the women in fertile ages have had 4.04 live births on average. In 1967, two years after, the average number of live births drops to 3.96 and it keeps dropping to 2.66 live births in 1985. On the other hand, contraceptive knowledge among married women of fertile age is expanding over time. In 1965, married women know about 3.5 modern contraceptive techniques on average; in 1967, married women know about 4 modern contraceptive techniques, and in 1980s, married women know about 8 modern contraceptive techniques. Figure 1 presents the prevalence of knowledge of the selected modern contraceptive techniques for married women in every survey year. It shows that the prevalence of each specific technique might reflect the target of contraception that family planning programs emphasize. For example, the family planning programs first encouraged practicing loop, ota ring, and tubal ligation; later on, the programs encouraged women to use condoms and oral pills. The data in Figure 1 is consistent with that pattern. Furthermore, the practices of contraception and abortion have been increasing (Table 1). In 1965, only 27% of married women ever practiced contraception; however, in 1985, 88% of them ever practiced contraception. In 1965, only 10% of married women had ever had an abortion; in 1985, 28% of them had had one or more abortion.

The increasing trends of mass media exposure, women's education levels, urban residence, and women's working status also reflect the rapid social changes and economic development of Taiwan during the 1960s-1980s. More and more women were regularly exposed to radio, TV, newspapers, and magazines over time. Women's education levels and working status also increased.

5. Identification Strategy:

The direction of causation between contraceptive knowledge and fertility behaviors is a concern. One possibility is that contraception choices affect fertility; women who have larger contraceptive knowledge are more resourceful in choosing among different kinds of contraceptive techniques and practice the contraception to control their fertility. Another possibility is that fertility affects the acquisition of contraceptive knowledge. Women who have reached their desired number of children, or have achieved their desired gender ratio among their children, have incentives to seek out more contraceptive knowledge than those who have not. Finally, external factors may determine levels of both fertility and contraceptive knowledge. For example, women who are more "modern" and "westernized" are more open to and resourceful with modern contraceptive techniques, and they at the same time demand fewer children.

Therefore, the Ordinary Least Squares (OLS) model without correcting the endogeneity in contraceptive knowledge, does not gauge the true effect of contraceptive knowledge on fertility. This study uses an instrumental variables approach to overcome the endogeneity issue, using mass media exposure and women's participation in organizations as the instruments of contraceptive knowledge. The hypotheses are: 1) married women who regularly listen to the radio, watch TV, read magazines, or read newspapers have more access to contraceptive advertisements and family planning campaigns, and hence, obtain more contraceptive information; 2) married women who actively participate in community-based organizations have a wider social network, and hence, obtain more contraceptive knowledge through word-of-mouth communications.

The instruments are believed to influence fertility only through contraceptive knowledge; that is, they are uncorrelated with the error term in fertility equation. Section 7 explains in detail the strength and validity of these instruments.

(1) Life-time fertility

First, I used the OLS model, which does not take into account endogeneity issue, to estimate the life-time fertility equation (1) to investigate the relationship between contraceptive knowledge and fertility. N_i refers to the number of live births by the woman *i*; K_i is the number of contraceptive techniques the woman *i* has heard of; X_i refers to other variables influencing fertility, such as the woman's age cohort, education, husband's education, husband's income, husband's ancestry, her current working status, urban/rural residence, cohabitation with parents-in-law, and other factors.

$$N_i = \beta_0 + \beta_1 K_i + \beta_2 X_i + \varepsilon_i \qquad (1)$$

Second, I take into account the endogeneity of contraceptive knowledge. In order to overcome the endogeneity issue, I use the two-stage least square (2SLS) approach: first, I use mass media exposure and organization participation as the instruments to identify the effect of contraceptive knowledge in equation (2), and then I use the predicted value of contraceptive knowledge from (2) to estimate the effect of contraceptive knowledge in the fertility equation (3). The variables indicating whether the respondents regularly watch TV, listen to the radio, read newspapers, or read magazines are proxies for exposure to the fertility-related campaigns and contraceptive advertisements in the mass media. The variables indicating whether they participate in

community organizations are proxies for exposure to contraceptive knowledge through social networks (word-of-mouth communication).

$$K_i = \gamma_0 + \gamma_1 IV1_i + \gamma_2 IV2_i + \gamma_3 IV3_i + \gamma_4 IV4_i + \gamma_5 IV5_i + \gamma_6 X_i + \nu_i \quad (2)$$

$$N_i = \beta_0 + \beta_1 \hat{K}_i + \beta_2 X_i + \varepsilon_i \quad (3)$$

(2) The probability of giving birth

The number of live births is recorded from the year of marriage to the current year, while contraceptive knowledge, women's working status, urban/rural residence, and cohabitation with parents-in-law, and the measures of mass media exposure and social network are measured in the current year. To ensure the examination of the causal effect of knowledge on fertility, all variables are measured in the current state. I use linear probability model to examine the likelihood of giving birth in the previous year in equation (4)[7].

$$B_{t-1,i} = \beta_0 + \beta_1 K_{t,i} + \beta_2 N_{t-1,i} + \beta_3 Boy_{t-1,i} + \beta_4 X_{t,i} + \varepsilon_i \qquad (4)$$

$B_{t-1,i}$ is a binary variable indicate whether the married women had a live birth last year; $K_{t,i}$ is the current contraceptive knowledge; $N_{t-1,i}$ is the number of live births until the last year; $Boy_{t-1,i}$ is the number of boy births until the last year; $X_{t,i}$ refers to other variables influencing fertility, such as the woman's age cohort, education, husband's education, husband's income, husband's ancestry, her current working status, urban/rural residence, cohabitation with parents-in-law, and other factors. OLS model without correcting the endogeneity issue is first estimated.

[7] This study examines the birth probability in the previous year instead of the current year, because it ensures the duration of each possible event occurs is one year and it can be consistent in each survey year.

In addition, I take into account the endogeneity of contraceptive knowledge and use the 2SLS approach. I first use mass media exposure and organization participation as the instruments to identify the effect of contraceptive knowledge in equation (5), and then I use the predicted value of contraceptive knowledge from (5) to estimate the effect of contraceptive knowledge in the fertility equation (6). I used the same set of instrumental variables as the total number of live birth equation indicating whether the respondents regularly exposed to mass media and their connections to social networks.

$$K_i = \gamma_0 + \gamma_1 IV1_i + \gamma_2 IV2_i + \gamma_3 IV3_i + \gamma_4 IV4_i + \gamma_5 IV5_i + \gamma_6 X_i + \nu_i \quad (5)$$

$$B_{t-1,i} = \beta_0 + \beta_1 \hat{K}_{t,i} + \beta_2 N_{t-1,i} + \beta_3 Boy_{t-1,i} + \beta_4 X_{t,i} + \varepsilon_i \quad (6)$$

6. Results:

(1) Life-time fertility equation:

Table 2 presents the regression results of the number of live births estimated with OLS. The regressions are estimated separately by each survey year. Wife's education level and current working status, which could serve as proxies for prices of having children, are negatively associated with the number of live births. Husband's education is negatively correlated with number of live births. Husband's income is not statistically associated with the number of births.

Older women have more live births than younger ones. Husband's ancestry is associated with the number of live births. Compared with the Fukiennese, the Mainlanders have fewer live births. Women who live in the city have fewer births. The OLS model indicates that contraceptive knowledge is positively associated with the number of live births in the earlier survey years: 1965, 1967, and 1976. The magnitude

of this association decreases with time. The sign of coefficient on contraceptive knowledge changes to negative in the later survey years: 1980 and 1985. The positive relationship between contraceptive knowledge and life time fertility contradicts the intuition that contraception prevents unintended births, since it does not take into account the endogeneity issue. Indeed, the positive relationship explains a possible source of endogeneity: there might be a target effect driving the positive relationship. For example, women with a very large number of children are the target of family planning programs and get more resources from the programs, such as family visits from health personnel, telephone contacts, etc about the contraceptive knowledge. The decreasing magnitude of positive target effects explains that the target effect has been vanishing over time. Another explanation for the positive relationship is the reverse causality between contraceptive knowledge and fertility: women who have had a large number of births might have more incentives to seek out effective contraceptive techniques on their own to prevent pregnancy.

In order to resolve the endogeneity issue, a 2SLS model which takes into account endogeneity is estimated. Table 3 and 4 present the results. The result of the first stage is listed in Table 3, and the second stage in Table 4. The result in Table 3 indicates that women who are regularly exposed to mass media, including watching TV, listening to the radio, reading magazines, or reading newspapers have larger contraceptive knowledge than those who do not; women who participate in organizations have greater contraceptive knowledge than their non-participating counterparts. The instruments explain contraceptive knowledge very well. The F statistics are 26.92, 65.50, 46.06, 14.60, and 29.75 in 1965, 1967, 1976, 1980, and 1985 respectively. All F statistics are

above 10, surpassing the threshold of powerfulness for instrumental variables[8]. The first stage indicates that mass media and social networks play crucial roles in obtaining contraceptive knowledge, consistent with the findings of previous literature.

The results of the second stage are listed in Table 4. After taking into account endogeneity, the signs of the coefficients on contraceptive knowledge change from positive to negative. An additional contraceptive technique known by women *decreases* the total number of births by 0.16, 0.09, 0.14, 0.18, and 0.20 in 1965, 1967, 1976, 1980, and 1985 respectively. The price effect in fertility equation is negative-- the women with high education and currently working outside of the family have fewer births. The income effect in the fertility equation is positive but only reaches statistical significance in 1967. The influences of other demographic factors on fertility are similar with the findings in OLS. Older cohorts have more live births. Mainlanders have fewer live births than Fukiennese on average.

(2) The probability of giving birth

This study estimates the probability of giving birth using OLS and 2SLS approach. The result of OLS is listed in Table 5. The result indicates that contraceptive knowledge has almost no effect on the likelihood of giving birth in the last year, conditional upon the accumulative live birth has been given before the previous year, except in 1967. Those who had not had any sons before the previous year yet are more likely to give birth last year than the counterparts. This is true in each survey year. The result implies that married couples' preference toward sons is still existent. The younger

[8] Staiger and Stock (1997) suggest that the instrument set is considered weak if the first stage F statistic is less than 10.

cohorts have a higher probability of giving birth in the previous year than older cohorts. Women who are currently working outside of family have a lower probability of giving birth within the past year. Women's education is not associated with the likelihood of giving birth. Mainlanders are less likely to have births last year compared to Fukiennese.

The result of 2SLS analysis is listed in Table 6 and 7. Table 6 presents the first stage. The results support the result in Table 3 that mass media exposure and social networks play important roles in the acquisition of contraceptive knowledge. The instruments are powerful in predicting contraceptive knowledge.

Table 7 presents the second stage. The results show that, conditional on the number of births until last year, one more contraceptive technique known *prevents* 0.06, 0.03. 0.04, 0.05, 0.05 births last year in survey years of 1965, 1967, 1976, 1980, and 1985 respectively[9]. The more births each woman has had, the less likely she is to give birth, and the magnitude of this effect increases over time. This explains the number of births to each woman has been decreasing over time which reflects the decreasing birth rate. Women who have not had any sons remain more likely to have another birth. This shows that sex preference toward sons still exists. Younger cohorts are more likely to have births than older ones. Women who are currently working outside of the family are less likely to give birth. Women with higher education are more likely to have given birth recently, which might reflect the positive relationship between high education and young ages. Mainlanders are less likely to give births than Fukiennese. Women who currently live with parents-in-law are more likely to have given birth recently, but the coefficients

[9] The proportion of women who gave birth in the previous year is 0.440, 0.386, 0.363, 0.281, 0.262 in each survey year.

are only significant in 1980 and 1985. Husband's income is positively associated with the probability of giving birth.

In general, the results indicate that contraceptive knowledge *reduces* fertility no matter whether that fertility is measured by life-time fertility or the probability of recently having given birth.

7. Evaluating the IV strategy

The instruments of contraceptive knowledge -- mass media exposure and social networks – have a strong joint influence on the obtainment of contraceptive knowledge. This study would be able to identify the causal effect of contraceptive knowledge on fertility as long as the exclusion restriction is valid, that is, as long as mass media exposure and social networks affect fertility only through contraceptive knowledge.

Indeed, the over-identification test suggests that the instruments this study uses are valid especially in the likelihood of having births equation. The p-values to over identification tests are listed in Table 4 and 7. The null hypothesis that no association between contraceptive knowledge and error term in fertility equation fail to be rejected in the year 1965 and 1976 for total number of live births equation, and every survey year for the likelihood of having birth equation.

However, a number of arguments still can be made to question exclusion restriction. First, mass media exposure and/or organization participation might not only expand contraceptive knowledge but also shape fertility attitudes in a way that influences fertility demand. If fertility attitudes changed through mass media exposure influence the acquisition of contraceptive knowledge, then the coefficient on contraceptive knowledge

in the second stage of the 2SLS approach does not solely reflect the effect of contraceptive knowledge on fertility; it also reflects the couple's attitudes about a desired number of children and/or the sex composition of their family. Women who are regularly exposed to mass media or who have a wider social network are more likely to have access to family planning messages on the benefits of having fewer children and access to knowledge of modern contraceptive techniques than women without that exposure. If contraceptive attitudes and knowledge are correlated, the coefficient on contraceptive knowledge in the fertility equation might not only reflect the contraceptive knowledge but also attitudes which lead to over-estimate the effect of contraceptive knowledge.

Another argument concerning the validity of the instrumental variables used in this paper is based upon a hypothetical unobserved characteristic which may collectively drive contraceptive knowledge, mass media exposure and organization participation. Women selected to the group with regular exposure to mass media and/or with wider social networks are different from the group of women who are not. They might be different in observable ways. For example, women who are regularly exposed to mass media and/or have larger social networks might have a higher level of education, be younger, and be wealthier. On the other hand, it is possible they might be different in unobservable ways. For example, women with regular mass media exposure and wider social networks might be more open to new information than those with less exposure. These observable and unobservable characteristics might influence the fertility decision. While this study controls for differences in observable characteristics, it does not control for differences in unobservable characteristics. If there is an unobservable difference between the two groups in the case described above, the coefficient on contraceptive

knowledge might be biased upward and not reflect the true effect of contraceptive knowledge on fertility.

8. Robustness Check

In order to take into account the potential factors leading to the biased contraceptive knowledge effects listed in the section 7 -- the unobserved married couple's modernity and attitudes toward family planning might lead to the over-estimated contraceptive knowledge effect on fertility. This study takes the advantages of the affluent data sets this study uses which have the information on attitudes toward family planning and general traditional viewpoints. It controls for the attitudes toward family planning and general traditional viewpoints in the fertility equation in 2SLS aims to resolve the potential issues and get the consistent contraceptive knowledge effect on fertility.

The results indicate that the equations of total live births and probability of having births are very robust after taking into account women's modernity and attitudes toward family planning. The evidence provides the credence to the causal effect of contraceptive knowledge this study finds. The results are listed in the Appendix.

9. Conclusion/Discussion

Taiwan's family planning programs, enacted nationwide in 1964, aimed to decrease women's fertility and control population growth. The programs changed married couples' fertility demand by educating them about population growth issues, and by disseminating knowledge of modern contraceptive methods. This paper examines the

effect of contraceptive knowledge on fertility, and focuses on the period right after the family planning programs were enacted. In order to take into consideration the endogeneity of contraceptive knowledge in the fertility equation, this study uses the 2SLS approach. Mass media exposure and social networks are the proxies for acquired contraceptive knowledge. The empirical results indicate that contraceptive knowledge significantly *reduces* fertility, whether fertility is measured as life-time fertility or the probability of giving birth.

Besides, this paper found that mass media exposure and social networks play important roles in obtaining knowledge of modern contraceptive techniques. Women who regularly watch TV, listen to the radio, or read newspapers and magazines are more likely to be exposed to contraceptive-related information and hence have more knowledge of contraceptives. Similarly, women who participate in women's organizations are more likely to obtain contraceptive information through word-of-mouth communication.

Price and income are the fundamental factors in the demand functions. In the fertility equation, women's working status and years of schooling, which can serve as proxies for the price (opportunity cost) of having children are negatively associated with fertility; income (husband's income) is positively associated but not statistically significant with the number of births. Demographic characteristics, such as ethnicity, age cohorts, and residency with parents-in-law are associated with fertility decisions. The preference toward sons is still existent in Taiwanese society. Women who haven't had any sons are more likely to give birth, conditional upon the number of babies they have already had.

There is a large body of literature investigating the relationship between knowledge and behaviors, covering different fields of interests, such as product consumption, risky behaviors, and health outcomes. Very few such studies focus on the relationship between contraceptive knowledge and fertility decision. This paper investigates the effect of contraceptive knowledge on fertility, and helps to shed new light on the relationship between knowledge and behavior.

Table 1: Summary Statistics

	KAP 1 (1965)	KAP 2 (1967)	KAP 4 (1976)	KAP 5 (1980)	KAP 6(1985)
Sample size	3,719	4,989	5,587	3,852	3,819
Dependent variable					
Number of living births	4.04	3.96	3.20	2.70	2.66
Ideal number of births	3.96	3.89	3.25	2.84	2.57
Abortion	0.10	0.12	0.20	0.23	0.28
Number of abortion	1.57	1.60	1.57	1.60	1.54
Number of contraceptive techniques known	3.5	4.00	6.15	8.05	7.97
Contraception practice	0.27	0.41	0.68	0.83	0.88
Independent variable					
Whether the respondent reads the newspaper often	0.14	0.21	0.29	0.51	0.62
Whether the respondent reads magazines often			0.11	0.16	0.22
Whether the respondent listens to the radio often		0.54	0.15	0.27	0.49
Whether the respondent watches the TV often		0.21	0.70	0.79	0.93
Does the respondent own a Radio	0.55				
Whether living with other married couples	0.27	0.28	0.16	0.10	0.11
Organization participation			0.15	0.06	0.06
No son	0.18	0.15	0.18	0.20	0.18
Women's Education level					
Illiterate	0.49	0.40	0.25	0.12	0.08
Elementary	0.41	0.49	0.59	0.58	0.48
Junior high	0.06	0.06	0.08	0.11	0.17
Senior high	0.03	0.04	0.05	0.13	0.21
College	0.01	0.01	0.02	0.06	0.06
Husband's years of schooling	5.78	6.19	7.32	8.60	9.26
Whether working outside of family	0.17	0.20	0.44	0.31	0.33
Whether living with parents or parent's in law	0.52	0.46	0.39	0.38	0.40
Women's age	31.95	32.15	33.49	30.70	32.20
Living in city dummy	0.30	0.31	0.43	0.47	0.50

Table Continued					
	KAP 1 (1965)	KAP 2 (1967)	KAP 4 (1976)	KAP 5 (1980)	KAP 6(1985)
Sample size	3,719	4,989	5,587	3,852	4,312
Husband's ethnicity (Fukiennese)	0.76	0.73	0.68	0.72	0.73
(Hakka)	0.14	0.13	0.12	0.12	0.14
(Mainlander)	0.09	0.14	0.17	0.12	0.09
Contraceptive Knowledge					
Know Condom	0.29	0.30	0.54	0.85	0.89
Know Foam Tablets	0.29	0.28	0.29	0.36	0.24
Know Jelly	0.17	0.15	0.23	0.35	0.26
Know Diaphragm	0.12	0.14	0.19	0.35	0.38
Know Rhythm	0.20	0.27	0.45	0.60	0.67
Know Basic Temperature	0.05	0.09	0.20	0.43	0.53
Know Coitus Interruption	0.04	0.08	0.24	0.45	0.50
Know Ota Ring	0.64	0.61	0.76	0.87	0.75
Know Loop	0.47	0.62	0.89	0.96	0.92
Know Oral Pill	0.31	0.47	0.85	0.93	0.93
Know Vasectomy	0.33	0.35	0.65	0.93	0.93
Know Tubal Ligation	0.61	0.63	0.83	0.96	0.96

Figure 1

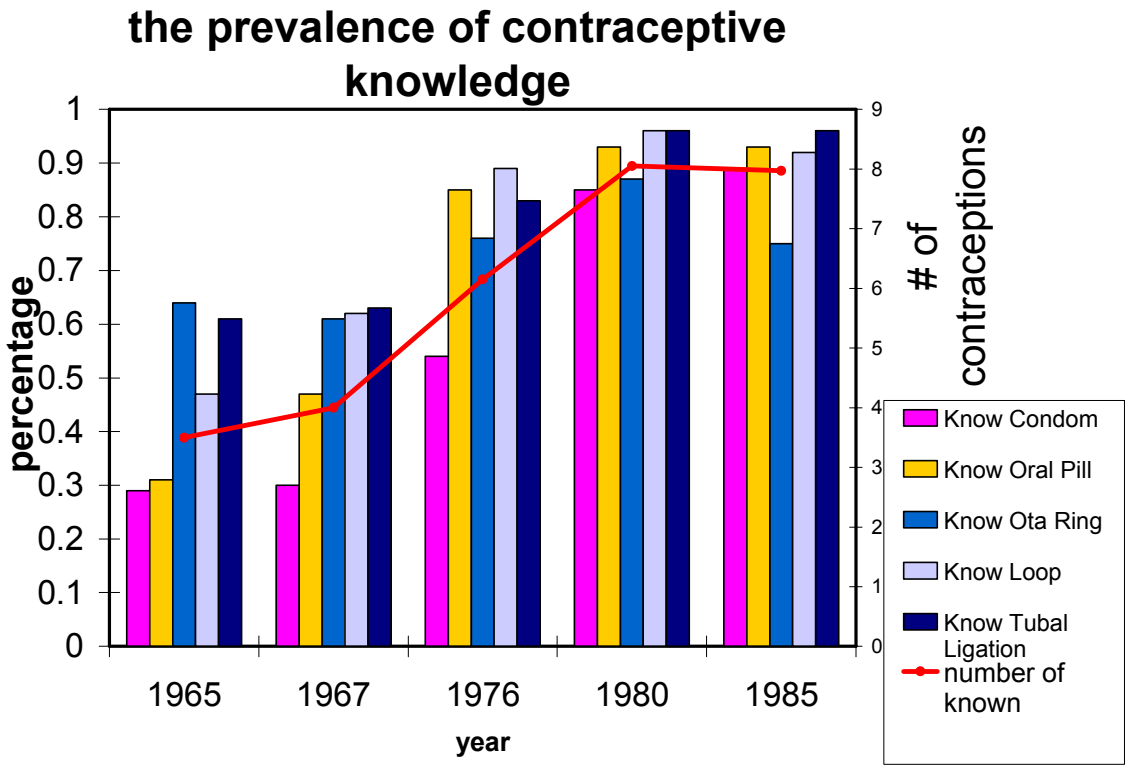
the prevalence of contraceptive knowledge
percentage
# of contraceptions
year
1965
1967
1976
1980
1985
Know Condom
Know Oral Pill
Know Ota Ring
Know Loop
Know Tubal Ligation
number of known

Table 2: OLS model

OLS: dependant variable: number of live births					
	1965	1967	1976	1980	1985
Number of contraceptives known	0.07	0.05	0.02	-0.02	-0.02
	[0.01]**	[0.01]**	[0.01]**	[0.01]*	[0.01]+
No son	-1.49	-1.64	-1.15	-0.97	-0.90
	[0.10]**	[0.09]**	[0.06]**	[0.06]**	[0.05]**
age1822	-3.95	-3.75	0.00	-1.97	-1.78
	[0.14]**	[0.11]**	[0.00]	[0.11]**	[0.08]**
age2327	-3.27	-3.13	-2.20	-1.44	-1.31
	[0.14]**	[0.09]**	[0.07]**	[0.08]**	[0.07]**
age2832	-2.06	-2.09	-1.45	-0.80	-0.81
	[0.11]**	[0.08]**	[0.05]**	[0.08]**	[0.06]**
age3337	-0.83	-1.01	-0.64	-0.24	-0.37
	[0.10]**	[0.09]**	[0.04]**	[0.08]**	[0.05]**
Wife is working outside of family	-0.25	-0.17	-0.15	-0.12	-0.21
	[0.07]**	[0.07]**	[0.04]**	[0.04]**	[0.04]**
Wife years education 12 and over	-0.61	-0.74	-0.58	-0.47	-0.46
	[0.14]**	[0.12]**	[0.07]**	[0.04]**	[0.05]**
Wife years education 0-6	0.29	0.36	0.37	0.24	0.03
	[0.07]**	[0.06]**	[0.05]**	[0.06]**	[0.10]
Husband years education 0-6	0.30	0.12	0.20	0.26	0.21
	[0.07]**	[0.06]+	[0.06]**	[0.06]**	[0.12]+
Husband years education 12 and over	-0.42	-0.20	-0.30	-0.28	-0.25
	[0.07]**	[0.08]*	[0.05]**	[0.04]**	[0.05]**
Husband's ancestry: hakka	0.00	-0.13	-0.06	-0.09	-0.14
	[0.09]	[0.09]	[0.07]	[0.06]	[0.06]*
Husband's ancestry: mainlander	-0.56	-0.43	-0.14	-0.19	-0.33
	[0.09]**	[0.09]**	[0.06]*	[0.05]**	[0.07]**
Live in a city	-0.66	-0.22	-0.20	-0.20	-0.22
	[0.16]**	[0.10]*	[0.07]**	[0.07]**	[0.05]**
Live with parents-in-law	-0.08	-0.02	0.05	0.05	0.03
	[0.06]	[0.05]	[0.04]	[0.04]	[0.04]
Husband's income		-0.04	0.00	-0.04	-0.03
		[0.04]	[0.01]	[0.04]	[0.03]
Constant	6.11	6.38	4.60	3.76	4.03
	[0.13]**	[0.22]**	[0.06]**	[0.10]**	[0.11]**
Observations	3662	4871	4678	3852	3817
R-squared	0.56	0.53	0.49	0.47	0.46
Robust standard errors in brackets					
+ significant at 10%; * significant at 5%; ** significant at 1%					

Table 3: 2SLS, first stage

2SLS: first stage: dv: number of contraceptive techniques known					
	1965	1967	1976	1980	1985
No son	-0.89	-0.84	-0.61	-0.00	-0.11
	[0.13]**	[0.12]**	[0.12]**	[0.12]	[0.10]
age1822	-0.66	-0.91	0.00	-0.65	0.11
	[0.22]**	[0.18]**	[0.00]	[0.31]*	[0.19]
age2327	-0.16	-0.34	-0.48	-0.12	0.62
	[0.14]	[0.13]**	[0.14]**	[0.20]	[0.15]**
age2832	0.43	0.24	-0.02	0.04	0.41
	[0.10]**	[0.12]*	[0.12]	[0.19]	[0.12]**
age3337	0.41	0.36	0.28	0.18	0.20
	[0.13]**	[0.12]**	[0.09]**	[0.16]	[0.11]+
Wife is working outside of family	0.00	0.25	0.16	0.07	0.25
	[0.14]	[0.11]*	[0.13]	[0.13]	[0.09]*
Wife's education is 12 or above	1.08	0.86	0.84	0.89	1.03
	[0.36]**	[0.28]**	[0.16]**	[0.12]**	[0.11]**
Wife's education is 0-6	-1.02	-0.80	-0.66	-0.77	-0.88
	[0.12]**	[0.11]**	[0.11]**	[0.18]**	[0.23]**
Husband's education is 0-6	-0.31	-0.46	-0.46	-0.45	-0.91
	[0.10]**	[0.09]**	[0.11]**	[0.13]**	[0.27]**
Husband's education is 12 or above	1.28	0.98	0.78	0.61	0.66
	[0.21]**	[0.17]**	[0.13]**	[0.12]**	[0.10]**
Husband's ancestry: hakka	0.68	0.26	0.95	0.03	0.32
	[0.33]*	[0.15]+	[0.33]**	[0.26]	[0.17]+
Husband's ancestry: mainlander	0.17	0.24	0.33	-0.13	-0.44
	[0.19]	[0.16]	[0.17]+	[0.15]	[0.14]**
Living in a city	-0.14	0.62	0.54	0.04	0.80
	[0.47]	[0.18]**	[0.37]	[0.24]	[0.29]**
Living with parents in law	-0.18	-0.26	-0.27	-0.01	0.07
	[0.09]+	[0.09]**	[0.09]**	[0.08]	[0.08]
Listen to radio	0.36	0.82	0.51	0.21	0.30
	[0.10]**	[0.09]**	[0.13]**	[0.11]+	[0.09]**
Read newspapers	1.88	1.59	1.17	0.83	1.07
	[0.22]**	[0.16]**	[0.13]**	[0.15]**	[0.13]**
Live with married couples	0.06	-0.13	-0.39	-0.08	-0.09
	[0.11]	[0.09]	[0.16]*	[0.13]	[0.10]
Husband's income		0.49	0.09	0.38	0.24
		[0.07]**	[0.02]**	[0.10]**	[0.08]**
Watch tv		0.72	0.83	0.29	-0.03
		[0.13]**	[0.12]**	[0.13]*	[0.15]
Read magazines			0.89	0.84	0.54
			[0.14]**	[0.13]**	[0.08]**
Join organizations			0.49	0.42	0.52
			[0.19]*	[0.18]*	[0.16]**
Constant	4.47	2.19	1.86	6.27	6.33
	[0.18]**	[0.19]**	[0.14]**	[0.28]**	[0.22]**

F statistics	26.92	65.50	46.06	14.60	29.75
Observations	3662	4868	4678	3852	3819
R-squared	0.38	0.43	0.40	0.31	0.35
Robust standard errors in brackets					
+ significant at 10%; * significant at 5%; ** significant at 1%					

Table 4: 2SLS, second stage

2SLS: dependent variable: number of live births					
	1965	1967	1976	1980	1985
Number of contraceptive techniques known	-0.16	-0.09	-0.14	-0.18	-0.20
	[0.05]**	[0.03]**	[0.03]**	[0.03]**	[0.03]**
No son	-1.68	-1.76	-1.24	-0.96	-0.92
	[0.09]**	[0.07]**	[0.06]**	[0.05]**	[0.05]**
age1822	-4.10	-3.86	0.00	-2.06	-1.76
	[0.14]**	[0.12]**	[0.00]	[0.10]**	[0.09]**
age2327	-3.31	-3.16	-2.25	-1.46	-1.20
	[0.09]**	[0.07]**	[0.06]**	[0.06]**	[0.06]**
age2832	-1.98	-2.04	-1.45	-0.79	-0.72
	[0.08]**	[0.07]**	[0.05]**	[0.06]**	[0.06]**
age3337	-0.76	-0.96	-0.58	-0.22	-0.33
	[0.08]**	[0.07]**	[0.05]**	[0.06]**	[0.05]**
Wife is working outside of family	-0.24	-0.14	-0.13	-0.11	-0.18
	[0.07]**	[0.06]*	[0.05]**	[0.04]**	[0.04]**
Wife's education 12 or above	-0.18	-0.55	-0.32	-0.25	-0.20
	[0.19]	[0.13]**	[0.09]**	[0.08]**	[0.07]**
Wife's education 0-6	-0.03	0.15	0.20	0.06	-0.22
	[0.10]	[0.07]*	[0.05]**	[0.06]	[0.08]**
Husband's education 0-6	0.22	0.04	0.11	0.18	0.02
	[0.07]**	[0.06]	[0.06]+	[0.07]**	[0.11]
Husband's education 12 or above	-0.00	0.01	-0.08	-0.13	-0.08
	[0.14]	[0.09]	[0.06]	[0.06]*	[0.05]
Husband's ancestry: hakka	0.15	-0.10	0.09	-0.08	-0.07
	[0.10]	[0.08]	[0.07]	[0.06]	[0.06]
Husband's ancestry: mainlander	-0.52	-0.36	-0.06	-0.21	-0.41
	[0.11]**	[0.08]**	[0.05]	[0.06]**	[0.07]**
Living in a city	-0.67	-0.12	-0.06	-0.17	-0.06
	[0.11]**	[0.10]	[0.07]	[0.06]**	[0.07]
Live with parents in law	-0.12	-0.06	0.01	0.05	0.04
	[0.06]+	[0.05]	[0.04]	[0.04]	[0.04]
Husband's income		0.06	0.03	0.04	0.04
		[0.04]	[0.01]*	[0.04]	[0.03]
Constant	7.25	6.79	5.01	4.81	5.32
	[0.37]**	[0.21]**	[0.20]**	[0.29]**	[0.28]**
Observations	3662	4868	4678	3852	3817
R-squared	0.50	0.50	0.43	0.40	0.36
Over-identification test (p-value)	0.4707	0.0826	0.1415	0.0307	0.0099
Standard errors in brackets					
+ significant at 10%; * significant at 5%; ** significant at 1%					

Table 5: OLS model

OLS: dv: whether having births last year					
	1965	1967	1976	1980	1985
Cumulative not having sons	0.09	0.18	0.12	0.08	0.11
	[0.02]**	[0.02]**	[0.02]**	[0.02]**	[0.02]**
Total live births until last year	-0.00	-0.00	-0.04	-0.09	-0.09
	[0.00]	[0.00]	[0.01]**	[0.01]**	[0.01]**
Number of contraceptive techniques known	-0.00	-0.01	0.00	0.00	0.00
	[0.00]	[0.00]*	[0.00]	[0.00]	[0.00]+
age1822	0.41	0.43	0.00	0.20	0.26
	[0.04]**	[0.04]**	[0.00]	[0.04]**	[0.05]**
age2327	0.52	0.49	0.31	0.20	0.26
	[0.03]**	[0.03]**	[0.03]**	[0.03]**	[0.03]**
age2832	0.39	0.33	0.28	0.09	0.13
	[0.02]**	[0.02]**	[0.02]**	[0.02]**	[0.02]**
age3337	0.15	0.13	0.15	-0.00	0.00
	[0.02]**	[0.02]**	[0.01]**	[0.02]	[0.01]
Wife is working outside of family	-0.10	-0.05	-0.13	-0.09	-0.07
	[0.02]**	[0.02]**	[0.02]**	[0.01]**	[0.02]**
Wife years education 12 or above	0.00	-0.02	0.03	-0.01	0.00
	[0.04]	[0.04]	[0.04]	[0.02]	[0.02]
Wife years education 0-6	-0.00	0.02	0.02	-0.01	0.01
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]
Husband years education 0-6	0.05	0.04	0.00	0.03	-0.01
	[0.02]*	[0.02]*	[0.02]	[0.02]	[0.03]
Husband years education 12 and above	-0.03	-0.01	-0.04	-0.04	-0.01
	[0.03]	[0.02]	[0.02]*	[0.02]*	[0.02]
Husband ancestry: hakka	0.03	-0.00	-0.01	-0.00	-0.02
	[0.03]	[0.03]	[0.02]	[0.02]	[0.02]
Husband ancestry: mainlander	-0.07	-0.02	-0.08	-0.08	-0.06
	[0.03]*	[0.02]	[0.02]**	[0.02]**	[0.02]**
Living in a city	-0.06	-0.01	-0.03	-0.03	-0.03
	[0.02]*	[0.03]	[0.02]	[0.02]	[0.02]+
Live with parents-in-law	0.01	0.01	0.02	0.04	0.04
	[0.02]	[0.02]	[0.01]	[0.01]**	[0.01]**
Husband's income		-0.02	-0.00	0.02	0.02
		[0.01]	[0.00]	[0.01]	[0.01]+
Constant	0.08	0.31	0.27	0.34	0.23
	[0.04]+	[0.08]**	[0.03]**	[0.04]**	[0.04]**
Observations	3564	4776	4460	3788	3614
R-squared	0.21	0.24	0.21	0.26	0.33
Robust standard errors in brackets					
+ significant at 10%; * significant at 5%; ** significant at 1%					

Table 6: 2SLS first stage

2SLS, first stage, dv: number of contraceptive techniques known					
	1965	1967	1976	1980	1985
Cumulative having no sons	-0.63	-0.70	-0.60	0.02	-0.15
	[0.12]**	[0.12]**	[0.11]**	[0.10]	[0.10]
Number of live births until last year	0.19	0.17	0.09	-0.09	-0.08
	[0.03]**	[0.03]**	[0.03]**	[0.04]*	[0.05]
Age1822	0.43	0.08	0.00	-0.90	-0.06
	[0.25]+	[0.22]	[0.00]	[0.31]**	[0.26]
age2327	0.73	0.43	-0.09	-0.31	0.50
	[0.19]**	[0.16]**	[0.16]	[0.20]	[0.17]**
age2832	0.96	0.69	0.22	-0.06	0.33
	[0.13]**	[0.13]**	[0.13]	[0.19]	[0.14]*
age3337	0.64	0.56	0.38	0.16	0.17
	[0.13]**	[0.12]**	[0.10]**	[0.16]	[0.12]
Wife is working outside of family	-0.00	0.26	0.15	0.06	0.23
	[0.14]	[0.11]*	[0.13]	[0.13]	[0.09]*
Wife's education is 12 or above	1.17	1.00	0.95	0.83	1.00
	[0.37]**	[0.27]**	[0.15]**	[0.13]**	[0.11]**
Wife's education is 0-6	-1.16	-0.84	-0.69	-0.75	-0.88
	[0.13]**	[0.11]**	[0.11]**	[0.18]**	[0.23]**
Husband's education is 0-6	1.36	1.00	0.80	0.59	0.64
	[0.21]**	[0.17]**	[0.13]**	[0.12]**	[0.10]**
Husband's education is 12 or above	0.73	0.26	0.94	0.02	0.31
	[0.32]*	[0.15]+	[0.33]**	[0.26]	[0.16]+
Husband's ancestry: hakka	0.27	0.31	0.32	-0.14	-0.47
	[0.19]	[0.15]*	[0.17]+	[0.16]	[0.13]**
Husband's ancestry: mainlander	0.03	0.66	0.57	0.02	0.78
	[0.45]	[0.18]**	[0.37]	[0.24]	[0.28]**
Live in a city	-0.16	-0.24	-0.26	-0.01	0.07
	[0.09]+	[0.09]**	[0.09]**	[0.08]	[0.08]
Live with parents in law	0.41	0.84	0.50	0.21	0.29
	[0.10]**	[0.09]**	[0.13]**	[0.11]+	[0.09]**
Listen to the radio	1.91	1.63	1.18	0.82	1.07
	[0.21]**	[0.16]**	[0.13]**	[0.15]**	[0.13]**
Read newspapers	0.10	-0.11	-0.40	-0.09	-0.09
	[0.11]	[0.09]	[0.16]*	[0.13]	[0.10]
Live with married couples		-0.47	-0.47	-0.43	-0.90
		[0.09]**	[0.11]**	[0.13]**	[0.27]**
Husband's income		0.48	0.09	0.38	0.24
		[0.07]**	[0.02]**	[0.10]**	[0.08]**
Watch TV		0.70	0.85	0.29	-0.03
		[0.13]**	[0.12]**	[0.12]*	[0.15]
Read magazines			0.90	0.84	0.53
			[0.14]**	[0.13]**	[0.08]**
Join Organization			0.49	0.43	0.52
			[0.18]*	[0.18]*	[0.16]**

Constant	3.16	1.15	1.46	6.57	6.62
	[0.23]**	[0.25]**	[0.18]**	[0.29]**	[0.24]**
F statistics					
Observations	3662	4868	4678	3852	3817
R-squared	0.39	0.44	0.41	0.32	0.35
Robust standard errors in bracket					
+ significant at 10%; * significant at 5%; ** significant at 1%					

Table 7: 2SLS, second stage

2SLS, second stage, dv: whether having births last year					
	1965	1967	1976	1980	1985
Number of contraceptive techniques known	-0.06	-0.03	-0.04	-0.05	-0.05
	[0.02]**	[0.01]**	[0.01]**	[0.01]**	[0.01]**
Cumulative having no sons	0.05	0.16	0.10	0.08	0.10
	[0.03]*	[0.02]**	[0.02]**	[0.02]**	[0.02]**
Number of live births until last year	0.01	-0.00	-0.04	-0.10	-0.09
	[0.01]	[0.00]	[0.01]**	[0.01]**	[0.01]**
age1822	0.44	0.44	0.00	0.14	0.25
	[0.05]**	[0.04]**	[0.00]	[0.04]**	[0.04]**
age2327	0.55	0.50	0.31	0.18	0.28
	[0.03]**	[0.03]**	[0.03]**	[0.03]**	[0.03]**
age2832	0.44	0.34	0.29	0.09	0.15
	[0.03]**	[0.02]**	[0.02]**	[0.02]**	[0.02]**
age3337	0.19	0.15	0.16	0.01	0.01
	[0.03]**	[0.02]**	[0.02]**	[0.02]	[0.02]
Wife is working outside of family	-0.10	-0.04	-0.12	-0.08	-0.06
	[0.02]**	[0.02]*	[0.02]**	[0.02]**	[0.01]**
Wife's education is 12 or above	0.13	0.02	0.10	0.06	0.08
	[0.06]*	[0.04]	[0.03]**	[0.03]*	[0.02]**
Wife's education is 0-6	-0.09	-0.01	-0.03	-0.07	-0.08
	[0.03]**	[0.02]	[0.02]	[0.02]**	[0.03]**
Husband's education is 0-6	0.02	0.02	-0.02	-0.00	-0.06
	[0.02]	[0.02]	[0.02]	[0.03]	[0.04]
Husband's education is 12 or above	0.08	0.02	0.02	0.01	0.04
	[0.04]*	[0.03]	[0.02]	[0.02]	[0.02]*
Husband's ancestry: hakka	0.07	0.01	0.03	0.00	0.00
	[0.03]*	[0.02]	[0.02]	[0.02]	[0.02]
Husband's ancestry: mainlander	-0.06	-0.01	-0.06	-0.09	-0.09
	[0.03]+	[0.02]	[0.02]**	[0.02]**	[0.02]**
Live in a city	-0.06	0.00	0.01	-0.02	0.02
	[0.03]+	[0.03]	[0.02]	[0.02]	[0.02]
Live with parents in law	0.00	0.00	0.01	0.04	0.05
	[0.02]	[0.01]	[0.01]	[0.01]**	[0.01]**
Husband's income		0.00	0.00	0.04	0.04
		[0.01]	[0.00]	[0.02]**	[0.01]**
Constant	0.32	0.35	0.36	0.75	0.68
	[0.10]**	[0.06]**	[0.07]**	[0.12]**	[0.11]**
Observations	3564	4773	4460	3788	3614
R-squared	0.12	0.23	0.16	0.16	0.23
Over-identification test(p-value)	0.9775	0.6887	0.1788	0.2236	0.7259
Standard errors in brackets					
+ significant at 10%; * significant at 5%; ** significant at 1%					

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Appendix[10]:

The number of live births equation (2SLS)					
	1965	1967	1976	1980	1985
Contraceptive knowledge	-0.17	-0.10	-0.13	-0.18	-0.21
	[0.06]**	[0.03]**	[0.03]**	[0.04]**	[0.03]**
Tradition	0.02	0.17	0.09	0.12	
	[0.09]	[0.07]*	[0.04]*	[0.04]**	
Attitudes	0.42	0.44	0.27	0.06	0.11
	[0.11]**	[0.08]**	[0.09]**	[0.08]	[0.04]**
No son	-1.66	-1.71	-1.23	-0.96	-0.92
	[0.09]**	[0.07]**	[0.06]**	[0.05]**	[0.05]**
Age1822	-4.14	-3.88	0.00	-2.06	-1.78
	[0.14]**	[0.12]**	[0.00]	[0.10]**	[0.09]**
Age2327	-3.36	-3.21	-2.25	-1.45	-1.21
	[0.09]**	[0.07]**	[0.06]**	[0.06]**	[0.06]**
Age2832	-2.02	-2.08	-1.46	-0.78	-0.73
	[0.08]**	[0.06]**	[0.05]**	[0.06]**	[0.06]**
Age3337	-0.78	-0.99	-0.59	-0.21	-0.33
	[0.08]**	[0.07]**	[0.05]**	[0.06]**	[0.05]**
Wife is working outside of family	-0.25	-0.13	-0.13	-0.11	-0.18
	[0.07]**	[0.06]*	[0.05]**	[0.04]**	[0.04]**
Wife education is 12 or above	-0.17	-0.52	-0.31	-0.23	-0.20
	[0.19]	[0.13]**	[0.09]**	[0.08]**	[0.07]**
Wife education is 0-6	-0.02	0.14	0.19	0.04	-0.23
	[0.10]	[0.07]*	[0.05]**	[0.07]	[0.08]**
Husband education is 0-6	0.22	0.05	0.10	0.17	0.01
	[0.07]**	[0.06]	[0.06]+	[0.07]*	[0.11]
Husband education is 12 or above	-0.01	0.03	-0.08	-0.12	-0.08
	[0.14]	[0.09]	[0.06]	[0.06]*	[0.05]
Husband's ancestry: hakka	0.13	-0.09	0.09	-0.08	-0.07
	[0.10]	[0.08]	[0.07]	[0.06]	[0.06]
Husband's ancestry: mainlander	-0.51	-0.35	-0.06	-0.21	-0.42
	[0.11]**	[0.08]**	[0.05]	[0.06]**	[0.07]**
Living in a city	-0.68	-0.13	-0.05	-0.18	-0.07
	[0.11]**	[0.10]	[0.07]	[0.06]**	[0.07]
Live with parents in law	-0.11	-0.06	0.00	0.04	0.05
	[0.06]+	[0.05]	[0.04]	[0.04]	[0.04]
Husband's income		0.06	0.03	0.05	0.04
		[0.04]	[0.01]*	[0.04]	[0.03]
Constant	6.91	6.25	4.80	4.77	5.35
	[0.37]**	[0.22]**	[0.20]**	[0.28]**	[0.28]**
Observations	3662	4868	4678	3852	3817
R-squared	0.50	0.51	0.44	0.39	0.35
Standard errors in brackets					
+ significant at 10%; * significant at 5%; ** significant at 1%					

[10] The variable, tradition, measures the married women's viewpoints toward tradition. Tradition is coded with "1" if the respondents answer "definitely yes" or "probability yes" to the question "do you expect to live with your children or grandchildren in old age?"; and "0" otherwise. The variable, attitude, measures the married women's viewpoints toward family planning programs. Attitude is coded with "1" if the respondents answer "approve very much" or "approve" to the question "are you in favor of family planning/ contraception?"; and "0" otherwise.

The probability of having birth (2SLS)					
	1965	1967	1976	1980	1985
Number of contraceptive knowledge known	-0.10	-0.04	-0.04	-0.06	-0.05
	[0.02]**	[0.01]**	[0.01]**	[0.02]**	[0.01]**
Tradition	-0.02	0.03	0.01	0.04	n/a
	[0.03]	[0.02]	[0.02]	[0.02]+	n/a
Attitudes	0.20	0.12	0.14	0.06	0.06
	[0.04]**	[0.03]**	[0.04]**	[0.04]	[0.02]**
Cumulative having no sons	-0.18	-0.08	-0.18	-0.08	-0.08
	[0.04]**	[0.03]**	[0.03]**	[0.02]**	[0.02]**
Number of live births until last year	0.00	-0.00	-0.06	-0.12	-0.11
	[0.01]	[0.01]	[0.01]**	[0.01]**	[0.01]**
age1822	0.34	0.41	0.00	0.21	0.28
	[0.06]**	[0.05]**	[0.00]	[0.06]**	[0.05]**
age2327	0.55	0.58	0.35	0.30	0.37
	[0.05]**	[0.03]**	[0.04]**	[0.03]**	[0.03]**
age2832	0.53	0.45	0.39	0.19	0.23
	[0.04]**	[0.03]**	[0.03]**	[0.03]**	[0.02]**
age3337	0.26	0.18	0.23	0.09	0.07
	[0.03]**	[0.02]**	[0.02]**	[0.03]**	[0.02]**
Wife is working outside of family	-0.09	-0.05	-0.10	-0.09	-0.06
	[0.03]**	[0.02]*	[0.02]**	[0.02]**	[0.02]**
Wife education is 12 or above	0.16	0.05	0.11	0.07	0.14
	[0.07]*	[0.04]	[0.04]**	[0.03]*	[0.03]**
Wife education is 0-6	-0.10	-0.02	-0.06	-0.09	-0.08
	[0.04]**	[0.03]	[0.02]**	[0.03]**	[0.03]*
Husband education is 0-6	0.02	0.02	0.02	-0.02	-0.03
	[0.03]	[0.02]	[0.02]	[0.03]	[0.04]
Husband education is 12 or above	0.12	-0.01	0.02	0.05	0.03
	[0.05]*	[0.03]	[0.03]	[0.03]+	[0.02]
Husband's ancestry: hakka	0.07	0.04	-0.00	-0.02	-0.02
	[0.04]+	[0.03]	[0.03]	[0.03]	[0.02]
Husband's ancestry: mainlander	-0.01	-0.00	-0.04	-0.10	-0.08
	[0.04]	[0.03]	[0.02]	[0.02]**	[0.03]**
Living in a city	-0.13	-0.01	0.02	-0.01	0.02
	[0.04]**	[0.03]	[0.03]	[0.03]	[0.03]
Live with parents in law	-0.01	0.03	-0.02	0.05	0.03
	[0.02]	[0.02]+	[0.02]	[0.02]**	[0.02]+
Husband's income		-0.01	0.01	0.02	0.04
		[0.01]	[0.00]+	[0.02]	[0.01]**
Constant	0.64	0.29	0.58	0.98	0.80
	[0.13]**	[0.08]**	[0.09]**	[0.13]**	[0.12]**
Observations	2497	3567	3291	3032	3054
R-squared		0.22	0.17	0.21	0.25
Standard errors in brackets					
+ significant at 10%; * significant at 5%; ** significant at 1%					