Family Planning and Women's Economic Empowerment: Incentive Effects and Direct Effects among Malaysian Women

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Abstract

Although family planning programs can improve women's welfare directly through changes in realized fertility, they may also have important incentive effects by increasing parents' investments in girls not yet fertile. Exploiting the staggered implementation of family planning programs in Malaysia during the 1960s and 1970s among girls of varying ages, we study these potential incentive effects, finding that family planning may have raised raise girls' educational attainment substantially. We also find that these early investments are linked to gains in women's paid labor at prime working ages and to greater support for women's elderly parents (a marker for women's bargaining power within the household). Notably, these incentive effects may be larger than the direct effects of family planning alone.

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1. Introduction

Family planning programs became a prominent feature of economic development strategies in the 1960s, and by the 1990s, more than 115 countries had introduced them (Cleland et al., 2006). Although initially motivated by dire predictions about population growth, famine, and macroeconomic catastrophe (Coale and Hoover, 1959, Ehrlich, 1968, NAS, 1971), the rationale for family planning programs shifted over time, increasingly emphasizing poverty reduction and the empowerment of women (Glasier et al., 2006, Kelley, 2001, Merrick, 2001).[1] However, empirical research on family planning programs has not generally matched this shift, with a majority of studies focusing on its consequences for fertility—and a much smaller share examining women's overall welfare (Canning and Schultz, 2012, Babiarz and Miller, 2016).

Some welfare benefits associated with family planning programs flow directly from reductions in women's realized fertility (which we term "direct effects"). With greater control over the timing and number of births, for example, women may prevent unwanted pregnancies and complete more schooling, increase their labor supply, and earn more throughout their lifetime (Angeles et al., 2005, Becker, 1991, Greene and Merrick, 2005, Miller, 2010).

Family planning programs may also have important indirect "incentive effects" among girls not yet at risk of pregnancy—effects which improve their future welfare independent of contraceptive use or changes in their ultimate fertility (and so are distinct from "direct effects"). For example, the availability of modern contraceptives may mean that parents expect their daughters to live longer and healthier lives,[2] have fewer children, and time pregnancies in a way that is more conducive to participation in the labor force—raising the expected return to women's education and increasing women's expected lifetime earnings (Canning and Schultz, 2012, Jayachandran and Lleras-Muney, 2009). As a result, family planning could strengthen incentives for investing in girls' human capital (Becker, 1991), which could subsequently improve women's economic welfare and bargaining power within marriage later in life (Schultz, 2001).[3] Importantly, these incentive effects of family planning

[1] The 4th International Conference on Population and Development held in Cairo in 1994 placed women's individual reproductive rights and reproductive health at the center of the call for family planning services, emphasizing the potential of family planning to have differentially large effects on the health, status, and wellbeing of women and girls compared to their husbands and brothers (Glasier et al., 2006).

[2] By reducing the number of times women are at risk of dying in childbirth, family planning may reduce the maternal mortality rate (the number of maternal deaths per population of reproductive-aged women) mechanically (Rahman and Menken, 2012). If family planning differentially reduces the incidence of high-risk pregnancies (pregnancies at young ages and high parity pregnancies), family planning may also lead to reductions in the maternal mortality ratio (the number of maternal deaths per live births) (Cleland et al., 2012, Jain, 2011, Winikoff and Sullivan, 1987).

[3] For example, Axinn and Yabiku (2001) study the introduction of schools and health facilities, finding marked changes in forward-looking behavior (and presumably through expectations about the future), including contraceptive use.

could accrue to all women and girls, regardless of their ultimate use of modern contraceptives or their realized fertility.

The vast majority of empirical research on family planning focuses on its consequences for fertility—and few studies examine women's overall empowerment or welfare gains (Canning and Schultz, 2012, Babiarz and Miller, 2016). Importantly, we know of only one study that explicitly distinguishes the incentive effects of family planning on women's education from its direct effects. Angeles, Guilkey, and Mroz (2005) use the Indonesian Family Life Survey to study the relationship between family planning and both school attainment and fertility. They find that family planning leads to greater human capital investments (education) prior to marriage, reducing the likelihood of school drop-out and raising educational attainment by nearly one year—presumably due to changes in expectations about future health, wages, and returns to education.[4]

This paper contributes to existing literature by providing new evidence on the incentive effects (and direct effects) of family planning among women in Malaysia. The case of Malaysia provides an unusual opportunity to study both the incentive effects as well as more traditional direct effects of family planning for several reasons. First, Malaysia was one of the first low-income countries to provide modern contraceptives on a large scale, first introducing services in 1954 and establishing a National Family Planning Board in 1966 (Lee et al., 1973)—enabling estimation of long-term consequences of family planning. Second, contraceptive prevalence rates in Malaysia rose rapidly during this same period, with contraceptive use as a share of fertile time rising from 3 percent in 1961 to 39 percent in 1975 (and total fertility rates falling from 6.2 to 4.3 over the same period (DaVanzo et al., 1986, DOSM, 2015)). Third, the Malaysian Family Life Survey (MFLS), conducted in 1976 and again in 1988, provides detailed information about the timing of community-level family planning programs as well as a variety of individual-level measures of women's status.

To first study the incentive effects of family planning on human capital investments in girls, we exploit the staggered expansion of family planning programs across Peninsular Malaysian together with variation in girls' age when family planning was introduced. Specifically, we compare human capital investments (educational attainment and school drop-out) among girls with family planning exposure at young ages—prior to reaching fertile or socially-feasible child-bearing ages[5]—with human capital investments among girls not exposed until early adulthood (after educational investments have been completed). Preliminary results suggest that family planning increases average educational attainment by approximately 0.5 years by reducing the probability that girls drop-out of school before entering secondary

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[4] Although the effects of individual family planning program components are not statistically significant at conventional levels, predictions of "full" family planning program effects in areas with varying school quality are statistically significant (and larger than the estimated return to improvements in school quality).

[5] Throughout this paper we assume that women are generally aware of family planning services when they are introduced locally. Qualitative historical accounts support this assumption given active community-based promotion that accompanied family planning implementation. This assumption is also supported by our findings of a contemporaneous reduction in primary school drop-out rates under family planning (and the grades at which the change occurred—prior to adolescence) (see section 4.2).

school (the stage at which girls otherwise commonly dropped-out of school in Malaysia during the years we study).[6] Because premarital sex was rare and marriage did not lead to early school drop-out in Malaysia during our study period (WHO, 2005),[7] these gains can plausibly be interpreted as incentive effects (rather than direct effects) of family planning.

Comparisons between girls first exposed to family planning at young ages and those beyond feasible school ages also provides a natural test of the identifying assumption that the introduction of family planning was unrelated to pre-existing trends in girls' educational attainment. Testing for program effects among women ages 20 and older, we find small, statistically insignificant estimates (consistent with our identifying assumption). In a companion paper, we also find that family planning program implementation is not significantly related to pre-existing trends in fertility (also consistent with our identifying assumption) (Babiarz et al., 2017).

We then study how both direct and incentive effects of family planning lead to changes in the status of women during adulthood, focusing specifically on women's labor force participation, pay for work, and intergenerational transfers (a measure of women's bargaining power within the household (Lillard and Willis, 1997)).[8] Comparing women first exposed to family planning at birth and in early childhood (subject to both incentive and direct effects of family planning) with women first exposed at fertile ages (subject only to direct effects), we are plausibly able to distinguish incentive effects from direct effects. Importantly, we emphasize that these comparisons assume that learning and diffusion of knowledge about family planning occurred quickly. Although we do not have direct measures of knowledge back in time, this assumption is consistent both with our educational attainment results (because education investments are made prior to childbearing years, the education gains that we find cannot plausibly be interpreted as direct effects due to gradual learning about family planning over time) and with historical evidence on Malaysia's widespread promotion of family planning through community meetings, mass media, and other advertising activities.[9]

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[6] Students in our sample most commonly dropped out of school after completing 6 years of primary school, with 21 percent dropping out in the year after completing primary school, and more than half of girls completing 6 or fewer years of schooling.

[7] Due to conservative social norms, premarital sex and pregnancy were rare during this period. Among women in our sample, 93 percent wait more than one year after completing school to marry, suggesting that marriage (and pregnancy) is unlikely to be an important cause of school drop-out during the years we study. Only 0.26 percent of births occurred prior to marriage (WHO, 2005). This implies that family planning program effects on education can plausibly be interpreted as incentive effects (rather than direct effects).

[8] Lee et al. (1994) and Lillard and Willis (1997) show that greater bargaining power and control over household resources predicts greater support to women's own parents in environments where old age support is primarily borne by adult children. In Malaysia, transfers commonly include both co-residence and financial support of parents living alone.

[9] An extensive network of family planning information officers worked to promote family planning, focusing both on the benefits of family planning and on specific services available. Activities included publicity campaigns, public talks, community dialogues, and distribution of promotional material (pamphlets, posters, leaflets,

Our preliminary results suggest that exposure to family planning early in life (prior to adolescence) may increase the probability that women earn wages (rather than working in unpaid jobs) at prime working ages between 26 and 40.[10] Exposure at young ages is also associated with greater intergenerational transfers to the elderly parents of wives—in particular, through matrilineal co-residence (a marker for women's bargaining power within the home in societies in which families provide elder care (Lillard and Willis, 1997)), which rose by 7-12 percentage points. Alternatively, we do not find statistically significant evidence of direct family planning effects (operating through changes in fertility) on labor market outcomes or intergenerational transfers, suggesting that the incentive effects of family planning could ultimately play a larger role in proving women's economic welfare.

This paper proceeds as follows. Section 2 describes the theoretical relationship between family planning and women's empowerment, related literature, and provides context on Malaysian family planning programs. Section 3 describes our sources of data. Section 4 describes our empirical strategy and results related to incentive effects on education. Section 5 describes our methods and results related to women's empowerment in adulthood. Finally, section 6 concludes.

2. Conceptual Approach and the Malaysian Context

2.1 Conceptual Approach

There are a number of mechanisms through which family planning may affect women's empowerment or the "ability of women to access the constituents of development—in particular health, education, earning opportunities, rights and political participation" (Duflo, 2012).

The "direct" empowerment effects of improved control over fertility are perhaps most obvious for women at risk of becoming pregnant outside marriage, as delayed marriage leads to improved educational and marriage market outcomes (Goldin and Katz, 2002), as well as women who are already married at the time family planning technology becomes available. The ability to control the number and timing of births may benefit married women because couples are able to better achieve their optimal fertility targets. In particular, women's labor market opportunities may expand as they are better able to control fertility, thus leading to higher wages and potentially increased labor market participation through a substitution effect (Aaronson et al., 2017). [11] In addition to higher wages, a relative increase in the wages of women compared to their husbands may also raise women's bargaining power within

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brochures). National Family Planning Board workers and nurses from the Ministry of Health also visited homes, community halls, and maternity wards.

[10] Women working in the formal sector were most commonly employed in agriculture and fishing, followed by manufacturing and clerical work (Yahaya, 1988).

[11] Conditioning on higher wages, women should individually control a higher share of non-labor income and therefore may also choose to consume more leisure and work less, as found to be the case in response to the legalization of abortion in the United States by Oreffice (2007).

their households, increasing women's decision making power, including decisions regarding household expenditures and fertility.[12] Clarke and Muhlrad (2016) find that a large-scale family planning program providing free access to abortion services raised women's within-household decision making power by about 10 percent. Because the authors focus on married, fertile aged women, these effects are likely to flow in part through greater control over the timing and quantity of births.

These direct effects on women's empowerment may be larger if married women are able to use the new contraception technology without their husbands' knowledge. It is often the case that women have lower self-reported fertility preferences than men—as in our dataset.[13] Ashraf et al. (2014) find that women are more likely to take up contraception when given access to the services without their husbands, suggesting that women may be better able to achieve their own, lower fertility targets.

There are also compelling reasons to believe that the introduction of family planning may have important incentive effects leading to greater empowerment for all women, including unmarried women in areas where family planning may only be available to married women, and women who never use modern contraception. Specifically, there are several mechanisms through which family planning may lead to increased education among young girls and unmarried women, thus improving women's welfare, increasing labor force participation, and possibly strengthening their bargaining power within marriage later in life (Heath and Jayachandran, 2016). Standard theory predicts that individuals invest in human capital as long as the present value of their benefits exceeds that of their investment costs. The availability of improved contraceptive technology should increase the expected benefits of a girl's human capital because women will, on average, have fewer children, and/or be able to time pregnancies in a way that raises lifetime earnings. Expectations of lower maternal morbidity and mortality under family planning could also raise the expected average returns to female education (Jayachandran and Lleras-Muney, 2009). If family planning services were bundled together with maternal health programs and campaigns to promote the benefits of family planning, this expectation—and accompanying behavioral responses—may also be enhanced.[14] We emphasize that behavioral responses reflect *expectations* about the future; as learning about actual benefits occurs over time, expectations may change (and initial expectations may be overly optimistic or pessimistic).

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[12] Rasul (2008) proposes two models of household bargaining over fertility, one in which couples bargain with commitment, and another in which they bargain without commitment. Using the same Malaysian survey as the one used in this paper, he finds support for the model without commitment, in which the influence of each parent's fertility preferences depends on individual threat points. Access to modern contraceptive technology could be seen as increasing the woman's threat point due to her lower fertility and improved labor market prospects. This would in turn increase the influence of women's fertility preferences on the couple's fertility decisions.

[13] Rasul (2008) reports that women report wanting a total of 4.6 children compared to 4.97 among men in MFLS-1.

[14] Although empirical work is sparse, evidence from sociology suggests that the introduction of health facilities and schools can have a large impact on desired fertility (Axinn and Yabiku, 2001).

Importantly, increases in the average returns to female education should increase investments in the human capital and labor force participation of all girls, not only those who ultimately use family planning later in life. These incentive effects are demonstrated in a 2005 study of Indonesia's family planning programs. Angeles, Guilkey, and Mroz (2005) show that family planning leads to greater human capital investments among unmarried school-age girls, presumably due to changing expectations about future health, wages, and returns to education. Their simulations combining the effects of school quality improvements, family planning, and fertility changes on educational attainment suggest that the effect of family planning programs had substantial effects on education (exceeding the effect of investment in school quality).[15]

Conditioning on increases in returns to education, the implications of improved birth control technology for marriage market outcomes and the future intra-household bargaining power of women who are not yet married is less clear-cut. Chiappori and Oreffice (2008) show theoretically that, in a matching model assuming no friction, when birth control technology improves *for all women*, whether married or not, then it increases the share of the marital surplus obtained by all wives, irrespective of whether they use the method or not (except in very specific circumstances where husbands are in very short supply). This result follows from the increase in the reservation utility of the marginal woman (who only just chooses not to marry), which in a matching model is transmitted to all married women. If single women are not sexually active or if family planning is not available to unmarried women (as in many developing countries in general, and in Malaysia during the period covered by our data, in particular), then their utility is not improved by the new technology and therefore does not "trickle-up" to married women. If there is sex outside marriage but the new technology is not available to unmarried women, then women may actually lose out because some women who would not otherwise marry do so in order to access the technology, which increases competition among women and thus leads them to obtain lower shares of the marital surplus.[16]

2.2 The Malaysian Context

Malaysia's family planning programs began during the 1950s, prior to the country's independence in 1957. With crude birth rates of around 41-45, Malaysia was early among low- and middle-income countries by introducing family planning services in 1954 (Hanna

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[15] The famous Matlab family planning experiment provides some evidence on factors that may be inputs to education decisions—specifically, women's expected future health and earnings. These studies show that intensive family planning programs reduced women's mortality risk by 17 percent, and seemingly did so through increased consumption (BMI among women aged 25-54 increased by 1kg/m^2, a 5 percent improvement over control areas) (Menken et al., 2003). These effects of family planning, however, may not be easily separated from the effects of bundled infant and maternal health programs.

[16] Alternatively, if the technology is only available through marriage, and available in some areas but not in others, women in served areas may lose out. Peters (2011) tests this hypothesis in the Matlab district of Bangladesh, where the well-known Maternal and Child Health and Family Planning program (MCHFP) was randomized across villages in the 1970s. She finds that women in treatment villages have a lower self-reported ability to make purchases without their husbands' permission, and have to make higher dowry payments.

1971). By 1962, Malaysia's Family Planning Association established regional FPAs in all 11 states of Peninsular Malaysia, utilizing the existing network of Ministry of Health (MOH) facilities to accelerate the pace of service dissemination (Lee et al., 1973). In 1966, Malaysia was among the first wave of countries to develop centralized national family planning programs with the creation of the National Family Planning Board (LPPKN), making family planning an official part of national public health policy and coordinating with government agencies to extend family planning services throughout all parts of Malaysia. Capitalizing on the existing network of MOH and FPA facilities and providers, the LPPKN provided free intrauterine contraceptives and sterilization surgeries as well as heavily-subsidized oral contraceptives. Across all three major providers (MOH, FPA, and LPPKN), oral contraceptives were the most commonly used form of contraception (accounting for 55 percent of contraceptive prevalence in 1975), followed by sterilization and condoms (DaVanzo et al., 1986). In parallel, Malaysia's new cadre of family planning workers also advertised these new programs and promoted the benefits of family planning through community meetings and outreach (Hanna, 1971, Nortman and Hofstatter, 1978).[17]

Malaysia's family planning efforts are considered to have successfully increased contraceptive prevalence and reduced fertility (DaVanzo et al., 1986). The proportion of women at risk of conceiving who were using modern contraception increased from 3 percent-39 percent between 1961 and 1975 (DaVanzo et al., 1986). During this period, Malaysia's total fertility rate fell by about 30 percent, decreasing from 6.2 in 1961 to 4.3 in 1975 (DOSM, 2015). Although family planning programs were initially concentrated in urban areas, they scaled up to include rural areas through private clinics and mobile units in four distinct phases between 1967 and 1975 (Hanna, 1971, Tey, 2007).[18]

During this period, women's participation in the formal labor market also rose. Between 1957 and 1980, women's labor force participation increased from 31 percent to 42.2 percent, with largest gains among women ages 18 to 45 (Yahaya, 1988, Hirschman and Aghajanian, 1980). These increases largely reflected shifts from unpaid household worker to paid work in agriculture and fishing (42 percent), services (22 percent), and manufacturing (16 percent) (Yahaya, 1988, Chia, 1987).

3. Data

Data from this study are drawn from the nationally representative Malaysia Family Life Survey, Wave Two (MFLS-2), conducted in 1988. In each surveyed household, detailed life histories were collected among all women enumerated in the first wave, or aged 18-49 at the

[17] Family planning was promoted through an extensive network of family planning officers across Peninsular Malaysia. These family planning officers conducted promotional campaigns, held community forums, and distributed promotional materials. Family planning workers and Ministry of Health staff also conducted outreach services in community meetings, maternity wards and through in-home visits.

[18] The timing of family planning introduction in Malaysia was not randomly determined and we must, therefore, assume that programs were not targeted to areas with systematically different trends in human capital investment. Our main analysis of educational outcomes provides a natural test of this assumption, which is discussed in Section 4.

time of the second wave. This information includes educational attainment (years of schooling), work history (timing and earnings associated with current and past jobs), measures of household resource allocation (child care resources and expenditures in support of elderly parents), basic socio-demographic data (year of birth, ethnic group, religion), and characteristics of respondents' parents (including educational attainment). A separate module collected the information in parallel about each woman's husband. In total, the survey records life history data on 3,859 women and 3,063 spouses, and pregnancy histories of 2,747 women. Table 1 shows summary statistics and sample sizes for those included in our study by sex and ethnic group.

The MFLS-2 also included a community survey, which recorded the year in which each type of family planning service provider first began providing services in each enumeration block (including FPAs, MOH providers, LPPKN providers, and other private providers). We consider an individual to be exposed to family planning services in the first year that modern contraceptives were available by any type of provider in their community. Figure 1 shows the proportion of communities surveyed in each of Malaysia's districts served by any type of family planning provider. Although family planning services were provided in a small proportion of communities in the early 1960s, the majority of Malaysia's service expansion occurred between 1965 and 1975.

4. Incentive Effects: Education

4.1 Estimation

To study the incentive effects of family planning for female human capital investments, we exploit joint variation in the timing and location of family planning program introduction to estimate its relationship to girls' lifetime educational attainment and as well as contemporaneous, grade-specific primary and secondary school drop-out.[19]

Educational Attainment. We first compute school completion z-scores for girls relative to peers in the same sex and birth cohort group.[20] We emphasize that within the constraints of Malaysia's conservative social norms of the 1960s and 1970s, marriage and childbearing followed school completion with a substantial lag (on average, marriage occurs 7 years after leaving school, and just 6.8 percent of girls marry within one year of their last completed year of schooling); childbearing outside of marriage at any age was extremely rare during our study period, with just 0.26 percent of births reportedly occurring prior to marriage (WHO,

[19] Primary school is defined as the first 6 years of schooling, followed by two years of lower secondary and two years of upper secondary education.

[20] The z-score is computed as the difference between the individual's observed years of completed schooling and the average number of years of completed schooling among individuals of the same sex and five-year birth cohort, divided by the standard deviation of educational attainment in that group. This approach allows us to compare educational outcomes relative to peers across birth cohorts with potentially heterogeneous educational distributions.

2005). Our estimation therefore plausibly captures incentive effects (rather than direct effects) of family planning.

Specifically, for individual *i* born in cohort *c* and living in enumeration block *e*, we stratify our sample by sex and estimate:

$$Education_{iec} = \propto + \sum \beta_1^g FirstExposure_i^g + \sum \beta_2^j X_i^j + \sum \beta_3^d District_e^d + \sum \beta_4^c Cohort_i^c + \varepsilon_i \quad (1)$$

where $Education_{iec}$ is the educational attainment z-score of individual *i* living in enumeration area *e* relative to peers of the same sex- and five-year birth cohort, $FirstExposure_i^g$ is a vector of indicators capturing the age of first exposure to family planning in 5 year age groups,[21] X_i^j is a vector of individual characteristics (dummy variables for ethnic groups Malay, Chinese, Indian and other, and for maternal and paternal educational attainment). $District_e^d$ and $Cohort_i^c$ represent district and 5-year birth cohort fixed effects. For all specifications throughout the paper, we estimate robust standard errors clustered at the enumeration block level.

A key assumption required throughout the paper is that the joint timing and location of family planning introduction is exogenous with respect to human capital investments in girls. An implication of this assumption is that there should be no relationship between family planning and educational attainment among women first exposed to family planning beyond school age (after age 15).[22] Equation 1 allows us to test this assumption (and as Section 4.2 shows, we find no evidence of such a relationship).

School Drop-Out. We then use a Cox Proportional Hazard (CPH) model to compare annual school drop-out risk (conditional on entering school) among primary and secondary students exposed to family planning in each year of school. Specifically, we model the drop-out hazard $h_{ie}(t)$ for student *i* [23] in enumeration block *e* and period *t* (survival time, measured in single years of school) as:

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[21] $FirstExposure_i^0$ takes a value of 1 if an individual born in year *y* in enumeration block *e* was exposed to family planning for her entire life and zero otherwise; $FirstExposure_i^1$ takes a value of 1 if first exposed to family planning in the interval 0<*age*<=5 and zero otherwise; $FirstExposure_i^2$ takes a value of 1 if first exposure occurs in the interval 5<*age*<=10; etc. The reference group are those exposed to family planning after age 30.

[22] Our data show that 80 percent of girls finish schooling before the age of 15.

[23] Because our survey only sampled women who were married at the time of the survey, we risk increasingly severe selection toward women who marry young among the youngest cohorts. We therefore restrict our analysis to cohorts born at least 30 years prior to our survey. The vast majority of women in our survey (99 percent) marry before the age of 30.

$$h_{ie}(t) =$$

$$h_0(t)exp^{(\beta_0 + \beta_1 FP_{te} + \sum \beta_2^t FP_{te} \times T_i^t + \sum \beta_3^j X_i^j + \sum \beta_4^d District_e^d + + \sum \beta_4^d Cohort_e^d + \varepsilon_i)} \quad (2)$$

where $h_0(t)$ is an unspecified baseline hazard function; FP_{te} is a dummy variable for the availability of family planning services at time *t* in enumeration area *e*; T_i^t is a set of indicator variables taking a value of 1 if individual *i* is in school year *t* in a given person-year observation (and zero otherwise). An attractive feature of the CPH model is that it does not require us to specify or make assumptions about the underlying baseline hazard function $(h_0(t))$ for school drop-out (Cox and Oakes, 1984). However, it does assume that the ratio of drop-out hazards is constant across student age. We relax this proportional hazards assumption for family planning by interacting the time-varying family planning dummy with a set of indicators for each individual year of school, T_i^t.[24] This approach allows family planning to have a separate effect on the drop-out risk in each year of school (or grade).

To estimate the parameters in Equation 2, we construct a student-year dataset in which a student enters our sample when she enters school and exits after her last completed year of school. We write the joint probability of all realized drop-outs (assuming independence across individuals) as the following partial likelihood function:

$$L(\beta) = \prod \left\{ \frac{\exp(\beta Z_i)}{\sum_{j \in R(t_j)} \exp(\beta Z_j)} \right\}^{\delta_i} \quad (3)$$

where Z_i represents independent variables shown in Equation (1) (and the unspecified baseline hazard expressions cancel out). Taking the natural log of Equation 1, we then estimate the model parameters by maximum likelihood estimation (MLE).

4.2 Results

Educational Attainment. Table 2 reports estimates from Equation 1 for educational attainment z-scores. Column 1 shows that lifetime exposure to family planning (exposure beginning in the year of birth) is associated with 0.31 standard deviation gain in educational attainment, implying an additional 1.2 years of schooling among those with the longest exposure to family planning. Although not statistically significant among those with first family planning exposure at subsequent ages, point estimates gradually decline and are then close to zero beyond school age. Small, statistically insignificant estimates for those first exposed to family planning after schooling ages (age 20 or older) is consistent with our identifying assumption

[24] The estimated hazard ratio $exp^{(\beta_1 + \beta_2^t)}$ then captures the relative risk of drop-out at age *t* for those living in areas served by family planning providers in time *t* compared to those without available services.

that family planning programs were not systematically targeted to areas with pre-existing trend differences in schooling (or fertility).[25]

Although our results appear robust to the inclusion of varying groups of control variables, an interpretational issue is that girls first exposed to family planning early in life may stay in school longer because they have fewer younger siblings (or a different sibship sex composition) (Aslan, 2017). Table 2, Columns 3-4 report estimates from Equation 1, controlling for realized sibship size and sibship sex composition, suggesting that gains in girls' education are not due to sibship changes.

School Drop-Out. Figure 2 then shows the relationship between family planning exposure and year-to-year school drop-out risk, plotting hazard ratios $exp^{(\beta_1 + \beta_2^t)}$ for each year of school *t* (1-12) estimated using Equation 3.[26] Each hazard ratio measures year-specific risk of drop-out conditional on completing the previous year of schooling. It shows that the relationship between family planning and girls' drop-out risk is greatest in the earlier years of schooling, reducing the probability of drop out in the second, third, and fourth years of school by 48 percent, 62 percent, and 68 percent, respectively. This relationship is attenuated after the fourth year of school and is no longer statistically significant. These results suggest that the incentive effects of family planning are concentrated among those children that would have otherwise had the least amount of education (four years or fewer). Alternatively, conditional on entering secondary school, family planning has little relationship with drop-out risk among girls.

Finally, we use our estimation framework for school drop-out to compute implied changes in total years of education. First, we estimate the baseline hazard function $h_0(t)$ setting all independent variables to zero. Second, we adjust the baseline hazard function in each school year using all statistically significant hazard ratios associated with family planning availability, implying an average of 0.5 additional years of schooling for girls in areas with family planning.[27] These estimates, in combination with overall results of our z-score analysis are consistent with simulated gains in girls' education associated with family planning in Indonesia reported by Angeles et al. (2005) (0.9 years of education), and with effect sizes due to programs and policies specifically aiming to increase educational attainment, which range from 0.1 to 0.5 additional years of schooling (Case and Deaton, 1999, Duflo, 2001, Angrist et al., 2002, Lleras-Muney 2002).

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[25] In a companion paper, we also find that family planning program implementation was not targeted to areas with pre-existing trend differences, also consistent with our identifying assumption (Babiarz et al., 2017).

[26] The coefficient β_1 captures the effect of family planning on the risk of drop-out in the reference year (school year 1). The coefficient β_2^t captures any marginal effects on school drop-out risk in year *t*, relative to the reference year. The sum of the coefficients thus represents the full effect of family planning on drop-out risk for each year of school.

[27] Our proportional hazards model implies that when averaged across all exposed students, family planning leads to an additional 0.5 years of education on average. Results from Equation (1) imply that among those with the longest family planning exposure (those exposed to family planning from birth), these gains are larger (1.2 years of additional education).

5. Women's Economic Status in Adulthood

5.1 Estimation

Exposure to family planning prior to fertile ages may also lead to improvements in women's status later in life. Moreover, family planning exposure at fertile ages can also improve women's welfare directly by providing greater control over the number, timing, and spacing of births. To study both incentive and direct effects on women's empowerment in adulthood, we focus on labor market outcomes and intergenerational transfers (in particular, differential support to wives' and husbands' parents—a measure of women's bargaining power within the household). By comparing women first exposed to family planning at birth and in early childhood (who reflect both incentive and direct effects of family planning) with women first exposed at fertile ages (who reflect only direct effects), we are plausibly able to distinguish incentive effects from direct effects.

Labor Market Outcomes. We study the relationship between age at first family planning exposure and three different labor market outcomes: (1) the probability of participating in the labor force (both at any point in time and at each single year of age), (2) the probability of receiving pay for work (as opposed to unpaid labor or family work), conditional on being in the labor force, (3) age-specific wages, conditional on receiving pay for work.

Specifically, we estimate the following regression for married woman *i* born in cohort *y* and living in enumeration block *e* with first family planning exposure in age group *g*:[28]

$$LaborForce_{iec} = \propto + \sum \beta_1^g FirstExposure_i^g + \sum \beta_2^j X_i^j + \sum \beta_3^d District_e^d + \sum \beta_4^c Cohort_i^c + \varepsilon_i \quad (4)$$

where $LaborForce_{iec}$ is an indicator labor force participation—either measuring labor force participation at any age prior to the survey or at each single year of age 18-40—and all other variables are defined as before. The coefficient β_1^g measures the average family planning effect on labor market participation among all women first exposed to family planning in age group *g*. We note that because we do not condition on education or other human capital investments, coefficients estimated for early exposure to family planning capture the total effect of all human capital investments incentivized by family planning as well as direct effects working through a reduction in fertility from use of family planning, including observable and unobservable channels.[29]

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[28] Due the large number of area and cohort fixed effects and well-known incidental parameters problems inherent in nonlinear models such as logit regression, we use the linear probability model. However, our results are highly consistent using logit regression (see online appendix).

[29] Although we do not observe all types of human capital investment, which include (but are not limited to) years of education, quality of education, health investments, we expect point estimates of effect sizes to diminish when

We plausibly isolate incentive effects from direct effects of family planning by calculating the difference between β_1^{birth} (measuring incentive and direct effects among those with the longest exposure) and β_1^{20-24} (measuring the direct effects of those exposed only during childbearing years). We note that the difference between β_1^{birth} and β_1^{20-24} plausibly isolates the incentive effect if there is generally not gradual learning about family planning over time. This assumption is supported both by historical evidence on Malaysia's widespread promotion of family planning through community meetings, mass media, and other advertising activities and by the fact that we find evidence of contemporaneous reductions in primary school drop-out among girls prior to adolescence (Section 4.2).

To study changes in women's type/sector of work, we also estimate regressions similar to Equation (4) for the probability of ever receiving pay for work (conditional on working) and for the probability of receiving pay for work at each age (18-40), conditional on working at that age.[30] Finally, we study changes in women's wages associated with family planning by estimating Equation (4) for average reported monthly wages at each single year of age in Malaysian ringgits, conditional on receiving pay for work.[31]

Intergenerational Transfers/Cohabitation. When old-age support is primarily the responsibility of adult children, greater bargaining power and control over household resources predicts greater support to women's own parents (vs. their spouses' parents), including both co-residence and financial support of non co-resident parents (Lee et al., 1994, Lillard and Willis, 1997).[32] We study these intergenerational transfers using two measures. First we study the effects of family planning on the likelihood that wives' parents and, separately, their spouses' parents co-reside with married couples. Second, for non co-resident families, we study the proportion of total parental support directed toward wives' parents.[33]

To study cohabitation with elderly parents, we estimate regressions for married woman *i*, born in birth cohort *y*, living in enumeration block *e*, and having age at first family planning exposure *g*:

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we condition on imperfect measures of human capital. Tables in the online appendix show that effect sizes conditioning on years of education are smaller but remain statistically significant, suggesting that there are important unobserved incentive effect channels.

[30] We define receiving pay as being a paid employee, a business owner, or an employer.

[31] Interpolating between reported earnings at the start and end of each job, we calculate monthly wages for each year of employment.

[32] In Malaysia, the dominant direction of intergenerational transfers is from adult children to elderly parents (Lillard and Willis, 1997).

[33] Transfers that we observe include cash and the value of in-kind transfers.

$$Cohabitate_{iec} =$$

$$\propto + \sum \beta_1^g FirstExposure_i^g + \sum \beta_2^j X_i^j + \sum \beta_3^j Z_i^j + \sum \beta_3^d District_e^d$$
$$+ \sum \beta_4^c Cohort_i^c + \varepsilon_{ie} \quad (5)$$

where $Cohabitate_{iec}$ is an indicator for whether or not a married woman's parents co-reside, Z_i^j is a vector of parental attributes (mean parental age for each set of parents,[34] whether or not the wife's and the husband's parent is a widow/widower, and indicators for self-reported bad parental health), and all other variables are as previously defined (with the exception that the vector of individual characteristics X_i^j now includes the count of siblings). We estimate separate models for co-residence with husbands' parents, and isolate incentive effects from direct effects using the same approach as described before.

5.2 Results

Labor Market Outcomes. Figure 3 and Appendix Table 1 show that we first find no evidence that exposure to family planning at any age is related to the probability of labor force participation in adulthood. Point estimates for ever participating in the labor force and for age-specific labor force participation are quantitatively small and indistinguishable from zero. These results suggest that there are not meaningful incentive or direct effects of family planning on labor force participation.[35]

Figure 4 and Table 3 then show that family planning exposure in childhood increases the probability of receiving pay for work (vs. unpaid family work) in adulthood. Figure 4 plots estimates of β_1^g by age obtained from Equation (4) for paid labor at ages 18-40. Conditional on working, lifetime exposure to family planning (family planning exposure in the year of birth or before) increases the probability of receiving pay for work at age 26 by 19 percentage points and subsequently rising to 45 percentage points by age 39.[36] Table 3 shows corresponding point estimates and 95 percent confidence intervals.

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[34] We control for the age of wives' parents and their spouses' parents separately. When both parents are alive, we include the average age between the two parents. When only one parent is alive, we include the age of the surviving parent.

[35] This may be due to substitution and income effects cancelling each other out. Increased education and a higher ability to control fertility should improve female potential wages (or claims to the profits of family business), and thus contribute to an increase in female labor supply through a substitution effect. However, holding wages constant, if women have higher bargaining power in the household, one would expect female leisure to increase and female labor supply to decrease through an income effect. In our context, most women do not work for an observable pay and it is therefore impossible to disentangle the positive substitution effect from the negative income effect.

[36] Because we measure family planning exposure early in life or prior to birth, it is possible that subsequent changes in parents' fertility may have contributed to human capital investments in girls through a quality-quantity

To plausibly isolate the incentive effect, we then compute the difference between β_1^{birth} and β_1^{20-24}. Figure 5 shows this difference, depicting the relative magnitude of incentive and direct effects on paid labor at each age 18-40. Strikingly, it suggests that incentive effects accounts for 74-91 percent of total family planning effects on probability of working in a paid job at prime working ages (26-40).[37] This finding underscores the potential importance of incentive channels, which have so far have largely been overlooked in the family planning literature.

Finally, Appendix Table 2 shows that among those earning wages, there is no clear relationship between family planning exposure and self-reported monthly wage. However, we note that wages received do not necessarily reflect wages offered on the market.

Intergenerational Transfers/Co-residence. Table 4, Column 1 shows marginal probabilities for the relationship between married women's age of first exposure to family planning and probability of co-residence with her parents at the time of the survey. In general, there is an age gradient of estimates similar to the gains in education and paid labor shown in Tables 2 and 3. Specifically, women exposed to family planning at ages 14 or younger are 7.6-12.2 percentage points more likely to support their own parents through co-residence than those first exposed after age 30.[38] The magnitude of this relationship declines to approximately 2-6 percentage points among those first exposed at ages 15-19 and older. Notably, we do not find evidence of a strong relationship between family planning and patrilineal co-residence, with point estimates close to zero and not statistically significant (Table 4, Column 2).

Overall, our findings suggest that family planning has a marked effect on women's labor market outcomes, and possibly their bargaining power in the home (reflected in intergenerational transfers to women's elderly parents through co-residence (Lee et al., 1994, Lillard and Willis, 1997)). Importantly, we also find that these gains appear largely due to the incentive effects (rather than the direct effects) of family planning.

6. Conclusion

A central contribution of this working paper is that it studies possible incentive effects of family planning programs for human capital investments in girls—which could then translate into improvements in women's economic status throughout their lives. By potentially changing parents' expectations about future returns to girls' human capital, family planning

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tradeoff (Becker, 1991). However, as with our education results, these results are robust to controlling for sibship size and sibship sex composition, suggesting that our results are not driven by changes in parents' fertility (see online appendix).

[37] F-tests demonstrate that coefficients β_1^{birth} and β_1^{20-24} for age-specific paid labor are statistically distinguishable from each other after age 26 at the 95-99 percent confidence level.

[38] Due to the smaller sample available for this analysis (couples for whom at least one parent of each spouse is alive and for whom we have complete information data about parent health), we group those exposed to family planning after the age of 30 together to form a reference group.

programs could potentially improve the status of women beyond those whose ultimate realized fertility actually changes.

Focusing on the case of Malaysia, an early lower-income country to introduce family planning, our preliminary results suggest that family planning may have created such incentives for investments in girls, raising female educational attainment by approximately one-third of a standard deviation (0.5 years on average) by discouraging elementary school drop-out among girls. These gains are on-par with incentive effects found in Indonesia (Angeles et al., 2005)—and notably, comparable to effects produced by programs and policies specifically focused on boosting educational attainment in low- and middle-income countries (Case and Deaton, 1999, Duflo, 2001, Angrist et al., 2002, Lleras-Muney 2002).[39]

Exposure to family planning early in life is then also linked to measurable improvements in women's welfare later in life. Specifically, women were substantially more likely to be paid for their work at prime working ages (between 26 and 40). Moreover, these women also appear to have gained bargaining power within their households, increasing their households' support—particularly through co-residence—for women's elderly parents (relative to support for their husband's parents) (Lillard and Willis, 1997).

Finally, we find that the incentive effects of family planning may outweigh its direct effects in our context, accounting for 74 percent of the total labor market gains (increases in pay for work) related to family planning and 53 percent of the total increase in support for women's elderly parents. The primacy of incentive effects (over direct effects linked to changes in realized births or birth timing) is consistent with evidence from more than 100 countries spanning 200 years suggesting no strong direct relationship between changes in fertility and labor force participation among low-income countries (Aaronson et al. 2017).

[39] These include school construction in Indonesia (raising educational attainment by 0.15 years on average) (Duflo 2001), school voucher programs in Colombia (0.1 additional years of schooling) (Angrist et al., 2002), compulsory school laws in early 20th century United States (0.5 years of schooling) (Lleras-Muney, 2002), and class size effects in South Africa (0.5 additional years of schooling) (Case and Deaton, 1999).

References

AARONSON, D., DEHEJIA, R., JORDAN, A., POP-ELECHES, C., SAMII, C. & SCHULZE, K. 2017. The Effect of Fertility on Mothers' Labor Supply over the Last Two Centuries. *NYU Wagner Research Paper No. 2915334*.

ANGELES, G., GUILKEY, D. K. & MROZ, T. A. 2005. The effects of education and family planning programs on fertility in Indonesia. *Economic Development and Cultural Change,* 54**,** 165-201.

ASHRAF, N., FIELD, E. & LEE, J. 2014. Household bargaining and excess fertility: an experimental study in Zambia. *American Economic Review,* 104**,** 2210-37.

ASLAN, M. 2017. *The Gendered Spillover Effect of Young Children's Health on Human Capital: Evidence from Turkey,* Stanford, Working Paper.

AXINN, W. & YABIKU, S. 2001. Social Change, the Social Organization of Families, and Fertility Limitation. *American Journal of Sociology,* 106**,** 1219-61.

BABIARZ, K. S., LEE, J., MILLER, G., TEY, N. P. & VALENTE, C. 2017. *Family Planning and Fertility Behavior,* Stanford, Unpublished Working Paper.

BABIARZ, K. S. & MILLER, G. 2016. Family Planning Program Effects: A Review of Evidence from Microdata. *Population and Development Review,* 42**,** 7-26.

BECKER, G. S. 1991. *A treatise on the family,* Cambridge, Harvard University Press

BLUNDELL, R., CHIAPPORI, P.-A. & MEGHIR, C. 2005. Collective Labor Supply with Children. *Journal of Political Economy,* 113**,** 1277-1306.

CANNING, D. & SCHULTZ, T. P. 2012. The economic consequences of reproductive health and family planning. *Lancet,* 380**,** 165-171.

CHIA, S. Y. 1987. *Women's Economic Participation in Malaysia,* Bangkok, ESCAP/UN.

CHIAPPORI, P. A. & OREFFICE, S. 2008. Birth control and female empowerment: An equilibrium analysis. *Journal of Political Economy,* 116**,** 113-140.

CLARKE, D. & MUHLRAD, H. 2016. The Impact of Abortion Legalization of Fertility and Female Empowerment: New Evidence from Mexico.

CLELAND, J., BERNSTEIN, S., EZEH, A., FAUNDES, A., GLASIER, A. & INNIS, J. 2006. Family planning: the unfinished agenda. *Lancet,* 368**,** 1810-1827.

COALE, A. J. & HOOVER, E. M. 1959. Population growth and economic development in low-income countries. *American Economic Review,* 49**,** 436-438.

COX, D. R. & OAKES, D. 1984. *Analysis of Survival Data,* London, Chapman & Hall.

DAVANZO, J., ANN, T. B., OTHMAN, R. & PETERSON, J. 1986. *Determinants of Contraceptive method Choice in Peninsular Malaysia, 1961-1975,* Santa Monica, CA, RAND Corporation.

DOSM 2015. Total Fertility Rate 1958-2015. *In:* DEPARTMENT OF STATISTICS MALAYSIA (ed.).

DUFLO, E. 2012. Women Empowerment and Economic Development. *Journal of Economic Literature,* 50**,** 1051-1079.

EHRLICH, P. 1968. *The Population Bomb,* New York, Ballantine Books.

GLASIER, A., GULMEZOGLU, A. M., SCHMID, G. P., MORENO, C. G. & VAN LOOK, P. F. 2006. Sexual and reproductive health: a matter of life and death. *Lancet,* 368**,** 1595-1607.

GOLDIN, C. & KATZ, L. F. 2002. The power of the pill: Oral contraceptives and women's career and marriage decisions. *Journal of Political Economy,* 110**,** 730-770.

GREENE, M. E. & MERRICK, T. 2005. Poverty reduction: does reproductive health matter? . *Health, nutrition and population discussion paper*. Washington DC: The World Bank.

HANNA, W. A. 1971. Family Planning in Malaysia: Programs and Prospects. *American Universities Fieldstaff Reports,* 19**,** 1-11.

HEATH, R. & JAYACHANDRAN, S. 2016. The Causes and Consequences of Increased Female Education and Labor Force Participation in Developing Countries. *In:* AVERETT, S. L., ARGYS, L. M. & HOFFMAN, S. D. (eds.) *Oxford Handbook on the Economics of Women*. New York: Oxford University Press.

HIRSCHMAN, C. & AGHAJANIAN, A. 1980. Women's Labour Force Participation and Socioeconomic Development: the Case of Peninsular Malaysia, 1957-1970. *Journal of Southeast Asian Studies,* 11.

JAYACHANDRAN, S. & LLERAS-MUNEY, A. 2009. Life Expectancy and Human Capital Investments: Evidence from Maternal Mortality Declines. *Quarterly Journal of Economics,* 124**,** 349-397.

KELLEY, A. C. 2001. The Population Debate in Historical Perspective: Revisionism Revisited. *In:* BIRDSALL, N., KELLEY, A. C. & SINDING, S. W. (eds.) *Population Matters: Demographic Change, Economic Growth, and Poverty in the Developing World*. Oxford: Oxford University Press

LEE, E., ONG, M. & SMITH, T. E. 1973. Family Planning in west Malaysia: The Triumph of Economics and Health over Politics *In:* SMITH, T. E. (ed.) *The Politics of Fmaily Planning in the Third World*. London: George Allen & Unwin.

LEE, Y. J., PARISH, W. L. & WILLIS, R. J. 1994. Sons, Daughters, and Intergenerational Support in Taiwan. *American Journal of Sociology,* 99**,** 1010-1041.

LILLARD, L. A. & WILLIS, R. J. 1997. Motives for Intergenerational Transfers: Evidence from Malaysia *Demography,* 34**,** 115-134.

MENKEN, J., DUFFY, L. & KUHN, R. 2003. Childbearing and women's survival: New evidence from rural Bangladesh. *Population and Development Review,* 29**,** 405-+.

MERRICK, T. 2001. Population and Poverty in Households: A Review of Reviews. *In:* BIRDSALL, N., KELLEY, A. C. & SINDING, S. W. (eds.) *Population Matters: Demographic Change, Economic Growth and Poverty in the Developing World*. Oxford: Oxford University Press.

MILLER, G. 2010. Y Contraception as Development? New Evidence from Family Planning in Colombia. *Economic Journal,* 120**,** 709-736.

NAS 1971. *Rapid Population Growth: Consequences and Policy Implicatons,* Baltimore, National Academy of Sciences Office of the Foreign Secretary.

NORTMAN, D. L. & HOFSTATTER, E. 1978 *Population and Family Planning Programs,* New York, The Population Council

OREFFICE, S. 2007. Did the Legalization of Abortion Increase Women's Household Bargaining Power? Evidence from Labor Supply. *Review of Economics of the Household,* 5**,** 181-207.

PETERS, C. 2011. Effects of Family Planning and Health Services and Women's Welfare: Evidence on Dowries and Intra-householdl Bargaining in Bangladesh. *Review of Economics of the Household,* 9**,** 327-348.

RASUL, I. 2008. Household bargaining over fertility: Theory and evidence from Malaysia. *Journal of Development Economics,* 86**,** 215-241.

SCHULTZ, T. P. 2001. Women's Roles in Agricultural Household: Bargaining and Human Capital Investments *In:* EVENSON, R. & PINGALI, P. (eds.) *Handbook of Agricultural Economics*

TEY, N. P. 2007. The Family Planning Program in Peninsular Malaysia. *In:* ROBINSON, W. C. & ROSS, J. A. (eds.) *The Global Family Planning Revolution: Three Decades of Population Policies and Programs* Washington DC: The World Bank.

WHO 2005. *Sexual and Reproductive Health in Malaysia: A Review of Literature and Projects,* Manila, World Health Organization, Asia Pacific Region.

YAHAYA, J. 1988. *The Role, Status, and Income-Earning Activities of Women in Small-Scale Fisheries, Peninsular Malaysia,* Kuala Lumpur, Food and Agriculture Organization of the United Nations.

Figure 1: Family Planning Program Expansion in Peninsular Malaysia

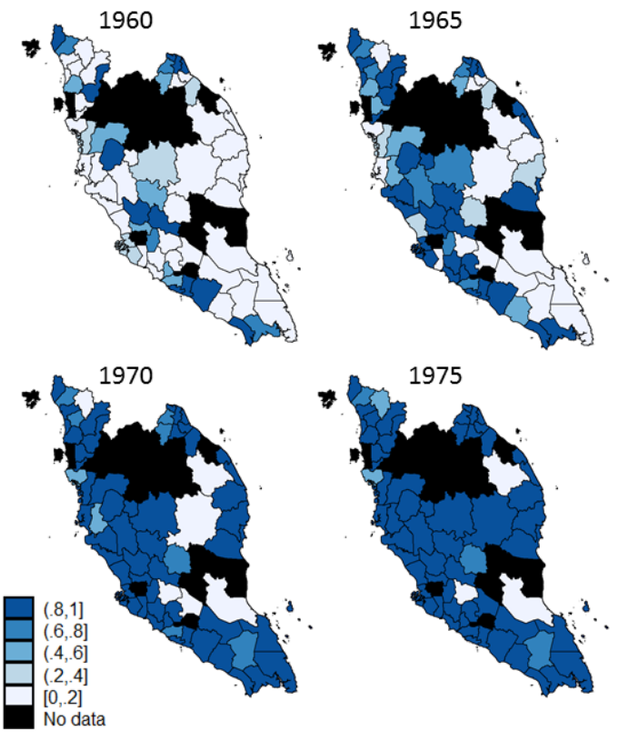


Figure shows the expansion of family planning providers over time based on the Malaysian Family Life Survey: Community Survey. Within each district, we calculate the share of enumeration blocks with at least one provider of family planning services (including Ministry of Health, National Family Planning Board, Family Planning Association or other providers).

Figure 2: Effects of Family Planning on Risk of Drop-Out

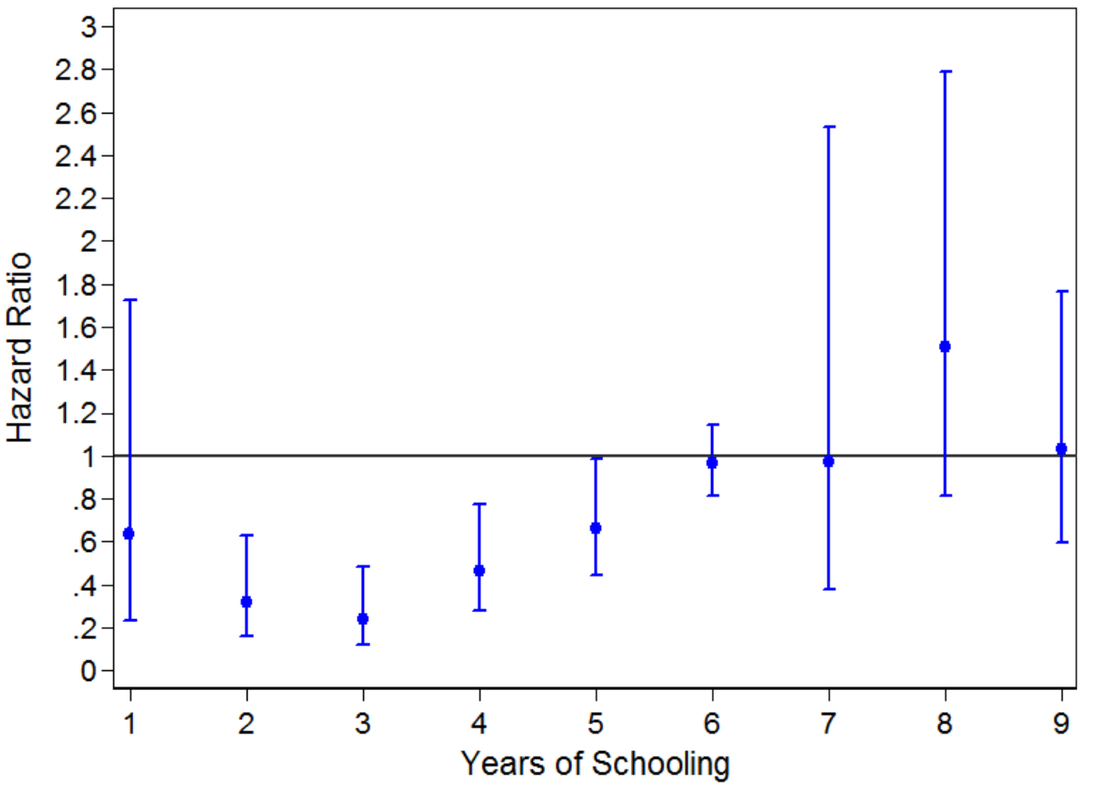
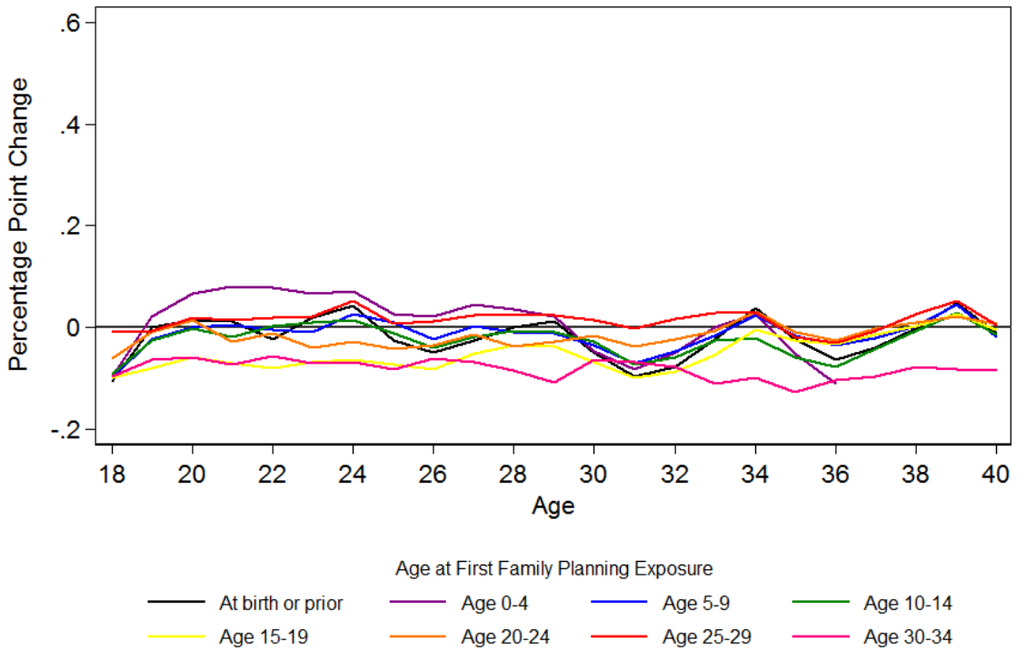


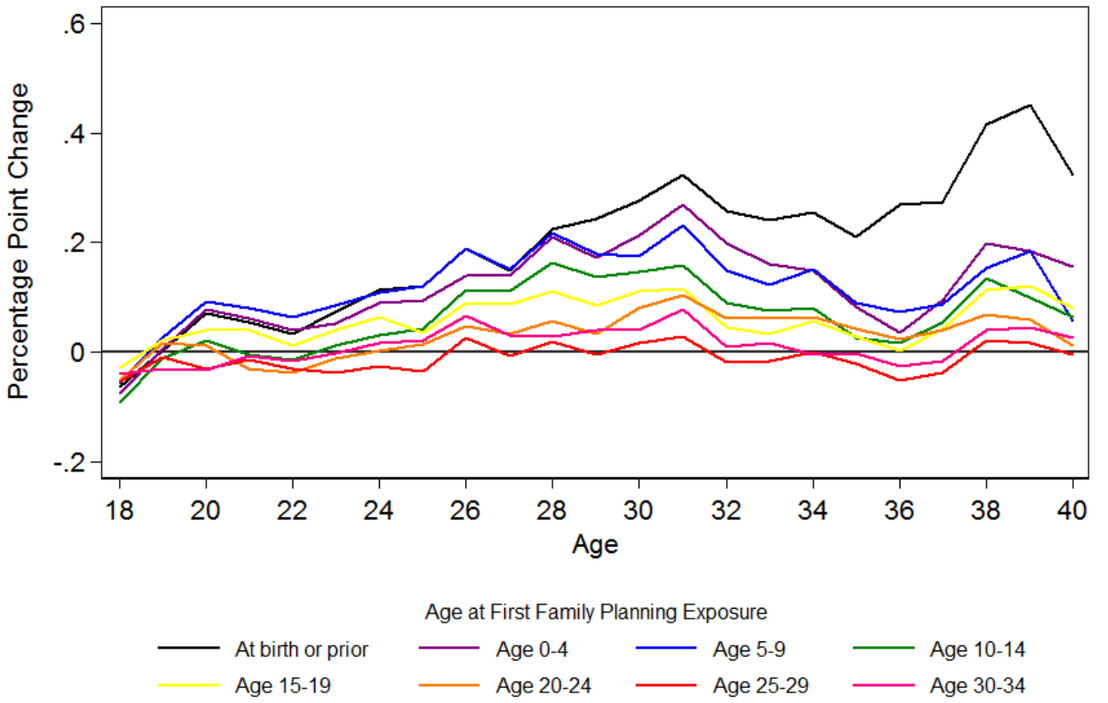
Figure shows the hazard ratios and 95 percent confidence intervals associated with contemporaneous family planning availability on the risk of female drop out in each year of schooling. Data from Malaysian Family Life Survey are used to estimate a Cox Proportional Hazards Model with time-varying family planning service availability indicators fully interacted with school year indicators, controlling for individual characteristics, district and birth cohort fixed effects. Standard errors are clustered at the enumeration block level.

Figure 3: Effects of Age of Family Planning Exposure on Labor Force Participation



This figure shows the estimated effect of family planning on the probability of being in the labor force at each single year of age, by age of first exposure to family planning (coefficients β_1^g estimated from Equation (4)). Ordinary Least Squares regressions control for individual characteristics, as well as district and birth cohort fixed effects. Appendix Table 1 shows detailed results, including point estimates and 95 percent confidence intervals.

Figure 4: Effects of Age of Family Planning Exposure on Paid Labor, Conditional on Labor Force Participation



This figure shows the estimated effect of family planning on the probability of earning wages, conditional on being in the labor force, at each single year of age, by age of first exposure to family planning (coefficients β_1^g estimated from Equation (4)). Ordinary Least Squares regressions control for individual characteristics, as well as district and birth cohort fixed effects. Table 3 shows detailed results, including point estimates and 95 percent confidence intervals.

Figure 5: Incentive and Direct Effects of Family Planning on Paid Labor

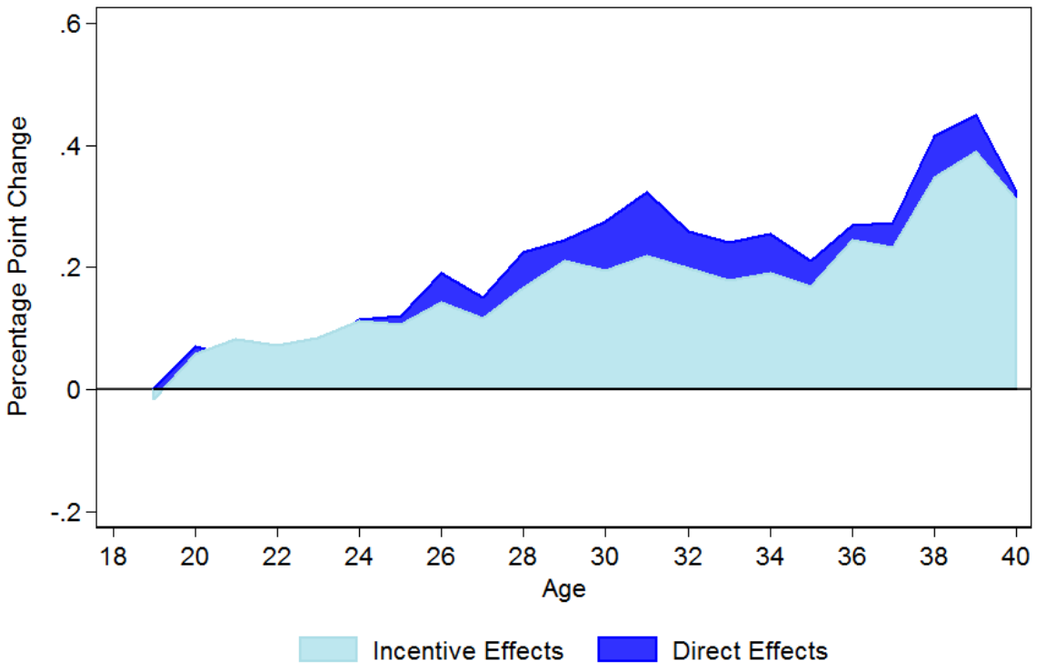


Figure shows the estimated incentive and direct effects of family planning on the probability of earning wages, conditional on being in the labor force, at each single year of age. Beginning with the effect of family planning exposure since birth (coefficient β_1^{birth}), which measures both incentive and direct effects, we subtract the direct effects of exposure during fertile years (coefficient β_1^{20-24}, shown as the dark blue region) to measure incentive effects (light blue region).

Table 3: Incentive and Direct Effects of Family Planning on Paid Worker Status, Conditional on Labor Force Participation

Age of First Exposure to Family Planning Services	Any Paid Employment	Paid Employment at Age 18	Paid Employment at Age 20	Paid Employment at Age 22	Paid Employment at Age 24	Paid Employment at Age 26
At Birth or Prior	0.089 (-0.063 - 0.242)	-0.062 (-0.273 - 0.149)	0.071 (-0.129 - 0.271)	0.034 (-0.164 - 0.232)	0.115 (-0.100 - 0.330)	0.190* (-0.036 - 0.417)
Age 1-4	0.109 (-0.039 - 0.256)	-0.075 (-0.288 - 0.138)	0.078 (-0.117 - 0.273)	0.041 (-0.157 - 0.239)	0.091 (-0.117 - 0.299)	0.14 (-0.078 - 0.359)
Age 5-9	0.117 (-0.029 - 0.263)	-0.056 (-0.253 - 0.140)	0.093 (-0.098 - 0.284)	0.065 (-0.127 - 0.257)	0.11 (-0.099 - 0.319)	0.189* (-0.027 - 0.405)
Age 10-14	0.102 (-0.041 - 0.246)	-0.092 (-0.284 - 0.100)	0.022 (-0.154 - 0.198)	-0.014 (-0.201 - 0.173)	0.03 (-0.168 - 0.229)	0.114 (-0.098 - 0.327)
Age 15-19	0.082 (-0.056 - 0.220)	-0.027 (-0.206 - 0.151)	0.04 (-0.117 - 0.198)	0.013 (-0.167 - 0.192)	0.063 (-0.133 - 0.260)	0.09 (-0.121 - 0.302)
Age 20-24	0.075 (-0.064 - 0.215)	-0.05 (-0.234 - 0.132)	0.012 (-0.157 - 0.181)	-0.038 (-0.216 - 0.141)	0.002 (-0.186 - 0.190)	0.049 (-0.153 - 0.251)
Age 25-29	0.023 (-0.108 - 0.153)	-0.053 (-0.214 - 0.109)	-0.029 (-0.165 - 0.107)	-0.031 (-0.177 - 0.116)	-0.024 (-0.175 - 0.127)	0.026 (-0.147 - 0.198)
Age 30-34	0.078 (-0.046 - 0.202)	-0.04 (-0.211 - 0.131)	-0.031 (-0.211 - 0.149)	-0.017 (-0.172 - 0.139)	0.018 (-0.155 - 0.190)	0.068 (-0.095 - 0.230)
Age >= 35	*Reference Group*					
Observations	3,271	1,810	1,953	1,776	1,657	1,480
R-squared	0.216	0.281	0.302	0.299	0.287	0.291
Incentive Effects F-test $H_0: \beta_1^{\text{At Birth or Prior}} - \beta_1^{\text{Age 20-24}} = 0$	0.123	0.0363	1.330	1.977	3.767	5.561
Prob > F	0.726	0.849	0.250	0.161	0.0532	0.019

Table 3: Incentive and Direct Effects of Family Planning on Paid Worker Status, Conditional on Labor Force Participation (Continued)

Age of First Exposure to Family Planning Services	Paid Employment at Age 28	Paid Employment at Age 30	Paid Employment at Age 32	Paid Employment at Age 34	Paid Employment at Age 36	Paid Employment at Age 38	Paid Employment at Age 40
At Birth or Prior	0.225*	0.276**	0.259*	0.256*	0.270*	0.416***	0.325*
	(-0.017 - 0.467)	(0.033 - 0.518)	(-0.001 - 0.518)	(-0.035 - 0.548)	(-0.024 - 0.562)	(0.127 - 0.705)	(-0.040 - 0.690)
Age 1-4	0.210*	0.212*	0.199	0.151	0.036	0.201	0.158
	(-0.018 - 0.439)	(-0.015 - 0.439)	(-0.047 - 0.447)	(-0.104 - 0.406)	(-0.241 - 0.313)	(-0.081 - 0.484)	(-0.204 - 0.521)
Age 5-9	0.218*	0.174	0.148	0.153	0.075	0.156	0.058
	(-0.004 - 0.439)	(-0.047 - 0.396)	(-0.090 - 0.387)	(-0.100 - 0.405)	(-0.196 - 0.346)	(-0.104 - 0.416)	(-0.229 - 0.346)
Age 10-14	0.163	0.147	0.091	0.082	0.02	0.138	0.068
	(-0.052 - 0.377)	(-0.064 - 0.357)	(-0.126 - 0.309)	(-0.148 - 0.311)	(-0.214 - 0.254)	(-0.091 - 0.367)	(-0.198 - 0.334)
Age 15-19	0.113	0.112	0.046	0.057	0.003	0.113	0.082
	(-0.090 - 0.315)	(-0.081 - 0.306)	(-0.154 - 0.245)	(-0.138 - 0.251)	(-0.201 - 0.208)	(-0.086 - 0.313)	(-0.145 - 0.308)
Age 20-24	0.058	0.081	0.061	0.066	0.025	0.07	0.015
	(-0.135 - 0.250)	(-0.094 - 0.256)	(-0.126 - 0.248)	(-0.122 - 0.255)	(-0.166 - 0.217)	(-0.117 - 0.256)	(-0.199 - 0.228)
Age 25-29	0.019	0.017	-0.017	0.001	-0.051	0.023	-0.004
	(-0.152 - 0.190)	(-0.123 - 0.156)	(-0.159 - 0.124)	(-0.161 - 0.162)	(-0.210 - 0.107)	(-0.124 - 0.171)	(-0.181 - 0.173)
Age 30-34	0.029	0.041	0.011	-0.004	-0.025	0.041	0.026
	(-0.134 - 0.192)	(-0.111 - 0.194)	(-0.145 - 0.167)	(-0.156 - 0.148)	(-0.172 - 0.122)	(-0.104 - 0.187)	(-0.129 - 0.181)
Age >= 35							
Observations	1,349	1,231	1,100	976	838	735	619
R-squared	0.301	0.294	0.293	0.304	0.315	0.316	0.284
Incentive Effects F-test							
H_0: $\beta_1^{\text{At Birth or Prior}} - \beta_1^{\text{Age 20-24}} = 0$	5.679	7.006	5.593	3.578	5.740	10.47	4.185
Prob > F	0.0178	0.00861	0.0188	0.0598	0.0174	0.00141	0.0422

Table shows the effects of family planning on the probability of being being in paid employment (conditional on being in the labor force) by age of exposure to family planning programs. Column 1 shows effect of family planning on ever receiving wages, and Columns 2-12 show family planning effects on age-specific probability of receiving wages for a select subset of ages (conditional on being in the labor force at that age). Regressions are estimated using Ordinary Least Squares, controling for individual characteristics (indicators for ethnic group and parental education), and both district and cohort fixed effects (not shown, but available upon request). Equivalent logit models are shown in online appendix. Standard errors are clustered at the enumeration block; robust 95% confidence intervals given in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table 4: Incentive and Direct Effects of Family Planning on Intergenerational Support

Age of First Exposure to Family Planning Services	Matrilineal Co-Residence (marginal effects)	Patrilineal Co-Residence (marginal effects)
At Birth or Prior	0.122**	0.061
	(0.019 - 0.225)	(-0.098 - 0.221)
Age 1-4	0.084*	0.007
	(-0.014 - 0.183)	(-0.148 - 0.162)
Age 5-9	0.082*	0.023
	(-0.008 - 0.172)	(-0.129 - 0.174)
Age 10-14	0.076*	0.022
	(-0.006 - 0.158)	(-0.113 - 0.157)
Age 15-19	0.019	-0.043
	(-0.057 - 0.095)	(-0.171 - 0.086)
Age 20-24	0.057	0.032
	(-0.039 - 0.154)	(-0.110 - 0.174)
Age 25-29	0.024	-0.031
	(-0.053 - 0.101)	(-0.131 - 0.069)
Age >= 30	*Reference Group*	
Observations	1,451	1,451
R-squared	0.081	0.181

Table shows the effects of family planning on intergenerational transfers by age of exposure to family planning programs. Column 1 shows effect of family planning on the probability of supporting wives' parents through co-residence, and Column 2 shows equivalent results for support of husbands' parents through co-habitation. For those couples not residing with any parent, Column 3 shows the effect of family planning on the proportion of intergenerational transfers from children to parents directed toward wives' parents. Regressions are estimated using Ordinary Least Squares, controling for individual characteristics (indicators for ethnic group, number of siblings, and parental education), characteristics of parents (indicator for one parent deceased, and indicators for self-reported bad health), as well as both district and cohort fixed effects (not shown, but available upon request). Standard errors are clustered at the enumeration block; robust 95% confidence intervals given in parentheses. *** p<0.01, ** p<0.05, * p<0.10.