Does Fasting During Pregnancy Affect Children's Labor Market Outcomes? Evidence from Indonesia

By Muhammad Farhan Majid

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ABSTRACT

This paper studies the long term effects of maternal fasting during the Islamic holy month of Ramadan. By exploiting exogenous variation in timing of Ramadan and timing of birth, including within family members, I compare outcomes for those potentially exposed to their mothers fasting to those not exposed. Using data from the Indonesian Family Life Survey(IFLS) Wave 3, I find that those potentially exposed work fewer hours and are more likely to be self-employed with disproportionate effects on females and rural borns. Though those exposed have worse adult general health, adult health does not seem to be an important channel through which exposure affects labor supply outcomes. When family fixed effects are used, the OLS estimates increase in magnitude suggesting that time invariant family levels co-variates are not explaining these results.

Keywords: Early childhood Environment, Health and Economic Development, Ramadan, Pregnancy, Nutrition, Indonesia, Labor economics

The most valuable of all capital is that invested in human beings; and of that capital the most precious part is the result of the care and influence of the mother. - Marshall (1890, paragraph VI.IV.11)

1.1 Introduction and Background

A large empirical literature finds that improvements in adult health lead to improved economic outcomes (Strauss and Thomas(1998); Strauss and Thomas(2008)). Another distinct large contemporaneous literature documents that religious people typically have better health outcomes (see Koenig et al. (2000) and McCullough et al. (2003)). Deaton(2009) recently study the correlation between religion, health, and income in more than 140 countries. He finds that women are more religious, that religious people report better health and that these effects are stronger in the more poverty stricken countries. Moreover, conditional on income, self reported health is significantly higher in Muslim majority countries. But very little has been studied on how religious practice affects health and how subsequent health changes determine labor market outcomes. My research will take an exception to this by exploring the causal effects of early childhood health on adult labor market outcomes, induced by a religious ritual practiced by millions every year. The ritual of fasting by Muslims.

One of the five pillars upon which the Islamic faith is built is fasting during daylight hours in the 9th month of the Islamic calendar, Ramadan. The Islamic Calendar is a lunar calendar consisting of 12 months in a year of roughly 355 days. In relation to the Georgian Calendar, Ramadan moves 11 days ahead every year as it does not follow the seasons. Muslims are to observe a complete fast from any sort of drinking, eating and sexual behavior during the period. There are exceptions though. Among others, pregnant women are supposed to fast only if their health is not affected.

But what does religious fasting have to do with the health and income based economic underdevelopment? Medical theory predicts that maternal fasting during pregnancy can create "accelerated starvation" for the fetus which can not only affect body size, birth weight but also long term health outcomes including coronary heart disease and type 2 diabetes (Almond et al. 2011). This is consistent with the fetal origins hypothesis (FOH). FOH states that early childhood environment, particularly in utero, can have serious consequences for adult heath. Recently economists have contributed to this literature providing growing evidence that not only health, but education and income in the later stages of the life-cycle can be explained by events early in life (Heckman et al. ,(2006); Almond et al., (2010)). Many studies suggest that a significant variation in adult schooling related outcomes, earnings even in the early thirties, and the probability of employment can be predicted as early as age 7 (Almond et al. , 2010). For example, using data from the 1958 British Birth Cohort study, Currie et al. (1999) state that 4 to 5% of the variation in employment at age 33, and

as much as 20% of the variation in wages can be predicted form an early age. Children in poor countries tend to be even more vulnerable to negative early life health shocks due to nutritional deficits or infectious diseases than those in rich countries (Hoyt (2010); Frankenberg et al. (2005)).

There is also empirical evidence that many Muslim pregnant fast, for at least a few days, during Ramadan. For example, a study in Singapore of 181 Muslim women found that seventy four percent fasted at least 1 day during pregnancy (Joosoph et al. (2004)). In a study conducted in Sanaa City, Yemen, more than ninety percent fasted over 20 days (Makki, (2002); See Almond and Mazumder (2011) for a more detailed survey).

The results show that the effect of fasting during pregnancy by Muslim mothers on their children's adult health effects is more severe for males than females, and for urban borns than rural borns, although labor supply of males and urban borns is much less responsive than females and rural borns. These results are consistent with the idea that in patriarchal societies, female labor supply is much more responsive than male labor supply to a given health shock, since males are usually bred earners and are responsible for earning where as women are not held responsible for earning. Since males and urban borns are usually more healthy, this finding is also consistent with the a concave labor supply function with diminishing returns to health, which implies that the link between health and market labor outcomes is weaker in more healthy populations.

The OLS estimates show that exposure in utero leads to a reduction in hours worked at primary job, with disproportionate effects for females. But the effects are not just limited to hours worked. Those exposed are also more likely to be self employed (shift to a low productivity sector), with exposed female more likely to be self employed than exposed males . Despite the disproportionate adult health shock for urban borns, the urban and rural borns are affected similarly in that urban borns are less likely to do wage work, whereas rural borns are more likely to be self-employed. In addition, those who are exposed have 0.12 fewer years of schooling on average, with effects for males as high as 0.21 fewer years of schooling and urban borns more severely affected than rural borns(although results are statistically insignificant).

I also provide suggestive evidence that adult general health is not an important channel through which exposure effects labor supply outcomes, although it does seem to be relatively important for the choice of sector than hours worked. In contrast to the irrelevance of adult health as a channel for labor hours, part of the effect of exposure on hours worked seems to be related to the choice of being self-employed.

To take into account any family level unobservables , such as mother's motivation to fast during pregnancy and any attempt to time births, I redo the basic OLS estimates for a sample of siblings. The magnitude of the estimates get larger for all outcomes of interest. Although general health and self-employment are still statistically significant at 10 % level, the p-values increase for all of them , with effect on hours worked becoming statistically insignificant at 10% level and years of schooling remaining insignificant. Since there

is no evidence that OLS estimates reduce in size, when controls for family fixed effects are included, this provides evidence that it its not selective timing by mothers or any other family level observables and unobservables which are deriving the effects of exposure.

The next section will do a brief literature review from Epidemiology and Economics on the literatures on maternal fasting (including in Ramadan) and its effects.

1.1.1 Theory and evidence on effects of fasting of mother on human development outcomes of the children

Within Epidemiology, Metzger et al.(1982) were one of the very first to document the high level of ketones and free fatty acids in pregnant women along with low glucose levels in pregnant vs non pregnant women after 12 hours of nighttime fasting. Two years later, Meis, Rose & Swain (1984) showed that daytime fasting for eight hours leads to symptoms that are as severe as in Metzger et al. (1982) after nighttime plus morning fasting for eighteen hours. Both studies emphasized the importance of pregnant women to eat during daytime hours.

Thereafter, several studies have shown that 'accelerated starvation' caused by fasting during pregnancy is correlated with malfunctioning of certain cognitive functions (Rizzo et al., (1991)). Recently, Dikensoy et al. (2009) reported that Ramadan fasting is associated with increases in cortisol levels during pregnancy. This finding is of interest because cortisol is a stress hormone understood to potentially 'program' health in adulthood (Kapoor et al., (2006)).

There is a sizable literature in epidemiology on the impact of Ramadan fasting in particular (see Almond et al. (2006) for a more detailed summary this literature). Many studies give evidence that pregnant women in Ramadan do indeed reach low levels of blood glucose and high levels of ketones. Arab(2004) found that 31% of pregnant women in Iran had ketonuria whereas 61% had hypoglycemia before breaking their fast. In the UK and West Africa, Prentice et al. (1983) and Malhotra et al.(1989) measured unambiguous signs of accelerated starvation in Ramadan among pregnant women who were fasting.

Several studies of maternal fasting during Ramadan have found adverse effects on fetal health indicators. Mirghani et al.(2004) found evidence of reduced fetal breathing movements where measures of fetal breathing were taken both before and after fasting on the same day. DiPietro et al.(2007) found a strong association between variation in fetal heart rate in utero and mental and psychomotor development and language ability during early childhood. The above are only few of the many studies. Most evidence points towards strong first stage effects of exposure to Ramadan fasting among pregnant women and its effect on health and nutrition of the mother (and the fetus).

There are two main hypothesis concerning effects of fetal health on long term outcomes. These can be viewed under the umbrella of the FOH. The first is described as fetal under-nutrition. According to this view, inadequate prenatal nutrition leads to developmental adaptations that are beneficial for short-term survival but affect the general growth of the fetus(e.g lower birth weight). Moreover, organs which are undergoing their critical growth period get a permanent dent. This effect takes place despite a short period of nutritional deficiency(Barker,1997).

Often, such damage does not create problems immediately, but only much later in life, as degeneration sustained during the lifetime has taken its own toll. This can lead to effects on kidney, higher risk for having type-2 diabetes. Type 2 diabetes in turn is a key risk factor in development of coronary heart disease. In fact, low birth weight is itself understood to predict coronary heart disease in adult life. Almond et al.(2011) provide evidence that Ramadan does in fact cause lower birth weights. However, birth weight only captures part of the changes of the fetal body to maternal nutrition.

A second prominent hypothesis is that nutritional restrictions hamper the development of a placental enzyme that is required to convert cortisol into inactive cortisone, thereby exposing the fetus to excessive amounts of cortisol (Almond et al. (2006)). It is believed that exposure to glucocorticoids such as cortisol in utero leads to a reprogramming of the hypothalamic pituitary adrenal axis (HPA) which is linked with not only type 2 diabetes, high blood pressure but also cognitive impairment (Seckl et al.(2007), Kapoor et al.(2006)). Moreover, fasting during Ramadan is shown to be correlated with high cortisol levels (Dikensoy et al.(2009)).

Existing studies of birth outcomes have relied on comparisons between mothers who reported fasting to those who did not. The largest and one of most commonly cited study on the effects of Ramadan on birth weight conducted a retrospective analysis of 13,351 babies born at full term from 1964-84 in Birmingham, England Cross et al. (1990). Cross et al.(1990) found a higher frequency of low birth weight among fasters during the second trimester of pregnancy, although there were no significant effects on mean birth weight. Malhotra et al. (1989) and Mirghani and Hamud (2006) found no effects on birthweight and APGAR scores, even though they detected substantial biochemical changes. In the same study, Mirghani and Hamud(2006) find that there is a higher incidence of gestational diabetes (GDM), induced labor , the cesarean section rate and a higher rate of admission to the special care baby unit (SCBU) among fasting group vs the control group.

Azizi et al. (2004) is the only well-known study in epidemiology which considers long term impact of fasting on human capital outcomes. They found no significant difference in the IQ's of school-age children by maternal fasting behavior during the third trimester of pregnancy.

There are a number of problems inherent in most of these empirical studies in epidemiology. These include

small sample sizes, consideration of effects from a given trimester instead of comprehensively studying effects for different trimesters or even for different months. More seriously, most of these studies have attempted to evaluate average treatment effects of Ramadan by comparing outcomes of those who actually fasted vs. not but under the assumption that the decision to fast is exogenous. Although some of these studies control for variables like mothers pre-pregnancy BMI, the list is not exhaustive. For example, a number of these studies may not control for smoking behavior and fathers education or for diversity in ethnic backgrounds or varying levels of community health facilities available to different mothers which may inform different fasting behaviors on part of fasting mothers. In fact, few, if any, of these studies are experimental /quasi-experimental in their nature relying on simple OLS regressions with limited controls.

Within economics, Almond and Mazumder (2011) are the first to systematically consider the effects of fasting during pregnancy by Muslim women on their children's long term outcomes. Using data from Michigan, they first show that the health of newborns is negatively affected by exposure to Ramadan in utero. Using Ugandan data, they next look at long-term effects of exposure on the probabilities of having disabilities as an adult. They find that Muslims who were conceived in utero during Ramadan had higher probabilities of having vision, hearing and mental or learning disabilities as adults. They also find an effect on the male/female ratio (a lower share of males) that can be related to adverse pre-birth condition.

Ewijk(2011) is the closest to my study. It uses Indonesian Family Life Survey data (Wave 3) to study long term effects of Ramadan on health measures. The paper shows that people who were exposed to Ramadan fasting during their mother's pregnancy have a poorer general health and are sick more often than people who were not exposed. This effect is especially pronounced among older people, who, when exposed, also report health problems more often that are indicative of coronary heart problems and type 2 diabetes. The exposed are a bit smaller in body size and weigh less. Among Muslims born during, and in the months after Ramadan, the share of males is lower, corroborating the findings of Almond and Mazumder (2011).

It's important to highlight the common methodology of these two papers. Instead of estimating Average Treatment Effects, they estimate ITT(Intent To Treatment effects) by comparing children of those mothers for whom at least some part of Ramadan coincided with some part of their pregnancy. The identification assumption is that timing of pregnancy is exogenous with respect to timing of Ramadan. We do not know who actually fasted or not. All we know is that non-Muslim mothers cannot be in the pool of potential treatment group and that the actual group of mothers who fasted will be among the Muslim population. In this sense their estimates can be understood to be lower bounds.

However, their identifying assumption is questionable. There are a host of social factors which not only determine whether or not a given Muslim pregnant women may fast but also how her family(community) tries to remedy for any subsequent negative effects on the exposed child(ren) via intra-household (intra-

communal) reallocations of resources. For example educated mothers may attempt to selectively time their births to avoid any overlap between pregnancy and Ramadan. Or more health clinics may be devoted to areas where there is greater concentration of Muslim women fasting because in such areas there is greater incidence of low child birth. Even if one can rule out the endogeneity of decision to fast under their identification assumption, one cannot rule out endogeneity of effects of such fasting behavior on long term outcomes.

The treatment group is defined broadly enough to include any pregnant women who is Muslim. Although they justify this with their interpretation of their estimates as lower bounds its not clear why they are lower bounds. If there are two pregnant women within the same household with only one of the women exposed to Ramadan, the unexposed woman may still be affected through peer effects or because the two share the same budget constraint. Thus, we may observe a negative effective on health of the children of such mothers too although they did not fast. In this case , it is not clear why the estimates are necessarily lower bounds. By taking mother fixed effects, such a concern can be addressed. Another reason one might be concerned about the ITT estimates not being lower bounds is due to sibling spill over effects i.e. if a sibling who was not exposed to Ramadan gets negatively effected due to a spill over effect from the sibling who is exposed.

1.2 Data

I use the Wave 3 of the Indonesian Family Life Survey (IFLS) which was carried out in 2000. IFLS covers 13 of the (then) 26 provinces of Indonesia, which in total represent 83% of the Indonesian population. It consists of 4 waves: IFLS 1 (1993/4); IFLS 2 (1997/8) and IFLS 3 (2000) and IFLS 4 (2007/8) and a 5th one(IFLS 2 +) in 1998 which was carried out for 25% of the population right after the East Asian Financial Crises in 1997. IFLS is a broadly set up survey which collects a great amount of information at individual, household and community level on a large array of economic, health and social indicators. Sampling took place at the household level. Great care was taken to assure representativeness of the sample for the reference population. IFLS covers 13 of the (then) 26 provinces of Indonesia, which in total represent 83% of the Indonesian population. One of the most appealing characteristics of IFLS is its low attrition rates, comparing favorably even against longitudinal data sets in developed countries. In IFLS 3 the re-contact rate was as high as 95.3% of IFLS 1 households.. Another feature of the data set which is conducive to my study is that around 88% of sample population is Muslim which gives me a large enough sample size to compare siblings in Muslim families. This also means that there is a significant minority (12%) which leaves me some room for any falsification tests on non-Muslim population i.e. I should find no Ramadan effect for non-Muslim pregnant women because they are not supposed to be fasting during Ramadan. My study will be a cross sectional one using the third wave, IFLS 3 for this purpose, although I plan to use wave 4 in the

future work.

I closely follow Almond and Mazumder (2011) and Ewijk (2011) in defining the exposure to Ramadan variable(see their papers for details on the construction of the exposure variable). However, I differ in two ways. First , I use proportion of days potentially exposed to tease out how many days of exposure makes the most significant impact. Secondly, for my regression analysis I focus on those who are potentially exposed for a whole month rather than those who were exposed to Ramadan for a few days only.

To estimate exposure, using self-reported exact date of birth, I determine how many days before somebodys date of birth the last Ramadan fell, restricting the sample to those born between 1935 and 1985 (15-65 years of age in 2000) who are Muslims.[1] Assuming that the average pregnancy lasted for 266 days , I calculate the conception date from the date of birth. If Ramadan starts and ends any time between an individual's date of birth and their estimated conception date, then one is potentially exposed to Ramadan fasting for a whole month. But if Ramadan started and ended before ones' conception date they would not possibly be exposed to mothers potential fasting during Ramadan. Days of exposure can be determined by calculating how many days Ramadan overlapped with any time between conception and birth. Proportion of days of exposure is calculated by dividing days of exposure by 29 days (assumed average length of Ramadan).

One may be concerned that if pregnancy lasted longer than 9 months then I may be declaring someone to be not exposed but who was actually exposed so that the estimates will be biased further down. Since Kieler et al. (1995) document that very few pregnancies last more than three weeks beyond the average, following Ewijk (2011), I also control for all those who were conceived within three weeks after the end of Ramadan.

Table 1 reports selected summary statistics for males and females by exposure. Exposure is a dummy for whether the individual was potentially exposed to a full month of Ramadan while in utero. General Health captures the overall health of the individual as assessed by trained health nurses and health practitioners. This is based on a nine-point scale, where 9 denotes best health and 1 the worst health. This measure has a mean of 6.224 with a standard deviation of 0.975 overall. Those males who are exposed have a worse general health which is lower than those not exposed. Ewijk (2011) finds the cleanest and strongest effects of ramadan exposure on this general health measure, which is more credible than self reported measures of health. Although I focus on labor market outcomes, I also show results on general health but for adults aged 15-65 only, who are my sample of interest. This will be particularly relevant when I explore the role adult heath could play as a channel to determine labor market outcomes.

[1]The start and end of Ramadan dates were taken from from www.phys.uu.nl/ vgent/islam/ummalqura.htm and (before 14 March, 1937) www.al-islam.com/eng. Although I did explore other websites as well and in some cases found very minor discrepancies in these dates. In many areas of the Muslim world, the start and end of Ramadan is determined by moon sightings for that there will be very minor noise in the estimates.

Labor market outcomes include log of hours worked in a normal week at the primary job(Log Hours) , self employment status (Self-Emp), participation in wage-earning sector either private or government job (Wagework), labor force participation (Work) and log monthly wages at primary job(Log Monthly Wages). The average of log hours for the sample of Muslims aged 15-65, is 3.581 (aprox. 36 hours) with standard deviation of 0.703 . Males who are exposed are very similar to those not exposed, but females who are exposed work fewer hours at their primary job. Log monthly wages has a mean of 6.682 (800 rupiah per hour on average in a given month) with standard deviation of 2.350. Exposure seems to not effect wages for females, but the mean wages are lower for men. This is consistent with the hypothesis that although men do not alter their work hours, being bred earners for their family, exposure to Ramadan may have lowered their productivity leading to reduced wages.

Overall, mean labor force participation is 66% with a standard deviation of 0.474, with the effect of exposure on participation being similar across genders. On average 31.5 % of the sample is self-employed, with a standard deviation of 0.465. Males and females who are exposed are more likely to be self-employed, though females, compared to males, are more likely to be self employed if exposed. Among those not self-employed, a similar story holds true for participation in wage earnings private or government jobs, where exposure reduces likelihood of working in earning wage earning sector.

Next I explore schooling outcomes. Th overall sample has about 9 years of schooling, with those exposed among males having fewer years of schooling , although years of schooling for females does not seem to differ by exposure. A similar story exists for education level(junior, middle school, high school,etc) and age to join school, reading and writing in Indonesian language. Although , for reading and writing in Indonesian language , effects of exposure does not seem to vary much by gender.

Mean age is 30 year, but those who are exposed seem to be almost a full year older than those who are not. I will control for age in a flexible way to take such age effects into account.

1.2.1 Empirical Methodology

The traditional ordinary least squares formulation is shown in (1.1) as follows:

$$Y_{if} = \alpha + \beta_1 exposure_{if} + \beta_2 age_{if} + \beta_3 age^2{}_{if} + \beta_4 male_{if} + \sum_{m=1}^{11} \gamma_m month_{mif} + \beta_5 FC_f + U_{if} \qquad (1.1)$$

where Y_{if} is the set of human development outcomes of interest for individual i belonging to family f . $Exposure_{if}$ is a dummy for whether one was potentially exposed for a full month in utero. age_{if} is age

measured in days. γ_m denotes the coefficients for the calendar month of birth fixed effects. [2] In order to control for any communal and social factors which may bias our estimates of exposure to Ramadan, one can carry out a family fixed effects study. We assume that the FC, family/community level variables, remains constant over time and so can drop out the fixed effect FC through differencing across t_1 and t_2 , the year of births of family member.

$$\Delta Y_{[t_1,t_2]} = \alpha + \beta_1 exposure_{[t_1,t_2]} + \beta_2 \Delta age_{[t_1,t_2]} + \beta_3 \Delta age^2{}_{[t_1,t_2]} + \beta_4 \Delta male_{[t_1,t_2]} + \sum_{m=1}^{11} \gamma_m \Delta month_{[mt_1,mt_2]} + \Delta V_{[t_1,t_2]} \tag{1.2}$$

This method compares family members who are exposed to Ramadan compared to those who were not under the identifying assumption that timing of birth and timing of ramadan is exogenous and fixed effects are time invariant.

1.3 Results

Potential fasting during pregnancy by Muslim women is inversely related with their children's adult labor market outcomes and general health. Three sets of figures summarize this relationship. No controls are added and a pure relationship between potential exposure to Ramadan and outcomes of interest is explored. Figure 1 examines the non-linear relationship between proportion of days of potential exposure to mothers fasting in utero and the adult general health measure, for overall sample of ages 15-65, and by gender. [3] Days of potential exposure is a continuos measure of the proportion of days Ramadan overlapped with any period in utero. More days of potential exposure reduces general health for overall sample as well as for males and females. Its worth noting that the effect for those even exposed for little more than half the Ramadan (about 60%) seems to be quite similar to those fully exposed , although the effect gets relatively more intense for males compared to females.

Figure 2 explores effects on hours worked at primary job, for overall sample of ages 15-65, and by gender. Exposure to Ramadan reduces hours worked , but mainly for females and not for males. Moreover,the effect of potential exposure for a full month are quite similar to those who were exposed even for a little less than half of the Ramadan (about 45 %). Figure 3 explore effects on self-employment status, for overall sample of ages 15-65, and by gender. Exposure to Ramadan increases the probability of working in a less productive sector- the self-employment sector for males as well for females. For males, the effect of potential exposure

[2] For some specifications. I explored an alternate set of controls for month of Ramadan fixed effects. The estimates did not change much

[3] The graphs are local polynomial smooth plots using the epanechnikov kernel and a bandwidth of 0.2. Shaded areas represent 95% confidence intervals.

for a full month are quite similar to those who were exposed for 20 days (about 65%) but for females, even if they are exposed to about about 15 days, the effects are quite similar to those females exposed for a full month. Together these figures suggest that exposure in utero to mothers fasting effects general health during adulthood for males and females, but labor market outcomes for females are more responsive than males. The regression tables will explore the robustness of this observation.

Table 2 presents results from estimation of equation (1.1) for general health, and labor market outcomes. In these set of estimates, I do control for any family level covariates, so that FC_f is assumed not to be correlated with exposure and outcome of interest Y_{if}. For each outcome, the coefficient on exposure to Ramadan is presented row by row for overall sample(first row), males , females , urban borns, rural borns, those aged 45 and above and those younger than age 45. Standard errors are in parentheses, and the number of observations mentioned for every sample and regression estimate. All controls and fixed effects will not be shown (subsequent tables will follow the same format).

In the overall sample of those aged between 15-65, those who are exposed in utero have 0.057 of a standard deviation worse general health. This is similar to the estimate of 0.061, Ewijk(2011) found for a larger sample of all those aged 1 and above. Those exposed also report working 4.7% fewer hours at their primary job in a normal week. They are 3.4% less likely to do wage work and are 3.7% more likely to be self employed. These estimates are statistically significant at the 5 % level. They also likely to complete 0.12 fewer years of schooling, although these estimates are not statistically significant at 10 % level.

Next I study effects separately for males and females. I find that general health is worse for males, who have 0.072 of a standard deviation worse general health compared to females who have 0.037 of a standard deviation worse general health (consistent with Ewijk(2011)). In fact, the estimates are not statistically significant for women but are statistically significant for men at the 10% level. In contrast to the asymmetric health effect which is biased towards males, females work 7.7% fewer hours in a normal week at their primary job (statistically significant at 10 % level) compared to 2.1% fewer hours for men (statistically insignificant at 10 % level). Moreover, females who are exposed are 4.7% more likely to be self-employed (statistically significant at the 5 % level) compared to males who are 3.1 % more likely to be self employed(statistically insignificant at the 10 % level). Although statistically insignificant at 10 % level, the effect of exposure to Ramadan on years of schooling, is highly skewed towards men with exposed men reporting 0.21 fewer years of schooling vs women reporting 0.05 (not different from 0) more years of schooling. These results are consistent with the idea that in a largely patriarchal society like Indonesia, female labor supply is much more responsive than male labor supply to a given health shock, since males are usually bred earners and are responsible for earning where as women are not held responsible for earning. So that even though males have worse general health , there is not much effect on their labor supply response compared to females.

When outcomes for those born in urban areas are compared to the rural borns, I find that those born in urban areas have 0.099 of a standard deviation (statistically significant at the 5 %) worse general health compared to rural borns who have 0.024 of a standard deviation worse general health(statistically insignificant at the 10 %). The magnitude of the hours worked is similar at about 5.1% of a standard deviation and the likelihood of being self employed is similar (3.6%), though those who are urban born report 0.13 fewer years of schooling vs rural borns who report report 0.03 (not different from 0) fewer years of schooling (though statistically insignificant at 10 % level). Again one can note how the health response differs from labor market response. Where as adult general health seems to be disproportionally worse for those exposed and born in urban areas, labor supply response to Ramadan shock is not much different across rural-urban areas. So that urban born's labor supply response to adult health seem to be less responsive to health shocks than rural borns. Since rural borns and females, who generally have worse health outcomes , have a stronger link between general health and labor supply than urban borns and males,respectively, this finding is consistent with a concave labor supply function with diminishing returns to heath .

1.3.1 Suggestive Pathways determining outcomes

How important a channel is adult general health in determining labor supply and choice to engage in self employment rather than wage work? How much of the changes in hours worked due to change in sector of work and vice versa? In principle one can think that exposure has a direct effect on labor supply through changes in adult health or it could effect through all other channels including cognitive ability and years of schooling. The approach I take is similar to (Maccini and Yang 2009) and the results shown in Table 3. First, I regress the labor market outcomes on exposure in utero for the overall sample(columns (1) and (2)) and then successively add controls for general health ((columns (3) and (4)). If controlling for adult health, reduces the magnitude of the coefficient on exposure variable and increases its R-squared, this would suggest that general health represent an important pathway toward adult socioeconomic status. This is only suggestive evidence and the pathways are not causal due to presence of omitted variables bias.

Column (3) shows that controlling for general health increases, rather than reduces, the magnitude of log hours, with little change in R-squared. This suggests that though exposure does have a significant effect on adult general health, adult heath (and any uncontrolled unobservables which are correlated to adult health) is not an important channel through which exposure in utero effects log hours. This suggests that though exposure does have a significant effect on adult general health, adult heath (and any uncontrolled unobservables which are correlated to adult health) is not an important channel through which exposure in utero effects log hours. Column (4), in contrast, shows that controlling for general health increases, does

reduce the magnitude of self-employment variable by 0.1% with a slight increase in R-squared.Although the change is very small, it does suggest that relative to labor supply, general health seems to play a more important role in the choice of sector of work.

It may be the case that part of the reason individuals work fewer hours is due to change in sector of work towards a low productivity sector -self employment sector. To explore this, I control for self-employment variable in (5). Controlling for self-employment reduces the magnitude of exposure variable by 0.3% and increases R-squared, suggesting that its indeed the case that self-employment is an important channel through which hours worked are affected . This may reflect the cumulative effect of exposure on childhood health, cognitive ability and schooling which is in turn leads individuals to be self employed. To tease out what role adult general health may have played to determine log hours indirectly through its effect on self-employment, I additionally control for general health in (6). The coefficient rises by 0.5% points and R-squared declines suggesting that general health did not play any an important indirect role in determining labor hours either.

1.3.2 Within Family Comparisons

There are a host of social factors which not only determine whether or not a given Muslim pregnant women may fast but also how her family(community) tries to remedy for any subsequent negative effects on the exposed child(ren) via intra-household (intra-communal) reallocations of resources. For example educated mothers may attempt to selectively time their births to avoid any overlap between pregnancy and Ramadan. Or more health clinics may be devoted to areas where there is greater concentration of Muslim women fasting because in such areas there is greater incidence of low child birth weight. Even if one can rule out the endogeneity of decision to fast under their identification assumption, one cannot rule out endogeneity of effects of such fasting behavior on long term outcomes. The fact that those exposed choose to leave wage work and be self employed provide evidence that indeed selection is present. Finally, although potential exposure is exogenous, actual exposure may well be endogenous. By doing a within family comparison I can control for time invariant factors which are common to the family and which may determine actual exposure and also any investment response by the parents.

In Table 4, I restrict the overall sample, to those family members who are biological children of the household head (siblings) , their parents and the co-residing siblings of the parents. Given that I am primarily interested in adult outcomes(15 and above) , doing a siblings effect analysis becomes a challenge as siblings may disperse into different households and even out if areas sampled by the Indonesian Family Life Survey. I thus include siblings of the household and the siblings of the spouse of the household in addition to the siblings who are children of the household head to create a large data set. To the extent that

any of the non co-residing siblings are household heads in other households in my sample, this sample will not suffer from any selection bias related to exposed siblings sorting themselves out in different households than those not exposed.

The first row of Table 4, presents the OLS estimates for this restricted sample. The estimates for most outcomes are very similar to the overall sample, and generally grow larger in magnitude. Self-employment not only increases from 3.7 to 4.2 % but also becomes significant at 1% level. General health grows in magnitude to 0.072 from 0.057 of a standard deviation. In contrast, magnitude of the hours worked variable decreases by 1% and reduces in significance from 5% to 10 % level.

When family fixed effects are included, all the estimates with the exception of general health increase in magnitude. General health falls by 0.011 of standard deviation . In contrast, to Ewijk (2011) who finds that inclusion of family fixed effects for siblings 18 or younger, increases the magnitude of general health variable, I find that there is small reduction in the size of the effect. The sibling comparison for children provides evidence against selective timing of pregnancy. This paper's finding that exposure in utero reduces the magnitude of the effect is consistent with the standard view that common unobserved family effects - such as mothers degree of religiosity or mother's cognitive ability- which are correlated with exposure in utero and adult outcomes may be responsible for the OLS estimates.

Given that in the earlier section, we found that general health was not an important channel to affect labor hours , and a channel of rather minor importance to affect self-employment status, we may expect in utero exposure to affect labor market outcomes, despite the reduction in the magnitude of general health. The effect size of log hours almost doubles to 6 % from 3.7%, although it becomes insignificant . Those exposed are also 6.1% less likely to do wage work in contrast to 3.3% in the OLS model. Similarly, they are 6.7% more likely to be self-employed rather than 4.2% although the estimate is statistically significant at 10% rather than 1%. Years of Schooling, however, stays insignificant. These results are consistent with Smith (2009) who uses PSID data from the US to estimate effect of childhood health on adult labor market outcomes in that they find childhood health has no effect on adult education outcomes , with fixed effects are used and in that inclusion of fixed effects increases the magnitude of the estimates rather than reducing them.

1.4 Discussion

Fasting during pregnancy by Muslim women affects not only their children's adult health, but their children's labor supply as well. The adult health effects are more severe for males than females, and for urban borns than rural borns, although labor supply of males and urban borns is much less responsive than females and

rural borns. These results are consistent with the idea that in patriarchal societies, female labor supply is much more responsive than male labor supply to a given health shock, since males are usually bred earners and are responsible for earning, where as women are not. Since males and urban borns are usually more healthy, this finding is also consistent with the a concave labor supply function with diminishing returns to health, which implies that the link between health and market labor outcomes is weaker in more healthy populations.

The OLS estimates show that exposure in utero reduces individual's hours worked at their primary job, with disproportionate effects for females. But the effects are not just limited to hours worked. Those exposed are also more likely to be self employed (shift to a low productivity sector), with exposed females more likely to be self employed than exposed males. Despite the disproportionate adult health shock for urban borns, urban and rural borns are affected similarly in that urban borns are less likely to do wage work, whereas rural borns are more likely to be self-employed. In addition, those who are exposed have 0.12 fewer years of schooling on average, with effects for males as high as 0.21 fewer years of schooling and urban borns more severely affected than rural borns(although results are statistically insignificant).

I also provide suggestive evidence that adult general health is not an important channel through which exposure effects labor supply outcomes, although it does seem to be relatively more important for the choice of shifting to the self- employment sector. In contrast to the irrelevance of adult health as a channel for exposure to affect labor hours, I find evidence that shift to the self-employment sector may be one channel though which hours worked are reduced, although there could be reverse causality.

To take into account any family level unobservables , such as mother's motivation to fast during pregnancy or time births, I redo the basic OLS estimates for a sample of siblings. The magnitude of the estimates get larger for all outcomes of interest. Although general health and self-employment are still statistically significant at 10 % level, the p-values increase for all of them . The effect of exposure on hours worked becomes statistically insignificant at 10% level and years of schooling remains statistically insignificant. Since there is no evidence that OLS estimates reduce in size, when family fixed effects are included, this provides evidence that it its not selective timing by mothers or any other invariant family level observables and unobservables which are deriving the effects of exposure.

1.4.1 Importance of Magnitude of the Estimates

One way to compare the negative effects of an in utero health shock is to think about the magnitude of improvements in labor market outcomes which may have happened in the absence of such a negative effect. Those exposed have 0.10-0.14 fewer years of schooling, with males suffering with 0.21 fewer years

of schooling and urban borns more severely effected than rural borns(although results are statistically insignificant). These estimates are comparable, in some sense , to Duflo (2001) who finds that each new primary school which is built per 1,000 children in Indonesia , on average, raised years of schooling by 0.12-0.19 years. Maccini and Yang (2009) who also use IFLS 3, document that a 20% increase in rainfall around the location of birth and during year of birth in their rural sample, increases schooling outcomes by 0.15 years. In Columbia, a family planning program which delayed age of mother at first birth, is reported to have increased female education by 0.15 years (Miller 2006).

The hours worked estimates imply that those exposed work 5% fewer hours on average in a normal week, with females working 7.7% fewer hours .Thomas et al. (2006) find that among those treated with 120mg of iron per week of a year, there was no change in hours worked. Adhvaryu and Nyshadham (2011) study effects of better quality healthcare usage on labor supply outcomes of those who are sick in Tanzania. They find that using higher quality health care, has no statistically significant effect on total hours worked and the size of the effects are rather small. Given that , in our sample, the mean number of hours worked is close to full time for primary jobs (38 hours form Table 1), a 5-7 % reduction in hours worked is non trivial . Since female labor supply is affected more, this is not only important for its own sake, but may have important implications for bargaining power of women within their household as well as may effect human capital outcomes of children.

Arguably, the strongest evidence is for change in sector of work away from wage work to self-employment. Thomas et al. (2002) document the economic impact of the East Asian financial crises in Indonesia. They find very modest changes in total employment rates, but that the male employment declined by 3.7% in the wage sector with a 1.74% increase in self-employment sector as a result. Among women , they find that those who have highest schooling, are 4.2% less likely to be do wage work. The size of effects of mother's fasting during pregnancy of children's self-employment probabilities of about 3.7%- 6.67% are similar, and if at all, larger than the labor supply response during the financial crises.

1.5 Conclusion

This paper examined the effect of fasting during pregnancy by Muslim mothers on their children's adult general health, adult labor supply and years of schooling. I first document that potential exposure in utero, for even half a month of Ramadan , can have similar effects as if one is fully exposed to Ramadan in utero. In contrast to adult general health , it requires fewer days of potential exposure to cause an effect of similar size on female labor supply as the size of those fully exposed. This suggests that female labor supply is more sensitive to Ramadan shocks than adult general health.

OLS estimates reveal that in contrast to adult health effects which are more 0.035 of a standard deviation more severe for males than females, and 0.075 of a standard deviation worse for urban borns than rural borns, hours worked for males is 5.6% less responsive than females and very similar for urban and rural borns;females are 1.5% more likely to be self employed than males, but self-employment/wage-work does not differ much across urban and rural borns. Since males and urban borns are usually more healthy, this finding is also consistent with a concave labor supply function with diminishing returns to health, which implies that the link between health and market labor outcomes is weaker in more healthy populations.

In terms of magnitudes, the OLS estimate for years of schooling suggests that those who are exposed have 0.12 fewer years of schooling on average, with effects for males as high as 0.21 fewer years of schooling and urban borns more severely affected than rural borns(although results are statistically insignificant).

I further provide suggestive evidence that adult general health is not a key channel through which exposure affects hours worked or probability of being self-employed, although it seems to be more important for the choice of being self-employed than the number of hours worked. Furthermore, there is some evidence which suggests that part of the explanation for fewer hours worked is associated with the change to a low productivity sector of work (self-employment).

To take into account time-invariant unobservables and observables common to one's family, I include family fixed effects. I find that estimates for outcomes of interest grow larger in magnitude , although the p-values also get higher . If it was family level unobservables which were driving the estimates , I would have expected the estimates to fall. The rise in size of estimates suggests that time invariant family level covariates are not explaining the results.

Future extensions of this paper intend to explore the latest wave (IFLS 4) where I should have a larger sample size for siblings. I can also explore effects of exposure on earnings along with other variables measuring cognitive skills such as test-scores and non-cognitive skills such as patience. In addition, I can exploit panel feature of the IFLS to determine not only effects on levels of outcomes, but growth rates as well. Exposure by trimester can be explored to determine the most critical stage in pregnancy for labor market outcomes. Lastly, I also plan to explore heterogeneity by mothers age, education , income and religiosity.

Bibliography

[1] Arab, M. (2004), Ketonuria and Serum Glucose of Fasting Pregnant Women at the End of a Day in Ramadan. Acta Medica Iranica, 42(3), 209-212.

[2] Arab, M. Nasrollahi, S. (2001), Interrelation of Ramadan Fasting and Birth Weight, Medical Journal of Islamic Academy of Sciences 14(3), 91-95.

[3] Azizi, F. (2002), Research in Islamic Fasting and Health, Annals of Saudi Medicine, 22(3 -4), 186 191.

[4] Barker, D.J.P. (1997), Fetal nutrition and cardiovascular disease in later life. British Medical Bulletin, 53(1) 96-108.

[5] Barker, D.J.P. (2002), Fetal programming of coronary heart disease. TRENDS in Endocrinology Metabolism, 13(9), 364-368.

[6] Cunha, Flavio Heckman, James J. Lochner, Lance,(2006). Interpreting the Evidence on Life Cycle Skill Formation, Handbook of the Economics of Education, Elsevier.

[7] Douglas Almond Bhashkar Mazumder, (2011). Health Capital and the Prenatal Environment: The Effect of Ramadan Observance During Pregnancy, American Economic Journal: Applied Economics

[8] Douglas Almond Janet Currie, (2010). Human Capital Development Before Age Five, NBER Working Papers 15827, National Bureau of Economic Research, Inc.

[9] Reyn van Ewijk, (2011). Long-Term Health Effects on the Next Generation of Ramadan Fasting During Pregnancy, Journal of Health Economics.

[10] Godfrey, K.M. Barker, D.J.P. (2000), Fetal nutrition and adult disease. The American Journal of Clinical Nutrition, 71(suppl), 1344S52S. .

[11] Godfrey, K.M. Barker, D.J.P. (2001), Fetal Programming and Adult Health, Public Health Nutrition, 4(2B), 611-624.

[12] Harding, J.E. (2001), The nutritional basis of the fetal origins of adult disease, International Journal of Epidemiology, 30, 15-23

[13] Hoddinott, J. and B. Kinsey (2001) , Child Growth in the Time of Drought, Oxford Bulletin of Economics and Statistics 63(4): 409-36.

[14] Joosoph, J., Abu, J. Yu S.L. (2004), A survey of fasting during pregnancy. Singapore Med J, 45(12), 583-586

[15] Sharon Maccini Dean Yang (2009), Under the Weather: Health, Schooling, and Economic Consequences of Early-Life Rainfall, American Economic Review, American Economic Association, vol. 99(3), pages 1006-26, June.

[16] Malhotra, A., Scott, P.H., Scott, J., Gee, H. Wharton, B.A. (1989), Metabolic changes in Asian Muslim pregnant mothers observing the Ramadan fast in Britain. British Journal of Nutrition, 61, 663-672.

[17] Metzger, B.E., Ravnikas, V., Vileisis, R.A. Norbert, F. (1982), Accelerated starvation and the skipped breakfast in late normal pregnancy. The Lancet, 1(8272), 588-592.

[18] Mirghani, H.M., Weerasinghe, D.S.L., Ezimokhai, M. Smith, J.R. (2003), The effect of maternal fasting on the fetal biophysical profile. International Journal of Gynecology and Obstetrics, 81, 17-21.

[19] Mirghani, H.M., Weerasinghe, S.D., Smith, J.R. and Ezimokhai, M. (2004), The effect of intermittent maternal fasting on human fetal breathing movements, Journal of Obstetrics and Gynaecology, 24(6),635-637.

[20] Mirghani, H.M., Weerasinghe, S.D., Al-Awar, S., Abdulla, L. Ezimokhai, M. (2005), The Effect of Intermittent Maternal Fasting on Computerized Fetal Heart Tracing, Journal of Perinatology, 25, 9092.

[21] Prentice A.M., Prentice A., Lamb W.H., Lunn P.G. Austin S. (1983), Metabolic consequences of fasting during Ramadan in pregnant and lactating women. Hum. Nutr. Clin. Nutr., 37C, 283294.

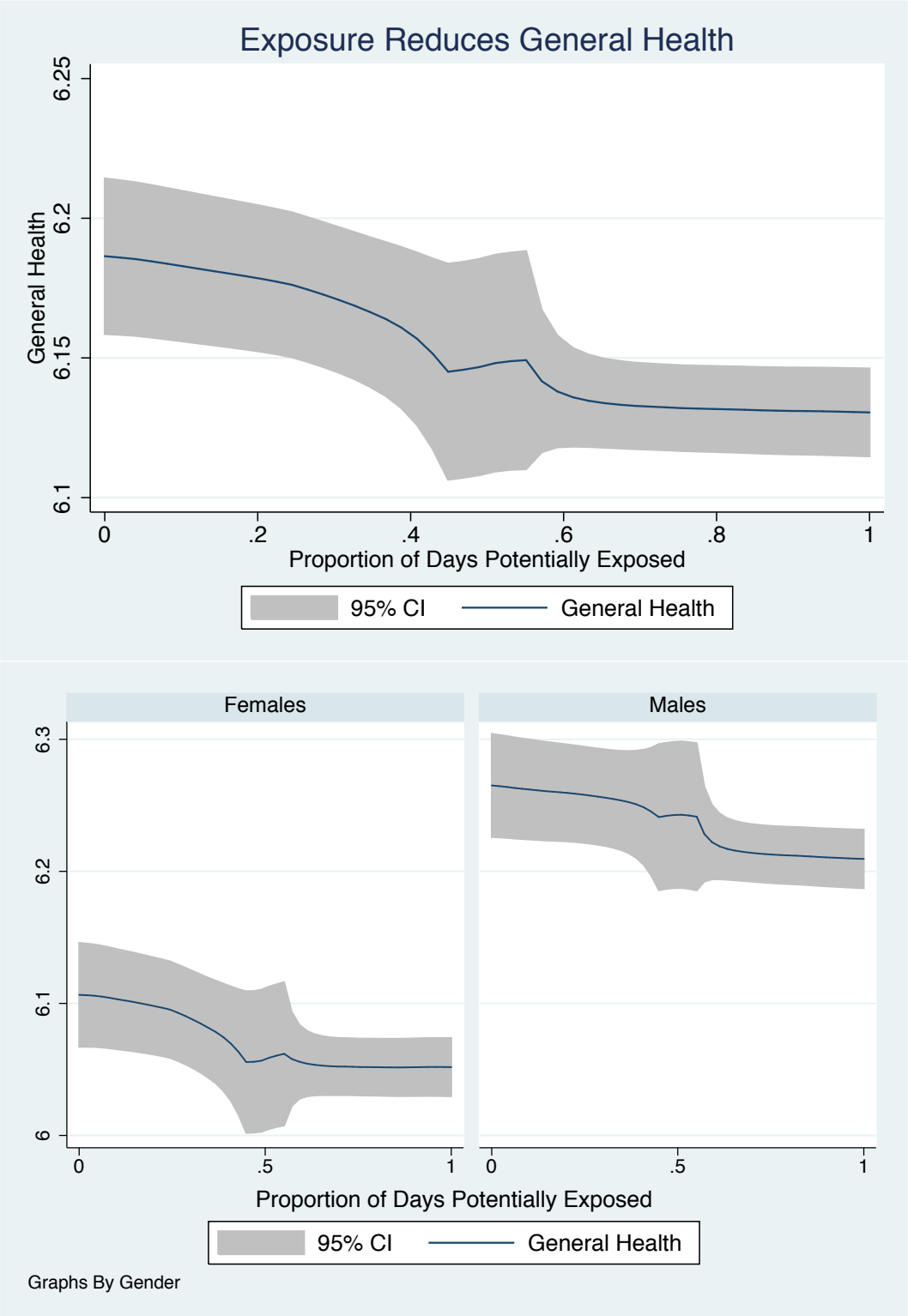
[22] Schaefer, U.M., Songster, G., Xiang, A., Berkowitz, K., Buchanan, T.A., Kjos, S.L. (1997), Congenital malformations in offspring of women with hyperglycemia first detected during pregnancy. Am J Obstet Gynecol, 177,1165-1171.

[23] Seckl, J.R. Holmes, M.C. (2007), Mechanisms of Disease: glucocorticoids, their placental metabolism and fetal programming of adult pathophysiology, Nat Clin Pract Endocrinol Metab, 3, 479488.

[24] Duncan Thomas James P. Smith Kathleen Beegle Graciela Teruel Elizabeth Frankenberg, (2002), Wages, employment and economic shocks: Evidence from Indonesia, Journal of Population Economics, Springer, vol. 15(1), pages 161-193.

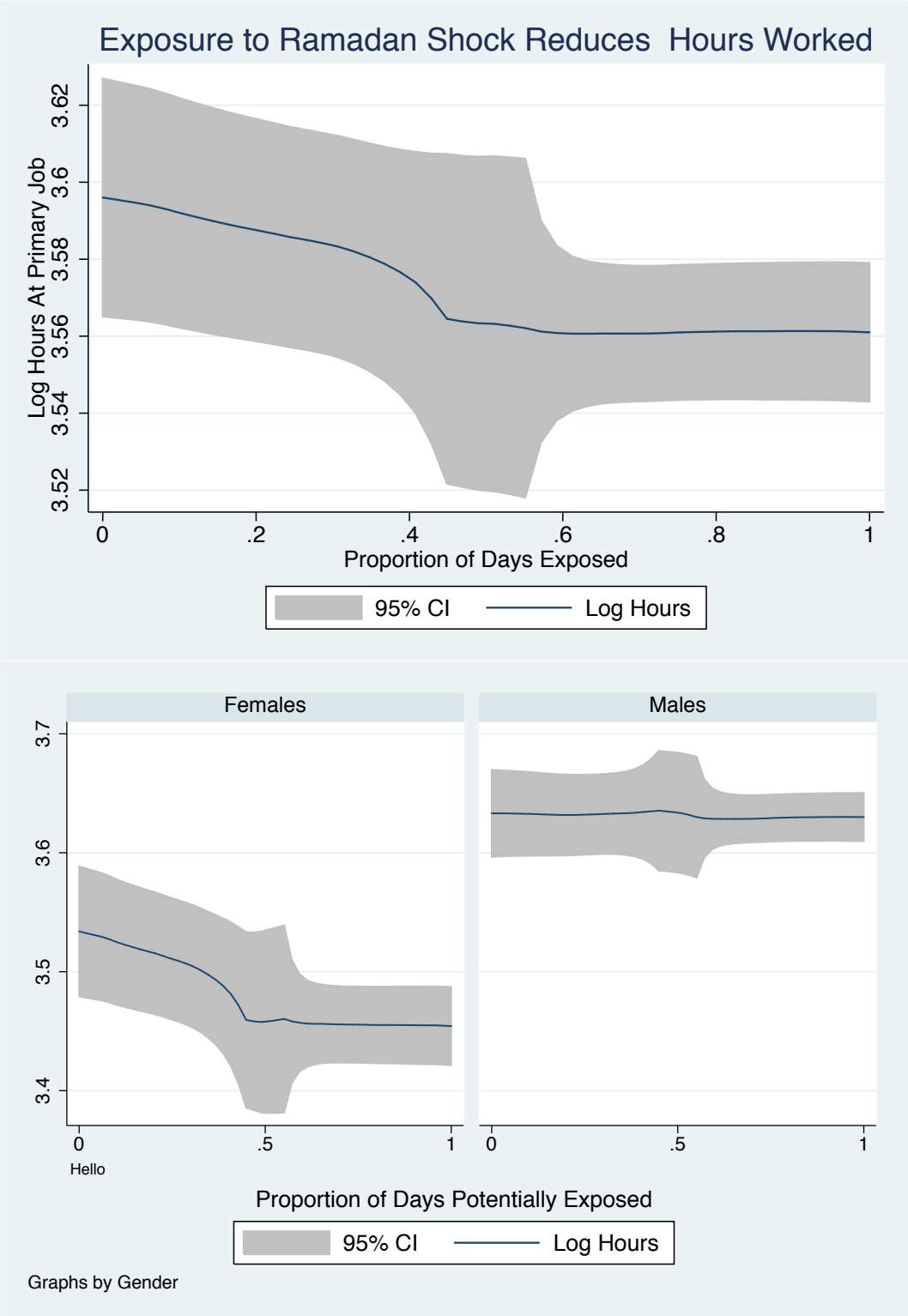
[25] Duncan Thomas, Elizabeth Frankenburg, Jed Friedman, Jean-Pierre Habicht, Mohammed Hakimi, Nicholas Ingwersen, Jaswadi, Nathan Jones, Christopher McKelvey, Gretel Pelto, Bondan Sikoki, Teresa Seeman, James P. Smith, Cecep Sumantri, Wayan Suriastini and Siswanto Wilopo. (2006), Causal Effect of Health on Labor Market Outcomes: Experimental Evidence. California Center for Population Research working paper, no. CCPR-070-06.

Fig 1: Effect of Ramadan Exposure on General Health, Overall And By Gender



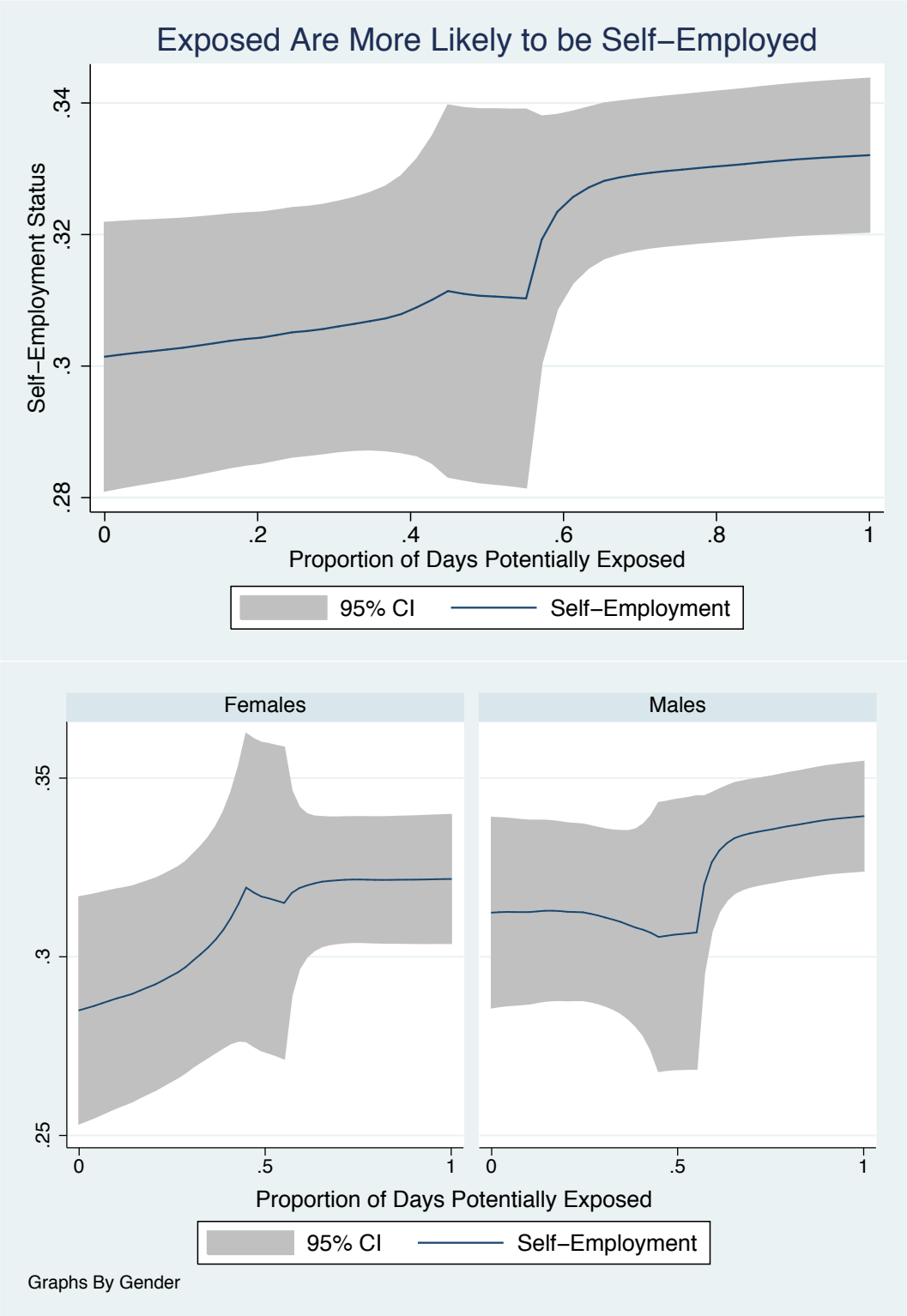
Note: The graphs are local polynomial smooth plots using the epanechnikov kernel and a bandwidth of 0.2. Shaded areas represent 95% confidence intervals. Days of potential exposure measures the proportion of days Ramadan overlapped with any period in utero

Fig 2: Effect of Ramadan Exposure on Hours Worked, Overall And By Gender



Note: The graphs are local polynomial smooth plots using the epanechnikov kernel and a bandwidth of 0.2. Shaded areas represent 95% confidence intervals. Days of potential exposure measures the proportion of days Ramadan overlapped with in utero

Fig 3: Effect of Ramadan Exposure on Self-Employment Status, Overall And By Gender



Note: The graphs are local polynomial smooth plots using the epanechnikov kernel and a bandwidth of 0.2. Shaded areas represent 95% confidence intervals. Days of potential exposure measures the proportion of days Ramadan overlapped with in utero period

1.6 Tables

Table1: Summary Stats for Muslims by Gender

	Males Exposed	Males Not Exp	Females Exposed	Females Not Exp	Total
General Health	6.344	6.424	6.089	6.122	6.224
	(0.950)	(0.974)	(0.979)	(0.971)	(0.975)
Log Hours	3.640	3.657	3.473	3.537	3.581
	(0.620)	(0.624)	(0.813)	(0.784)	(0.703)
Log Monthly Wages	6.702	6.865	6.594	6.571	6.682
	(2.453)	(2.143)	(2.260)	(1.935)	(2.350)
Age	30.89	29.81	29.29	28.21	29.95
	(12.30)	(11.55)	(11.64)	(11.12)	(11.92)
Work	0.807	0.794	0.512	0.492	0.660
	(0.394)	(0.405)	(0.500)	(0.500)	(0.474)
Wagework	0.587	0.615	0.504	0.545	0.558
	(0.492)	(0.487)	(0.500)	(0.499)	(0.497)
Self-Emp	0.333	0.295	0.305	0.240	0.315
	(0.471)	(0.456)	(0.461)	(0.428)	(0.465)
Educ. Level	4.150	4.251	3.885	3.872	4.026
	(2.001)	(1.937)	(1.974)	(1.944)	(1.986)
Age School	6.987	6.890	6.760	6.712	6.865
	(2.185)	(0.970)	(1.630)	(0.866)	(1.825)
Write	0.965	0.973	0.942	0.949	0.955
	(0.183)	(0.163)	(0.233)	(0.220)	(0.207)
Write2	0.763	0.746	0.759	0.754	0.759
	(0.426)	(0.436)	(0.428)	(0.431)	(0.428)
Literate	0.970	0.977	0.947	0.956	0.960
	(0.170)	(0.151)	(0.224)	(0.205)	(0.196)
Literate2	0.781	0.769	0.772	0.770	0.776
	(0.413)	(0.421)	(0.419)	(0.421)	(0.417)
Years of Schooling	9.216	9.462	8.713	8.695	8.985
	(3.644)	(3.509)	(3.744)	(3.652)	(3.688)
Observations	4951	832	4883	756	11422

Note: Includes all Muslims of Ages 15-65. Mean of each variable with standard deviation in parentheses

Table 2: Estimates for Overall Sample with Heterogeneity

	(1)	(2)	(3)	(4)	(5)
VARIABLES	General Health	Log Hours	Wagework	Self-Employed	Yrs. of Schooling
Overall Sample					
Exposed	-0.057**	-0.047**	-0.034**	0.037**	-0.116
	(0.028)	(0.023)	(0.016)	(0.015)	(0.101)
Observations	11,410	7,646	8,135	8,135	11,697
Male					
Exposed	-0.072*	-0.021	-0.030	0.031	-0.212
	(0.038)	(0.026)	(0.021)	(0.019)	(0.138)
Observations	5,698	4,755	4,875	4,875	5,931
Female					
Exposed	-0.037	-0.077*	-0.037	0.047**	0.049
	(0.040)	(0.045)	(0.027)	(0.023)	(0.148)
Observations	5,712	2,891	3,260	3,260	5,766
Urban Born					
Exposed	-0.099**	-0.054	-0.045*	0.036	-0.131
	(0.043)	(0.035)	(0.026)	(0.024)	(0.154)
Observations	4,225	2,645	2,864	2,864	4,412
Rural Born					
Exposed	-0.024	-0.051	-0.029	0.036*	-0.028
	(0.036)	(0.031)	(0.021)	(0.019)	(0.129)
Observations	7,145	4,989	5,258	5,258	7,259

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Sample is restricted to Muslims only of ages 15-65, unless stated otherwise.
Exposed is a dummy for whether one was potentially exposed for a whole month in utero.
Log Hours is log hours worked in a normal week in primary job. Self- Employed is a dummy for being self-employed.
All regressions control for gender, month of birth fixed effects, age and age squared, where age is defined in days.
In addition, I control for all those estimated to be conceived less than 21 days after the end of Ramadan

Table 3: Estimates for Overall Sample With Controls

VARIABLES	(1) Log Hours	(2) Self-Emp	(3) Log Hours	(4) Self-Emp	(5) Log Hours	(6) Log Hours
Exposed	-0.047**	0.037**	-0.052**	0.036**	-0.044*	-0.049**
	(0.023)	(0.015)	(0.024)	(0.015)	(0.023)	(0.024)
General Health			0.010	-0.010*		0.010
			(0.009)	(0.005)		(0.009)
Self-Emp					-0.080***	-0.079***
					(0.018)	(0.018)
Observations	7,646	8,135	7,420	7,875	7,640	7,414
R-squared	0.035	0.070	0.035	0.074	0.038	0.037

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Sample is restricted to Muslims only of ages 15-65, unless stated otherwise.
Exposed is a dummy for whether one was potentially exposed for a whole month in utero.
Log Hours is log hours worked in a normal week in primary job. Self- Employed is a dummy for being self-employed.
All regressions control for gender, month of birth fixed effects, age and age squared, where age is defined in days.
In addition, I control for all those estimated to be conceived less than 21 days after the end of Ramadan

Table 4: Estimates for Family Fixed Effects

VARIABLES	(1) General Health	(2) Log Hours	(3) Wagework	(4) Self-Employed	(5) Yrs. of Schooling
OLS Estimates					
Exposed	-0.072**	-0.037	-0.033*	0.042***	-0.098
	(0.030)	(0.025)	(0.017)	(0.016)	(0.108)
Observations	9,717	6,689	7,133	7,133	9,972
Family Fixed Effect Estimates					
Exposed	-0.061*	-0.060	-0.061*	0.067*	-0.142
	(0.034)	(0.061)	(0.036)	(0.036)	(0.143)
Observations	9,717	6,689	7,133	7,133	9,972

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Sample is restricted to Muslims only of ages 15-65 which is restricted to biological children of the household head, household head, spouse of the household head and the co-residing siblings of the household head and the co-residing siblings of the spouse.
Exposed is a dummy for whether one was potentially exposed for a whole month in utero.
Log Hours is log hours worked in a normal week in primary job. Self- Employed is a dummy for being self-employed.
All regressions control for gender, month of birth fixed effects, age and age squared, where age is defined in days.
In addition, I control for all those estimated to be conceived less than 21 days after the end of Ramadan