Pregnancy, breastfeeding and time use:

Lifecycle effects of women's labor-intensive activities in rural China, Mexico and Tanzania.

DRAFT

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Abstract:

Labor intensive work, such as agricultural subsistence, is often a way of life for women in rural areas of developing countries. This type of work requires physical exertion and may need to be continued through pregnancy and breastfeeding periods, which may result in poor health outcomes for both mother and infant. Using longitudinal data from China, Mexico and Tanzania, this paper provides evidence of the relationship of being pregnant or breastfeeding on women's time use. Four time use outcomes, measured in hours spent in the last week, are investigated: 1) housework, 2) care giving, 3) agricultural work, and 4) self-employed or non-agricultural work outside the home. An individual fixed effects approach is adopted to overcome time invariant woman-level endogeneity of reproductive health status. With the exception of care giving, results indicate women do not alter time spent in physically demanding activities and may actually increase work during breastfeeding periods. This finding remains unchanged with a number of extensions and robustness checks, hence suggesting a need for a better understanding of programs designed to aid expectant mothers.

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I. Introduction

Women residing in rural areas of developing countries often rely on agriculture or other labor intensive work for subsistence and livelihoods, which requires physical exertion. This is particularly true for women who have received minimal education or are asset poor and therefore have fewer income-producing alternatives. At the same time, women of prime working age are also likely to be in the child bearing stage of the lifecycle. Total fertility rates (TFRs) are still over 4.4 children per women in least developed countries, and over 5.1 in sub-Saharan Africa (SSA) (United Nations, 2008).[1] These TFRs mask large variations among and within countries by socio-economic status, religion and by cultural or geographical factors. For example, among the developing countries studied in this paper, TFRs range from 1.6 in China (PRB (Population Reference Bureau), 2009), to a projected 2.1 in Mexico (CONAPO 2002), to 5.7 in Tanzania (NBS and ORC Macro 2005). However, in Tanzania, the TFR is 6.5 among rural women and 7.3 among women in the lowest wealth quintile (National Bureau of Statistics (NBS) & ORC Macro, 2005). In Mexico the TFR varies by state, with a low of 1.8 in the Federal District to a high of 2.5 in Guerrero (CONAPO 2002). Even in China where families are subject to restrictive family planning policies, the fertility rates vary both with age and location. Using a representative sample of women aged 15 to 49 from the Chinese National Family Planning and Reproductive Health Survey, Ding and Hesketh (2006) found that the average fertility rate in women over 35 (under 35) was 2.1 (1.25) in rural areas and 1.4 (1.79) in urban areas (Ding & Hesketh, 2006). Consequently, in many environments, a significant amount of time during rural women's prime years is spent on child-bearing and care-related activities. Simple arithmetic calculations of length of pregnancy (nine months) and median duration of any reported breastfeeding (21.4 months) from the aforementioned Tanzanian data equate to an approximately 14.44 to 18.49 years either pregnant or breastfeeding—hardly a trivial duration of time.

However, labor intensive work during later stages of pregnancy may result in poor maternal and child health outcomes, such as low birth weight, and may also risk exposure to pesticides and other dangerous chemicals in the case of agricultural labor (Lima, Ismail, Ashworth, & Morris, 1999; Roa et al.,

[1] Projections are for the 2005 to 2010 period using medium variant assumptions.

2003). In addition, engaging in heavy labor post delivery while breastfeeding or caring for infants have similar risks for adverse child development outcomes, such as an increased probability of anemia and malnutrition. Mothers who are time constrained may not be able to exclusively breastfeed infants, and instead substitute complimentary feeding, which has been linked to increased mortality risk from infections, diarrheal and respiratory diseases (Black, Morris, & Bryce, 2003; Clemens et al., 1997; WHO, 2000). Furthermore, the Fetal Origins Hypothesis postulates that malnutrition in mid to late gestation increases the child's propensity for chronic diseases in adulthood (Adair & Prentice, 2004; Barker, 1998). There is also evidence suggesting that individuals who faced worse health conditions while in-utero may have lower socioeconomic outcomes, such as less schooling and lower wages (Nelson, 2009). Despite these risks to both women and children's heath, we know relatively little about if or how poor rural women manage both activities concurrently.

While attempts to quantify the changes in women's time use over pregnancy and breastfeeding periods have been conducted, the number of studies, as well as their scope and methodological approaches are limited when compared to the importance of the issue. Conventional wisdom would suggest pregnancy and subsequent increased fertility decreases opportunities for women's productive work, both through restrictions in mobility, levels of physical exertion and though increasing time constraints. Most previous studies find exactly this relationship. Using bivariate analysis and data collected in 1986 among 186 households in rural Kenya, Baksh *et al.* (1994) finds women who are pregnant or lactating reduce the time spent on labor activities in order to increase the time allocated to child care (Baksh, Neumann, Palisso, Trostle, & J, 1994). This is particularly true during the third trimester of pregnancy and the first period of lactation. A study using 24 hour recall in rural Southern India likewise finds pregnant women spend almost two fewer hours working in fields when compared to non-pregnant and non-lactating women, however the study is primarily descriptive among 115 women (McNeill & Payne, 1985). A study estimating reduced form time allocation among urban households in India found that home production of women increased with younger children aged zero to six nearly six times the magnitude of older children, implying the reallocation of activities to incorporate childcare

(Malathy, 1994). Although these studies confirm seemingly obvious relationships suggesting that women who are pregnant or breastfeeding simply have less time or desire to devote time to labor intensive activities, they do not address the confounding relationship that the opportunity costs of women's time as well as labor force participation options all affect women's desire for children. Therefore, there is an endogenous relationship between reproductive health and time use, which must be carefully considered in the context of cultural norms and environmental factors which may influence both these outcomes.

We are primarily concerned about the linkages above because they may have implications for both the health and welfare of the woman and child. Prentice and colleagues (1981) follow the energy intake of 143 pregnant and lactating Gambian women for a year and find that breast milk output quality and early infant growth are significantly worse during the wet season, when heavy agricultural duties are performed. Using data from five countries in West Africa, Kim (2010) shows that rainfall shocks have adverse effect on the survival of young children born in the rainy season. The author attributes this finding to the agricultural time burden placed on mothers, and the potential reduction in breastfeeding (Kim, 2010). A similar analysis in Senegal finds that highest child survival rates are found in the dry months after the harvest, when the opportunity cost of time is the lowest and monthly household income is at the highest annual level (Pitt & Sigle, 1997). In a survey of 50 women working in the sugar beet industry in Egypt, 12 percent reported leaving children alone at home, 70 percent left children with grandmother or brothers, 10 with other relatives or neighbors and eight percent brought children to the fields with them (El-Eshmawiy, El-Shiraif, & El-Khafif, 2007). Even in developed countries where access to high quality health care is arguably better for expectant and recent mothers, labor activities have also been linked to negative birth outcomes. Whelan *et al.* (2007) finds night shifts and long work hours among nurses in the United States may be associated with increased risk of spontaneous abortion (Whelan et al., 2007). However, it should be noted that studies conducted in developed countries often have different foci; such studies tend to look at predictors of change in leisure activity in women during pregnancy (Pereira et al., 2007), changes in energy expenditure (Lof & Forsum, 2006), and lifestyle choices (Devine, Bove, & Olson, 2000). This difference in focus is likely a result of the wider availability

of employment avenues to women in developed countries, as well as varying expectations for instance in maternity leave and childcare options. Without a clear understanding of how physically intensive activities affect maternal and child health, it becomes difficult to tailor types and timing of programs to alleviate the dual burden of reproduction and labor.

As shown from the studies linking reproduction to time use discussed above, the literature is generally outdated and typically involves small sample sizes in geographically restricted areas. As previously mentioned, little is done to address endogeneity issues between reproduction and time use, therefore, potentially biasing what we assume to be conventional relationships. We propose to address this gap by examining the effects of pregnancy and breastfeeding periods on women's time use in labor-intensive activities using large-scale longitudinal data from China, Mexico and Tanzania collected in the 1990s and 2000s. We restrict our sample to rural women of reproductive ages (which we define as 15 to 49 years) to control for labor market heterogeneities between rural and urban areas. The strict definitions of time use activities vary slightly across countries (see Appendix Table A1), and we examine both productive and reproductive activities across four main categories measured as hours in last week working in: 1) housework, 2) care giving, 3) agriculture and livestock, and 4) self employed or non-agricultural work outside the home. We use multivariate modeling including individual fixed effects regressions to isolate relationships accounting for unobserved time-invariant woman-level heterogeneity and find that in general women do not reduce hours working in response to pregnancy or breastfeeding. Further robustness checks indicate that in general these relationships do not vary significantly between wealthy and asset poor women, and are rather exhibited relatively uniformly across all women. We conclude with policy and programmatic implications as well as next steps for further research.

II. Theoretical model

Time is a valuable resource, especially to households in developing countries where access to other resources such as land or technology are limited. Within a household, time is often unequally distributed across household members, and has been identified as an essential component of analysis of

gender equality, intrahousehold allocation of resources and estimation of behavioral effects of policy variables (Apps, 2003).

Conceptually, the framework developed by Kes and Swaminathan can be used to analyze time-use (Kes & Swaminathan, 2006). A woman's time can be distributed between market (or income-generating work, e.g., agriculture) and non-market work (e.g., reproduction). Allocation of time will also depend on factors such as the availability of work and the composition of the household. Since time is a limited resource, trade-offs will occur between competing tasks, determined through factors such as social norms, and the financial stability of the household. For example, an increase in working hours subtracts from leisure time, thereby lowering welfare created through leisure. Conversely, working usually increases an individual's purchasing power, which broadens the individual's ability to improve her own health and utility, and possibly that of her children, through the purchase of goods and services. From this framework, it is clear that time poverty may be a result of the many competing burdens with which women of reproductive age are saddled with.

Formally, time use analysis usually relies on the traditional neoclassical models where households maximize their utility through the consumption of goods and services, subject to budgetary, time, and technology constraints. Becker (1965) and later Gronau (1977) extended these models to explicitly incorporate women's home production (e.g., housework and child care) (Becker, 1965; Gronau, 1977). Following Beegle (2005), solving the utility maximization problem yields the following reduced form time demand function:

$$(1)\quad T_i^j = T_i^j(p_m, p_{hg}, w_i, T_{hh}, Y_{hh}, \mu_i, \mu_{hh} \mid Z);$$

where T_i^j is time for woman i in activity j, p_m is a vector of market good prices, p_{hg} is a vector of home-grown goods prices, w_i is the wage rate for woman i, T_{hh} is the total time available for physically demanding tasks, and Y_{hh} is non-labor income (e.g. from income generating assets). Woman-level unobservables are captured through μ_i whereas household unobservables are accounted for through μ_{hh}. The equation is conditional on Z, a preference set, which may include preferences for number of children or on gender roles within the family (Beegle, 2005).

Pregnancy and breastfeeding can affect a woman's allocation of time towards different activities through a number of paths. First, time is reallocated among activities and total time available for physically demanding tasks (T_{hh}) may be reduced as women who are pregnant become unable to perform these tasks. Furthermore, the pregnant woman may require additional care, and thus the time available from other household members may be redirected. Second, the wage potential (w_i) of the women may be lower. For example, due to other demands on her energy, pregnant women may not be able to exert themselves as much in agricultural work. There may be discrimination against pregnant and breastfeeding women as employers may perceive their labor to be of a lower quality and thus less effective. Third, the distribution income (Y_{hh}) could be affected, in that pregnant or breastfeeding women may have additional needs requiring financial outlays. Fourth, woman-level unobservables could drive time allocation, depending on individual-specific endowments, such that some women may be better able to balance working and reproductive activities simultaneously. Similarly, exogenous household factors (μ_{hh}) such as cultural attitude may affect the extent to which pregnant women may engage in work. Regardless of the pathway through which the effects are channeled, the expected outcome is that women who are pregnant, breastfeeding or have young infants will work less because of the binding time constraint on managing childcare and productive activities.

III. Data and research methods

III a. China: China Health and Nutrition Survey

The CHNS is a longitudinal survey started in 1989 collected by the Carolina Population Center at the University of North Carolina at Chapel Hill in collaboration with the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention (Carolina Population Center, 2008). The CHNS covers nine diverse provinces and includes over 200 communities and approximately 4,400 households drawn from a multi-stage random cluster sample, stratified on income and urban/rural location. The CHNS was designed to help understand the effects of governmental health, nutrition, and family planning policies and to determine how the health and nutritional status of the Chinese population

is being affected by the social and economic changes in China. Questionnaires covered a range of socio-economic modules such as income, employment and education, as well as detailed nutritional modules facilitating the calculation of caloric intake, body composition, blood pressure and clinical measures of health. The CHNS includes six rounds in 1989, 1991, 1993, 1997, 2000, 2004 and 2006, and we include both and 'early' panel from 1997 to 2000 and a 'later' panel from 2004 to 2006. The objectives of including both panels are twofold in that we gain an additional comparison across countries, while also allowing a comparison across time in China. For further information on the CHNS including fieldwork details, questionnaires and survey design see (Carolina Population Center, 2008).

III b. Mexico: Mexican Family Life Survey

The MxFLS is a longitudinal, nationally, representative survey initiated to better understand the social, economic, demographic and health transitions occurring in Mexico (Rubalcava & Teruel, 2006). Funding and implementing institutions vary by wave and are collaborative efforts between Mexican government agencies and research and academic institutions in both the US and Mexico.[2] Wave I (MxFLS-1) was collected in 2002 and wave II (MxFLS-2) was collected in 2005 and 2006. The baseline survey is a stratified, multi-stage sample of dwellings in Mexico and includes approximately 8,440 households and over 35,000 individuals. The panel is expected to continue for a 10 year time span. Particular attention is paid to issues surrounding international migration of family members and implications for remaining household members. Community questionnaires were administered in both waves to capture information on infrastructure, schools, health centers, social programs and prices. For further information on the survey design, objectives and implementation see (Rubalcava & Teruel, 2006, 2008).

[2] The first wave (MxFLS-1), was a collaborative effort between researchers and officials from Universidad Iberoamericana, AC (UIA), *Centro de Investigación y Docencia Económicas (CIDE),* the Mexican National Bureau of Statistics (INEGI) and the Mexican National Institute of Perinatology (INPer). Funding for MxFLS-1 activities was provided by the Mexican Council for Science and Technology (CONACYT), the Mexican Ministry for Development (SEDESOL), the Mexican Social Security Institute (IMSS), the Ford Foundation, the University of California Institute for Mexico and the United States (UC-Mexus) and UIA. The Second Wave of the Mexican Family Life Survey (MxFLS-2) is a collaborative effort among researchers from UIA, CIDE, the Mexican National Institute of Public Health (INSP), and the California Center for Population Research (CCPR) at the University of California, Los Angeles (UCLA).

III c. Tanzania: Kagera Health and Development Survey

The KHDS was originally part of a joint research project titled the "Economic Impact of Fatal Adult Illness from AIDS and Other Causes in Sub-Saharan Africa" launched by the Population and Human Resources and Africa Technical Department of the World Bank (World Bank-Development Research Group, 2004).[3] Kagera is in the Lake Victoria region bordering Rwanda and Burundi to the west and Uganda to the north. The region is primarily rural and is home to over two million people, divided into five administrative districts (Tanzania National Bureau of Statistics, 2002). The KHDS interviewed approximately 832 households in 50 communities over four passages at seven month intervals between 1991 and 1994 and again in 2004. Special concern was given to tracking and re-interviewing respondents in an attempt to understand economic mobility and changes in living standards induced by or affecting migration choices. The household sample was random, stratified on agronomic zones, community adult mortality rates[4] and indicators at the household level that were thought to be predictive of future adult deaths.[5] The KHDS questionnaires were modeled after the World Bank's Living Standards Measurement Surveys and collected extensive, detailed information on household income, consumption expenditure, individual economic activities, education and individual health status, including the height and weight of all household members. In addition, matching community modules were administered on local markets and price information, health facilities and education facilities. The analysis will utilize the first four waves of KHDS which started in 1991 and took place approximately every six to seven months afterward until 1994. The sample is limited to women between the ages of 15

[3] The research project is also known as the Economic Impact of Adult Mortality (EIAM) Study. Funding was provided by the World Bank Research Committee, the United States Agency for International Development (USAID) and the Danish Agency for Development Assistance (DANIDA).

[4] Community adult mortality rates were taken from the 1988 census and a subsequent enumeration for the survey (WB-DRG, 2004).

[5] "Sick" households were those who either had an adult death (aged 15 to 50) due to illness in the last year or an adult too sick to work at the time of the survey or both. "Well" households were all others with no recent deaths or sick members (WB-DRG, 2004).

and 49, corresponding to the age range of women who were asked the fertility modules.[6] For more detailed information on the sampling procedure, survey objectives and fieldwork details see (Beegle, De Weerdt, & Dercon, 2006; World Bank-Development Research Group, 2004).

IV d. Models and measurement of key variables

Descriptive, bivariate and multivariate methods are used to assess the linkages between pregnancy, breastfeeding and time use outcomes. We focus on four primary time use outcomes for women, measured in hours spent in the last week: 1) housework (including purchasing, cooking, cleaning, preparing food, and fetching water and firewood); 2) care giving (including children, elderly and sick); 3) working in agriculture (including fieldwork and kitchen gardens, caring for and processing livestock products, processing crops, fishing); 4) self employed or small handicraft and non-agricultural work outside the home. Although these categories capture general components of time use measurements, there are definitional differences across the surveys which are detailed in Table A1 in the Appendix.

The key methodological challenge in exploring linkages between reproductive health and labor intensive activities is the endogeneity of reproductive health indicators, where women who are more likely to be pregnant or breastfeeding may also be more likely to have unobserved heterogeneities related to time use. For example, women of reproductive ages are also in prime labor force participation ages and be more likely to spend time working in agriculture or other occupations. Likewise, women with high fertility may be in lower wealth households and be more likely to spend longer hours carrying water, fetching firewood or completing housework activities. We start by modeling time use (in logged hours per week) among pooled cross-sections where the illustrative unit of analysis is the individual woman *(i)* in community *(j)* and the model can be written as follows:

(2) $\textbf{\textit{Log hours in activity}}\ \boldsymbol{Y_i} = \beta_0 + \beta_1 * \textbf{\textit{Pregnant}}_i + \beta_2 * \textbf{\textit{Breastfeeding}}_i + \beta_3 * \boldsymbol{X_i} + \beta_4 * \boldsymbol{X_j} + \beta_4 * \boldsymbol{T_2} + \varepsilon_i$

[6] In wave 1, all women are asked. In the remaining waves, the module is asked to only 15-50 year olds and married 14 year olds. Note, the 2004 survey did not include a fertility module and therefore we are unable to utilize this survey round.

Here time use in activity $\boldsymbol{Y}_i$ of women of reproductive ages is a function of current pregnancy status $\boldsymbol{Pregnant}_i$, current breastfeedinging status $\boldsymbol{Breastfeeding}_i$, a vector of individual woman-level characteristics $\boldsymbol{X}_i$, a vector of community-level indicators $\boldsymbol{X}_j$ and an indicator for time $\boldsymbol{T}_2$. Hours of time use are logged to account for skewed distributions and 0.1 hours is added to all zero outcomes. Additional control variables grouped into individual and household socio-economic indicators (age and age squared, education levels, marital status, wealth proxy), community indicators (population, infrastructure, service availability) and seasonal indicators.[7] Controlling for seasonal indicators is especially important as both labor market, time use and health indicators have been found to vary significantly according to time of year (Panter-Brick, 1993) (see Appendix Table A2 for descriptive statistics of control variables by country). Standard errors are clustered at the community level to account for unobserved cluster-level variation.

As previously mentioned, a simple cross-sectional model such as (2) does not take into account unobserved heterogeneous preferences or fixed traits that could influence individual-level pregnancy or breastfeeding status and time use. If we believe these factors to be important, the error term ε_i would take the following form:

$$(3)\ \varepsilon_i = \lambda_i + u_{it}$$

where λ_i is constant across individuals and u_{it} is assumed to be $\sim N(0, \sigma^2_u)$. To address this potential bias, from time invariant sources, an individual-level panel fixed effects model is estimated and following specification:

$$(4)\ \Delta \boldsymbol{Log\ hours\ in\ activity}\ \boldsymbol{Y}_{i\,t} = \beta_0 + \beta_1 * \Delta \boldsymbol{Pregnant}_{i\,t} + \beta_2 * \Delta \boldsymbol{Breastfeeding}_{i\,t} + \beta_3 * \Delta \boldsymbol{X}_{i\,t} + \beta_4 * \Delta \boldsymbol{X}_{j\,t} + \Delta\, \varepsilon_{i\,t}$$

[7] Wealth proxies are indices created though principal component analysis by survey using indicators of economic welfare such as ownership of key assets or provision of water and sanitation services. For example, in Tanzania, contributing factors (in order of magnitude of contribution) are as follows: 1) dwelling value, 2) land value, 3) livestock value (all in logged Tanzanian shillings deflated to the baseline year), 4) toilet, 5) TV, 6) car, 7) bicycle, 8) refrigerator, 9) radio, 10) cement floors in dwelling, 11) per-capita number of rooms in dwelling and 12) electricity. The wealth index is preferred to conventional measures of welfare such as income or expenditure which are notoriously noisy and difficult to measure, especially in a rural low-income setting. For methodology and application of principal component analysis see Jolliffe (2002) or Vyas and Kumaranayake (2006).

Equation (4) maps the change in time use of the activity of each woman over time as a function of the change in reproductive indicators, the change in individual woman-level and community-level indicators. In this specification, the constant term (λ_i) is eliminated through differencing and equation (4) is left with a random error component, thus accounting for individual and community-level fixed sources of bias. This approach relies on the assumption that the main source of endogeneity is from time-invariant factors influencing reproductive status.[8] Although we present results of both models (2) and (4), our preferred estimates are from model (4) in which we expect coefficients to decrease in magnitude and significance levels when purged of bias in cross-sectional models. Note that in this case, it is to our advantage if panel periods are relatively close together (for example two to three years) as reproductive status is likely to vary, whereas other factors are likely to remain fixed.

IV. Results

IV a. Descriptive statistics

Table 1 presents descriptive analysis of the sample and reproductive health outcomes across surveys. As previously mentioned, we limit our samples to women residing in rural areas as they face differing labor market policies and institutions, and are more likely to undertake labor intensive, often agricultural, work as compared to their urban counterparts (Fussell & Zenteno, 1997). The early CHNS sample includes 2101 women (4202 women years), the late CHNS sample includes 1700 women (3400 women years) between the ages of 15 and 49, the KHDS sample includes 903 women (1806 women years) between the ages of 15 and 49 and the MxFLS sample includes 1896 women (3792 women years) between the ages of 15 and 49. Average time between sample rounds is approximately two to three years in all three countries. Approximately eight percent of the Tanzanian, three percent of the Mexican and

[8] We acknowledge the possibility that time variant bias exists, which may affect both time use and reproductive status. The solution for this problem would typically include an instrumental variable approach. We explore this approach using the Tanzanian sample which includes a number of potential instruments including community-level availability of family planning services (types of contraception distance to clinic, and complimentary services such as pregnancy tests) at the nearest health facility. In addition, we test potentially exogenous fertility shocks such as the sex ratio of surviving children and the sex of last born child. Unfortunately none of these instruments are strong enough to be considered valid predictors, and thus we do not present the models. Note however that since our panels are all relatively short (two to three years), we have confidence that the largest source of bias is time invariant.

two percent of the Chinese women included in the samples are currently pregnant. This percentage is larger among women currently breastfeeding, which is 15, seven, and three to four percent, respectively. Given the population control policies in China, it is not surprising that the incidence of current pregnancy is low in this population compared to Tanzania and Mexico.[9] In addition to these main indicators, we present additional auxiliary indicators which help to place the data in context. For example, in China, the majority of women are married or in unions (80-91 percent) and their age is higher (34 - 38 years) in contrast to women in Tanzania, who are younger (27 years) and are less likely to be married or in a union (46 percent). Women in Mexico have higher contraceptive use, approaching 60 percent of the sample, while this percentage is approximately 11 percent in Tanzania. Finally, the average parity of women in our sample range from approximately 1.5 in China to 2.4 and 2.7 in Mexico and Tanzania respectively. These dynamics are important to keep in mind as we present results and subsequent policy implications.

[Table 1 approximately here]

Table 2 shows results of the descriptive and bivariate analysis of time use indicators, by pregnancy and breastfeeding status. Women in the early China panel report the highest average weekly hours spent working self employed or outside the home (46.75 hours), followed by agriculture (22.30 hours), housework (15.11 hours) and care giving (6.38 hours). Women in the later China panel spend relatively less time in all labor-intensive activities, but especially in agricultural and housework. In the Mexican sample, housework is the largest reported component (22.47 hours), followed by caring for household members (13.11 hours) and working either self employed or employed (10.13 hours). Very few women in Mexico report time spent working in agriculture (six percent). This is in contrast to the Tanzanian sample where women spend on average the greatest amount of time in home and agricultural work (17.57 and 15.22 hours respectively), and very little time spent working in employment or care

[9] Although China is well known for the one-child policy, this policy is not homogenous across the country. Rural household are generally allowed to have a second child if the first is a female, or has a physical or mental disability. In addition, in many provinces, families can have more than one child if they pay penalties, the rates of which vary from place to place. Moreover, the enforcement of population control policies is not standardized and varies substantially.

giving.[10] There are generally few bivariate differences in time use by reproductive status across all countries. In China, earlier women who are both pregnant or breastfeeding spend fewer hours on housework, pregnant women in both panels spend fewer hours working in agriculture and breastfeeding women in both panels spend more hours care giving. In Mexico, women of both reproductive statuses spend more time care giving and less time working self employed or outside the home. In Tanzania, only significant differences are found in breastfeeding women, who report significantly more time spent in agricultural work.

[Table 2 approximately here]

IV b. Cross-sectional and individual fixed effects regression results

Table 3 presents a summary of coefficients on pregnancy and breastfeeding from our main cross-sectional and individual-level fixed effects regression models by country (Panels A1 and A2, China; Panel B, Mexico; Panel C, Tanzania). In both cross-sectional and fixed effects models in both China panels, women spend significantly less time care giving while pregnant; however spend significantly more time care giving while breastfeeding, which is an expected result. Women who are breastfeeding in both panels spend significantly more time working for an employer, however this is only significant at the 10% level in the later panel. The main differences between the earlier and later panels is that breastfeeding women in the later panel spend significantly less time both in agricultural and working for themselves or an employer. In Mexico, women spend significantly more time (1% level) care giving if they are breastfeeding, and this finding is robust to model choice. These women also work fewer hours, but while this effect is significant at the 1% level in the cross-sectional model, it is only significant at the 10% level in the fixed-effect model. Furthermore, in the fixed effect model, pregnant women spend less time caring for household members (10% level). In contrast, in Tanzania, women are actually more likely

[10] Although there are important differences between countries which influence the types of time use activities women may engage in, the differences in overall levels and categories here are not surprising. Recall that not only are categories defined in different ways (see Table A1), but alternative categories included in surveys also differ. For example, MxFLS collects information on leisure time, which may affect how women categorize overall time spent in various activities. Therefore, these hours are not strictly comparable across countries, however are on average relative to their counterparts in the same country.

to spend time working in the house and in agriculture while breastfeeding across both models. Pregnancy and breastfeeding status are unrelated to the majority of outcomes which confirms the bivariate results in Table 2.

[Table 3 approximately here]

IV c. Extensions and robustness checks

We conduct two extensions and robustness checks to further explore our main findings. First, we re-run cross-sectional and individual fixed-effects models to include interaction terms between wealth (bottom 40 percent of wealth quintiles) and our reproductive indicators (pregnant and breastfeeding) in all countries. Our hypothesis is that women who are poorer will have fewer resources, and assets and increased time burdens with which to manage reproduction and productive activities, and thus effects may be found among these women who differ from their relatively wealthier counterparts. Second, we examine the linkages between reproductive health indicators and nutritional indicators: BMI (kilograms/meters^2) in all countries and daily caloric intake (average from three day recall) in China. We would expect BMI and caloric intake to increase among pregnant and lactating women, though less so among the latter group. However, these effects may be dampened if women have poor food security or if they are exposed to particularly labor intensive work. By triangulating nutritional and time use findings, a more complete understanding of linkages is expected. Finally, we explore the potential that pregnancy and breastfeeding

A summary of the results from the first extension are reported in Table 4 which show interaction terms and coefficients on reproductive health and wealth indicators by country for both pooled cross-sectional and individual fixed effects models. Results show that, nearly all interaction terms are insignificant across time use activities, countries and models. The exceptions are among poor, breastfeeding women in the earlier China panel who spent fewer hours in agriculture and poor pregnant women in the later China panel who spent fewer hours working for themselves or an employer. In general this suggests that relatively poorer and richer women in rural areas do not differ in their labor-intensive activities based on pregnancy or breastfeeding status. While in some ways this is promising, it

is also means that women across the income spectrum may face difficulties decreasing their other time and work burdens during pregnancy and breastfeeding periods.

[Table 4 approximately here]

Table 5 shows a summary of results examining the linkages between pregnancy, breastfeeding and nutritional indicators (BMI top panel, caloric intake bottom panel). Note that because anthropometry measurements were often taken among a select sample, these sample sizes are slightly smaller as compared to the time use analysis. Average BMI is lowest in Tanzania (21.27), followed by China (22.27 and 23.31) and highest in Mexico (27.17). We find that pregnancy status is associated with increased BMI in China and Tanzania, however not in Mexico, which may be a function of a larger proportion of overweight women in the general sample. Interestingly, we find that breastfeeding status is actually associated with lower BMI in Tanzania, which may be a function of extended breastfeeding periods. We find that earlier in China, caloric intake increases significantly among women who are breastfeeding, however not among women who are pregnant. By the later period in China however, this relationship is no longer significant among women using the fixed effects model.

[Table 5 approximately here]

V. Discussion and conclusions

Interactions between reproduction and productive work are complex. Development economists have, on one hand advanced the understanding of effects and program dynamics surrounding labor intensive agricultural work among both genders. Meanwhile, international health researchers have on the other increased knowledge around pregnancy and lactation in low income settings. However, there has been little advancement of what we know about the interaction of these two areas of research. Indeed, there are inherent complexities, as reproduction, including fertility desires and child care methods are often culturally specific or individually determined, thus policy makers may be hesitant (at least from an economic view) to make prescriptions concerning best practices or indicate what women should or should

not do. For example, while there may be some beneficial effects for children's development when women are able to stay home from the field or market based activities, there may be adverse effects on these women's bargaining power (which directly affects children's welfare) within the household when they cease to bring home an independent source of income. We should not assume that a pregnant woman should be exempt from carrying water from a distant source while she is pregnant, when the alternative is for example, sending a young girl to carry it, or using water from an unclean source. However, despite these complexities, it is likely that the linkages between reproduction and productive activities are a central concern over the course of women's lives in developing countries, and thus a better understanding of the dynamics surrounding these issues is essential for those engaging in gender and development policy, research and program implementation.

There are several findings across and within countries which warrant further discussion. First, we find little evidence of changes in time use based on pregnancy or breastfeeding status, except for time spent care giving among breastfeeding women, which we expect given the existence of a newborn in the household.[11] In fact, we find that in Tanzania, women actually increase labor intensive work in the home and field during lactation, which may be a function of trying to 'make up' time lost during the delivery period or end of pregnancy. This was also found among the women in the early China panel using the fixed-effects model. Although theoretical models would suggest that women who are pregnant or breastfeeding would work less, empirical evidence from developing countries may suggest otherwise. In a recent study from Ghana (Hill, Fink, Lince, & Osei-Akoto, 2010), the authors found that in the Accra Metropolitan Area, women did not lower their labor force participation—while they worked slightly less during pregnancies, the return to the labor market after giving birth was fairly immediate. A study in Brazil using over 100,000 retrospective fertility histories found that differences in fertility across women were only weakly associated with differences in labor supply, most notably among women with multiple children (Lam & Duryea, 1999). A plausible suggestion for this unexpected finding is that the time

[11] In contrast to other countries, we do not expect to find this relationship in Tanzania per se, as the care giving variable is defined as caring for sick individuals, and not children.

constraint is not binding in developing countries because women can engage in home production and other activities simultaneously. Our results lend strength to this latter theoretical hypothesis. To try and explore if women are decreasing leisure in response to increasing child care obligations, we test the same models in Mexico where time in leisure was specifically collected—however find no significant effects. The total stock of time available for physically demanding tasks (T_{hh}) does not appear to decrease. Furthermore, traditional neoclassical household models were often created to be applicable to developed countries where home production activities are relatively straightforward. In contrast, home production in developing countries (particularly the rural regions) is often limited by the failure or complete absence of markets for basic services, which results in the need for activities such as fetching water, and carrying firewood.

However, there are several exceptions to this general finding. In particular, case of the later China panel women do reduce time spent both in agricultural and self and employment work and women in Mexico reduce work hours outside the home. These relationships may be a product of relative economic development, for example employer based benefits like maternity leave or ability to use earnings to pay for child care. Alternatively, this finding may indicate discriminatory policies against pregnant and recently pregnant women. For example, *maquiladoras,* which are export processing plants operated in Northern border cities of Mexico and are a major source of formal sector employment for Mexican women, are known to discriminate against pregnant women. Forms of discrimination include pre-employment pregnancy screenings, forced resignation upon revealing pregnancy status, and refusing pregnant women appropriate breaks and time off for pregnancy-related illnesses (Smith, 1998; Williams, 2005). However, in the case of Mexico, since the effect of breastfeeding on work attenuates when moving from the cross-sectional to the fixed effect model and is only significant at the 10% level, this result may be due to unobserved heterogeneity of the women making labor decisions and not a function of breastfeeding itself.

There are inherently limitations to any study, and recognition of weaknesses will help to correctly interpret results and make more accurate policy prescriptions. We first note that data on time use are

notoriously hard to collect and analyze (Apps, 2003; Ilahi, 2000; Sagrario Floro, 1995). In a review of time use research preceding the 1990's, Juster and Stafford (1991) claim time diaries to be the only reliable method of collecting time use data. This is because many activities performed throughout the day are not memorable, and often not conducted on a daily basis, and therefore, when asked to recall these events, people tend to overestimate these activities as being representative of an average day (Juster & Stafford, 1991). However, since we utilize more general economic and health survey data, not designed specifically to collect time use, which is very labor intensive to implement, we are not able to use more reliable data from time diaries. When specifically examining hours worked per week in a given activity, an econometric concern has been how to model an outcome which has mass points at zero hours and which may have skewed distributions. Indeed in our data, for certain outcomes, but not all, there are significant percentages of women reporting zero hours (See Table 3). For example, only 14 percent of women in Tanzania report working self employed or outside the home, and only six percent of women in Mexico report working in agriculture or livestock. There is a potential selection issue in that women who report positive outcomes may be somehow systematically different as compared to those who report positive measures. Ilahi and Grimard (2000) consider the effect of infrastructure on Pakistani women's time use in market work, time collecting water and leisure by first limiting the sample to women who have non-zero use across the total of all outcomes (Ilahi & Grimard, 2000). They then use Heckman selection and Tobit models to account for the selection into a given activity and the large numbers of women reporting zero hours in any given activity. Although a potential fix to the selection (distribution) problem, we do not attempt to implement Heckman or Tobit models, because they do not allow for fixed effects panel modeling, which we believe are preferred models given that the majority of our outcomes do not have significant mass points at zero. However, we acknowledge that results from indicators with higher percentage of zero outcomes are less defendable in comparison to those in which the majority of women report some positive working hours. Furthermore, studies have shown that recall of time use can be highly inaccurate, even for one or two days prior to the survey (Engle & Lumpkin, 1992; Klumb & Perrez, 2004). As a final note, we are unable to more accurately identify timing of pregnancy at interview

(e.g. trimesters or months pregnant), and therefore it is possible that our results which treat pregnancy as a uniform state may be unable to capture nuances in time changes.

We find little recent empirical evidence on the effect of women's lifecycle during reproductive years and connections with labor intensive work in developing countries. To fill this gap we analyze longitudinal data among women of reproductive ages in China, Mexico and Tanzania to examine the relationship between pregnancy, breastfeeding and time use in labor intensive outcomes. With the exception of time spent care giving, we find little evidence that women modify time spent in physically demanding activities, and in some cases such as home and agricultural work, women actually increase work in breastfeeding periods. In addition, we find that generally these relationships are found among all women, not limited to those who are asset or resource poor. The exception to this general finding is among women in the later China panel (2004 to 2006) where women in breastfeeding periods decrease agricultural and work for themselves or an employer, which may suggest a transition to more formalized economy and maternal leave expectations.

In light of these findings, logical next steps include research and program evaluation of formal and informal programs to assist mothers and pregnant women participate in work activities, or public provision of infrastructure such as water and electricity which may alleviate household work (Quisumbing, Hallman, & Ruel, 2007). For example, one previous study found nearly 27 percent of women cite childcare as a reason for not applying to public works (typically food-for-work) programs in rural Ethiopia in contrast to approximately three percent of men (Quisumbing & Yohannes, 2004). However, there have been some innovative and promising interventions and programs being developed to tackle lifecycle issues which can be used as a starting point for thinking about next steps in assisting poor rural women. In Gambia, the Baby-Friendly Community Initiative (BFCI), coordinated by The Gambia's National Nutrition Agency, runs a demand driven intervention to promote exclusive breastfeeding in rest houses that are built where women can breastfeed while working their fields. In addition, some participatory communities have instituted policies of community assistance for women during the three months before and six months after delivery to mirror traditional government provided maternity leave

(Jallow, 2005, 2006). Among the younger generation of adolescent girls in Nepal, the 'Menstruation and Education in Nepal Project' is testing the acceptability and impact of randomly distributed menstrual cups on educational attainment and a range of human capital outcomes with the hope of alleviating mobility and other restrictions during menstrual cycles (Oster & Thornton, 2009).[12] These two programs are examples of how lifecycle challenges, including reproductive health and pregnancy related concerns are clearly linked to general economic welfare, labor force participation and poverty reduction. In addition, although we find that women seem to gain weight during pregnancy, this does not necessarily translate into increased caloric consumption in China, which is consistent with our time use outcomes and is suggestive that more attention is needed to addressing nutritional concerns during pregnancy. We hope this study will add to the general knowledge surrounding these linkages and is a first step in better understanding and how to aid poor women in their joint productive and reproductive roles.

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[12] Menstrual cups are small, silicone, bell-shaped, re-useable cups which are inserted into the vaginal canal to collect menstrual blood. The brand used in the study is the MoonCup, although similar products are sold under the Keeper and Diva Cup brands. For most women the cup needs to be emptied approximately every 12 hours. For more information see Oster and Thornton (2009) or www.mooncup.co.uk/.

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Tables

Table 1. Key reproductive health indicators in China, Mexico and Tanzania

	China		China		Mexico		Tanzania	
	CHNS (1997-2000)		CHNS (2004-2006)		MxFLS (2002-2005)		KHDS (1991 - 1994)	
	(N = 4202)		(N = 3400)		(N=3792)		(N = 1806)	
Key indicators	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Currently pregnant (=1)	0.02		0.02	[0.12]	0.03	--	0.08	--
Currently breastfeeding (=1)	0.04	--	0.03	[0.17]	0.07	--	0.15	--
Auxiliary indicators								
Age (years)	34.29	[9.74]	37.63	[8.04]	31.31	[9.43]	26.59	[10.06]
Currently married/partnered (=1)	0.80	--	0.91	--	0.66	--	0.46	--
Ever pregnant (=1)	--	--	--	--	0.69	--	0.61	--
Total fertility (parity)	--	--	1.45	[0.89]	2.37	[2.32]	2.74	[3.32]
Contraceptive use (=1)	--	--	--	--	0.58	--	0.11	--

Note: Sample is limited to women ages 15 to 49; contraceptive use includes both modern and traditional methods.

Table 2. Descriptive and bivariate analysis on time use outcomes and reproductive health by survey

	China CHNS (1997-2000)				China CHNS (2004-2006)				Mexico MxFLS (2002-2005)				Tanzania KHDS (1991 -1994)			
Time use (hours last week)	Any hours (=1)	Full Mean N=4202	Pregnant Mean N=89	Bfeed Mean N=166	Any hours (=1)	Full Mean N= 3400	Pregnant Mean N= 50	Bfeed Mean N= 103	Any hours (=1)	Full Mean N=3792	Pregnant Mean N=105	Bfeed Mean N=254	Any hours (=1)	Full Mean N = 1804	Pregnant Mean N = 134	Bfeed Mean N = 264
Housework	0.87	15.11	12.01	12.53	0.95	9.12	7.44	8.92	0.94	22.47	23.97	23.54	0.91	17.57	17.98	21.19
	--	[11.58]	[1.11]*	[0.85]*	--	[8.99]	[1.14]	1.22]	--	[15.69]	[16.04]	[14.01]	--	[11.47]	[13.01]	[10.30]
Care giving	0.16	6.38	7.23	51.24	0.22	5.63	3.09	37.61	0.42	13.11	17.76	30.87	0.21	1.15	1.14	1.39
	--	[21.49]	[3.17]	[3.84]***	--	[18.24]	[1.56]	[3.57] ***	--	[21.16]	[22.70]**	[27.02]***	--	[4.17]	[3.68]	[3.98]
Agriculture	0.63	22.3	14.87	19.44	0.53	16.18	8.34	9.46	0.06	0.57	0.36	0.44	0.80	15.22	14.02	18
	--	[26.29]	[2.31]*	[1.76]	--	[24.59]	[1.88] **	[1.35] ***	--	[3.54]	[2.22]	[2.12]	--	[12.65]	[11.38]	[11.90]***
Working self or employed	0.84	46.75	48.3	46.23	0.75	43.73	38.88	39.49	0.27	10.13	5.06	4.46	0.14	2.23	2.82	1.42
	--	[26.06]	[2.28]	[1.42]	--	[31.06]	[3.54]	[3.05]	--	[19.48]	[12.34]***	[13.61]***	--	[8.46]	[10.93]	[4.91]

Note: Mean values are preserved (not log transformed) for descriptive presentation, for details on components of time use see Table A1. Standard deviations are presented in [ ] brackets below where appropriate. Sample is restricted to women ages 15 to 49. Significance levels reported from t-tests. **denotes significance at the 5% level, *** at the 1% level.

Table 3. Summary of reproductive health coefficients from cross-sectional and Individual-level fixed effects regression models in China, Mexico and Tanzania				
	Panel A1: China CHNS (1997 - 2000; N = 4116)			
	Cross-sectional		Individual FE	
	Pregnant	Bfeed	Pregnant	Bfeed
Dependent variable:	Coeff	Coeff	Coeff	Coeff
Time use (logged hours last week)	(SE)	(SE)	(SE)	(SE)
Housework	0.07	-0.09	0.20	-0.13
	(0.16)	(0.14)	(0.31)	(0.17)
Care giving	-0.67	3.04	-1.47	1.88
	(0.26)***	(0.23)***	(0.51)***	(0.47)***
Agriculture	-0.34	0.18	-0.40	0.33
	(0.25)	(0.19)	(0.41)	(0.31)
Working self or employed	-0.05	0.09	0.25	0.20
	(0.28)	(0.17)	(0.40)**	(0.22)
	Panel A2: China CHNS (2004 - 2006; N = 3400)			
Housework	0.01	-0.16	-0.01	-0.46
	(0.17)	(0.17)	(0.34)	(0.26) *
Care giving	-1.39	2.58	-1.38	1.12
	(0.33) ***	(0.27) ***	(0.46) ***	(0.44) ***
Agriculture	0.16	-0.08	-0.40	-0.64
	(0.30)	(0.25)	(0.52)	(0.28) **
Working self or employed	0.23	-0.23	0.98	-1.54
	(0.39)	(0.31)	(0.51) *	(0.42) ***
	Panel B: Mexico MxFLS (2002 - 2005; N = 3792)			
Housework	-0.05	-0.03	-0.10	-0.02
	(0.12)	(0.09)	(0.16)	(0.11)
Care giving	0.03	1.53	-0.76	0.99
	(0.33)	(0.17)***	(0.45)*	(0.28)***
Agriculture	-0.04	-0.02	0.01	0.01
	(0.10)	(0.08)	(0.14)	(0.11)
Working self or employed	-0.19	-0.40	-0.36	-0.31
	(0.21)	(0.14)***	(0.28)	(0.16)*
Sample size (N)	3792		3792	
	Panel C: Tanzania KHDS (1991 - 1994; N = 1806)			
Housework	-0.08	0.55	0.03	0.50
	(0.55)	(0.11)***	(0.18)	(0.16)***
Care giving	0.03	0.16	0.08	0.04
	(0.15)	(0.11)	(0.22)	(0.20)
Agriculture	-0.15	0.60	0.05	0.55
	(0.22)	(0.13)***	(0.29)	(0.22)**
Working self or employed	-0.01	-0.16	-0.07	0.15
	(0.15)	(0.12)	(0.20)	(0.16)

Note: Coefficients are from OLS pooled cross-sectional and individual fixed effects models where dependent variables are logged hours per week. For details on construction of outcome indicators see Table A1. Control variables are at the individual, community level and include seasonal and regional indicators. Standard errors clustered at the community-level are presented in ()s below coefficients. Sample is restricted to women ages 15 to 49. * denotes significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 4. Summary of reproductive health coefficients and interactions with wealth from individual-level fixed effects regression models in China, Mexico and Tanzania

	Panel A1: China CHNS (1997 - 2000; N = 4116)			
Dependent variable:	Pregnant Coeff	Interaction Coeff	Bfeed Coeff	Interaction Coeff
Time use (logged hours last week)	(SE)	(SE)	(SE)	(SE)
Housework	0.07	0.47	-0.10	-0.08
	(0.30)	(0.84)	(0.21)	(0.36)
Care giving	-1.38	-0.35	1.91	-0.11
	(0.65) **	(0.99)	(0.56) ***	(0.88)
Agriculture	-0.63	0.72	0.62	-1.15
	(0.40)	(1.07)	(0.37) *	(0.53) **
Working self or employed	0.44	-0.74	0.29	-0.41
	(0.51)	(0.76)	(0.28)	(0.32)
	Panel A2: China CHNS (2004 - 2006; N = 3400)			
Housework	-0.06	0.12	-0.59	0.58
	(0.38)	(0.80)	(0.32) *	(0.50)
Care giving	-0.99	-1.20	0.99	0.56
	(0.52) *	(1.00)	(0.50) **	(1.04)
Agriculture	0.08	-1.71	-0.77	0.61
	(0.52)	(1.26)	(0.30) ***	(0.72)
Working self or employed	1.61	-2.21	-1.56	0.12
	(0.58) ***	(0.99) **	(0.49) ***	(0.97)
	Panel B: Mexico MxFLS (2002 - 2005; N = 3792)			
Housework	0.04	-0.36	0.07	-0.18
	(0.22)	(0.38)	(0.16)	(0.19)
Care giving	-0.75	-0.02	1.29	-0.63
	(0.62)	(0.94)	(0.39)***	(0.52)
Agriculture	0.01	-0.02	-0.11	0.25
	(0.12)	(0.30)	(0.12)	(0.18)
Working self or employed	-0.32	-0.13	-0.42	0.24
	(0.37)	(0.54)	(0.21)**	(0.33)
	Panel C: Tanzania KHDS (1991 - 1994; N = 1806)			
Housework	-0.10	0.25	0.57	-0.17
	(0.25)	(0.38)	(0.23)**	(0.35)
Care giving	0.17	-0.21	0.31	-0.63
	(0.33)	(0.39)	(0.26)	(0.42)
Agriculture	-0.32	0.70	0.65	-0.24
	(0.38)	(0.59)	(0.27)**	(0.41)
Working self or employed	-0.14	0.13	0.16	-0.02
	(0.28)	(0.37)	(0.16)	(0.26)

Note: Coefficients are from individual fixed effects models where dependent variables are logged hours per week and interaction terms with bottom 40 percent of wealth index. For details on construction of outcome indicators see Table A1. Control variables are at the individual, community level and include seasonal and regional indicators. Standard errors clustered at the community level are presented in ()s below coefficients. Sample is restricted to women ages 15 to 49. * denotes significance at the 10% level, ** at the 5% level and *** at the 1% level.

Table 5. Summary coefficients for the effect of reproductive health indictors on nutrition nutrition indicators in China, Mexico and Tanzania.

		BMI			
		Cross-sectional		Individual FE	
Country	Mean [SD]	Pregnant Coeff (SE)	Bfeed Coeff (SE)	Pregnant Coeff (SE)	Bfeed Coeff (SE)
China 1997 - 2000 (CHNS = 4202)	22.27	1.50	0.08	0.77	0.45
	[3.10]	(0.30)***	(0.23)	(0.57)	(0.29)
China 2004 - 2006 (CHNS = 3392)	23.31	1.41	0.78	1.10	0.51
	[5.10]	(0.62) **	(0.50)	(0.63) *	(0.75)
Mexico (MxFLS = 2505)	27.17	0.55	-0.24	0.90	0.54
	[5.68]	(0.45)	(0.45)	(0.59)	(0.48)
Tanzania (KHDS = 1674)	21.27	0.84	-0.54	0.67	-0.26
	[2.99]	(0.26)***	(0.22)**	(0.19)***	(0.14)*
		Caloric Intake (logged)			
China 1997 - 2000 (CHNS = 4090)	2250.65	-0.01	0.07	-0.02	0.12
	[677.48]	(0.04)	(0.03)**	(0.06)	(0.05)**
China 2004 - 2006 (CHNS = 3331)	2160.41	0.04	0.06	-0.01	0.03
	[694.45]	(0.05)	(0.03) *	(0.08)	(0.05)

Note: Coefficients are from OLS pooled cross-sectional and individual fixed effects models where dependent variables BMI and caloric intake. Control variables are at the individual, community level and include seasonal and regional indicators. Standard errors clustered at the community-level are presented in ()s below coefficients. Sample is restricted to women ages 15 to 49. * denotes significance at the 10% level, ** at the 5% level and *** at the 1% level.

VII. Appendix materials

Table A1. Definitions of labor intensive time use variables in China, Mexico and Tanzania

Panel A: Reproductive Labor	Description (*number hours weekly spent…*)
(1) Housework	
China	Domestic chores (e.g buying/cooking/preparing food, washing clothes)
Mexico	Domestic chores (e.g. cooking/preparing food, washing clothes, cleaning) and fetching water, carrying firewood.
Tanzania	Domestic chores (e.g. preparing meals, cleaning, doing laundry, shopping for food), fetching water, carrying firewood.
(2) Care giving	
China	Caring for own or other's children.
Mexico	Caring for children, sick individuals, and elderly.
Tanzania	Caring for or visiting sick household members.
Panel B: Productive Labor	
(3) Agriculture and livestock	
China	Working field/garden plots, fishing and lifestock.
Mexico	Working field/garden plots and caring for animals.
Tanzania	Working field/garden/plots (e.g. preparation and planting, weeding, pruning, applying fertilizer), caring for livestock (e.g. feeding, tending, transporting), processing crops or livestock products (e.g. harvesting, transforming, marketing).
(4) Self employed or work for pay	
China	Handicraft, household business or market based employment. Time recorded for up to two self or employed business activities.
Mexico	Work including paid, self-employed, selling handicrafts, and sale of other homemade products.
Tanzania	Working for self or household in an independent activity (e.g. fisherman, lawyer, medical) or working for someone outside the household (e.g. government, firm, private enterprise). Time recorded for up to two self or employed business activities.
(5) Leisure	
Mexico	Watching television, reading, using the internet, visiting family/friends, attending sporting events or other entertainment activities outside the home

Notes: All measures are hours on a weekly basis, definitions are authors interpretations based on survey questions.

Table A2. Control variables in China, Mexico and Tanzania

	China		China		Mexico		Tanzania	
	CHNS (1997-2000)		CHNS (2004-2006)		MxFLS (2002-2005)		KHDS (1991 - 1994)	
	(N = 4202)		(N = 3400)		(N=3792)		(N = 1806)	
Individual level controls [a]	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (years)	34.29	[9.74]	37.63	[8.04]	31.31	[9.43]	26.58	[10.06]
Age squared (years squared)	1270.39	[651.25]	1480.44	[579.72]	1069.10	[597.08]	808.09	[604.37]
No schooling (=1)	--	--	--	--	0.06	--	0.10	--
Incomplete primary schooling (=1)	0.22	--	0.13	--	--	--	0.34	--
Completed primary schooling (=1)	0.63	--	0.66	--	0.50	--	0.42	--
Secondary schooling (=1)	--	--	--	--	0.29	--	--	--
Secondary or above schooling (=1)	0.15	--	0.21	--	--	--	0.04	--
Above secondary schooling (=1)	--	--	--	--	0.14	--	--	--
Married, union (omitted =1)	0.80	--	0.91	--	0.66	--	0.46	--
Never married (=1)	0.19	--	0.08	--	0.29	--	0.37	--
Widowed, separated, divorced (=1)	0.02	--	0.01	--	0.05	--	0.17	--
Household level variables								
Bottom 40 percent of wealth index (=1)	0.37	--	0.39	--	0.37	--	0.43	--
Community level variables								
Population (in 1,000s)	3.34	[7.61]	3.80	[6.55]	7.18	[53.15]	3.24	[3.17]
Electricity (=1)	--	--	--	--	0.92	--	0.17	--
Piped water (=1)	--	--	--	--	0.67	--	0.12	--
Bank (=1)	--	--	--	--	0.43	--	0.13	--
Public transportation (=1)	--	--	--	--	0.37	--	0.30	--
Transportation score (0-10) [b]	5.11	[2.59]	5.63	[2.57]	--	--	--	--
Communications score (0-10) [b]	6.84	[2.22]	6.00	[2.05]	--	--	--	--
Economic score (0-10) [b]	4.74	[2.25]	6.21	[1.84]	--	--	--	--
Health facilities score (0-10) [b]	5.92	[2.05]	5.29	[2.36]	--	--	--	--
Sanitation infrastructure score (0-10) [b]	6.03	[3.72]	6.82	[3.06]	--	--	--	--
Housing infrastructure score (0-10) [b]	4.98	[2.56]	6.37	[2.25]	--	--	--	--
Regional indicators [c]								
Northern region (=1)	0.31	--	0.37	--	--	--	--	--
Central region (=1)	0.35	--	0.31	--	--	--	--	--
Southern region (=1)	0.34	--	0.31	--	--	--	--	--
Pacific North region (=1)	--	--	--	--	0.18	--	--	--
North Central Gulf region (=1)	--	--	--	--	0.21	--	--	--
Bajio region (=1)	--	--	--	--	0.19	--	--	--
Central region and Mexico City (=1)	--	--	--	--	0.28	--	--	--
Southeast region (=1)	--	--	--	--	0.14	--	--	--

Note: Sample is limited to women ages 15 to 49. Control variables for seasons (months) and for endline (=1) in the case of OLS regressions are included but not reported in all countries.

[a] Differences in education categories reflect differences in response categories and relative distributions of educational attainment in each country (e.g. since Chinese women are relatively better educated, it does not makes sense to include a category "no schooling" as in Mexico and Tanzania).

[b] Scores are community-level measures of urbanicity ranging 0 - 10 with 10 being more developed (see Ng et al., 2009 for details on construction and components).

[c] Regional indicators are omitted for Tanzania, as data is entirely from the population living in the Kagera region.