Are Children Normal or Inferior Goods?
Evidence from Indonesia's Financial Crisis of 1997

by

Raymond Anthony Farkouh

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Approved by:

David Guilkey

Donna Gilleskie

John Akin

Gustavo Angeles

Peter Lance

ABSTRACT

RAYMOND ANTHONY FARKOUH. Are Children Normal or Inferior Goods? Evidence from Indonesia's Financial Crisis of 1997
(Under the direction of David Guilkey)

The purpose of this dissertation is to provide insight into an individual family's fertility response to a short term financial shock. As economies develop, the number of children born in a household decreases at both the inter and intra-country level. This paper examines a household's fertility response to a short run financial shock where there are no confounding effects of economic development present in the decision making process. Micro-economic theory defines income elasticity as: the percentage change in the quantity of a good given a percentage change in income, holding all else constant; previous examinations of income elasticity of the demand for children fail to hold child quality constant.

I develop a theoretical economic framework to motivate an empirical model containing seven equations which predict the probability of conception while controlling for family size, women's education and employment, marital status, income, and consumption. The model is estimated using longitudinal data from waves 2 and 3 of the Indonesian Family Life Survey (IFLS), which spanned the Asian financial crisis. With this micro-level economic and socio-demographic data, I identify changes in fertility behavior in response to individual and household financial shocks, measured by changes in per capita expenditure and household income.

Results indicate a slight decline in fertility at the onset of the crisis, followed by an increase in fertility during the crisis. Household income exerts no effect on the probability of conception, while per-capita consumption exerts a negative, but insignificant effect. Households which experience some hardship show declines in the probability of conception. Over the four years spanning the Asian financial crisis, children are indicated as neither inferior nor normal goods. The effects of other children in the household, the mother's age, and marital status are the more dominant predictors of fertility; therefore, I conclude that although household economy changes impact fertility, cultural factors and permanent economic factors are a better predictor of fertility than short run financial shocks.

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Good luck to all in your future endeavors..

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ABBREVIATIONS

BKKBN	Badan Koordinasi Keluarga Berencana Nasional (National Family Planning Coordination Board)
CE	Conception Event (irrelevant of pregnancy outcome)
DFM	Discrete Factor Method
FIML	Full Information Maximum Likelihood
GDP	Gross Domestic Product
IFLS	Indonesian Family Life Survey
IMF	International Monetary Fund
INPRES	Presidential Instruction
Rp	Rupiah
STATA	StataCorp Data Analysis and Statistical Software Package Version 9
TFR	Total Fertility Rate
USD	United States Dollar

CHAPTER 1

INTRODUCTION

This dissertation will explore the impact of short term economic shocks on the fertility of Indonesian women. Trends in fertility rates both across and within countries show a negative relationship between fertility rates and income, giving the impression of children as inferior goods. Previous studies on the economic impact of fertility have produced inconclusive or conflicting results. The problems these analyses face is as incomes rise, expenditures on children also rise, resulting in changes in child quality not controlled for within these analyses. The Asian Financial Crisis, which began in 1997, provides a unique opportunity to examine the immediate effects of an unanticipated, short duration macroeconomic shock on a woman's fertility while child quality remains relatively constant.

Following the literature review, I present a theoretical model where women maximize utility by choosing the number of children to have, the quality at which to raise those children, and the family's consumption, subject to time and budget constraints. This theoretical model motivates an empirical analysis using full information maximum likelihood and the discrete factor method on a system of seven equations controlling for the endogeneity of women's education, employment status, income, consumption, marriage, and family size to determine the effect

economic shocks have on a woman's fertility. In the empirical analysis I use the Indonesian Family Life Survey collected before and after the Asian Financial Crisis of 1997, which offers extensive information on individuals, households, and communities. Following the analysis, I run simulations to give relative context to the parameter estimates. Finally I conclude with a discussion of the results and implications of this work.

CHAPTER 2

MOTIVATION

At the macro level, researchers observe a decrease in the average fertility rates of women as per-capita Gross Domestic Products (GDP) rise. If a household's income increases, do we observe a decrease in the demand for children? Does this imply that children are inferior goods?

Parents derive utility from having children, but children are costly to the household's limited resources. Richer societies have lower fertility rates, and Bollen(2002) refers to this as the negative inter and intra-country fertility-income gradient. Fertility at the household level can be a factor of many things, including biology, economic factors, religion, family, peer, and community influences, personal preferences of the husband and wife, and random events such as contraceptive failure, pre-natal and infant mortality, along with others. Studying the affect of economic factors on fertility is a worthwhile exercise for three main reasons. First, the majority of world population growth will occur in the developing world, contributing nearly 2 billion people to the world population by 2125 (Bongaarts, 1998). Countries with fewer resources are those that have higher fertility, causing thin resources to be spread thinner across growing populations, limiting opportunities for economic growth through capital accumulation. Second,

childbearing is a major event that affects the entire household, including maternal and child health, maternal labor supply, and thus income and consumption. Third, studies on the impact of income on fertility have yet to produce conclusive results or a clear understanding of the root causes of the negative inter / intra-country income fertility gradient (Bollen, 2002).

No discussion concerning income elasticities of children is complete without considering child quality. Quality can be measured by the human capital investment in education, the physical investment in nourishment and health, and the time spent by the parent or proxy on child care and education. Razin and Sadka (2005) discuss the endogeneity of fertility where the higher value (opportunity cost) of time makes raising children relatively more expensive in more productive economies. In addition, the importance of education and training in these countries will further raise the costs of children. In poorer economies, the economic costs of children are relatively lower due to lesser human capital investment, whereas the economic benefits are higher in the short term through labor, and in the long term through support of the parents in old age, thus demanding larger families.

This project focuses on the impact of economic variables on fertility. The economic shock experienced in Indonesia in 1997 was devastating for its residents, but fortuitous to social scientists, as the unanticipated, short duration financial crisis allows scientists to study how Indonesians reacted to a changing economic climate. By using the detailed economic and demographic data contained within the IFLS from before and after the crisis, I can determine how households in Indonesia reacted to economic shocks with regards to their fertility.

Policy-makers concerned with populations in developing countries are generally interested in two initiatives. First are those policies which reduce mortality, allowing those born to live longer healthier lives, and second are those policies intended to reduce total fertility rates. The total fertility rate (TFR) is defined as the number of live births an average woman has over her lifetime. The “Replacement TFR” is defined as the average number of children a woman bears to keep the population level constant. This number is considered to be very close to 2.1 children per woman, slightly greater than two since a certain proportion of female children will not survive to reproduce. Populations grow when total births exceed total deaths, and since all people inevitably die, mortality declines do not reduce total deaths, but merely postpone them, resulting in small, one-time increases in population counts. The larger impact on population growth comes from reducing total births, which has an exponential impact on population growth.

Indonesia has made incredible progress on reducing its TFR over the last 45 years from 6.0 to 2.4 children per woman. The root cause of this reduction has been the subject of many research projects over the last two decades (Pitt, Rosenzweig, and Gibbons, 1993) (Gertler and Molyneaux, 1994) (Angeles, Guilkey, and Mroz, 2005). Government programs not only to incorporate contraceptives into society but also to educate women on the importance of smaller families began in the early 1960’s. This increased the awareness and availability of contraception and resulted in improved education opportunities for women. Increased education of females led to higher female labor force participation rates, which further led to higher household

income and consumption. Infant mortality fell (World Bank, 1993), and access to health care has improved throughout the entire country.

CHAPTER 3

LITERATURE REVIEW

3.1 Overview

Fertility within the household can be investigated as a rational economic decision, and one can investigate both the supply of and demand for children. Ultimately, fertility is constrained by a biological upper limit known as a reproductive couple's fecundity, or in economic terms, the available supply of household births even if endowed with unlimited resources. To a first approximation this fecundity will be distributed randomly across a population (Rosenzweig and Schultz, 1985). We have every reason to believe the supply of births per woman has increased over time due to advances in modern science. Women previously unable to bear children have access to new methods of fertility treatments which can increase the probability of having live births, as well as increase years of fecundity.

With some minor exceptions, couples choose, or demand, some amount of children less than the available supply (Rozenzweig and Schultz, 1985, T P Schultz, 2005). There are many reasons documenting this phenomenon: 1) Improved accessibility, quality, knowledge, and acceptance of contraceptives, sterilization, and abortion, 2) reduced child mortality, 3) high rates of urbanization, 4) increases in the cost-benefit ratio of children, 5) increased education of women has raised their earning power and increased the opportunity cost of child bearing and child rearing,

6) rapid technological change has raised the rate of return to human capital and education, and 7) increases in the standard of living of parents (Butz and Ward, 1979). I will discuss each individually and examine the mechanisms through which they operate to impact fertility choices at the individual level, keeping in mind in fact many of these phenomena are interrelated and may jointly impact fertility.

Contraception gives women greater control over their reproductive destiny, it allows them to delay the birth of their first child, pursue additional years of education, work more, and live independently longer. Improved contraceptive techniques became readily available in much of the world following World War II. The pill first became available in the US in 1960, and quickly spread throughout the world. Today, over 100 million women of childbearing age take the pill as their primary method of birth control (Hatcher, 2004).

Abortion is available to many women as a means to prevent childbirth. Sterilization is encouraged by many societies for couples who have achieved their target family size and desire no further children, and is considered a safe and reliable method of birth control. Bongaarts, Mauldin, and Phillips (1990) find fertility is negatively associated both with development and family planning program effort. Government sponsored family planning programs legitimize the usage of contraception which then allow individuals to convert latent demand for lowered fertility into a physical demand for contraception (Ronald Freedman, 1994). For example, Miller (2005) finds the PROFAMILIA program sponsored by the government in Columbia was responsible for a one-half child reduction in the total fertility rate.

Healthcare advancements in developed countries improved mortality outcomes over the entire range of the life course, and naturally, these improvements spilled over into the developing world as well. Lower child mortality directly reduces fertility since parents can achieve their target number of surviving children with greater certainty and fewer births (Wolpin, 1997).

The cost-benefit ratio of children has increased due to increased costs and decreased benefits stemming from children. The most relevant cost to obtaining an additional child is the loss of the maternal income from the labor market (Ohlsson, 1994). As real wages have risen, this cost has risen accordingly. Increasing rates of return to human capital and education have raised the incentives of parents to invest more in their children's education. At the margin, additional years of education add additional educational expenses as well as an increase in the duration of parental dependence. This detraction from current production in the labor force resulting in opportunity costs explains the negative relationship between the number of children in a family and the children’s education (Schultz, 1997). Finally, the physical investment in health and nourishment of children accounts for a larger portion of the household’s budget constraint. These factors are responsible for raising the relative costs associated with children and have led to a substitute of quality for quantity in family size decisions (Becker, 1960).

Meanwhile, the benefits of having children have decreased. The most obvious decrease in the benefit of many children lies in urbanization, where financial benefits from children do not materialize until they enter the labor force. In agrarian societies, children are relatively more productive earlier in their lives as laborers on the family

farm and participants in home production when compared to non-agrarian societies, thus the economic benefits from children are more immediate and transparent. Children also provide a natural insurance mechanism for aging parents. In the absence of social programs aimed at the elderly, parents turn to their children for physical and financial support in their old age. Thus, children acted as a physical investment in retirement security; the greater the investment, the greater the security. In less developed societies, most households face significant income risks, but have very few means of mitigating these risks or responding to shocks. Hence, these households must rely on self insurance and coping mechanisms that may be suboptimal in the long run, especially for the poorest households (Portner, 2005). In this case, having more children is a natural insurance mechanism for these poor households (Khoo and Dennis, 1999). In turn, this insurance mechansim creates a larger unskilled workforce, capital dilution, and ultimately stunts economic growth (Khoo and Dennis, 1999), (Keane and Chen, 2002). Portner (2005) presents a hypothesis where children may act as imperfect substitutes for insurance. By estimating the effects of the risks of various natural disasters on fertility and education using data from Guatemala, Portner shows how increased risk of disasters boosts fertility and lowers the education of children. It is often noted larger families are more likely to be poor, which is consistent with families giving up the possibility of higher per capita consumption for a more secure, substantially lower consumption.

As women became more prevalent in the workforce, the need for human capital accumulation amongst females fueled an increase in desired education,

furthering women's position in the workforce through a simple feedback mechanism (Barro and Lee, 1994). Contraceptive availability encouraged women to plan the timing of births as well as family size, helping them invest in careers both in the home and outside of their family. Women's increased education, access to new family-planning technologies, and accumulation of work experience outside of the home increased the share of women's earnings in total family income. Studies suggest this redistribution of economic power [from men] to women is associated with a reallocation of family expenditures toward children, while helping women with dependent children to head their own households if necessary, and further strengthening women's incentives to have fewer children over their lifetime because they expect to bear more of the cost of children (Becker, 1981; P. Schultz, 2001). In many studies conducted in a wide range of contexts, it has been shown relative to the education of the mother, her husband's schooling has a smaller effect on both the quantity and quality of her children, as indicated by, for example, survival rates and health status (Thomas, 1999). Higher educated women spend more time in the workforce, causing a delay in the age of marriage, which in turn leaves the woman unmarried during a greater proportion of her fertile years, possibly adding to the decline in fertility.

Part of the association between education and fertility appears to have nothing to do with the education production function, but reflects how education is endogenous to the fertility decision. Specifically, women and their families choose their educational attainment given the opportunities and constraints they face, so the better educated are a self selected sub-sample of the underlying population. This

implies the relationship between education and fertility is not entirely causal, and could overestimate the impacts of programs designed to increase female educational attainment (Thomas, 1999). A simple example of this is a poor family with low aspirations and several children. One of those children grows up and marries. Most likely, this man is poor since he is poorly educated. Further, he married a poor woman since people tend to marry within their socioeconomic group. When they have children, they will probably have several children since both came from large families, and won't have the desire or means to push those children to high educational attainment, thus continuing the cycle.

Increases in the standard of living operate in conjunction with many of the other mechanisms mentioned. Female labor force participation led to dual income households, leading to a preference of increased consumption of other goods rather than children, which in turn raised the standard of living of parents (Barro and Lee, 1994) (Butz and Ward, 1979). Fertility decisions are based in part on expected lifetime income relative to material aspirations formed in childhood. In a steadily growing economy successive generations are raised in increasingly affluent households, hence they develop successively higher living aspirations in the course of their normal upbringing. Therefore, even though each generation normally has more resources at its command upon reaching adulthood, it also has greater goods aspirations to satisfy (Easterlin, 2000).

Another study examines the relationship between income relative to one's socioeconomic group and fertility. Relative income is more closely related to birth spacing than to cumulative fertility, and the relationship between relative income and

fertility is strongest among those couples who plan their life ahead and have a high level of education and occupation (Chaudhury, 1977). This indicates certain peer effects existing in the fertility decision will most likely spill over into future decisions relating to child quality, such as education expenses. In a dynamic framework, existing children and previous labor supply decisions constrain future choices regarding additional children and labor supply decisions (Ermisch, 1991).

3.2 Income and Fertility

At the individual level, researchers want to understand the effect of changes in household income on fertility. Across time and populations, per capita income exerts an ambiguous effect on fertility. Some studies find the relationship to be positive, implying children to be normal goods, while others contend it is inverse, implying children to be inferior goods. Analytical models based on economic theory have not provided an unequivocal answer to this apparent puzzle (Nagarajan, 1980). Reproductive demands are likely to be coordinated with other family time and resource allocations, and reflect not only socioeconomic constraints on choices, but also parents' heterogeneous preferences among various goals and outcomes (Rosenzweig and Schultz, 1985). This also implies the binding constraint on fertility is demand side driven. Household income is endogenous because it is influenced directly by a woman’s choice to work as opposed to bearing and caring for children. Docquier (2004) finds the two appear to be negatively correlated. Thomas (1999) finds current income does have a significant, but small, negative effect on fertility: A three-fold increase in current income would predict a 20% decline in fertility. The

estimated effects of income on fertility reflect a combination of two mechanisms. First, better educated people tend to earn higher wages, implying a higher market value of their time, and assuming child rearing is time-intensive, a reduction in the number of children a woman will want to have. Second, higher income implies more resources for the family to spend on consumption goods, and assuming children are valued and hence normal goods, raising the demand for children. The impact of income being negative suggests the first effect, the substitution effect, dominates (Thomas, 1999). The problem with this analysis is the data is constrained to a simple cross-section, implying no forward-looking expectation or dynamic component to the model.

Increases in income may induce parents to spend more money on quality instead of quantity. This results in an increased cost per child and reduced desired quantity, giving the incorrect impression children are inferior goods. A true inferior good requires the quantity of children to decrease when income increased, holding all else constant, including quality. Since quality is constantly changing, the children purchased before and after an income increase are not homogenous goods. The overall effect seems to be as income rises, higher quality of children is substituted for quantity of children.

There are multiple mechanisms by which income shocks affect fertility in the short run. First, potential parents may delay child rearing during times of hardship to avoid the direct and immediate costs of an additional child through a simple income effect. An extreme response to a short run negative economic shock is to decrease target family size to permanently avoid the marginal cost of an additional child.

The second response is to increase fertility during times of economic hardship when the opportunity costs of time are lowered and may present relatively less costly time commitments to child rearing. This inter-temporal substitution of births does not necessarily change total fertility at the household level. There are numerous studies that present arguments for each mechanism. I will summarize some of the key findings here.

Butz and Ward (1979, 1980) estimate a forward looking dynamic model of expected employment and wages in order to determine if reductions in the U.S. fertility rate reflected a structural decrease in target family size (a permanent decrease in the TFR), or an intertemporal substitution of births (a temporary decrease in the TFR). Further, current period fertility decisions and completed family size are both part of the same optimization problem, since completed family size is simply a consequence of period specific decisions, and at all periods during the fertile years, fertility plans are upwardly revisable. They hypothesize current period wage increases will depress current fertility, and likewise, expectations on future wage changes will shift fertility into earlier periods. The traditional model predicts changes in the husband's wage and income are associated only with income effects, since men tend to bear less of the time burden associated with childbearing (Thomas, 1999), whereas changes in the wife's wage and income are associated with both income and substitution (price) effects in the derived demand for child services under the presumption children are wife's time intensive. They find empirical evidence that expected wage increases in the near term depress fertility, conditional on the wife's intention to work in the current time period. As the time

horizon for expected wage increases extends further into the future, the effects are mitigated until a horizon around ten years is reached, where a switch in the coefficient sign indicates an increase in fertility. They claim this is evidence of some inter-temporal substitution of births, although the main result states the decline in total fertility rates in the US during the 1960's was a structural downward revision in couples' total lifetime fertility.

Docquier (2004) derives a model where a positive income shock has an immediate effect on the desired educational attainment of children as a shift in child quality. He models two effects, the first being a within group effect, where the individuals within a group can not increase their child's educational attainment, so they alter fertility directly based on income effects. The second is a between group effect, where a negative income shock causes a decrease in desired child quality, causing an increase in fertility. He finds the total fertility rate can increase or decrease with income, depending on the income distribution of the population and the private cost of education.

Eberstadt(1994) examined fertility in Eastern Germany during the fall of the Soviet Union. He notes declines in fertility during this course are comparable to nations in war, plague, or famine. He attributes this in large part to the tremendous economic uncertainty during that period. Ranjan (1999) examines the link between this economic uncertainty and the timing of childbearing using a two-period stochastic model of fertility behavior, and finds when agents lie below a certain income threshold increases in economic uncertainty theoretically predict a postponement of the childbearing decision until the uncertainty is removed. The

higher the uncertainty, the higher the income threshold. Due to the irreversibility of the childbearing decision and the option of postponing childbearing for a later time, it may be optimal for individuals to postpone childbearing during increased income uncertainty.

Income can come from different sources in the household, and may encourage or discourage fertility (Mincer, 1963). For example, if an increase in family income is due to the women's income contribution, this not only expands income opportunities of the family, but also raises the effective price of children to the family. Because it is empirically observed that higher values of women's time are associated with lower levels of lifetime fertility (P. Schultz, 1981, 1994), it is also inferred the price effect of women's wages outweighs its income effect on fertility. In contrast, if an increase in total family income is due to an increase in the husband's income, returns to physical assets, financial assets, business assets, land, or natural resources, this adds to family endowments while not necessarily affecting the relative opportunity cost of children to parents, in which case these income sources are expected to be associated with higher fertility, other things being equal (P. Schultz, 1981, 1994).

Ohlsson(1994) shows anecdotal evidence in Scandinavia of increased fertility when the labor force is less receptive to females. If the relative wages of wives to their spouses falls, then women take the opportunity to exit the labor force to have children, possibly to reenter during a more appealing time.

Nagarajan(1980) suggests the true relationship between income and fertility may be nonlinear, rising together up to some income level and diverging beyond that

level. In the empirical part of the paper, a quadratic functional form of the relationship between per capita income and birth rates is specified and estimated. Data used in the analysis span the period from 1909-1957 for the United States. Her results confirm the existence of the hypothesized nonlinear relationship.

3.3 Indonesian Fertility

Indonesia is the fourth most populous nation in the world with 242 million inhabitants on an archipelago of over 13,000 islands. With 88% of the population Muslim, Indonesia contains the most Muslims of any nation, while the remainder is 5%Protestant, 3%Roman Catholic, 2%Hindu, 1%Buddhists, and 1% undefined (2005).

Indonesia has had its share of successes and failures over the past few years. The terrorist attacks in Bali in October 2002 and October 2005 indicate the struggle between conservative Islam and the liberal westernization occurring throughout Asian societies. The most horrific tragedy to hit Indonesia was the tsunami of December 2004. Of the 216,000 total casualties, Indonesia sustained close to half, with over 104,000 lives lost. More recently, additional earthquakes and tsunami threats continue to ravage the volcanic island chain. On the positive side, Indonesia experienced consistent economic development over the past 50 years. The country has averaged GDP growth of 4.5 % per year over the 30 years prior to the financial crisis of 1998.

Indonesia's total fertility rate decreased at astounding levels compared to other developing countries. Table 3.1 illustrates the decline in the total fertility rate in Indonesia over the past 46 years.

Table 3.1 Fertility Rates in Indonesia: Last 45 Years

Year	1961	1970	1975	1980	1985	1998	2006
TFR	6.1 – 5.7	5.6	4.9	4.1	3.2	2.8	2.4

Source: Hull, 1980, Encyclopedia, Nationmaster Statistics

Hull (1980) notes prior to 1970, it is likely a secular rise in the age of marriage that had the major influence on fertility, while after 1970, the BKKBN (National Family Planning Coordinating Board) played an increasing, though not exclusive role in the process by providing access to inexpensive and reliable contraceptives and sex education to Indonesian women. This decline is attributed to increased contraceptive use (Gertler, Molyneaux, 1994) and female education, leading to increased female labor force participation, increased age of marriage, urbanization, and other improvements in proximate determinants(Angeles, Guilkey, Mroz, 2005). Indonesia is subject to many of the same economic, social, and cultural forces driving the decline in fertility in the remainder of the developed world.

Because of the dramatic decline in fertility rates in Indonesia, there has been substantial work done by demographers and economists to determine the root causes. Several social and economic trends have emerged as a result of the fertility declines, and different researchers have found different causes over different time periods. Demographic studies, as opposed to economic studies, focus on behavioral mechanisms through which couples limit fertility and are less concerned with measuring the effects of factors that motivate reductions in fertility(Gertler and Molyneaux, 1994).

Many governments have established explicit policies designed to reduce population growth. These include aggressive family planning programs as well as improving women's general education and economic opportunities. The Indonesian government embarked on an aggressive campaign of health care reform in 1968, funded by revenues from oil exports as a good faith signal to the people from the newly elected president Suharto. In 1970, the BKKBN (National Family Planning Coordination Board) formed and was tasked with providing contraceptive education and supplies throughout the country, with the most targeted placement in areas of the highest fertility. BKKBN activities focused most intensively in Java and Bali from 1970 to 1974.

BKKBN is responsible for coordinating government funding to local level distribution channels through local governments, health care clinics, and volunteers. After making contraception available, they promote two child families by informing women on the importance of education, postponing marriage and using contraceptives. By 1980, BKKBN activities spread to all areas of the Indonesian archipelago.

Because of this intentional program placement, program inputs are correlated with unobserved tendencies towards higher fertility, and are therefore endogenous to the fertility decision. Empirical work not accounting for this potential endogeneity suffer from biased estimates on the effects of inputs on contraception and fertility (Pitt, Rosenzweig, and Gibbons, 1993) (Gertler and Molyneaux, 1994) (Angeles, Guilkey, and Mroz, 2005).

Pitt, Rosenzweig, and Gibbons (1993) use a fixed effects model to control the endogeneity of family planning programs and education program placement. They examine the determinants of school attendance, fertility, and child mortality. In an uncontrolled model, family planning programs significantly increase fertility. However, when using the fixed effects model, the sign on the coefficient takes the expected negative value. They find the presence of middle and high schools exerts no influence on fertility when using the fixed effects model. The most significant finding is the enormous negative impact a mother's education has on fertility.

Gertler and Molyneaux (1994) examined fertility declines from 1982 to 1987, where over this short time span, average fertility in Indonesia declined by almost an entire child per woman. Fertility reductions have been associated with general economic development, but Gertler and Molyneaux go one step further to show the most consistently observed fertility reducing factors are: 1) those which increase the cost of children by increasing the value of a woman's time by creating opportunities for education, thus improving female wages and increasing the attractiveness of participating in the labor force, and 2) reducing the costs of contraception price and the accessibility of contraception by decreasing the travel time necessary to obtain it. After controlling for program endogeneity, Gertler and Molyneaux's major conclusion is program effects on fertility are not significant even though simple methods not controlling for endogeneity indicate a significant negative impact on fertility for health centers.

Angeles, Guilkey, and Mroz (2005) recently presented results comparing the estimated impacts of education on fertility from a simple model assuming the

exogeneity of education to the results from an unobserved factor model allowing for the endogeneity of schooling. Their empirical results provide key evidence showing the importance of female education as a means of reducing fertility would be overstated for Indonesia if one uses a naive empirical model which does not control for endogeneity due to the self-selection of a woman's educational status. Further, through simulation studies they find family planning programs had a much larger effect on reducing fertility than the improved school quality when controlling for the endogeneity of schooling and spousal selection.

The INPRES (Presidential Instruction) program, implemented between 1973 and 1978, was a combination of specific purpose and block grants used for construction of and improvements in education and health care facilities, reforestation, and other projects to benefit the Indonesian people. A major result was the construction of 61,000 primary schools, equaling 2 schools per 1000 children aged 5 to 14. Moreover, primary school enrollment rates increased by between .12 and .19 years per child, thus completed education levels rose.

Duflo (2001) examines the effect of Indonesia's INPRES program on educational attainment. (Overall macroeconomic effects of increased human capital were not examined, but would be expected to increase overall productivity and GDP per capita.) This research is relevant because the INPRES directly impacted the women in this study cohort. The younger the woman, the higher the magnitude of influence the INPRES program had on her educational attainment. Woman aged 5 in 1973 would reach 25 in 1993, the first year of the Indonesian Family Life Survey (IFLS), and were around 30 at the height of the financial crisis, conceivably still in

their prime reproductive years. Thus, women giving the most recent and thorough retrospective fertility histories are the same as those most impacted by both the BKKBN and the INPRES programs.

Krishnamurty (2000) examines patterns of fertility and consumption in Indonesia using data from the 1990 census. She designs an economic model where utility is a function of both consumption and number of children and obtains a relationship under a spatial risk-sharing model. She finds income does not affect the number of births per woman at risk of pregnancy at the Kabupaten level, suggesting evidence of fertility smoothing. This could mean births respond only to drastic changes in income such as floods or famines and not to small fluctuations in income. Second, income fluctuations could affect parent's investments in the quality of children rather than change the quantity. Third, it could mean the number of births is smoothed, either spatially by risk sharing or inter-temporally. Fourth, it is possible income is mis-measured and there is downward attenuation bias on income coefficients.

Becker (1960) theorizes the purchase of children is less likely to be postponed than the purchase of other durables during economic uncertainty or depression. The initial cost of children is a small fraction of total cost, as costs are naturally spread out over long periods, requiring less borrowing to enter into the purchase. The period required to construct a pregnancy added to the 9 month gestation period is sufficiently long to reduce the impact of temporary movements in income. If agents are truly forward looking they should ignore temporary shocks. Becker does put forth a counter argument as to why children may be postponed

during times of uncertainty. Children are not liquid assets. They represent a lifetime of expenditure, and times of economic uncertainty increase the desire to hold more liquid assets.

3.4 Financial Crisis

The Asian financial crisis began in Thailand in July 1997, and quickly spread to currencies, stock markets, and other asset prices of several Asian countries. Indonesia, South Korea and Thailand were most affected by the crisis, while Hong Kong, Malaysia, Laos and the Philippines were moderately affected. The key domestic factors leading to the crisis were: 1) the failure to dampen overheating pressures manifested in large external deficits, property, and stock market bubbles, 2) the maintenance of pegged exchange rate regimes for too long, and 3) lax financial oversight leading to a decline in the quality of banks' loan portfolios. Until 1996, Asia attracted almost half of total capital inflows to developing countries, totaling close to $100 billion per year. However, Thailand, Indonesia and South Korea had large private current account deficits due to the maintenance of pegged exchange rates. This encouraged external borrowing and led to excessive exposure to foreign exchange risk in both the financial and corporate sectors.

In June 1997, Indonesia had low inflation, a trade surplus of more than 900 million dollars, foreign exchange reserves in excess of 20 billion dollars, and a solid banking sector. However, a large number of Indonesian corporations borrowed in U.S. dollars. In July of 1997, Thailand changed currency policies and floated the baht. In response, Indonesia's monetary authorities widened the rupiah trading band

from 8 percent to 12 percent. The rupiah came under severe attack in August 1997 when the managed floating exchange regime was replaced by a free-floating exchange rate, and the rupiah dropped further. The IMF came forward with a rescue package of 23 billion dollars, but the selloff of rupiah continued amid fears over corporate debts and strong demand for dollars. The rupiah and Jakarta Stock Exchange fell to a historic low in September 1997. The crisis intensified in November when markets realized many corporations who borrowed dollars were facing higher repayment costs due to the rupiah's decline.

The rupiah’s inflation and the resulting steep hikes in the prices of food staples led to riots throughout the country. In February 1998, president Suharto relieved the governor of Bank Indonesia. This gesture and the IMF’s loan package proved insufficient to quell the crisis and the political fallout. Suharto was forced to resign in May of 1998 after 31 years as Indonesia’s president.

Before the crisis, the exchange rate between the rupiah and the dollar was roughly 2000 rupiah to 1 U.S. Dollar (USD). The rate plunged to over 10000 rupiah to 1 USD during the crisis. Indonesia’s GDP declined 13.5% in 1998, and real gross domestic fixed investment declined 35.5%.

At the individual level, households felt rapid and large swings in prices, resulting from exchange rate volatility. Most imported goods experienced sharp relative price increases. From January 1998 through March 1999, nominal food prices increased three-fold. Nonfood prices also increased, but relatively less. Since the typical Indonesian’s budget allocates 50% of resources to food (Strauss et al., 2004), this increase was substantial with magnified effects on the poor. This price

increase caused a decrease in real incomes for net food consumers. Rice consumption fell from 14% of budget expenditure in 1997 (20% for the poor) to 11.6% in 2000, due mostly to the relative price increase in rice as opposed to other goods (Strauss et al., 2004). Poverty increased sharply from late 1997 through March of 1999, and was correlated strongly with the food price index, indicating the importance of food expenditures to a household's budget constraint (Strauss et al., 2004). Nominal wages increased, but real wages decreased: data from the IFLS sample indicate real wages declined 22% from 1997 to 1998, and a further 1% by 1999 before increasing again in 2000.

3.5 Crisis Effects on Fertility

Frankenberg (2003) finds no difference in contraceptive prevalence or method choice before, during, or after the financial crisis. This indicates there were neither shortages of supplies nor changes in demand for contraceptives. From this data, Frankenberg concludes couple's fertility plans were well established and did not change significantly during the economic crisis. BKKBN was mostly successful in maintaining a continuous supply of condoms and pills in the marketplace throughout the crisis. There was, however, a shift in the choice of supplier, indicating health centers were impacted differently by the crisis (Lance and Farkouh, data on file). With the onset of the crisis, the price of contraceptives rose because contraceptives are typically imported or produced domestically with imported inputs. Contraceptive demand may not be highly sensitive to changes in price, since contraceptives are typically quite inexpensive, amounting to about 1% of monthly per capita household

expenditure for a typical Indonesian. As part of a more general social safety net program, poor households were issued cards providing access to free health and family planning services. These social safety net measures were funded by loans put in place during the 1998/99 fiscal year but were slow to get off the ground (Sumarto et al., 2001).

The Frankenberg study shows contraceptive supplies were little impacted by the financial crisis, but behaviors did change as some couples found it necessary to travel to different health care providers to obtain their chosen method of birth control, or even to change method if supply was unattainable. The Frankenberg study does not imply fertility is unaffected by the financial crisis.

As discussed above, studies show changes in income affect fertility in other settings. The remaining empirical question is how this particular financial crisis impacted couples' fertility decisions. The first mechanism is one where women observed unfavorable economic conditions as the crisis began, took the opportunity to exit the workforce to have a child, resulting in an increase in fertility. An alternate mechanism hypothesizes that couples choose to cancel or delay intended births during times of economic uncertainty. Since the financial crisis was largely unforeseen, there was no expectation of wage decreases leading up to the crisis. However, during the crisis couples may have decided to avoid the immediate and long term expenses associated with an additional child. Further, the financial crisis may change expectations of future economic shocks and wage increases, also having the effect of reducing fertility, assuming that children in Indonesia are normal goods, as found by Angeles, Guilkey, and Mroz (2005).

Ruhm (2005) presents a survey of how macroeconomic conditions effect other microeconomic decisions and outcomes, such as mortality, morbidity, and health care utilization. He finds, as others did before him, inconclusive results as to how outcomes change in the face of adverse economic conditions both in developed and developing countries. Brenner (1979) argues sources of economic instability increase overall mortality, infant deaths, and fatalities from cardiovascular disease, cirrhosis, suicide, and homicide, as well as morbidity, alcoholism, and admission to mental hospitals. Others (Gravelle, 1981; Stern, 1983; Wagstaff, 1985; Cook and Zarkin, 1986) disagree with Brenner's analysis and offer evidence disputing his findings. They claim economic downturns improve health and reduce mortality.

Regardless of past studies, the financial crisis is a unique event which informs us of how Indonesians react to sudden financial changes at the household, community, and national level. The remainder of this paper is devoted to generating and executing an empirical analysis to determine how Indonesians reacted to the Asian Financial crisis with regards to their fertility.

CHAPTER 4

THEORETICAL MODEL

This chapter presents a theoretical model motivating the empirical model in Chapter 5 and the empirical analysis in Chapter 7. Here I propose a model incorporating critical aspects of the fertility decision process, including the mother's education, timing of marriage, labor force participation, the quantity and quality of children, and time and budget allocations. The model follows women from the time women enter school, typically age seven, until the loss of fecundity through sterilization or menopause, thus capturing an entire fertility history.

Some critical assumptions of the model are:

- All pregnancies are planned, successfully gestate, and result in live births
- Women are the primary and only caregivers to their children
- No social safety nets or methods of savings between periods exist
- Unlimited demand in the labor market implies workers may enter and exit the labor force at will
- Women know their fecundity with perfect foresight
- All consumption is evenly distributed across all household members.

A time period is one year, enough time to conceive and birth a child. The timing of the decision process is as follows:

First, a woman who is in school at age seven decides whether or not to remain in school for an additional year. When in school, a woman is constrained to be unmarried and unemployed, and receives a transfer C^G from an exogenous outside source. The second decision a woman makes is when to marry, which occurs after the woman exits school. Leaving school and getting married are absorbing states: This model makes no attempt to model school re-enrollment, divorce, separation, or death of a spouse. The benefit of the marriage union is the additional income from the husband and the opportunity to bear children, at the cost of the husband's consumption.

Once married, the available supply of births is $S_B = T - A_M + 1$, where A_M is the age of marriage and T is the age of the woman in her final fertile period. The demand for children is given by a couple's target family size, denoted N^T. The target is a choice variable in the model, revisable each period in either direction, but obviously constrained in the downward direction to be greater than or equal to the current number of children, denoted N_t. From this point, the woman can begin to choose whether or not to conceive, indicated by the decision to have a child, $n_t = 1$, in period t.

The final decision a woman must make is how to allocate her time towards the labor market. More children in the household requires more resources, increasing the demand for income. However, the mother also devotes more time towards the children within the household, leaving less time available to devote to

the labor market. The child quality choice is endogenously determined by the mother's allocation of time, which determines total household income and ultimately per-capita consumption. The husband's labor force participation and wage are exogenously given.

Utility (U_{mt}) is an increasing function of the number of children (N_t), the quality of those children (Q_{kt}), the consumption of the woman (C_{mt}), and the leisure of the woman (T_{mt}^L).

(4.1) $$U_{mt} = U(N_t, Q_{kt}, C_{mt}, T_{mt}^L)$$

I assume parents derive positive marginal utility from additional children $\left(dU / dN_k > 0 \right)$ at a decreasing rate $\left(d^2U / (dN_k)^2 < 0 \right)$. The utility framework considers only the utility of the altruistic mother, where children are valued through the quality argument. The woman's husband's utility is exogenous to this model, however, per-capita consumption will enter both the woman's and husband's utility simultaneously, causing a positive relationship between the two functions.

A child's quality is a function of the education and the health of the child.

(4.2) $$Q_{kt} = Q(a_t, E_t, C_{kt}(I_t, N_t))$$

In the empirical model, data restrictions limit the modeling of specific child outcomes such as education, health, or consumption. Quality of children is instead represented as a function of the mother's per-child time commitment (a_t), the mother's education, (E_t), and per-capita consumption (C_{kt}). Per-capita consumption is a function of household income (I_t), and the household size (N_t + 2). Per-capita consumption correlates negatively with education through direct costs of schooling, such as

tuition, supplies, and transportation, and positively correlates with child health through nutrition, quality of clothing, and quality of residence. I restrict all children within a single household to be homogenous in everything except age.

The woman allocates time to the following three tasks: Leisure, labor force participation, and child rearing.

(4.3) $$T_{mt} = T_{mt}^{L} + T_{mt}^{W} + T_{mt}^{H}$$

where T_{mt} is the total time available to the mother in each period, T_{mt}^{L} is the time devoted to leisure, T_{mt}^{W} is the time devoted to the labor market, and T_{mt}^{H} is the time devoted to child rearing.

If there are no children in the household, then no time is required of the woman for child care. Once a child is born to a couple, the woman is required to devote some time to child rearing, denoted

(4.4) $$T_{mt}^{H} = R + N_t * a_t$$

where R is the parameter defining a baseline amount of household work required in the children's presence and a_t is a choice of how much time to devote per child. There is some minimum subsistence level of a_t, denoted $a^{\min}$, required of the woman to keep her children alive. Women must choose $a_t \geq a^{\min}$.

The household income equation is given by

(4.5) $$I_t = T_{mt}^{W} * W_{mt} + I_{ft} + \nu_t$$

where ν_t represents a shock to household income in period t with mean $\bar{\nu}_t$ and variance σ_ν. The wage of the woman is defined by

(4.6) $W_{mt} = W(E_t, X_{mt}, \nu_t)$

The woman's wage is a function of her education and other individual characteristics such as age, health, and experience in the labor force, all contained in the vector of individual characteristics, X_{mt}. Education and age are positively correlated with wages. This model naturally biases the father towards the labor market since the burden of childcare falls on the mother. However, the mother has the option to work as well, indicated by $T_{mt}^{W} > 0$.

Income from equation 4.5 is divided evenly across all household members and denoted C_t^{PC}. That is

(4.7) $C_t^{PC} = I_t / (N_t + 2) = \left(T_{mt}^{W} * W(E_t, X_{mt}) + I_{ft} + \nu_t\right) / (N_t + 2)$

The woman makes her fertility and labor market decisions after the realization of ν_t. The budget constraint of a student, unmarried, and married woman respectively are:

(4.8) $C_{mt} = C_G$ if e_t = 1 and M_t = 0.

(4.9) $C_{mt} = \left(T_{mt}^{W} * W(E_t, X_{mt}) + \nu_t\right)$ if e_t = 0 and M_t = 0

(4.10) $C_{mt} = \left(T_{mt}^{W} * W(E_t, X_{mt}) + I_{ft} + \nu_t\right) / (N_t + 2)$ if M_t = 1 and

$$C_{mt} = C_{ft} = C_{kt}, \ \forall \ k = 1, \ldots, N_t$$

The evolution of the education state variable for the woman is defined by

(4.11) $E_t = E_{t-1} + e_t$

where e_t is 0 if the woman is not in school in period t, or 1 if she is. Exiting school is an absorbing state, thus the decision to exit school effects the wage profile and quality of her children for all future periods.

Marriage (M_t), takes on values of 0 if unmarried and 1 if married. If M_t = 0, then I_{ft} = 0, and C_{ft} = 0. Once the woman exits school, she must begin working in the absence of a husband to provide income for her own consumption. In this state where M_t = 0 and e_t = 0 her only decisions each period are m_t and T_{mt}^W and her consumption is given by equation 4.9.

The woman seeks out a husband to provide income to the household and to father her children. Upon entering the married state, the couple has the option to add one child to the household per period. The number of children in the household is represented by

(4.12) $N_t = N_{t-1} + n_t$ where n_t = {1 if birth at t, 0 if no birth}

n_t must equal zero if the woman is unmarried (M_t = 0 and m_t = 0), however, the woman may have a child in the first period she is married.

At the beginning of each period, a woman realizes the economic environment by observing ν_t. The mean of ν_t is negative during the crisis years. She then chooses whether or not to leave school conditional on being in school last period, when to get married conditional on not being married last period, and if she is married she will choose whether or not to conceive a child. Once these decisions are made, the woman must decide how to allocate her time across leisure, labor, and child care. Finally, the couple has the opportunity to reevaluate their target fertility.

The state at time t is represented by the vector S_t:

(4.13) $S_t = \{E_t, e_{t-1}, M_t, m_{t-1}, N_t, N^T, \nu_{t-1}, X_{mt}\}$

where X_{mt} also contains a complete history of all past employment decisions.

Evaluation of the optimization problem requires a terminal utility function to close the system at the end of the couple's fecundity. I define this terminal utility to reflect a one-time modification to the total lifetime utility based on achieving, underachieving, or exceeding a couple's target fertility. This value is normalized to zero if the couple hits it's target, and is negative if the couple misses the target. If the couple does not behave according to the target fertility hypothesis, this component is zero. The disutility is represented by:

(4.14) $D\left(N^T - N_T\right)$ where $D(0) = 0$ and $D(\neq 0) < 0$.

The discounted present value of lifetime utility conditional on all past decisions in period t where 7 ≤ t ≤ T is given by:

(4.15) $$V_t(S_t) = \max_{e_t, m_t, n_t, T_{mt}^W, a_t, N^T} \left\{ U_{mt}(*, \nu_t) + \beta * E_t * V_{t+1}(S_{t+1}) \right\}$$

where E_t is the expectation of future wage disturbances (ν_s), for s > t, and * represents all previously stated arguments in the utility function. The present value of lifetime utility in the final fertile period T is given as

(4.16) $$V_T(S_T) = \max_{e_T, m_T, n_T, T_{mT}^W, a_T, N^T} \left\{ U_{mT}(*, \nu_T) + \beta * D\left(N^T - N_T\right) \right\}$$

Notice the number of children enters the utility function in several different places. While additional children provide positive utility to their mother through the normal biological family concept of caring and nurturing, they negatively impact the mother's leisure time, the mother's ability to work (negatively impacting the mother's future wage potential by decreasing her current workforce experience), household income, per-capita consumption, and sibling quality.

The model contains many defining factors responsible for driving down fertility in much of the developed world. Higher educated women may have higher marginal production in the labor force than in household tasks including child rearing. Households where the woman participates in the labor force have fewer children and more resources as a result of these efforts. The second income from the laboring woman has increased household resources resulting in increased per-capita consumption, both through declining household size and higher household income.

The impact of the financial crisis may exhibit two conflicting effects. First, a reduction in household income may cause a reduction in fertility during the crisis by decreasing household resources. This mechanism is a standard income effect, assuming children are normal goods. This reduction in fertility may be a short term reduction, resulting in latent demand for children, which may either (1) be postponed until a later period when economic conditions improve, or (2) cause a structural decrease in desired future fertility by changing expectations concerning the future wages draws or offsetting the previously planned timing of children.

The second effect exhibits an increase in fertility when real wages diminish as a result of the crisis. Fertility may increase if women choose to exit the labor force when the opportunity cost of doing so is low relative to periods of better economic conditions. The opportunity cost of lost wages is one critical factor in the fertility decision, and the marginal product of raising children may be greater than the marginal product of labor when real wages are temporarily depressed. Since women are forward looking, they should anticipate the financial shock to be temporary.

I leave the question to be answered empirically. The next chapter develops the empirical model, motivated by this theoretical discussion, and uses it to test which responses are observed in Indonesian women during the financial crisis.

CHAPTER 5

EMPIRICAL MODEL

5.1 Overview

In this chapter, I derive an empirical model to be combined with Indonesian Family Life Survey (IFLS) data to determine the impact of economic shocks on fertility. Specifically I examine how changes in consumption impact the probability of conceiving a child from 1996 through 1999, the time period immediately surrounding the Asian Financial Crisis. Other studies (Strauss, 2002, Frankenberg, Thomas, and Beegle, 1999) have shown most households within Indonesia experienced massive inflation, and those in urban centers felt a greater impact than those in rural areas. The financial crisis left some households worse off, some better off, and others were not impacted. I exploit this variance in the crisis effects to determine impacts on the demand for children during times of economic hardship.

The IFLS only contains longitudinal economic data in the years immediately surrounding the financial crisis, therefore, instead of a single hazard model predicting the probability of conception throughout a woman's entire fecundity, I divide her reproductive years into two distinct periods, encapsulated in two separate equations. The first equation captures all live births from 1995 retrospective to age seven with no economic variables included. The second equation, the equation of

interest, captures all conceptions between 1996 through 1999 while including the full set of economic variables. The IFLS includes data for the year 2000, but it must be omitted from the analysis since births and pregnancies reported in 2000 most likely resulted from conceptions in 1999. This results in an extremely low count of such events occurring in 2000 (current early pregnancies only) relative to the other years in the analysis.

In addition to the conception and birth equations, 5 additional equations are simultaneously estimated to control for endogeneity, sample selection, and initial conditions. These are discussed in detail below. The remainder of this chapter discusses the empirical model, with emphasis placed on the specification of each equation motivated by the theoretical model presented in the previous chapter. I conclude the chapter with a discussion of the discrete factor method and estimation procedure.

5.2 Unobserved Heterogeneity, Endogeneity, Sample Selection, and Initial Conditions

Individual data observations possess time invariant unobserved heterogeneity at the individual and community level which impacts one or more of the seven equations in the model. Individual heterogeneity comes from such sources as individual fecundity, family history, preferences for family oriented tasks versus labor market oriented tasks, preferences towards the timing and spacing of births, and any other unobserved characteristics effecting when and how many children a women will conceive. Community level time invariant influences come from sources such as

an influential religious leader, peer effects and group preferences for family size, societal norms concerning child quality, and expectations for schooling and career choice.

This community and individual level unobserved heterogeneity could cause biased coefficient estimates in a maximum likelihood estimation of the conception equation. Theoretically and probabilistically, the same unobserved factors which affect a woman's choices regarding fertility in the time period from 1996 to 1999 affect her decisions regarding education, marriage, and labor force participation throughout her entire life. The inclusion of the six additional equations controls for the potential bias caused by unobserved heterogeneity, sample selection, and measurement error. Table 5.1 displays all seven equations contained within the empirical model. The specification of each equation is discussed in detail in section 5.3 and the purpose of each equation's inclusion in the model is presented here.

Table 5.1: List of Equations

#	Abbreviation	Name of Equation	Purpose
1	F	Conception	Predict the probability of conception
2	E	Women's Education	Control for Endogeneity
3	M	Age of First Marriage	Control for Sample Selection
4	B	Previous Births	Control for Initial Condition
5	W	Woman's Labor Force Participation	Control for Endogeneity
6	I	Household Income	Control for Endogeneity
7	C	Household Consumption	Control for Endogeneity

The conception equation, also referred to as the "Main Equation", contains those economic variables which identify the effect the financial crisis had on women's fertility. The remaining six equations reflect other choices the woman makes before or during her fertile years which relate to the fertility decision. These

choices are endogenous within the model for many reasons, discussed in the following sections. Each equation other than the main equation contains a vector Z_{it}^{J} of exogenous, time varying exclusion restrictions. These are supportive in obtaining additional identification of the complete model (Bhargava, 1991), even though the non-linear model is in itself identified without exclusion restrictions (Mroz, 1999).

Women's education is endogenous because fertility intentions affect the demand for education. A woman who desires a large family most likely avoids the opportunity costs of additional education (time and resources) knowing her time will be better utilized within the household to raise the children instead of capitalizing on her education in the workplace.

The marriage equation controls for the sample selection of the IFLS survey. Only women whom have ever been married at some point in their lives are presented with the conception, marital, and breastfeeding related questions contained within "Book 4"[1]. The dependent conception and birth variables are derived from this survey module.

It is necessary to model the number of live children a woman has prior to 1996 since the theoretical model predicts the decision to have a child depends on the number of pre-existing children. The previous births equation corrects for selectivity into the period of interest (covered by the main equation). Approximately half of the women in the sample report a specific target fertility level, implying some ideal number of children in the household, thus existing children impact the probability of additional births. By modeling all births in a woman's life, the initial

[1] The IFLS and Book 4 are discussed in detail in chapter six

condition of the number of children present in the household is accounted for in the main equation.

A women's participation in the labor force increases her financial independence and delays the age of first marriage, thus the woman's decision to work must be modeled endogenously. The woman's participation in the labor force impacts her decisions to marry and have children, the amount of income she brings in to the household, and the time she is able to devote to child care and household tasks.

Income is endogenous because household income is impacted by the woman's decision to work, which is determined by the number of children at home, if she is planning to have any additional children, and her husband's income. Per-capita consumption is endogenous in this model because it is a function of the income brought in by both the husband and the wife and the number of children in the household, implying the decision for the wife to pursue education and work are all impacted by the same unobserved heterogeneity which impact the amount and timing of children.

5.3 Empirical Equation Details

In this section, I discuss the categories of regressors in each equation. A complete list of variables in each equation may be ascertained from the complete results table available in Appendix A. Let X represent a vector of exogenous characteristics for the woman and her husband including age of the woman, age of her husband, religion of the woman and husband, literacy of the woman and

husband, the education of the husband, an urban indicator, province indicators, and urban-province interactions. Religions included in the analysis are: Islam, Protestant, Catholic, Hindu, and Buddhist. Islam is the omitted category, as Indonesia is predominantly Muslim (90%). Religion indicator variables are included to control for any religiously motivated preferences for family size and family planning methodology, and any other unobserved preferences consistent within a religious group.

Previous studies by Angeles, Guilkey, and Mroz (2005) found within a very similar sample (IFLS1), controlling for the endogeneity of the husband's education had very little impact on coefficient estimates, thus the husband's education is treated as exogenous. An individual enters school at the age indicated or at age seven if not indicated. Schooling is assumed to be continuous and exiting school is an absorbing state. No attempt to model repeated grades is made. The set of education variables contains whether the individual is currently attending school, attended school last year, and indicator variables for specific attainment levels: Attended primary school but did not graduate, graduated from primary school, graduated from junior high school, graduated from senior high school, and graduated from university. The omitted category contains those who never attended school.

Each IFLS household is located in one of thirteen provinces in either an urban or rural setting. These location factors are controlled by a complete set of province

dummies interacted with an urban and rural indicator.[2] These community specific characteristics are intended to control for region specific effects such as: Underlying structural beliefs about family size and family dynamics, socially accepted roles of women, the available employment opportunities within different provinces, and most importantly, the effects of government placement of education and family planning programs.

5.3.1 Main Equation: Conception

The probability of woman i conceiving a child in year t for t = 1996 through 1999 is modeled as a multiple spell hazard model:

$$\text{(5.1)} \qquad \Pr\left(n_{it}^{F} = 1 \mid X_{it}, Q_{it}^{F}, E_{it}^{F}, \varepsilon_{it}^{F}\right) = \Pr\left(n_{it}^{F} = 1 \mid F_{it}\right) = \frac{e^{F_{it}\mathrm{B}^{F}}}{1 + e^{F_{it}\mathrm{B}^{F}}}$$

The dependent variable, n_{it}^{F}, equals one if woman i conceived a child in year t. Planned pregnancies were decided a minimum of nine months prior to the birth of the child. If the month and year of the birth is known, nine months were subtracted and the year of conception is known. If the month of birth was not reported, then the month of birth is drawn from a uniform distribution and the year of conception is interpolated. Due to the short duration of the time period encompassed by this equation, the decision to have a child is the critical decision in the model, therefore the outcome of the pregnancy is not relevant.

[2] All interviews conducted in the Jakarta Province took place in an urban setting, therefore no rural counterpart for that term exists.

The vector E_{it}^{F} contains endogenous and exogenous household and community level economic variables. This includes community level subjective wellbeing, household expectations, community level income changes from the financial crisis, the husband's employment status, household income, log per-capita consumption, and the incidence of any hardships such as death, job loss, or sickness. The endogenous economic variables are controlled by the income, consumption, and labor force participation equations.

Expected subjective wellbeing is included to indicate the overall economic morale of a household. Individuals are asked whether or not they expect themselves to be better off, worse off, or the same a year from the time of their interview. Community subjective wellbeing obtained from community leaders through interviews concerning the effects of the financial crisis on their village's inhabitants gives an exogenous perspective of the financial crisis effects at the local level.

The set of employment status variables for the husband includes indicator variables for whether the husband is an unemployed family worker, self employed, government employee, or working for a corporation. The omitted category is unemployment. This data is only available in the same periods as the income data, thus is restricted to appear only in the main, income, consumption, and woman's employment equations.

The vector Q_{it}^{F} contains endogenous sets of variables: Education attainment (whether or not the woman is currently attending school, if the woman attended school in the previous period, indicators for her educational attainment), marital

status (whether or not the woman is currently married, if the woman has ever been married), previous births (a set of dummy variables indicating discrete numbers of children present in her household), labor force participation (whether or not a woman works for a wage, or is an unpaid family worker), total household income, and per-capita consumption. In addition, this vector contains variables indicating the presence of family planning facilities when the woman was age seven and the presence of family planning facilities at the year of the observation.

Each of these endogenous variables contained in Q_{it}^{F} has a separate equation to control for the bias the endogeneity causes in the coefficient estimates. The construction of each endogenous variable is discussed in the context of the relevant equation below.

5.3.2 Woman's Education

According to the theoretical model the first choice a woman makes is the amount of schooling to obtain, represented here by the decision to exit school. The probability a woman exits school in year t is given by the following logistic regression:

$$\text{(5.2)} \qquad \Pr\left(e_{it} = 0 \mid e_{it-1} = 1, X_{it}^{W}, Z_{it}^{E}, \varepsilon_{it}^{E}\right) = \Pr\left(e_{it} = 0 \mid E_{it}\right) = \frac{e^{E_{it}\mathrm{B}^{E}}}{1 + e^{E_{it}\mathrm{B}^{E}}}$$

where e_{it} = 0 if the woman remains in school, and e_{it} = 1 in the period during which she terminates her education attainment. The probability of remaining in school is then $1 - \Pr\left(e_{it} = 0 \mid E_{it}\right)$. The duration of schooling defines the total level of attainment.

Some women never enter school, denoted by the decision to exit school in the first period.

Let X_{it}^{W} represent the characteristics of the woman in the absence of her husband and Z_{it}^{E} represent a vector of identifying instrumental variables. The equation includes woman year observations from the year a woman enters school (or the year she is age seven if no response was provided) until she exits school. In 1999 some younger women still remain in the school. No endogenous variables appear in this equation because the reduced form specification of the theoretical model states no previous choices affect the decision to exit school.

This equation requires an instrumental variable which is correlated with being in school, but is uncorrelated with the decision to conceive a child. Z_{it}^{E} contains the four average student-teacher and student-school ratios in the primary and secondary schools in the woman's community. These values are collected during survey years, and linearly trended during off-survey years. Z_{it}^{E} also contains an indicator for the availability of a school in the woman's community, indicated if a woman had an appropriate school type open and available to her in the appropriate year.

5.3.3 Age of First Marriage

The woman also decides when to marry. This equation controls for the "ever married" and "currently married" variables. The probability of getting married for the first time is given by

$$(5.3) \qquad \Pr\left(m_{it}=1 \mid m_{it-1}=0, X_{it}^{W}, Q_{it}^{M}, Z_{it}^{M}, \varepsilon_{it}^{M}\right)=\Pr\left(m_{it}=1 \mid M_{it}\right)=\frac{e^{M_{it}\mathrm{B}^{M}}}{1+e^{M_{it}\mathrm{B}^{M}}}$$

where m_{it} = 0 if never married, and m_{it} = 1 if ever married. Though some women will marry before finishing school, on average, there is a three year lag between finishing school and getting married. Theory predicts the woman's education level has an effect on timing the decision to get married for the first time, and so the endogenous variables contained in Q_{it}^{M} include the complete set of education variables for the woman. Women enter this sample at age seven, making the assumption that the probability of marriage younger than age seven is zero. The sample for this equation includes an additional sample of never-married women in the IFLS between the ages of 14 and 38 in 1999 to more accurately predict the transition into the married state.

Z_{it}^{M} is a vector of time varying, exogenous education and health care facility instrumental variables. Within Z_{it}^{M} is the same "Availability of schools" variable from the schooling equation, the presence of family planning facilities when the woman was age seven, and the presence of family planning facilities in the year of the observation. Other exclusion restrictions included in this equation are the fertility of the mother, indicated between the timing of menarche and menopause, and an indicator for if the married couple moved outside the community, a proxy for whether or not they live near parents implying access to childcare.

5.3.4 Previous Births

To account for the existing children in the household at the beginning of each period, I model all previous births using a multiple spell hazard model where the dependent variable (n_{it}^{B} = 1) indicates a live birth. The specification of the equation is almost identical to the main equation, with the exclusion of the vector of economic variables, and the inclusion of time varying exogenous instrumental variables contained in Z_{it}^{B} :

$$\text{(5.4)} \qquad \Pr\left(n_{it}^{B} = 1 \mid X_{it}, Q_{it}^{B}, Z_{it}^{B}, \varepsilon_{it}^{B}\right) = \Pr\left(n_{it}^{B} = 1 \mid B_{it}\right) = \frac{e^{B_{it}\mathrm{B}^{B}}}{1 + e^{B_{it}\mathrm{B}^{B}}}$$

where t ranges from 1968 to 1995. Miscarriages and stillbirths must not be counted as births contributing to family size. Most of these adverse events have occurred far enough in the past that any residual emotional or physical effects have diminished to negligible amounts by 1996.

Exogenous time varying instrumental variables further identify this equation. From the work of Jeff Rous (2001), two instruments for this initial condition are contained in the vector Z_{it}^{B} . They are fertility of the mother, indicated between the timing of menarche and menopause, and whether or not the married couple moved outside the community, indicating whether or not they live near parents and have access to childcare.

The vector Q_{it}^{B} contains the endogenous variables for the woman's education, if she is currently married, the duration of the current marriage, and the set of dummy variables indicating discrete amounts of children present in the household.

These indicators for children present give probabilities of having additional children given how many children are already present. In addition, this vector contains variables indicating the presence of family planning facilities when the woman was age seven and the presence of family planning facilities at the year of the observation. Whether the woman is ever married is omitted from this analysis as it is collinear with currently married over the earlier time periods.

5.3.5 Female Labor Force Participation

The probability a woman works for a wage in period t is given by

$$\Pr\left(w_{it}=1 \mid X_{it}, Q_{it}^{W}, Z_{it}^{W}, E_{it}^{W}, \varepsilon_{it}^{W}\right)=\Pr\left(w_{it}=1 \mid W_{it}\right)=\frac{e^{W_{it}\mathrm{B}^{W}}}{1+e^{W_{it}\mathrm{B}^{W}}} \tag{5.5}$$

where $w_{it}=1$ if $T_{it}^{w} \succ 0$ and $w_{it}=0$ if $T_{it}^{w}=0$ for t = 1996 through 1999. Women who report they are working in any environment where they earn a wage are considered to be working for a wage, even if that wage is negative, as is the case for some self employed workers. Q_{it}^{W} is the vector of endogenous variables in the work equation, including household income, her full set of education indicators, if she has ever been married, if she is currently married, and the set of variables indicating the number of children in her household. E_{it}^{W} contains the labor force status of the husband, as this status could affect the woman's probability of working.

Time varying, exogenous instruments contained in Z_{it}^{W} contain indicators for the presence of agricultural jobs in the community, the presence of industrial jobs in the community, the main sources of employment in the community including farming,

manufacturing, construction, tourism, social services, and other, if the community is considered to be underdeveloped, and the average community wages for women and men in both agricultural and industrial jobs if those job types are present.

5.3.6 Household Income

Household income is a proxy variable for the socioeconomic status of a household. Four observations per household are calculated as the sum of historical income data for the husband and wife in each year, divided by 10xE6, and adjusted to 1997 prices using published CPI deflators. Income is modeled as

$$(5.6) \qquad i_{it} = \left(\mathrm{B}_0^I + X_{it}\mathrm{B}_1^I + Q_{it}^I\mathrm{B}_2^I + Z_{it}^I\mathrm{B}_3^I + E_{it}^I\mathrm{B}_4^I + \varepsilon_{it}^I\right)$$

where t = 1996, 1997, 1998, and 1999. Income from laboring children is ignored in this analysis. E_{it}^I is the vector of employment indicators of the husband and Q_{it}^I contains the endogenous variables: Whether or not the woman works for a wage, her full set of education indicators, if she has ever been married, if she is currently married, and the set of variables indicating the number of children she has previously birthed.

Time varying, exogenous instruments contained in $Z_{it}^I = Z_{it}^W$ will act as exclusion restrictions to further identify the model.

5.3.7 Per-Capita Consumption

Per-capita consumption is measured in 1997 and 2000, and the 2000 value is assigned to the year 1999. The consumption equation is

$$(5.7) \qquad \ln\left(\frac{hhc_{it}}{N_{97}+2}\right) = c_{it} = \left(\mathrm{B}_0^C + X_{it}\mathrm{B}_1^C + Q_{it}^C\mathrm{B}_2^C + Z_{it}^C\mathrm{B}_3^C + E_{it}^C\mathrm{B}_4^C + \varepsilon_{it}^C\right)$$

where the natural log of per-capita consumption is the dependent variable, t = 1997 and 1999, and $Z_{it}^C = Z_{it}^I$. Producer prices are correlated directly with the final sale price of consumption goods, but are not be correlated with women's fertility heterogeneity. In the main equation, I make the assumption that a change in permanent income occurred as a result of the financial crisis, and assign consumption values from 1997 to the years 1996, 1997, and 1998, and assign 2000 consumption data to 1999.

5.4 Summary of the Empirical Model

Figure 5.1 displays a timeline of decisions each women faces throughout her lifetime. I have represented three different women. If a box is indicated by "-" there is no corresponding woman-year observation within the empirical model for the indicated equation. Notice the conception, birth, and work equations are multiple spell hazards, while the schooling and marriage equations represent decisions into absorbing states. The income and consumption equations contain continuous dependent variables, represented by a real number, "#". Also indicated by the figure is the relationship between the birth and conception equation. The main differences between the two are the inclusion of economic variables in the latter, and the time periods each equation covers.

Woman A is representative of the average woman defined by the mean summary statistics presented in Chapter 6. This woman enters school at age seven,

exits school after junior high school at age 16, marries at 19, and has two {or three] children. One-third of her cohort work, so I represented her not working until 1999, when her third child is 1 year old.[3]

Woman B is at the younger end of the age distribution within the sample. She chooses to complete senior high school, thus exiting school when she is 19. She is never married during the period over which I observe her, and only enters in the marriage hazard equation.

Woman C is representative of the older cohort of Indonesian women. She enters the school system at age seven, continues school until she decides to get married, indicated in Figure 5.1 by exiting school and getting married in the same year. She also clearly has a desire for a large family. By the time the crisis hit, she already had given birth to 5 children, and had completed her target fertility.

[3] A conception in 1997 would most likely result in a birth in 1998, correspondingly a one year old child in 1999

Figure 5.1: Representation of a Dynamic Choice Set for Three Indonesian Women

Has a Conception	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	**Y**	N	N
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N	N
Has a Birth	N	N	N	N	N	N	N	N	N	N	N	N	N	N	**Y**	N	N	**Y**	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	N	**Y**	N	N	**Y**	N	N	N	**Y**	N	N	**Y**	N	N	**Y**	N	N	-	-	-	-
Exited school	N	N	N	N	N	N	N	N	N	N	Y	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ever Married	N	N	N	N	N	N	N	N	N	N	N	N	Y	-	-	-	-	-	-	-	-	-
	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	N	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Working	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N	Y
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N	N
Household Income	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	#	#	#	#
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	#	#	#	#
Per Capita Consumption	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	#	#	#	#
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	#	#	#	#
Age of Woman A	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Age of Woman B									7	8	9	10	11	12	13	14	15	16	17	18	19	20
Age of Woman C	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999

Key: N: Event has not yet occurred, Y: Event occurs in this period -: No woman-year observation for this combination
: Income and Consumption are continuous dependent variables, represented by a real number

5.5 The Likelihood Function

The theoretical model implies couples make fertility decisions in response to current and previous decisions regarding schooling, marriage, consumption, income, labor force participation, and the presence of other children. Changes in the current or expected income stream, among many other external influences, may affect the demand for additional children. The woman's desire to work is negatively affected by her household responsibilities, and positively impacted by the increased demand for household resources. Prior decisions regarding schooling will have an impact on all future decisions and future opportunities. Estimating fertility during the financial crisis without considering the endogeneity of these critical factors would result in biased estimates. For this reason, all seven equations are jointly estimated using full information maximum likelihood (FIML) estimation procedures.

The joint distribution of the non-linear heterogeneity is estimated using a semi-parametric discrete factor method (DFM) (Heckman and Singer, 1984; Mroz and Guilkey, 1995; Mroz, 1999). DFM allows for a flexible specification of the unobserved heterogeneity without imposing restrictions such as joint normality (Mroz, 1999). In this application of DFM, I allow for time invariant non-linear unobserved heterogeneity at the individual and community level. Parameters for each equation are identified through the inherent non-linearity of the model (Mroz, 1999), and further identification is achieved through the exclusion restrictions contained in the vectors Z_{it}^{J} for J = {E,M,B,W,I,C}. The error structure for the seven equations (J = {F,E,M,B,W,I,C}) is assumed to be the following mixed term error structure:

F:	$\varepsilon_{it}^{F} = \rho_{kc}^{F}\mu_{kc} + \rho_{ki}^{F}\mu_{ki} + \nu_{it}^{F}$	where	$\mu_{j}^{F} = \rho_{kc}^{F}\mu_{kc}$	and	$\omega_{i}^{F} = \rho_{ki}^{F}\mu_{ki}$
E:	$\varepsilon_{it}^{E} = \rho_{kc}^{E}\mu_{kc} + \rho_{ki}^{E}\mu_{ki} + \nu_{it}^{E}$	where	$\mu_{j}^{E} = \rho_{kc}^{E}\mu_{kc}$	and	$\omega_{i}^{E} = \rho_{ki}^{E}\mu_{ki}$
M:	$\varepsilon_{it}^{M} = \rho_{kc}^{M}\mu_{kc} + \rho_{ki}^{M}\mu_{ki} + \nu_{it}^{M}$	where	$\mu_{j}^{M} = \rho_{kc}^{M}\mu_{kc}$	and	$\omega_{i}^{M} = \rho_{ki}^{M}\mu_{ki}$
B:	$\varepsilon_{it}^{B} = \rho_{kc}^{B}\mu_{kc} + \rho_{ki}^{B}\mu_{ki} + \nu_{it}^{B}$	where	$\mu_{j}^{B} = \rho_{kc}^{B}\mu_{kc}$	and	$\omega_{i}^{B} = \rho_{ki}^{B}\mu_{ki}$
W:	$\varepsilon_{it}^{W} = \rho_{kc}^{W}\mu_{kc} + \rho_{ki}^{W}\mu_{ki} + \nu_{it}^{W}$	where	$\mu_{j}^{W} = \rho_{kc}^{W}\mu_{kc}$	and	$\omega_{i}^{W} = \rho_{ki}^{W}\mu_{ki}$
I:	$\varepsilon_{it}^{I} = \rho_{kc}^{I}\mu_{kc} + \rho_{ki}^{I}\mu_{ki} + \nu_{it}^{I}$	where	$\mu_{j}^{I} = \rho_{kc}^{I}\mu_{kc}$	and	$\omega_{i}^{I} = \rho_{ki}^{I}\mu_{ki}$
C:	$\varepsilon_{it}^{C} = \rho_{kc}^{C}\mu_{kc} + \rho_{ki}^{C}\mu_{ki} + \nu_{it}^{C}$	where	$\mu_{j}^{C} = \rho_{kc}^{C}\mu_{kc}$	and	$\omega_{i}^{C} = \rho_{ki}^{C}\mu_{ki}$

The ρ_{h}^{J}, where $h = \{ki, kc\}$ for individual or community and J refers to the equation, are parameters to be estimated which explain the level of correlation between the outcome of each equation and the distribution of community, μ_{kc}, and individual, μ_{ki}, level unobservable factors. Both ω_{ki}^{J} and μ_{kc}^{J} are assumed to be time invariant for this analysis $\forall J$, although this assumption may not be true. In addition, there is a time variant disturbance added to each equation represented by ν_{it}^{j}. I assume the ν_{it}^{j} are distributed logistically for j = {F,E,M,B,W}, and ν_{it}^{J} are distributed normally for J ={ I,C}. All ν_{it}^{J} are independent.

The distribution of the individual random effects with K_I points of support is specified as:

(5.8) $$\Pr\left(\omega_{i}^{F} = \omega_{1q}, \omega_{i}^{E} = \omega_{2q}, \omega_{i}^{M} = \omega_{3q}, \omega_{i}^{B} = \omega_{4q}, \omega_{i}^{W} = \omega_{5q}, \omega_{i}^{I} = \omega_{6q}, \omega_{i}^{C} = \omega_{7q}\right) = \pi_{I}(q)$$

for q = 1…K_I.

The distribution of the community random effects with K_C points of support is specified as:

(5.9) $$\Pr\left(\mu_j^F = \mu_{1r}, \mu_j^E = \mu_{2r}, \mu_j^M = \mu_{3r}, \mu_j^B = \mu_{4r}, \mu_j^W = \mu_{5r}, \mu_j^I = \mu_{6r}, \mu_j^C = \mu_{7r}\right) = \pi_C(r)$$

for r = 1…K_C.

To obtain unbiased parameter estimates using FIML, I maximize the following unconditional likelihood function (A complete specification of the likelihood function is presented in Appendix B):

(5.10) $$L = \prod_{c=1}^{C}\left(\sum_{kc=1}^{Kc}\left(PW_{kc}\prod_{i=1}^{I}\left(\sum_{ki=1}^{Ki}PW_{ki}\left(\prod_{t=1}^{T}(S_{it})(M_{it})\prod_{t=1}^{t=28}(B_{it})\prod_{t=29}^{T}(F_{it})(W_{it})(C_{it})(I_{it})\right)\right)\right)\right)$$

where $S_{it} = \Pr\left(e_{it} = 0 \mid e_{it-1} = 1, X_{it}^W, Z_{it}^E, \omega_i^E, \mu_j^E\right)^{e_{it}}$

$$* \left(1 - \Pr\left(e_{it} = 0 \mid e_{it-1} = 1, X_{it}^W, Z_{it}^E, \omega_i^E, \mu_j^E\right)\right)^{1-e_{it}}$$

$$M_{it} = \Pr\left(m_{it} = 1 \mid m_{it-1} = 0, X_{it}^W, Q_{it}^M, Z_{it}^M, \omega_i^M, \mu_j^M\right)^{m_{it}}$$

$$* \left(1 - \Pr\left(m_{it} = 1 \mid m_{it-1} = 0, X_{it}^W, Q_{it}^M, Z_{it}^M, \omega_i^M, \mu_j^M\right)\right)^{1-m_{it}}$$

$$B_{it} = \Pr\left(n_{it}^B = 1 \mid X_{it}, Q_{it}^B, Z_{it}^B, \omega_i^B, \mu_j^B\right)^{n_{it}^B}$$

$$* \left(1 - \Pr\left(n_{it}^B = 1 \mid X_{it}, Q_{it}^B, Z_{it}^B, \omega_i^B, \mu_j^B\right)\right)^{1-n_{it}^B}$$

$$F_{it} = \Pr\left(n_{it}^F = 1 \mid X_{it}, Q_{it}^F, Z_{it}^F, \omega_i^F, \mu_j^F\right)^{n_{it}^F}$$

$$* \left(1 - \Pr\left(n_{it}^F = 1 \mid X_{it}, Q_{it}^F, Z_{it}^F, \omega_i^F, \mu_j^F\right)\right)^{1-n_{it}^F}$$

$$W_{it} = \Pr\left(w_{it} = 1 \mid X_{it}, Q_{it}^W, Z_{it}^W, E_{it}^W, \omega_i^W, \mu_j^W\right)^{w_{it}}$$

$$* \left(1 - \Pr\left(w_{it} = 1 \mid X_{it}, Q_{it}^W, Z_{it}^W, E_{it}^W, \omega_i^W, \mu_j^W\right)\right)^{1-w_{it}}$$

where $w_{it} = 1$ if $T_{it}^w \succ 0$ and $w_{it} = 0$ if $T_{it}^w = 0$

$$C_{it} = \frac{1}{\sigma_C}\Phi\left(c_{it} - \mathrm{B}_0^C - X_{it}\mathrm{B}_1^C - Q_{it}^C\mathrm{B}_2^C - Z_{it}^C\mathrm{B}_3^C - E_{it}^C\mathrm{B}_4^C - \omega_i^C - \mu_j^C - \nu_{it}^C\right)$$

$$I_{it} = \frac{1}{\sigma_I}\Phi\left(i_{it} - \mathrm{B}_0^I - X_{it}\mathrm{B}_1^I - Q_{it}^I\mathrm{B} - Z_{it}^I\mathrm{B}_3^I - E_{it}^I\mathrm{B}_4^I - \omega_i^I - \mu_j^I - \nu_{it}^I\right)$$

K_C	Number of Community level mass points	(7)
PW_{kc}	Probability weight of mass point kc	
K_I	Number of Individual level mass points	(16)
PW_{ki}	Probability weight of mass point ki	
C	Number of communities	(312)
I	Number of individuals	(6821)
T	Number of time periods	(32)
Φ	Standard normal probability density function	
$\frac{1}{\sigma_J}$	Standard deviation of equation J, where J = {C,I}	

Results from this estimation are presented in Chapter 7.

The identification of the parameters from the discrete factor method, which include probability weights (PW_k for $k = \{ki, kc\}$), and factor loads (ω_{ki}^J and μ_{kc}^J) is achieved because we observe each individual within each community making the same decisions across multiple time periods. The choice of non-linear heterogeneity allows the product $\rho^J * \mu_k^J$ to be estimated, but estimation of the individual components is not possible. The discrete factor parameters result in an additional eight parameters for each community and individual mass point added to the model after the first mass point (1 mass point indicates no heterogeneity controls within the model), thus the final specification of seven community and sixteen individual mass points adds 168 additional parameters to be identified within the model.

CHAPTER 6

DATA

6.1 IFLS

Data for this analysis comes from the Indonesian Family Life Survey, or IFLS. The IFLS is designed as a longitudinal, population representative sampling of Indonesian households and communities. The first Indonesian Family Life Survey (IFLS1) was conducted in 1993 and interviewed 22 thousand individuals in 7,224 households across 13 of Indonesia's 27 provinces. The second wave (IFLS2) was conducted in 1997 and relocated and re-interviewed at least one household member from a remarkable 94% of households interviewed in IFLS1. In 1998, a special wave, IFLS2+, interviewed 25% of IFLS2 respondents in order to capture immediate impacts of the then ongoing economic crisis[4]. The third wave (IFLS3) was conducted in 2000. IFLS3 covered all 321 enumeration areas (communities) and relocated and re-interviewed at least one household member from 96% of households interviewed in IFLS2. 91% of original IFLS1 households have complete panel responses.

IFLS2 was concluded one month prior to the onset of the Asian Financial Crisis. Because of this unintended "luck", IFLS2 and IFLS3 data offer a unique opportunity to researchers to determine individual, household, and community

[4] IFLS2+ has never been released to the public.

responses to economic changes because this dataset possesses a before and after picture of so many individuals.

"Book 4" interviews were administered to women between the ages of 15 and 59 in 1993 who have ever been married, female panel respondents who enter the married state in later waves, or qualifying married women who enter the survey in later years (through marriage or age). Book 4 obtains complete fertility and marital histories as well as detailed information on contraception and breastfeeding. Within the fertility history is information about every single conception the woman recalls to the interviewer, and the outcome of the conception, be it a live birth, a miscarriage, a stillborn, or if the woman is currently pregnant during the interview. This data is used to construct the dependent variable of the main conception and previous birth equations.

6.2 Sample

The empirical model estimates the probability of conception for a married couple, therefore, the sample should include only those women at risk of pregnancy even though this significantly inhibits the sample size. 25 years of age is the average age of conception over the entire sample, therefore I expand coverage of women ten years in either direction to obtain an age range of 15 to 35 years old during 1996 through 1999. This results in a sample of women most likely to conceive during the financial crisis. Of the 8270 women who completed the Book 4 survey module in IFLS3, 2635 are older than 38 and 20 are 15 years old in the year 2000 and thus are not included in the sample.

Next, 325 currently unmarried women are dropped from the sample for two reasons. First, unmarried women have a much smaller probability of conception and may be less likely to report children born out of wedlock to the IFLS surveyors. Second, no data for a male partner is available. In addition, 387 married women's husbands were absent from the household at the time of the survey and were not available for interview. These observations must also be dropped due to missing values for the husband's data. Women whose husband is absent from the household are also theoretically not at risk of pregnancy.

From the remaining 4903 women, I construct a unique identifier for her husband in order to link his constant and time varying characteristics to the wife's. An additional 25 women are dropped due to missing data on school openings, duration of marriage, subjective wellbeing, employment, and education. 196 women are dropped due to missing consumption data, and 305 husbands had missing values for education, employment, or income data.

Because of the transient nature of the labor market in Indonesia, many individuals or households migrated from their original community to seek work away from their original community. The crisis compounded this issue, as households migrated to seek other employment opportunities. In the remaining sample of 4077 women who are interviewed, roughly a third moved out of their original IFLS community between 1993 and 2000, and four times as many households changed communities in the three years after 1997 as did in the four years prior to 1997. Households who no longer reside in an IFLS enumeration area, but still reside in an IFLS province are preserved in the sample by extrapolating community level data

from their original 1997 community. 298 women who moved from an IFLS community prior to 1997 do not have community level data for 1997 or 2000 survey years and must be dropped from the sample.

The wife and husband's characteristics are then matched to the conception history file constructed from the book 4 interview. One woman from the sample is dropped because no conception history was provided during her interview. In addition to the remaining 4076 married women at risk of pregnancy, an additional 2745 unmarried women of the same age cohort are included in the sample of the marriage hazard. They are included to more accurately estimate the probability of entering the marriage state. These women have not completed the book 4 questions, but that information is not relevant to the marriage equation.

Table 6.1 summarizes the data characteristics. The dataset is expanded to include one observation per woman per year of her life beginning at age 7 and ending in 1999. The 4076 married women expand to 89,451 observations, and the 2745 unmarried women contribute 35,062 observations. A total of 124,513 woman year observations of 6821 women, for an average of 18.3 observations per woman, with a maximum of 32 observations for the oldest women.

Table 6.1 – Data Characteristics

Variable	All Women	Sample 15 - 38
Total Women	10034	6821
Married	7190	4076
Unmarried	2844	2745
Households	7542	5653
Years	1940 – 1999	1968-1999
Communities	312	312
Observations	230189	124513

6.3 Summary Statistics

Tables 6.2 through 6.5 display summary statistics for the sample of women used in the analysis, and the entire sample of 8270 (7190 after data cleaning) women not constrained by the sample age limits. I compare these groups both to show certain trends in the younger cohort, as well as the representative nature of the limited sample. Dependent variables used in the seven equation model are shown in bold.

Table 6.2 displays family characteristics. A total of 8300 conception events are recorded for the 4076 married women over their entire lives, for an average of 2.04 pregnancies per woman. Based on the age group, many women have not yet started or completed family construction, therefore this number is well below the national total fertility rate, as can be seen in the number of children in 1996. Notice how the younger cohort is almost an entire child behind the older cohort. If we were to remove the younger women who bring down the average fertility rate, we would see a number very representative of the population average of 2.4.[5] Next, notice raw conceptions per year spanning the financial crisis, also displayed in Figure 6.1. These numbers indicate a significant percentage change in the number of conceptions reported by year. The crisis first manifested itself in July of 1997, and became most prevalent towards the end of the year. Conception initially drops in 1997, increases in 1998 and then explodes in 1999. It is possible the drop in births in 1997 is an uncertainty response to the beginning of the crisis, followed by an increase in fertility as real wages decreased and mother's opportunity costs of leaving the labor force diminished.

[5] Recall this data was collected 11 years ago, so the TFR was higher than the current 2.4.

Table 6.2 – Family Characteristics

Variable	All Women		Sample 15 - 38	
	Mean	Std Dev	Mean	Std Dev
N	7190		4076	
Conceptions 1996	712		635	
1997	569		518	
1998	659		621	
1999	939		901	
Conception 1996 – 1999	.123	.328	.164	.370
Conception 1970 – 1995	.202	.401	.225	.417
Number of Children in 1996	2.35	2.36	1.49	1.59
Has No Children in 1996	.417		.526	
Has 1 Child in 1996	.141	.348	.167	.373
Has 2 Children in 1996	.134	.341	.139	.346
Has 3 Children in 1996	.105	.307	.084	.277
Has 4 Children in 1996	.072	.258	.042	.201
Has 5 or more Children in 1996	.131	.338	.042	.201
Family Planning Available in Puskesmas when woman age 7	.398	.490	.578	.494
Family Planning Available in Posyandu when woman age 7	.121	.326	.176	.381
Family Planning Available in Private Facility when woman age 7	.247	.431	.359	.480
Family Planning Available in Puskesmas in 1999	.996	.062	.996	.060
Family Planning Available in Posyandu in 1999	.881	.324	.873	.333
Family Planning Available in Private Facility in 1999	.990	.097	.989	.104
Year Family Planning became available in Puskesmas	1976	7.451	1976	7.378
Year Family Planning became available in Posyandu	1987	7.305	1987	7.349
Year Family Planning became available in Private Facility	1982	7.469	1982	7.485
Age of Menarche	14.19	2.86	14.01	1.78
Age of first marriage	19.69	4.97	19.48	4.28
Duration of Current Marriage	11.2	10.2	6.7	6.6
Age of First Birth	19.8	4.28	19.8	3.90

In the full sample of all women in the IFLS, the mother's average age of childbirth is 22 years old. In the 15-38 year old sample, the age has increased a full year to 23 years old. This figure is consistent with the hypothesis concerning the effects of increased female education, increased labor force participation, and postponed marriage delaying and reducing the fertility of Indonesian women. In both samples of women, the mother's average age of first childbirth is 19.8 years old.

The presence of facilities with family planning services has had an impact on fertility in Indonesia. Notice how the younger cohort has increased exposure to family planning facilities within their community at the time they are seven years old. This number continued to grow as program infiltration continued, as seen in the data for family planning currently present. Almost every community has some method of providing family planning services by 1999.

Table 6.3 presents summary statistics on age, location, and religion. The younger women have younger husbands, however, the main purpose of this table is to show the representative nature of the younger cohort to the full sample.

Table 6.4 displays the summary statistics for education of the woman and her husband. First, the set of education variables for the women show fewer women report never attending school or leaving primary school without graduating, and the percentage of women who achieve graduation milestones increases across the board for the younger cohort. The same trends emerge for the younger husbands. For both men and women, the younger cohort reports higher literacy rates, a younger age when first entering school, and a later age when exiting school.

Figure 6.1: Number of Conceptions by Year

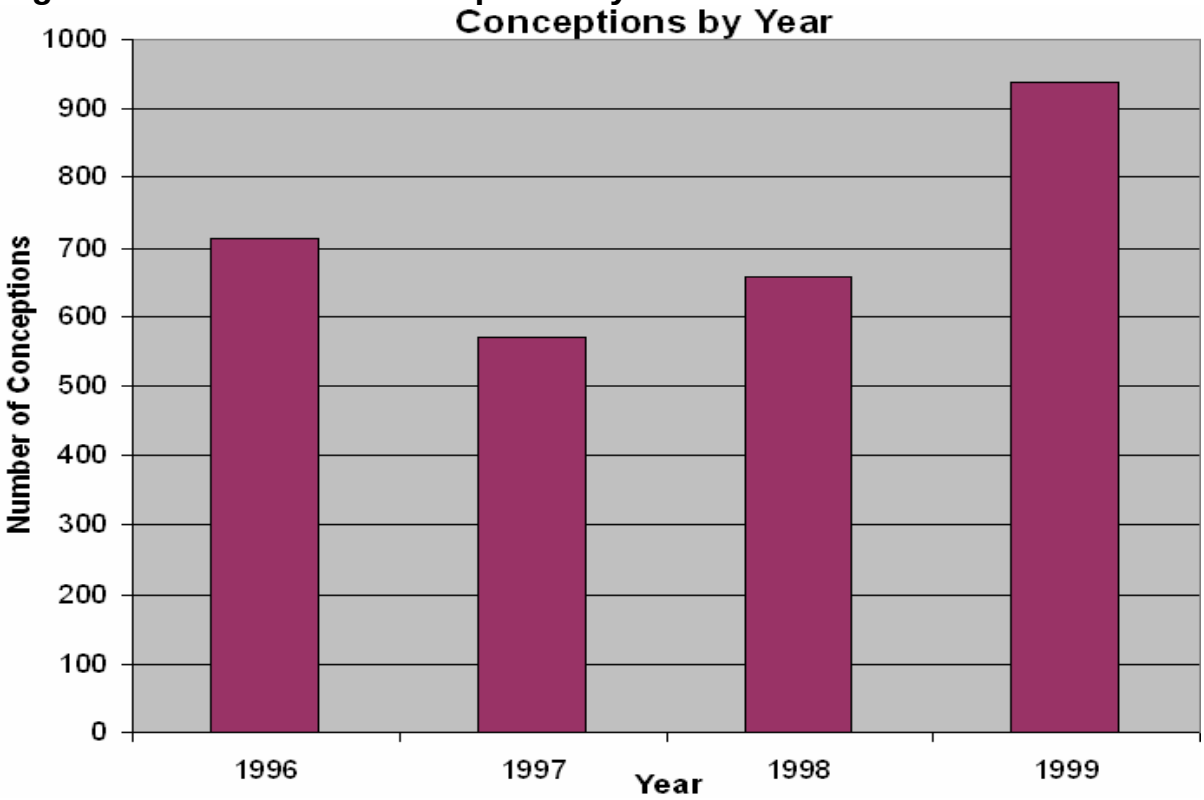

Figure 6.2: Household Income by Year

Table 6.3 – Household Characteristics

Variable	All Women		Sample 15 - 38	
	Mean	Std Dev	Mean	Std Dev
Age of the Woman	34.379	9.867	28.958	6.228
Age of the Husband	39.994	20.867	34.009	7.782
Household Located in Urban Area	.452	.498	.441	.497
North Sumatra Rural	.026	.160	.022	.147
North Sumatra Urban	.028	.165	.027	.163
West Sumatra Rural	.031	.173	.032	.176
West Sumatra Urban	.019	.136	.015	.121
South Sumatra Rural	.030	.172	.034	.181
South Sumatra Urban	.016	.125	.015	.121
Lampung Rural	.037	.189	.039	.194
Lampung Urban	.008	.092	.009	.095
DKI Jakarta Urban	.080	.271	.076	.265
West Java Rural	.090	.286	.094	.291
West Java Urban	.079	.269	.081	.273
Central Java Rural	.081	.273	.075	.264
Central Java Urban	.048	.214	.046	.210
DI Yogyakarta Rural	.020	.141	.019	.136
DI Yogyakarta Urban	.033	.179	.031	.174
East Java Rural	.096	.294	.103	.304
East Java Urban	.056	.230	.054	.226
Bali Rural	.037	.188	.035	.185
Bali Urban	.022	.145	.023	.151
West Nusa Tenggara Rural	.045	.207	.049	.215
West Nusa Tenggara Urban	.015	.123	.015	.120
South Kalimantan Rural	.028	.166	.031	.174
South Kalimantan Urban	.018	.133	.018	.133
South Sulawesi Rural	.026	.158	.026	.158
South Sulawesi Urban	.030	.171	.030	.170
Woman is Muslim	.866	.341	.866	.341
Woman is Protestant	.035	.184	.027	.162
Woman is Catholic	.014	.117	.010	.100
Woman is Hindhu	.056	.229	.054	.227
Woman is Buddhist	.003	.059	.002	.044
Man is Muslim	.887	.317	.897	.304
Man is Protestant	.034	.181	.026	.161
Man is Catholic	.014	.116	.010	.100
Man is Hindhu	.056	.231	.056	.230
Man is Buddhist	.003	.059	.002	.041

Table 6.5 displays the economic variables used in the analysis. Female unemployment consistently fell from 1996 to 1999, which further solidifies claims the financial crisis did not produce unemployment. The decrease in unemployment likely results from a joint effect of women entering the labor force due to increasing gender equality, the aging of the sample, and survey recall ability. The husband's data mimic the trends observed within the women. Women who report working for a wage steadily increases in contrast to the unemployment figures. The younger cohort of women shows larger percentage increases in labor force participation compared to the full sample, indicating they are more likely to begin careers at this age. The decrease in unemployment amongst the men implies the same is true for them.

Figure 6.2 displays the nominal household income. Notice how it trends similarly to the number of conceptions displayed in Figure 6.1. Real wages show a consistent yearly decline for working women and men. Nominal wages continued to rise over this same time period. These figures display the true effect of the financial crisis at the individual level. By 2000, real wages had fully rebounded on average, but some sectors of the economy still lagged behind real 1996 levels (Strauss, 2004).

Consumption figures reflect the same effects of the financial crisis as wages: The increase in the price level. Nominal consumption expenditure doubled from 1997 to 2000, as did per-capita consumption. 2000 consumption figures, when adjusted to 1997 rupiah, show average real consumption above pre-crisis levels.

Table 6.4 – Education

Variable	All Women		Sample 15 - 38	
	Mean	Std Dev	Mean	Std Dev
Woman Never Attended School	.105	.307	.066	.248
Woman Did Not Graduate Primary School	.245	.430	.200	.400
Woman Graduated Primary School	.294	.456	.312	.463
Woman Graduated Junior High School	.145	.352	.171	.376
Woman Graduated Senior High School	.167	.373	.204	.403
Woman Graduated University or Higher	.044	.204	.048	.213
Husband Never Attended School	.070	.255	.050	.219
Husband Did Not Graduate Primary School	.236	.425	.211	.408
Husband Graduated Primary School	.275	.447	.273	.446
Husband Graduated Junior High School	.141	.348	.147	.355
Husband Graduated Senior High School	.218	.413	.255	.436
Husband Graduated University Or Higher	.060	.238	.063	.243
Woman Can Read	.824	.381	.882	.323
Woman Can Write	.812	.391	.873	.333
Husband Can Read	.887	.316	.913	.282
Husband Can Write	.875	.331	.902	.297
Student Teacher Ratio in Secondary School	16.37	5.422	16.246	5.441
Student School Ratio in Secondary School	591.1	336.9	589.5	349.0
Student Teacher Ratio in Primary School	24.91	10.102	25.244	10.256
Student School Ratio in Primary School	215.8	102.6	218.1	102.5
Year Primary School opened	1959	16.632	1959	16.557
Year Junior High School opened	1974	13.277	1974	13.234
Year Senior High School opened	1978	13.541	1977	13.650
Age the woman started school	6.68	1.77	6.66	1.76
Age the husband started school	7.36	2.58	7.18	2.67
Age the woman ended school	16.29	4.81	16.56	4.61
Age the husband ended school	14.95	5.80	15.83	5.68

Table 6.5 – Economic Variables

Variable	All Women		Sample 15 -38	
	Mean	Std Dev	Mean	Std Dev
Woman Unemployed in 1996	.556	.497	.624	.484
Woman Unemployed in 1997	.526	.499	.592	.491
Woman Unemployed in 1998	.495	.500	.560	.496
Woman Unemployed in 1999	.461	.499	.520	.500
Woman works for wage in 1996	.313	.464	.263	.440
Woman works for wage in 1997	.340	.474	.292	.455
Woman works for wage in 1998	.368	.482	.319	.466
Woman works for wage in 1999	.397	.489	.350	.477
Woman's wage in 1996 (Annually, only the working women)	1028324	5479179	903390	6079295
Woman's wage in 1997	1110111	5429896	989858	5965339
Woman's wage in 1998	798859	3676298	720823	4182710
Woman's wage in 1999	776978	3274861	698410	3536832
Husband Unemployed in 1996	.112	.316	.118	.322
Husband Unemployed in 1997	.088	.283	.086	.280
Husband Unemployed in 1998	.068	.252	.060	.237
Husband Unemployed in 1999	.054	.226	.040	.197
Husband's wage in 1996 (Annually, only the working men)	4608107	16400000	4314427	10500000
Husband's wage in 1997	4883625	13500000	4718436	12100000
Husband's wage in 1998	3670569	12700000	3587883	10300000
Husband's wage in 1999	3207064	7608556	3283222	7707462
Per-Capita Consumption in 1997	1126202	1487995	1068934	1175117
Per-Capita Consumption in 2000	2262251	2594966	2292559	2629708
Real Per-Capita Consumption in 2000 (1997 Rp)	1159317	1343676	1156631	1326728
Nominal Total Household Consumption in 1997	6381593	8140529	6062919	7577119
Nominal Total Household Consumption in 2000	12200000	13700000	11600000	12900000
Community Subjective Wellbeing – Worse	.315	.465	.319	.466
Better	.102	.303	.102	.303
Individual Subjective Wellbeing – Expect Worse	.015	.121	.013	.112
Expect Better	.320	.466	.343	.475

6.4 Challenges

As mentioned in chapter 5, the availability of data defined the empirical specification used for the analysis. The ideal model to answer this question would be a multiple spell hazard model where a woman makes fertility decisions in every year of her fertile life as a function of time varying economic and demographic variables, however, the income and employment data collected during IFLS2 was not made available to the public. As a result, a dynamic retrospective picture of the entire wage profile for any individual is impossible to obtain prior to 1996, limiting the types of models available to analyze IFLS data.

CHAPTER 7

EMPIRICAL RESULTS

7.1 Overview

To ascertain the effects of short term financial shocks on the demand for children, the empirical model from Chapter 5 is estimated using the data presented in Chapter 6. This analysis uses real per-capita consumption measured both before and after the financial crisis as a proxy for whether a particular household experienced a financial shock during the time period spanning the crisis, and then examines what effect these changes in real per-capita consumption have on the probability of conceiving a child in each year from 1996 through 1999. Coefficient estimates of economic indicators such as consumption and income variables provide an answer to this question.

In this chapter I present the empirical results from two different analyses. First, I estimate a single equation model which predicts the probability of conception and does not control for any unobserved heterogeneity or random effects. The second is the estimation of the model discussed in a previous chapter which controls for unobserved heterogeneity and inter-equation error term correlations. The results from each analysis are presented separately and then compared in the final section of this chapter. I expect the results from the uncontrolled analysis to suffer from endogeneity biased coefficient estimates, and the heterogeneity controlled analysis

to correct for it. Comparing the two analyses will show the direction of any endogeneity bias in the uncontrolled model. The results of interest are obtained from the conception equation (equation 5.1), however, results for the remaining six equations: previous births, education, marriage, labor force participation, income, and consumption are also presented in an abridged form. The complete results from all analyses are available in Appendix A.

The next section presents results from a simple logistic regression of equation 5.1. This estimation is performed using the data analysis software package STATA (StataCorp, College Station TX). Following that is a discussion of the procedure to obtain the joint estimation coefficient estimates using full information maximum likelihood and the discrete factor method, and then joint estimation results are presented and discussed. Finally, a brief discussion of the differences between the two analysis is presented.

7.2 Uncontrolled Results

Preliminary statistical work was performed on the full dataset using the data analysis software package STATA. The model estimated is a multiple spell hazard model with a conception occurring in a given year by a woman as the dependent variable. The estimated model is given by equation 5.1. This model does not control for any heterogeneity or endogeneity, thus the remaining six equations are not estimated as part of this model. The results are displayed in Table 7.1.

This model was initially used to explore the possibility such economic effects did in fact exert an influence on fertility. The immediate result from this analysis is the extremely strong decrease in fertility noted during 1997 and 1998. This is accentuated by the sharp increase in fertility in 1999, possibly due to suppressed latent demand during the crisis. Such a difference in the reported conceptions over the span of these four years indicates a strong possibility the financial crisis was responsible. The year effect results motivated the second half of the project, indicating some effect of the financial crisis on fertility.

Though the financial crisis appeared to play a negative role in the household's short run decision to bear children through the significance of the consumption variable, structural factors played a significant role as well. The most important of these appears to be marital status and the number of children present in the household. Though this paper does not include target fertility as an explanatory variable, I believe from my own experience many households do plan for the number and timing of children, of course with the opportunity to delay conceptions given certain circumstances. Thus, notice the magnitude and significance of the marital status and number of children coefficients. Relative to having no children in the household, existing children predict a strong decrease in the probability of conception. Marital status carries the obvious positive sign. Ever married strongly predicts conception as well.

A woman's education is expected to be endogenous for reasons previously discussed. A woman currently attending school predicts an insignificant decrease in the probability of conception. The more education a

woman obtains, the more this predicts an increase in the probability of conception relative to having no education. A college education positively and significantly predicts the probability of conception, which runs counter-intuitive, since the more education a woman obtains, the more likely she would be expected to work and less likely to bear children.

The husband's education follows similar, but not exact patterns. If the husband is still in school, the couple is insignificantly less likely to conceive a child. This may be due to budget constraints, an inherent desire to avoid childcare tasks while in school, or the husband's education status does not enter the conception decision process. The husband's total education is insignificant with the exception of primary school graduation, which negatively affects the probability of conception.

The presence of some hardship in a given year such as a death or illness of a family member, loss of a job, damage to crops, damages due to natural disasters such as earthquake fire and flood, and decreases in household income due to decreases in production or price level fluctuations negatively and significantly effects the probability of conception, indicating households are responsive to sudden and unexpected changes with respect to fertility.

Employment of any sort by the woman carries the expected negative and significant sign relative to unemployment indicating women who perform any sort of labor related tasks are less likely to conceive a child than women who do not work, a very intuitive result. Employment by the husband carries a positive but insignificant effect on the probability of conception. This is expected, as the

husband's labor force status shouldn't change the households demand for children while holding income and consumption constant.

Household income is insignificant, but household consumption is negative and significant, indicating children are inferior goods. Households who experience declines in per-capita consumption are much more likely to have children, while households who experience increases in per-capita consumption are less likely to conceive an additional child.

Table 7.1: Uncontrolled Results: Conception Equation

Conception	Estimate		Std Error	Z
Constant	-4.5999	***	0.6134	-7.50
Year 1996	-0.2676	***	0.0672	-3.98
Year 1997	-0.5701	***	0.0676	-8.43
Year 1998	-0.4597	***	0.0641	-7.17
Married	1.8730	***	0.4959	3.78
Ever Married	1.4534	***	0.4864	2.99
Mother has 1 child	-1.6526	***	0.0667	-24.77
Mother has 2 children	-2.2530	***	0.0869	-25.92
Mother has 3 children	-2.2435	***	0.1056	-21.25
Mother has 4 children	-1.8926	***	0.1248	-15.17
Mother has 5 or more children	-1.9886	***	0.1402	-14.18
Woman currently attends school	-0.0896		0.1686	-0.53
Woman started but not graduate Primary School	0.0013		0.1152	0.01
Woman Graduated Primary School	-0.0118		0.1220	-0.10
Woman Graduated Junior High School	0.0582		0.1282	0.45
Woman Graduated Senior High School	0.1431		0.1327	1.08
Woman Graduated University or higher	0.2481		0.1734	1.43
Husband currently attends school	-0.2025		0.2622	-0.77
Husband did not graduate primary school	-0.0810		0.1097	-0.74
Husband Graduated Primary School	-0.2213	*	0.1139	-1.94
Husband Graduated Junior High School	-0.0994		0.1228	-0.81
Husband Graduated Senior High School	-0.1019		0.1235	-0.82
Husband Graduated University or higher	0.0162		0.1633	0.10
Household Experienced a Hardship (Death, Sickness,..)	-0.1885		0.0967	-1.95
Woman Works For a Wage	-0.3470	***	0.0611	-5.68
Woman is Unpaid Family Worker	-0.3208	***	0.0831	-3.86
Husband is Self Employed	0.0868		0.1438	0.60
Husband is Unpaid Family Worker	0.1127		0.2027	0.56
Husband works for the government	0.2026		0.1683	1.20
Husband works for a corporation	0.0693		0.1429	0.49
Household Income	0.0004		0.0187	0.02
Real Per Capita Consumption	-0.1460	***	0.0351	-4.16

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

7.3 Full Information Maximum Likelihood Using the Discrete Factor Method

The complete seven equation model was estimated simultaneously using the full information maximum likelihood discrete factor method (FIML DFM). Table 7.2 displays the likelihood function values for different combinations of community and individual level mass point specifications. Using Mroz's (1999) suggestion to increase the amount of community and individual level mass points up to the point where the increase in the likelihood function value is less than the number of parameters added to the model, the reported results originate from the seven equation model discussed in the previous chapter with seven community sixteen individual level mass points. In a seven equation model, the addition of one mass point results in the addition of eight parameters; one heterogeneity term per equation, and a weight coefficient which determines the probability of individual i or community j falling within a particular mass point. Note from table 7.2 additional parameters could have been added to increase the magnitude of the likelihood function, however the addition of a seventeenth individual or eighth community mass point did not under all specifications result in an increase of at least eight points in the likelihood function value.

TABLE 7.2: Likelihood Function Values

Likelihood Function Value		Community Level Mass Points								
		1	2	3	4	5	6	**7**	8	9
Individual Level Mass Points	1	-86618.21								
	2		-82452.35							
	3			-81548.86						
	4				-81298.02					
	5					-80892.11	-80879.51	-80856.90		
	6					-80802.36	-80690.30	-80668.73	-80665.18	
	7					-80574.31	-80549.94	-80525.56	-80510.07	-80510.09
	8					-80522.05	-80503.80	-80342.21	-80316.75	
	9					-80327.61	-80292.21	-80270.82	-80266.31	
	10					-80278.19	-80244.91	-80233.13	-80230.13	
	11					-80254.91	-80192.57	-80171.57	-80150.06	-80132.55
	12					-80155.71	-80097.34	-80073.50	-80052.48	-80032.25
	13					-80118.41	-80050.57	-80026.16	-80016.87	-79993.53
	14					-80083.85	-80029.55	-80012.00	-80006.55	-79972.96
	15					-80071.28	-80043.92	-80004.96	-79987.26	-79959.82
	16					-80053.22	-79967.72	**-79947.64**	-79941.79	-79923.84
	17					-80036.40	-79957.21	-79938.13	-79924.23	-79908.68

* Blank cells imply that no estimation was performed for a particular combination of community and individual heterogeneity
The cell in bold indicates the estimation of 16 individual and 7 community mass points which produced the results presented in this chapter.
The final results reported here have a different likelihood function value than the specification in the table. The final specification fixed a small calculation error on the 2000 per-capita consumption variable in the database program which built the dataset being analyzed. Fixing this error resulted in a shift of approximately 300 points in the likelihood function at the maximum. The final likelihood function value is -80253.03.

The analysis of one community and one individual mass point, which is indicative of no heterogeneity controlls in the model produces identical results for the main equation as the uncontrolled results in section 7.1, as expected. The likelihood function value of the analysis was -86618, and the likelihood function value of the final specification was -79947, an increase in the likelihood function of 6670. Table 7.3 summarizes the benefit of using the discrete factor method over not controlling for heterogeneity.

To test the identification of the model, I performed two model specification tests to prove the validity of the exclusion restrictions. In the first test, I removed the 30 instruments from the supporting equations resulting in a decrease of 65 parameters. The specification of the conception equation remained the same. The likelihood function value of this restricted model is -80999.43, resulting in a likelihood ratio test value of 1471.54, which strongly rejects the null hypothesis, implying the exclusion restrictions are significant as a group as included in the supporting equations, thus the exclusion restrictions are appropriate identifying instruments. The second test was to include all the exclusion restrictions in the specification of the conception equation, while leaving the specification of the six supporting equations the same. This resulted in an addition of 30 parameters to the model. The likelihood function value of this restricted model at its maximum is -80243.83. The resulting likelihood ratio test statistic equals 39.66, and as such, the null hypothesis is not rejected, indicating the exclusion restrictions are insignificant as a group when specified in the conception equation, even though some of the coefficients are individually significant in the main equation. This test implies the exclusion

restrictions are appropriately omitted from the conception equation, as they are not significant predictors of fertility as a group.

Table 7.3: Benefit of the Discrete Factor Method

Model	Parameters	Likelihood Function
No Heterogeneity, seven equations	579	-86618.21
7 Community, 16 Individual Mass Points	747	-79947.64
Difference	+168	+6670.57

Table 7.4: Heterogeneity Probability Weight Estimates

Estimate			Std Error	Z	Mass Point	Probability Weight
Community						
Community Weight Parameters					1	0.0179
2	2.8526	***	0.5175	5.51	2	.2569
3	2.3954	***	0.5622	4.26	3	.2167
4	2.1355	***	0.5600	3.81	4	.1927
5	2.1846	***	0.5286	4.13	5	.1417
6	1.8099	***	0.5913	3.06	6	.1180
7	1.1305	*	0.6415	1.76	7	.0538
Individual						
Individual Weight Parameters					1	0.0425
2	-0.7015	*	0.3717	-1.89	2	.0214
3	0.2899		0.7596	0.38	3	.0456
4	0.4994		0.3810	1.31	4	.0708
5	-1.8326	***	0.4170	-4.39	5	.0070
6	-0.6286	*	0.3764	-1.67	6	.0245
7	0.7442	**	0.3600	2.07	7	.0922
8	0.6161		0.5056	1.22	8	.0778
9	-1.5064	**	0.6516	-2.31	9	.0073
10	1.9408	***	0.3013	6.44	10	.3117
11	-0.6739		0.4552	-1.48	11	.0188
12	-1.2087	***	0.4650	-2.60	12	.0128
13	-1.3355	***	0.4546	-2.94	13	.0121
14	0.8000	**	0.3888	2.06	14	.0968
15	1.0641	**	0.4693	2.27	15	.1204
16	-0.0031		0.4012	-0.01	16	.0411

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

As a final test of the model specification, I performed one additional test where all time dependent instrumental variables from past decisions are included in all future decisions. For example, the theoretical model predicts education decisions factor in to all future decisions, therefore the instruments from the education

equation are included in the marriage, work, previous births, and conception equations. After running this specification, I concluded that the current specification was sufficient in that no changes to parameter values were observed. The likelihood function value of this restricted model is -80218.18 with 776 parameters, resulting in a likelihood ratio test value of 90.96, which rejects the null hypothesis. Though this implies that the two models are statistically different, the parameter estimates of all coefficients of interest do not differ in sign, magnitude, or statistical significance.

Table 7.4 displays the heterogeneity weights. To determine the relative weights of seven community mass points, only six coefficients need be estimated, as the weights are restricted to sum to one. The second column displays the coefficient estimate of the model for the mass point indicated in the first column. The third and fourth columns display the standard errors and Z statistics respectively. The mass points are almost all significant, indicating the model is not over-parameterized. The final column displays the relative weights for each mass point in the fifth column.

7.4 FIML DFM Results

The results presented here are obtained using the aforementioned discrete factor method to estimate the set of 747 parameters. The model was initially estimated using starting values of zero for all parameters except for the standard deviation of the continuous equations, which were normalized to one. The models were estimated until the first partial derivative took on a value smaller than 9.0x10e-4. Once this was achieved, the estimation was considered complete. with one community, one individual, or both mass points added to the specification. The

model was then iterated again until the final specification was determined to optimize the parameter estimates.

The relevant results to the question concerning economic effects on conception are derived from the conception equation, which spans the financial crisis. Parameter results of interest are displayed in tables 7.5 through 7.11, with the full results for all seven equations and 747 parameters available in Appendix A. Following each equation, the heterogeneity parameters for each equation are displayed. These will not be discussed, but are included for completeness.

At the beginning of this project, I indicated three possible outcomes of an intra-household financial shock: The financial crisis may be responsible for an increase, decrease, or no change in fertility. In the literature review, I put forth various hypotheses concerning the different effects of certain variables, however, there always existed the possibility where fertility preferences are deeply rooted in structural beliefs concerning the number and timing of children, and are not affected by short run financial shocks. The answer to this question in the context of Indonesian households follows.

7.4.1 Conceptions

Table 7.5 displays the main results of interest for this research project, as it contains the pertinent economic factors in the household spanning the course of the financial crisis. The main result of interest is the influence the financial crisis exerted on fertility. Similar to the uncontrolled results, household income exerted no effect when household consumption was also included in the model. Household consumption exerts a negative and significant influence on the probability of

conception, thus holding all else constant, children are inferior goods: An increase in the available resources within the household results in a decrease in the probability of conception, resulting in fewer children per household. Although the significance of the consumption coefficient is very high, simulations displayed in Chapter 8 will show the effects of changes in consumption have very small relative and absolute effects on the predicted probability of conception.

Removing consumption from the model causes the income coefficient to remain positive and insignificant. Removing income from the baseline specification results in a significant coefficient estimate of consumption of -.2214, whereas the coefficient estimate of the baseline equation is -.2203. This indicates the inclusion of income in the model has very little effect on the outcome. This is also confirmed through simulations performed in Chapter 8.

The year dummies are significant, indicating fewer births in the three years prior to 1999 are still not entirely attributed to the variables within the system of equations. If the variables in the system captured all the economic and socio-demographic impacts of the financial crisis, the coefficients on the year indicator variables would be insignificant. As can be observed, these indicators are all highly significant, implying other unobserved year specific effects not included in this specification are still present. One possible interpretation of this are time factors unrelated to the financial crisis, however, this scenario seems unlikely. No other events of such magnitude had macro- socio and economic effects on the entire region during this time. The second, and more likely is the year indicators are a proxy for remaining unobserved factors related to the crisis.

As also observed in the initial results, structural factors play the significant role in the decision to conceive a child. The most important of these appears to be marital status and the number of children. Notice again the magnitude and significance of the marital status and number of children coefficients. Relative to having no children in the household, existing children predict a strong decrease in the probability of conception, however, notice how the presence of only one child is much smaller in magnitude from the other coefficients. Recall the TFR in Indonesia is 2.4 children per woman. This confirms the prevalence of two and three child households. Once a household has two children, the probability of having additional children is lower. These results are confirmed in Chapter 8 through simulation experiments. The presence of family planning at thee posyandu when the woman is age seven significantly reduces the probability of conception. An interpretation of this is that the influence of family planning carries life-long impacts on women to delay the age of childbearing, as was found by Angeles et al. 2005. The current presence of family planning resources in the community predicts an increase in the probability of conception. Marital status carries the obvious positive sign. Ever married strongly predicts children as well.

Employment by the woman carries oppositely signed coefficients relative to unemployment. Women who work for a wage insignificantly predict an increase in the probability of conception, whereas women who work as unpaid family workers predict a significant decrease in the probability of conception. I argue at the margin, women who are expending similar energies towards the labor market in time respond differently based on the financial outcome of their labor. Women working

who are not earning a wage are less likely to bear children than unemployed women because of time commitments to the labor force. Women who are earning may have opportunities to receive time off to bear children, or work out arrangements with child caregivers, thus explaining the different response. Employment by the husband carries a positive but insignificant effect on the probability of conception. This is expected, as the husband's labor force status shouldn't change the households demand for children while holding income and consumption constant.

A woman's education is expected to be endogenous for reasons previously discussed. All education variables for the woman are insignificant, implying the level or status of education does not play a role in the decision to conceive a child. The husband's education variables are also all insignificant. This is a main result obtained once heterogeneity is controlled for within the model. Education leads to different types of labor force participation, which results in higher wages, ultimately leading to increased consumption. Thus I would expect the education coefficients to be less significant in a model where heterogeneity is controlled. Angeles, Guilkey, and Mroz (2005) report the identical result using IFLS1 data from 1993.

The presence of some hardship negatively and significantly predicts the probability of conception, indicating households are responsive to sudden and unexpected changes in either social or economic aspects. Adverse events cause the household to lower the likelihood of having another child in the immediate timeframe. Medium and long run effects of the crisis are discussed in Chapter 9.

The model surprisingly predicts higher probability of births in an urban setting. This is counter to expectations, where larger families tend towards more rural,

agricultural based areas. Province indicators interacted with the urban indicator, not displayed, control for endogenous program placement of family planning programs and province specific effects on family size and dynamics. Ten out of thirteen provinces indicate lower coefficient values on the urban interaction terms when comparing one province's provinceXurban vs. provinceXrural coefficients, and therefore when examining the true marginal effect of urbanicity, provinces must be included in the analysis. Simulations will reveal the true marginal effect of urban dwelling on fertility.

7.4.2 Number of Children

The second equation controls for previous births in the household prior to the financial crisis. As observed in the main conception equation, the number of children in the household is again the strongest predictor of the addition of children. Marriage carries the expected positive and significant sign. The presence of other children also exerts similar effects as in the conception equation. The duration of marriage significantly predicts an increase in the probability of birth, while the indicator for fertility and vicinity to the parents are insignificant.

The husband's age plays a larger role in this equation. Men younger than age 20 and older than 40 are less likely to father children, whereas those in the 21 to 39 age group are more likely to father children, with those age 21 to 30 more likely to father children, although the coefficient is just barely insignificant at the 10% level.

Table 7.5: FIML Results: Conception Equation

Conception	Estimate		Std Error	Z
Constant	-3.4808	***	0.4722	-7.37
Year 1996	-0.2124	***	0.0673	-3.16
Year 1997	-0.5349	***	0.0712	-7.51
Year 1998	-0.4480	***	0.0697	-6.43
Married	1.9391	***	0.6050	3.21
Ever Married	1.8248	***	0.6048	3.02
Mother has 1 child	-2.0771	***	0.1059	-19.61
Mother has 2 children	-2.8535	***	0.1371	-20.81
Mother has 3 children	-2.9350	***	0.1543	-19.02
Mother has 4 children	-2.6822	***	0.1831	-14.65
Mother has 5 or more children	-2.8897	***	0.1997	-14.47
Family Planning Available in Puskesmas when woman age 7	0.0349		0.0732	0.48
Family Planning Available in Posyandu when woman age 7	-0.1644	**	0.0764	-2.15
Family Planning Available in Private Facility when woman age 7	-0.0143		0.0701	-0.20
Family Planning Available in Puskesmas now	0.5065		0.4835	1.05
Family Planning Available in Posyandu now	0.1070		0.0794	1.35
Family Planning Available in Private Facility now	0.4822	*	0.2653	1.82
Household in Urban area	0.5880	***	0.1587	3.71
Woman currently attends school	-0.0606		0.1775	-0.34
Woman started but did not graduate Primary School	-0.0194		0.1206	-0.16
Woman Graduated Primary School	-0.0778		0.1205	-0.65
Woman Graduated Junior High School	-0.0465		0.1374	-0.34
Woman Graduated Senior High School	-0.0409		0.1415	-0.29
Woman Graduated University or higher	0.0037		0.1823	0.02
Husband currently attends school	-0.1674		0.2760	-0.61
Husband did not graduate primary school	0.0376		0.1211	0.31
Husband Graduated Primary School	-0.1520		0.1055	-1.44
Husband Graduated Junior High School	-0.0265		0.1219	-0.22
Husband Graduated Senior High School	-0.0932		0.1083	-0.86
Husband Graduated University or higher	-0.0400		0.1582	-0.25
Woman Works For a Wage	0.1142		0.1375	0.83
Woman is Unpaid Family Worker	-0.3132	***	0.0875	-3.58
Husband is Self Employed	0.0049		0.1649	0.03
Husband is Unpaid Family Worker	0.0881		0.2006	0.44
Husband works for the government	0.0726		0.1824	0.40
Husband works for a corporation	-0.0096		0.1628	-0.06
Household Experienced a Hardship (Death, Sickness,…)	-0.1712	*	0.0920	-1.86
Household Income	0.0162		0.0274	0.59
Household Consumption	-0.0534		0.0684	-0.78

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

Table 7.5a: Heterogeneity Parameters: Conception Equation

Conception	Estimate	Std Error	Z
Community Point 1	Normalized to Zero		
Point 2	0.1194	0.3196	0.37
Point 3	-0.0321	0.3244	-0.10
Point 4	0.2979	0.3143	0.95
Point 5	-0.0114	0.3160	-0.04
Point 6	0.4958	0.3163	1.57
Point 7	0.4282	0.3641	1.18
Individual Point 1	Normalized to Zero		
Point 2	-0.5765	0.4686	-1.23
Point 3	0.2580	0.4241	0.61
Point 4	-0.4818	0.3651	-1.32
Point 5	0.7649 *	0.4488	1.70
Point 6	-4.5992 ***	0.8630	-5.33
Point 7	0.6089 *	0.3290	1.85
Point 8	0.2396	0.3659	0.66
Point 9	0.8205 *	0.4488	1.83
Point 10	0.4726	0.3025	1.56
Point 11	0.0962	0.4185	0.23
Point 12	-0.4168	0.6170	-0.68
Point 13	-0.8251	1.1670	-0.71
Point 14	0.2252	0.3324	0.68
Point 15	0.1767	0.3416	0.52
Point 16	-0.1543	0.3527	-0.44

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

Coefficients estimated for the influence of the mother's age were estimated at every discrete age level, creating an extensive age profile, however it is too inefficient to display these results here. The probability of conception peaks at age 22, remains high around 26 to 28, and falls off sharply after age 30. Women younger than age 17 have much lower probabilities of conceiving a child than those age 30.

The year indicators contained in this table are strongly correlated with the age of the women in the sample, and the signs of the coefficients reflect that. Again, households in urban areas are more likely to have conceptions than those in rural areas.

The woman's education results are more intuitive in this equation than the conception equation. Relative to no education, women with education are less likely

to conceive, consistent with hypotheses put forth regarding woman's employment and labor force participation (income and employment variables are not estimated in this equation because no data is available). Women who graduated high school are significantly less likely to have births in the years prior to the financial crisis. The husband's education trends entirely opposite to the woman's. Husbands who have low education predict a lower probability of birth, whereas high school (insignificantly) or college (significantly) increases the probability of birth. The lack of income and employment data in this equation may cause the education variable to act as proxies for socio-economic status. If this is the case, then the result where the women's education predicts a decrease in the probability of conception and the husband's predicts an increase in the probability of conception is consistent with previous findings where the woman's contribution to the household economy may be a strong negative determinant of the number of children the household will produce, while the husband's income relative to conception indicates children to be normal goods.

Lagged education variables are displayed here because the conception resulting in the reported birth most likely resulted in the previous year. Women attending school this year or husbands attending school last year significantly predict a decrease in the probability of birth.

Table 7.6: FIML Results: Number of Children Equation

Birth	Estimate		Std Error	Z
Constant	-2.4148	***	0.6110	-3.95
Married	1.3197	***	0.3598	3.67
Mother has 1 child	-1.4870	***	0.0588	-25.30
Mother has 2 children	-1.9092	***	0.0765	-24.94
Mother has 3 children	-2.1417	***	0.0964	-22.22
Mother has 4 children	-2.1467	***	0.1190	-18.03
Mother has 5 or more children	-1.9791	***	0.1348	-14.68
Family Planning Available in Puskesmas when woman age 7	-0.0231		0.0468	-0.49
Family Planning Available in Posyandu when woman age 7	-0.0814		0.0845	-0.96
Family Planning Available in Private Facility when woman age 7	0.0845		0.0651	1.30
Family Planning Available in Puskesmas now	-0.0502		0.0922	-0.55
Family Planning Available in Posyandu now	0.0061		0.0475	0.13
Family Planning Available in Private Facility now	-0.0713		0.0559	-1.28
Husband's age 20 or younger	-0.2619	**	0.1026	-2.55
Husband's age 21 to 30	0.0803	*	0.0486	1.65
Husband's age 40 or older	-0.2985	***	0.0975	-3.06
Year is before 1976	0.6152		0.3974	1.55
Year is 1976 to 1980	0.2453	**	0.1089	2.25
Year is 1981 to 1985	0.3759	***	0.0602	6.24
Year is 1986 to 1990	0.1254	***	0.0386	3.25
Household in Urban area	0.4386	***	0.1002	4.38
Woman started but did not graduate Primary School	0.0378		0.0767	0.49
Woman Graduated Primary School	-0.0838		0.0821	-1.02
Woman Graduated Junior High School	-0.1233		0.0942	-1.31
Woman Graduated Senior High School	-0.1496		0.0920	-1.63
Woman Graduated University or higher	-0.0302		0.1502	-0.20
Husband did not graduate primary school	0.0623		0.0594	1.05
Husband Graduated Primary School	-0.0179		0.0705	-0.25
Husband Graduated Junior High School	-0.0640		0.0791	-0.81
Husband Graduated Senior High School	0.0577		0.0759	0.76
Husband Graduated University or higher	0.2248	**	0.1054	2.13
Woman attended school last year	0.1037		0.0985	1.05
Woman currently attends school	-0.2742	**	0.1242	-2.21
Husband attended school last year	-0.2210		0.1489	-1.48
Husband currently attends school	0.2749	*	0.1669	1.65
Duration of marriage	0.1498	**	0.0680	2.20
Woman is fertile	0.2275		0.2098	1.08
Woman lives near her parents	-0.0555		0.0570	-0.97

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

7.4.3 Education

The education equation predicts the probability a woman exits school in a given year. The presence of a child in the household positively and significantly predicts a woman will exit school. The woman's age indicators are relative to age 16

Table 7.6a: Heterogeneity Parameters: Number of Children Equation

Conception	Estimate	Std Error	Z
Community Point 1	Normalized to Zero		
Point 2	0.2566	0.2143	1.20
Point 3	0.1788	0.2258	0.79
Point 4	0.4279 **	0.2156	1.98
Point 5	0.1444	0.2161	0.67
Point 6	0.7953 ***	0.2185	3.64
Point 7	0.3338	0.2398	1.39
Individual Point 1	Normalized to Zero		
Point 2	-0.3644	0.4302	-0.85
Point 3	-0.2012	0.3497	-0.58
Point 4	-0.2213	0.3197	-0.69
Point 5	0.2135	0.3113	0.69
Point 6	-3.9604 ***	0.6338	-6.25
Point 7	-0.0001	0.3507	0.00
Point 8	-0.1740	0.3048	-0.57
Point 9	0.0682	0.4218	0.16
Point 10	0.1227	0.2558	0.48
Point 11	0.2324	0.4052	0.57
Point 12	0.1312	0.3132	0.42
Point 13	-0.3897	0.5349	-0.73
Point 14	0.1261	0.2866	0.44
Point 15	0.0808	0.2863	0.28
Point 16	0.1197	0.2740	0.44

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

to 20. Those younger than 16 are significantly less likely to exit school, and those older than 20 are much more likely to exit school, and discrete increases in the probability of exiting school are noted at ages 13 and 16, which coincides with women completing grammar school and high school respectively.

The exogenous instruments in this equation are proxies for school quality in the communities where they reside. These ratios are student-teacher and student-school in both primary and secondary schools.

Table 7.7: FIML Results: Education Equation

Exit School	Estimate		Std Error	Z
Constant	3.5225	***	0.3142	11.21
Mother has 1 child	0.9241	***	0.1443	6.41
Woman's age 7	-3.0888	***	0.1337	-23.10
Woman's age 8	-4.1622	***	0.1644	-25.32
Woman's age 9	-3.3670	***	0.1276	-26.40
Woman's age 10	-2.6003	***	0.1011	-25.73
Woman's age 11	-2.0932	***	0.0957	-21.86
Woman's age 12	-1.0930	***	0.0806	-13.56
Woman's age 13	-0.5750	***	0.0746	-7.70
Woman's age 14	-0.7340	***	0.0704	-10.42
Woman's age 15	-0.7827	***	0.0794	-9.85
Woman's age 21 to 25	0.3698	***	0.1039	3.56
Woman's age 26 to 30	0.0490		0.2639	0.19
Woman's age 31 to 35	-0.5906		0.5268	-1.12
Woman's age 36 and up	2.3777	***	0.8989	2.65
Year is before 1976	-0.2030		0.1241	-1.64
Year is 1976 to 1980	-0.6293	***	0.1065	-5.91
Year is 1981 to 1985	-1.1002	***	0.1013	-10.86
Year is 1986 to 1990	-0.9822	***	0.0948	-10.36
Year is 1991 to 1995	-0.7851	***	0.0870	-9.02
Household in Urban area	-0.3691	***	0.1344	-2.75
Woman can read	-1.9049	***	0.2890	-6.59
Woman can write	-1.2466	***	0.2645	-4.71
Student Teacher Ratio in Secondary Sch	0.0613	*	0.0338	1.81
Student School Ratio in Secondary Sch	-0.0596		0.2111	-0.28
Student Teacher Ratio in Primary Sch	0.0867	**	0.0415	2.09
Student School Ratio in Primary Sch	-0.2427	**	0.0978	-2.48
School was available to woman in her community	-0.1166	*	0.0667	-1.75

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

A higher student teacher ratio in secondary school, indicating a lower school quality, positively predicts a student will exit school. The same ratio in primary school was of the same sign, but not significant. This is possibly explained by decreasing marginal returns to education. The marginal value of earlier years of education is higher, independent of school quality. Once the student is in high school, a school of lower quality may provide a lower marginal product of education, and thus the student exits school. The student-school ratios are insignificant, but negatively predict the propensity to exit school. Perhaps larger schools provide higher average resources per student because of economies of scale with regards to limited school resources and thus attract students. Having a school available in the vicinity of the community at the time when the woman would matriculate into that school is significant to the woman remaining in school. This indicates that transaction costs do play a role in the attainment of education, and students exit school when the transaction costs exceed the benefit of additional education.

Table 7.7a: Heterogeneity Parameters: Education Equation

Conception	Estimate		Std Error	Z
Community Point 1	Normalized to Zero			
Point 2	-0.6696	***	0.1649	-4.06
Point 3	-0.1291		0.2059	-0.63
Point 4	-1.0151	***	0.2041	-4.97
Point 5	-0.3660	**	0.1767	-2.07
Point 6	-0.0986		0.1862	-0.53
Point 7	0.5451	***	0.1939	2.81
Individual Point 1	Normalized to Zero			
Point 2	-0.5966	**	0.2718	-2.20
Point 3	-0.0746		0.2454	-0.30
Point 4	0.3208		0.2265	1.42
Point 5	-0.0099		0.2830	-0.04
Point 6	0.4997	*	0.2944	1.70
Point 7	0.2549		0.2210	1.15
Point 8	-0.1174		0.2390	-0.49
Point 9	-0.8139		0.6434	-1.27
Point 10	0.3006		0.2239	1.34
Point 11	-0.6449	**	0.2657	-2.43
Point 12	-3.2773	***	0.7294	-4.49
Point 13	0.4484		0.4526	0.99
Point 14	0.2446		0.2481	0.99
Point 15	0.0471		0.2267	0.21
Point 16	0.0427		0.2200	0.19

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

Table 7.8: FIML Results: Hazard of First Marriage

First Marriage	Estimate		Std Error	Z
Constant	-2.6237	***	0.3696	-7.10
Woman's age 11 to 15	-0.4021	***	0.0566	-7.10
Woman's age 21 to 25	0.0157		0.0644	0.24
Woman's age 26 to 30	-0.2194	**	0.1120	-1.96
Woman's age 31 to 35	-0.9848	***	0.2071	-4.76
Woman's age 36 and up	-1.4229	***	0.4906	-2.90
Year is before 1976	-1.0677	***	0.1684	-6.34
Year is 1976 to 1980	-0.6959	***	0.1042	-6.68
Year is 1981 to 1985	-0.5423	***	0.0874	-6.21
Year is 1986 to 1990	-0.4621	***	0.0688	-6.72
Year is 1991 to 1995	-0.4289	***	0.0566	-7.58
Household in Urban area	-0.3265	***	0.1071	-3.05
Woman started but did not graduate Primary School	0.8874	***	0.0740	12.00
Woman Graduated Primary School	1.0459	***	0.0748	13.98
Woman Graduated Junior High School	1.3442	***	0.0791	16.99
Woman Graduated Senior High School	1.1318	***	0.0848	13.34
Woman Graduated University or higher	1.2468	***	0.1210	10.31
Woman can read	-0.6412	***	0.1764	-3.64
Woman can write	0.0356		0.1624	0.22
Woman attended school last year	-0.1551	**	0.0651	-2.38
Woman currently attends school	-0.8656	***	0.0804	-10.77
Schooling was available to woman	-0.0825		0.0611	-1.35
Family Planning Available in Puskesmas when woman age 7	-0.4071	***	0.0523	-7.79
Family Planning Available in Posyandu when woman age 7	-0.6773	***	0.0676	-10.03
Family Planning Available in Private Facility when woman age 7	-0.4708	***	0.0529	-8.89
Family Planning Available in Puskesmas now	0.1602	*	0.0885	1.81
Family Planning Available in Posyandu now	0.0896	*	0.0525	1.71
Family Planning Available in Private Facility now	0.1200	**	0.0582	2.06
Woman is fertile	1.5251	***	0.0837	18.23
Woman lives near her parents	0.5503	***	0.0633	8.70

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

7.4.4 First Marriage

The marriage equation predicts the probability of first marriage. No characteristics of the husband are contained in this equation, so this is not billed as a matching model. Only characteristics of the woman are considered, and family planning and family characteristics act as exogenous instruments. Indonesia embarked on a massive campaign to incorporate family planning materials and education into the communities, and the women in this sample were the primary recipients of that effort. It appears from the results obtained here those programs were successful. The presence of family planning programs in the Puskesmas, Posyandu, and private facilities in the woman's community when she resided at age seven all significantly decrease the probability of marriage. A decrease in the probability of marriage is representative of a delay in the age of first marriage; it does not indicate fewer women are getting married, although this may be the case. Many women in the sample are of the age where they will marry with high probability outside of the observed survey period. The presence of family planning available at the time of the marriage decision significantly and positively influences the marriage decision. The availability of contraception may be a driving force behind this decision.

Fertility of the woman is highly correlated to her age, and thus is positively associated with marriage. Women who live in the vicinity of her parents may have a motivation to leave the household, or have access to family support systems, this significantly and positively affects the decision to marry.

The woman's education variables are highly significant and positive, which implies completion of education milestones positively predicts marriage, as these indicators are all relative to no education. Summary statistics in Chapter 6 show women typically marry a few years after the completion of school. Literacy is a negative predictor of marriage.

Woman age 16 to 20 is the omitted category in the age analysis, and women age 21 to 25 had a insignificant but positive probability of marriage. All other age categories predict a significant decrease in the probability of marriage. This is consistent with the average age of first marriage. This is also consistent with the observed sample statistics.

The omitted year category in the analysis was 1996 through 1999. All other years prior to these years had a significant and decreased probability of marriage. Again, these year dummies correlate strongly to the age of the sample, and most likely do not contain any information about specific year effects.

7.4.5 Women's Employment

The employment equation predicts the probability of working in each of the four years spanning the financial crisis. Exogenous instruments for this analysis are producer prices, the presence of jobs in different industries, and the related wages for those industries. The price of gasoline positively and significantly predicts employment of the woman, whereas the price of sugar negatively and

Table 7.8a: Heterogeneity Parameters: Hazard of First Marriage

Conception	Estimate		Std Error	Z
Community Point 1	Normalized to Zero			
Point 2	-0.5073		0.3355	-1.51
Point 3	-0.1030		0.3404	-0.30
Point 4	-0.6416	*	0.3374	-1.90
Point 5	-0.5605	*	0.3416	-1.64
Point 6	-0.7394	**	0.3396	-2.18
Point 7	-0.0250		0.3572	-0.07
Individual Point 1	Normalized to Zero			
Point 2	-0.0985		0.2691	-0.37
Point 3	0.7311	***	0.2119	3.45
Point 4	0.4722	***	0.1730	2.73
Point 5	0.6770	**	0.3309	2.05
Point 6	-0.0799		0.2735	-0.29
Point 7	0.0924		0.2035	0.45
Point 8	0.6194	***	0.1747	3.55
Point 9	0.2298		0.3112	0.74
Point 10	0.3700	**	0.1467	2.52
Point 11	0.0301		0.4075	0.07
Point 12	0.7769	***	0.2144	3.62
Point 13	0.9977	**	0.3929	2.54
Point 14	0.3076	*	0.1861	1.65
Point 15	0.4495	***	0.1737	2.59
Point 16	-0.2917		0.1828	-1.60

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

significantly predicts the women will participate in the wage earning labor force. Industrial sector wages for women have no impact on the probability of working, however the presence of agricultural jobs and the wages received by women in those jobs significantly increases the probability a woman will work for a wage.

If a woman is married, she is less likely to work, and if she has children, she is more likely to work the more children she has. This result is counterintuitive; we would expect large households to require the mother to stay home and raise the children. It may be the demand for income in a large household is greater than the demand for the woman's contribution to household

Table 7.9: FIML Results: Woman Works for a Wage

Works For a Wage	Estimate		Std Error	Z
Constant	-2.6324		2.1692	-1.21
Married	-2.5518	**	1.1566	-2.21
Ever Married	-0.7033		0.7076	-0.99
Mother has 1 child	0.2741		0.2891	0.95
Mother has 2 children	1.0852	**	0.4382	2.48
Mother has 3 children	0.9156	**	0.4568	2.00
Mother has 4 children	1.3829	**	0.5580	2.48
Mother has 5 or more children	3.3816	***	0.7010	4.82
Husband's age 20 or younger	-1.6668	**	0.7402	-2.25
Husband's age 21 to 30	-0.7372	**	0.3298	-2.24
Husband's age 40 or older	0.1381		0.3184	0.43
Woman's age 11 to 15	-7.1817	***	0.7121	-10.09
Woman's age 16 to 20	-5.0327	***	0.5019	-10.03
Woman's age 21 to 25	-3.9973	***	0.4118	-9.71
Woman's age 26 to 30	-2.0101	***	0.3350	-6.00
Woman's age 31 to 35	-0.8693	***	0.2757	-3.15
Year 1996	-1.7508	***	0.3031	-5.78
Year 1997	-1.1853	***	0.2817	-4.21
Year 1998	-0.5678	***	0.1303	-4.36
Household in Urban area	-1.0923	**	0.4718	-2.32
Woman currently attends school	-0.6166		0.4324	-1.43
Woman started but did not graduate Primary School	2.3067	***	0.4265	5.41
Woman Graduated Primary School	1.4337	***	0.4785	3.00
Woman Graduated Junior High School	1.1936		0.6122	1.95
Woman Graduated Senior High School	1.7060	***	0.5050	3.38
Woman Graduated University or higher	2.9005	***	0.6846	4.24
Husband currently attends school	-0.4171		0.7998	-0.52
Husband did not graduate primary school	0.6061		0.4440	1.37
Husband Graduated Primary School	-0.4495		0.5187	-0.87
Husband Graduated Junior High School	-0.3607		0.5404	-0.67
Husband Graduated Senior High School	0.2009		0.5331	0.38
Husband Graduated University or higher	0.6601		0.6052	1.09
Husband is Self Employed	0.6531		0.5477	1.19
Husband is Unpaid Family Worker	0.5957		0.6961	0.86
Husband works for the government	4.6449	***	0.6845	6.79
Husband works for a corporation	0.7893		0.5006	1.58
Community is Underdeveloped	-0.4543		0.2944	-1.54
Main source of income in community is Farming	0.8130	***	0.3073	2.65
Average Community Price for Gasoline	0.6515	***	0.1913	3.41
Average Community Price for Salt	-0.1234		0.1511	-0.82
Average Community Price for Sugar	-1.7672	*	0.9922	-1.78
Community employs in the Industrial Sector	0.0149		0.3142	0.05
Average community industrial wage for women	-0.4148		0.4194	-0.99
Community employs in the Agricultural Sector	-1.3185	***	0.2802	-4.71
Average community agricultural wage for women	1.4320	***	0.4941	2.90

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

Table 7.9a: Heterogeneity Parameters: Woman Works for a Wage

Conception	Estimate		Std Error	Z
Community Point 1	Normalized to Zero			
Point 2	1.9906		1.8548	1.07
Point 3	4.1569	**	1.8829	2.21
Point 4	0.5573		1.9039	0.29
Point 5	3.4910	*	1.8391	1.90
Point 6	-0.1456		1.9033	-0.08
Point 7	0.6417		1.8961	0.34
Individual Point 1	Normalized to Zero			
Point 2	12.0733	***	1.2004	10.06
Point 3	-8.1463	***	1.7036	-4.78
Point 4	10.5862	***	0.7007	15.11
Point 5	-8.4985	***	1.2229	-6.95
Point 6	2.4524	***	0.7023	3.49
Point 7	-7.3108	***	1.5440	-4.74
Point 8	5.4942	***	0.5257	10.45
Point 9	-12.0589		19.7611	-0.61
Point 10	-10.6210	***	0.9630	-11.03
Point 11	-2.0842		1.2889	-1.62
Point 12	5.8776	***	1.0508	5.59
Point 13	-0.8986		0.8199	-1.10
Point 14	5.2666	***	0.5198	10.13
Point 15	-0.6450		0.5970	-1.08
Point 16	8.0595	***	0.7432	10.85

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

tasks, especially if other family resources are available such as other family member available to raise children.

The age of the woman indicates the younger the woman, the less likely she is to work. The woman is also less likely to work the younger the husband is. Urban households predict a woman is less likely to work relative to a rural household, also a very counterintuitive result. We should expect women in urban settings to be more likely to work. One possible explanation for this is labor opportunities for women in rural settings are driven by the availability of agricultural tasks.

Women with more education are more likely to work relative to women with no education, a very intuitive result. A husband's education has no impact on the wife's probability of working. The industry where the husband is employed does not

affect the woman's employment, unless the husband works as a government employee, which significantly increases the woman's probability of working for a wage.

7.4.6 Household Income

The exogenous instruments in the income equation consisted of producer prices and characteristics of the labor force in the community where the woman resides. Of the instruments in the analysis, five are significant. A community which predominates in farming has a significant decrease in income. Communities which predominate in social services have significantly higher income. Communities with either industrial or agricultural jobs have significantly lower income, and agricultural wages for women are positively and significantly related to income. Industrial wages for women are also positively related to household income, but not quite significant at the ten percent level. Higher wages offered to women will increase their propensity to work, and will therefore increase household income.

There are significant year effects, most likely due to the crisis. With inflation as it was throughout the crisis, real incomes were significantly higher in 1996 and 1997 relative to 1998 and 1999. Recall the crisis did not begin until July of 1997, and there would be some lag for the effects to trickle down to each community. Effects at the community level marketplace were most apparent by

Table 7.10: FIML Results: Income Equation

Income	Estimate		Error	Z
Constant	0.4028		0.3520	1.14
Year 1996	0.9554	***	0.0548	17.42
Year 1997	0.2582	***	0.0477	5.41
Year 1998	0.0097		0.0186	0.52
Married	-1.3969	***	0.2870	-4.87
Ever Married	0.3383		0.2610	1.30
Mother has 1 child	0.0881	*	0.0490	1.80
Mother has 2 children	0.2012	***	0.0597	3.37
Mother has 3 children	0.2946	***	0.0759	3.88
Mother has 4 children	0.2809	***	0.0942	2.98
Mother has 5 or more children	0.3999	***	0.1276	3.13
Husband's age 20 or younger	-0.0350		0.0950	-0.37
Husband's age 21 to 30	-0.0730	**	0.0350	-2.09
Husband's age 40 or older	0.0555		0.0396	1.40
Woman's age 11 to 15	0.0145		0.1390	0.11
Woman's age 16 to 20	-0.1630	*	0.0902	-1.81
Woman's age 21 to 25	-0.1290	*	0.0681	-1.90
Woman's age 26 to 30	-0.1105	**	0.0541	-2.04
Woman's age 31 to 35	-0.1179	***	0.0424	-2.78
Household in Urban area	0.3349	***	0.0841	3.98
Woman currently attends school	-0.0228		0.1029	-0.22
Woman started but did not graduate Primary School	-0.2081	***	0.0717	-2.90
Woman Graduated Primary School	-0.0123		0.0736	-0.17
Woman Graduated Junior High School	0.1229		0.0803	1.53
Woman Graduated Senior High School	0.2270	***	0.0847	2.68
Woman Graduated University or higher	0.5228	***	0.1027	5.09
Husband currently attends school	-0.2010		0.1493	-1.35
Husband did not graduate primary school	-0.1184		0.0735	-1.61
Husband Graduated Primary School	-0.0406		0.0714	-0.57
Husband Graduated Junior High School	-0.0081		0.0818	-0.10
Husband Graduated Senior High School	0.0252		0.0774	0.33
Husband Graduated University or higher	0.1416		0.1145	1.24
Woman Works For a Wage	1.2119	***	0.0799	15.16
Woman is Unpaid Family Worker	0.1299	**	0.0550	2.36
Husband is Self Employed	4.1109	***	0.1354	30.35
Husband is Unpaid Family Worker	0.6447	***	0.2151	3.00
Husband works for the government	4.2656	***	0.1475	28.91
Husband works for a corporation	4.0825	***	0.1376	29.66
Community is Underdeveloped	-0.0806	**	0.0368	-2.19
Main source of income in community is Farming	-0.0776	*	0.0410	-1.90
Main source of income in community is Manufacturing	0.0105		0.0309	0.34
Main source of income in com is Building Construction	0.0376		0.0403	0.93
Main source of income in com is Large Retail / Tourism	0.0192		0.0594	0.32
Main source of income in com is Social Services	0.0681	**	0.0347	1.96
Community employs in the Industrial Sector	-0.0614		0.0490	-1.25
Average community industrial wage for men	-0.0418		0.0457	-0.91
Average community industrial wage for women	0.0771		0.0598	1.29
Community employs in the Agricultural Sector	-0.1543	***	0.0474	-3.26
Average community agricultural wage for men	0.0290		0.0362	0.80
Average community agricultural wage for women	0.1414	**	0.0641	2.20
Estimated Standard Deviation	1.1574			

Table 7.10a: Heterogeneity Parameters: Income Equation

Conception	Estimate		Std Error	Z
Community Point 1	Normalized to Zero			
Point 2	1.1155	***	0.1771	6.30
Point 3	0.7913	***	0.1891	4.18
Point 4	0.7798	***	0.1935	4.03
Point 5	0.7918	***	0.1927	4.11
Point 6	0.5759	***	0.1779	3.24
Point 7	0.7401	***	0.1877	3.94
Individual Point 1	Normalized to Zero			
Point 2	2.3095	***	0.2835	8.15
Point 3	1.2801	***	0.1762	7.26
Point 4	0.0269		0.2008	0.13
Point 5	-3.6362	***	0.2332	-15.59
Point 6	0.3302		0.2215	1.49
Point 7	-0.7779	***	0.2046	-3.80
Point 8	0.7421	***	0.2276	3.26
Point 9	3.1913	***	0.2645	12.07
Point 10	0.9012	***	0.1726	5.22
Point 11	-1.5058	***	0.2326	-6.47
Point 12	0.3235		0.2478	1.31
Point 13	2.3331	***	0.3620	6.45
Point 14	-0.2388		0.3074	-0.78
Point 15	0.3766	**	0.1854	2.03
Point 16	1.8748	***	0.2362	7.94

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

early 1998, which is confirmed by the dummy variables. 1998 was not significantly different from 1999.

Marriage has a significantly negative impact on household income.[6] The presence of children seems to increase the demand for income, as households with more children seem to earn higher incomes. Recall there are no child wages included in the model, therefore that is not a possible explanation unless the parents report their child's earnings in their own income. No attempt was made to explore this possibility.

An increase in the age of the husband and wife each predict higher household income, best explained by a human capital formation argument.

[6] Draw your own conclusions from this.

Households in urban areas earn more than their rural counterparts, further supporting the argument for the agriculture instruments, which predict lower earnings in agricultural areas, located in rural communities. Women who finish senior high school or graduate from a university have significantly higher household income than those who did not attend school, most easily explained by a larger contribution to household income through higher wages offered to the higher educated wife. The husband's education is surprisingly insignificant, at all levels of education.

A woman working for a wage is positively and significantly associated with household income. Less interesting, but more puzzling is the significance of those unpaid women still predicting a higher household income. The model restricts woman who report themselves as unpaid family workers, but report a positive wage to be recoded as working for a wage. Thus there is some other phenomenon occurring with the husband's income. Perhaps husbands who have higher income are economically stable enough to allow for opportunities for their wives to perform other duties in the household, or more likely, from a survey standpoint, the husband is claiming the economic benefit reaped by the wife in their survey responses.

The husband's employment is as expected highly positive and significant, with the highest paid employees reporting government employment, followed by self employment, and then corporate employees.

7.4.7 Per-Capita Consumption

The final equation in the seven equation model predicts the level of household consumption. As in the income equation, this continuous equation's coefficients are interpretable from the perspective of sign, significance and magnitude. The exogenous time varying instruments in this model are the producer prices and community employment characteristics as measured before and after the crisis. The indicator for community development predicts underdeveloped communities to experience significantly lower consumption. Communities with a focus on agriculture have significantly lower household consumption, yet women's wages in the agricultural sector predict higher household consumption.

Because consumption is measured only in 1997 and 2000, the later which acts as a proxy for consumption in 1999, there are only half as many observations in the data as there are for income and employment. Because of this, an indicator for 1999 is the omitted category, and the indicator for 1997 is significantly positive, indicating higher consumption before the crisis.

Table 7.11: FIML Results: Consumption Equation

Per-Capita Consumption	Estimate		Std Error	Z
Constant	4.3029	***	0.2106	20.43
Year 1997	0.0696	**	0.0312	2.23
Household Income	0.0015		0.0089	0.17
Married	0.0193		0.1225	0.16
Ever Married	-0.2445	**	0.1081	-2.26
Mother has 1 child	-0.0665	*	0.0361	-1.84
Mother has 2 children	-0.0136		0.0505	-0.27
Mother has 3 children	-0.0247		0.0690	-0.36
Mother has 4 children	-0.1162		0.0850	-1.37
Mother has 5 or more children	-0.2421	**	0.0991	-2.44
Husband's age 20 or younger	0.0137		0.0702	0.20
Husband's age 21 to 30	-0.0995	***	0.0298	-3.34
Husband's age 40 or older	0.0317		0.0281	1.13
Woman's age 11 to 15	-0.3447	***	0.0746	-4.62
Woman's age 16 to 20	-0.2780	***	0.0646	-4.30
Woman's age 21 to 25	-0.2428	***	0.0572	-4.25
Woman's age 26 to 30	-0.1495	***	0.0433	-3.45
Woman's age 31 to 35	-0.0693	**	0.0293	-2.37
Household in Urban area	0.5130	***	0.0658	7.79
Woman currently attends school	0.1834	***	0.0596	3.08
Woman started but did not graduate Primary School	-0.0480		0.0375	-1.28
Woman Graduated Primary School	-0.0196		0.0376	-0.52
Woman Graduated Junior High School	0.0846	*	0.0449	1.88
Woman Graduated Senior High School	0.1057	**	0.0494	2.14
Woman Graduated University or higher	0.3347	***	0.0791	4.23
Husband currently attends school	0.0288		0.1328	0.22
Husband did not graduate primary school	-0.0891	*	0.0463	-1.92
Husband Graduated Primary School	-0.0695		0.0504	-1.38
Husband Graduated Junior High School	-0.0575		0.0542	-1.06
Husband Graduated Senior High School	0.0764		0.0525	1.46
Husband Graduated University or higher	0.1763	**	0.0765	2.30
Woman Works For a Wage	0.0193		0.0485	0.40
Woman is Unpaid Family Worker	0.0446		0.0301	1.48
Husband is Self Employed	0.1186	*	0.0689	1.72
Husband is Unpaid Family Worker	0.1270	*	0.0766	1.66
Husband works for the government	0.2339	***	0.0747	3.13
Husband works for a corporation	-0.0065		0.0675	-0.10
Community is Underdeveloped	-0.1473	***	0.0279	-5.28
Community employs in the Agricultural Sector	-0.1290	***	0.0372	-3.47
Average community agricultural wage for men	-0.0058		0.0415	-0.14
Average community agricultural wage for women	0.2005	***	0.0518	3.87
Estimated Standard Deviation	0.5674			

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

Table 7.11a: Heterogeneity Parameters: Consumption Equation

Conception	Estimate		Std Error	Z
Community Point 1	Normalized to Zero			
Point 2	0.5762	***	0.0977	5.90
Point 3	0.3501	***	0.0909	3.85
Point 4	0.2378	**	0.1096	2.17
Point 5	-0.0224		0.0979	-0.23
Point 6	0.2030	**	0.0919	2.21
Point 7	0.0939		0.1319	0.71
Individual Point 1	Normalized to Zero			
Point 2	1.6097	***	0.2555	6.30
Point 3	1.5294	***	0.1659	9.22
Point 4	0.7710	***	0.1362	5.66
Point 5	0.7582	***	0.1502	5.05
Point 6	0.8853	***	0.1893	4.68
Point 7	0.5525	***	0.1192	4.64
Point 8	1.3874	***	0.1937	7.16
Point 9	1.1800	***	0.2357	5.01
Point 10	0.6814	***	0.0957	7.12
Point 11	1.4465	***	0.1512	9.57
Point 12	0.6438	***	0.1967	3.27
Point 13	0.7022	***	0.1544	4.55
Point 14	0.6427	***	0.1463	4.39
Point 15	0.9395	***	0.0781	12.03
Point 16	0.5258	***	0.1702	3.09

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

Marriage predicts a decline in per-capita consumption.[7] The model has controlled for household size through the number of children indicators, and so it may seem those who live alone may have higher consumption. This is consistent with Caldwell's theories of societies becoming more consumption driven, and thus focusing more on economic advancement rather than the family. An increasing number of children present in the household decreases the amount of per-capita consumption. Again, this is very intuitive and predicted by the theoretical model: A larger number of individuals in the household naturally dilutes the available resources available to all other members of the household. This also validates that children in Indonesia are overall an economic burden, and not a short term supply of

[7] Same as footnote 1

income producing labor, as can be the case in underdeveloped countries. If the parents in the household have consumption driven aspirations, as most individuals do, a decline in fertility seems an obvious method with which to increase available intra-household resources.

The husband's age is insignificant at all levels. The woman's age is positively predictive of per-capita consumption, with all age levels lower than the over thirty five category significantly lower. Households in urban areas have significantly higher consumption. This is also consistent with Caldwell's theories where individuals more interested in success and economic advancement naturally migrated towards cities and urban areas, creating more economic opportunities and advancement.

The education of the parents is for the most part insignificant compared to the omitted category (no education) with the exception of university degrees. Both men and women who graduate from college have significantly higher per-capita consumption, proving the value of higher education.

The employment status of the woman and her husband are positively correlated with household consumption, as is household income, however, surprisingly none of these variables are significant at even the 10% level. Only if the husband works as a government employee is the per-capita consumption significantly increased.

7.5 Comparison of Methods

Inclusion of the six additional equations and sixteen individual and seven community heterogeneity mass points eliminated some of the bias caused by unobserved heterogeneity. This section compares the coefficients from the main conception equation as they were estimated with no heterogeneity controls and FIML DFM (heterogeneity controlled). Overwhelmingly, the coefficient estimates were extremely similar. It is worthwhile to note here the few major implications of controlling for heterogeneity.

The inclusion of previous births accounts for household demand for children. The marriage equation controls for the sample selection problem in the model where only women who were ever married participated in the survey and as such were included in the dataset. The remaining 4 equations; education, employment, income, and consumption are all intended to control for endogeneity bias these variables may have on the probability of birth and other variables in the model.

Coefficients on the year effects, marriage variables, education, husband's age and employment, the urban indicator, household income, and the hardship indicator are all indistinguishable between the two different models.

Per-capita consumption is no longer significant in the controlled model, though the magnitude and sign of the coefficient estimate is relatively unchanged, further indicating that changes in consumption have very small effects on fertility.

Table 7.12 displays the most notable differences between the two analyses. First is the woman's employment, which was predicted to be highly endogenous in this fertility model. In the uncontrolled model, a woman working for a wage is

predicted to have significantly lower probability of conceiving a child, whereas in the DFM model, where the endogeneity of the women's employment is controlled for through the exogenous producer price and employment characteristic instruments, the woman's employment status no longer plays a significant role in the decision to conceive a child. The unpaid family worker characteristic is identical between the two models.

The next notable differences are the indicators for the number of children already present in the household. Though the sign and significance is unchanged between the two models, the magnitude of the coefficients in the DFM model are consistently higher in magnitude, predicting a more dramatic decline in the probability of conception in the DFM model when considering existing children in the household. This is confirmed through simulations using both sets of parameters, and is reported in Chapter 8.

Finally, the education of the woman is very different between the models. In the uncontrolled model, all education variables predict an increase in the probability of conception relative to no education. The more education a woman obtained, the higher the probability of conception. In the controlled model, higher education, although insignificant, takes on the expected negative sign, indicating higher education predicts a decrease in fertility.

Table 7.12 : Comparison of FIML DFM to Uncontrolled estimates

Conception	Estimate (DFM)		Estimate (Uncontrolled)	
Constant	-3.4808	***	-4.5999	***
Year 1996	-0.2124	***	-0.2676	***
Year 1997	-0.5349	***	-0.5701	***
Year 1998	-0.4480	***	-0.4597	***
Household Income	0.0162		0.0004	
Household Consumption	-0.0534		-0.1460	***
Household Experienced a Hardship (Death, Sickness,…)	-0.1712	*	-0.1885	
Married	1.9391	***	1.8730	***
Ever Married	1.8248	***	1.4534	***
Mother has 1 child	-2.0771	***	-1.6526	***
Mother has 2 children	-2.8535	***	-2.2530	***
Mother has 3 children	-2.9350	***	-2.2435	***
Mother has 4 children	-2.6822	***	-1.8926	***
Mother has 5 or more children	-2.8897	***	-1.9886	***
Household in Urban area	0.5880	***	0.5502	***
Woman started but did not graduate Primary School	-0.0194		0.0013	
Woman Graduated Primary School	-0.0778		-0.0118	
Woman Graduated Junior High School	-0.0465		0.0582	
Woman Graduated Senior High School	-0.0409		0.1431	
Woman Graduated University or higher	0.0037		0.2481	
Husband did not graduate primary school	0.0376		-0.0810	
Husband Graduated Primary School	-0.1520		-0.2213	*
Husband Graduated Junior High School	-0.0265		-0.0994	
Husband Graduated Senior High School	-0.0932		-0.1019	
Husband Graduated University or higher	-0.0400		0.0162	
Woman Works For a Wage	0.1142		-0.3470	***
Woman is Unpaid Family Worker	-0.3132	***	-0.3208	***
Husband is Self Employed	0.0049		0.0868	
Husband is Unpaid Family Worker	0.0881		0.1127	
Husband works for the government	0.0726		0.2026	
Husband works for a corporation	-0.0096		0.0693	

* = Significant at the 10% level;** = Significant at the 5% level;*** = Significant at the 1% level

CHAPTER 8

SIMULATIONS

8.1 Overview

Logit models such as the one estimated in this dissertation produce coefficient estimates that are interpretable with regards to direction and statistical significance, however the magnitudes of these coefficients are not immediately quantitatively interpretable with respect to the dependent variable. In order to calculate the marginal effects of the coefficients obtained through the full information maximum likelihood estimation using the discrete factor method, simulations must be run.

To perform these uni-variate simulations, the following tasks are executed: First, a single characteristic variable within the original dataset is modified to a single value for the entire sample. For example, to estimate the marginal effects of unemployment, all the employment variables for every woman in the sample are simultaneously set to zero. Second, the coefficient estimates produced by the DFM estimation are perturbed according to a multivariate normal distribution. Third, the predicted probability of conception is calculated by year, individual, and for each combination of community and individual heterogeneity. Finally, the estimated heterogeneity weights are used to calculate a probability weighted average of each probability of conception for the four years spanning the financial crisis, with the

overall probability of conception computed as a simple average of each of the individual year estimates. This calculation is iterated ten thousand replications, and the resulting normally distributed probabilities are averaged and reported in the following tables.

The first simulation was performed with no alterations to the data, and is denoted the base case. This base case utilizes the predicted parameters and heterogeneity coefficients from the DFM results reported in chapter 7 with 16 individual and 7 community mass points. This estimation predicted the women in the sample, who are aged 15 to 35 in 1996, have an average per year probability of conceiving a child of 19.3%. Notice the sharp decline in fertility predicted in 1997, measured as an absolute 3% decline in fertility, or in relative terms, a 16% decline in the probability of conception in the year the crisis began. Recall from earlier discussions the catalyst which caused the financial crisis emerged in July of 1997. The initial decline from 1996 to 1997 may either be noise in the model, or may be due to the crisis, though we would expect the true marginal effects of the crisis to be understated in the data because the crisis began in July and lagged in its effects on individuals, thus the true impacts of the crisis were only felt for a fraction of 1997. Fertility increases in 1998 back to the levels observed in1996. The number of conceptions explodes in 1999, a relative 38% increase, or an absolute 6.8% increase from the previous year, either from delayed births from previous years, or a true increase in the probability of conception as a result of the financial crisis.

These baseline measurements provide the true predicted probability of conception based on the data and the estimated coefficients. All subsequent

simulations provide a means to determine marginal effects of specific parameters. Within each analysis, the baseline results are reported in the table as a comparator to the results derived from each simulation. Section 8.2 focuses on the simulations of economic variables in the conception equation. Section 8.3 discusses household endogenous variables which have been previously discussed as critical factors in the conception decision, and section 8.4 provides a brief comparison of endogenous variables showing different results between the controlled and uncontrolled analysis.

8.2 Simulations of Economic Variables

The theoretical model is based on a change in real income from before to after the crisis, and is proxied for by real per-capita consumption measured in 1997 (before the crisis) and again in 2000, after the effects of the crisis had dissipated. Table 8.1 displays the results of the uni-variate analysis of fixing per-capita consumption at various levels. Average per-capita consumption is 1.1 million Rp, therefore the first simulation simulates very poor households. Imposing a level of consumption of 16,318 (The lowest recorded level of consumption in the model is 17,189 Rp) results in a probability of conception of 21%, a 2% absolute relative increase from baseline. Increasing consumption to levels equal to the highest consumption recorded in the sample of 28.7 million Rp decreases the probability of conception by 2%. Absolute levels of consumption, though insignificant, do exert an influence on the probability of conception, lending further to the claim children are inferior in this sample. Plotting the average change in conception with respect to the log of per-capita consumption results in a linear series with a slope of -.43, which

implies a change in the probability of conception of roughly one-half of one percent given a change of one in the log of per-capita consumption. The overall result obtained from this analysis shows the magnitude of the fertility increase given a decline in per-capita consumption is very small, and conversely, the decrease given an increase in consumption is also quite small. The results of this analysis display how changes in consumption have a small impact on the overall fertility within the household.

95% confidence intervals are included in tables 8.1 and 8.1a, but are omitted for the subsequent tables, as the results show over 10,000 iterations, the sampling error is quite small, resulting in well confined intervals. Table 8.1a displays the results of simulations where the per-capita consumption of a household is altered by a discrete percentage. Again, this analysis shows how negative changes in the household economy result in very small increases in the probability of conception.

Table 8.1: The Effects of Altering Per-Capita Consumption to a Value

Total Consumption	All Years	1996	1997	1998	1999
Baseline	19.05%	18.26%	15.49%	17.90%	24.56%
16,318	21.45%	20.6% ± 0.17	17.61% ± 0.17	20.21% ± 0.16	27.4% ± 0.16
59,874	20.61%	19.77% ± 0.15	16.86% ± 0.15	19.39% ± 0.15	26.41% ± 0.14
442,413	19.37%	18.56% ± 0.13	15.77% ± 0.13	18.2% ± 0.13	24.94% ± 0.11
3,269,017	18.29%	17.52% ± 0.14	14.85% ± 0.14	17.17% ± 0.14	23.62% ± 0.13
24,154,953	17.34%	16.6% ± 0.17	14.06% ± 0.17	16.27% ± 0.16	22.43% ± 0.16

Table 8.1a: The Effects of Altering Per-Capita Consumption by a Percentage

Percent Change Consumption	All Years	1996	1997	1998	1999
Baseline	19.05%	18.26%	15.49%	17.90%	24.56%
-1%	19.06%	18.26% +/- 0.13	15.5% +/- 0.13	17.9% +/- 0.12	24.56% +/- 0.11
-5%	19.08%	18.28% +/- 0.13	15.52% +/- 0.13	17.92% +/- 0.12	24.59% +/- 0.11
-10%	19.11%	18.31% +/- 0.13	15.55% +/- 0.13	17.95% +/- 0.12	24.63% +/- 0.11
-15%	19.14%	18.35% +/- 0.13	15.57% +/- 0.13	17.98% +/- 0.12	24.67% +/- 0.11
-20%	19.18%	18.38% +/- 0.13	15.6% +/- 0.13	18.02% +/- 0.12	24.71% +/- 0.11
-25%	19.21%	18.41% +/- 0.13	15.63% +/- 0.13	18.05% +/- 0.12	24.75% +/- 0.11
-50%	19.45%	18.64% +/- 0.13	15.84% +/- 0.13	18.28% +/- 0.13	25.04% +/- 0.11

Table 8.2 displays the changes to the probability of conception based on percentage changes to the household income. As can be seen in the table, income changes have no effect on the probability of conception, as was also predicted in chapter 7 by the consistent insignificance of the income coefficient estimate under different model specifications.

Table 8.2: The Effects of Imposing Income Changes

Income Change (%)	All Years	1996	1997	1998	1999
Baseline	19.3%	18.5%	15.6%	18.1%	24.9%
5%	19.2%	18.5%	15.6%	17.9%	24.8%
10%	19.2%	18.5%	15.5%	17.9%	24.8%
15%	19.2%	18.4%	15.5%	17.9%	24.8%
20%	19.1%	18.4%	15.5%	17.9%	24.7%
30%	19.1%	18.4%	15.5%	17.8%	24.7%
50%	19.0%	18.3%	15.4%	17.7%	24.6%
75%	18.8%	18.1%	15.2%	17.6%	24.3%
99%	18.1%	17.4%	14.6%	16.8%	23.4%

Table 8.3 displays the impact of a loss to the household. This variable includes individual economic and non-economic losses. The simulation results show houses who report a loss of any sort in the survey are likely to have an average 1.7% absolute decrease in the probability of conception.

Table 8.3: The Effects of a Loss to the Household

Income Change (%)	All Years	1996	1997	1998	1999
Baseline	19.3%	18.5%	15.6%	18.1%	24.9%
No Loss	19.4%	18.5%	15.7%	18.3%	25.1%
Loss	17.7%	16.9%	14.3%	16.7%	23.1%

8.3 Simulations of Household Variables

In addition to analysis of the economic variables, I performed simulations on structural household variables. The results presented in chapter 7 indicate some of these variables may exert a larger impact on fertility than the economic variables. I next altered the number of children present in the household. The coefficients on the number of children have consistently carried tremendous magnitudes and significance relative to other variables in the model regardless of the specification of the model. Therefore I expected this simulation to display the largest effects on the probability of conception. As displayed in table 8.4, this was exactly the case. Households without any children entering the period of interest in 1996 have greater than a 50% annual chance of having their first child. Following the first child, the probability of having additional children falls off rapidly after the birth of the first child, and continues to decline with the addition of more children, with the minor exception of the state of having four children: The probability of having a fifth child is higher than the probability of having a fourth child, indicating some large family effects, possibly indicating a bimodal distribution of children, with the second mode at some family size larger than four children.

Very similar to the total number of children in the household simulation, I instead added children to the previous number of existing children. The most

Table 8.4: The Effects of Modifying the Number of Children Present in the Household

Number of Children in the Household	All Years	1996	1997	1998	1999
Baseline	19.3%	18.5%	15.6%	18.1%	24.9%
0 Kids	51.8%	48.5%	45.6%	50.5%	62.6%
1 Kid	18.1%	17.4%	14.5%	16.5%	24.1%
2 Kids	10.4%	10.0%	8.2%	9.3%	14.0%
3 Kids	10.1%	9.7%	8.0%	9.0%	13.6%
4 Kids	11.9%	11.4%	9.4%	10.7%	16.0%
5 Kids	10.2%	9.9%	8.1%	9.2%	13.8%

notable result from this analysis, displayed in table 8.5, is how the probability of conception quickly falls to the lower bound around 10% per year with the addition of only one child, indicating many households may be close to or have already achieved their target fertility.

Table 8.5: The Effects of Increasing the Number of Children Present in the Household

Add to the number of children in the household	All Years	1996	1997	1998	1999
Baseline	19.3%	18.5%	15.6%	18.1%	24.9%
+ 1 Kid	11.6%	11.2%	9.1%	10.5%	15.7%
+ 2 Kids	10.6%	10.2%	8.4%	9.5%	14.3%
+ 3 Kids	10.7%	10.3%	8.4%	9.6%	14.4%
+ 4 Kids	10.5%	10.1%	8.3%	9.4%	14.1%
+ 5 Kids	10.2%	9.9%	8.1%	9.2%	13.8%

Table 8.6 displays the effects of modifications to the woman's age. The woman's current age was modified by adding varying years to her current age. Adding one or two years to the current age results in no change in the probability of conception. Aging the woman by more than five years decreases the probability of conception by a small amount, indicating births are distributed across a wide range of ages throughout the sample of women.

Table 8.7 displays the effects of setting all women's labor force participation status to unemployed. This does not change their probability of conception as

Table 8.6: The Effects of the Woman's Age

Age	All Years	1996	1997	1998	1999
Baseline	19.3%	18.5%	15.6%	18.1%	24.9%
+ 1 year	19.5%	18.6%	15.7%	18.4%	25.2%
+ 2 year	19.4%	18.7%	15.8%	18.2%	24.9%
+ 5 year	19.1%	18.5%	15.6%	18.1%	24.4%
+ 10 year	17.8%	17.3%	14.6%	16.8%	22.5%
+ 20 year	15.0%	14.4%	12.1%	14.1%	19.4%

compared to the baseline analysis. If all women are working for a wage, then the probability increases by one absolute percentage point. However, the largest change is observed for those women working without earning a wage. These women predict a relative 16 percent decrease, or an absolute 3% decrease in the probability of conception. This provides further evidence for the claim that at the margin, women devoting energies to the labor force are more likely to have children if they are formally compensated.

Table 8.7: The Effects of Woman's Employment Status

Woman's Employment	All Years	1996	1997	1998	1999
Baseline	19.3%	18.5%	15.6%	18.1%	24.9%
Unemployed	19.1%	18.4%	15.4%	18.0%	24.7%
Unpaid Family Worker	16.1%	15.5%	12.9%	15.1%	21.0%
Working for Wage	20.8%	20.0%	16.9%	19.6%	26.7%

Table 8.8 displays the endogenous education variables. In the coefficient estimate results, the insignificance of the education variables was determined, and through this simulation, it can be seen the marginal effects on the probability of conception are negligible.

The next simulation, displayed in table 8.9 provides the effects of marital status on the probability of conception. Never married women have the expected very low probability of conception. Women ever married, but currently not married have a probability of conception roughly one third that of married women.

Table 8.8: The Effects of Woman's Education

Woman Ed	All Years	1996	1997	1998	1999
Baseline	19.3%	18.5%	15.6%	18.1%	24.9%
No education	20.0%	19.2%	16.2%	18.9%	25.9%
Some Primary Ed	19.3%	18.5%	15.6%	18.2%	25.0%
Grad Prim	18.8%	18.0%	15.1%	17.6%	24.3%
Grad Jr. High	19.4%	18.6%	15.7%	18.3%	25.1%
Grad Sr. High	19.4%	18.6%	15.7%	18.3%	25.1%
Grad College	20.6%	19.7%	16.7%	19.4%	26.4%

Table 8.9: The Effects of Marital Status

Marriage	All Years	1996	1997	1998	1999
Baseline	19.3%	18.5%	15.6%	18.1%	24.9%
No marriage	2.8%	3.4%	2.5%	2.5%	3.0%
Currently Married	27.2%	31.6%	24.8%	24.5%	28.1%
Ever married, not currently married	10.3%	12.4%	9.1%	9.1%	10.7%

As discovered in chapter 7, the urban indicator produced a coefficient estimate which was counterintuitive. I felt it was important to report the results of the simulation on the urban indicator, because it truly was surprising that urban households predicted a higher probability of conception, simply because urban households generally have smaller families than rural households, whose economy is traditionally dominated by agriculture. In this dataset however, it is urban households who indicate a higher absolute probability of conception by 2%, as observed in table 8.10. The marginal effect of this coefficient is small, but still significant. One possible interpretation of this, though totally unsubstantiated, is that because urban households were more impacted by the crisis, the urban indicator is in some way another proxy for the financial crisis, and thus urban households increased their fertility as a response to the crisis.

Table 8.10: The Effects of Urban Vs. Rural

Residence	All Years	1996	1997	1998	1999
Baseline	19.3%	18.5%	15.6%	18.1%	24.9%
All Rural	18.2%	17.4%	14.7%	17.2%	23.7%
All Urban	20.2%	19.3%	16.4%	19.0%	26.0%

8.4 Simulation comparisons using Uncontrolled Results

As a final comparison, simulations on the variables whose coefficients varied between the heterogeneity controlled and uncontrolled models were performed using the heterogeneity uncontrolled coefficient estimates. The results from these analyses give an idea of the changes to the marginal effects of the coefficients from the uncontrolled analysis to the heterogeneity controlled analysis. Below I present the results of those simulations and discuss the differences between them and the heterogeneity controlled results presented in the previous section. The baseline results were recalculated using the procedure discussed above, but with the uncontrolled heterogeneity coefficients presented in section 7.2. The baseline probability differed from the original baseline probability by 0.2% points, indicating the two models are comparable using this method.

Heterogeneity uncontrolled and controlled results presented differing significances of the effects of per-capita consumption on the probability of conception. I first compare the effects of varying per capita consumption using the uncontrolled heterogeneity results to see what effects these modifications have compared to the heterogeneity controlled model. The analysis shows a similar increase in the probability of conception following a decrease in consumption, however the magnitude of this shift is miniscule. A 50% decrease in per-capita consumption indicates a .5% decrease in the probability of conception. The difference in the probability between the poorest group and the richest group is a 5.8% decrease in the uncontrolled results versus a 3.1% decrease in the

heterogeneity controlled results. Controlling for the heterogeneity within the model caused a decrease in the marginal effect of consumption.

Table 8.11 presents the marginal effects from the number of children currently in the household on the probability of conceiving another child. As previously discussed, these variables exerted the largest effects on the entire model. The effects using the uncontrolled model produced more muted effects. For example, no children indicates a probability of 43.3%, but with the heterogeneity controlled coefficients, the probability was higher at 51.8%. At the opposite end of the scale, having five or more children in the household predicts a decline in probability to 13.6%, whereas in the controlled model, this probability was lower, at 10.2%. This is all consistent with the findings in chapter 7, where the magnitudes of the coefficients on the family size variables in the controlled model were larger than in the uncontrolled model.

Table 8.11: The Effects of Modifying the Number of Children Present in the Household Using Uncontrolled Coefficients

Number of Children in the Household	All Years	1996	1997	1998	1999
Baseline	19.1%	18.3%	15.5%	17.9%	24.6%
0 Kids	43.3%	41.0%	37.3%	41.6%	53.4%
1 Kid	17.3%	16.5%	13.9%	15.8%	22.8%
2 Kids	11.4%	10.9%	9.1%	10.4%	15.2%
3 Kids	11.6%	11.1%	9.2%	10.5%	15.4%
4 Kids	14.5%	13.9%	11.6%	13.2%	19.2%
5 Kids	13.6%	13.1%	10.9%	12.4%	18.1%

The next set of variables which appeared significantly different between the controlled and uncontrolled analyses was the set of woman's employment variables. The most notable difference observed in table 8.12 is the predicted probability for those women working for a wage. In this uncontrolled model, the probability is much lower than the baseline and unemployed predicted probabilities. It is also

significantly lower than the predicted probability when all women are working for a wage using the heterogeneity controlled model which controls for the endogeneity of the woman's labor force participation. In this uncontrolled mode the marginal effects of working for a wage cause a decline in the probability of conception, whereas in the controlled model, working for a wage is slightly higher than baseline and unemployed.

Table 8.13 displays the effects of the woman's education variables. These endogenous variables were shown to have different coefficient estimates between the controlled and uncontrolled models. The uncontrolled model indicates larger marginal effects on the probability of conception as predicted through the set of education variables. This quantifies the claims made in chapter 7 which stated the education of the woman becomes insignificant once the endogeneity of education was controlled for in the multi-equation model.

The simulations using the uncontrolled coefficients produced the expected results based on the analysis in section 7.4. The controlled model produced larger marginal effects on the variables indicating the household size, and smaller marginal effects on education and employment, indicating the heterogeneity controls eliminated the effects of education and employment, while placing more emphasis on household structural factors such as household composition. This could indicate fertility plans are not subject to sudden changes in short run economic shocks at the margin, but are more deeply rooted in structural beliefs about family size and dynamic.

Table 8.12: The Effects of Woman's Employment Status Using Uncontrolled Coefficients

Woman's Employment	All Years	1996	1997	1998	1999
Baseline	19.1%	18.3%	15.5%	17.9%	24.6%
Unemployed	20.6%	19.7%	16.7%	19.4%	26.6%
Unpaid Family Worker	17.3%	16.5%	13.9%	16.2%	22.5%
Working for Wage	16.9%	16.1%	13.6%	15.8%	22.0%

Table 8.13: The Effects of Woman's Education Using Uncontrolled Coefficients

Woman Ed	All Years	1996	1997	1998	1999
Baseline	19.1%	18.3%	15.5%	17.9%	24.6%
No education	18.4%	17.7%	14.9%	17.3%	23.8%
Some Primary Ed	18.6%	17.9%	15.1%	17.5%	24.0%
Grad Prim	18.5%	17.7%	14.9%	17.3%	23.8%
Grad Jr. High	19.1%	18.4%	15.5%	18.0%	24.6%
Grad Sr. High	20.3%	19.6%	16.5%	19.1%	26.0%
Grad College	22.0%	21.2%	18.0%	20.7%	27.9%

CHAPTER 9

CONCLUSIONS

The Asian Financial Crisis impacted Indonesians across the archipelago. This study specifically examines how couples altered their fertility plans in reaction to financial shocks. Most studies which examine income effects on fertility are performed on a macro scale and thus do not adequately control for the confounding effects of increases in child quality accompanying economic development. This study examines households over a short period in which the economic landscape exhibited large fluctuations. I assume child quality is held constant due to the rapid nature of the onset and departure of the financial crisis eliminating the opportunity for households to adjust child quality levels.

I first developed a simple theoretical model which predicts that the desired number of children will decrease as the mother's education rises, which causes her future earning potential in the labor force to rise. Additional children negatively impact the mother's leisure time, consumption, sibling quality, the mother's ability to work. which consequently decreases household income, per-capita consumption, quality of other children, and negatively impacts the mother's future wage potential by decreasing her current workforce experience. The model leaves the determination of the income effect with respect to the quantity of children uncertain and to be answered as an empirical question.

To estimate the effects of the financial crisis, I employed this theoretical model to motivate the development of a seven equation empirical model to estimate the probability of conception during each of the four years surrounding the Asian financial crisis. The main equation is modeled as a multiple spell hazard where the dependent variable is whether or not a woman conceived a child in a given year, assuming a logistic distribution of the error term. The remaining six equations model previous live births of the mother, education and employment of the mother, marital status, household income, and per-capita consumption.

To identify changes in fertility behavior in response to individual financial shocks, measured by changes in per capita consumption and household income, I estimated the empirical model using data from the Indonesian Family Life Survey, an individual level economic and socio-demographic dataset. The survey followed 4076 women from age seven through 1999, resulting in over 124-thousand woman-year observations in the dataset, with over 16 thousand woman-year observations from 1996 through 1999. I used time varying data constructed from all three waves of the IFLS to construct a dynamic picture of each woman's life with regards to education, marital status, conceptions and births, income and employment, and several community level variables, some of which serve as exogenous exclusion restrictions to aid in identification of the model.

The model framework is designed to estimate the probability of conception while controlling for sample selection and the endogeneity of education, female labor force participation, income, and consumption. To control for the heterogeneity in the model, the seven equations are simultaneously estimated using the full information

maximum likelihood discrete factor method estimation technique. The model was specified with 16 individual and 7 community level heterogeneity mass points. The entire model contained 747 parameters and was estimated using a proprietary estimation package coded in FORTRAN.

Household income imposes no effects on conception, uncontrolled results indicate households with a decrease in per-capita consumption are more likely to conceive children, however this coefficient is not significant in the heterogeneity controlled model, though the sign and magnitude remain the same. Households who experience a hardship predict a significant decline in the probability of conception. Simulations predict changes in the log of per-capita consumption impose no effect on the probability of conception, specifically a one percent change in the log of per-capita consumption results in no noticeable change in the probability of conception. Therefore children appear to be neither inferior goods nor normal goods during the four years surrounding the financial crisis in Indonesia.

Economic effects may exert a small but existent impact on the probability of conceiving a child, however, the probability of conceiving an additional child is most determined by the existence of other children in the household, the mother's age, and marital status. Though this model does not incorporate target fertility as a variable, I believe target fertility plays a large role in any family's fertility decision, and thus families plan for the number and spacing of children, and in the absence of catastrophic events, indicated by the household loss variable, or tremendous shifts in real income (proxied for by per-capita consumption), these plans remain largely unchanged, as indicated by the magnitude and significance of the coefficients on

existing children. Families with less significant positive or negative impacts to their economies appear to have no altered fertility response due to the economic crisis.

Controlling for the endogenous variables in the model resulted in a decrease in the significance of consumption, education, and employment with regards to the probability of conception. The presence of other children in the household coefficients increased in magnitude. From this, I conclude that fertility preferences are more structurally rooted in cultural factors and permanent economic factors than in short run financial shocks. The results are robust to alternate specifications of the model, and the model identification is enhanced by exclusion restrictions which are correlated with explanatory variables in the main equations, but not with the probability of conception.

This dissertation provides a thorough examination of the climate in Indonesia during the financial crisis with regards to changes in fertility preferences. I confirm many of the significant findings of Angeles, Guilkey and Mroz (2005), and provide an additional perspective on the woman's fertility decision with regards to short term financial shocks. Policy makers are interested in knowing the determinants of fertility, as many societies will be faced with questions of how to deal with aging populations as fertility rates in first world countries continue to fall. This work may indicate to policy makers around the world how the populations served react to changing financial climates with regards to fertility.

APPENDIX I

COMPLETE RESULTS TABLES

Table A.1: Uncontrolled Results: Conception Equation

Conception	Estimate		Std Error	Z
Constant	-4.5999	***	0.6134	-7.50
Married	1.8730	***	0.4959	3.78
Ever Married	1.4534	***	0.4864	2.99
Household Income	0.0004		0.0187	0.02
Household Consumption	-0.1460	***	0.0351	-4.16
Household Experienced a Hardship (Death, Sickness,…)	-0.1885		0.0967	-1.95
Woman Works For a Wage	-0.3470	***	0.0611	-5.68
Mother has 1 child	-1.6526	***	0.0667	-24.77
Mother has 2 children	-2.2530	***	0.0869	-25.92
Mother has 3 children	-2.2435	***	0.1056	-21.25
Mother has 4 children	-1.8926	***	0.1248	-15.17
Mother has 5 or more children	-1.9886	***	0.1402	-14.18
Husband's age 20 or younger	0.1163		0.1551	0.75
Husband's age 21 to 30	-0.0051		0.0693	-0.07
Husband's age 40 or older	-0.3026	***	0.0903	-3.35
Woman's age 13	-1.0689		0.6695	-1.60
Woman's age 14	-1.7248	***	0.5569	-3.10
Woman's age 15	-0.1148		0.2613	-0.44
Woman's age 16	0.0382		0.2225	0.17
Woman's age 17	0.0364		0.2011	0.18
Woman's age 18	0.2906		0.1840	1.58
Woman's age 19	0.0238		0.1794	0.13
Woman's age 20	0.1364		0.1694	0.80
Woman's age 21	0.1415		0.1627	0.87
Woman's age 22	-0.1044		0.1634	-0.64
Woman's age 23	0.1194		0.1567	0.76
Woman's age 24	0.3316	**	0.1501	2.21
Woman's age 25	0.1621		0.1510	1.07
Woman's age 26	0.2553	*	0.1443	1.77
Woman's age 27	0.0177		0.1476	0.12
Woman's age 28	0.1657		0.1412	1.17
Woman's age 29	0.3415	**	0.1379	2.48
Woman's age 31	0.2291		0.1421	1.61
Woman's age 32	-0.0143		0.1553	-0.09
Woman's age 33	-0.0941		0.1581	-0.60
Woman's age 34	-0.1055		0.1574	-0.67
Woman's age 35	-0.0763		0.1616	-0.47
Woman's age 36	-0.4979	**	0.1954	-2.55
Woman's age 37	-0.6150	**	0.2420	-2.54
Year 1996	-0.2676	***	0.0672	-3.98
Year 1997	-0.5701	***	0.0676	-8.43
Year 1998	-0.4597	***	0.0641	-7.17
Household in Urban area	0.5502	***	0.1328	4.14

Conception, cont.	Estimate		Std Error	Z
North Sumatra Rural Area	0.9303	***	0.1843	5.05
North Sumatra Urban Area	0.0819		0.1708	0.48
West Sumatra Rural Area	0.8510	***	0.1551	5.49
West Sumatra Urban Area	0.5420	***	0.1921	2.82
South Sumatra Rural Area	0.8500	***	0.1522	5.59
South Sumatra Urban Area	-0.2093		0.2266	-0.92
Lampung Rural Area	0.4115	***	0.1527	2.70
Lampung Urban Area	0.0338		0.2671	0.13
DKI Jakarta Urban Area	0.4835	***	0.1206	4.01
West Java Rural Area	0.0475		0.1174	0.40
West Java Urban Area	0.5167	***	0.1291	4.00
Central Java Rural Area	0.0052		0.1477	0.03
Central Java Urban Area	0.3825	*	0.2074	1.84
DI Yogyakarta Rural Area	-0.1120		0.1640	-0.68
DI Yogyakarta Urban Area	-0.0397		0.1378	-0.29
East Java Rural Area	0.4493	*	0.2565	1.75
East Java Urban Area	0.0173		0.2315	0.07
Bali Rural Area	0.5050	***	0.1515	3.33
Bali Urban Area	-0.1512		0.2319	-0.65
West Nusa Tenggara Rural Area	0.2752		0.1827	1.51
West Nusa Tenggara Urban Area	0.1070		0.2070	0.52
South Kalimantan Rural Area	0.4075	**	0.1782	2.29
South Kalimantan Urban Area	0.0791		0.1696	0.47
Woman is Protestant	-0.4058		0.3045	-1.33
Woman is Catholic	0.5775		0.4842	1.19
Woman is Hindhu	1.0047	***	0.3105	3.24
Woman is Buddhist	-1.1776		0.8025	-1.47
Man is Protestant	0.7054	**	0.3044	2.32
Man is Catholic	-0.3537		0.5066	-0.70
Man is Hindhu	-0.8188	***	0.2757	-2.97
Man is Buddhist	0.6359		0.9836	0.65
Woman started but did not graduate Primary School	0.0013		0.1152	0.01
Woman Graduated Primary School	-0.0118		0.1220	-0.10
Woman Graduated Junior High School	0.0582		0.1282	0.45
Woman Graduated Senior High School	0.1431		0.1327	1.08
Woman Graduated University or higher	0.2481		0.1734	1.43
Husband did not graduate primary school	-0.0810		0.1097	-0.74
Husband Graduated Primary School	-0.2213	*	0.1139	-1.94
Husband Graduated Junior High School	-0.0994		0.1228	-0.81
Husband Graduated Senior High School	-0.1019		0.1235	-0.82
Husband Graduated University or higher	0.0162		0.1633	0.10
Woman can read	0.0962		0.2156	0.45
Woman can write	0.0127		0.2058	0.06
Husband can read	0.4796	**	0.2238	2.14

Conception, cont.	Estimate		Std Error	Z
Husband can write	-0.3933	*	0.2107	-1.87
Woman attended school last year	0.0752		0.1426	0.53
Woman currently attends school	-0.0896		0.1686	-0.53
Husband attended school last year	0.1356		0.2274	0.60
Husband currently attends school	-0.2025		0.2622	-0.77
Woman is Unpaid Family Worker	-0.3208	***	0.0831	-3.86
Husband is Self Employed	0.0868		0.1438	0.60
Husband is Unpaid Family Worker	0.1127		0.2027	0.56
Husband works for the government	0.2026		0.1683	1.20
Husband works for a corporation	0.0693		0.1429	0.49
Community Subjective Wellbeing - Worse	-0.0039		0.0666	-0.06
Community Subjective Wellbeing - Better	-0.0926		0.0960	-0.96
Households in Community in general are worse now	0.0384		0.0972	0.39
Households in Community in general are better now	-0.0569		0.0982	-0.58
Households in Community better and worse now	-0.0415		0.1236	-0.34
Individual Subjective Wellbeing – Expect Worse	0.1997		0.2057	0.97
Individual Subjective Wellbeing – Expect Better	-0.0233		0.0507	-0.46
Family Planning Available in Puskesmas when woman age 7	0.0034		0.0638	0.05
Family Planning Available in Posyandu when woman age 7	-0.1663	**	0.0731	-2.27
Family Planning Available in Private Facility when woman age 7	-0.0097		0.0584	-0.17
Family Planning Available in Puskesmas now	1.3658	**	0.5614	2.43
Family Planning Available in Posyandu now	0.1252		0.0821	1.52
Family Planning Available in Private Facility now	0.4476	*	0.2530	1.77

Table A.2: FIML Results: Conception Equation

Conception	Estimate		Std Error	Z
Constant	-3.4808	***	0.4722	-7.37
Married	1.9391	***	0.6050	3.21
Ever Married	1.8248	***	0.6048	3.02
Household Income	0.0162		0.0274	0.59
Household Consumption	-0.0534		0.0684	-0.78
Household Experienced a Hardship (Death, Sickness,…)	-0.1712	*	0.0920	-1.86
Woman Works For a Wage	0.1142		0.1375	0.83
Mother has 1 child	-2.0771	***	0.1059	-19.61
Mother has 2 children	-2.8535	***	0.1371	-20.81
Mother has 3 children	-2.9350	***	0.1543	-19.02
Mother has 4 children	-2.6822	***	0.1831	-14.65
Mother has 5 or more children	-2.8897	***	0.1997	-14.47
Husband's age 20 or younger	0.0017		0.1655	0.01
Husband's age 21 to 30	-0.0630		0.0744	-0.85
Husband's age 40 or older	-0.2931	***	0.0973	-3.01
Woman's age 13	-1.6761	***	0.6498	-2.58
Woman's age 14	-2.3180	***	0.6056	-3.83
Woman's age 15	-0.6593	**	0.2804	-2.35
Woman's age 16	-0.4742	**	0.2221	-2.14
Woman's age 17	-0.4460	**	0.2037	-2.19
Woman's age 18	-0.1514		0.1900	-0.80
Woman's age 19	-0.3871	**	0.1951	-1.98
Woman's age 20	-0.2031		0.1829	-1.11
Woman's age 21	-0.1322		0.1655	-0.80
Woman's age 22	-0.3329	**	0.1640	-2.03
Woman's age 23	-0.0801		0.1665	-0.48
Woman's age 24	0.1893		0.1528	1.24
Woman's age 25	0.0417		0.1594	0.26
Woman's age 26	0.1628		0.1507	1.08
Woman's age 27	-0.0153		0.1547	-0.10
Woman's age 28	0.1360		0.1618	0.84
Woman's age 29	0.3317	**	0.1356	2.45
Woman's age 31	0.2258		0.1436	1.57
Woman's age 32	-0.0007		0.1519	-0.01
Woman's age 33	-0.0977		0.1611	-0.61
Woman's age 34	-0.0870		0.1485	-0.59
Woman's age 35	-0.0396		0.1558	-0.25
Woman's age 36	-0.4556	**	0.2013	-2.26
Woman's age 37	-0.5573	**	0.2341	-2.38
Year 1996	-0.2124	***	0.0673	-3.16
Year 1997	-0.5349	***	0.0712	-7.51
Year 1998	-0.4480	***	0.0697	-6.43

Conception, cont.	Estimate		Std Error	Z
Household in Urban area	0.5880	***	0.1587	3.71
North Sumatra Rural Area	0.7537	***	0.2322	3.25
North Sumatra Urban Area	0.1427		0.1560	0.92
West Sumatra Rural Area	0.8590	***	0.1408	6.10
West Sumatra Urban Area	0.6093	***	0.1668	3.65
South Sumatra Rural Area	0.7805	***	0.2041	3.82
South Sumatra Urban Area	-0.0466		0.2535	-0.18
Lampung Rural Area	0.6308	***	0.1556	4.06
Lampung Urban Area	0.0796		0.2043	0.39
DKI Jakarta Urban Area	0.5447	***	0.1452	3.75
West Java Rural Area	0.0499		0.1188	0.42
West Java Urban Area	0.4523	***	0.1635	2.77
Central Java Rural Area	-0.0235		0.1808	-0.13
Central Java Urban Area	0.3962	*	0.2185	1.81
DI Yogyakarta Rural Area	-0.2178		0.1618	-1.35
DI Yogyakarta Urban Area	0.0156		0.1441	0.11
East Java Rural Area	0.3099		0.2743	1.13
East Java Urban Area	-0.2410		0.2351	-1.03
Bali Rural Area	0.5302	***	0.1454	3.65
Bali Urban Area	-0.0314		0.2534	-0.12
West Nusa Tenggara Rural Area	0.1960		0.1550	1.26
West Nusa Tenggara Urban Area	0.0764		0.2194	0.35
South Kalimantan Rural Area	0.4149	*	0.2405	1.73
South Kalimantan Urban Area	0.0667		0.1996	0.33
Woman is Protestant	-0.4202		0.3004	-1.40
Woman is Catholic	0.4838		0.4882	0.99
Woman is Hindhu	1.2223	***	0.3852	3.17
Woman is Buddhist	-0.1532		0.6042	-0.25
Man is Protestant	0.7028	**	0.3023	2.33
Man is Catholic	-0.3932		0.4723	-0.83
Man is Hindhu	-0.8696	***	0.3383	-2.57
Man is Buddhist	-0.6043		0.7382	-0.82
Woman started but did not graduate Primary School	-0.0194		0.1206	-0.16
Woman Graduated Primary School	-0.0778		0.1205	-0.65
Woman Graduated Junior High School	-0.0465		0.1374	-0.34
Woman Graduated Senior High School	-0.0409		0.1415	-0.29
Woman Graduated University or higher	0.0037		0.1823	0.02
Husband did not graduate primary school	0.0376		0.1211	0.31
Husband Graduated Primary School	-0.1520		0.1055	-1.44
Husband Graduated Junior High School	-0.0265		0.1219	-0.22
Husband Graduated Senior High School	-0.0932		0.1083	-0.86
Husband Graduated University or higher	-0.0400		0.1582	-0.25
Woman can read	0.2769		0.2622	1.06
Woman can write	-0.1188		0.2582	-0.46

Conception, cont.	Estimate	Std Error	Z
Husband can read	0.3219	0.2245	1.43
Husband can write	-0.3430	0.2115	-1.62
Woman attended school last year	0.0893	0.1422	0.63
Woman currently attends school	-0.0606	0.1775	-0.34
Husband attended school last year	0.1084	0.2376	0.46
Husband currently attends school	-0.1674	0.2760	-0.61
Woman is Unpaid Family Worker	-0.3132 ***	0.0875	-3.58
Husband is Self Employed	0.0049	0.1649	0.03
Husband is Unpaid Family Worker	0.0881	0.2006	0.44
Husband works for the government	0.0726	0.1824	0.40
Husband works for a corporation	-0.0096	0.1628	-0.06
Community Subjective Wellbeing - Worse	-0.0206	0.0773	-0.27
Community Subjective Wellbeing - Better	-0.0868	0.0971	-0.89
Households in Community in general are worse now	0.0124	0.1206	0.10
Households in Community in general are better now	-0.0627	0.1244	-0.50
Households in Community better and worse now	-0.0744	0.1350	-0.55
Individual Subjective Wellbeing – Expect Worse	0.2753	0.2043	1.35
Individual Subjective Wellbeing – Expect Better	-0.0217	0.0544	-0.40
Family Planning Available in Puskesmas when woman age 7	0.0349	0.0732	0.48
Family Planning Available in Posyandu when woman age 7	-0.1644 **	0.0764	-2.15
Family Planning Available in Private Facility when woman age 7	-0.0143	0.0701	-0.20
Family Planning Available in Puskesmas now	0.5065	0.4835	1.05
Family Planning Available in Posyandu now	0.1070	0.0794	1.35
Family Planning Available in Private Facility now	0.4822 *	0.2653	1.82

Table A.3: FIML Results: Number of Children Equation

Birth	Estimate		Std Error	Z
Constant	-2.4148	***	0.6110	-3.95
Married	1.3197	***	0.3598	3.67
Mother has 1 child	-1.4870	***	0.0588	-25.30
Mother has 2 children	-1.9092	***	0.0765	-24.94
Mother has 3 children	-2.1417	***	0.0964	-22.22
Mother has 4 children	-2.1467	***	0.1190	-18.03
Mother has 5 or more children	-1.9791	***	0.1348	-14.68
Husband's age 20 or younger	-0.2619	**	0.1026	-2.55
Husband's age 21 to 30	0.0803	*	0.0486	1.65
Husband's age 40 or older	-0.2985	***	0.0975	-3.06
Woman's age 11	-1.3139	***	0.3682	-3.57
Woman's age 12	-0.9151	***	0.2882	-3.18
Woman's age 13	-0.7461	***	0.2769	-2.69
Woman's age 14	-0.4855	**	0.2025	-2.40
Woman's age 15	-0.2320		0.1966	-1.18
Woman's age 16	-0.0128		0.1660	-0.08
Woman's age 17	-0.0241		0.1644	-0.15
Woman's age 18	0.3055	*	0.1597	1.91
Woman's age 19	0.1926		0.1536	1.25
Woman's age 20	0.2509	*	0.1442	1.74
Woman's age 21	0.3178	**	0.1350	2.35
Woman's age 22	0.3529	***	0.1304	2.71
Woman's age 23	0.2993	**	0.1314	2.28
Woman's age 24	0.1505		0.1324	1.14
Woman's age 25	0.2723	**	0.1273	2.14
Woman's age 26	0.2804	**	0.1227	2.29
Woman's age 27	0.1789		0.1335	1.34
Woman's age 28	0.2669	*	0.1392	1.92
Woman's age 29	0.0751		0.1471	0.51
Woman's age 31	-0.0522		0.1612	-0.32
Woman's age 32	-0.0232		0.1695	-0.14
Woman's age 33	0.0031		0.1905	0.02
Woman's age 34	-0.9345	**	0.3887	-2.41
Woman Age 7 to 10	-1.7113	***	0.4662	-3.67
Year is before 1976	0.6152		0.3974	1.55
Year is 1976 to 1980	0.2453	**	0.1089	2.25
Year is 1981 to 1985	0.3759	***	0.0602	6.24
Year is 1986 to 1990	0.1254	***	0.0386	3.25
Household in Urban area	0.4386	***	0.1002	4.38
North Sumatra Rural Area	0.7142	***	0.2048	3.49
North Sumatra Urban Area	0.4410	***	0.1167	3.78
West Sumatra Rural Area	0.3070	***	0.0944	3.25
West Sumatra Urban Area	0.4100	***	0.1239	3.31

Birth, cont.	Estimate		Std Error	Z
South Sumatra Rural Area	0.3126	***	0.1098	2.85
South Sumatra Urban Area	0.3151	**	0.1474	2.14
Lampung Rural Area	0.3837	***	0.1142	3.36
Lampung Urban Area	0.3894	***	0.0949	4.10
DKI Jakarta Urban Area	0.3101	***	0.1069	2.90
West Java Rural Area	-0.0182		0.0944	-0.19
West Java Urban Area	0.0669		0.1171	0.57
Central Java Rural Area	-0.1593		0.1017	-1.57
Central Java Urban Area	0.2364	*	0.1403	1.69
DI Yogyakarta Rural Area	-0.3020	***	0.0837	-3.61
DI Yogyakarta Urban Area	-0.2017		0.1273	-1.59
East Java Rural Area	0.7011	***	0.1750	4.01
East Java Urban Area	0.1144		0.1597	0.72
Bali Rural Area	0.7666	***	0.1158	6.62
Bali Urban Area	0.1915		0.1468	1.30
West Nusa Tenggara Rural Area	0.2820	**	0.1123	2.51
West Nusa Tenggara Urban Area	-0.1218		0.2349	-0.52
South Kalimantan Rural Area	0.6571	***	0.1525	4.31
South Kalimantan Urban Area	0.0626		0.1301	0.48
Woman is Protestant	-0.1407		0.2321	-0.61
Woman is Catholic	0.2441		0.5642	0.43
Woman is Hindhu	0.3746		0.5106	0.73
Woman is Buddhist	-0.2601		0.4359	-0.60
Man is Protestant	0.2256		0.2135	1.06
Man is Catholic	-0.2039		0.5447	-0.37
Man is Hindhu	-0.6761		0.4678	-1.45
Man is Buddhist	0.1677		0.4632	0.36
Woman started but did not graduate Primary School	0.0378		0.0767	0.49
Woman Graduated Primary School	-0.0838		0.0821	-1.02
Woman Graduated Junior High School	-0.1233		0.0942	-1.31
Woman Graduated Senior High School	-0.1496		0.0920	-1.63
Woman Graduated University or higher	-0.0302		0.1502	-0.20
Husband did not graduate primary school	0.0623		0.0594	1.05
Husband Graduated Primary School	-0.0179		0.0705	-0.25
Husband Graduated Junior High School	-0.0640		0.0791	-0.81
Husband Graduated Senior High School	0.0577		0.0759	0.76
Husband Graduated University or higher	0.2248	**	0.1054	2.13
Woman can read	0.0338		0.1323	0.26
Woman can write	-0.0515		0.1334	-0.39
Husband can read	-0.2801	*	0.1583	-1.77
Husband can write	0.2810	*	0.1508	1.86

Birth, cont.	Estimate	Std Error	Z
Woman attended school last year	0.1037	0.0985	1.05
Woman currently attends school	-0.2742 **	0.1242	-2.21
Husband attended school last year	-0.2210	0.1489	-1.48
Husband currently attends school	0.2749 *	0.1669	1.65
Duration of marriage	0.1498 **	0.0680	2.20
Family Planning Available in Puskesmas when woman age 7	-0.0231	0.0468	-0.49
Family Planning Available in Posyandu when woman age 7	-0.0814	0.0845	-0.96
Family Planning Available in Private Facility when woman age 7	0.0845	0.0651	1.30
Family Planning Available in Puskesmas now	-0.0502	0.0922	-0.55
Family Planning Available in Posyandu now	0.0061	0.0475	0.13
Family Planning Available in Private Facility now	-0.0713	0.0559	-1.28
Woman is fertile	0.2275	0.2098	1.08
Woman lives near her parents	-0.0555	0.0570	-0.97

Table A.4: FIML Results: Education Equation

Exit School	Estimate		Std Error	Z
Constant	3.5225	***	0.3142	11.21
Mother has 1 child	0.9241	***	0.1443	6.41
Woman's age 7	-3.0888	***	0.1337	-23.10
Woman's age 8	-4.1622	***	0.1644	-25.32
Woman's age 9	-3.3670	***	0.1276	-26.40
Woman's age 10	-2.6003	***	0.1011	-25.73
Woman's age 11	-2.0932	***	0.0957	-21.86
Woman's age 12	-1.0930	***	0.0806	-13.56
Woman's age 13	-0.5750	***	0.0746	-7.70
Woman's age 14	-0.7340	***	0.0704	-10.42
Woman's age 15	-0.7827	***	0.0794	-9.85
Woman's age 21 to 25	0.3698	***	0.1039	3.56
Woman's age 26 to 30	0.0490		0.2639	0.19
Woman's age 31 to 35	-0.5906		0.5268	-1.12
Woman's age 36 and up	2.3777	***	0.8989	2.65
Year is before 1976	-0.2030		0.1241	-1.64
Year is 1976 to 1980	-0.6293	***	0.1065	-5.91
Year is 1981 to 1985	-1.1002	***	0.1013	-10.86
Year is 1986 to 1990	-0.9822	***	0.0948	-10.36
Year is 1991 to 1995	-0.7851	***	0.0870	-9.02
Household in Urban area	-0.3691	***	0.1344	-2.75
North Sumatra Rural Area	0.0553		0.2745	0.20
North Sumatra Urban Area	0.0680		0.1505	0.45
West Sumatra Rural Area	-0.2354		0.1473	-1.60
West Sumatra Urban Area	-0.3879	*	0.2029	-1.91
South Sumatra Rural Area	-0.1651		0.1929	-0.86
South Sumatra Urban Area	-0.5960	***	0.2005	-2.97
Lampung Rural Area	0.1102		0.1383	0.80
Lampung Urban Area	0.1287		0.1881	0.68
DKI Jakarta Urban Area	0.4540	***	0.1167	3.89
West Java Rural Area	-0.1333		0.1493	-0.89
West Java Urban Area	0.1218		0.1586	0.77
Central Java Rural Area	0.0674		0.1989	0.34
Central Java Urban Area	-0.8081	***	0.1921	-4.21
DI Yogyakarta Rural Area	-0.1507		0.1371	-1.10
DI Yogyakarta Urban Area	-0.0563		0.1519	-0.37
East Java Rural Area	0.2293		0.1905	1.20
East Java Urban Area	-0.0368		0.2247	-0.16
Bali Rural Area	-0.1177		0.1595	-0.74
Bali Urban Area	-0.3089		0.2027	-1.52

Exit School, cont.	Estimate		Std Error	Z
West Nusa Tenggara Rural Area	0.3049		0.2429	1.26
West Nusa Tenggara Urban Area	0.2620		0.2461	1.07
South Kalimantan Rural Area	-0.2133		0.2200	-0.97
South Kalimantan Urban Area	-0.1861		0.1516	-1.23
Woman is Protestant	-0.6614	***	0.1804	-3.67
Woman is Catholic	-0.4289	*	0.2262	-1.90
Woman is Hindhu	-0.2569	**	0.1246	-2.06
Woman is Buddhist	0.3555		0.5616	0.63
Woman can read	-1.9049	***	0.2890	-6.59
Woman can write	-1.2466	***	0.2645	-4.71
Student Teacher Ratio in Secondary Sch	0.0613	*	0.0338	1.81
Student School Ratio in Secondary Sch	-0.0596		0.2111	-0.28
Student Teacher Ratio in Primary Sch	0.0867	**	0.0415	2.09
Student School Ratio in Primary Sch	-0.2427	**	0.0978	-2.48
School was available to woman in her community	-0.1166	*	0.0667	-1.75

Table A.5: FIML Results: Hazard of First Marriage

First Marriage	Estimate		Std Error	Z
Constant	-2.6237	***	0.3696	-7.10
Woman's age 11 to 15	-0.4021	***	0.0566	-7.10
Woman's age 21 to 25	0.0157		0.0644	0.24
Woman's age 26 to 30	-0.2194	**	0.1120	-1.96
Woman's age 31 to 35	-0.9848	***	0.2071	-4.76
Woman's age 36 and up	-1.4229	***	0.4906	-2.90
Year is before 1976	-1.0677	***	0.1684	-6.34
Year is 1976 to 1980	-0.6959	***	0.1042	-6.68
Year is 1981 to 1985	-0.5423	***	0.0874	-6.21
Year is 1986 to 1990	-0.4621	***	0.0688	-6.72
Year is 1991 to 1995	-0.4289	***	0.0566	-7.58
Household in Urban area	-0.3265	***	0.1071	-3.05
North Sumatra Rural Area	-0.4896	*	0.2726	-1.80
North Sumatra Urban Area	-0.4395	***	0.1408	-3.12
West Sumatra Rural Area	-0.3699	**	0.1534	-2.41
West Sumatra Urban Area	-0.2780	*	0.1688	-1.65
South Sumatra Rural Area	-0.0657		0.1030	-0.64
South Sumatra Urban Area	-0.2395		0.1569	-1.53
Lampung Rural Area	0.3201	**	0.1312	2.44
Lampung Urban Area	0.0372		0.2233	0.17
DKI Jakarta Urban Area	0.1741	*	0.1051	1.66
West Java Rural Area	-0.0424		0.1135	-0.37
West Java Urban Area	-0.0171		0.1202	-0.14
Central Java Rural Area	0.0151		0.1169	0.13
Central Java Urban Area	-0.2119		0.1411	-1.50
DI Yogyakarta Rural Area	-0.0720		0.1319	-0.55
DI Yogyakarta Urban Area	0.0204		0.1052	0.19
East Java Rural Area	-0.1095		0.2086	-0.53
East Java Urban Area	-0.0835		0.2309	-0.36
Bali Rural Area	-0.6369	***	0.1436	-4.44
Bali Urban Area	-0.5547	***	0.1857	-2.99
West Nusa Tenggara Rural Area	-0.0537		0.1716	-0.31
West Nusa Tenggara Urban Area	0.1717		0.2719	0.63
South Kalimantan Rural Area	-0.4668	***	0.1467	-3.18
South Kalimantan Urban Area	-0.3834	**	0.1636	-2.34
Woman is Protestant	-0.3372	***	0.1284	-2.63
Woman is Catholic	-0.2404		0.1696	-1.42
Woman is Hindhu	-0.2570		0.1689	-1.52
Woman is Buddhist	-0.3823		0.3847	-0.99
Woman started but did not graduate Primary School	0.8874	***	0.0740	12.00
Woman Graduated Primary School	1.0459	***	0.0748	13.98
Woman Graduated Junior High School	1.3442	***	0.0791	16.99

First Marriage, cont.	Estimate		Std Error	Z
Woman Graduated Senior High School	1.1318	***	0.0848	13.34
Woman Graduated University or higher	1.2468	***	0.1210	10.31
Woman can read	-0.6412	***	0.1764	-3.64
Woman can write	0.0356		0.1624	0.22
Woman attended school last year	-0.1551	**	0.0651	-2.38
Woman currently attends school	-0.8656	***	0.0804	-10.77
Schooling was available to woman	-0.0825		0.0611	-1.35
Family Planning Available in Puskesmas when woman age 7	-0.4071	***	0.0523	-7.79
Family Planning Available in Posyandu when woman age 7	-0.6773	***	0.0676	-10.03
Family Planning Available in Private Facility when woman age 7	-0.4708	***	0.0529	-8.89
Family Planning Available in Puskesmas now	0.1602	*	0.0885	1.81
Family Planning Available in Posyandu now	0.0896	*	0.0525	1.71
Family Planning Available in Private Facility now	0.1200	**	0.0582	2.06
Woman is fertile	1.5251	***	0.0837	18.23
Woman lives near her parents	0.5503	***	0.0633	8.70

Table AI.6: FIML Results: Woman Works for a Wage

Works For a Wage	Estimate		Std Error	Z
Constant	-2.6324		2.1692	-1.21
Married	-2.5518	**	1.1566	-2.21
Ever Married	-0.7033		0.7076	-0.99
Mother has 1 child	0.2741		0.2891	0.95
Mother has 2 children	1.0852	**	0.4382	2.48
Mother has 3 children	0.9156	**	0.4568	2.00
Mother has 4 children	1.3829	**	0.5580	2.48
Mother has 5 or more children	3.3816	***	0.7010	4.82
Husband's age 20 or younger	-1.6668	**	0.7402	-2.25
Husband's age 21 to 30	-0.7372	**	0.3298	-2.24
Husband's age 40 or older	0.1381		0.3184	0.43
Woman's age 11 to 15	-7.1817	***	0.7121	-10.09
Woman's age 16 to 20	-5.0327	***	0.5019	-10.03
Woman's age 21 to 25	-3.9973	***	0.4118	-9.71
Woman's age 26 to 30	-2.0101	***	0.3350	-6.00
Woman's age 31 to 35	-0.8693	***	0.2757	-3.15
Year 1996	-1.7508	***	0.3031	-5.78
Year 1997	-1.1853	***	0.2817	-4.21
Year 1998	-0.5678	***	0.1303	-4.36
Household in Urban area	-1.0923	**	0.4718	-2.32
North Sumatra Rural Area	2.9455	***	0.8228	3.58
North Sumatra Urban Area	-2.6228	***	0.6579	-3.99
West Sumatra Rural Area	1.6452	*	0.9613	1.71
West Sumatra Urban Area	0.4962		0.5009	0.99
South Sumatra Rural Area	-1.4448	***	0.5390	-2.68
South Sumatra Urban Area	-0.6290		0.6510	-0.97
Lampung Rural Area	-4.8371	***	0.6173	-7.84
Lampung Urban Area	1.9704	**	0.9758	2.02
DKI Jakarta Urban Area	-0.2403		0.3891	-0.62
West Java Rural Area	-0.1528		0.6217	-0.25
West Java Urban Area	1.3921	**	0.5943	2.34
Central Java Rural Area	2.3909	***	0.6250	3.83
Central Java Urban Area	0.0422		0.4396	0.10
DI Yogyakarta Rural Area	3.1070	***	0.6832	4.55
DI Yogyakarta Urban Area	-0.4685		0.4693	-1.00
East Java Rural Area	-1.6353	**	0.7676	-2.13
East Java Urban Area	2.6931	***	0.9187	2.93
Bali Rural Area	-1.1095	***	0.4064	-2.73
Bali Urban Area	-3.8194	***	0.6831	-5.59
West Nusa Tenggara Rural Area	-1.7681	**	0.7255	-2.44
West Nusa Tenggara Urban Area	-1.1577		2.7217	-0.43
South Kalimantan Rural Area	-3.2746	***	0.5207	-6.29
South Kalimantan Urban Area	-3.8564	***	0.7511	-5.13

Works For a Wage, cont.	Estimate		Std Error	Z
Woman is Protestant	3.8898	***	0.6978	5.58
Woman is Catholic	-1.7799	**	0.7982	-2.23
Woman is Hindhu	-1.5548	**	0.7221	-2.15
Woman is Buddhist	-4.0393	***	0.7246	-5.58
Man is Protestant	-2.0017	**	0.8516	-2.35
Man is Catholic	1.8337	**	0.9159	2.00
Man is Hindhu	3.1382	***	0.7843	4.00
Man is Buddhist	2.0122		1.2858	1.57
Woman started but did not graduate Primary School	2.3067	***	0.4265	5.41
Woman Graduated Primary School	1.4337	***	0.4785	3.00
Woman Graduated Junior High School	1.1936		0.6122	1.95
Woman Graduated Senior High School	1.7060	***	0.5050	3.38
Woman Graduated University or higher	2.9005	***	0.6846	4.24
Husband did not graduate primary school	0.6061		0.4440	1.37
Husband Graduated Primary School	-0.4495		0.5187	-0.87
Husband Graduated Junior High School	-0.3607		0.5404	-0.67
Husband Graduated Senior High School	0.2009		0.5331	0.38
Husband Graduated University or higher	0.6601		0.6052	1.09
Woman can read	-3.7188	***	1.1150	-3.34
Woman can write	3.5057	***	1.0101	3.47
Husband can read	2.0462	***	0.6776	3.02
Husband can write	0.2840		0.7025	0.40
Woman attended school last year	0.0691		0.3947	0.18
Woman currently attends school	-0.6166		0.4324	-1.43
Husband attended school last year	1.5191	**	0.6468	2.35
Husband currently attends school	-0.4171		0.7998	-0.52
Husband is Self Employed	0.6531		0.5477	1.19
Husband is Unpaid Family Worker	0.5957		0.6961	0.86
Husband works for the government	4.6449	***	0.6845	6.79
Husband works for a corporation	0.7893		0.5006	1.58
Community is Underdeveloped	-0.4543		0.2944	-1.54
Main source of income in community is Farming	0.8130	***	0.3073	2.65
Main source of income in community is Manufacturing	0.2321		0.1799	1.29
Main source of income in com is Building Construction	-0.0749		0.2112	-0.36
Main source of income in com is Large Retail / Tourism	-0.1584		0.3658	-0.43
Main source of income in com is Social Services	0.1923		0.2066	0.93
Main source of income in com is Other (Mining, Utility, Transportation, Finance, Other)	0.0890		0.3036	0.29

Works For a Wage, cont.	Estimate		Std Error	Z
Average Community Price for Gasoline	0.6515	***	0.1913	3.41
Average Community Price for Salt	-0.1234		0.1511	-0.82
Average Community Price for Sugar	-1.7672	*	0.9922	-1.78
Community employs in the Industrial Sector	0.0149		0.3142	0.05
Average community industrial wage for men in	0.1238		0.3378	0.37
Average community industrial wage for women	-0.4148		0.4194	-0.99
Community employs in the Agricultural Sector	-1.3185	***	0.2802	-4.71
Average community agricultural wage for men	-0.2607		0.4295	-0.61
Average community agricultural wage for women	1.4320	***	0.4941	2.90

Table AI.7: FIML Results: Income Equation

Income	Estimate		Std Error	Z
Constant	0.4028		0.3520	1.14
Married	-1.3969	***	0.2870	-4.87
Ever Married	0.3383		0.2610	1.30
Woman Works For a Wage	1.2119	***	0.0799	15.16
Mother has 1 child	0.0881	*	0.0490	1.80
Mother has 2 children	0.2012	***	0.0597	3.37
Mother has 3 children	0.2946	***	0.0759	3.88
Mother has 4 children	0.2809	***	0.0942	2.98
Mother has 5 or more children	0.3999	***	0.1276	3.13
Husband's age 20 or younger	-0.0350		0.0950	-0.37
Husband's age 21 to 30	-0.0730	**	0.0350	-2.09
Husband's age 40 or older	0.0555		0.0396	1.40
Woman's age 11 to 15	0.0145		0.1390	0.11
Woman's age 16 to 20	-0.1630	*	0.0902	-1.81
Woman's age 21 to 25	-0.1290	*	0.0681	-1.90
Woman's age 26 to 30	-0.1105	**	0.0541	-2.04
Woman's age 31 to 35	-0.1179	***	0.0424	-2.78
Year 1996	0.9554	***	0.0548	17.42
Year 1997	0.2582	***	0.0477	5.41
Year 1998	0.0097		0.0186	0.52
Household in Urban area	0.3349	***	0.0841	3.98
North Sumatra Rural Area	-0.2212	*	0.1210	-1.83
North Sumatra Urban Area	-0.2122	**	0.0970	-2.19
West Sumatra Rural Area	-0.1013		0.2081	-0.49
West Sumatra Urban Area	-0.1380		0.1563	-0.88
South Sumatra Rural Area	-0.2212	**	0.1116	-1.98
South Sumatra Urban Area	-0.1907	*	0.1124	-1.70
Lampung Rural Area	-0.1927		0.1214	-1.59
Lampung Urban Area	-0.4532	***	0.1550	-2.92
DKI Jakarta Urban Area	0.0583		0.0764	0.76
West Java Rural Area	-0.1425	*	0.0783	-1.82
West Java Urban Area	-0.0560		0.0826	-0.68
Central Java Rural Area	-0.3561	***	0.0790	-4.51
Central Java Urban Area	-0.5018	***	0.0971	-5.17
DI Yogyakarta Rural Area	-0.4622	***	0.0740	-6.25
DI Yogyakarta Urban Area	-0.4143	***	0.1129	-3.67
East Java Rural Area	-0.4562	***	0.1323	-3.45
East Java Urban Area	-0.4770	***	0.1373	-3.48
Bali Rural Area	0.0241		0.1076	0.22
Bali Urban Area	-0.2703	**	0.1277	-2.12
West Nusa Tenggara Rural Area	0.1870		0.1246	1.50
West Nusa Tenggara Urban Area	-0.0012		0.1974	-0.01
South Kalimantan Rural Area	-0.0114		0.1274	-0.09

Income, cont.	Estimate		Std Error	Z
South Kalimantan Urban Area	-0.3598	***	0.0972	-3.70
Woman is Protestant	-0.0054		0.1606	-0.03
Woman is Catholic	0.0335		0.2647	0.13
Woman is Hindhu	-0.1538		0.2477	-0.62
Woman is Buddhist	0.4335		0.3445	1.26
Man is Protestant	-0.0696		0.1661	-0.42
Man is Catholic	-0.0043		0.3113	-0.01
Man is Hindhu	0.3270		0.2777	1.18
Man is Buddhist	0.6170	**	0.2750	2.24
Woman started but did not graduate Primary School	-0.2081	***	0.0717	-2.90
Woman Graduated Primary School	-0.0123		0.0736	-0.17
Woman Graduated Junior High School	0.1229		0.0803	1.53
Woman Graduated Senior High School	0.2270	***	0.0847	2.68
Woman Graduated University or higher	0.5228	***	0.1027	5.09
Husband did not graduate primary school	-0.1184		0.0735	-1.61
Husband Graduated Primary School	-0.0406		0.0714	-0.57
Husband Graduated Junior High School	-0.0081		0.0818	-0.10
Husband Graduated Senior High School	0.0252		0.0774	0.33
Husband Graduated University or higher	0.1416		0.1145	1.24
Woman can read	0.1698		0.1743	0.97
Woman can write	0.0605		0.1616	0.38
Husband can read	0.2872		0.2711	1.06
Husband can write	-0.1169		0.2483	-0.47
Woman attended school last year	0.0935		0.0918	1.02
Woman currently attends school	-0.0228		0.1029	-0.22
Husband attended school last year	0.1762		0.1139	1.55
Husband currently attends school	-0.2010		0.1493	-1.35
Woman is Unpaid Family Worker	0.1299	**	0.0550	2.36
Husband is Self Employed	4.1109	***	0.1354	30.35
Husband is Unpaid Family Worker	0.6447	***	0.2151	3.00
Husband works for the government	4.2656	***	0.1475	28.91
Husband works for a corporation	4.0825	***	0.1376	29.66
Community is Underdeveloped	-0.0806	**	0.0368	-2.19
Main source of income in community is Farming	-0.0776	*	0.0410	-1.90
Main source of income in community is Manufacturing	0.0105		0.0309	0.34
Main source of income in com is Building Construction	0.0376		0.0403	0.93
Main source of income in com is Large Retail / Tourism	0.0192		0.0594	0.32
Main source of income in com is Social Services	0.0681	**	0.0347	1.96
Main source of income in com is Other (Mining, Utility, Transportation, Finance, Other)	0.0390		0.0544	0.72

Income, cont.	Estimate		Std Error	Z
Average Community Price for Gasoline	-0.0099		0.0192	-0.52
Average Community Price for Salt	-0.0016		0.0235	-0.07
Average Community Price for Sugar	0.1501		0.2098	0.72
Community employs in the Industrial Sector	-0.0614		0.0490	-1.25
Average community industrial wage for men	-0.0418		0.0457	-0.91
Average community industrial wage for women	0.0771		0.0598	1.29
Community employs in the Agricultural Sector	-0.1543	***	0.0474	-3.26
Average community agricultural wage for men	0.0290		0.0362	0.80
Average community agricultural wage for women	0.1414	**	0.0641	2.20
Theta (Standard Deviation)	0.1461	***	0.0147	9.93
Estimated Standard Deviation	1.1574			

Table AI.8: FIML Results: Consumption Equation

Per-Capita Consumption	Estimate		Std Error	Z
Constant	4.3029	***	0.2106	20.43
Married	0.0193		0.1225	0.16
Ever Married	-0.2445	**	0.1081	-2.26
Household Income	0.0015		0.0089	0.17
Woman Works For a Wage	0.0193		0.0485	0.40
Mother has 1 child	-0.0665	*	0.0361	-1.84
Mother has 2 children	-0.0136		0.0505	-0.27
Mother has 3 children	-0.0247		0.0690	-0.36
Mother has 4 children	-0.1162		0.0850	-1.37
Mother has 5 or more children	-0.2421	**	0.0991	-2.44
Husband's age 20 or younger	0.0137		0.0702	0.20
Husband's age 21 to 30	-0.0995	***	0.0298	-3.34
Husband's age 40 or older	0.0317		0.0281	1.13
Woman's age 11 to 15	-0.3447	***	0.0746	-4.62
Woman's age 16 to 20	-0.2780	***	0.0646	-4.30
Woman's age 21 to 25	-0.2428	***	0.0572	-4.25
Woman's age 26 to 30	-0.1495	***	0.0433	-3.45
Woman's age 31 to 35	-0.0693	**	0.0293	-2.37
Year 1997	0.0696	**	0.0312	2.23
Household in Urban area	0.5130	***	0.0658	7.79
North Sumatra Rural Area	-0.0642		0.0746	-0.86
North Sumatra Urban Area	-0.3931	***	0.0649	-6.06
West Sumatra Rural Area	0.1325		0.1163	1.14
West Sumatra Urban Area	-0.2301	**	0.1079	-2.13
South Sumatra Rural Area	-0.2151	***	0.0663	-3.25
South Sumatra Urban Area	0.0447		0.0967	0.46
Lampung Rural Area	0.0499		0.0561	0.89
Lampung Urban Area	-0.3320	***	0.0862	-3.85
DKI Jakarta Urban Area	0.3439	***	0.0561	6.13
West Java Rural Area	-0.1741	***	0.0634	-2.75
West Java Urban Area	0.2011	***	0.0630	3.19
Central Java Rural Area	-0.4049	***	0.0686	-5.91
Central Java Urban Area	0.0460		0.1310	0.35
DI Yogyakarta Rural Area	-0.3599	***	0.0732	-4.92
DI Yogyakarta Urban Area	-0.5211	***	0.1091	-4.78
East Java Rural Area	0.0819		0.0974	0.84
East Java Urban Area	-0.3729	***	0.1305	-2.86
Bali Rural Area	0.0317		0.0781	0.41
Bali Urban Area	-0.2878	***	0.0970	-2.97
West Nusa Tenggara Rural Area	0.1935	***	0.0510	3.79
West Nusa Tenggara Urban Area	-0.2987	***	0.1025	-2.92
South Kalimantan Rural Area	0.0332		0.0670	0.50
South Kalimantan Urban Area	-0.4206	***	0.0735	-5.73

Per-Capita Consumption, cont.	Estimate		Std Error	Z
Woman is Protestant	-0.0309		0.0933	-0.33
Woman is Catholic	0.0302		0.1637	0.19
Woman is Hindhu	-0.0908		0.0927	-0.98
Woman is Buddhist	0.2857		0.2511	1.14
Man is Protestant	-0.0001		0.0938	0.00
Man is Catholic	0.0994		0.1808	0.55
Man is Hindhu	-0.0089		0.0589	-0.15
Man is Buddhist	0.0710		0.3392	0.21
Woman started but did not graduate Primary School	-0.0480		0.0375	-1.28
Woman Graduated Primary School	-0.0196		0.0376	-0.52
Woman Graduated Junior High School	0.0846	*	0.0449	1.88
Woman Graduated Senior High School	0.1057	**	0.0494	2.14
Woman Graduated University or higher	0.3347	***	0.0791	4.23
Husband did not graduate primary school	-0.0891	*	0.0463	-1.92
Husband Graduated Primary School	-0.0695		0.0504	-1.38
Husband Graduated Junior High School	-0.0575		0.0542	-1.06
Husband Graduated Senior High School	0.0764		0.0525	1.46
Husband Graduated University or higher	0.1763	**	0.0765	2.30
Woman can read	0.1151		0.1126	1.02
Woman can write	0.0147		0.1058	0.14
Husband can read	0.1450		0.1110	1.31
Husband can write	0.0456		0.1029	0.44
Woman attended school last year	-0.0515		0.0506	-1.02
Woman currently attends school	0.1834	***	0.0596	3.08
Husband attended school last year	0.0584		0.1214	0.48
Husband currently attends school	0.0288		0.1328	0.22
Woman is Unpaid Family Worker	0.0446		0.0301	1.48
Husband is Self Employed	0.1186	*	0.0689	1.72
Husband is Unpaid Family Worker	0.1270	*	0.0766	1.66
Husband works for the government	0.2339	***	0.0747	3.13
Husband works for a corporation	-0.0065		0.0675	-0.10
Community is Underdeveloped	-0.1473	***	0.0279	-5.28
Main source of income in community is Farming	-0.0122		0.0400	-0.31
Main source of income in community is Manufacturing	-0.0155		0.0225	-0.69
Main source of income in com is Building Construction	0.0144		0.0292	0.49
Main source of income in com is Large Retail / Tourism	-0.0407		0.0552	-0.74
Main source of income in com is Social Services	0.0301		0.0277	1.09
Main source of income in com is Other (Mining, Utility, Transportation, Finance, Other)	0.0325		0.0562	0.58

Per-Capita Consumption, cont.	Estimate		Std Error	Z
Average Community Price for Gasoline	0.0192		0.0317	0.61
Average Community Price for Salt	0.0257		0.0196	1.31
Average Community Price for Sugar	-0.0292		0.1411	-0.21
Community employs in the Industrial Sector	0.0066		0.0398	0.17
Average community industrial wage for men	-0.0015		0.0453	-0.03
Average community industrial wage for women	0.0525		0.0515	1.02
Community employs in the Agricultural Sector	-0.1290	***	0.0372	-3.47
Average community agricultural wage for men	-0.0058		0.0415	-0.14
Average community agricultural wage for women	0.2005	***	0.0518	3.87
Theta (Standard Deviation)	-0.5667	***	0.0149	-37.95
Estimated Standard Deviation	0.5674			

APPENDIX II

COMPLETE LIKELIHOOD FUNCTION

Figure AII: Complete Specification of the Likelihood Function

$$L=\prod_{c=1}^{C}\left(\sum_{kc=1}^{K_C}PW_{kc}\prod_{i=1}^{I}\left(\sum_{ki=1}^{K_I}PW_{ki}\left(\begin{array}{l}\prod_{t=1}^{T}\left(\begin{array}{l}[\Pr(e_{it}=0\,|\,e_{it-1}=1,X_{it}^{W},Z_{it}^{E},\varepsilon_{it}^{E})^{e_{it}}(1-\Pr(e_{it}=0\,|\,e_{it-1}=1,X_{it}^{W},Z_{it}^{E},\varepsilon_{it}^{E}))^{1-e_{it}}]\\ [\Pr(m_{it}=1\,|\,m_{it-1}=0,X_{it}^{W},Q_{it}^{M},Z_{it}^{M},\varepsilon_{it}^{M})^{m_{it}}(1-\Pr(m_{it}=1\,|\,m_{it-1}=0,X_{it}^{W},Q_{it}^{M},Z_{it}^{M},\varepsilon_{it}^{M}))^{1-m_{it}}]\end{array}\right)\\ \prod_{t=1}^{t=28}[\Pr(n_{it}^{B}=1\,|\,X_{it},Q_{it}^{B},Z_{it}^{B},\varepsilon_{it}^{B})^{n_{it}^{B}}(1-\Pr(n_{it}^{B}=1\,|\,X_{it},Q_{it}^{B},Z_{it}^{B},\varepsilon_{it}^{B}))^{1-n_{it}^{B}}]\\ \prod_{t=29}^{T}\left(\begin{array}{l}[\Pr(n_{it}^{F}=1\,|\,X_{it},Q_{it}^{F},E_{it}^{F},\varepsilon_{it}^{F})^{n_{it}^{F}}(1-\Pr(n_{it}^{F}=1\,|\,X_{it},Q_{it}^{F},E_{it}^{F},\varepsilon_{it}^{F}))^{1-n_{it}^{F}}]\\ [\Pr(w_{it}=1\,|\,X_{it},Q_{it}^{W},Z_{it}^{W},E_{it}^{W},\varepsilon_{it}^{W})^{w_{it}}(1-\Pr(w_{it}=1\,|\,X_{it},Q_{it}^{W},Z_{it}^{W},E_{it}^{W},\varepsilon_{it}^{W}))^{1-w_{it}}]\\ [\frac{1}{\sigma_C}\Phi\left(c_{it}-\mathrm{B}_0^C-X_{it}\mathrm{B}_1^C-Q_{it}^C\mathrm{B}_2^C-Z_{it}^C\mathrm{B}_3^C-E_{it}^C\mathrm{B}_4^C-\varepsilon_{it}^C\right)]\\ [\frac{1}{\sigma_I}\Phi\left(i_{it}-\mathrm{B}_0^I-X_{it}\mathrm{B}_1^I-Q_{it}^I\mathrm{B}_2^I-Z_{it}^I\mathrm{B}_3^I-E_{it}^I\mathrm{B}_4^I-\varepsilon_{it}^I\right)]\end{array}\right)\end{array}\right)\right)\right)$$

where

K_C = Number of Community level mass points

PW_{kc} = Probability weight of mass point kc

K_I = Number of Individual level mass points

PW_{ki} = Probability weight of mass point ki

C = Number of communities

I = Number of individuals

T = Number of time periods (T = 32, implies year 1999)

Φ = Standard normal probability density function

$\frac{1}{\sigma_j}$ = Standard deviation of equation j, where j = C,I

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