Consequences of Economic Development on Women's Lives in India

Jagori Saha

A dissertation
submitted in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy

University of Washington

2018

Reading Committee:

Rachel M. Heath, Chair

Chris Anderson

Xu Tan

James D. Long, GSR

Program Authorized to Offer Degree:
Economics

University of Washington

Abstract

Consequences of Economic Development on
Women's Lives in India

Jagori Saha

Chair of the Supervisory Committee:
Rachel M. Heath

This dissertation is a collection of three essays that explore the effects of India's development policies and economic growth on women's outcomes, ranging from their mortality to quality of marriage.

The first chapter estimates the effect of access to credit on the probability of marriage of women and men in rural India. In societies where dowry payments are customary, an increase in access to credit can potentially increase the probability of marriage of girls either through an increase in income or consumption smoothing. Using a formal bank branch expansion in rural India and an instrumental variables approach, I find the following: First, the probability of marriage increases for girls but does not change for boys in response to an increase in formal banking; Second, the effect of formal bank branch expansion on the probability of marriage of daughters is concentrated during the years that households do not experience a positive agricultural income shock; Third, consistent with this result of a tighter "marriage squeeze", that is, there are more potential brides in the marriage market than potential grooms, an increase in per capita rural bank branches also leads to an increase in dowry payments and women's distance of marriage migration. The marriage market results are further supported by the following findings: (a) An increase in per capita rural bank branches increases the probability of school enrollment of young girls but fails to increase the probability of school enrollment of older girls who are at the highest risk of marriage; (b) An increase in per capita rural bank branches decreases labor participation of women, and therefore,

fails to increase the value of women's labor in a household.

The second chapter, which is a joint work with Joshua D. Merfeld, revisits the relationship between agricultural productivity shocks and excess female mortality in India and focuses on investigating how this relationship changes when households have access to employment opportunities outside of agriculture. When household's preference for son coincides with adverse income shocks, in order to smooth consumption overtime, households tend to disproportionately reduce care (prenatal or postnatal) for their female children, which leads to excess female child mortality. Building on previous work (Rose, 1999), we show that agricultural productivity shocks in rural India, proxied by rainfall, continue to be an important predictor of the sex of an infant: the sex-ratio of infants is more balanced in good rainfall years than in poor rainfall years. In addition, we show that the effect of rainfall during the year of birth on height-for-age is stronger for girls than for boys. We then show that a guaranteed rural workfare program in India, that provides labor opportunities outside of agriculture, attenuates the relationship between rainfall and both the sex ratio and height-for-age for girls. We also show that the negative relationship between agricultural productivity shocks (rainfall) and the number of dowry deaths (Sekhri and Storeygard, 2014) also dissipates after the introduction of the workfare program.

The third chapter, which is a joint work with Rachel M. Heath, evaluates the effect of woman's job opportunities on their ability to choose their own spouse and their eventual marriage quality. We find that an increase in women's job opportunities during their year of marriage increases their ability to chose their spouse independently by 28% and also the likelihood that they have had some interaction with their spouse prior to marriage. Women are more likely to marry men who are more educated, are closer to their age, and grew up in a different village/town in response to a positive female labor demand shock. Lastly, we find that current female labor demand shocks are a stronger determinant of women's household bargaining power compared to female labor demand shocks at the time of marriage.

TABLE OF CONTENTS

ACKNOWLEDGMENTS

I first wish to thank my advisor, Professor Rachel M. Heath for her unwavering support and motivation during every stage of the program. I am deeply indebted to her for her insightful advice and comments, her encouragement to think independently, trust my intuition and participate in discussions and collaborations, and her patience with me and my research. I am immensely grateful for my time under her mentorship.

I thank my committee members, Professors Chris Anderson, Xu Tan, and James D. Long, for their support every step of the way, their detailed comments and suggestions, and for always making the time to meet with me.

I am grateful to Professor Fahad Khalil and the entire Department of Economics for welcoming me to this program and the education that I have received here. I specially want to mention the value that I have gained as a graduate student from the Labor/Development Brownbag, Forum on Political Economy and Economics, and the Joint Seminar in Development Economics at the University of Washington and want to thank the faculty and students for organizing them. I owe special thanks to Simon Reeve-Parker and Chris Fendrich for providing invaluable departmental support.

I have been extremely lucky to have Shamma Adeeb Alam, Bijetri Bose, Jane Lee, Mishita Mehra, Joshua D. Merfeld, Aurora Stephany, and Syed Galib Sultan as friends and colleagues in graduate school. I also want to thank Nitin Agarwal, Souvik Banerjee, Malaina Bishop, Ananya Chakraborty, Abhishek De, Navin Kumar, Nisha Noor, Desbosmit Ray, Rishabh Saha, Harsh Seth, Dhruv Seth, Debmalya Sinha, and Rishabh Ukil for being extremely entertaining and occupying so that I almost never miss home.

It is impossible to thank my family in just the next few lines but I will try. I have been lucky

to have my Ma and Baba who have encouraged me to think for myself, challenge the status-quo (especially that for girls), and basically do whatever I wanted as long as I could justify it to my older and wiser self. My Dada paved a braver and more unconventional path before me, which makes me think anything is possible with a little more time and work. KK has always reminded me that things could be a lot worse and to keep calm and carry on. My little nephew, Aurho, is my sunshine on a gloomy day. Last but definitely not the least, I thank G for being my family and home away from home and always managing to find a place around me, even when I am an island in a sea of papers.

DEDICATION

to my Baba and Ma

Chapter 1

BANKING AND MARRIAGE MARKETS

1.1 Introduction

In the past few decades, we have witnessed major efforts towards the provision and evaluation of access to credit in emerging economies, especially through microfinance (Crepon et al., 2015; Angelucci et al., 2015; Tarozzi et al.; Banerjee et al., 2015). However, very little is known about how an increase in access to credit can affect women during critical stages of their lives, such as, marriage. Such consequences are particularly relevant for countries where early marriage and financial transfers at the time of marriage (such as, bride price or dowry) are common practices. Recent work by Corno et al. (2016) shows that marriage timing of girls is used as a tool of consumption smoothing at the time of adverse income shocks. Specifically, they find that, when households face a negative agricultural productivity shock, a girl is more likely to marry in Sub-Saharan Africa where the practice of brideprice is common and less likely to marry in India where the practice of dowry is common. Therefore, either through consumption smoothing or income effects, an increase in access to credit can potentially increase the risk of marriage of girls in India. From a policy point of view, it is important to empirically test this hypothesis as early marriage can have long-run adverse effects on the health, education, and household bargaining power of women and also the health and education of their children (Field and Ambrus, 2008; Sekhri and Debnath, 2014; Chari et al., 2016).

In this paper, I examine the effect of access to rural banking on the marriage timing and other marriage outcomes of women and men in rural India. Additionally, I shed light on the other channels, such as, school enrollment and labor demand, that can be affected by access to credit and can consequently affect marriage timing decisions.

To empirically address the above question, first, I use the rural bank branches data from 1951 to 1999, which is available from India's central bank. Second, the analysis also requires detailed information on the birthplace and eventual marriage outcomes of the women and men in the sample. The Rural Economic and Demographic Survey of 1999 contains retrospective marriage information of the interviewed households' children. This enables me to match the financial access information to the location of birth of these children and evaluate its impact on the decisions made before and at the time of their marriage. Third, opening bank branches is very costly and therefore, in the absence of policy interventions, banks are more inclined to open branches in more remunerative and developed locations. However, in case of rural India, most bank branch expansions were policy driven. In either case, the ordinary least squares estimate of the impact of formal bank branches on the outcome of interest is likely to be biased due to the endogenous placement of bank branches. To deal with this selection, following Kochar (2011), I use a rural bank expansion program, the *Branch Licensing Policy*, to instrument for per capita rural bank branches in a district. From 1979 to 1993, the Indian central bank implemented the *Branch Licensing Policy* to expand the country's formal banking network into its rural areas. The *Branch Licensing Policy* followed district-level rules, such that, during the policy years, only districts that were above a predetermined rural population-to-bank ratio received rural bank branches as an increasing function of their initial rural population-to-bank ratio. I exploit these rules to instrument for per capita rural banks in a district.

Using the instrumental variables approach, I confirm that an increase in per capita bank rural bank branches increases the probability that a rural household borrows. Specifically, an additional rural bank branch for every million persons in a district increases the probability of that a household borrows by about 3%. Consequently, I find that an additional rural bank branch for every million persons in a district increases the probability of marriage of a daughter between by about 5.5% but does not statistically significantly affect the probability of marriage of boys. The marriage timing results suggest that households are more willing to have their daughters married in response to an increase in per capita rural bank branches but not their sons. This indicates that an increase in access to credit tightens the "marriage squeeze", that is, there are more potential brides in the marriage market than potential grooms.

A possible way for the market to adjust in response to the tighter "marriage squeeze" can be an increase in groom price (or dowry). As a result, I find that dowry payments increase by approximately 8% in response to a unit increase in per capita rural bank branches per million persons in a district. This is consistent with the intuition that sons' households who are now less willing to enter a marriage match have to be compensated more for agreeing to it. I further find that a unit increase in per capita rural bank branches for every million persons in a district leads to women migrating approximately 11% more distance after marriage. I interpret this as another result of the tighter "marriage squeeze" caused by the increase in access to finance. As the pool of potential grooms shrinks, daughters' households increase their search radius for a groom, which eventually culminates into a greater distance of marriage migration of women in a patrilocal society.

Additionally, I explore whether access to credit increases school enrollment and/or labor supply as either of these changes can potentially delay the marriage of girls. I find that an increase in per capita rural bank branches increases the probability of school enrollment for young girls for whom the risk of marriage is very low but fails to increase the school enrollment of girls who are 14 years or older and for whom the risk of marriage is high. Also, labor supply of women decreases as they are less likely to work for wages in response to an increase in per capita rural bank branches. These results suggest that access to credit only has weak effects on schooling for girls and detrimental effect on labor participation of women and provide further support to the marriage timing result for girls.

This study primarily contributes to two strands of existing literature. First, this work fits into the research on how marriage markets work in developing countries (Banerjee et al., 2013; Sautmann, 2014) and how they are affected by changing economic conditions. Recent studies in Bangladesh and India show that wealth shocks (Mobarak and Kuhn, 2013), income shocks (Corno and Voena, 2016; Corno et al., 2016), and female labor demand shocks (Mbiti, 2008; Heath and Mobarak, 2014; Jensen, 2012) can affect the probability of marriage of women. Here, I show that access to finance is another economic factor that marriage decisions respond to in rural India.

Second, the study is also very closely related to the growing literature on the effects of access to finance on development outcomes. Since the advent of microcredit in the 1970's, providing access to finance to the poor has become a front-runner as a tool of economic development. Though initially received with optimism, empirical evidence on the long run impact of access to finance is mixed (Banerjee et al., 2015). Recent studies show that access to credit either through formal banks (Fulford, 2013) or microfinance (Kaboski and Townsend, 2012, 2011) can increase consumption in the short-term but can have detrimental effects on consumption in the long run. This study shows that even though access to formal banks in rural India has been documented to decrease poverty (Burgess and Pande, 2005), and increase consumption (Kochar, 2011; Fulford, 2013) and manufacturing growth (Young, 2017), it has adverse consequences for women's marriage outcomes. The observed increase in early marriage of women can eventually lead to negative long-run effects on their health, status within household and decisions about investment in children. Therefore, from the standpoint of women's lives, there are reasons to be wary of access to finance policies, especially in societies that practice dowry.

The Indian central bank launched its most recent bank branch expansion program, the *Branch Authorization Policy* in September, 2005. In more recent years, the *Pradhan Mantri Jan Dhan Yojana* was launch in August 2014 to provide every household with a bank account and basic insurance cover. The Micro Unit Development and Refinance Agency was launched in April 2015 to fund and promote microfinance institutions, which will, in turn provide loans to small businesses. These policies show India's persistent commitment towards financial inclusion. However, this paper finds that access to finance policies can have adverse effects on women's welfare by increasing their risk of early marriage, dowry payments, and marriage migration. Therefore, the results in this paper indicate that there is a need to accompany these programs with complementary policies that increase the value of unmarried women (such as, labor policies that promote educational investment in women and their eventual employment) and can potentially counter the marriage market effects of access to finance policies.

The rest of this chapter proceeds as follows. Section 1.2 provides a brief historical background on the expansion of formal bank branches and marriage markets in rural India. Section 1.3 provides a simple theoretical framework that describes the potential effects of an increase in credit on a marriage market where dowry is prevalent. Sections 1.4 and 1.5 describe the data and empirical methodology used in the study, respectively. Section 1.6 gives results. Section 1.7 discusses the results and concludes.

1.2 Background

In this section, first, I describe the major policies that extended India's formal banking network into the rural areas. Second, I briefly discuss some distinct features of the marriage market in India.

1.2.1 Bank Expansion in Rural India

Prior to 1969, the Indian central bank's role in rural credit was very limited. The All India Rural Credit Survey Committee of 1954 reported that less than 9% of rural credit was provided by formal financial institutions, and more than 75% of rural credit was provided by moneylenders, traders, and rich landlords (Shah et al., 2007). During the 1950's and 1960's most of the efforts towards the provision of rural credit was focused on developing cooperative credit societies. However, elite and state capture of these institutions constrained their ability to serve the rural borrowers. At this time, the only significant step towards social banking was the nationalization of the Imperial Bank of India (now called the State Bank of India) in 1955. Yet, even after the State Bank of India was directed to open 400 new branches in semi-urban areas and prioritize agricultural credit, only 2.4% of rural credit was provided by formal institutions by 1971.

Although, India's villages were home to the agricultural industry, which contributed to 60% of the Gross Domestic Product at the time, the 1961 Census reports that almost none of the villages had any formal bank branches. The first major push towards social banking in India commenced with the nationalization of the 14 largest commercial banks in 1969. This was done with a clear message of the central bank playing a more active role in aligning the growth of the financial sector with the overall developmental goals of the country.

In line with these objectives, an *entitlement formula* was implemented in July 1962. This required commercial banks in India to follow a 2:1 ratio between their new branches in banked and unbanked centers[1]. To intensify the rural bank branch expansion, this ratio was later modified to 1:3 in February 1970, and 1:4 in 1977 (Panagariya, 2006). However, even the *entitlement formula* failed to accelerate growth in the rural banking network as needed. Therefore, a new *Branch Licensing Policy* was initiated in its place.

Branch Licensing Policy The government of India implemented a major poverty alleviation program in 1978, the *Integrated Rural Development Program* (IRDP). IRDP promoted self-employment by providing income-generating assets through credit and subsidy. The program provided financial assistance to below-poverty-line families and was intended to help them rise above the poverty line. In 1978, the central bank also implemented a flat-rate of interest of 9% per annum for all priority sector lending (agriculture and allied activities, and small-scale and cottage industries) and directed that down payments were not mandatory for small rural borrowers.

The government implemented the IRDP in all blocks of the country by October 1980. The IRDP was India's primary poverty alleviation program at the time and the government needed India's formal banking network to expand into the rural areas to assist in the implementation of the program.

According to the 1949 Banking Companies Act, banks can only open a new branch in India after procuring a license from the central bank. Therefore, during this policy, the central bank was able to restrict the growth of formal banks to only rural areas of financially underdeveloped districts. The policy spanned three periods: January 1979 to March 1982, April 1982 to March 1985, and April 1985 to March 1993. During each period of the *Branch Licensing Policy*, the central bank classified each district as *deficit* or *non-deficit* based on the district's initial rural population-to-bank ratio[2]. The central bank classified the districts that exceeded a rural population-to-bank ratio of 20,000 as *deficit* in the first period of the *Branch Licensing Policy*. The central bank re-

[1] A centre is defined as a revenue unit and is classified by the respective state government, i.e., it can be a village or city or municipality, or other geographical areas. A banked center is a revenue division with at least one bank branch and an unbanked center is a revenue division without any bank branches.

[2] This corresponded to the number of rural bank branches at the end of September 1978, March 1982, and March 1985, respectively. The district-level rural population data was used from the 1971 Census for the first period of the *Branch Licensing Policy* and the 1981 Census for the last two periods

duced this threshold to 17,000 in the following two periods of the policy. During each policy phase, the central bank granted new branch licenses to only rural areas in *deficit districts*. Each *deficit district* received these new rural bank branch licenses such that they reached the target rural population-to-bank ratio by the end of the policy phase (20,000 for the first phase, and 17,000 for the second and third phase). Therefore, the number of new rural bank branches that a *deficit district* was assigned was positively related to how far this *deficit district* was from the policy's initial rural-population-to-bank ratio cutoff. During each of the three phases of the *Branch Licensing Policy*, the central bank issued a total of 5475, 6121, and 5360 rural bank branch licenses. Together these new licenses accounted for approximately a 60% increase in the total number of bank branches in the country.

Even though the IRDP and the *Branch Licensing Policy* ran together, they had separate implementation criteria. IRDP expenditures were the same across all blocks in the country. However, the implementation of the *Branch Licensing Policy* was based on how far a *deficit district*'s initial rural population-to-bank ratio was from the policy cut-off. Therefore, these unique district-level rules enable me to identify the effect of rural bank branch expansion on the outcomes of interest without picking up the the effects of other programs, running alongside the *Branch Licensing Policy*, like the IRDP.

Eventually, the government ceased the *Branch Licensing Policy* owing to the bad financial health of the banks. Since then the central bank redirected its attention to "improving efficiency, quality of assets and financial strength of banks" and further bank expansion was considered on the basis of "need, business potential, and financial viability"[3].

---

[3]Though the *Branch Licensing Policy* was concluded, the Service Area Approach (SAA) that was implemented in April 1989 was continued. The SAA's objective was to reduce spatial gaps in the rural banking network. Specifically, the SAA required each block, consisting of 15-25 villages, to be assigned a rural bank branch. The SAA was concluded at the start of the central bank's most recent branch expansion policy (the *Branch Authorization Policy*) that was implemented in September 2005.

1.2.2 Marriage Market in India

Banerjee, Duflo, Ghatak, and Lafortune (2013) show that, even in more recent times and in an urban setting, less than 25% of the women in their sample worked after marriage. This makes marriage one of the most important decisions made during the life of a girl in India. However, potential brides and grooms play very little role in their marriage decisions. Literature documents that a marriage match in India is like a strategic contract between two households (Rao and Rao, 1982). Rosenzweig and Stark (1989) show that, in rural India, marriage matches are used as social insurance against income shocks.

India is one of the twelve countries that is part of UNFPA(United Nations Population Fund) and UNICEF's (United Nations Children's Fund) Global Programme to Accelerate Action to End Child Marriage. According to the Prohibition of Child Marriage Act of 2006[4], the legal age of marriage in India is 18 years for girls and 21 years for boys. Yet, even today, 48% of girls in rural areas and 29% of girls in urban areas are married before they are 18 years of age (UNICEF India, 2017). Qualitative evidence suggests that, there are several reasons why parents dislike delaying a daughter's marriage like higher dowry, declining number of potential matches, protection from sexual assault and pregnancy.

A marriage agreement in India is almost always accompanied by a dowry. A dowry is a financial transfer from the bride's household to the groom's household at the time of marriage. Traditionally, these marriage payments were only practiced among the upper caste[5] households in North India. However, over time, the tradition has spread to the rest of the country (Caldwell, Reddy, and Caldwell, 1983). These payments are generally much larger than the average household income (Anukriti, Kwon, and Prakash, 2016). Despite, state-level bans implemented as early as 1939 and the national Dowry Prohibition Act in 1961, there has been a surge in dowry payments and dowry-related deaths over time. In 2012, more than 18,000 dowry death cases were reported in India (National Crime Record Bureau). Some researchers propose "marriage squeeze",

---

[4]This replaced the earlier legislation, Child Marriage Restraint Act 1929.

[5]Caste system is a social stratification practiced by Hindus in India, which is inherited at birth. It is a hierarchical system that was originally based on occupation and lifestyle practices.

that is, fewer potential grooms than potential brides in the marriage market, as the cause of the rising groom prices (Rao, 1993; Sautmann, 2014). Other competing theories propose "marrying up", that is, lower caste women marrying upper caste men (Anderson, 2003; Rajaraman, 2006) and increased ability to replicate customs of the upper caste (Srinivas, 1952) as the causes of dowry inflation.

Another distinct feature of the marriage market in India is the practice of patrilocal exogamy. It refers to the custom in which a girl travels, often long distances, from her parent's house to her husband's house after marriage. In the National Sample Survey of 2007-08, 74% of rural women reported to have migrated for marriage (Fulford, 2015). Rosenzweig and Stark (1989) argue that these migration patterns of married women can be explained as risk-mitigating strategies adopted by agricultural households with high income variability. To smooth consumption, they create a marriage match with a household with low income variability in a distant village. Recent work by Fulford (2015) emphasizes on a different determinant of the marriage migration and shows that the marriage migration of women in India is largely associated with the status of women in society. Societies that place a lower value on their unmarried daughters (for example, the North Indian states) also exhibit greater distances of marriage migration of women.

1.3 Conceptual Framework

In this section, I develop a simple theoretical model to demonstrate how an increase in the availability of credit can affect the probability of marriage of daughters and sons in a society where dowry is customary. I also detail two other channels outside this simplistic framework that can affect marriage timing decisions in response to a relaxation of the credit constraint.

1.3.1 The Model

I build on a framework developed in Corno and Voena (2016) and Corno, Hilderbrandt and Voena (2017), where households solve a consumption optimization problem and decide on the marriage timing of their daughters and sons. I introduce borrowing to the model, which enables households to move resources to future periods.

In the model, a household lives for two periods during which they maximize their utility, $(U(c_1, c_2))$, subject to the inter-temporal budget constraint and credit constraint. Every period, a unit mass of households with a daughter and a unit mass of households with a son are born. The two periods correspond to the young and old life stages of the daughter or the son. If they are not married by the first period, then they re-enter the marriage market in the second period. Once a marriage occurs, there is no more search. Brides and grooms are matched and can only marry within their own cohort. The instantaneous utility, $u(c_t)$, is increasing and concave in consumption. The household chooses consumption, c_t, in each period. The household also chooses how much to borrow in the first period, b, which is constrained by a constant, α. The household pays an interest rate, r, on the borrowings. The household is saving instead of borrowing when $b < 0$, in which case they earn an interest on it that is equal to r.

The household chooses the period in which their daughter or son marries. m_t is an indicator that is equal to 1 if a son or daughter marries in period t and zero otherwise and M_2 is an indicator that is equal to one if a son or daughter is married by the second period. A daughter's household has to pay dowry, d_t, for her marriage in period t. Similarly, a son's household receives a dowry, d_t, for his marriage in period t. d_t is endogenously determined from the marriage market equilibrium.

The household income, y_t, is subject to idiosyncratic shocks and is an i.i.d. stochastic process. A household has to invest i in their daughter or daughter-in-law (assuming patrilocal exogamy). The daughter or daughter-in-law contributes positively to household consumption when $i < 0$. If married by the second period, then $\varepsilon^f \geq 0$ and $\varepsilon^m \geq 0$ are a utilities derived by the daughter's and son's households, respectively. ε^f can be interpreted as the value received by the daughter's household from avoiding the stigma of an unmarried daughter and ε^m can be thought of the value from an offspring.

The optimization problem of a household with a daughter can be written as

$$\begin{aligned} \underset{c_1,c_2,m_1,m_2,b}{\text{maximize}} \quad & U(c_1,c_2) = u(c_1) + \beta\{E_1[u(c_2)] + M_2\varepsilon^f\} \\ \text{subject to} \quad & c_1 + m_1 d_1 + (1-m_1)i = y_1 + b \\ & c_2 + m_2 d_2 + (1-M_2)i + (1+r)b = y_2 \\ & b \leq \alpha. \end{aligned} \tag{1.1}$$

Suppose μ^f is the Lagrange multiplier associated with the credit constraint, $b \leq \alpha$, then the first order condition of the above problem with respect to b is

$$u'(y_1 + b^* - m_1 d_1 - (1-m_1)i) = \beta(1+r)E_1[u'(y_2 - m_2 d_2 - (1-M_2)i - (1+r)b^*)] + \mu^f \tag{1.2}$$

The household prefers to have their daughter married in the first period if the utility derived from it is greater than the utility derived from waiting. If the credit constraint binds, that is, $\mu^f > 0$ and $b^* = \alpha$, then the household prefers to have their daughter married in the first period if

$$u(y_1 + \alpha - d_1) + \beta E_1[u(y_2 - (1+r)\alpha)] \geq u(y_1 + \alpha - i) + \beta E_1[u(y_2 - d_2^* - (1+r)\alpha)] + \varepsilon^f\}. \tag{1.3}$$

d_2^* in item 1.3.1 is the equilibrium dowry payments in the market for older brides and grooms[6]. Using this framework, the optimization problem for the son's household is also derived in the Appendix.

Proposition 1: If (i) $u'(.) > 0$ and $u''(.) < 0$; (ii) $b^* = \alpha$; (iii) $d_1 > i$[7] and $d_2 >= 0$, then an exogenous increase in the credit limit, α:

1. Increases the value of having a daughter marry in the first period compared to the second

[6] The marriage market for older brides and grooms is described in the Theoretical Appendix.

[7] Throughout the model I assume that $d_1 > i$ as it is common for households to spend more than annual income (and therefore, child expenses) on daughter's dowry.

period, as

$$\frac{\partial[u(y_1+\alpha-d_1)-u(y_1+\alpha-i)+\beta[E_1[u(y_2-(1+r)\alpha)]-E_1[u(y_2-d_2-(1+r)\alpha)]]]}{\partial\alpha}>0,$$

and therefore, increases the supply of young brides.

2. Decreases the value of having a son marry in the first period compared to the second period, as

$$\frac{\partial[u(y_1+\alpha+d_1-i)-u(y_1+\alpha)+\beta[E_1[u(y_2-(1+r)\alpha)-i]-E_1[u(y_2+d_2-i-(1+r)\alpha)]]]}{\partial\alpha}<0,$$

and therefore, decreases the demand for young brides.

Corollary 1: If (i) $u'(.) > 0$, $u''(.) < 0$, and $u'''(.) > 0$[8]; (ii) $b^* = \alpha$; (iii) $d_1 > i$, then an exogenous increase in y_1:

1. Decreases $\partial V^f/\partial\alpha$, where

$$V^f = [u(y_1+\alpha-d_1)-u(y_1+\alpha-i)+\beta[E_1[u(y_2-(1+r)\alpha)]-E_1[u(y_2-d_2-(1+r)\alpha)]]].$$

2. Increases $\partial V^m/\partial\alpha$, where

$$V^m = [u(y_1+\alpha+d_1-i)-u(y_1+\alpha)+\beta[E_1[u(y_2-(1+r)\alpha)-i]-E_1[u(y_2+d_2-i-(1+r)\alpha)]]].$$

Corollary 1 shows that an increase in income during the first period will attenuate the effect of an increase in the credit limit on a household's willingness to marry their daughter or son.

In case of households with daughters, there must be some value of $\alpha = \alpha^f$ for which holds with equality. For any $\alpha < \alpha^f$, a household will prefer to marry their daughter in the second period

[8]Here, I assume prudence in addition to risk aversion. This implies precautionary saving, that is, households save more in response to an increase in risk.

than the first period. Given that a unit mass of young daughters are born each period, the supply of young brides in the marriage market is equal to $1 - \alpha^f$.

Proposition 2: The quantity supplied of young brides is decreasing in d_1 and the quantity demanded of young brides is increasing in d_1.

Proof: See Appendix.

Corollary 2: An exogenous increase in the credit limit, α, increases equilibrium dowry payments for young brides, d_1^*.

Proof: As shown in Proposition 1, an exogenous increase in the credit limit, α, increases the supply of young brides and decreases the demand for young brides. Therefore, in the market for young brides, an increase in α shifts the downward sloping supply curve outwards and the upward sloping demand curve inwards (Proposition 2). As a result, equilibrium dowry payments for young brides increases in response to an exogenous increase in α.

1.3.2 Alternate Channels

One can think of more channels through which access to credit can change the marriage timing of girls and boys. Here, I elaborate two such channels that I think are most likely to be present:

Schooling For both girls and boys, credit can increase school enrollment through income and risk management effects. Berhman and Knowles (1999) show that to the extent to which microfinance influences the growth in income, it can also positively affect the demand for schooling. Jacoby and Skoufias (1997) find that, in India, a decline in agricultural income across seasons caused a drop in school attendance. These findings suggest that through an increase in income and risk-coping mechanisms, access to finance can increase educational attainment and thereby can potentially delay marriage, especially for girls.

Labor Participation An increase in credit opportunities may also lead to additional productive activities. This can increase a household's demand for labor either directly for these additional activities or indirectly for childcare or livestock duties (Jensen and Nielsen, 1997). In either case, this increases the value of an unmarried daughter in the household and can lead to the postponement of her marriage. Given the tradition of patrilocal exogamy, for boys, this is likely to increase their probability of marriage to bring in more labor into the household.

1.4 Data and Variable Construction

In this section, I describe the sources and suitability of the data that I use to test the effect of access to rural bank branches on marriage markets in India. I also detail the construction of the variables used in the study.

1.4.1 Bank Data

In this paper, I estimate the effect of rural bank branch expansion on marriage outcomes. For this purpose, I use per capita rural bank branches per million persons at the district-level[9] from 1951 to 1999 as the measure of rural bank branch network. The bank data is sourced from India's central bank (Reserve Bank of India's Directory of Commercial Banks). It records the state, district, revenue division[10], and date of open of all operating[11] bank branches in India.

1.4.2 Household Data

The household data on the outcomes of interest are from the Additional Rural Incomes Survey/Rural Economic and Demographic Surveys (ARIS/REDS). The ARIS/REDS is a nationally representative panel survey of rural India. It consists of detailed economic and demographic information at the household and village levels. The National Council of Applied Economic Research

[9] This was computed for each of 96 districts in the ARIS/REDS survey according to 1981 Census district boundaries. Also, using the 1981 Census Final Population Totals, I classified each revenue division within these districts as rural if the revenue division has a population of less than 10,000 persons (as per the available literature on the *Branch Licensing Policy*).

[10] Revenue divisions, also previously referred to as a centers, are classified by the respective state governments. They can be a village or city or municipality, or other geographical areas.

[11] I downloaded the data used in this paper on June 26, 2016. The central bank updates this list every month to include only currently operating branches. Therefore, the data for bank branches that were originally opened before June 2016 and were either closed or merged with other branches are either unavailable (for the closed branches) or only the merger dates (for the merged branches) are available.

collected the first wave of ARIS/REDS in 1969. In this study, I use the 1982 and 1999 waves of the ARIS/REDS.

Marriage Timing

To explore the effects of per capita rural bank branches on marriage timing, I use the 1999 ARIS/REDS wave which covers 7,474 rural households across 100 districts and 17 states[12]. The 1999 ARIS/REDS data is uniquely suited for this study as it records retrospective marriage data on all sons and daughters of the surveyed households. This is particularly important in the case of married women because of the tradition of patrilocal exogamy in India. For example, in the ARIS/REDS data, over 85% of married daughters were reported to have moved outside of their natal village. However, most household surveys, only record a married woman's current area of residence and not her location of birth. Over 97% of all household heads in the ARIS/REDS data report that they were born in the village of their current residence. The low level of migration of household heads enables me to match the rural bank data to their daughters' natal district during the time that they were in the marriage market.

To examine the effect of an increase in rural access to credit on the timing of marriage of women and men, I use a discrete-time hazard model of marriage. I create a retrospective panel for each daughter and son in a household from 1951 to 1999. A daughter enters the panel at the age of 12 and exits the panel either at marriage or at the age of 24, whichever occurs first. The outcome variable of interest is an indicator that is equal to zero during the years that the daughter is unmarried and is equal to one during the year she gets married. I examine the risk of marriage for daughters between 12 and 24 years of age because the age of marriage for 90 percent of married daughters in the sample is between these ages. A similar retrospective panel is created for sons between 14 and 30 years old[13].

Dowry is one of the primary channels through which access to finance can affect marriage

[12] In this paper, I can only include 96 of these districts in the analysis as there is no 1981 Census data for Assam due to the separatist movements at the time. Therefore, the 4 ARIS/REDS districts in Assam are dropped.

[13] In the 1999 REDS data, age of marriage of 90 percent of the married sons is between the ages of 14 and 30.

outcomes. Previous literature largely documents that the practice of dowry originated and is still deep-rooted in Hinduism (Goody and Tambiah, 1973, Borooah and Iyer, 2004; Bloch, Rao, and Desai, 2004; Srinivasan, 2005; Chowdhury, 2010). It is said that *kanyadana*, the act of giving your daughter along with financial or other transfers, is one of the paths to attain enlightenment in Hinduism. In contrast, it has been documented that the practice of dowry is less prevalent and less approved of in Muslim households in India (Srinivasan and Lee, 2004). Several recent studies have used this cultural heterogeneity to show, for example, that adverse income shocks delay the marriage of daughters more among Hindu households (Corno, Hilderbrandt, and Voena, 2017) and also leads to a lower increase in dowry-related deaths in districts with higher proportion of Muslim population (Sekhri and Storeygard, 2014). For these reasons and the importance of dowry as a channel of change in this study, I restrict all analysis to only Hindu households who constitute 89 percent of the surveyed households in the 1999 ARIS/REDS.

Other Marriage Outcomes

I also employ the 1999 ARIS/REDS to explore the change in the characteristics of marriage matches formed when the brides' households experience an increase in access to rural bank branches. For this purpose, I use the dowry paid[14], distance of marriage migration data, spouse's years of schooling, and spouse's household landholding from all marriages of household heads' daughters between 1951 and 1999. To understand what happens to the quality of matches as grooms' households experience an increase in access to rural bank branches, I use the dowry received, spouse's distance of marriage migration, and spouse's years of schooling of male household heads. I also use the sample of male household heads to test the effect of an increase in per capita bank branches on spousal age gap[15].

[14]All dowry variables are converted to 1999 Rupees value using the Consumer Price Index.

[15]This information is unavailable for the sample of daughters and sons in the 1999 ARIS/REDS.

Borrowing

A unique feature of the ARIS/REDS data is that, starting from the 1982 wave, it records information on household borrowing during the year of the survey. The 1982 ARIS/REDS interviewed 4,979 households[16]. As I described previously, the *Branch Licensing Policy* was in its second phase since April 1982. Therefore, I use the cross-sectional data from the 1982 wave of the ARIS/REDS to test the effect of an increase in per capita rural bank branches on the probability that a rural household borrows. For this purpose, I use an indicator variable that is equal to one if a household took out a loan in 1982 and equal to zero otherwise as the dependent variable.

School Enrollment

I also explore if schooling is a channel through which marriage timing is affected. The 1999 ARIS/REDS records years of schooling of all daughters and sons in the interviewed households. Using this, I create two retrospective panels from 1951 to 1999 for daughters and sons, respectively. A child enters the panel at the age of 5 and exits the panel either at dropout or at the age of 18[17], whichever occurs first. I investigate the effect of per capita rural bank branches on school enrollment using a binary variable that is equal to one during the years that the child is enrolled in school and is equal to zero during the year the child drops out.

Labor Supply

I also use the 1982 ARIS/REDS to study labor supply changes of women and men in response to an increase in per capita rural bank branches. For, this purpose, I create an indicator variable $Work$ that is equal to one if a household member is self-employed or working for salary/wage and zero otherwise. Also, I use the reported activity status for each member of the interviewed households and code it into five indicator variables to capture different types of work status: (i) Self-employed

[16] The 4,979 households who were interviewed in 1982 are re-interviewed in 1999. Moreover, household divisions and an addition of a new random sample leads to a final sample of 7,474 households in the 1999 ARIS/REDS survey.

[17] Children typically enroll in school when they are 5 years of age and graduate from high school when they are 18 years of age.

(Farm); (ii) Self-employed (Non-farm); (iii) Salaried Work; (iv) Wage Work and; (v) Domestic Work.

1.4.3 Other Data Sources

Census

I use the 1971 and 1981 Comparative Primary Census Abstract to impute district-year level data on rural population, population density, percentage of scheduled caste, percentage of scheduled tribe, percentage of literates, percentage of cultivators and agricultural laborers, and percentage of other workers. These variables control for time-varying district characteristics in the specifications described below.

Rainfall

Lastly, I use district-level deviation of annual rainfall from the mean of annual rainfall (using 15 year lags), scaled by the standard deviation, to measure rainfall shocks. I use these z-scores as an additional district-level covariate in the specifications below and also to investigate heterogeneous effects of per capita rural bank branches on marriage timing by rainfall shocks. The precipitation data is from the University of Delaware. It is a monthly series of 0.5 degree by 0.5 degree grids with global coverage. I create a district-level series by matching the center coordinates of each district to the closest grid available in this data (within the national boundaries of India).

1.5 Empirical Strategy

This section describes the empirical specification that I use to examine the effect of an increase in per capita rural bank branches on marriage timing, other marriage marriage characteristics, school enrollment, borrowing and labor supply.

1.5.1 Main Specification

A simple ordinary least squares (OLS) specification to estimate the effect of per capita rural bank branches on the outcomes of interest is as follows:

$$\begin{aligned} Outcome_{ihdt} =& \theta PerCapitaRuralBanks_{dt} + Age_t + DistrictCharacteristics_{dt} \\ &+ Household_h + Year_t + District_d \times (t - 1951) + u_{ihdt} \end{aligned} \tag{1.4}$$

In Equation 1.4, $Outcome_{ihdt}$, is the dependent variable of interest of daughter/son i in household h, districtd d and year t[18]. $PerCapitaRuralBanks_{dt}$ is the number of rural banks in district d at the end of year t per million persons and measures rural financial access. Age_t is a vector of age dummies. $DistrictCharacteristics_{dt}$ includes time varying district characteristics such as rural population, z-score of rainfall, percentage of literates, percentage of scheduled caste, percentage of scheduled tribe, population density, percentage of cultivators and agricultural laborers, and percentage of other workers. $Household_h$ captures household fixed effects to control for unobserved time-invariant characteristics of a household. $Year_t$ are year dummies that capture aggregate shocks. $District_d$ are district dummies and $District_d \times (t - 1951)$ are district-specific linear time trends that capture the differential growth rates in districts. u_{ihdt} is an idiosyncratic error term.

In the above specification, θ is identified within a household, however, for studying the marriage outcomes of the sample of male households heads, I am unable to take household fixed effects. Therefore, instead, I include district fixed effects and controls for the characteristics of their parents, as follows:

$$\begin{aligned} Outcome_{ihdt} =& \theta PerCapitaRuralBanks_{dt} + Age_t \\ &+ ParentCharacteristics_h + DistrictCharacteristics_{dt} \\ &+ District_d + District_d \times (t - 1951) + \mu_{ihdt} \end{aligned} \tag{1.5}$$

[18] t refers to the year of marriage for marriage outcomes, such as, dowry paid, distance of marriage migration, spouse's years of schooling, and spouse's household landholdings for the sample of married daughters.

In Equation 1.5, $ParentCharateristics_i$ includes land owned by male head of households' parents and its square, and an indicator for whether household belongs to a high-caste.

In the above OLS models, θ is the primary coefficient of interest and measures the effect of an increase in per capita rural banks on the outcome of interest. However, changes in the rural banking network are unlikely to be exogenous. Therefore, the estimate of θ is likely to be biased. In the absence of government intervention, banks are more likely to open branches in more developed districts. Conversely, government intervention may allow banks to open branches only in less developed districts. If the the outcome variable of interest takes larger values in more developed districts then: (a) θ will be overestimated, in the absence of policy intervention. (b) θ will be underestimated, in the presence of policy intervention. The opposite is true for an outcome variable that takes smaller values in more developed districts.

To overcome the limitations of the OLS model, I draw on the instrumental variables approach used by Kochar (2012) and exploit the district-level rules implemented during the Branch Licensing Policy. During the policy, if targeted rural branch expansion was successful, we will observe higher per capita rural bank branches in *deficit districts* with higher initial rural population-to-bank ratio compared to *deficit districts* just above the cutoff value of the initial rural population-to-bank ratio. I test the effectiveness of the Branch Licensing Policy in increasing rural access to formal banking as follows:

$$\begin{aligned} PerCapitaRuralBanks_{dt} = &\sum_{N=1}^{3} \alpha_N [PhaseN_t * I(DeficitN_d > 0) * DeficitN_d] \\ &+ \sum_{N=1}^{3} \psi_N [PhaseN_t * I(DeficitN_d > 0)] \\ &+ \sum_{N=1}^{3} \gamma_N [PhaseN_t * DeficitN_d] + \sum_{N=1}^{3} \psi_N PhaseN_t \\ &+ DistrictCharacteristics_{dt} + District_d \\ &+ Year_t + District_d \times (t - 1951) + \epsilon_{dt} \end{aligned} \tag{1.6}$$

In Equation 1.6, N denotes the three *Branch Licensing Policy* periods[19]. $PhaseN_t$ is an indicator variable that is equal to one during the years of policy period N and zero otherwise. $DeficitN_d$[20] is the difference between district d's initial rural population-per-bank ratio and the cut-off during policy period N. A higher $DeficitN_d$ indicates a higher initial rural population-to-bank ratio for district d. $I(DeficitN_d > 0)$ is an indicator variable that is equal to one if district d has an initial rural population-per-bank ratio above the cut-off and qualifies as a *deficit district*.

α_N is the coefficient of interest in Equation 1.6. It estimates how per capita rural bank branches in a *deficit district* changes during period N if, at the start of period N, a rural bank branch in that *deficit district* served 1,000 more rural residents compared to *deficit districts* just above the cutoff. A successful *Branch Licensing Policy* means that, during each of the policy periods, *deficit districts* with an initial rural population-to-bank ratio farther away from the policy cutoff received more rural bank branches, and therefore, implies positive α_N for all three policy periods.

The estimation result of Equation 1.6 using bank data from 1951 to 1999 is reported in Table 1.1. Consistent with the aims of the *Branch Licensing Policy*, coefficient estimates of α_N are positive and statistically significant. Table 1.1 shows that a 1000 unit increase in the initial rural population-to-bank ratio increases the number of rural bank branches per million persons in a *deficit district* by approximately 2 branches during each of of the three policy phases. This confirms that *deficit districts* did receive more rural bank branches during the policy as a positive function of the their initial rural population-to-bank ratio. A F-test on these three-way interactions rejects that they are jointly insignificant. Therefore, based on Equation 1.6, I use the three-way interactions between the policy phase indicators, the *deficit district* indicators and the degree of the deficits to instrument for the per capita rural bank branches in Equation 1.4 and Equation 1.5. This two-stage least squares (2SLS) instrumental variables approach is my main empirical strategy to estimate the effect of an increase in rural banking network on marriage markets.

---

[19] $Phase1$, $Phase2$ and $Phase3$ correspond to 1979 to 1981, 1982 to 1984 and 1985 to 1992, respectively.

[20] In the analysis, it is scaled down by a 1,000 persons.

1.5.2 Cross-sectional Specification

The main specification implicitly assumes that an increase in the rural banking network leads to an increases in the use of credit by rural households. Using the the nationally representative 1982 cross-sectional data on household borrowing and the following estimation model, I explore if an increase in per capita rural bank branches increases rural household borrowing:

$$\begin{aligned} Borrow_{hds} =& \theta PerCapitaRuralBanks_{ds} + HouseholdCharacteristics_h \\ &+ DistrictCharacteristics_d + State_s + \pi_{hds} \end{aligned} \tag{1.7}$$

The dependent variable, $Borrow_{hds}$, is an indicator variable that is equal to one if a household h in districtd d and state s took out a loan in 1982 and equal to zero otherwise. $PerCapitaRuralBanks_d$ is the number of rural banks in district d in 1982 per million persons. $HouseholdCharacteristics_h$ is a vector of household characteristics that includes dummies for age of household head, farmland owned by household and its square, dummies for household size, dummies for educational attainment of household head, an indicator for the household's caste. $State_s$ captures state fixed effects.

In equation Equation 1.7, θ is the primary coefficient of interest. However, as described previously, the OLS estimate of θ is likely to be biased. To address this, I use a modification of Equation 1.6 to instrument $PerCapitaRuralBanks_{ds}$ in 1982, as follows:

$$\begin{aligned} PerCapitaRuralBanks_{ds} =& \kappa_1[I(Deficit2_d > 0) \times Deficit2_d] + \kappa_2 I(Deficit2_d > 0) \\ &+ \kappa_3 Deficit2_d + DistrictCharacteristics_d + State_s + \chi_{ds} \end{aligned} \tag{1.8}$$

I also use the estimation strategy described in Equation 1.7 and Equation 1.8 to study the effect of an increase in per capita rural bank branches on the labor supply variables in 1982.

1.6 Results

1.6.1 First Stage

Based on Equation 1.6, Panels A and B in Table 1.2 report the 2SLS first-stage results of the marriage timing and school enrollment regressions, respectively. The instruments exploit the fact that, during each phase of the *Branch Licensing Policy*, qualifying *deficit districts* received more rural bank branches as an increasing function of their deficit. Consistent with the policy compliance result in Table 1.1, in both Panels A and B of Table 1.2, the coefficients on all three instruments are positive and confirm that, during each phase of the *Branch Licensing Policy*, more bank branches were opened in *deficit districts* with higher initial rural population-to-bank ratios. Also, the first-stage F-statistics are large enough to alleviate concerns about weak instruments.

Based on Equation 1.8, Panels A, B, and C in Table 1.3 show the 2SLS first-stage results of the household borrowing and labor supply regressions. These first-stage results show that *deficit districts* that were farther away from the *Branch Licensing Policy*'s initial rural population-to-bank ratio cutoff in 1982 received statistically significantly more rural bank branches per capita compared to the *deficit districts* that were just above the cutoff. Specifically, the coefficient on the instrument shows that, within a state, *deficit districts* that were serving on average 1000 more persons per rural bank branch at the end of March 1982, compared to the *deficit districts* just above the 1982 initial rural population-to-bank ratio cutoff, received approximately 5 new rural bank branches per million persons in the district.

1.6.2 Marriage Timing

Column (1) in Table 1.4 reports the OLS estimate of the effect of an increase in per capita rural bank branches on the probability of marriage of daughters in rural India. I find that the OLS estimate of the effect of per capita rural bank branches on daughters' probability of marriage is small, positive and statistically indistinguishable from zero.

Column (2) in Table 1.4 shows the reduced form results of the discrete hazard model of marriage for the sample of daughters. The estimates show that the first phase of the policy intervention had no statistically significant effect on the probability of marriage of daughters. However, during the second and third phase of the *Branch Licensing Policy*, the policy intervention had a positive effect on the probability of marriage of daughters. Specifically, compared to the daughters in *deficit districts* that lie just above the policy cutoff, the probability of marriage of daughters increased by 0.0109 percentage points during the second phase of the policy and by 0.0067 percentage points during the third phase of the policy in *deficit districts* that served on average 1000 more persons per rural bank branch at the start of the policy phase. Since, there is a large overlap in the districts that qualified as *deficit* during each of the policy periods, the reduced form evidence suggests that, over time, the *Branch Licensing Policy* increased the risk of early marriage of girls.

Consistent with the prediction in Proposition 1 and the reduced form results, the 2SLS estimate in Column (3) of Table 1.4 shows that an additional rural bank branch for every million persons in a district increases the probability of marriage of daughters in that district by approximately 0.0049 percentage points. Given that the mean of the dependent variable is 0.09, this effect corresponds to an increase of approximately 5.5% in the hazard of daughters getting married during a given year.

Column (4) in Table 1.4 shows that the OLS estimate of the effect of per capita rural bank branches on the probability of marriage of sons is small, negative, and statistically insignificant. Column (5) in Table 1.4 shows the reduced form results of the discrete hazard model of marriage for the sample of sons. The estimates show that the first and second phase of the policy intervention have no statistically significant effect on the probability of marriage of sons. This is similar to the result for daughters and may suggest a delayed response of the marriage market to an increase in access to formal banking. The coefficient on the instrument for the third phase of the policy is negative and statistically significantly different from zero. Specifically, compared to the sons in *deficit districts* that lie just above the policy cutoff, the probability of marriage of sons decreased by 0.0060 percentage points during the last phase of the policy in *deficit districts* that served on average 1000 more persons per rural bank branch at the start of the policy phase. Consistent with the prediction of the theoretical model, the 2SLS estimate in Column (6) of Table 1.4 is negative, however, it is statistically indistinguishable from zero.

By Agricultural Productivity Shocks Households often use the marriage timing of their daughters as an instrument of consumption smoothing. Corollary 1, shows that, the effect of banking on the marriage timing of girls should be concentrated during the years that households do not experience a positive agricultural productivity shock. Rural household incomes are primarily governed by agricultural production, which is heavily dependent on good rainfall. Therefore, I use deviation of annual rainfall from the long-run average, scaled by the long-run standard deviation as a measure of agricultural productivity shock. To test the difference in the effect of per capita banks on the probability of marriage by income shocks, I interact per capita rural bank branches with the z-score of rainfall.

Column (2) in Table 1.5 shows that, consistent with the prediction in Corollary 1, the coefficient on the interaction is negative and statistically significant. This indicates that the positive effect of access to credit on the probability of marriage of daughters is concentrated during the years of adverse income shocks. Also consistent with Corollary 1, Column (4) in Table 1.5 shows that the coefficient on the interaction is positive for the sample of boys. However, the coefficient is not statistically significant.

1.6.3 Other Marriage Outcomes

It is likely that the change in the marriage probabilities of women in response to an increase in the formal banking network can lead to changes in the characteristics of marriage matches formed. I investigate this using Equation 1.4 and Equation 1.5 for the sample of daughters and male heads of households, respectively. However, the following coefficient estimates cannot be treated as causal because the characteristics of individuals who marry in response to an increase in per capita rural bank branches may be different from those who do not. Therefore, the estimates are a combination of the differential characteristics of those who choose to marry (the selection bias) and the different kind of marriage matches formed (the coefficient of interest) in response to an increase in access to finance.

Dowry The theoretical model shows that when the credit constraint is relaxed, a household's willingness to have a daughter married increases and the willingness to have a son married decreases. As a result, the equilibrium groom price (or dowry) increases to compensate the less willing groom's household to agree to a marriage. To test this, I estimate the OLS and 2SLS models with the amount of dowry paid for a daughter's marriage and the amount of dowry received for a male head of household's marriage as the dependent variables.

Columns (1) and (2) in Panel A of Table 1.6 report the OLS and 2SLS estimates of this regression for the sample of daughters. Consistent with the theoretical model, I find that an additional rural bank branch per million persons in a daughter's natal district increases dowries paid for the daughter by approximately Rs. 2200. Evaluated at the sample average, this effect translates into an 8% increase in dowries paid.

I repeat the analysis using dowries received by male heads of households. Columns (1) and (2) in Panel B of Table 1.6 report the OLS and 2SLS estimates of this regression. The 2SLS estimate shows that an additional rural bank branch per million persons in the groom's district increases dowries received by approximately Rs.1300. Evaluated at the sample average, this translates into a 5% increase in the amount of dowries received.

Marriage Migration Patrilocal exogamy is almost universal in India. It is common for women to leave their natal household after marriage and reside in the groom's household. Therefore, one consequence of the marriage timing results can be that girls from more financially developed districts marry grooms in less financially developed districts. I do not observe the district that the daughters marry into but I do observe the distance that they migrate after marriage. Therefore, I test the effect of per capita rural bank branches on the distance of migration of married daughters.

Columns (3) and (4) in Panel A of Table 1.6 display the OLS and 2SLS regression results for the sample of daughters. Using the 2SLS specification, I find that an additional rural bank branch for every million persons increases a daughter's marriage migration distance by approximately 3 kilometers. Evaluated at the sample average, this translates into an 11 percentage increase in women's distance of marriage migration.

I repeat the analysis using the distance migrated by male head of households' spouses to explore the search efforts of grooms' households. Columns (3) and (4) in Panel B of Table 1.6 report the OLS and 2SLS estimates for this sample. The 2SLS estimate is relatively small, negative and statistically insignificant. Therefore, I do not find any changes in the search efforts of grooms' households in response to an increase in formal banking.

Characteristics of Spouse Columns (5) to (8) in Panel A and Columns (5) to (10) in Panel B of Table 1.6 report the estimates for the effect of per capita rural bank branches during the year of marriage on spouse characteristics, such as, spouse's years of schooling, spouse's household landownership, and whether spouse was a relative before marriage. I do not find any statistically significant changes in these characteristics in response to an increase in per capita rural bank branches.

Spousal Age Gap The marriage timing results results show that the expansion of rural banks leads to an increase in the number of potential brides in the marriage market. A possible way for the marriage market to adjust in the aftermath of this change is for younger girls to marry older boys, thereby increasing spousal age gap. I test this by looking at the effect of an increase in per capita rural banks on the age difference between male household heads and their spouses.

Columns (11) and (12) in Panel B of Table 1.6 report the OLS and 2SLS estimates of the effect of an increase in per capita rural banks on the age difference between male household heads and their spouses. However, I do not find any effect of per capita rural bank branches on this spousal age gap.

1.6.4 Household Borrowing

Column (1) in Table 1.7 shows that the OLS estimate of per capita rural bank branches on the probability that a household borrows in 1982 is negative, small and statistically insignificant. Column (2) in Table 1.7 reports the reduced form result from the regression of the indicator for loan uptake on the instrument (the interaction between whether a district qualified as *deficit* in 1982 and the degree of the deficit). Here, the coefficient on the instrument shows that, within the same state, for every additional 1,000 persons served by a rural bank branch in a *deficit district* at the end of March 1982, the probability that a rural household in this *deficit district* borrows during 1982 increases by approximately 0.0198 percentage points, compared to the households in *deficit districts* that lie just above the policy cutoff.

Column (3) in Table 1.7 shows that the the 2SLS estimate of the effect of per capita rural bank branches on the probability of borrowing is positive and statistically significant. Specifically, the 2SLS estimate shows that an additional rural bank branch for every million persons in a district increases the probability that a rural household in that district borrows during 1982 by 0.0038 percentage points. Evaluated at the sample average, the effect translates into approximately 3% increase in the probability that a rural household borrows. A policy intervention interpretation can explain the difference between the OLS and 2SLS estimates. During 1982, financially underdeveloped districts were targeted to receive more rural bank branches. These are also the districts that have a lower incidence of household borrowing. Thus, the OLS estimate of the effect of per capita rural bank branches on the probability of rural household borrowing is underestimated.

By Landownership It is possible that despite the increase in the banking network there exists unequal access to or use of credit by economic status (Kochar, 2012). This can be because of various reasons, such as, the more well off can take more advantage of the newly available banking network, or have more productive use for these loans, or have a higher availability of collateral. Therefore, I investigate if the effect of per capita rural bank branches on the probability of rural household borrowing varies by landownership. To test this, I re-estimate the OLS and 2SLS models by including interactions between per capita rural bank branches and indicators for the last four quintiles of owned farmland.

The OLS (Column (1)) and 2SLS (Column (2)) results of this model are reported in Table 1.8. The 2SLS estimates of the effect of per capita rural bank branches on the probability of borrowing for the five quintiles of landowners is graphed in Figure 1.1. Specifically, I find that an additional rural bank branch per million persons increases the probability that a household borrows during

1982 by 0.0075, 0.0042, and 0.036 percentage points for the first, second, and fifth quintile of landowners, respectively. However, the estimates for the third and fourth quintile of landowners is statistically indistinguishable from zero. Also, the top quintile of landowners are significantly more likely to obtain a loan in response to an increase in the formal bank network compared to the bottom quintile of landowners.

1.6.5 School Enrollment

As described in the Conceptual Framework, an increase in access to credit can potentially increase schooling which in-turn can delay marriage, especially for girls. Therefore, in this section, I explore if the schooling channel is at work.

Column (1) in Table 1.9 shows the OLS result of the discrete hazard model of school enrollment for the sample of daughters. The OLS coefficient is small, positive, and statistically insignificant. The reduced form result in Column (2) of Table 1.9 shows that, during the first phase of the policy intervention, a girl in a *deficit district* farther away from the policy's rural population-to-bank ratio cutoff was less likely to be enrolled in school compared to a girl in a *deficit district* just above the cutoff. However, during the second and third phase of the *Branch Licensing Policy*, *deficit districts* that were farther away from the initial rural population-to-bank ratio policy cutoff display a positive and statistically significant effect of the policy intervention on the probability of school enrollment of girls. Specifically, for every additional 1,000 persons that a rural bank branch in a *deficit district* served at the start of the policy phase, the probability of school enrollment of daughters in the *deficit district* increases by approximately 0.023 percentage points during the second phase of the policy and by 0.0070 percentage points during the third phase of the policy, compared to the daughters in *deficit districts* just above the policy cutoff. This is consistent with delayed results found in the reduced form specification of the marriage timing models. Column (3) in Table 1.9 shows that, consistent with the reduced form results, the 2SLS estimate of per capita rural bank branches on the probability of school enrollment of girls is positive and larger compared to the OLS estimate, however, it is statistically insignificant.

Column (4) in Table 1.9 shows that the OLS estimate of per capita rural bank branches on the probability of school enrollment of sons is positive, small, and statistically insignificant. Column (5) in Table 1.9 shows the reduced form results of the discrete hazard model of school enrollment for the sample of sons. Column (5) shows that, contrary to the results for girls, during the first phase of the policy intervention, a son in a *deficit district* farther away from the rural population-to-bank ratio cutoff was more likely to be enrolled in school compared to a boy in a *deficit district* just above the cutoff. However, this effect does not continue into the later policy periods, which may indicate that access to finance led to an initial increase in school enrollment of boys but this did not hold over time. Column (6) in Table 1.9 shows that the 2SLS estimate is positive but much smaller than the 2SLS estimate for girls and statistically insignificant.

In both samples of daughters and sons, the 2SLS estimates are much larger than the OLS estimates. Like the household borrowing results, this is consistent with the argument that the OLS estimates are underestimated because school enrollment in financially underdeveloped districts is lower and bank expansion during the sample period majorly occurred due to policy intervention in these underdeveloped locations.

By Age The effect of access to credit on school enrollment of children may vary by the age of a child. This is is most likely because, as a child grows older, there are more competing uses of her/his time. For example, an older child is more useful in helping with farm work than a younger child or it is a greater taboo to have an older unmarried daughter than a younger unmarried daughter. Therefore, I investigate if the effect of per capita rural bank branches on the probability of school enrollment varies by age by re-estimating the OLS and 2SLS model by including interactions of per capita rural bank branches with age and age squared.

The results of this specification are reported in Table 1.10. The 2SLS estimates of the effect of per capita bank branches on the probability of school enrollment by age are graphed in Figure 1.2(a) for the sample of daughters and in Figure 1.2(b) for the sample of sons. Specifically, I find that an increase in per capita rural bank branches only increases school enrollment of daughters between 6 and 13 years of age and the effect starts to decline from age 10 and becomes insignificant from age 14 onwards. For the sample of sons, I only find a small increase in school enrollment at the youngest school enrollment age of 5 in response to an increase in per capita rural bank branches.

1.6.6 Labor Supply

I have briefly described that an increase in access to credit can increase productive opportunities of a household. These additional activities can also potentially increase a household's labor demand either directly for these new activities or indirectly through reallocation of time among household members. If access to credit especially increases the value of female labor, then it could be a channel through which the marriage of daughters is delayed but boys might prefer to marry earlier. Therefore, in this section, I explore if an increase in access to credit through formal institutions increases labor participation of women and men.

Table 1.11 shows the effect of per capita rural bank branch expansion on the probability that a household member of works in1982. Column (2) in Panel A of Table 1.11 shows that the probability that a woman works decreases in response to an increase in per capita rural bank branches. Further analysis shows that this decline in women's probability of work in response to the increase in per capita rural bank branches primarily stems from a decline in women's wage employment (Column (10) Panel A of Table 1.11).

Column (2) in Panel B of Table 1.11 shows that, in contrast to the result for women, there is no statistically significant change in the probability of work for men in response to an increase in per capita rural bank branches. However, interestingly, in response to an increase in per capita rural bank branches, there is almost a one-to-one shift from self-employment in non-farm activities to self-employment in farm activities for men. Specifically, I find that an additional rural bank branch per million persons increases the probability that men are self-employed in farm work by 0.0034 percentage points and decreases the probability that men are self-employed in non-farm work by 0.0038 percentage points. This result can be either because agriculture is the more remunerative enterprise with credit assistance compared to other enterprises or because agriculture was a priority lending sector during this year and access to credit was largely restricted to this sector. I also find that the probability that men work in salaried jobs decreases in response to an increase in per capita rural bank branches.

By Landownership Since, self-employment in farm-work heavily depends on landownership and I find that the effect of per capita rural bank branches on the probability of borrowing varies by landownership. I test if the change in the probability of being self-employed in farm work in response to an increase in access to credit also varies by the ownership of farmland. To test this, I re-estimate the OLS and 2SLS model by including interactions between per capita rural bank branches and indicators for the last four quintiles of owned farmland.

The OLS (Columns (1) and (3)) and 2SLS (Columns (2) and (4)) results of this model are reported in Table 1.12. The 2SLS estimates of the effect of per capita rural bank branches on the probability of being self-employed in farm work for the five quintiles of landownership is graphed in Figure 1.3(a) for women and Figure 1.3(b) for men. I find that Figure 1.3(b) exhibits a similar u-shape as Figure 1.1. This suggests that the economic strata that borrow more in response to an increase in access to credit are also those who are more likely to engage in agricultural work. This can be either because most of the loans issued during this time were for the purpose of agriculture or because access to credit made agriculture a more remunerative source of income compared to other alternatives. However, I do not find similar effects for the sample of women.

1.7 Discussion and Conclusion

This paper evaluates the impact of access to formal banking in rural India on the risk of marriage of girls and boys. For the analysis, I match the bank branches data from the Indian central bank to the retrospective marriage information of daughters and sons of interviewed households in the 1999 ARIS/REDS. The empirical strategy uses district-level rules that governed rural bank branch expansion from late 1970's to early 1990's to instrument per capita rural bank branches in a district.

The results show that an increase in per capita rural bank branches increases the probability of marriage of girls. This result is consistent with the theory that, for a credit constrained household, an increase in the credit limit increases the utility of having a daughter marry earlier than later when dowry payments are customary. Unfortunately, this increase in the early marriage of girls can have long-run effects on the welfare of these women and their children (Field and Ambrus, 2008 ; Sekhri and Debnath, 2014; Chari, Heath, Maertens and Fatima, 2017).

In their recent work, Corno, Hildebrandt and Voena (2017) find that a negative income shock decreases the probability of marriage of girls in India. They argue that this is because a family is less likely to be able to procure the dowry required for a daughter's wedding during adverse times. Therefore, it is possible that the observed increase in the probability of marriage of girls in response to an increase in per capita rural bank branches is primarily driven by banks aiding the payment of dowries during the years that households do not experience a positive income shock. Consistent with this theory, I find that the increase in the probability of marriage of girls in response to an increase in per capita rural bank branches is more when households do not experience a positive agricultural productivity shock.

From a general equilibrium perspective, the probability of marriage of boys is expected to respond in the same manner as the change in the probability of marriage of girls. However, from a partial equilibrium perspective, an increase in access to credit provides sons' households with a viable financing substitute, therefore, it may decrease the utility derived by a household from marrying their son earlier rather than later. Yet, I do not find any change in the probability of marriage of boys in response to an increase in per capita rural bank branches.

As girls are more likely to marry and there is no statistically significant change in the probability of marriage of boys, there is a tighter "marriage squeeze" in response to the increase in access to formal credit. This implies that the sons' household can now command more dowry payments as a result of this "marriage squeeze". Consistent with is argument, I find that an increase in per capita rural bank branches leads to an increase in dowries paid by girls' households and dowries received by boys' households.

The marriage timing results suggest that the competition between potential brides searching for a groom increases as access to formal banking increases. Therefore, another possible consequence of the tighter "marriage squeeze" can be an increase in the search efforts to find a groom. Consistent with this theory, I find that an increase in per capita rural bank branches increases married daughters' distance of migration. This result indicates that daughters' households increase the search distance for grooms and eventually the daughters get married farther away from their natal homes.

Using the 1982 ARIS/REDS data on household borrowing from 16 states, I also confirm that an increase in per capita rural bank branches does indeed increase the probability of loan uptake in 1982. This is in line with Kochar's (2012) work where, using this *Branch Licensing Policy*, she establishes that, in the Indian state of Uttar Pradesh, an increase in the number of rural bank branches increases loan uptake among rural households. Additionally, I find that the rural bank branch expansion was most successful in providing credit to the poorest and richest households defined in terms of farmland-ownership. I argue that this result is attributable to the central bank's directive during this time, that is, down payments were not mandatory for small rural borrowers, and therefore, poorer households could acces credit even without the availability of collateral. However, richer households, either because of more availability of collateral or more use for these agricultural loans, took advantage of this formal bank expansion as well. Therefore, consistent with Kochar's (2012) results, I find that the increase in the probability of loan uptake by the richest households is statistically significant more than the increase in the probability of loan uptake by the poorest households. This indicates that even though the expansion of the formal banking network made credit more readily available to the rural poor, the richest households benefitted the most from this larger network.

Apart from making it easier for households to pay a dowry, an increase in access to credit may affect the probabilities of marriage through other channels as well. I specifically explore whether an increase in per capita rural bank branches increases school enrollment and/or labor supply of women and men, which can potentially delay their marriage, especially for girls. I find that an increase in per capita rural bank branches increases the probability of school enrollment of only young girls for whom the risk of marriage is quite low. Lastly, I find that labor supply of women decreases in response to an increase in per capita rural bank branches. These results add further support to the marriage timing results.

The findings in this paper highlight the large impact of access to credit on marriage markets that practice marriage payments. The practice of brideprice is widespread in Sub-Saharan Africa

Table 1.1: Branch Licensing Policy Compliance

	(1) Per Capita Rural Banks
Phase1 × Deficit1 × I(Deficit1>0)	2.03**
	(0.79)
Phase2 × Deficit2 × I(Deficit2>0)	1.69***
	(0.43)
Phase3 × Deficit3 × I(Deficit3>0)	1.74*
	(0.99)
Observations	4704
R^2	0.95
F-test on excluded instruments	25.08
	[0.00]

and parts of Asia. Therefore, there is an urgent need to investigate the consequences of access to finance policies in these societies.

Overall, this paper establishes that an increase in access to formal banking plays only a limited role in increasing school enrollment but has large adverse effects on women's labor participation and marriage outcomes. The results emphasize the need to be cautious of access to finance policies, especially in societies that practice dowry. In face of India's continued investment in access to credit policies in recent years, the findings in this paper call for interventions that can be implemented alongside access to finance policies to minimize their effect on the marriage market such as an increase in labor opportunities for women, which can increases women's school enrollment and decrease their risk of marriage.

1.8 Tables & Figures

Table 1.2: First-stage Estimates - Panel Regressions

	DAUGHTERS	SONS
PANEL A: Second Stage Dependent Variable - $Married$	(1)	(2)
	First Stage	First Stage
	$PerCapitaRuralBanks$	$PerCapitaRuralBanks$
$Phase1_t * I(Deficit1_d > 0) * Deficit1_d$	1.36***	1.74***
	(0.24)	(0.36)
$Phase2_t * I(Deficit2_d > 0) * Deficit2_d$	1.48**	1.43**
	(0.75)	(0.66)
$Phase3_t * I(Deficit3_d > 0) * Deficit3_d$	1.08	1.19
	(0.84)	(0.83)
Observations	49,041	69,646
Level of Observation	Individual	Individual
First-stage F statistic	317.26	687.43
PANEL B: Second Stage Dependent Variable - $Enrolled$	(1)	(2)
	First Stage	First Stage
	$PerCapitaRuralBanks$	$PerCapitaRuralBanks$
$Phase1_t * I(Deficit1_d > 0) * Deficit1_d$	1.70***	1.65***
	(0.22)	(0.48)
$Phase2_t * I(Deficit2_d > 0) * Deficit2_d$	1.44**	1.83**
	(0.62)	(0.74)
$Phase3_t * I(Deficit3_d > 0) * Deficit3_d$	1.24	1.77**
	(0.83)	(0.88)
Observations	111,134	137,231
Level of Observation	Individual	Individual
First-stage F statistic	822.69	1835.52

Table 1.3: First-stage Estimates - Cross-sectional Regressions

PANEL A: Second Stage Dependent Variable - $Borrow$	
	First Stage
	$PerCapitaRuralBanks$
$(I(Deficit2_d > 0) * Deficit2_d$	5.28***
	(1.82)
Observations	4,075
Level of Observation	Household
First-stage F statistic	535.43
PANEL B: Second Stage Dependent Variable - $Work$**, Female Household Members**	
	First Stage
	$PerCapitaRuralBanks$
$(I(Deficit2_d > 0) * Deficit2_d$	5.37***
	(1.80)
Observations	10,717
Level of Observation	Individual
First-stage F statistic	1620.45
PANEL C: Second Stage Dependent Variable - $Work$**, Male Household Members**	
	First Stage
	$PerCapitaRuralBanks$
$(I(Deficit2_d > 0) * Deficit2_d$	5.22***
	(1.77)
Observations	12,825
Level of Observation	Individual
First-stage F statistic	1766.38

Table 1.4: Probability of Marriage

	DAUGHTERS			SONS		
	OLS	Reduced Form	2SLS	OLS	Reduced Form	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
	Married	*Married*	*Married*	*Married*	*Married*	*Married*
Per Capita Rural Banks	0.0003		0.0049**	-0.0001		-0.0038
	(0.0005)		(0.0024)	(0.0004)		(0.0024)
Phase1 × Deficit1 × I(Deficit1>0)		-0.0027			-0.0039	
		(0.0046)			(0.0053)	
Phase2 × Deficit2 × I(Deficit2>0)		0.0109*			0.0040	
		(0.0058)			(0.0082)	
Phase3 × Deficit3 × I(Deficit3>0)		0.0067**			-0.0060***	
		(0.0031)			(0.0019)	
Observations	49249	49249	49041	69802	69802	69649
Overidentification test			2.20			4.03
			[0.33]			[0.13]

Table 1.5: Probability of Marriage by Rainfall Shock

	DAUGHTERS		SONS	
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
	$Married$	$Married$	$Married$	$Married$
Per Capita Rural Banks	0.0003	0.0065*	-0.0001	-0.0023
	(0.0005)	(0.0033)	(0.0004)	(0.0022)
Per Capita Rural Banks $\times$ Rain z-score	0.0011	-0.0138*	-0.0004	0.0005
	(0.0009)	(0.0072)	(0.0008)	(0.0034)
Observations	49249	49041	69805	69653
First-stage F-statistic		60.92		170.29
Overidentification test		6.80		8.13
		[0.15]		[0.09]

Table 1.6: Characteristics of marriage matches formed

Panel A: Sample of Daughters	OLS (1) Dowry Paid	2SLS (2) Dowry Paid	OLS (3) Distance Migrated	2SLS (4) Distance Migrated	OLS (5) Spouse's School Years	2SLS (6) Spouse's School Years	OLS (7) Spouse's HH Land	2SLS (8) Spouse's HH Land
Per Capita Rural Banks	-116.46	2193.30**	-0.05	3.02*	0.01	0.12	1.92	-6.39
	(116.64)	(1062.26)	(0.23)	(1.62)	(0.02)	(0.08)	(1.51)	(4.63)
Observations	4512	3346	4512	3346	4512	3346	4512	3346
Mean of Dependent Variable	28103.29	28103.29	28.22	28.22	6.45	6.45	214.43	214.43
First-stage F-statistic		12.44		12.44		12.44		12.44
Overidentification test		2.05		3.68		3.80		1.31
		[0.36]		[0.16]		[0.15]		[0.52]

Panel A: Sample of Male Head of Households	OLS (1) Dowry Paid	2SLS (2) Dowry Paid	OLS (3) Distance Migrated	2SLS (4) Distance Migrated	OLS (5) Spouse's School Years	2SLS (6) Spouse's School Years	OLS (7) Spouse's HH Land	2SLS (8) Spouse's HH Land	(9) Related	(10) Related	(11) Age Gap	(12) Age Gap
Per Capita Rural Banks	-75.53	1313.65*	0.08	-0.33	-0.01	0.03	3.88**	-2.29	0.00	-0.00	0.00	-0.03
	(172.27)	(756.43)	(0.07)	(0.65)	(0.01)	(0.04)	(1.86)	(4.36)	(0.00)	(0.00)	(0.01)	(0.05)
Observations	4615	4615	4615	4615	4615	4615	4615	4615	4543	4543	4615	4615
Mean of Dependent Variable	26965.09	26965.09	24.47	24.47	2.52	2.52	553.60	553.60	0.05	0.05	4.82	4.82
First-stage F-statistic		43.25		43.25		43.25		43.25		48.01		43.25
Overidentification test		3.10		1.75		3.21		1.42		1.39		0.69
		[0.21]		[0.42]		[0.20]		[0.49]		[0.50]		[0.71]

Table 1.7: Probability of Borrowing

	OLS (1) *Borrow*	Reduced Form (2) *Borrow*	2SLS (3) *Borrow*
Per Capita Rural Banks	-0.0003		0.0038*
	(0.0007)		(0.0022)
Deficit2 $\times$ I(Deficit2>0)		0.0198**	
		(0.0100)	
Observations	4075	4075	4075

Figure 1.1: Effect of Per Capita Banks on the Probability of Borrowing by Landownership

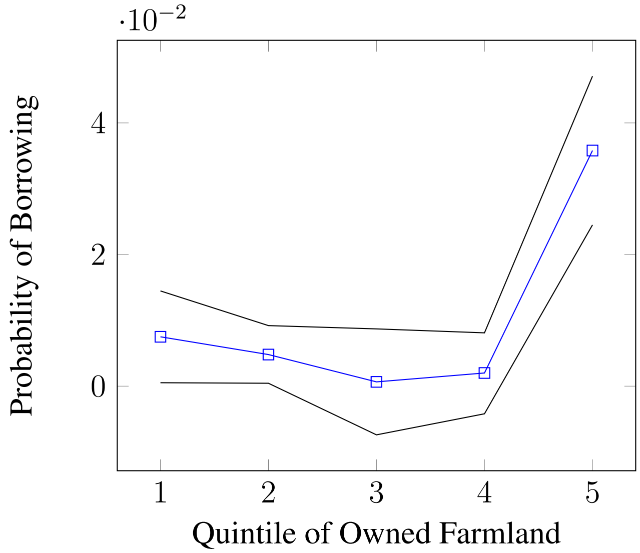


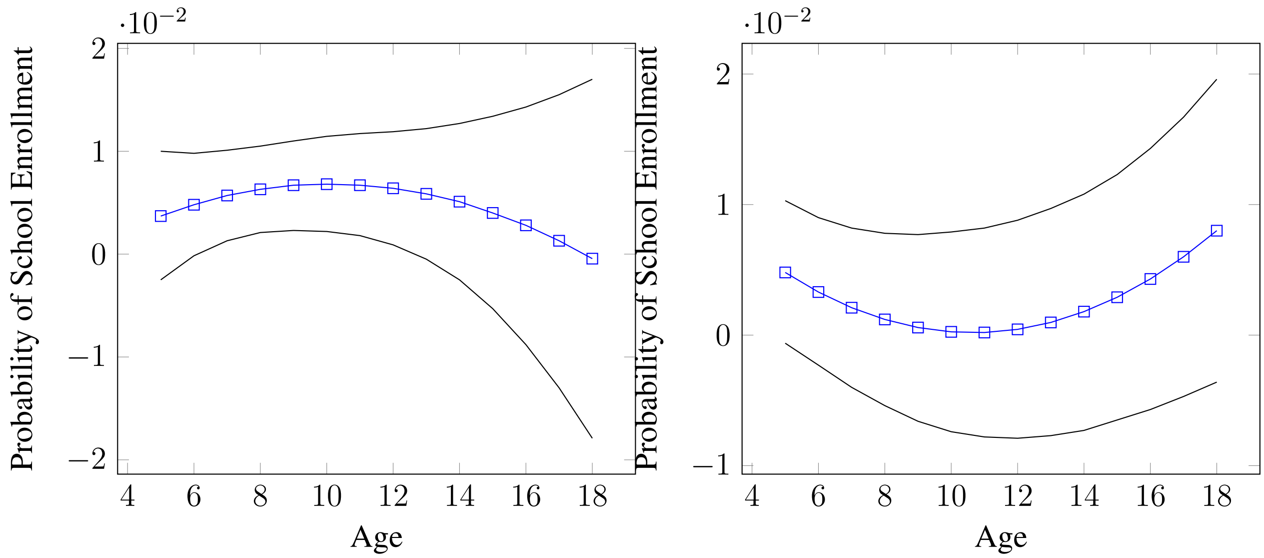
Table 1.8: Probability of Borrowing by Landownership

	OLS (1) *Borrow*	2SLS (2) *Borrow*
Per Capita Rural Banks	-0.0010	0.0075**
	(0.0011)	(0.0036)
Per Capita Rural Banks $\times 2^{nd}$ Quintile of Landowners	0.0004	-0.0027
	(0.0009)	(0.0045)
Per Capita Rural Banks $\times 3^{rd}$ Quintile of Landowners	0.0013	-0.0068
	(0.0011)	(0.0045)
Per Capita Rural Banks $\times 4^{th}$ Quintile of Landowners	0.0013	-0.0055**
	(0.0013)	(0.0025)
Per Capita Rural Banks $\times 5^{th}$ Quintile of Landowners	0.0013	0.0283***
	(0.0015)	(0.0030)
Observations	4075	4075

Table 1.9: Probability of School Enrollment

	DAUGHTERS			SONS		
	OLS	Reduced Form	2SLS	OLS	Reduced Form	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
	Enrolled	*Enrolled*	*Enrolled*	*Enrolled*	*Enrolled*	*Enrolled*
Per Capita Rural Banks	0.0001		0.0043	0.0008		0.0021
	(0.0008)		(0.0031)	(0.0005)		(0.0033)
Phase1 $\times$ Deficit1 $\times$ I(Deficit1>0)		-0.0077**			0.0153*	
		(0.0038)			(0.0087)	
Phase2 $\times$ Deficit2 $\times$ I(Deficit2>0)		0.0225***			-0.0002	
		(0.0050)			(0.0097)	
Phase3 $\times$ Deficit3 $\times$ I(Deficit3>0)		0.0070*			0.0026	
		(0.0041)			(0.0059)	
Observations	111244	111244	111134	137361	137361	137231
Mean of Dependent Variable	0.40	0.40	0.40	0.57	0.57	0.57
Overidentification test			4.31			3.70
			[0.12]			[0.16]

Figure 1.2: Effect of Per Capita Banks on the Probability of School Enrollment by Age



(a) Daughters (b) Sons

Table 1.10: Probability of School Enrollment by Age

	DAUGHTERS		SONS	
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
	Enrolled	*Enrolled*	*Enrolled*	*Enrolled*
Per Capita Rural Banks	-0.0046***	-0.0052	-0.0031**	0.0167***
	(0.0015)	(0.0104)	(0.0016)	(0.0059)
Per Capita Rural Banks × Age	0.0012***	0.0024	0.0008***	-0.0031**
	(0.0003)	(0.0021)	(0.0003)	(0.0013)
Per Capita Rural Banks × Age^2	-0.0001***	-0.0001	-0.0000***	0.0001**
	(0.0000)	(0.0001)	(0.0000)	(0.0001)
Observations	111244	111134	137361	137231
First-stage F-statistic		53.53		221.06
Overidentification test		9.31		6.65
		[0.16]		[0.35]

Table 1.11: Probability of Work

PANEL A: Women

	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$Work$	$Work$	Self-Employed (Farm)	Self-Employed (Farm)	Self-Employed (Non-farm)	Self-Employed (Non-farm)	Salaried Work	Salaried Work	Wage Work	Wage Work	Domestic Work	Domestic Work
Per Capita Rural Banks	-0.0006	-0.0021*	0.0003	-0.0001	-0.0001	0.0001	-0.0000	-0.0000	-0.0007**	-0.0021**	0.0009	0.0023
	(0.0004)	(0.0012)	(0.0002)	(0.0009)	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0003)	(0.0010)	(0.0006)	(0.0016)
Observations	10717	10717	10717	10717	10717	10717	10717	10717	10717	10717	10717	10717
Mean of Dependent Variable	0.16	0.16	0.05	0.05	0.01	0.01	0.01	0.01	0.10	0.10	0.62	0.62

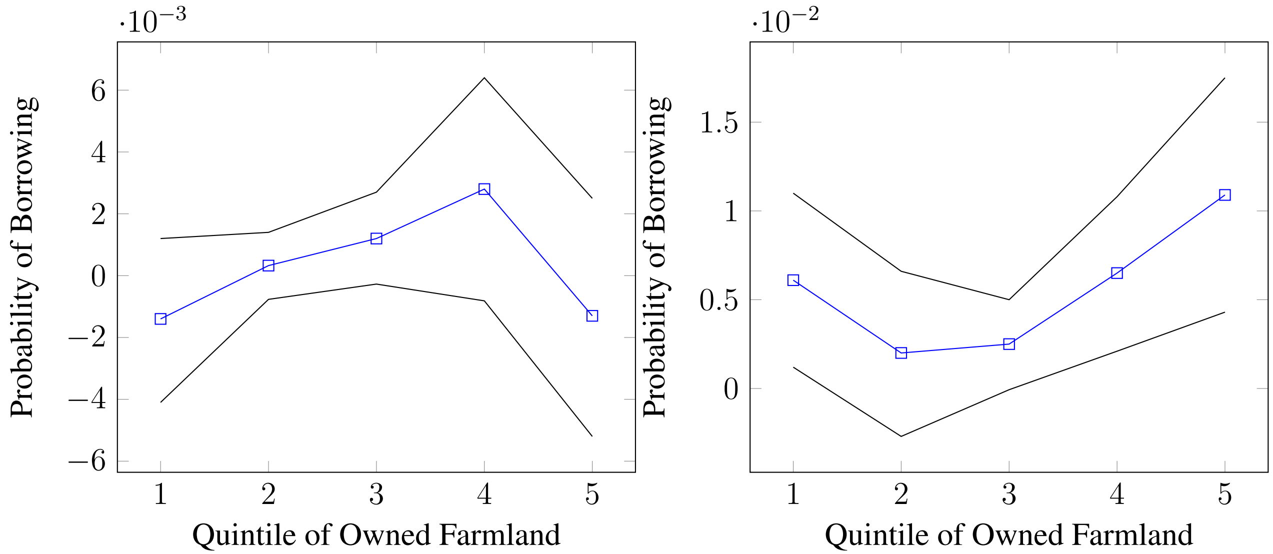
PANEL B: Men

	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$Work$	$Work$	Self-Employed (Farm)	Self-Employed (Farm)	Self-Employed (Non-farm)	Self-Employed (Non-farm)	Salaried Work	Salaried Work	Wage Work	Wage Work	Domestic Work	Domestic Work
Per Capita Rural Banks	0.0015***	-0.0003	0.0015***	0.0034**	0.0001	-0.0038**	-0.0001	-0.0017**	0.0001	0.0018	-0.0008*	0.0012
	(0.0003)	(0.0012)	(0.0005)	(0.0017)	(0.0003)	(0.0018)	(0.0002)	(0.0007)	(0.0003)	(0.0015)	(0.0004)	(0.0012)
Observations	12825	12825	12825	12825	12825	12825	12825	12825	12825	12825	12825	12825
Mean of Dependent Variable	0.53	0.53	0.28	0.28	0.04	0.04	0.06	0.06	0.15	0.15	0.17	0.17

Table 1.12: Probability of Self-employment in farm-work by Landownership

	OLS (1) Self-employed (Farm)	2SLS (2) Self-employed (Farm)	OLS (3) Self-employed (Farm)	2SLS (4) Self-employed (Farm)
Per Capita Rural Banks	0.0001	-0.0014	0.0023***	0.0050**
	(0.0003)	(0.0013)	(0.0006)	(0.0022)
Per Capita Rural Banks $\times 2^{nd}$ Quintile of Landowners	-0.0003	0.0015	-0.0017**	-0.0028
	(0.0002)	(0.0015)	(0.0008)	(0.0037)
Per Capita Rural Banks $\times 3^{rd}$ Quintile of Landowners	0.0004	0.0025**	-0.0017**	-0.0051**
	(0.0004)	(0.0010)	(0.0007)	(0.0022)
Per Capita Rural Banks $\times 4^{th}$ Quintile of Landowners	0.0008	0.0042**	0.0007	0.0002
	(0.0006)	(0.0017)	(0.0007)	(0.0018)
Per Capita Rural Banks $\times 5^{th}$ Quintile of Landowners	0.0000	0.0003	0.0003	0.0026*
	(0.0005)	(0.0009)	(0.0009)	(0.0016)
Observations	10717	10717	12825	12825

Figure 1.3: Effect of Per Capita Banks on the Probability of Self-employment in Farm by Landownership



(a) Women

(b) Men

Chapter 2

INSURING GIRLS' LIVES AGAINST DROUGHT

2.1 Introduction

An extensive literature shows that girls and boys are treated differently in countries where households exhibit a strong preference for sons. In extreme cases, this discrimination leads to sex-selection of children at early ages[1] through postnatal neglect or prenatal sex-selective abortions[2] (Chen et al., 2013; Bhalotra and Cochrane, 2010). In countries where families provide equal care for both daughters and sons, the sex-ratio is about 1050 females to 1000 males (Sen, 1992). However, the most recent Census in 2011 reports that the child sex-ratio in India is 914 females to 1000 males, which translates into a 13-percent deficit. One would expect the sex-ratio to improve with greater economic development over time. Figure 1A shows that, in India's case, the child sex-ratio has only worsened over the last half century during which India experienced rapid economic growth with an average annual GDP growth rate of about 5 percent[3]. Therefore, there is an urgent need to understand the determinants of sex-selection in-depth and device novel policies to tackle the issue.

Even for fetuses who are carried to term, there is a gender-gap in prenatal investments: For example, women who are pregnant with a boy are more likely to visit antenatal clinics (Bharadwaj and Lakdawala, 2013). Throughout their childhood, the unequal human capital investments continue by the means of breastfeeding (Jayachandran and Kuziemko, 2011), food allocation (Chen et al.,

[1] This has been argued as one of the leading causes of unbalanced sex-ratios in South and Southeast Asian countries. In his seminal work, Sen (1990) estimated that more than 100 million women were "missing" worldwide. More recent estimates suggest that this number has been steadily increasing over time (reaching 126 million in 2010) and that India and China account for most of this deficit (Bongaarts and Guilmoto, 2015).

[2] Specifically, since the introduction of reliable ultrasound technology in the 1980s.

[3] Jayachandran (2017) finds that sex-selection of children in India is increasing with declining fertility as households still prefer to have at least one son.

1981; Das Gupta, 1987), parental time allocation (Barcellos et al., 2014), vaccination (Borooah, 2004; Ganatra and Hirve, 2001), other health-care allocations (Ganatra and Hirve, 1994), and education (Song et al., 2006).

Income shocks in developing countries tend to exacerbate these gender-gaps. Notably, Rose (1999) finds that, in a primarily agrarian society like rural India, the probability that a child born during a given year is a girl increases with the rainfall in that year (proxy for a positive agricultural shock). When son-preference coincides with the lack of formal mechanisms to insure against bad agricultural shocks, these households reduce investments in their female children in order to smooth consumption. This leads to adverse outcomes for the female children and in extreme cases culminates into excess female child mortality. Moreover, increased female mortality in the face of negative income shocks is not restricted only to the young. Using witch killings in Tanzania (Miguel, 2005) and dowry deaths in India (Sekhri and Storeygard, 2014), recent research shows that adult women in developing countries are also less likely to survive during bad agricultural years. Figure 1B shows that, similar to the worsening sex-ratio, dowry deaths are also increasing over time and is of urgent concern to policymakers.

Throughout this literature that shows an increase in the mortality of women in response to an adverse income shock, the authors highlight that the developing world lacks the formal insurance mechanisms that could enable consumption-smoothing during these bad times and can potentially attenuate these gender-biased mortality effects. Therefore, the common conclusion in this body of literature is that an important policy measure to improve women's lives moving forward is the provision of these formal insurance mechanisms. However, despite the growing number of risk-coping programs implemented in developing countries today, there still remains a gap in the literature that empirically tests whether these policies help in consumption-smoothing and reduce female mortality during adverse income shocks. To our knowledge, this is the first paper that formally tests this policy implication. Specifically, in the context of infant mortality and dowry deaths in India, we provide the first evidence of how the relationship between agricultural productivity shocks and female mortality attenuates when a national workfare program enables consumption-smoothing during bad years.

We develop an inter-temporal consumption maximization problem in which a household decides how much to invest in their male and female children during the first period, and how much time to spend in dowry appropriation from their daughters-in-law in the second period. This model yields three main testable predictions: First, if having a girl entails a large future cost – which is likely in a society that typically practices dowry, such as India – then a positive agricultural shock leads to more investment in female children and, consequently, a higher likelihood of their survival; Second, a positive agricultural shock decreases the marginal product of labor hours spent in dowry appropriation relative to agricultural work. Therefore, less time is spent on appropriation behavior and, consequently, it is less likely that a daughter-in-law is killed due to dowry demands; Third, the introduction of a non-agricultural labor market with guaranteed minimum wages (to which labor can move freely during bad agricultural years) attenuates the relationship between agricultural productivity shocks and excess female mortality through consumption-smoothing.

To empirically test these predictions, we use: (a) deviation of district-level rainfall from its long-run average as a proxy for agricultural productivity shocks; and (b) the interaction of (a) with the spatial and temporal variation in the roll-out of the national workfare program. There is a growing body of literature on the effects of India's workfare program, the Mahatma Gandhi National Rural Employment Guarantee Scheme (NREGS)[4], on various development outcomes such as wages (Imbert and Papp, 2015; Merfeld, 2017), consumption (Jha et al., 2011; Ravi and Engler, 2015), risk (Foster and Gehrke, 2017; Gehrke, 2017; Fetzer, 2014), and time allocation decisions (Merfeld, 2018; Shah and Steinberg, 2015a). The most relevant to this paper is the work by Santangelo (2016), where she shows that NREGS attenuates the pro-cyclical response of local wage, income, and consumption to agricultural productivity shocks in rural India[5]. Therefore, NREGS is an ideal income-risk-coping policy to study how a disruption in the positive relationship between agricultural productivity shocks and household consumption can affect excess female infant mortality and dowry deaths.

[4]NREGS guarantees up to 100 days of wage employment at the state-level minimum wage in a financial year to every household in India whose adult members volunteer to do unskilled manual work.

[5]Santangelo (2016) shows these results using the National Sample Surveys. We replicate the effects on consumption using the last wave of the Rural Economic and Demographic Surveys for further support.

Consistent with previous literature and the model predictions, we find that rainfall continues to be a significant predictor of the gender of an infant and dowry deaths in India in more recent years and prior to the implementation of NREGS: An increase in annual rainfall by one standard deviation (from the 10 year long mean) increases the probability that an infant born during that years is a girl by 2 percentage points. However, in contrast to Rose (1999)'s findings in 1970's, we do not find that rainfall is a significant determinant of the gender of older children in 2000's. This is consistent with more recent findings that a large part of the sex-selection of children is at early stages since the advent of reliable ultrasound technology. We also find that and increase in annual rainfall by one standard deviation (from the 10 year long mean) decreases dowry deaths by 1.5 percent.

We then present evidence that these relationships are attenuated after the introduction of NREGS. One standard deviation increase in rainfall increases the probability that a child born in a non-NREGS district is 5.4 percentage points more likely to be a girl. Following the introduction of the program, this effect is 4.6 percentage points lower for NREGS districts. This suggests that there is almost no relationship between agricultural productivity shocks and the sex of an infant following the implementation of NREGS. Similarly, the negative relationship between dowry deaths and rainfall dissipates following the intervention of NREGS.

We also examine the effect agricultural productivity shocks at the time of birth on the long-run health of the surviving children. In particular, we explores the relationship between rainfall during the year of birth and child anthropometrics. We first confirm that rainfall during year of birth is a significant predictor of height-for-age for both boys and girls in India, similar to recent results from Indonesia (Maccini and Yang, 2009). As previous literature suggests that those girls who manage to survive sex-selection at birth still receive gender-biased early-life investments. This discrimination in care during the year of birth is likely to have long-run gender-gaps in the health of the surviving children. Consistent with this, we find that prior to the implementation of NREGS, an increase in annual rainfall by one standard deviation increases the height-for-age of female children by 0.6 standard deviations compared to the male children. Post NREGS, this relationship is significantly attenuated.

While is not possible to provide direct evidence of mechanisms, we present suggestive evidence that an improved ability to smooth consumption is responsible for these findings. To add support to Santangelo (2016)'s findings with National Sample Survey data, we use the most recent Rural Economic Demographic Survey to show that NREGS attenuates the positive relationship between rainfall and consumption. Additionally, we show that NREGS has no effect on household alcohol consumption, tobacco consumption, clothing expenditures for girls, or education expenditures for girls, which are typically dependent on gender-specific bargaining power within a household. Therefore, overall, the evidence suggests that consumption smoothing is indeed the main mechanism for the effects of NREGS on the infant sex ratio, anthropometrics, and dowry deaths.

This paper primarily contributes to three strands of existing literature: First, this work fits into the research on how sex-selection is affected by changing economic conditions (Rose, 1999; Bhalotra et al., 2016; Qian, 2008). Second, the study contributes to the literature on the effectiveness of different policies for the well-being of girls and women, such as greater political participation of women (Kalsi, 2017) and financial incentives offered for having daughters (Anukriti, forthcoming; Balakrishnan, 2017). Finally, these results add to our the growing literature on the risk-mitigation effects of rural workfare programs and the subsequent effects on development outcomes, including conflict (Fetzer, 2014) and child education (Foster and Gehrke, 2017).

The rest of this chapter proceeds as follows: Section 2 provides a simple theoretical framework that provides testable predictions; Section 3 describes the data and variable construction; Section 4 provides the empirical strategy used to test them; Section 5 gives results; and Section 6 concludes.

2.2 Conceptual Framework

Building on the framework developed in Eswaran (2002), Rosenblum (2013) and Balakrishnan (2017), and the intuition described in Sekhri and Storeygard (2014), we present a simple theoretical model to demonstrate the following: In a primarily agrarian society, where the birth of a girl is associated with very high future costs[6], a favorable agricultural productivity shock can increase the

[6]Miller (1981) argues that the practice of dowry, a financial transfer from the bride's household to the groom's household at the time of marriage, is one of the major determinants of the gender bias observed in India. Using the prices of

survival of daughters and decrease dowry-motivated killing of daughters-in-law. Using this model, we then show that access to employment opportunities outside the agricultural sector can alleviate these effects.

2.2.1 Set Up

In this model, the household lives for two periods. The household's utility u and follows $u'(.) > 0$ and $u''(.) < 0$. In the first period, the household chooses consumption (c_1), the number of children they have (N), and the health investments in their male children (k_b) and female children (k_g). The probability of a child's survival into the second period is increasing in the investments made during the first period and is given by $p(k_j)$ (where $j = b, g$, $p'(.) > 0$, and $p''(.) < 0$). The probability that a child born is a boy is θ and the probability that a child born is a girl is $(1 - \theta)$. Therefore, in the second period, the surviving number of male children is $N\theta p(k_b)$ and female children is $N(1 - \theta)p(k_b)$.

In the second period, the household derives utility from consumption (c_2) and the total number of surviving children. During this period, the household derives a net benefit ($B \times A$) from its alive male children and incurs a net cost (G) from its female children. The net benefit from alive sons are the dowry receipts from their spouses and is therefore assumed to be linearly increasing in labor hours spent in dowry appropriation behavior (A)[7]. The household has no intrinsic preferences over its male and female children. Instead, preference for sons stems from the future benefits they bring and the future costs associated with daughters. The net cost of alive daughters may be thought of as dowry payments upon marriage.

In each period, the household has a unit of total labor hours. Therefore, the household's labor supply is inelastic and equal to one in the first period. In the second period, the household chooses how much to allocate to agricultural labor hours (L_2) and dowry appropriation hours (A). The

gold, which is an important part of dowries in India, Bhalotra et al. (2016) empirically formalize this idea and show that higher gold prices leads to higher mortality of fetal and newborn girls.

[7]The model can assume that the net benefit from the male children includes labor income from sons and their spouses but that will not affect the main predictions of the model.

household derives an income from its agricultural labor hours and the profits from its agricultural enterprise, $y_t = \pi_t^* + w_t L_t$. The agricultural production function is given by $\alpha_t F(L_t)$, where α_t is the agricultural productivity parameter, $F'(.) > 0$, and $F''(.) < 0$.

Therefore, the household's optimization problem is given by:

$$\begin{aligned} \underset{c_1,c_2,N,k_b,k_g}{\text{maximize}} \quad & U = u_1(c_1) + \beta u_2(c_2) + \beta u_c(p(k_b)\theta N + p(k_g)(1-\theta)N) \\ \text{subject to} \quad & c_1 + k_b\theta N + k_g(1-\theta)N \leq \pi_1^* + w_1 L_1 \\ & c_2 \leq \pi_2^* + w_2 + \theta N p(k_b)BA - (1-\theta)Np(k_g)G \\ & \pi_t^* = \underset{L_t}{\text{maximize}} \alpha_t F(L_t) - w_t L_t \\ & L_1 = 1 \\ & L_2 + A = 1 \end{aligned} \tag{2.1}$$

Introducing NREGS

The Mahatma Gandhi Rural Employment Guarantee Act entitles every rural household in India to 100 days of employment in public works at the state-level minimum wage. Therefore, we assume that the introduction of NREGS imposes a wage floor in the labor market (Santangelo, 2016) such that $w_t \geq w^N$.

2.2.2 Testable Predictions

The above model gives the following predictions that guide our empirical work. The proofs of these propositions are reported in the Appendix.

Prediction 1 *A positive agricultural shock in a year leads to less time spent on dowry appropriation behavior in that year and consequently lower number of dowry-related deaths.*

The proof is in the Appendix. Intuitively, as the agricultural productivity parameter increases for a period, the marginal product of labor in agriculture increases in that period. Therefore, the optimal amount of labor hours spent in agricultural work increases and he optimal amount of labor hours spent in dowry appropriation decreases.

Prediction 2 *If the future net costs of a girl is large enough then a positive agricultural shock leads to more investment in female children and consequently a higher likelihood of their survival.*
The proof is in the Appendix. Intuitively, the optimal health investment in female children is chosen such that the marginal utility from consumption in the first period is equal to net discounted marginal utility derived from the surviving female children in the second period. This is described by the Euler equation in 11. An increase in the agricultural productivity parameter increases profits from the agricultural sector, and therefore, diminishes the positive marginal utility from consumption in the first period. Following this, the household can operate at the Euler equation by increasing in the health expenditure on the female children.

Prediction 3 *The elasticity of health investments in a girl and time spent in dowry appropriation with respect to agricultural productivity is lower in the presence of NREGS.*
Intuitively,

2.3 Data

First, we use the 0.5 degree by 0.5 degree grid monthly precipitation data from the University of East Anglia's Climate Research Unit (CRU) to construct agricultural productivity shocks. We aggregate the CRU data to annual precipitation and then match the district centroids to the closest grid in the CRU data to construct district-level annual rainfall. Our measure of rainfall shock is the deviation of annual district-level rainfall from its long-run mean (using previous 10 years) and scaled by the long-run standard deviation.

Second, he data on the gender of infants is from the National Sample Surveys (NSS). We use is the nationally representative labor survey, Employment and Unemployment rounds of the NSS, collected by the Government of India's Ministry of Statistics and Programme Implementation. We use the 2004-05, 2007-08, and 2011-12 thick waves of NSS. This data records the age of every resident member of the interviewed households at the time of the survey. We use this to create a panel of the sex and year of birth of all surviving children born between 2001 and 2011. We take the data on the children born between these waves from the immediately succeeding wave.

Third, the data on children's anthropometric measure is from the 2011-12 wave of the India Human Development Survey (IHDS II). The IHDS II collects height and age of all children between 0 and 9 years of age of interviewed households[8]. Using this we construct height-for-age measures using the Center for Disease Control's (CDC) growth charts.

Fourth, we use National Crime Records Bureau of India's data on reported annual dowry deaths at the district-level to test the hypotheses on dowry appropriation behavior.

Lastly, we use publicly available information on the roll-out of the NREGS at the district-level to create an indicator variable that is equal to one if a district received the program during a year and zero otherwise. The NREGS was implemented in 200 districts starting April 2006, 130 districts starting June 2007, and the remaining districts received the program starting July 2008[9].

2.4 Empirical Strategy

We use the following estimation model to find NREGS's effect on the relationship between rainfall and the gender of a child born in a given year:

$$\begin{aligned} Girl_{idt} =& Rainzscore_{dt} + NREGS_{dt} \times Rainzscore_{dt} \\ &+ NREGS_{dt} + District_d + Birthyear_t + +DistrictVar_{dt} + Phase_d \times (t - 2001) + \epsilon_{idt} \end{aligned} \tag{2.2}$$

In Equation 2.2, $Girl_{idt}$ is an indicator variable that is equal to one if a child i born in district d and year t is a girl and is equal to zero otherwise. $Rainzscore_{dt}$ is the deviation of district d's rainfall in t from the 10-year mean and scaled by the 10-year standard deviation. $NREGS_{dt}$ is an indicator that is equal to one from 2006, 2007, and 2008 for Phase 1, Phase 2, and Phase 3 districts, respectively and otherwise zero. $District_d$ and $Birthyear_t$ are district and year of

[8]Who were present at the time of survey.

[9]Primarily urban districts like Kolkata, Mumbai, Chennai, and Delhi never rceived NREGS and are not included in this study.

birth fixed effects, respectively. $District_d$ is a vector of interactions of 2001 census values of log population, sex-ratio, literacy rate, percentage of scheduled caste and scheduled tribe, employment rate, and percentage of rural population with year of birth dummies. Lastly, $Phase_d \times (t - 2001)$ are phase specific linear time trends which partially address the differential trends in outcome by the treatment status of the districts.

To investigate the effect of NREGS on the relationship between early-life agricultural productivity shocks and children's health, we use the following specification:

$$\begin{aligned} Outcome_{idt} =& Rainzscore_{dt} + NREGS_{dt} \times Rainzscore_{dt} \times Girl_{idt} + NREGS_{dt} \times Rainzscore_{dt} \\ &+ NREGS_{dt} \times Girl_{idt} + Rainzscore_{dt} \times Girl_{idt} + NREGS_{dt} + Girl_{idt} \\ &+ District_d + Birthyear_t + +DistrictVar_{dt} + Phase_d \times (t - 2001) + \mu_{idt} \end{aligned} \tag{2.3}$$

In Equation 2.3, $Outcome_{idt}$ is height for age of child i born in district d and year t and $Girl_{idt}$ is an indicator for whether this child is a girl.

2.5 Results

We begin with a simple graphical representation of our key motivation in Figure 2.2. It shows kernel-weighted polynomial regressions of infant-gender (Panel A), child's height-for-age by gender (Panel B), and dowry deaths (Panel B) on the rainfall during the year of birth (for Panels A and B) or the year of police report (for Panel C). These figures clearly show that agricultural productivity shocks are positively related to the survival and health of women. In other words, during bad agricultural years female mortality is high. Taken together, these results suggest that there is a still a lack of formal consumption-smoothing mechanisms in India and supports that loss of female life may still be a common consumption-smoothing strategy.

We move to a more robust empirical examination of this relationship in Table 2.2. In all columns, the dependent variable is a dummy variable indicating whether a child is female. In the first five columns, we restrict estimation to children under the age of one. In columns one through three, we examine the relationship between between rainfall and child gender prior to implementation of NREGS. Column one presents the most basic specification. The coefficient on rainfall indicates that a one-standard-deviation increase in rainfall increases the probability that a randomly chosen child is female by 1.4 percentage points. Adding more control variables for district characteristics and household characteristics in columns two and three increases the estimated effect size slightly; the coefficient in both columns is around 1.9 percentage points. In all three cases, the coefficient is significantly different from zero ($p<0.01$).

Column four removes the sample restriction to pre-NREGS years and estimates the relationship for the years 2001-2011.[10] Comparing the same specifications in columns three and four, removing the year restriction decreases the coefficient by more than 40 percent, from 0.019 to 0.011. This is suggestive evidence that something happened between 2006 and 2011 to attenuate this relationship; below, we present additional evidence that NREGS may be responsible.

In the fifth column, we add the previous year's rainfall and the following year's rainfall to the regression. Both coefficients are small and statistically insignificant. This evidence is consistent with rainfall right around birth being the most important component of child survival. We explore this possibility further in columns six and seven. Rose (1999) found that rainfall during the ages of one and two also had a significant impact on the sex ratio. While the results in column five suggest this is unlikely to be the case, we now test this explicitly. In neither columns six nor seven is the coefficient on rainfall significant. In fact, the coefficient in column six is just 0.003 and the coefficient in column seven is actually negative. These results again suggest that only rainfall right around birth is an important predictor of child gender in modern India. This also supports the argument in Bharadwaj and Lakdawala (2013) that families are more now more likely to sex-select during pregnancy, relative to previous decades.

Table B.1 presents several robustness checks, mostly related to specification choices. We first show that the inclusion of state by wave fixed effects does not affect the conclusions and, in fact, increases the coefficient to 0.026. We also explore different definitions of our rainfall variables, including bins, a simply dummy, and an ordinal variable as in Jayachandran (2006). In all cases,

[10] Recall that NREGS was implemented in 2006 for phase one districts, 2007 for phase two districts, and 2008 for phase three districts.

substantive conclusions are unchanged by these specification changes.

We next move to an analysis of the effects of NREGS on the relationship between rainfall and newborn gender in Table 2.3. In columns one through four, we include the continuous rainfall variable and the years 2001-2011. The coefficient on "Current rainfall (Z)" is positive in all four columns, suggesting the effect of rainfall on the probability of being female is positive prior to NREGS's implementation. However, the interaction term is negative, suggesting this relationship decreases markedly following implementation. In all four columns, the interaction term is more than 80 percent as large as the coefficient on rainfall and the linear combination is never significant (results not shown), suggesting NREGS almost completely reverses the relationship between rainfall and the sex ratio. Additionally, the coefficients are very stable across specifications. Column two adds year of birth fixed effects, column three adds household variables, and column four adds phase linear trends.

Columns one through four utilize the entire panel we have constructed, from 2001-2011. While we include district and year of birth fixed effects, there may still remain concerns that we are isolating variation in years far removed from NREGS implementation. To test this possibility, in column five we restrict estimation only to the years 2005-2009, one year prior to NREGS to one year following the final phase of NREGS. Though the results are slightly more imprecise, conclusions are unchanged. In fact, the interaction term is now slightly larger than the rainfall coefficient.

The previous results focused on the sex ratio. However, does the effect of rainfall at the time of birth also extend to long-run indicators of female human capital investments, like anthropometrics? Figure 2.2 has already presented suggestive evidence that this is indeed the case. Table 2.4 presents a number of different specifications exploring this. The dependent variable in all columns is height-for-age, defined using CDC growth charts. Column one estimates the effect of year-of-birth rainfall on height-for-age in 2012. The coefficient on rainfall is positive but small and insignificant. The coefficient on the female dummy is negative and significant suggesting that there is differential investment in boys and girls in India. We can see this in Figure 2.2 as well, the curve for girls always lies below that of boys.

The coefficient on female in conjunction with our previous results raises the possibility that rainfall may differentially affect height-for-age for boys and girls. To explore this possibility, the specification in column two adds an interaction between female and rainfall. The coefficient on rainfall decreases modestly to approximately zero. Moreover, the coefficient on the interaction term between rainfall and female is positive and significant, and the linear combination of this coefficient with the coefficient on rainfall is also significant (results not shown; p=0.049). It is also worth noting that this relationship is only identified off of surviving children. It seems plausible that poorer households may be more affected by rainfall shocks, such that children who do not survive would come from the lower end of height-for-age distribution. If so, then the true results are actually much stronger than the results in Table 2.4 would indicate (Barcellos et al., 2014).

Column three again removes the pre-NREGS restriction and estimates the relationship over the years 1998-2012. Similar to Table 2.2, the result is no longer significant and, in fact, actually reverses, though the coefficients are small in magnitude. This also supports the contention that something changed between 2006 and 2012.

Column four explores the effects of NREGS on the relationship between rainfall and height-for-age, restricting the effect to be the same for both boys and girls. Consistent with the results in column one, it does not appear that NREGS affects the average relationship between rainfall and height-for-age. Nonetheless, the coefficients are in the expected direction and the coefficient on rainfall – which now represents the effect of rainfall on height-for-age prior to NREGS implementation – is actually marginally significant.

Column five allows the effects of NREGS to vary by gender, consistent with previous results. We find further evidence that NREGS impacts human capital investments differently for girls and boys. In particular, the triple interaction of *NREGS* $\times$ *Female* $\times$ *Rainfall* is negative and marginally significant, suggesting NREGS attenuated the relationship between rainfall and height-for-age more for girls than for boys. Since these results use the IHDS, we are also able to control for village fixed effects, which we do in column five. Many health outcomes are determined at levels below the district – due to differences in medical care, nutrient availability, etc. – so the inclusion of village fixed effects might be expected to affect the results. However, it appears that the inclusion of village fixed effects has no effect on our substantive conclusions and increases precision, providing further evidence that NREGS may help households smooth consumption in the face of negative income shocks.

Table 2.5 shows the effect of rainfall on the number of dowry deaths and how it changes after the implementation of NREGS. Column one shows that, prior to NREGS, one standard deviation increase in rainfall leads to a decrease in the number of dowry deaths by 0.17. Column two adds the number of all other reported crimes to the specification. This increases the coefficient on rainfall to 0.19. Evaluated at the average number of dowry deaths before NREGS (11.28), this shows a 1.7% decline in the incidence of dowry deaths. Column three removes the pre-NREGS restriction on the sample and re-estimates the effect of rainfall on dowry deaths for all years between 2001 and 2012.

Columns four and five investigates the effect of rainfall on dowry deaths by the availability of the NREGS program in a district during a year. We find that the coefficient on rainfall before the implementation of NREGS is negative, however, smaller and imprecise. The coefficient on the interaction between rainfall and NREGS is positive and statistically significant. This implies the after the implementation of NREGS the negative relation between rainfall and dowry deaths is attenuated. The results are robust to the inclusion of NREGS phase specific linear trends.

2.6 Conclusion

In this paper, we explore the effects of risk-mitigation through workfare programs in India on the relationship between agricultural productivity shocks and female mortality. First, using more recent data, we re-establish that a positive agricultural shock reduces female infant mortality and dowry deaths. Second, the introduction of a workfare program mitigates the effect of income shocks on both female infant mortality and dowry deaths. Third, we find that prior to the advent of NREGS, the positive relationship between agricultural shocks at the time of birth and the health of a surviving a child is stronger for girls than boys. Lastly, this relationship between income shocks during the year of birth and long-run health outcomes of girls is mitigated after the introduction of NREGS.

This paper establishes that policies that are successful in providing tools for consumption-smoothing to households in India can also successfully reduce sex-selection of infants, decrease differential child health investments by gender, and decrease dowry deaths. Though the paper uses one such policy, a rural workfare program, to show that a program which provides households with insurance during lean agricultural years reduces sex-selection among children and dowry deaths, the channels explored in this paper more broadly establish that policies that help risk-mitigation can decrease sex-selection when son-preference prevails.

2.7 Figures & Tables

Figure 2.1: Rainfall in Year of Birth and Child Outcomes

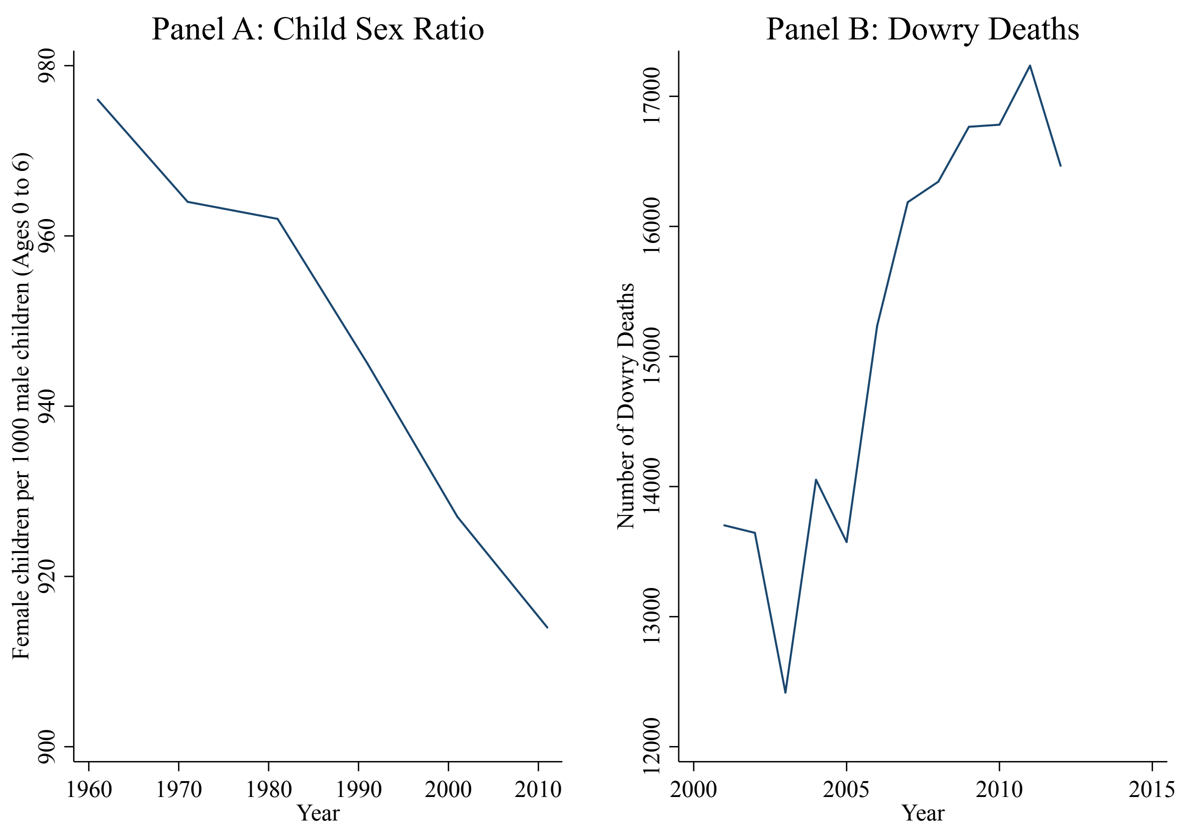
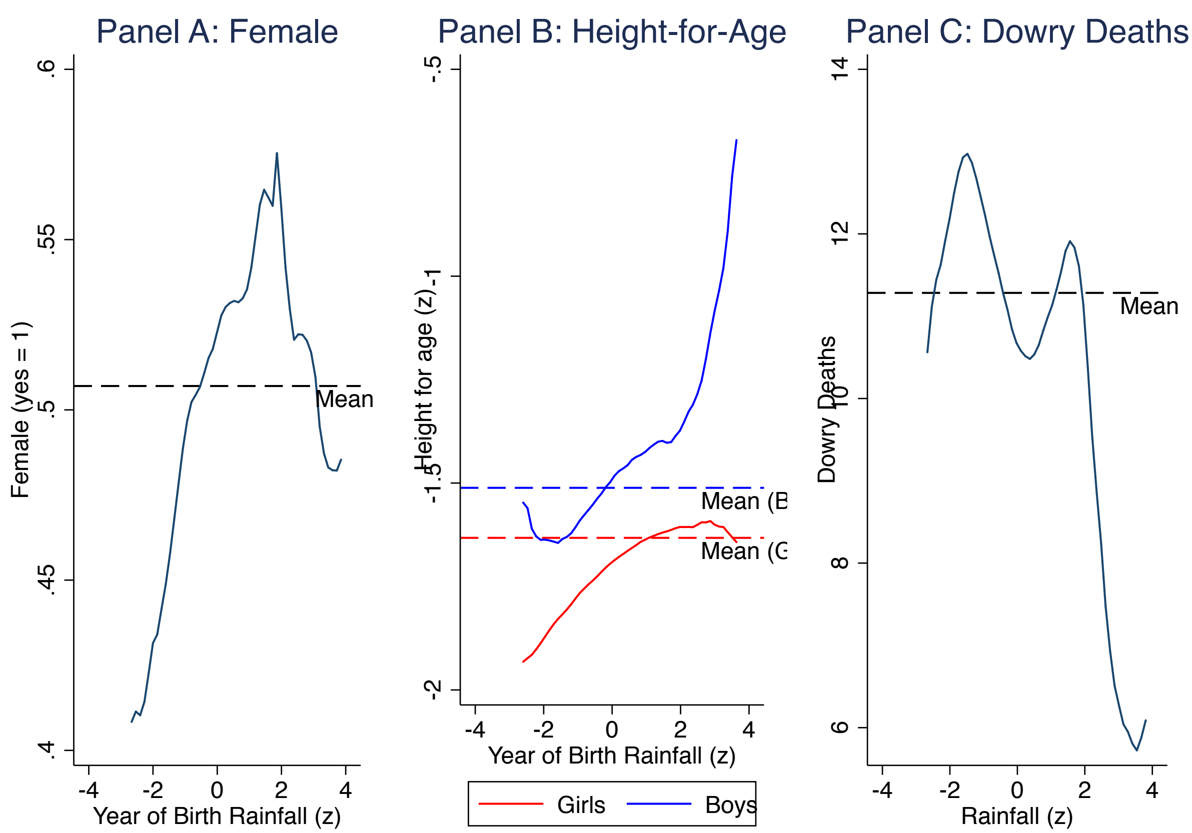


Table 2.1: Summary Statistics

	Phase 1	Phase 2	Phase 3
Panel A: NSS Individuals			
Girl (if < 1 year old)	0.49	0.48	0.48
	(0.50)	(0.50)	(0.50)
Girl (if one year old)	0.49	0.48	0.49
	(0.50)	(0.50)	(0.50)
Girl (if two years old)	0.48	0.47	0.48
	(0.50)	(0.50)	(0.50)
Household size	6.55	6.51	6.59
	(2.92)	(2.93)	(2.95)
Head is male	0.93	0.93	0.93
	(0.25)	(0.26)	(0.26)
Head age	41.62	42.00	42.63
	(13.64)	(13.80)	(14.37)
Head education	1.90	2.00	2.26
	(1.36)	(1.43)	(1.51)
Panel B: IHDS Individuals			
Girls' height for age (Z)	-1.65	-1.73	-1.57
	(1.56)	(1.52)	(1.53)
Boys' height for age (Z)	-1.53	-1.80	-1.33
	(1.45)	(1.45)	(1.46)
Panel C: NCIB Districts			
Dowry deaths	12.75	10.97	10.14
	(16.05)	(11.85)	(12.29)
Other crimes against girls	220.80	228.83	255.94
	(207.16)	(221.38)	(256.25)
All other crimes	2028.20	2243.32	3205.94
	(1721.05)	(1829.61)	(3668.59)
Panel D: Census Districts			
Percent SC/ST	0.38	0.31	0.27
	(0.20)	(0.21)	(0.22)
Percent literatre	0.47	0.53	0.58
	(0.11)	(0.13)	(0.10)
Labor force participation	0.42	0.40	0.40
	(0.07)	(0.07)	(0.07)
Population (log)	14.06	14.11	13.98
	(0.87)	(0.89)	(1.09)
Percent rural	0.86	0.82	0.72
	(0.09)	(0.13)	(0.17)
Sex ratio	945.83	940.27	926.76
	(45.99)	(46.97)	(64.60)

Statistics are means. All individual statistics are nationally representative and are estimated using survey weights. The individual statistics for the NSS are for children less than two years old, for the years 2001-2005. The NSS Districts data are from the 2000 census. The IHDS anthropometrics are constructed using CDC charts and the *zanthro* command in Stata (Vidmar et al., 2004).

Figure 2.2: Rainfall in Year of Birth and Child Outcomes



Graphs are kernel-weighted local polynomial regressions. All observations are before the implementation of NREGS in a district. The top and bottom one perce

Table 2.2: Rainfall and Child Gender

	Newborns					One-Year Olds	Two-Year Olds
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Current rainfall (Z)	0.014***	0.019***	0.019***	0.011*	0.019***	0.003	-0.006
	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)
Previous rainfall (Z)					0.001		
					(0.006)		
Next rainfall (Z)					0.006		
					(0.006)		
Years	Pre NREGS	Pre NREGS	Pre NREGS	2001-2011	Pre NREGS	Pre NREGS	Pre NREGS
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District Vars	No	Yes	Yes	Yes	Yes	Yes	Yes
Household Vars	No	No	Yes	Yes	Yes	Yes	Yes
Observations	66312	65810	65791	88547	65791	72315	78593

Standard errors are in parentheses and are clustered at the district level. Columns one through three and five through seven use the years 2001-2007; column four uses the years 2001-2011. All data are from NSS waves 61, 64, and 68. Newborns are defined as chilren less than one year of age. Current rainfall is standardized using the mean and standard deviation of the previous 10 years. * p<0.1 ** p<0.05 *** p<0.01

66

Table 2.3: NREGS, Rainfall, and Child Gender

	Years 2001-2011				Years 2005-2009
	Model 1	Model 2	Model 3	Model 4	Model 5
Rainfall (z) times NREGS	-0.044**	-0.044**	-0.045**	-0.046**	-0.054**
	(0.020)	(0.020)	(0.020)	(0.020)	(0.025)
Year of birth rainfall (Z)	0.051***	0.053***	0.053***	0.054***	0.052*
	(0.019)	(0.020)	(0.020)	(0.020)	(0.027)
NREGS	-0.029	-0.025	-0.024	0.017	0.006
	(0.036)	(0.037)	(0.037)	(0.042)	(0.043)
District FE	Yes	Yes	Yes	Yes	Yes
District Vars	Yes	Yes	Yes	Yes	Yes
Year of Birth FE	No	Yes	Yes	Yes	Yes
Household Vars	No	No	Yes	Yes	Yes
Phase Linear Trend	No	No	No	Yes	No
Observations	88570	88570	88547	88547	38451

Standard errors are in parentheses and are clustered at the district level. The dependent variable in all columns is whether a newborn (defined as less than one year of age) is a girl. Columns one through four use the years 2001-2011, while column five restricts estimation to just one year prior to NREGS to one year following implementation of the final phase. Current rainfall is standardized using the mean and standard deviation of the previous 10 years. * p<0.1 ** p<0.05 *** p<0.01

Table 2.4: NREGS, Rainfall, and Child Height-for-Age

	District FE					Village FE
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Year of birth rainfall (Z)	0.026	-0.001	0.023	0.033*	0.010	0.044***
	(0.021)	(0.025)	(0.018)	(0.018)	(0.023)	(0.015)
Female	-0.104***	-0.108***	-0.050*	-0.051*	-0.099***	-0.102**
	(0.039)	(0.038)	(0.030)	(0.030)	(0.038)	(0.042)
Female times Rainfall		0.057*	-0.005		0.047	0.032
		(0.033)	(0.023)		(0.032)	(0.021)
NREGS				0.006	-0.052	-0.128*
				(0.101)	(0.101)	(0.071)
Rainfall (z) times NREGS				-0.028	0.028	0.029
				(0.033)	(0.042)	(0.032)
Female times NREGS					0.129**	0.129***
					(0.061)	(0.032)
NREGS times Female times Rainfall					-0.118*	-0.107**
					(0.062)	(0.048)
Years	Pre NREGS	Pre NREGS	1998-2012	1998-2012	1998-2012	1998-2012
Year of Birth FE	Yes	Yes	Yes	Yes	Yes	Yes
District Vars	Yes	Yes	Yes	Yes	Yes	Yes
Household Vars	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12354	12354	19440	19440	19440	19440

Standard errors are in parentheses and are clustered at the district level (columns one through five) or village level (column six). Columns one and two include children born between the years 1998 and 2005, though only 3.38 percent of observations come from prior to 2002. Columns three through six includes children born during the years 1998-2011 (only 1.20 percent of observations are from prior to 2002). The dependent variable in all columns is height-for-age, standardized using the CDC charts and the *zanthro* command in Stata (Vidmar et al., 2004). Rainfall is always defined as rainfall during year of birth. * $p<0.1$ ** $p<0.05$ *** $p<0.01$

68

Table 2.5: Rainfall, NREGS, and Dowry Deaths

	(1)	(2)	(3)	(4)	(5)
Rainfall (z)	-0.17*	-0.19*	0.02	-0.12	-0.11
	(0.10)	(0.10)	(0.07)	(0.11)	(0.11)
NREGS				-0.05	-0.11
				(0.53)	(0.53)
Rainfall (z) × NREGS				0.26*	0.25*
				(0.14)	(0.14)
Years	Pre-NREGS	Pre-NREGS	2001-2012	2001-2012	2001-12
Year Effects	Yes	Yes	Yes	Yes	Yes
District Vars	Yes	Yes	Yes	Yes	Yes
Other Crime Variables	No	Yes	Yes	Yes	Yes
Phase Trends	No	No	No	No	Yes
Observations	3316	3316	6499	6499	6499

All specifications include district fixed effects. Standard errors are in parentheses and are clustered at the district level. * p<0.1 ** p<0.05 *** p<0.01

Table 2.6: Testing the Parallel Trends Assumption

	Female	HAZ		Dowry Deaths
	Full Sample	Female	Male	Full Sample
Phase=2 times Rainfall times Years to NREGS	-0.003	0.081	-0.016	-0.242
	(0.006)	(0.092)	(0.082)	(0.245)
Phase=3 times Rainfall times Years to NREGS	0.001	0.099	0.050	-0.204
	(0.005)	(0.077)	(0.063)	(0.216)
Phase=2 times Years to NREGS	0.013**	0.036	-0.000	0.288
	(0.007)	(0.094)	(0.095)	(0.254)
Phase=3 times Years to NREGS	0.008	0.084	-0.003	-0.332
	(0.008)	(0.098)	(0.082)	(0.208)
Phase=2 times Rainfall	5.215	-161.578	32.088	485.669
	(12.218)	(184.849)	(164.206)	(491.819)
Phase=3 times Rainfall	-1.158	-197.626	-99.519	409.309
	(10.612)	(154.145)	(125.401)	(433.764)
Rainfall times Years to NREGS	0.003	-0.059	-0.070	0.416**
	(0.005)	(0.074)	(0.049)	(0.201)
Rainfall	-6.105	119.082	139.141	-834.539**
	(9.114)	(147.868)	(98.371)	(403.236)
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
District Vars	Yes	Yes	Yes	Yes
Household Vars	Yes	Yes	Yes	Yes
Observations	49858	4501	4723	2706

Standard errors are in parentheses and are clustered at the district level. All four columns use observations up to the year 2005. Column one uses the NSS, columns two and three use the IHDS 2004-05, column four uses NCIB. The *Years to NREGS* variable is constructed by subtracting the year of observation from 2005. * p<0.1 ** p<0.05 *** p<0.01

70

Chapter 3

WOMEN'S JOB OPPORTUNITIES AND MARRIAGE QUALITY

3.1 Introduction

Globalization has created many new jobs for women in exporting industries in developing countries. By significantly improving women's earnings potential, these opportunities have affected many aspects of women's lives, such as their bargaining power within the household (Dharmalingam and Morgan, 1996; Rahman and Rao, 2004; Majlesi, 2016), their fertility (Schultz, 1997; Schultz), and the human capital investments they can make in their children (luk; atk). Marriage is another important component of a women's quality of life, and there is evidence that job opportunities delay marriage and childbearing by improving the attractiveness of the option of remaining unmarried (Singh and Samara, 1996; Jensen, 2012; Heath and Mobarak, 2014).

Job opportunities may also allow women to reject potential marriages that they find unattractive. However, there is very little empirical evidence on the relationship between job opportunities for women and their ability to choose a spouse they like. Because marriage conditions are an important determinant of a woman's quality of life (especially in developing countries where newly married women often move to an area where they know no one), understanding the determinants of marriage quality is an important policy question.

We study the impact of job opportunities for women on their ability to chose their spouse and the quality of marriages they enter in India. We exploit the considerable regional variation in the industries, we construct measures of female labor demand exogenous to local demographic changes and marriage trends. Specifically, we use national average wages in an industry (calculated leaving out the individual's locality to avoid area-specific shocks to productivity) weighted by the share of workers of each sex working in each industry in that locality (Bartik, 1991).

Overall, we find that an increase in job opportunities for women during their year of marriage increases their ability to chose their spouse independently and also improves quality of spouse. We find that 28% more women choose their own spouse as a result of average annual increases in female labor demand. Consistent with the intuition that women's autonomy in this decision should be determined by the absolute increase in their labor demand, we do not find that male labor demand shocks affect this outcome. We also find that women who experience an increase in their labor demand during the year of marriage are more likely to have had some contact with their spouse prior to the wedding. Increases in unmarried women's job opportunities also increase their spouse's education and decrease the spousal age gap. We also find that women are 14% less likely to have grown up in the same village as their spouses in response to an increase in female labor demand.

We find that current female labor demand shocks are a stronger determinant of women's household bargaining power compared to female labor demand shocks at the time of marriage. As relative status in the household is important for intra-household bargaining power, consistent with precious literature (Majlesi, 2016), we find that women's autonomy after marriage is an increasing function of female and decreasing function of male labor demand shocks.

Our work is closely related to Sivasankaran (2015), where she finds that the duration that a woman has worked increases her autonomy in her marriage decisions. This study differs from her's on several aspects: First, her study focuses on one textile firm in Tamil Nadu in India. Our results are more nationally representative; Second, her sample consists of only working women (or women who have worked previously)[1], whereas this study focuses on an outside option story, that is, even those women who do not work can choose to work if the labor shock is large enough. Therefore, the results are unconditional on the past and present employment status of the married women. Additionally, our gender-specific measure of job opportunities enables us to look at the role of both absolute and relative increases in female labor demand (compared to male labor demand) to evaluate which is a stronger predictor of the marriage outcomes. Lastly, she does not find any

[1] Her independent variable is a measure of how long a woman has worked, whereas we use district-level gender-specific wage shocks

effect of women's employment on an index of spouse quality. We look at the different dimensions of spouse quality separately and find that female labor demand shocks play a greater role in spouse quality and male labor demand shocks play a bigger role in the type of household the woman marries into.

The rest of this chapter proceeds as follows: Section 3.2 describes the conceptual framework that provides motivation and the hypotheses tested in this paper; Section 3.3 provides the empirical strategy used to test them; Section 3.4 describes the data and variable construction; Section 3.5 gives results; and Section 3.6 concludes.

3.2 Conceptual Framework

A simple search model presented in Appendix C formalizes the prediction that better job opportunities improve the quality of marriages that women enter. The prediction rests on the following intuition: As the demand for female labor increases, their wages increase. An increase in the wage that unmarried daughters draw from their jobs increases their value in their natal household or their ability to live independently[2] and therefore, lowers the household's or woman's cost of waiting for her to get married. A decline in the net cost of continuing to search for a spouse will then increase the reservation marriage quality that the woman or her natal household will agree to.

The prediction about an increase in the quality of the marriage match holds irrespective of whether the woman or her household makes the decision. However, who makes the marriage decisions is an important outcome: Women's autonomy in these decisions represents their say in the quality of a large part of their lives. Intuitively, one can argue that an increase in woman's labor demand increases her ability to live alone and therefore increases her ability to make any decision independently, including marriage decisions. We explicitly test this using the data and strategy described below. Additionally, the indicators of quality of marriage will depend on who the decision maker is: If the woman is the decision maker then we are likely to find changes in the marriage characteristics that she values, specifically, the characteristics of the spouse himself. If

---

[2]If the decision maker is the woman herself.

her household is the decision maker then we are more likely to find changes in the marriage match characteristics that they value, such as caste, economic status, and consanguinity (Banerjee et al.; Mobarak and Kuhn, 2013).

3.3 Empirical Strategy

To test this model, we construct measures of changes in local female labor demand in a district that are plausibly exogenous to local demographic trends and changes in marriage markets by using wage changes in districts other than the woman's own as a measure of demand shocks (Bartik, 1991). Specifically, let $\hat{D}^g_{dt}$ be equal to the change in the national wage w in industry i (leaving out district d, whose labor demand is being calculated) from year $t-1$ to year t, weighted by the share η of district d's employment of gender g in industry i in the prior year $t-1$. Specifically,

$$\hat{D}^g_{dt} = \sum_{i}^{N_i} \eta^g_{di,t-1}(\bar{w}_{di,t} - \bar{w}_{di,t-1}). \tag{3.1}$$

This strategy takes advantage of the considerable geographical variation in the industrial composition in India and pre-existing gender differences in the composition of the labor force in a specific industry. For instance, it predicts that female labor demand in the Darjeeling district in West Bengal (an area with lots of tea estates and has a history of hiring lots of women) will be high when wages in the tea industry in other parts of the country (such as the Dibrugarh district in Assam) are rising.

We then use these measures of changes in labor demand to test the main prediction that job opportunities increase the quality of marriages that began in that year. We also test whether improved job opportunities in the year that a woman enters marriage increases her autonomy to avoid entering undesirable marriages. Specifically, for women i in district d married in year t, a measure Y_{idt} of marriage outcome is assumed to be a function of the district-of-marriage fixed effects (δ_d) and year-of-marriage fixed effects(τ_t), as well as the woman's characteristics that are pre-determined at the time of marriage (X_{idt}), and the local demand for female labor ($\hat{D}^f_{dt}$).

$$Y_{idt} = \delta_d + \tau_t + X'_{id}\beta + \gamma \hat{D}^f_{dt} + \epsilon_{idt} \tag{3.2}$$

X_i includes indicator variables for the woman's year of birth, the highest education completed by her father, the highest education completed by her mother, her number of brothers, and her number of sisters. ϵ_{idt} captures the regression's i.i.d. error component. If women's labor force opportunities improve the marriage outcomes of women married in that year then $\gamma > 0$. We estimate the regression both conditional and unconditional on male labor demand ($\hat{D}^m_{dt}$): The results unconditional on male labor demand are likely to better represent the job opportunities for all workers, since male and female wages are likely to comove. Since, the most literal interpretation of the model is about a woman's absolute utility from her ability to live on her own or the household's absolute value of an unmarried daughter (and not her relative wage), this regression is a direct test of the model. We also re-estimate the regression conditional on male wage to see whether relative wages matter more for marriage outcomes than absolute female wages.

Apart from the quality of marriage outcomes that are decided at the time of marriage and are unchanged thereafter, we also investigate the effect of female labor demand shocks at the time of marriage on marriage outcomes that evolve during the course of a marriage such as intra-household bargaining power. These are likely to be a function of a woman's bargaining power going into marriage, but also, her intra-household bargaining afterwards. Even though we have district fixed effects in specification 3.2, the coefficient on female labor demand during the year-of-marriage reflects both if female labor demand is serially correlated. We partially address this concern by including district-specific-linear-time-trends. We further use a sub-sample of women for whom the year-of-marriage and year-of-interview are different to include both labor demand shocks at the time of marriage and labor demand shocks at the time of survey to evaluate which matters more.

$$Y_{idts} = \delta_d + \tau_t + +S_s + \gamma \hat{D}^f_{dt} + \mu \hat{D}^f_{ds} + e_{idts}. \tag{3.3}$$

$\hat{D}^{f}_{ds}$ is the labor demand shock in district d during survey year s and S_s includes year-of-survey fixed effects. Notice that district d indicates both the district where the woman gets married and where she lives after marriage and during the year of survey. This is a potential concern given that typically women in India migrate from their natal village to their husband's village after marriage. However, it is rare for women to migrate out of their natal district, which partially addresses this concern. We discuss these issues of migration further in the data and results section.

3.4 Data

We use the 61^{th}, 62^{th}, 64^{th}, 66^{th}, and 68^{th} Employment and Unemployment rounds of the National Sample Surveys (NSS) of India to construct gender-specific labor demand shocks. The NSS is a nationally representative repeated cross-sectional survey. The Employment and Unemployment rounds of the NSS collect individual (and household) labor data. The NSS administers the surveys typically across an entire year from July to June. They divide each round of the survey temporally into 3-month long sub-rounds and the labor survey is nationally representative during each sub-round. The 5 rounds of the NSS survey that we use were conducted in 2004-05, 2005-06, 2007-08, 2009-10, and 2011-12, respectively, and enables us to use labor data from 2004 to 2012.

The NSS asks all residents in the sampled households detailed information about their labor market experience, including their current employment status, the industry they work in[3], and their weekly wages[4]. Additionally, the survey collects demographic information about the household members such as their district of residence[5], gender, age, marital status and many more. We use the sample of individuals working for wages and equation 3.1 to construct the district-level Bartik labor demand shocks from 2005 to 2012.

The primary outcomes data is from the nationally representative India Human Development

[3]We use the sixty categories of the 2-digit National Industrial Classification (NIC) of 1998 to construct the labor demand shocks. Later rounds of the NSS use 2004 and 2008 NIC codes during the survey. We recode these back to the 1998 codes.

[4]We convert nominal wages to 2001 real wages using the Consumer Price Index

[5]We recode all districts to 2001 Census boundary definitions for this study. In case a district was formed from multiple parent districts, we drop the parents and the newly formed district from the analysis. This leaves us with 585 out of 593 districts in the 2001 Census.

Survey 2011-12 (IHDS II). The IHDS II interviewed a sample of ever-married women between 15 and 49 years of age. For these women, the survey collected detailed information on the decisions made at the time of their marriage and also on their current household bargaining power. Our analysis includes women who have been married only once, marry between 2005 and 2012, and marry by the age of 30[6]. This provides us with a sample of 7,751 women. Our analysis focuses on the following groups of outcomes:

1. Women's autonomy in their marriage decisions - An indicator variable that is equal to one if the woman herself selected her spouse and zero otherwise is our direct measure of women's say in their marriage match[7]. Apart from this, we also use an indicator for whether the woman had any contact with her spouse prior to marriage. This includes having met, talked over phone, seen photo, emailed and/or had a chat with her spouse.

2. Spouse's characteristics - These include (a) log of spouse's completed years of education; and (b) log of spousal age gap, which is equal to the woman's age subtracted from her spouse's age[8].

3. Characteristics of spouse's household - These include (a) an indicator variable for consanguinity, that is, whether the the woman is married to a cousin or an uncle; (b) an indicator for whether the economic status of the woman's natal household was worse off compared to her spouse's household and; (c) an indicator for whether the woman's natal household and spouse's household are of the same caste.

4. Marriage Migration - We use (a) an indicator variable that is equal to one if the woman grew up in the same village/town as her spouse and zero otherwise and; (b) log of hours of travel from residence to natal home.

---

[6] Only 1% of the sample report marrying above the age of 30.

[7] IHDS II asked the women information on who chose their spouse and the options were: (a) Respondent herself; (b) Respondent along with her parents and/or relatives; (c) Parents and/or Relatives and; (d) Others.

[8] Spousal age gaps are typically positive in India and therefore, we exclude the 0.79% of the sample that report negative spousal age gaps for analysis.

5. Women's intra-household bargaining power after marriage - We create the following indices using principal component analysis and groups of self-reported measures of women'ss autonomy in the household: (a) **Decision-making** is created from self-reports on her say in issues related to what to cook daily, purchase of expensive items, how many children to have, what to do when she falls sick, whether to buy land/property, expenditures on wedding, what to do when children are ill and whom the children should marry; (b) **Discussion** is created from her self-reports on whether she discusses work/farm matters, household expenditure, and local politics with husband; (c) **Permission** is created from self-reports on whether she has to ask for permission from her husband or others to go to the local health center, the local grocery store, visit friends/relatives, and go short distances by bus or train; (d) **Mobility** is created from her self-reports on whether (with or without permission) she can go alone to the local health center, the local grocery store, visit friends/relatives, and go short distances by bus or train; (e) **Men eat first** is an indicator for whether the men in the household eat first and; (f) **Go Out** is an indicator for whether woman can go on recreational family outings.

3.5 Results

Labor Force Participation

We start by using the NSS data to confirm that the constructed gender-specific labor demand shocks following equation 3.1 predicts an increase in gender-specific labor force participation. Table 3.2 shows that an increase in female Bartik wages by one rupee statistically significantly increases the probability that women work for wages by 0.000019. For the sample period, the average annual increase in female wages was Rs. 503.73 and the average proportion of women who worked was 0.11. Calculated at these sample averages, the probability that a woman worked for wages during a given year increased by roughly $\frac{503.73 \times 0.000019}{0.11} \times 100 = 8.7\%$. Similarly, an increase in male Bartik wages by one rupee statistically significantly increases the probability that men work for wages by 0.000005. This translates into a $\frac{872.70 \times 0.000005}{0.43} \times 100 = 1\%$ annual increase in male labor force participation due to increases in job opportunities.

Therefore, we find that the constructed female labor demand shocks are a strong predictor of labor force participation of women and this is robust to the inclusion of district-specific-linear-time-trends and also male labor demand shocks. Given that an increase in job opportunities for women increases their wage employment, we investigate how these opportunities affect women's autonomy in marriage decisions and the quality of their marriage match.

Autonomy and Contact

Panel A in table 3.3 shows that an increase in female labor demand during a year by one rupee increases the probability that a woman married during that year chose her own spouse by 0.000037. Table 3.1 shows that the average proportion of women who chose their own spouse during the sample years is 0.065. Therefore, evaluated at the average annual increase in female wages, we find that the proportion of women choosing their spouse independently increases by $\frac{503.73\times 0.000037}{0.065} \times 100 = 28\%$. Therefore, increase in woman's job opportunities has a quantitatively large impact on their autonomy in marriage decisions.

The coefficient estimates in Panel A of table 3.3 change very little with the inclusion of woman's characteristics determined prior to her marriage, and district-specific linear time trends. The coefficient estimates are also robust to the inclusion of male labor demand shocks and we do not find that male job opportunities affect women's ability to choose their spouse. This is consistent with the argument that absolute changes in women's job opportunities should matter more than relative changes (compared to job opportunities for men) as it is a more representative measure of her ability to live by herself.

Panel B in table 3.3 shows that an increase in women's job opportunities also increases the probability that they have any contact with their spouse before the wedding. One rupee increase in female labor demand increases the probability that they have met, talked over phone, seen photo of, emailed and/or had a chat with their husband prior to the wedding by 0.000037. Table 3.1 shows that the proportion of women who have had some contact with their husbands prior to the wedding is 0.62. Therefore, the coefficient estimate can be interpreted as a $\frac{503.73\times 0.000037}{0.62} \times 100 = 3\%$ increase in the probability that a woman has any opportunity to interact with her husband before marriage due to increases in women's job opportunities during a given year.

Our findings establish that better job opportunities for women improves their ability to choose or reject potential spouses and also their ability to interact with them. Next, we investigate if this converts to an improvement in the quality of spouses as well.

Spouse's Characteristics

Panel A in table 3.4 shows that one rupee increase in female labor demand increase the years of education completed by a woman's spouse by 0.0042 percentage points. Therefore, women marry men with $0.0042 \times 503.73 = 2.12\%$ more years of education on average in response to increase in female labor demand. Similarly, Panel B in table 3.4 shows that the age gap between women and their spouse also decreases by $0.0039 * 503.73 = 1.96\%$ in response to increases in female labor demand. Therefore, we find that women marry more educated men and those closer to their age in response to improved job opportunities for them. In both cases, we do not find that male labor demand have any statistically significant effect on spouse's characteristics.

Traditionally, marriages in India have been documented to be arrangements between families (Rao and Rao, 1982; Rosenzweig and Stark). Therefore, in addition to spouse's characteristics, woman's job opportunities may have an effect on the type of household she gets married into. We investigate this next.

Spouse's Household Characteristics

Table 3.5 shows that female labor demand has no statistically significant effect on the probability that a woman is related to her spouse, is from an economically worse off household than the one she marries into, or is from the same caste as her husband. Interestingly, however, an increase in male labor demand has a positive effect on the probability that a woman marries her cousin or uncle and the probability that she marries within the same caste. One rupee increase in male labor demand increases the probability that a women enters a consanguineous marriage by 0.000009 percentage points and marries within the same caste by 0.000008 percentage points. Evaluated at the average annual increase in male wages (Rs. 872.70), these translate into an increase of 8% consanguineous and 6% same-caste marriages for women.

Marriage Migration

Panel A in table 3.6 shows that an increase in female labor demand by one rupee decreases the probability that the woman is from the same village as her spouse by 0.000033 percentage points. Given that the proportion of women who marry men from their natal village is 0.12 across the sample years, the coefficient estimate suggests a decline of 14% in the fraction of women who marry men from their natal village. Consistent with this result, the coefficient on female labor demand is positive for the regression on women's travel time to their natal household. However, this estimate is not statistically significant.

An increase in this migration is not necessarily the result of a marriage match to a farther away household. One can argue that even within a district there are locations where the new job opportunities are concentrated. Therefore, our results may reflect that women migrate for these increased job opportunities and are more likely to choose and get married to men in these new locations. However, given our data we are unable to distinguish between these patterns.

Intra-household Bargaining

Tables 3.7, 3.8, and 3.9 show that female labor demand during the year of survey positively affects most of our measures of women's autonomy in the household after marriage. These include indices for whether woman discusses different matters with her husband, whether woman needs permission from husband or others to go out locally for chores, whether woman can go out locally for chores alone (with or without permission), and the probability that she partakes in recreational family outings. Largely, female labor demand shocks at the time of marriage does not seem to affect status within household after marriage.

Some exceptions to this pattern worth noting are: (a) Panel A in table 3.7 shows that male labor demand at the time of survey positively affects the index of woman's decision-making within the household. Moreover, the coefficient on female labor demand during the year of survey is negative, however, not statistically significant. These results likely represent that if the husband is currently experiencing a positive labor demand shock, then the wife is more likely to make decisions at home, and vice versa. (b) Panel A in table 3.9 does show that female labor demand at the time of marriage negatively impacts the probability that men of the household eat first. Since this practice is arguably more often a symbol of status within the household, a positive female labor demand shock at the time of marriage may have improved women's status within the household.

3.6 Conclusion

Present literature on the effect of women's job opportunities on their ability to make their own marriage decisions is limited. We show that positive female labor demand shocks have a large quantitative impact on women's ability to choose/reject marriage matches. In the context of India, where marriage decisions are traditionally made by households rather than the bride, this represents a powerful change from the prevailing culture. In India, marriages rarely end in separation or divorce. Therefore, greater autonomy in marriage decisions for women indicate that they have more control over the quality of life they will lead in the future. Additionally, we find that women's job opportunities also lead them to marrying more educated men, men who are closer to their own age, and who grew up in a different village/town.

3.7 Tables

Table 3.1: Married Women's Summary Statistics

	Mean	SD	N
Father's completed years of education	4.741676	4.852434	7719
Mother's completed years of education	2.354538	3.730475	7734
Number of brothers	1.729719	1.160312	7729
Number of sisters	1.685403	1.427925	7721
Proportion of women who chose spouse independently	0.0653409	0.2471424	7744
Proportion of women who had any contact with husband prior to wedding	0.617236	0.4860929	7728
Spouse's completed years of schooling	8.558466	4.363952	7560
Spousal age gap	4.787834	3.33	7513
Proportion of women who are married to their cousin or uncle	.1005657	0.3007843	4773
Proportion of woman whose natal household is economically worse off than husband's	0.1081675	0.3106119	7738
Proportion of women whose husband's family is same caste as woman's	0.9475592	0.2229286	7723
Proportion of woman who grew up in the same village/town as husband	0.1177994	0.3223913	7725
Distance (one way) to woman's natal home (in hours)	3.148897	6.288432	7522

83

Table 3.2: Probability of Working for Wages

	(1)	(2)	(3)	(4)
Female Labor Demand	0.000016**	0.000015**	0.000021***	0.000019***
	(0.000007)	(0.000007)	(0.000007)	(0.000006)
Female Labor Demand × Male	-0.000035***	-0.000036***	-0.000042***	-0.000042***
	(0.000010)	(0.000010)	(0.000009)	(0.000009)
Male	0.333187***	0.333403***	0.324245***	0.324524***
	(0.004409)	(0.004403)	(0.005540)	(0.005540)
Male Labor Demand			0.000001	0.000001
			(0.000001)	(0.000001)
Male Labor Demand × Male			0.000005***	0.000005***
			(0.000002)	(0.000002)
Year Effects	Yes	Yes	Yes	Yes
District Effects	Yes	Yes	Yes	Yes
District Trends	No	Yes	No	Yes
Observations	2346741	2346741	2346741	2346741

National Sample Survey sample weights applied. Clustered robust standard errors at the district level are included in parenthesis. * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

84

Table 3.3: Autonomy in Marriage Decisions

Panel A: Probability of choosing spouse independently

	(1)	(2)	(3)	(4)	(5)	(6)
Female Labor Demand	0.000035***	0.000037***	0.000035***	0.000036***	0.000038***	0.000037***
	(0.000012)	(0.000012)	(0.000013)	(0.000013)	(0.000013)	(0.000014)
Male Labor Demand				-0.000002	-0.000002	-0.000003
				(0.000003)	(0.000003)	(0.000004)
Year of Marriage Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual Covariates	No	Yes	Yes	No	Yes	Yes
District Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Trends	No	No	Yes	No	No	Yes
Observations	6774	6711	6711	6774	6711	6711

Panel B: Probably of having any contact with spouse prior to wedding

	(1)	(2)	(3)	(4)	(5)	(6)
Female Labor Demand	0.000028**	0.000027*	0.000035**	0.000032**	0.000032**	0.000037***
	(0.000014)	(0.000014)	(0.000015)	(0.000015)	(0.000014)	(0.000014)
Male Labor Demand				-0.000006	-0.000006	-0.000003
				(0.000005)	(0.000005)	(0.000004)
Year of Marriage Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual Covariates	No	Yes	Yes	No	Yes	Yes
District Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Trends	No	No	Yes	No	No	Yes
Observations	6759	6696	6696	6759	6696	6711

Clustered robust standard errors at the district level are included in parenthesis. * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

85

Table 3.4: Spouse's Characteristics

Panel A: Log(1+Spouse's Education)

	(1)	(2)	(3)	(4)	(5)	(6)
Female Labor Demand	0.000035*	0.000022	0.000040*	0.000034*	0.000020	0.000042*
	(0.000020)	(0.000020)	(0.000023)	(0.000020)	(0.000020)	(0.000023)
Male Labor Demand				0.000001	0.000002	-0.000003
				(0.000008)	(0.000008)	(0.000010)
Year of Marriage Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual Covariates	No	Yes	Yes	No	Yes	Yes
District Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Trends	No	No	Yes	No	No	Yes
Observations	6618	6559	6559	6618	6559	6559

Panel B: Log(1+Spousal Age Gap)

	(1)	(2)	(3)	(4)	(5)	(6)
Female Labor Demand	-0.000023	-0.000028	-0.000035	-0.000026	-0.000029	-0.000039*
	(0.000020)	(0.000019)	(0.000023)	(0.000020)	(0.000019)	(0.000022)
Male Labor Demand				0.000003	0.000002	0.000005
				(0.000007)	(0.000006)	(0.000007)
Year of Marriage Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual Covariates	No	Yes	Yes	No	Yes	Yes
District Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Trends	No	No	Yes	No	No	Yes
Observations	6573	6515	6515	6573	6515	6515

Clustered robust standard errors at the district level are included in parenthesis. * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

86

Table 3.5: Spouse's Household Characteristics

Panel A: Probability that spouse is a cousin or an uncle

	(1)	(2)	(3)	(4)	(5)	(6)
Female Labor Demand	0.000005	0.000005	-0.000004	-0.000002	-0.000002	-0.000010
	(0.000011)	(0.000012)	(0.000016)	(0.000012)	(0.000012)	(0.000017)
Male Labor Demand				0.000010***	0.000009***	0.000009**
				(0.000004)	(0.000004)	(0.000004)
Year of Marriage Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual Covariates	No	Yes	Yes	No	Yes	Yes
District Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Trends	No	No	Yes	No	No	Yes
Observations	4185	4132	4132	4185	4132	4132

Panel B: Probability that the economic status of natal household is worse off compared to spouse's household

	(1)	(2)	(3)	(4)	(5)	(6)
Female Labor Demand	-0.000005	-0.000005	-0.000006	-0.000008	-0.000007	-0.000009
	(0.000009)	(0.000009)	(0.000011)	(0.000009)	(0.000010)	(0.000011)
Male Labor Demand				0.000003	0.000003	0.000004
				(0.000003)	(0.000003)	(0.000004)
Year of Marriage Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual Covariates	No	Yes	Yes	No	Yes	Yes
District Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Trends	No	No	Yes	No	No	Yes
Observations	6767	6704	6704	6767	6704	6704

Panel C: Probability that natal household is the same caste as spouse's household

	(1)	(2)	(3)	(4)	(5)	(6)
Female Labor Demand	-0.000002	-0.000002	0.000000	-0.000003	-0.000004	-0.000005
	(0.000009)	(0.000009)	(0.000011)	(0.000009)	(0.000009)	(0.000011)
Male Labor Demand				0.000001	0.000002	0.000008**
				(0.000003)	(0.000003)	(0.000003)
Year of Marriage Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual Covariates	No	Yes	Yes	No	Yes	Yes
District Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Trends	No	No	Yes	No	No	Yes
Observations	6753	6690	6690	6753	6690	6690

Clustered robust standard errors at the district level are included in parenthesis. * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

Table 3.6: Marriage Migration

Panel A: Probability that spouse is from same village/town as woman

	(1)	(2)	(3)	(4)	(5)	(6)
Female Labor Demand	-0.000008	-0.000012	-0.000034*	-0.000009	-0.000013	-0.000033*
	(0.000016)	(0.000018)	(0.000018)	(0.000017)	(0.000018)	(0.000019)
Male Labor Demand				0.000001	0.000001	-0.000001
				(0.000004)	(0.000004)	(0.000005)
Year of Marriage Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual Covariates	No	Yes	Yes	No	Yes	Yes
District Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Trends	No	No	Yes	No	No	Yes
Observations	6755	6692	6692	6755	6692	6692

Panel B: Log(1+Hours to Natal Home)

	(1)	(2)	(3)	(4)	(5)	(6)
Female Labor Demand	0.000013	0.000016	0.000023	0.000004	0.000006	0.000015
	(0.000031)	(0.000031)	(0.000035)	(0.000032)	(0.000032)	(0.000036)
Male Labor Demand				0.000012*	0.000012*	0.000010
				(0.000006)	(0.000006)	(0.000007)
Year of Marriage Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual Covariates	No	Yes	Yes	No	Yes	Yes
District Effects	Yes	Yes	Yes	Yes	Yes	Yes
District Trends	No	No	Yes	No	No	Yes
Observations	6587	6526	6526	6587	6526	6526

Clustered robust standard errors at the district level are included in parenthesis. * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

Table 3.7: Intra-household Bargaining: Decision-making and Discussion

Panel A: Index for decision-making power within household

	(1)	(2)	(3)	(4)
Year of Marriage: Female Labor Demand	-0.000017	-0.000011	-0.000025	-0.000021
	(0.000102)	(0.000106)	(0.000103)	(0.000106)
Year of Marriage: Male Labor Demand		-0.000007		-0.000005
		(0.000031)		(0.000032)
Year of Survey: Female Labor Demand			-0.000409	-0.000518
			(0.000670)	(0.000858)
Year of Survey: Male Labor Demand				0.000315*
				(0.000178)
Year of Survey Effects	No	No	Yes	Yes
Year of Survey District trends	No	No	Yes	Yes
Observations	5207	5207	5207	5207

Panel B: Index for whether woman discusses various matters with husband

	(1)	(2)	(3)	(4)
Year of Marriage: Female Labor Demand	-0.000021	-0.000008	-0.000023	-0.000012
	(0.000055)	(0.000053)	(0.000054)	(0.000051)
Year of Marriage: Male Labor Demand		-0.000016		-0.000013
		(0.000021)		(0.000022)
Year of Survey: Female Labor Demand			0.002034*	0.002205*
			(0.001209)	(0.001170)
Year of Survey: Male Labor Demand				0.000695
				(0.000463)
Year of Survey Effects	No	No	Yes	Yes
Year of Survey District trends	No	No	Yes	Yes
Observations	6277	6277	6277	6277

All specifications include district effects, year of marriage effects, individual covariates, and year of marriage trends. Clustered robust standard errors at the district level are included in parenthesis. * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

89

Table 3.8: Intra-household Bargaining: Permission and Mobility

Panel A: Index for whether woman needs permission to travel locally

	(1)	(2)	(3)	(4)
Year of Marriage: Female Labor Demand	-0.000021	-0.000023	-0.000022	-0.000025
	(0.000074)	(0.000075)	(0.000074)	(0.000075)
Year of Marriage: Male Labor Demand		0.000003		0.000003
		(0.000022)		(0.000022)
Year of Survey: Female Labor Demand			-0.002265***	-0.002015**
			(0.000770)	(0.000968)
Year of Survey: Male Labor Demand				0.000058
				(0.000326)
Year of Survey Effects	No	No	Yes	Yes
Year of Survey District trends	No	No	Yes	Yes
Observations	4371	4371	4371	4371

Panel B: Index for whether woman can travel locally herself (with or without permission)

	(1)	(2)	(3)	(4)
Year of Marriage: Female Labor Demand	0.000023	0.000062	0.000021	0.000057
	(0.000071)	(0.000075)	(0.000071)	(0.000076)
Year of Marriage: Male Labor Demand		-0.000049*		-0.000047*
		(0.000027)		(0.000027)
Year of Survey: Female Labor Demand			0.003252***	0.002204***
			(0.001053)	(0.000311)
Year of Survey: Male Labor Demand				-0.000527***
				(0.000104)
Year of Survey Effects	No	No	Yes	Yes
Year of Survey District trends	No	No	Yes	Yes
Observations	5865	5865	5865	5865

All specifications include district effects, year of marriage effects, individual covariates, and year of marriage trends. Clustered robust standard errors at the district level are included in parenthesis. * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

90

Table 3.9: Intra-household Bargaining: Others

Panel A: Probability that men in the household eat first

	(1)	(2)	(3)	(4)
Year of Marriage: Female Labor Demand	-0.000025**	-0.000027*	-0.000026**	-0.000027*
	(0.000013)	(0.000014)	(0.000013)	(0.000014)
Year of Marriage: Male Labor Demand		0.000002		0.000002
		(0.000006)		(0.000006)
Year of Survey: Female Labor Demand			-0.000051	-0.000016
			(0.000268)	(0.000241)
Year of Survey: Male Labor Demand				0.000176*
				(0.000091)
Year of Survey Effects	No	No	Yes	Yes
Year of Survey District trends	No	No	Yes	Yes
Observations	6332	6332	6332	6332

Panel B: Probability that woman can go out on family outings

	(1)	(2)	(3)	(4)
Year of Marriage: Female Labor Demand	0.000007	0.000013	0.000008	0.000012
	(0.000018)	(0.000018)	(0.000018)	(0.000018)
Year of Marriage: Male Labor Demand		-0.000007		-0.000006
		(0.000006)		(0.000006)
Year of Survey: Female Labor Demand			0.000697***	0.000690***
			(0.000225)	(0.000139)
Year of Survey: Male Labor Demand				-0.000201***
				(0.000055)
Year of Survey Effects	No	No	Yes	Yes
Year of Survey District trends	No	No	Yes	Yes
Observations	6287	6287	6287	6287

All specifications include district effects, year of marriage effects, individual covariates, and year of marriage trends. Clustered robust standard errors at the district level are included in parenthesis. * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

91

BIBLIOGRAPHY

Anderson, S. (2003). Why dowry payments declined with modernization in Europe but are rising in India. *Journal of Political Economy*, 111(2):269–310.

Anderson, S. and Eswaran, M. (2009). What determines female autonomy? Evidence from Bangladesh. *Journal of Development Economics*, 90(2):179–191.

Angelucci, M., Karlan, D., and Zinman, J. (2015). Microcredit Impacts: Evidence from a Randomized Microcredit Program Placement Experiment by Compartamos Banco. *American Economic Journal: Applied Economics*, 7(1):151–82.

Anukriti, S. Financial Incentives and the Fertility-Sex Ratio Trade-off. *American Economic Journal: Applied Economics*.

Balakrishnan, U. (2017). Incentives for Girls and Gender Bias in India. *Working Paper*.

Banerjee, A., Duflo, E., Ghatak, M., and Lafortune, J. Marry for What? Caste and Mate Selection in Modern India. *American Economic Journal: Microeconomics*, 5(2).

Banerjee, A., Duflo, E., Ghatak, M., and Lafortune, J. (2013). Marry for What? Caste and Mate Selection in Modern India. *American Economic Journal: Microeconomics*, 5(2):33–72.

Banerjee, A., Duflo, E., Ghatak, M., and Lafortune, J. (2016). Dowry: Household Responses to Expected Marriage Payments. *Unpublished Manuscript*.

Banerjee, A., Duflo, E., Glennerster, R., and Kinnan, C. (2015). The Miracle of Microfinance? Evidence from a Randomized Evaluation. *American Economic Journal: Applied Economics*, 7(1):22–53.

Barcellos, S., Carvalho, L., and Lleras-Muney, A. (2014). Child Gender and Parental Investments In India: Are Boys and Girls Treated Differently? *American Economic Journal: Applied Economics*, 6(1):157–189.

Bartik, T. (1991). *Who benefits from state and local economic development policies?* Books from Upjohn Press.

Behrman, J. and Knowles, J. (1999). Household Income and Child Schooling in Vietnam. *World Bank Economic Review*, 13(2):211–256.

Bhalotra, S., Chakravarty, A., and Gulesci, A. (2016). The Price of Gold: Dowry and Death in India. *IZA Discussion Paper 9679*.

Bhalotra, S. and Cochrane, T. (2010). Where Have All the Young Girls Gone? Identifying Sex-Selective Abortion in India. *IZA Discussion Paper*, 5381.

Bharadwaj, P. and Lakdawala, L. (2013). Discrimination Begins in the Womb: Evidence of Sex-Selective Prenatal Investments. *Journal of Human Resources*, 48(1):71–113.

Bongaarts, J. and Guilmoto, C. Z. (2015). How many more missing women? Excess female mortality and prenatal sex selection 1970âĂŞ2050. *Ithaca: Cornell University Press*, 42(2):241–269.

Borooah, V. (2004). Gender Bias Among Children in India in their Diet and Immunisation Against Disease. *MPRA Paper from University Library of Munich, Germany*.

Browning, M., Chiappori, P.-A., and Lewbel, A. (2013). Estimating consumption economies of scale, adult equivalence scales, and household bargaining power. *Review of Economic Studies*, 80(4):1267–1303.

Burgess, R. and Pande, R. (2005). Do Rural Banks Matter? Evidence from the Indian Social Banking Experiment. *American Economic Review*, 95(3):780–795.

Caldwell, J., Reddy, P., and Caldwell, P. (1983). The Causes of Marriage Change in South India. *Population Studies*, 37(3):343–361.

Chari, A., Heath, R, M. A., and Fatima, F. (2016). The Effect of Early Cohabitation on Maternal and Child Outcomes: Evidence from India. *Working Paper*.

Chen, L., Huq, E., and D'Souza, S. (1981). Sex Bias in the Family Allocation of Food and Health Care in Rural Bangladesh. *Population and Development Review*, 7(1):55–70.

Chen, Y., Li, H., and Meng, L. (2013). Prenatal Sex Selection and Missing Girls in China: Evidence from the Diffusion of Diagnostic Ultrasound. *Journal of Human Resources*, 48(1):36–70.

Chokshi, M., Patil, B., Khanna, R., Neogi, S., Sharma, J., Paul, V., and Zodpey, S. (2016). Health Systems in India. *Journal of Perinatology*, 36:S9–S12.

Chowdhury, A. (2010). Money and Marriage: The Practice of Dowry and Brideprice in Rural India. *Brown University*.

Christian, P. J. and Dillon, B. (2017). Growing and Learning when Consumption is Seasonal: Long-term Evidence from Tanzania. *Demography, forthcoming*.

Cigno, A. (1998). Fertility decisions when infant survival is endogenous. *Journal of Population Economics,*, 5(3):175–183.

Corno, L., Hilderbrandt, N., and Voena, A. (2016). Weather Shocks, Age of Marriage and the Direction of Marriage Payments. *Working Paper*.

Corno, L. and Voena, A. (2016). Selling daughters: age of marriage, income shocks and the bride price tradition. *IFS Working Paper W16/08*.

Crepon, B., Devoto, F., Duflo, E., and ParientÃľ, W. (2015). Estimating the Impact of Microcredit on Those Who Take It Up: Evidence from a Randomized Experiment in Morocco. *American Economic Journal: Applied Economics*, 7(1):123–150.

Das, J., Holla, A., and Mohpal, A. (2016). Quality and Accountability in Health Care Delivery: Audit-Study Evidence from Primary Care in India. *American Economic Review*, 106(12):3765–3799.

Das Gupta, M. (1987). Sex Bias in the Family Allocation of Food and Health Care in Rural Bangladesh. *Population and Development Review*, 13(1):77–100.

Dharmalingam, . A. and Morgan, S. P. (1996). Women's work, autonomy, and birth control: Evidence from two south indian villages. *Population Studies*, 50(2):187–201.

Eswaran, M. (2002). The empowerment of women, fertility, and child mortality: Towards a theoretical analysis. *Journal of Population Economics,*, 15(3):433–454.

Fetzer, T. (2014). Social Insurance and Conflict: Evidence from India. *Working paper*.

Field, E. and Ambrus, A. (2008). Early Marriage, Age of Menarche, and Female Schooling Attainment in Bangladesh. *Journal of Political Economy*, 116(5):881–929.

Foster, A. D. and Gehrke, E. (2017). Consumption Risk and Human Capital Accumulation in India. *NBER Working Paper No. 24041*.

Fulford, S. (2013). The effects of financial development in the short and long run: Theory and evidence from India. *Journal of Development Economics*, 104:56–72.

Fulford, S. (2015). Marriage migration in India: Vast, varied, and misunderstood. *Working Paper*.

Ganatra, B. and Hirve, S. (1994). Male bias in health care utilization for under-fives in a rural community in Western India. *Bulletin of the World Health Organization*, 72(1):101–104.

Ganatra, B. and Hirve, S. (2001). Does increased access increase equality? Gender and child health investments in India. *Journal of Development Economics*, 89(1):62–76.

Gehrke, E. (2017). An employment guarantee as risk insurance? assessing the effects of the nregs on agricultural production decisions. *The World Bank Economic Review*, 1:23.

Heath, R. and Mobarak, A. M. (2015). Manufacturing growth and the lives of Bangladeshi women. *Journal of Development Economics*, 115:1–15.

Heath, R. and Mobarak, M. (2014). Manufacturing Growth and the Lives of Bangladeshi Women. *Journal of Development Economics*, 115:1–15.

Hulme, M. (1992). A 1951-80 global land precipitation climatology for the evaluation of General Circulation Models. *Climate Dynamics*, 7:57–72.

Hulme, M., Osborn, T., and Johns, T. (1998). Precipitation sensitivity to global warming: comparison of observations with HadCM2 simulations. *Geophysical Resesarch Letters*, 25:3379–3382.

Imbert, C. and Papp, J. (2015). Labor Market Effects of Social Programs: Evidence from India's Employment Guarantee. *American Economic Journal: Applied Economics*, 7(2):233–263.

Jacoby, H. and Skoufias, E. (1997). Risk, Financial Markets, and Human Capital in a Developing Country. *The Review of Economic Studies*, 64(3):311–335.

Jayachandran, S. (2006). Selling labor low: Wage responses to productivity shocks in developing countries. *Journal of political Economy*, 114(3):538–575.

Jayachandran, S. (2017). Fertility Decline and Missing Women. *American Economic Journal: Applied Economics*, 9(1):118–1392.

Jayachandran, S. and Kuziemko, I. (2011). Why Do Mothers Breastfeed Girls Less than Boys? Evidence and Implications for Child Health in India. *The Quarterly Journal of Economics*, 126(3):1485–1538.

Jensen, P. and Nielsen, H. (1997). Child Labour or School Attendance? Evidence from Zambia. *Journal of Population Economics*, 10(4):407–424.

Jensen, R. (2012). Do labor market opportunities affect young women's work and family decisions? Experimental evidence from India. *The Quarterly Journal of Economics*, 127(2):753–792.

Jha, R., Bhattacharyya, S., and Gaiha, R. (2011). Social safety nets and nutrient deprivation: An analysis of the National Rural Employment Guarantee Program and the Public Distribution System in India. *Journal of Asian Economics*, 22(2):189–201.

Kaboski, J. and Townsend, R. (2011). A structural evaluation of a large-scale quasi-experimental microfinance initiative. *Econometrica*, 79(5):1357–1406.

Kaboski, J. and Townsend, R. (2012). The impact of credit on village economies. *American Economic Journal: Applied Economic*, 4(2):98–133.

Kalsi, P. (2017). Seeing is Believing - Can Increasing the Number of Female Leaders Reduce Sex Selection in Rural India? *Journal of Development Economics*, 126(1).

Kochar, A. (2011). The Distributive Consequences of Social Banking: A Microempirical Analysis of the Indian Experience. *Economic Development and Cultural Change*, 59(2):251–280.

Lundberg, S. J., Pollak, R. A., and Wales, T. J. (1997). Do husbands and wives pool their resources? Evidence from the United Kingdom child benefit. *Journal of Human Resources*, pages 463–480.

Maccini, S. and Yang, D. (2009). Under the weather: Health, schooling, and economic consequences of early-life rainfall. *American Economic Review*, 99(3):1006–26.

Majlesi, K. (2016). Labor market opportunities and women's decision making power within households. *Journal of Development Economics*, 119:34–47.

Mbiti, I. (2008). Monsoon Wedding? The Effect of Female Labor Demand on Marriage Markets in India. *Working Paper*.

Merfeld, J. (2018). Moving up or Just Surviving? Non-Farm Self-Employment in India. *Working Paper*.

Merfeld, J. D. (2017). Spatially Heterogeneous Effects of a Public Works Program. *Working paper*.

Miguel, E. (2005). Poverty and Witch Killing. *Review of Economic Studies*, 72:1153âĂŞ1172.

Miller, B. (1981). The Endangered Sex: Neglect of Female Children In Rural North India. *Population and Development Review*.

Ministry of Law and Justice (2005). The National Rural Employment Guarantee Act. shttp://nrega.nic.in/rajaswa.pdf.

Mobarak, A. and Kuhn, R Peter, C. (2013). Consanguinity and Other Marriage Market Effects of a Wealth Shock in Bangladesh. *Demography*, 50:1845–1871.

Panagariya, A. (2006). Bank Branch Expansion and poverty reduction: A comment. *Technical Report, Mimeo, Columbia University*.

Qian, N. (2008). Missing women and the price of tea in China: The effect of sex-specific earnings on sex imbalance. *The Quarterly Journal of Economics*, 123(3):1251–1285.

Rahman, L. and Rao, V. (2004). The Determinants of Gender Equity in India: Examining Dyson and Moore's Thesis with New Data. *Population and Development Review*, 30(2):239–268.

Rajaraman, I. (1983). Economics of Bride-Price and Dowry. *Economic and Political Weekly*, 18(8):275–279.

Rao, V. and Rao, VN, C. (1982). *Marriage, the family, and women in India*. South Asia Books.

Ravi, S. and Engler, M. (2015). Workfare as an effective way to fight poverty: The case of India's NREGS. *World Development*, 67:57–71.

Rose, E. (1999). Consumption Smoothing and Excess Female Mortality in Rural India. *Review of Economics and Statistics*, 81(1):41–49.

Rosenblum, D. (2013). The effect of fertility decisions on excess female mortality in India. *Journal of Population Economics*, 26(1):147–180.

Rosenzweig, M. and Stark, O. Consumption smoothing, migration, and marriage: Evidence from rural India. *Journal of Political Economy*, 97(4).

Santangelo, G. (2016). Firms and Farms: The Impact of Agricultural Productivity on the Local Indian Economy. *Working paper*.

Sautmann, A. (2014). Partner search and demographics: the marriage squeeze in India. *Working Paper*.

Schultz, T. Changing world prices, women's wages, and the fertility transition: Sweden, 1860-1910. *The Journal of Political Economy*, 93(3).

Schultz, T. (1997). Demand for children in low income countries. *Handbook of Population and Family Economics*, 1:349–430.

Sekhri, S. and Debnath, S. (2014). Intergenerational Consequences of Early Age Marriages of Girls: Effect on Children's Human Capital. *Journal of Development Studies*, 50(12):1670–1686.

Sekhri, S. and Storeygard, A. (2014). Dowry deaths: Response to weather variability in India. *Journal of Development Economics*, 111:212–223.

Sen, A. (1990). More Than 100 Million Women Are Missing and prenatal sex selection 1970-2050. *The New York Review of Books*, 20:61–66.

Sen, A. (1992). How many more missing women? Excess female mortality and prenatal sex selection 1970-2050. *BMJ: British Medical Journal*, 304(6827):587.

Shah, M., Rao, R., and Shankar, P. (2007). Rural credit in 20th century India: overview of history and perspectives. *Economic and Political Weekly*, 42(15):1351–1364.

Shah, M. and Steinberg, B. M. (2015a). Workfare and human capital investment: Evidence from India. *National Bureau of Economic Research Working Paper*.

Shah, M. and Steinberg, B. M. (2015b). Workfare and Human Capital Investment: Evidence from India. *NBER Working Paper No. 21543*.

Shah, M. and Steinberg, B. M. (2017). Drought of opportunities: Contemporaneous and long-term impacts of rainfall shocks on human capital. *Journal of Political Economy*, 125(2):527–561.

Singh, S. and Samara, R. (1996). International Family Planning Perspectives. pages 148–175.

Sivasankaran, A. (2015). Work and Women's Marriage, Fertility and Empowerment: Evidence from Textile Mill Employment in India. *Unpublished Manuscript*.

Song, L., Appleton, S., and Knight, J. (2006). Does increased access increase equality? Gender and child health investments in India. *World Development*, 34(9):1639–1653.

Srinivas, M. (1952). *Religion and Society among the Coorgs of South India.* Clarendon Press, Oxford.

Srinivasan, P. and Lee, G. (2004). The Dowry System in Northern India: Women's Attitudes and Social Change. *Journal of Marriage and Family*, 66:1108–1117.

Tarozzi, A., Desai, J., and Johnson, K. The Impacts of Microcredit: Evidence from Ethiopia. *American Economic Journal: Applied Economics*, 7(1).

Vidmar, S., Carlin, J., Hesketh, K., Cole, T., et al. (2004). Standardizing anthropometric measures in children and adolescents with new functions for egen. *Stata Journal*, 4(1):50–55.

Young, N. (2017). Banking and Growth: Evidence from a Regression Discontinuity Analysis. *Working paper*.

Appendix A

BANKING AND MARRIAGE MARKETS

A.1 Conceptual Framework

The optimization problem of a household with a son can be written as

$$\begin{aligned} \underset{c_1,c_2,m_1,m_2,b}{\text{maximize}} \quad & U(c_1,c_2) = u(c_1) + \beta\{E_1[u(c_2)] + M_2\varepsilon^m\} \\ \text{subject to} \quad & c_1 - m_1(d_1 - i) = y_1 + b \\ & c_2 - m_2 d_2 + M_2 i + (1+r)b = y_2 \\ & b \leq \alpha. \end{aligned} \tag{A.1}$$

Suppose μ^m is the Lagrange multiplier associated with the credit constraint, $b \leq \alpha$, then the first order condition of the above problem with respect to b is

$$u'(y_1 + b^* + m_1(d_1 - i)) = \beta(1+r)E_1[u'(y_2 + m_2 d_2 - (1 - M_2)i - (1+r)b^*)] + \mu^m \tag{A.2}$$

The household prefers to have their son married in the first period if the utility derived from it is greater than the utility derived from waiting. If the credit constraint binds, that is, $\mu^m > 0$ and $b^* = \alpha$, then the household prefers to have their son married in the first period if

$$\begin{aligned} & u(y_1 + \alpha + d_1 - i) + \beta E_1[u(y_2 - (1+r)\alpha) - i] + \varepsilon^m \\ & \geq u(y_1 + \alpha) + \beta E_1[u(y_2 + d_2^* - i - (1+r)\alpha)] + \varepsilon^m. \end{aligned} \tag{A.3}$$

In case of households with sons, there must be some value of $\alpha = \alpha^m$ for which equation (A3) holds with equality. For any $\alpha < \alpha^m$, a household will prefer to marry their son in the first period than the second period. Given that a unit mass of young sons enter the marriage market each period, the supply of young grooms is equal to α^m.

Proof of Proposition 2: α^f and α^m satisfy equations (3) and (A3) with equality, therefore:

$$\begin{aligned} u(y_1 + \alpha^f - d_1) + \beta E_1[u(y_2 - (1+r)\alpha^f)] + \varepsilon^f = \\ u(y_1 + \alpha^f - i) + \beta E_1[u(y_2 - d_2^* - (1+r)\alpha^f)] + \varepsilon^f \end{aligned} \tag{A.4}$$

$$\begin{aligned} u(y_1 + \alpha^m + d_1 - i) + \beta E_1[u(y_2 - (1+r)\alpha^m) - i] + \varepsilon^m = \\ u(y_1 + \alpha^m) + \beta E_1[u(y_2 + d_2^* - i - (1+r)\alpha^m)] + \varepsilon^f. \end{aligned} \tag{A.5}$$

The equations in (A4) and (A5) can be written as:

$$\begin{aligned} \frac{u(y_1 + \alpha^f - i) - u(y_1 + \alpha^f - i - (d_1 - i))}{d_1 - i} = \\ \frac{\beta\{E_1[u(y_2 - (1+r)\alpha^f)] - E_1[u(y_2 - d_2^* - (1+r)\alpha^f)]\}}{d_1 - i} > 0 \end{aligned} \tag{A.6}$$

$$\begin{aligned} \frac{u(y_1 + \alpha^m + d_1 - i) - u(y_1 + \alpha^m)}{d_1 - i} = \\ \frac{\beta\{E_1[u(y_2 + d_2^* - i - (1+r)\alpha^m)] - E_1[u(y_2 - (1+r)\alpha^m) - i]\}}{d_1 - i} > 0. \end{aligned} \tag{A.7}$$

Taking $\lim_{d_1 - i \to 0}$ on both sides of equations (A.6) and (A.7) yields:

$$\frac{du(y_1 + \alpha^f - i)}{d(d_1 - i)} > 0 \tag{A.8}$$

$$\frac{du(y_1 + \alpha^m)}{d(d_1 - i)} > 0 \tag{A.9}$$

Equations (A.9) and A.10) can be rewritten as follows:

$$\frac{du(y_1 + \alpha^f - i)}{d(d_1 - i)} = \frac{d\alpha^f}{d(d - i)} \times \frac{du(y_1 + \alpha^f - i)}{d\alpha^f} > 0 \tag{A.10}$$

$$\frac{du(y_1 + \alpha^m)}{d(d_1 - i)} = \frac{d\alpha^m}{d(d - i)} \times \frac{du(y_1 + \alpha^m)}{d\alpha^m} > 0. \tag{A.11}$$

As u is increasing in α^f and α^m, equations (A.10) and (A.11) show that α^f and α^m are increasing in d_1. Therefore, quantity supplied of young brides $(1 - \alpha^f)$ is decreasing in dowry paid for young brides (d_1) and quantity demand of young grooms (α^m) is increasing in dowry received for young grooms (d_1).

A.1.1 Second Period: Marriage Market Equilibrium

In the second period, household agrees to marry a daughter or son if the following conditions hold:

$$u(y_2 - d_2 - (1 + r)\alpha) + \varepsilon^f \geq u(y_2 - i - (1 + r)\alpha) \tag{A.12}$$

$$u(y_2 + d_2 - i - (1 + r)\alpha) + \varepsilon^m \geq u(y_2 - (1 + r)\alpha) \tag{A.13}$$

Assuming a log utility function, equations (A.13) and (A.14) yield an upper and a lower bound, respectively, for d_2^*, as follows:

$$d_2^* \leq [y_2 - (1 + r)\alpha]\frac{[exp\{\varepsilon^f\} - 1]}{exp\{\varepsilon^f\}} + \frac{i}{exp\{\varepsilon\}} = \bar{d}_2 \tag{A.14}$$

$$d_2^* \geq -[y_2 - (1 + r)\alpha]\frac{[exp\{\varepsilon^m\} - 1]}{exp\{\varepsilon^m\}} + i = \underline{d_2} \tag{A.15}$$

In the second period, a marriage occurs if $d_2^* \in [\bar{d}_2, \underline{d_2}]$.

Appendix B

INSURING GIRLS' LIVES FROM DROUGHT

B.1 Conceptual Framework

After substituting the budget constraints in the utility maximization problem, equation (2) becomes:

$$\begin{aligned} \underset{N,k_b,k_g,A}{\text{maximize}}\; U =& u_1[\alpha_1 F(1) - k_b\theta N - k_g(1-\theta)N] \\ &+ \beta u_2[\alpha_2 F(1-A) + \theta N p(k_b)BA - (1-\theta)Np(k_g)G] \\ &+ \beta u_c[p(k_b)\theta N + p(k_g)(1-\theta)N] \end{aligned} \tag{B.1}$$

For a given number of children and optimal health made investments in male and female children during the first period, the optimal labor hours in dowry appropriation in the second period is given by:

$$\begin{aligned} &\frac{\partial U(N,k_b,k_g,A)}{\partial A} \\ &\qquad = \beta u_2'[-\alpha_2 F'(1-A) + \theta N p(k_b)B] = 0. \\ &\qquad \implies \alpha_2 F'(1-A) = \theta N p(k_b)B \end{aligned} \tag{B.2}$$

Solving equation 3.3 yields:

$$A^* = 1 - F'^{-1}\left[\frac{\theta N p(k_b)B}{\alpha_2}\right]. \tag{B.3}$$

From equation 3.4, we get the proof of Prediction 1, that is,

$$\frac{\partial A^*}{\partial \alpha_2} < 0. \tag{B.4}$$

We denote the optimal dowry appropriation hours $A^* = A^*(N, K_b)$ and re-wirte the household's problem as:

$$\begin{aligned}
\underset{N,k_b,k_g}{\text{maximize}}\ U =& u_1[\alpha_1 F(1) - k_b\theta N - k_g(1-\theta)N] \\
&+ \beta u_2[\alpha_2 F(1 - A^*(N, K_b)) + \theta N p(k_b) B A^*(N, k_b) - (1-\theta)Np(k_g)G] \\
&+ \beta u_c[p(k_b)\theta N + p(k_g)(1-\theta)N]
\end{aligned} \tag{B.5}$$

For a chosen number of children, the household's optimal health investment in its male children is given by:

$$\begin{aligned}
\frac{\partial U(N, k_b, k_g)}{\partial k_b} &= -u_1'\theta N + \beta u_2' p'(k_b) B A^*(N, k_b)\theta N + \beta u_c' p'(k_b)\theta N = 0 \\
&\implies u_2' B A^*(N, k_b) + u_c' = \frac{u_1'}{\beta p'(k_b)} > 0
\end{aligned} \tag{B.6}$$

and female children is given by:

$$\begin{aligned}
\frac{\partial U(N, k_b, k_g)}{\partial k_g} &= -u_1'(1-\theta)N - \beta u_2' p'(k_g) G(1-\theta)N + \beta u_c' p'(k_g)(1-\theta)N = 0 \\
&\implies u_c' - u_2' G = \frac{u_1'}{\beta p'(k_g)} > 0
\end{aligned} \tag{B.7}$$

After the total differentiation of equations 11 and 12 with respect to α_1, we get:

$$\begin{aligned}
\frac{\partial^2 U(N, k_b, k_g)}{\partial k_b^2}\frac{\partial k_b^*}{\partial \alpha_1} + \frac{\partial^2 U(N, k_b, k_g)}{\partial k_b \partial k_g}\frac{\partial k_g^*}{\partial \alpha_1} + \frac{\partial^2 U(N, k_b, k_g)}{\partial k_b \partial \alpha_1} = 0 \\
\frac{\partial^2 U(N, k_b, k_g)}{\partial k_g \partial k_b}\frac{\partial k_b^*}{\partial \alpha_1} + \frac{\partial^2 U(N, k_b, k_g)}{\partial k_g^2}\frac{\partial k_g^*}{\partial \alpha_1} + \frac{\partial^2 U(N, k_b, k_g)}{\partial k_g \partial \alpha_1} = 0
\end{aligned} \tag{B.8}$$

The second partial derivatives are as follows:

$$\begin{aligned}\frac{\partial^2 U(N,k_b,k_g)}{\partial k_b^2} =& u_1''\theta^2 N^2 + \beta u_2''\theta^2 N^2 p'(k_b)^2 B^2 A^*(N,k_b)^2 + \beta u_2'\theta N B[p''(k_b)A^*(N,k_b) \\ &+ p'(k_b)A^{*\prime}(N,k_b)] + \beta u_c'' p'(k_b)^2\theta^2 N^2 + \beta u_c' p''(k_b)\theta N < 0,\end{aligned} \tag{B.9}$$

as A^* decreases in k_b.

$$\begin{aligned}\frac{\partial^2 U(N,k_b,k_g)}{\partial k_b \partial k_g} =& u_1''\theta(1-\theta)N^2 - \beta u_2''\theta(1-\theta)N^2 p'(k_b)p'(k_g)GBA^*(N,k_b) \\ &+ \beta u_c'' p'(k_b)p'(k_g)\theta(1-\theta)N^2 > 0,\end{aligned} \tag{B.10}$$

if G is large enough.

$$\begin{aligned}\frac{\partial^2 U(N,k_b,k_g)}{\partial k_g^2} =& u_1''(1-\theta)^2 N^2 + \beta u_2''(1-\theta)^2 N^2 p'(k_g)^2 G^2 - \beta u_2'(1-\theta)N p''(k_g)G \\ &+ \beta u_c'' p'(k_g)^2(1-\theta)^2 N^2 + \beta u_c' p''(k_g)(1-\theta)N \\ =& u_1''(1-\theta)^2 N^2 + \beta u_2''(1-\theta)^2 N^2 p'(k_g)^2 G^2 + \beta u_c'' p'(k_g)^2 (1-\theta)^2 N^2 \\ &+ \beta(1-\theta)N p''(k_g)[u_c' - u_2' G] < 0,\end{aligned} \tag{B.11}$$

using equation 12.

$$\frac{\partial^2 U(N,k_b,k_g)}{\partial k_b \partial \alpha_1} = -u_1'' F(1)\theta N > 0 \tag{B.12}$$

$$\frac{\partial^2 U(N,k_b,k_g)}{\partial k_g \partial \alpha_1} = -u_1'' F(1)(1-\theta) N > 0 \tag{B.13}$$

Using Cramer's rule, we solve the system of equations in (5) to find:

$$\frac{\partial k_b^*}{\partial \alpha_1} = \frac{\begin{vmatrix} -\frac{\partial^2 U(N,k_b,k_g)}{\partial k_b \partial \alpha_1} & \frac{\partial^2 U(N,k_b,k_g)}{\partial k_b \partial k_g} \\ -\frac{\partial^2 U(N,k_b,k_g)}{\partial k_g \partial \alpha_1} & \frac{\partial^2 U(N,k_b,k_g)}{\partial k_g^2} \end{vmatrix}}{\begin{vmatrix} \frac{\partial^2 U(N,k_b,k_g)}{\partial k_b^2} & \frac{\partial^2 U(N,k_b,k_g)}{\partial k_b \partial k_g} \\ \frac{\partial^2 U(N,k_b,k_g)}{\partial k_g \partial k_b} & \frac{\partial^2 U(N,k_b,k_g)}{\partial k_g^2} \end{vmatrix}} = \frac{\begin{vmatrix} - & + \\ - & - \end{vmatrix}}{\begin{vmatrix} - & + \\ + & - \end{vmatrix}} \tag{B.14}$$

$$\frac{\partial k_g^*}{\partial \alpha_1} = \frac{\begin{vmatrix} \frac{\partial^2 U(N,k_b,k_g)}{\partial k_b^2} & -\frac{\partial^2 U(N,k_b,k_g)}{\partial k_b \partial \alpha_1} \\ \frac{\partial^2 U(N,k_b,k_g)}{\partial k_g \partial k_b} & -\frac{\partial^2 U(N,k_b,k_g)}{\partial k_g \partial \alpha_1} \end{vmatrix}}{\begin{vmatrix} \frac{\partial^2 U(N,k_b,k_g)}{\partial k_b^2} & \frac{\partial^2 U(N,k_b,k_g)}{\partial k_b \partial k_g} \\ \frac{\partial^2 U(N,k_b,k_g)}{\partial k_g \partial k_b} & \frac{\partial^2 U(N,k_b,k_g)}{\partial k_g^2} \end{vmatrix}} = \frac{\begin{vmatrix} - & - \\ + & - \end{vmatrix}}{\begin{vmatrix} - & + \\ + & - \end{vmatrix}} \tag{B.15}$$

If G is large enough, then the numerators in equation 19 and 20 are postive. Additionally, if $u_c'' > u_2'' GBA^*(N, k_b)$, then the denominators are also positive. Therefore,

$$\frac{\partial k_b^*}{\partial \alpha_1} > 0 \text{ and } \frac{\partial k_g^*}{\partial \alpha_1} > 0 \tag{B.16}$$

The second inequality proves Prediction 2.

B.2 Tables

Table B.1: Rainfall Robustness

	Model 1	Model 2	Model 3	Model 4
Year of Birth Rainfall (Z)	0.026***			
	(0.007)			
Rain <-2		-0.085***		
		(0.029)		
Rain between -1 and -2		-0.050**		
		(0.024)		
Rain between 0 and -1		-0.045**		
		(0.019)		
Rain between 0 and 1		-0.024		
		(0.019)		
Rain between 1 and 2		-0.010		
		(0.020)		
Good year (Z>1)			0.027*	
			(0.015)	
Ordinal Rainfall (cuts -1 and 1)				0.021**
				(0.010)
District FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes
Household Vars	Yes	Yes	Yes	Yes
State/Year of Birth FE	Yes	No	No	No
Observations	65791	65791	65791	65791

Standard errors are in parentheses and are clustered at the district level. The first column repeats results from Table 2.2 but adds state by wave fixed effects. Column two creates "bins" of rainfall. Column three uses a simple dummy variable equal to one if rainfall is greater than $Z = 1$. Column four defines an ordinal variable, similar to Jayachandran (2006).

* p<0.1 ** p<0.05 *** p<0.01

Table B.2: NREGS and Bargaining Power I

	Alcohol		Cigarettes	
	Any	Log (R's + 1)	Any	Log (R's + 1)
NREGS times Post	-0.048	-0.144	-0.010	0.099
	(0.065)	(0.622)	(0.066)	(0.480)
District FE	Yes	Yes	Yes	Yes
District Vars	Yes	Yes	Yes	Yes
Household Vars	Yes	Yes	Yes	Yes
Observations	8296	8296	8296	8296

Standard errors are in parentheses and are clustered at the district level. All regressions use the ARIS/REDS, collected in 1999 and 2008. The dependent variable (DV) in column one is a dummy variable for whether a household purchased any alcohol. In column two, the DV is amount spent on alcohol (log of rupees plus one). In column three, the DV is a dummy variable for cigarette purchases, while the DV in column four is total spent on cigarettes (log of rupees plus one).

* p<0.1 ** p<0.05 *** p<0.01

Table B.3: NREGS and Bargaining Power II

	Girl Clothing Exp. Percent (log R's + 1)		Girl Education Exp. Percent	
	All	Both	Both	All
NREGS times Post	0.080**	-0.011	0.015	-0.035
	(0.039)	(0.025)	(0.046)	(0.037)
District FE	Yes	Yes	Yes	Yes
District Vars	Yes	Yes	Yes	Yes
Household Vars	Yes	Yes	Yes	Yes
Observations	5634	2928	4734	2027

Standard errors are in parentheses and are clustered at the district level. All regressions use the ARIS/REDS, collected in 1999 and 2008. The dependent variable (DV) in column one is total spent on girls' clothing as a percentage of total children's clothing purchases. In column two, the DV restricts the sample to only households that purchased both girls' and boys' clothing. In columns three and four, the DV is similary defined but for education expenditures instead of clothing.

* p<0.1 ** p<0.05 *** p<0.01

Appendix C

WOMEN'S JOB OPPORTUNITIES AND MARRIAGE QUALITY

C.1 Conceptual Framework

We model the search of a household for a spouse of their unmarried daughter. The household lives indefinitely, is risk neutral, and has a discount factor, β. During each period, the household receives one marriage offer which they can accept or reject. If they accept a marriage offer then their daughter gets married in the next period and it lasts forever. We assume that there are no divorces and therefore there is no search while the daughter is married. This is a plausible assumption in India's context..

We assume an infinite-horizon, discrete time set-up in which an unmarried daughter is randomly matched with a potential spouse in each period. The quality of a marriage match (h) is drawn from a distribution $F(h)$ with a p.d.f $f(h)$: When a household accepts a marriage quality of h, they receive a utility of h during each period thereafter. A household with an unmarried daughter receives a wage (w) that the she draws from her job. They also incur a cost (c), which can be thought of as the cost of spousal search and the taboo cost of an unmarried daughter. V is the household's value of continuing to search for a spouse for their daughter and can be described by the following Bellman equation:

$$V = w - b + \beta \int_0^\infty max\left[\frac{h}{1-\beta}, V\right] f(h)dh. \tag{3.1}$$

The household accepts a marriage offer if the discounted value of marriage is at least equal to the value of continuing the search, that is:

$$V = \frac{h^*}{1-\beta}. \tag{3.2}$$

Using equation 3.2, we can simplify equation 3.1 to:

$$h^* = w - b + \frac{\beta}{1-\beta}\int_{h^*}^{\infty}[h - h^*]f(h)dh. \tag{3.3}$$

Differentiating equation 3.3 with respect to w, we get:

$$\frac{\partial h^*}{\partial w} = \frac{1}{\frac{\beta}{1-\beta}\int_{h^*}^{\infty}[h - h^*]f(h)dh} > 0 \tag{3.4}$$