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Abstract

THREE ESSAYS IN DEVELOPMENT ECONOMICS

Shilpa Aggarwal

This dissertation consists of three self-contained chapters on development economics. The dissertation is focused primarily on the effects of road provision on rural households' decisions to invest in physical and human capital, specifically agricultural technology, health, and education. As a separate project, I also look at the impact of microcredit and microsavings on business-financing in sub-Saharan Africa.

In the first chapter, entitled "Do Rural Roads create Pathways out of Poverty? Evidence from India", I exploit a natural experiment from India, to evaluate the effect of paved feeder roads on 4 different aspects of the rural economy. I start by showing that improved roads led to a reduction in transportation costs, which is reflected in a reduction in price dispersion. I then show that these altered relative prices had an impact on households' incentives to invest in physical and human capital. Specifically, I find two main pieces of evidence: first, beneficiary farmers were more likely to adopt modern technologies, such as chemical fertilizer and hybrid seeds; and second, teenagers were more likely to drop out of school and join the labor force. I also find that improved access and reduced prices had important ramifications for household consumption. Households with greater exposure to the program were more likely to reduce their consumption of staples in favor of more nutritionally-dense, but perishable goods like meat and dairy. There was also a sharp increase in the variety of manufactured goods and processed foods being consumed by households.

In the second chapter, entitled "Paving the Way to Better Health: Quality and Quantity Evidence from India", I extend the same experiment and identification strategy to study the effects of road construction on rural households' health-seeking behavior. I find 3 main pieces of evidence. First, road construction led to better access to health care facilities, which translated into more hospital visits for prenatal care and child birth. Second, women thus included in the formal health care system were more likely to receive better care and have better health outcomes - a non-obvious result in light of the widespread notoreity of public service delivery in India. Third, I find evidence that rural households make a proximity-quality tradeoff, switching to better quality providers as barriers to access weaken.

In the third chaper, entitled "Financing Businesses in Africa: The Role of Microfinance", coauthored with Leora Klapper and Dorothe Singer of the World Bank, we evaluate the performance of microfinance in terms of providing business financing in 27 Sub-Saharan African countries. We utilize data from the 2009 and 2010 waves of the Gallup World Poll, a nationally representative survey of at least 1,000 individuals per country, conducted in up to 150 countries over the calendar year. This data, along with rigorous econometric evidence on microcredit usage from around the world, demonstrates that the economic gains from microcredit have been remarkably more modest than what was once believed. On the other hand, an analysis of microsavings along similar lines helps us conclude that it can prove to be a key financial innovation in terms of poverty alleviation and wealth creation. We also consider the challenges that the poor face in setting money aside, and discuss how policymakers can promote savings.

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The text of this dissertation includes a reprint of the following previously published material: "Financing Business in Africa: the Role of Microfinance" (co-authored with Leora Klapper and Dorothe Singer), which appeared as Chapter 9 in the volume "Microfinance in Developing Countries: Issues, Policies and Performance Evaluation" (Editors: Jean-Pierre Gueyie, Ronny Manos, and Jacob Yaron), published by Palgrave Macmillan in 2013. It is reproduced here with the permission of Palgrave Macmillan and the co-authors. The full published version of this publication is available from http://www.palgrave.com/products/title.aspx?pid=533935.

1 Do Rural Roads Create Pathways out of Poverty? Evidence from India

1.1 Introduction

Markets in developing economies are often characterized by spatial fragmentation due to poor transportation infrastructure. This inhibits households' and firms' ability to access goods and labor markets, technological innovations, and government services (World Bank, 2007; 2009). Policy-makers have increasingly attempted to address this problem by making large investments for the provision of roads and railroads.[1] However, the causal impact of these investments is not well-understood as placement tends to be driven by endogenous economic, political, or social factors. This precludes drawing rigorous conclusions about the first-order relationship between infrastructure and market-integration, as well as its subsequent bearing upon economic and social welfare.

This chapter exploits a rule-based public program that led to plausibly exogenous provision of roads in rural India, to provide four distinct pieces of evidence on the relationship between roads and economic outcomes. I start by establishing that road construction indeed reduced transportation costs and led to greater market integration, as dispersion of food prices declined in districts with greater road construction. I then provide evidence on the impact of this relative price change on farms' and households' incentives to invest in technology adoption and human capital. Specifically, I show two things: first, farmers in districts which received more roads increased their use of fertilizer and hybrid seeds; and second, teenagers dropped out of school and started working

[1] For instance, the World Bank has spent more than $20 billion on transportation infrastructure projects annually since 2006 (Private Participation in Infrastructure projects database, The World Bank).

as access to labor market opportunities improved. Finally, I provide reduced-form evidence that households responded to these supply changes by adjusting consumption on the intensive as well as the extensive margins.

The program in question - the Prime Minister's rural road scheme (hereafter, PMGSY) - is unprecedented in its scale and scope. Under a federal mandate to bring all villages with a population of at least 500 within reach of the nearest market via an all-weather road, PMGSY provided paved roads to more than 110 million people between 2001 and 2010, about 14.5 percent of the entire rural population, or 47 percent of the unconnected rural population[2] of India as of the 2001 census.[3]

I exploit program roll-out across different districts over a 10 year period to pin down the causal impact of road connectivity. Identification is based on each district's annual exposure to new roads, which is a function of the distribution of village sizes in the district. In the existing literature on infrastructure effects, identification has largely stemmed either from instruments based on historical routes,[4] or from variations in the straight line distance between peripheral regions and the (rail)road.[5] However, these approaches might have potential threats to validity as infrastructure has been shown to create long-term path dependencies (Bleakley and Lin, 2012; Berger and Enflo, 2013; Jedwab et al., 2013). Further, there may be endogeneity in the spatial layout of the road network, as is well-documented in the political economy literature. For instance, Nguyen et al. (2012) and Burgess et al. (2013) provide evidence of mistargeted construction projects in Vietnam and Kenya on account of nepotism and ethnic favoritism.

[2]While very large, these numbers are representative of the connectivity status of rural populations globally. According to the World Bank's Rural Access Index, over 1 billion rural inhabitants (or 31 percent of the world's rural population) do not have adequate access to transportation. 98 percent of these individuals live in developing countries. See http://www.worldbank.org/transport/transportresults/headline/rural-access.html

[3]The program is still underway as of this writing.

[4]See, for instance, Duranton and Turner (2012) and Volpe Martincus et al. (2013)

[5]See, for instance, Atack et al. (2010), Datta (2012), and Jedwab and Moradi (2012)

Rasul and Rogger (2013) highlight the relationship between bureaucratic practices and the quality and quantity of public goods in the context of the Nigerian civil service. Khemani (2004) and Rogger (2013) find evidence from India and Nigeria, showing that public good provision improves when there is a higher degree of political competition. The research agenda is further complicated by the fact that road construction is very investment intensive.[6] This makes a privately-run randomized control trial of road provision unlikely. Since my identification strategy is underpinned by an exogenously determined rule, I am able to provide cleaner estimates of the causal impact of roads even in a non-randomized setting.

The primary channel through which we expect roads to affect economic outcomes is via a reduction in transport costs. As transport costs go down, a direct implication is that the spatial price-differential of traded goods should go down by the extent to which this differential was composed of transport costs. Accordingly, Donaldson (2013) finds large reductions in price differences between regions connected by the railroad. Keller and Shiue (2008) find similar evidence from 19th century Germany, showing that the adoption of steam trains led to a 14 percent decline in grain price-dispersion across 68 markets. The first main finding from my study corroborates the results of this literature, albeit in a different setting, by showing that access to paved roads decreases the spatial dispersion of prices for almost all types of food items.

We might also expect increased trade flows to be mirrored in household consumption, on the intensive as well as the extensive margins. Of these, the extensive margin is much easier to measure as quantity gains are likely to get attenuated if households switch to better quality goods, or choose to consume a greater variety of goods (which is precisely the extensive margin effect). While there is no study that directly explores

[6]Estimates suggest that roads constructed under PMGSY cost $23,000 per kilometer per lane. The aforementioned susceptibility to political capture also stems partly from the money involved.

the relationship between transportation infrastructure and consumption variety, there is a large literature on the variety gains from trade; wherein trade increases the availability of different types of goods available from different trading partners (Feenstra, 1994; Broda and Weinstein, 2006). In a framework with CES utility, this increase in variety directly enters the utility function in the form of new goods, and is welfare enhancing by itself. Moreover, even in the absence of assumptions on the exact form of the utility function, the gains in diversity in food consumption can be viewed as providing much needed micronutrients to combat malnutrition and increase productivity, especially in developing countries (Tontisirin et al., 2002; Kennedy et al., 2007).

This chapter provides evidence on the relationship between road construction and variety changes in household consumption. I find heterogeneous impacts by type of good: newly connected households decrease the types of non-perishables, and increase the types of perishables and non-locally produced goods in their consumption basket. To my knowledge, this is the first paper to use survey data on household consumption to measure variety gains,[7] the first to estimate variety gains from infrastructure provision, and also the first to show that there may be heterogeneity by good-type in how households adjust their consumption when they move out of relative autarky.

Independent of trade, roads can influence key economic variables by lowering the transport, time and information costs of accessing a host of different markets. This has potential implications for households' incentives to invest in physical and human capital. Consequently, I explore the impact of road construction on agricultural technology adoption and children's schooling. In the context of technology adoption, I find that

[7]Much of the existing trade literature uses countries' import composition to measure variety gains. See, for instance, Arkolakis et al. (2008). Broda and Weinstein (2006) and Handbury and Weinstein (2011) use supermarket scanner data, which provides an alternative measure of household consumption but does not allow the researcher to control for household charactersitics. Hillberry and Hummels (2008) analyze this from the firms' perspective and show that trade frictions reduce aggregate trade volumes primarily by reducing the number of goods shipped and the number of establishments shipping.

farmers with access to new roads are more likely to use chemical fertilizer and hybrid seeds on their farms. These findings serve as a direct test of Suri (2011), who shows that farmers with high gross returns to inputs such as hybrid seeds may still choose not to adopt them if there are high costs to acquiring these due to poor infrastructure. In a very similar vein, Ali (2011) finds that road improvements in Bangladesh led farmers to take up hybrid varieties of rice at a faster rate. She proposes a different mechanism for her results, suggesting instead that as transportation costs go down, it becomes possible for farmers to intensify production. Other potential explanations for greater technology take-up also come to mind, for instance, credit constraints. Roads could potentially alleviate some of these constraints by increasing output prices (Khandker et al., 2009), or by increasing the collateral value of land (Gonzalez-Navarro and Quintana-Domeque, 2012; Shreshtha, 2012; Donaldson and Hornbeck, 2013). Although data limitations preclude me from isolating the exact channels at play, the findings in this paper confirm the association between road construction and technology adoption.

In terms of human capital, I find that the effect is positive on the school enrollment of 5-14 year olds, and negative on that of 14-20 year-olds. The positive effects can be viewed as stemming from better access to schools. Indeed, there is a rich literature in development that finds large positive effects of school construction on children's school enrollment and attendance (Duflo, 2001; Aaronson and Mazumder, 2011; Burde and Linden, 2013; Kazianga et al., 2013). To the extent that the operative channel in these studies is greater proximity to the school, constructing a road might have similar positive effects by reducing the effective distance (in terms of travel time) and the cost of traveling to school. Muralidharan and Prakash (2013) analyze precisely the effect of reducing the effective distance to school without constructing any new schools. They use a public program from the Indian state of Bihar that provided bicycles to girls continuing to secondary school, and find a 30 percent gain in enrollment.

On the other hand, greater access brought about by roads may open up greater labor market opportunities for children , raising the opportunity cost of schooling, and potentially causing them to drop out. Atkin (2012) provides evidence that the availability of jobs due to new factory openings led children to drop out from high school sooner. Similarly, Nelson (2011) finds that improving self-employed households' access to credit causes their kids to drop out of school and start working in the family enterprise. Schady (2004), Kruger (2007), and Shah and Steinberg (2013) find similar effects for very transient labor market shocks, showing that kids are more likely to be in school when jobs are scarce (commodity price busts, droughts, and recessions), and more likely to be working when jobs are abundant.

There has been a great surge in recent research on understanding infrastructure effects. However, much of this work has focused on railroads and highways, and our understanding of the effects of rural roads remains limited. This is an important distinction as differences in the placement and reach of transportation infrastructure are likely to generate different qualitative and quantitative impacts. Moreover, many of these papers are in the fields of urban economics and spatial industrial organization.[8] This is one of the first papers to study the development impact of road connectivity in rural areas.

The remainder of this chapter proceeds as follows. The next section describes the PMGSY scheme in greater detail. Sections 3 and 4 describe the data and empirical strategy. Section 5 presents the estimation results. Sections 6 and 7 present robustness checks, and consider alternative hypotheses. Section 8 briefly discusses the implications of some of the results, and concludes.

[8] See, for instance, Baum-Snow and Turner (2012), Duranton and Turner (2012), Baum-Snow et al. (2013), and Faber (2013)

1.2 Context

The government of India announced PMGSY on December 25, 2000; actual work began in 2001.[9] The goal of the program was to provide an all-weather road within 500 meters[10] of all sub-villages (the program refers to these as "habitations") with a population of at least 500 (250 in the case of tribal areas, or areas pre-defined as desert or mountainous). A habitation is a sub-village level entity, and is defined as "a cluster of population, whose location does not change over time".[11] For the purpose of this study, I use the terms sub-village, habitation, and village interchangeably. The population of each village was determined using the 2001 census. The scheme was federally funded,[12] but implemented by individual states.

At the outset of the scheme, states were asked to draw up a core network of roads, which was defined as the bare minimum number of roads required to provide access to all eligible villages. Only those roads that were a part of the core network could be constructed under this scheme. Within the core network, construction was to be prioritized using population categories, wherein, villages with a population of 1000 or more were to be connected first, followed by those with a population of 500-1000, ultimately followed by those with a population of 250-500 (if eligible). The rules further stipulated that in each state, villages from lower population categories could start getting connected once all the villages in the immediately larger category were connected. Ex-

[9] The program website is http://pmgsy.nic.in/pmgsy.asp

[10] For mountainous areas, this was defined as 1.5 kilometers of path distance. As per an amendment made to the program rules in February, 2008, in mountainous regions located next to India's international borders, this distance could be up to 10 kilometers (Ministry of Rural Development, letter no. P-17023/38/2005-RC dated February 29, 2008).

[11] A village will have multiple habitations if it has 2 or more clearly delineated clusters. For instance, there might be two separate clusters of houses on either side of the village well. India has about 640,000 villages comprising of about 950,000 habitations.

[12] This scheme was funded by earmarking 1 Rupee per liter out of the tax on high speed diesel. The funds were disbursed to the states using a pre-determined formula known as "additional central assistance", which has the following weights: population - 0.6, per capita income - 0.25, tax efforts - 0.075, special problems - 0.075.

ceptions were allowed if a smaller (by population category) village lay on the straight path of a road that was being built to a larger village. In this case, the smaller village would get connected sooner.

Therefore, the program presents a potentially suitable setting to examine the causal impact of rural roads. Before we proceed with a causal analysis of outcomes in this context, we must ensure that the program guidelines were followed and that there were minimal deviations from the population rule. This is especially pertinent in the Indian setting as corruption is widespread. Accordingly, Table 1 looks at the determinants of road construction under the program over the period 2001-2010. We can see that by endline, villages with a population of 1000 or more were 42 percent more likely, and those with population 500-1000 were 26 percent more likely to have received a road as compared to villages with fewer than 500 inhabitants. However, the coefficients on Panchayat (Village Council) headquarters and primary school raise some concerns about potential selection on observables. In my empirical analysis, I deal with this issue by using various different specifications, with and without controlling for observables. My findings stay robust to the inclusion of controls, suggesting that the results are not being driven by selection.

I analyze program compliance in a slightly different manner in Figure 1, where I show the likelihood of road construction for more finely defined bins. The discontinuous jump in the probability distribution of road construction is more apparent here. In looking at both Table 1 and Figure 1, it is clear that as stipulated by the program, the larger villages dominated the smaller ones in terms of construction priority.[13] However, the prioritization is not completely clean as smaller villages begin to get roads before the larger ones are completely done. This may be explained by two factors. One, the program did allow for out-of-order connectivity if the location of the villages on the

[13] Appendix A1 presents cumulative density functions of connectivity by population category.

path to the market necessitated this. Second, it is virtually impossible to completely eliminate all deviations from the rule in a program of this scale. That said, I must admit at the outset that the possibility of a small degree of political manipulation cannot be completely ruled out, especially in light of the significant predictive power of Panchayat HQ on road construction.

However, corruption is a smaller concern here, than in other public programs, as it is not immediately obvious why political economy would dictate deviations from the rule. It would have been in the interest of state and district-level politicians to follow the population-based rule of the program as a mechanism to garner votes. For instance, Cole (2009) shows that politicians in India use their influence to get banks to disburse more credit during election years. More generally, even in the absence of "vote buying", the median voter theorem predicts that public goods are allocated in a manner where they benefit the most number of people.

As it stands, a far graver corruption concern pertaining to this program would be that the roads were not built at all, and that the funds were appropriated by local politicians and bureaucrats. 2 different factors help me mitigate this concern: 1) The government of India was hugely invested in making this scheme transparent to the greatest extent possible. As a result, the program was very closely monitored by many different stakeholders and all of the construction details are publicly available,[14] and 2) All of my specifications control for either district or state-level unobservables like corruption. Moreover, in case some areas did not get roads as per plan, then my estimates represent a lower bound on the causal impact of roads.

Nevertheless, my empirical analysis consists of a number of robustness checks. I am able to show that there were no pre-trends in outcomes as placebo specifications with

[14]The program has a three-tier monitoring system at the district, state and federal level. For details, see the program's operation manual, available at http://pmgsy.nic.in/op12.htm.

roads built during the program period have no predictive power in explaining changes in outcomes over the pre-program period, 1993-1999. I also try to rule out selection into program by controlling for a number of different observable characteristics, and by absorbing unobservables at the district and state level into fixed effects.

1.3 Data

1.3.1 Online Management and Monitoring System (OMMS)

The Government of India has recently mandated that the ministry in charge of any large public program make all program data publicly available. As a result, habitation-level road construction data is available through OMMS. Thus, for the universe of rural habitations, I have data on their baseline level of road-connectivity, population (in order to determine eligibility), whether they got a road under the program, and if so, the year in which the road was approved and built. In all of my analysis, in order to get around issues of implementation and quality, I use the approval date as the date on which the road was built, and use the words "approved" and "built" interchangeably.

1.3.2 Population Census, 2001

I use the village directories included in the 2001 census of India. I merge these villages with those from the OMMS, and get an 80 percent match. I then use these to study differences in baseline characteristics for connected and unconnected villages at the outset of the program.[15] These are presented in Appendix Table A1. Table A1 highlights the fact that at baseline, the average village with a road was significantly different from an average village without one, along all observable parameters. These statistics underscore the setting in which the inhabitants of the average unconnected

[15]Once village-level data from the 2011 census is available, my empirical analysis can be further refined by using the discontinuities at the population cut-offs

village lived, and help us contextualize the findings of this paper. Further, they also highlight the stark distinction between the 2 types of villages, and therefore, caution us against using the connected villages as a control group.

1.3.3 National Sample Survey (NSS) Data

The NSS is a very rich, nation-wide, repeated cross-section survey of individuals and households, or a panel of the districts that they reside in. The surveys contain extremely granular household-level information on the quantity and value of more than 350 distinct items, and individual-level information on education and labor-market participation. Even though the unit of observation is the household in the case of consumption data, and the individual in the case of education and employment data, the smallest identifiable unit provided by the Government of India is the household or individual's district of residence. In order to examine the consumption and human capital outcomes, I use data from the rural schedules of rounds 57 (year 2001) to 66 (year 2010) of NSS. However, since some modules are not fielded every year, this translates to consumption data for years 2001-2008 and 2010, and education and employment data for 2004-2006, 2008, and 2010. Since the smallest identifiable unit is the district, this necessitates that my unit of analysis be the district. I discuss this in greater detail in the next section.

1.3.4 Agricultural Inputs Survey

The Ministry of Agriculture conducts a 5-yearly survey on the usage of advanced inputs in agriculture, including the use of fertilizer, hybrid seeds, and pesticides. For this survey, all operational holdings from a randomly selected 7 percent sample of all villages in a sub-district are interviewed about their input use. These responses are then aggregated by crop and plot-size category (these categories are reported as: below 1 hectare (ha), 1-1.99 ha, 2-3.99 ha, 4-9.99 ha, and above 10 ha), and reported at a

district level. The survey also reports the irrigation status (rain-fed or irrigated) of the holdings separately. Therefore, I have a district-crop-plot size-irrigation status-year panel of operation holdings in rural India, which I aggregate at the district-crop-year level. I use the 2001-02, and the 2006-07 rounds of the survey for this study. To my knowledge, this is the first instance of the use of this survey in the literature.

1.3.5 Agricultural Prices Data

I also use high frequency price data at a weekly level for highly disaggregated food varieties from 3,566 agricultural markets, or *mandis*. Every day, these markets report the modal price of every animal/crop variety sold therein to a Ministry of Agriculture initiative known as Agmarknet.[16] I manually downloaded this data for each market and each crop for one day every week (each Thursday). I use this to supplement my results on price dispersion from the NSS consumption module. To my knowledge, this is the first instance that this data has been used for research.

1.4 Identification Strategy

The NSS does not have village-level identifiers, and everything is aggregated to the district. Therefore, I am unable to exploit the program rule of providing roads to villages based on their population category in a regression discontinuity design. Instead, I have to rely on a difference-in-differences strategy to estimate the differences between treatment and control over time. If I had individual-level data on road connectivity status, my estimating equation would have been the following:

$$y_{idt} = \alpha + \gamma_t + \delta_d + \beta * D_{idt} + \eta Z_{idt} + \varepsilon_{idt} \quad (1)$$

[16] Website: http://agmarknet.nic.in/

where subscript i denotes individuals or households (depending on the outcome of interest), d denotes district, and t denotes survey year. δ is a set of district fixed effects,[17] γ is a set of year fixed effects and Z is a vector of individual / household control variables. D_{idt} is an indicator variable for whether individual i in district d at time t has been exposed to the program, which amounts to an indicator for whether or not a road has been built to his or her village under the program.[18] However, with district-level outcomes, I must aggregate equation (1) as the following, where N_{dt} is the number of individuals in district d at time t:

$$y_{idt} = \alpha + \gamma_t + \delta_d + \beta * (D_{idt}/N_{dt}) + \eta Z_{idt} + \varepsilon_{idt} \tag{2}$$

which amounts to using the variations in the percentage of population that received a road in each district in each year.

It is worth keeping in mind here that the variations in the percentage of population receiving roads in each district are fundamentally a function of variations in the distribution of village sizes in each district. This is because the program rule was applied at the village level, wherein each village's likelihood of receiving a road was an increasing step function of its population, as shown in Figure 1. When aggregated up to the district, the implication of the rule is that the number of roads built in each district would be some increasing function of the number of villages in each population-size category in that district.

For some parts of my analysis, I only have access to, or make use of, just 2 rounds of data. In such cases, my estimating equation is given by:

[17] All estimating equations were also specified alternately to have state fixed effects, and yield similar results. The results from these specifications, where not presented in the paper, are available on request.

[18] As mentioned before, but as a reminder to readers: this is in fact an indicator for whether or not a road was approved to be built.

$$y_{idt} = \alpha + \delta_d + T + \beta * Pr(D_{idt}) * T + \sigma Z_{idt} + \varepsilon_{idt} \quad (3)$$

Here, T is an indicator for the post-treatment period.

In all specifications, the coefficient β is my estimate of the causal effect of road construction. All errors are clustered at the district level.

1.5 Estimation Results

1.5.1 Price Dispersion

Following Donaldson (2013), I argue that if roads indeed led to a reduction in transportation costs, then we should observe a reduction in price dispersion across markets.[19] Consequently, I seek to establish a "first-stage" effect of roads via price dispersion. I use 2 distinct data sources for my analysis of price dispersion. First, I back out prices based on household responses in the NSS: the survey does not directly report price data, reporting instead the value of each good consumed. However, for food items, the survey reports both the value and the quantity consumed, which enables me to back out the unit values. It must be borne in mind that this strategy will yield price information for only those households that report consuming a positive amount of a particular food. Further, since the survey questions disregard the quality dimension, this approach to computing prices is likely to understate the reductions in prices brought about by roads if households switch to higher quality goods.

With these caveats in mind, I turn to the first part of my analysis of prices. In order

[19] It is possible that there may be districts where a majority of the villages are inaccessible, and prices (including transport costs) are consequently high in all of them. In such districts, building roads to some villages, while others stay inaccessible, may actually increase district-level price dispersion. However, it is reasonable to expect a negative coefficient on price dispersion for the average district. Further, all my specifications control for the baseline level of road-connectivity, either explicitly, or via a district fixed effect.

to compute the effect on price dispersion of each broad category of foods, I create an index for each of these categories as the weighted average of the price dispersion of the individual food items included in the category. The weight for each item varies by district, and is given by the share of that item in the district's median household's budget share in the baseline year. The dispersion itself is the standard deviation of the price of each good reported by all households in each district. Any household that does not report consuming a good gets dropped from the calculation of the dispersion. Therefore, a downside to this approach is that as the number of households consuming a good expands, the dispersion will weakly increase as a mathematical construct. Further, since we have already seen that roads were associated with an expansion in variety, the results on price dispersion should be interpreted as a lower bound on the true program effect. The results from this analysis are presented in Panel A of Table 2. The results in this table are suggestive that the construction of roads lead to a reduction in the prices of all types of food items, other than lentils and processed food.

For the second part of this analysis, I use prices reported by agricultural markets. I calculated the district-wide dispersion in the modal price of each good, as reported by the markets. This analysis is presented in Panel B of Table 2. As in Panel A, I find evidence suggesting that there were huge reductions in the dispersion of prices in districts that were newly connected by roads.

1.5.2 Education & Employment

After establishing that road construction did in fact impact market access, I turn to analysis of human capital accumulation and market participation.I start by looking at the impact of road construction on school enrollment of 5-14 year old children. The results are presented in Panel A of Table 3. In my preferred difference-in-difference specification with district fixed effects (column 4), there is a 5 percentage point in-

crease in enrollment. This finding is of immense importance for public policy. The UN's Millennium Development Goals website notes that as of 2010, enrollment in primary school stood at 90 percent. These results suggest that rural road construction alone could potentially bridge half of the gap toward achieving universal primary education in India. From an external validity standpoint, it would be useful to isolate the channels through which these gains arise. For instance, roads might alter the returns to education, increasing the household's incentives to send children to school. Alternatively, roads might be leading to increases in family income, or relaxing credit constraints, or improving physical access to the primary school. However, I am unable to do so with existing data sources.

In Panel B, I do identical analyses for 14-20 year olds. In this case, the effects are strongly negative, and robust to the inclusion of various covariates and fixed effects. The interpretation is straightforward: going from not having a road to having one, leads to about an 11 percentage point drop in school enrollment, which is an almost 25 percent decline over mean enrollment rates at baseline. An alternative interpretation is in terms of network effects: since the program was implemented at the village-level, but my results track changes for the district, it is possible that some of the observed gains and losses from the program arose outside the beneficiary villages. At the district level, the average treatment effect needs to be rescaled by the average treatment size, which in this case is .05. Viewed in this manner, the program led to about a 0.006 percentage point drop in school enrollment for 14-20 year-olds, which translates to a .01 percent decline over mean.

There are a number of important points about Table 3. One, on decomposing by gender, I do not find any differences in the enrollment gains or losses between girls and boys. This is of great importance in a setting like India, where investment in girls tends to be disproportionately low due to cultural norms of son preference. My results suggest

that even though excludable private resources tend to overwhelmingly be concentrated on male children,[20] the benefits from public goods are potentially enjoyed by both genders equally. Two, in both panels, columns 2 and 4 differ from 1 and 3 in that the former control for household-level observables. Specifically, I control for the the household's religion, social group (scheduled caste, scheduled tribe, backward caste, or none of these), household type (self-employed or not, agricultural or non-agricultural), size of land owned, and household-size. Note that the inclusion of these controls does not alter the coefficients. To the extent that household characteristics are correlated with village-level unobservables, this provides additional evidence to rule out selection in road construction. Three, while the first two columns control for fixed effects at the state level, the latter two control for these at the district level. The coefficients on school enrollment remain substantively unaltered across these specifications. Not only does this provide further evidence for the robustness of my estimates, it also enables us to generalize these results to other road construction programs in different settings.

While the age-groups of 5-14 and 14-20 were created due to contextual relevance,[21] it may still be informative to analyze the effects of roads on enrollment for each age year separately. Figure 2 presents the results from this decomposition - the Xs represent the baseline mean of enrollment for each age, and the dots represent the treatment effect. While the biggest changes lie at the tails, the distribution strongly supports the manner in which the ages have been pooled in my regression results.

Table 4 summarizes the next set of my results, pertaining to market employment of 14-20 year old children and of adults. Panel A suggests that the school drop-out instance of the 14-20 age group that we witnessed in Table 3, is matched almost one to

[20] This is also apparent in the great gender disparity in baseline mean enrollment rates, especially for older children.

[21] 14 marks the threshold between primary and secondary education in India. Further, the employment of children below 14 is considered child labor, and is a legally punishable.

one by increased market employment. As before, these effects do not vary by gender: both girls and boys witness about a 10 percent rise in market employment, which constitutes more than a 40 percent increase over baseline employment levels.[22] Further, this increase in market employment is not limited to children, as can be evidenced in panel B. On receiving a road, prime-aged women were also 9 percentage points more likely to start working, a 25 percent increase. On the other hand, there is no comparable change for men, which is to be expected, as their employment was nearly universal even at baseline.

I attempt to investigate the mechanisms behind this observed jump in market participation by looking at the occupations that the newly-employed are joining. The results are presented in Table 5. For girls, the most marked increase in employment comes from animal-rearing, followed by textile manufacturing and tailoring. They are less likely than before to be working in forestry, and there is no significant impact on any of the other occupations. For boys, on the other hand, the biggest increase comes from construction[23], followed by smaller increases in animal-rearing and tailoring. The increase in animal-rearing is in line with the reduced transportation cost explanation as roads might make it possible to transport dairy and meat to the nearest market in a timely fashion. The increase in tailoring and making textiles also comes up in the anecdotal evidence provided on the program website as "success stories"[24]: the presence of the road makes it easier for weavers, embroiders, and other similar artisans to sell their crafts in the nearby town. The increases in tailoring may also explain some of the observed increases in school enrollment for younger children. For instance, Heath & Mobarak (2011) show that the advent of garment manufacturing in Bangladesh was

[22] A breakdown by age, similar to the one for school enrollment, is presented in Figure 3.

[23] The occupation codes for this category correspond to working as casual labor on private construction sites, and not to working on construction of public works, including roads.

[24] See http://pmgsy.nic.in/pmgi112.asp#6

associated with enrollment gains for young girl as tailoring jobs require a basic level of numeracy. In looking at occupations for women, I still find the biggest gains in animal rearing. There is also a small increase in textile manufacturing as an occupation. Taken together with the occupational choices of teenaged children, these results suggest that program villages saw the biggest increases in animal-rearing as an occupation, likely due to access to bigger markets. This increase in animal husbandry also constituted a positive supply shock for rural areas themselves, and led to increases in the kinds of dairy and meat products consumed by village inhabitants, which I will discuss later in the paper. Finally, I analyze men's occupation choices. I find that the only significant change came about in the form of large gains in retail as an occupation - prime-aged men are 3 percentage points more likely to work as retailers. This is also in line with the increased market-access hypothesis.

1.5.3 Technology Adoption

The results thus far provide evidence that road construction lead to a reduction in transport costs, and consequently, better access to goods and labor markets. As discussed before, the "reduction in transport costs" channel may also operate in input markets by making it cheaper to either buy the inputs themselves, or by easing credit constraints that hamper technology adoption in agriculture. I test this hypothesis by looking at the area under cultivation using advanced agricultural inputs. Specifically, I look at the adoption of chemical fertilizers and high-yielding varieties of seeds. Before we analyze the results, it would be useful to understand the underlying data.

The data that I use for this subsection comes from the input survey module of the 2001-02 and 2006-07 rounds of the agricultural census. The data from this survey are reported by the Ministry of Agriculture as district-level aggregates. So, for any district in the country, I have the aggregate acreage, as well as the acreage under modern inputs

for all crops grown in that district. This implies that for this part of the analysis, all treatment effect coefficients would need to be rescaled by treatment intensity. I now turn to the results, which are presented in Table 6. From Column 1, the average crop-district had 22,000 hectares under cultivation at baseline, and would have seen an increase of a little over 10,000 hectares in the area under fertilizer use in going from 0 to 100 percent connected. Therefore, the average district, where about 7 percent of the population received new roads, this translates to a 700 hectare, or a 3 percent gain in the area under fertilizer per crop. Similarly, for hybrid seeds, there was a 2 percent increase in the area under cultivation per crop. When I break down the analysis by crop type, significant differences emerge: the gains in technology use are entirely concentrated in food crop cultivation, and absent for cash crops. A potential explanation for this might be that cash crops tend to be grown more by bigger farmers, who are less likely to be constrained by low availability of credit. Alternatively, using the district as the unit of analysis might be masking significant heterogeneity in the pattern of cultivation within the district. Specifically, it is possible that remote regions with low road connectivity do not grow cash crops due to limited market access. In that case, the road construction program is likely to have benefited only those farmers that cultivate food crops.

1.5.4 Consumption Variety

Based on the analysis so far, treatment households witnessed supply-side changes in the goods available to them due to multiple reasons. The first-stage change arises from better access itself. In addition, occupational changes in the village, and the presumed expansion in agricultural production due to advanced inputs may have also led to a greater availability of goods. Therefore, it is a reasonable prediction that households are likely to start consuming a larger number of goods.

I start by running a regression that looks at differences in outcomes at baseline and

endline only, i.e. in 2001 and 2010 only, as mediated by road construction.[25] My outcome of interest is variety in the consumption basket, which I measure as number goods in a particular category (say, fruits or dairy) that are consumed by a household. Note that in this case, consumption of each variable is a binary variable that takes the value 1 for any positive reported amounts, and 0 otherwise, and so is the extensive margin effect.[26] Therefore, my specification is given by where all variables are as defined in case of equation 4, and T is the dummy for year 2010. Results are presented in Panel A of Table 7. The results suggest that among food items, a household that goes from not having a road to having one, consumes 0.6 fewer types of cereals and 0.4 fewer types of lentils. Additionally, there is a gain of 0.14 in the number of dairy products being consumed by such a household. Other food groups also have positive, albeit insignificant coefficients. For non-food items too, the estimates are large, positive, and significant. It stands out that for all types of non-food items, the coefficient on the interaction between roads and the time dummy is much larger (in some cases, by an order of magnitude) than the coefficient on the time dummy alone. Given that the Indian economy witnessed very rapid growth over this period,[27] these estimates provide remarkable testimony to the effectiveness of infrastructure provision in this regard.

Since Panel A is based on just 2 rounds of data (baseline and endline), the estimates contained therein are quite underpowered. I try to bolster these by utilizing the annual variation in outcomes available to me from successive rounds of the NSS, using the specification described in Equation (3). These estimates are presented in Panel B of

[25] The stated objective of the program was to provide all-weather roads, which could be achieved either by paving existing roads, or by constructing new ones. My analysis only considers new roads.

[26] My estimate could still, in some sense, be a lower bound on the consumption effect of roads if there are households that completely switch out of consuming a certain good, and substitute it with another, say, if the substituted good is inferior (for instance, a switch from coarse grain to fine grain). The estimated coefficient, in this case, would be 0, since the total number of goods consumed did not change, even though the household potentially moved to a higher indifference curve.

[27] According to the IMF's World Economic Outlook database, the average annual growth rate of per capita GDP (at constant prices) was 6.3 percent per annum for the period 2001-2010

table 7. By utilizing the entire panel, I find that not only do the coefficients from Panel A continue to be robust, variety gains in the consumption of fruit and processed food are also now significant. Many things stand out in looking at this table. One, for food items, we see a marked decrease in the consumption of non-perishables (cereal and lentils), and an increase for perishables and processed food. The increase in processed foods is consistent with the transport cost explanation as these foods tend to be produced in urban areas. For locally-produced foods, this upsurge is potentially explained by changes in production patterns. For instance, both Muto and Yamano (2009), and Goyal (2010) find supply responses by farmers to a reduction in search costs due to the introduction of mobile phones. In addition, in Muto and Yamano, this response is limited to perishable foods (bananas), while the non-perishable commodity (maize) stays unaffected.

Two, even though the estimated coefficient on "Meat" is insignificant, it should be borne in mind that this has been estimated off a sample with a large number of zeros due to the cultural prevalence of vegetarianism in Indian society.

Three, while the growth in vehicle ownership and the use of hired means of surface transport (given by the column titled "road-fares") are outcomes of interest in their own right, they also serve as a robustness check for my results, especially when viewed along side the absence of effects on non-road means of transportation.

1.5.5 Quantities Consumed

The analysis of quantities is also complicated by the possibility of substitution of one good for another, and also of higher/lower quality variants of the same good for each other. For instance, if households substitute a smaller quantity of fine grain for a larger quantity of coarse grain, the survey will record it as a reduction in quantity consumed. Similarly, it is hard to conclude anything about the welfare gains or losses for

a household which substitutes say, a liter of milk for 200 grams of yogurt. Nevertheless, I do such an analysis in the hope of being able to parse out some broad trends. It bears mentioning here that the survey reports quantities consumed only for food items, limiting my analysis to food consumption only. In order to facilitate comparisons, I create an index of the quantities consumed of each broad food group in the following manner: first, for each individual good (say, yogurt or ketchup) I create a z-score of the quantity consumed by each household, using the mean and standard deviation of the consumption of that good in each district in the baseline year. I then combine the individual z-scores to create consumption indices for broad categories like cereal and dairy. This index is the weighted mean of all the z-scores in each food category, where the weights are given by the share of that good in the median household's budget in the baseline year.[28]

The results are presented in Table 8. Panel A presentes the analysis of quantity indices for just the baseline and endline years, and Panel B replicates it for the entire sample period. In Panel B, we find that there is a large increase in the quantity consumed of cereals and lentils. This is in contrast to our analysis of consumption diversity, and suggests that even though households are consuming fewer varieties of cereals and goods, they are consuming a lot more of them, Similarly, while there are no variety gains in meat and vegetables, the quantity changes are substantial. On the other hand, for dairy and processed foods, households are consuming fewer quantities, but more varieties. This analysis suggests that households substitute between width and depth in their consumption basket. However, the welfare implications from this analysis are unclear.

[28]This index is akin to the one introduced by Kling et al. (2007). An index like this is particularly helpful when there is a large number of outcome variables (in this case the prices of close to 150 different types of food items) as it eliminates the problem of multiple inference.

1.6 Robustness

The fundamental concern with any study in a diff-in-diff setup is that trends might not be parallel, invalidating the results. This concern is especially acute in this case, as districts that had a lot of roads pre-program might be on a very different trajectory compared to the ones that had few roads. In order to rule this out, I adopt the standard method from the literature, which is to run placebo regressions of roads built during the program on outcomes during a pre-program period. The results from this test are presented in Table 9 for human capital outcomes, and in Table 10 for consumption outcomes. In both these tables, the post period is a dummy variable for the year 1999, the baseline year is 1993, and the roads built variable gives the percentage of population that received roads over the entire treatment period up to 2010. In all cases (except number of vegetables consumed), the point estimate is statistically insignificant. These results bolster our confidence in the hypothesis that my results are not picking up spurious effects.

In addition to these tests, I document in section 6.2 above that the results for human capital outcomes stay similar across a range of different specifications with and without covariates, and with and without fixed effects. This helps me rule out selection on observables in road construction. As a final robustness test, I look at consumption effects during the monsoon season. Since the program aimed at providing all-weather roads, its effects were likely to be most keenly felt during the Monsoon when the fair-weather roads to the town are most likely to be flooded or washed out. This is especially true for consumption outcomes, as households are unlikely to make seasonal adjustments to their enrollment or employment decisions. Moreover, any Monsoon-specific effects are unlikely to have come about due to other confounding factors. In order to do this, I combine the information provided by NSS on the date of the survey with consumption

information for food, which has a 30 day recall period in the survey. Unfortunately, I am unable to replicate this exercise for non-food items as the survey asks households to report these for a 365-day recall window. Using the Indian Meteorological Department's Monsoon maps as a guide,[29] I create a "monsoon" dummy to indicate whether the household was interviewed during the rainy season, or outside of it. I then interact this dummy with the road construction variable to confirm the robustness of my results, which are presented in Appendix Table A3. The specification underlying this table checks for the variety in a household's consumption basket. If the results presented so far are indeed causal, then I should expect to see bigger changes during the monsoon season, and smaller changes outside of it. The pattern of coefficients confirms this hypothesis for perishables and processed food - the categories most likely to have been affected by the roads.

1.7 Alternative Hypotheses

One concern is that what are seemingly program effects might in reality be driven by other factors. One such potential explanation that comes to mind is employment in road construction: if the construction of roads themselves is generating local employment, then the observed outcomes might be short-lived. Further, the results might lose even their short-term generalizability in a setting where construction is managed without tapping the local labor market. I can test this using data on employment location: 2 of the survey rounds (rounds 61 and 66) query all employed individuals regarding the location of their workplace. The responses to this question enable me to ascertain whether an individual's primary place of work is rural or urban. If the mechanism behind the results so far is employment at the local road construction site, then I should not observe individuals commuting to an urban location for work. On the other hand,

[29] Available at http://www.imd.gov.in/

if the mechanism is increased access to urban areas, I should be able to observe this in individuals' employment location.[30] I present this analysis in Table 11. In program villages, there is an overall 13 percent increase in the number of people reporting their employment location as urban. For teenaged girls and prime-age men, the coefficients are very large (representing an almost 100 percent increase for men, and a 500 percent increase for girls) and significant. Teenaged boys also witnessed a nearly 100 percent increase in the proportion working in urban areas. Further, this increase is borderline significant. The findings for prime-age men suggest that even though we failed to detect any magnitude changes, being connected to the city brought about qualitative shifts in their employment. Additionally, the results from the analysis of occupations in able 5 also aid in ruling out this explanation. Table 5 shows that none of the gains in market participation are driven by increased employment at public construction sites.[31]

Yet another potential explanation is that the observed outcomes might be driven by selective migration. However, the observed pattern of coefficients is unlikely to fit any sensible hypothesis about selective migration. For instance, for the observed results to conform with greater out-migration, it would have to be true that the families that left were less likely to send their younger children to school, but more likely to send their older children to school.

1.8 Discussion and Conclusion

The results presented in this chapter, specifically the ones on consumption, technology adoption, price dispersion, and women's labor force participation underscore the great importance of investments in road construction. For instance, the technol-

[30] Any individuals in the survey are those that necessarily live in the rural household, and not emigrants as the survey collects information for only resident individuals.

[31] The occupation codes included in the category construction pertain to private construction sites. The bulk of this category corresponds to employment as casual labor at private individual homes.

ogy adoption results alone have grave implications as governments in many developing countries provide large fertilizer subsidies to promote adoption. However, the increased probability of older children dropping out of school is both unexpected and unintended. Further, it has important policy implications. The labor literature documents significant returns to education. In this specific context, a Mincerian regression of wage on education pegs the return to education at 6.9 percent.Therefore, dropping out of school at an earlier age could potentially be reducing the lifetime earnings of these individuals.

On the other hand, it is debatable what the expected returns to education are in rural India. Further, even if lifetime earnings were going down, there may not be any welfare losses for individuals with sufficiently high discount rates. Unfortunately, the available data does not allow me to isolate these parameters. Additionally, it must be understood that this paper only analyzes short-run impacts. It is possible that as the income effect begins to dominate the substitution effect, the long-run steady state could correspond to higher enrollment. However, policy-makers may still want to design measures to mitigate the short-run effect due to a normative preference for schooling. Following the large successes of consditional cash-transfers, one prescription might be to provide cash conditional on school attendance. Alternatively, there is potential for policy such that the expected premium to skill acquisition is greater than the short-run gains from market participation at a young age.[32]

Apart from the outcomes studied in this chapter, roads can potentially impact many other economic variables. Access to credit markets, healthcare, service delivery, and changes to economic geography are some that come to mind. Research is needed on these before we fully understand the effects of infrastructure provision, especially the general equilibrium effects. Additionally, almost all of the current evidence is on short

[32]Policy-makers would also need to ensure that these gains are well-understood. For instance, Jensen (2010) provides evidence from the Dominican Republic showing that the perceived returns to education are much lower than actual.

term impacts. The scant evidence on longer term impacts is provided by Banerjee et al. (2012), and Berger and Enflo (2013). However, their evidence needs to be bolstered significantly as initial infrastructure placement can foster a virtuous cycle of public and private capital investments, making causal effects hard to pin down. One alternative is to also attribute the subsequent developments to the initial shock, and argue that infrastructure placement moved the beneficiaries to a higher growth trajectory. However, more work is needed before anything conclusive can be said in this regard. Finally, another item that is open for further investigation in this research agenda pertains to the optimal level of investment in transportation infrastructure.

2 Paving the Way to Better Health: Quality and Quantity Evidence from India

2.1 Introduction

Millions of people in developing countries, especially women and young children, die every year due to entirely preventable or treatable causes. For instance, despite great strides in reducing maternal and under-the-age-of-5 (U5) mortality in recent years, the WHO estimates that there were nearly 300,000 maternal, and 7.6 million U5 child deaths in 2010 (WHO, 2012). Many of these deaths could have been averted through simple preventive measures, such as medically-supervised deliveries for women, and adherence to recommended vaccination protocols for children[33]. Consequently, significant resources have been directed towards stimulating demand for such health products and services - for example, through free or subsidized provision (Cohen and Dupas, 2010; Dhillon et al., 2012; Meredith et al., 2013); provision on credit (Tarozzi et al., 2013); savings interventions (Durairaj et al., 2010; Dupas and Robinson, 2013) conditional cash or in-kind incentives (Morris et al., 2004; Lagarde et al., 2007; Barham et al., 2009; Banerjee et al., 2010; Dongre, 2012)[34]; unconditional cash transfers (Paxson and Schady, 2010; Robertson et al., 2013); or information provision (Thornton, 2008; Luo et al., 2012).

While the importance of understanding these demand-drivers cannot be overstated, it is equally important to examine the supply-side determinants of households' adoption decisions. For instance, a vast literature in epidemiology and public health has documented a large and negative correlation between distance to the nearest health facility and utilization of health services, and a corresponding positive correlation between dis-

[33] For instance, measles, which caused more than 150,000 child deaths globally in 2010, can be entirely prevented by administering a vaccine at 9 and 12 months of age.

[34] See Palmer et al. (2004) for a review of older studies on conditional incentives.

tance and mortality (World Development Report, 2004. Also, see Thaddeus and Maine, 1994 and Gabrysch and Campbell, 2009 for reviews).[35] This can be a particularly acute problem in rural areas due to large physical distances to health care facilities, and the lack of good motorable roads: in Zambia, more than 50 percent of rural women live at a distance of 10 kilometers or greater from a basic obstetric care facility (Gabrysch et al., 2011); in India, the average distance to the nearest primary health center was nearly 9 kilometers in 2008 (District Level Health Survey 3); in Yemen, less than half the children live within 5 kilometers of a government health center (Al-Taiar et al., 2010). However, despite strong cross-sectional evidence, the relationship between distance and utilization has been much harder to establish causally as residential location choices are usually endogenous. In addition, we can also expect an endogenous political economy process to at least partly determine the location of public health care facilities.[36]

In this chapter, I provide the first causal evidence on the relationship between the distance to health care facilities and service utilization by rural households in developing countries. In order to do this, I utilize the phased roll-out of a large-scale, public road-construction program in rural India. The program - the Prime Minister's Rural Road Program (henceforth, PMGSY, an abbreviation of the scheme's Hindi name), was launched at the end of the year 2000 and is still on-going. PMGSY created a federal mandate for all states to provide all-weather connectivity to all villages with a population of at least 500 via paved roads. Since various districts in the country varied

[35] In the Economics literature, Friedman (2014) provides suggestive evidence of this relationship from Kenya, by showing that after antiretroviral (ARV) drugs for HIV were introduced, risky health behaviors increased in villages with greater proximity to health care facilities due to easier access, and therefore greater availability of ARVs. However, she is unable to formally establish the first-stage effect due to paucity of data.

[36] Miller (2008) and Fujiwara (2013) provide evidence from the U.S. and Brazil, respectively that enfranchisement of underprivileged citizens resulted in greater government spending on health care, a preferred area of public spending for these citizens. While their results focus on health care spending as a whole, and not the setting up of clinics in particular, it is reasonable to expect the political economy considerations to be similar, if not larger, due to the large upfront costs of starting a facility from scratch.

from each other in their baseline level of road provision as well as in the distribution of villages of different sizes, this generated exogenous variation in the percentage of population in each district that was exposed to the program every year. Differential exposure to the road construction program presumably generated differential reductions in the accessibility of existing health care facilities via a reduction in transportation costs (for more evidence on the reduction in transport costs due to the roll-out of this program, see Aggarwal, 2014). I start by documenting that this was indeed the case, as evidenced by very large and significant increases in pregnant women's likelihood of visiting a formal health care facility for ante-natal care as well as for the delivery of their child. For those who deliver in such a facility, I also find large reductions in the self-reported transport cost of reaching there.[37]

My second contribution is to show that this better access to the formal health care sector translated into greater utilization of health care services and better outcomes for new adopters. While this may seem like an obvious implication, it is less clear-cut in the setting being considered, which is often rife with corruption and misappropriation. Indeed, a large literature on service delivery in developing countries documents abysmal levels of provision, often times due to rampant absenteeism, grossly under-qualified providers, and perverse incentives (Banerjee et al., 2004; Chaudhury and Hammer, 2004; Chaudhury et al., 2006; Das et al. 2008; Das and Hammer, 2013; Jayachandran, 2013; Muralidharan et al., 2011).[38] These grave inadequacies in the formal health sector beget a natural question - without first fixing the quality of care issues, is better access to, and greater utilization of services in this sector even a policy goal worth

[37]It is worth mentioning here that while I focus largely on outcomes pertaining to maternal and child health services due to the nature of the data available, the gains from access on health outcomes will comprise a much bigger set.

[38]In a recent audit study of a bednet distribution program in Ghana, Kenya, and Uganda, Dizon-Ross et al. (2014) do not find any evidence of corruption, suggesting that some of these problems might be less pervasive than what is conventionally believed.

pursuing? The second part of my analysis lays some of these concerns to rest by showing that following the road construction program, women were more likely to receive the recommended supplements and vaccinations during pregnancy, less likely to report having complications during child birth, and more likely to receive timely care during the post-natal period. Children are more likely to have received the recommended vaccinations, and households were more likely to report being beneficiaries of various national-level health promotion programs, such as those for preventing blindness and tuberculosis.

These findings also contribute to a large literature in health economics on the returns to health care spending in general, and hospital-based care in particular (Currie and Gruber, 1996; Buchmueller et al., 2006; Almond et al., 2010; Almond and Doyle, 2011; Doyle, 2011). However, by focusing on say, better hospital equipment or a longer stay in the hospital, much of this literature has been concerned with the intensive-margin of treatment for those already within the reach of the formal health care sector . By turning my attention to marginal patients instead, I provide estimates of the extensive-margin returns of having access to formal health care. In addition, I am able to corroborate the results from a predominantly developed country-focused literature in a developing country setting. In a recent paper, Adhvaryu and Nyshadham (2014) provide complementary evidence from Tanzania. By exploiting spatial and temporal variations in access to clinics, notable due to roads getting washed out during the rainy season, they are able to show that children from families with better access to clinics are more likely to get timely treatment for malaria, and also more likely to stick with the treatment for longer.

Finally, I also examine changes in the behavior of households that were already a part of the formal health care system. Surprisingly, I find that in the wake of the program, households were more likely to switch from private providers to public providers.

While *a priori* these results seem counter-intuitive, a simple logic emerges on closer examination of the rural health care system in India. Rural India has a multi-step hierarchy of public health centers, serving successively larger areas and populations. Consequently, an average remote village (the kind that benefited from PMGSY), likely did not have any public health facility. Indeed, Gill and Taylor (2013) report that there is only 1 sub-center (the smallest level of public clinics in the country) for every 8000 people. Aggarwal (2014) also documents that among villages that did not have roads at baseline, only 3 percent had a primary health center, and six percent had a maternal and child welfare center. The low density of public providers has implications for where households seek care: Gautham et al. (2011) and May et al. (2014) provide evidence from different parts of rural India showing that residents' first point of curative contact is with private individuals serving as unqualified practitioners of western-style medicine.[39] It is worth noting, however, that the choice to go to under-qualified providers is neither driven by a lack of information, nor by sub-optimal behavior. Ray et al. (2011) document that households' "preference" for these providers is driven by cost and proximity factors, and that in an unconstrained environment, they would rather visit a public facility. Klemick et al. (2009) provide similar evidence from Tanzania showing that households often tradeoff on quality and proximity while choosing doctors. Leonard (2007) shows that rural Tanzanians optimize on doctor quality by going to better doctors for more serious illnesses. In light of these, it makes sense that the road construction program caused households to switch to public providers, who were presumably farther, but of a higher quality.

The rest of this chapter proceeds as follows. Section 2 provides institutional de-

[39] As noted before, gross under-qualification of providers in the health sector is also documented in the service delivery literature by Das and Hammer (2014).

tails about PMGSY. Section 3 discusses the data and identification strategy. In Section 4, I present my main results, followed by a discussion of robustness and alternative hypotheses in Section 5. Section 6 concludes.

2.2 Institutional Details

The PMGSY program was launched in December, 2000, with the aim to provide a paved all-weather road within 500 meters of all villages that had a population of at least 500 (250 in the case of tribal areas, or areas pre-defined as desert or mountainous) according to the 2001 census. Even though this was a country-wide initiative led by the federal government, the actual construction was carried out by the states. The central government required that the construction be prioritized according to a population-based rule, wherein, villages with a population of 1000 or more were to be connected first, followed by those with a population of 500-1000, ultimately followed by those with a population of 250-500. Villages from lower population categories could start getting connected only once all the villages in the immediately larger category in their state had already received roads. Exceptions were allowed if a smaller (by population category) village lay on the straight path of a road that was being built to a larger village.[40]

Since public works in South Asia can often be rife with corruption and general mismanagement, we cannot commence a serious causal investigation of the effects of the program without ruling these out. In earlier work (Aggarwal, 2014), I use data from the program website and the 2001 census to provide detailed evidence showing that the program rules were largely followed. While I must direct readers with an interest in the details of this analysis to the earlier work, in the interest of completeness, I present here Figure 1 (borrowed from Aggarwal, 2014) showing that the population-based rule

[40]For a much more detailed exposition of the program rules, see Aggarwal (2014).

was followed as there are discontinuous jumps in the likelihood of receiving a road by endline at each of the population cutoffs.

2.3 Data & Identification Strategy

2.3.1 Data

All ministries of the government of India are now required to make data on all large public programs publicly available for scrutiny and accountability. As the implementing ministry for PMGSY, the Ministry of Rural Development has detailed village level data on road construction available for download through its website through a database called the Online Management and Monitoring System (OMMS). Therefore, for the universe of villages in India (irrespective of their baseline road status), I was able to download data from the OMMS, on their baseline level of road-connectivity, population (in order to determine eligibility), whether they got a road under the program, and if so, the year in which the road was approved and built.In order to get around issues of implementation and quality, I use the approval date as the date on which the road was built, and use the words "approved" and "built" interchangeably.

District Level Household Survey I use data from the rural module of 2 rounds of the District Level Household Survey (DLHS-2 and 3) in this paper, conducted in 2002-2004 and 2007-2009 respectively. The DLHS is a district-level repeated cross-section, and contains retrospective birth histories of a representative sample of ever-married women in the age group 15-49. Since the pre-natal period for most of the births recorded in DLHS-2 falls in the pre-treatment period, I use this round of the survey for robustness and placebo checks only. For all the women in DLHS-3 who report ever being pregnant

during the survey period, there is basic data on each of these pregnancies, comprising of the outcome of the pregnancy, the date of birth/abortion, and the gender of the child. In addition, for the last child born to each woman, the survey has detailed data on the pre- and post-natal care, as well as the details of the delivery. For the last 2 children born, there is rich data on vaccinations. Finally, the survey also collects information on a host of covariates about the women themselves, their husband, and their household.

I use this data to create a district-level panel of births between the years 2004 and 2009, and combine it with the roads data to get each district's road connectivity status at the time of each child's birth.

2.3.2 Identification Strategy

The DLHS is a district level survey, wherein even though the unit of observation is the individual woman, all identities are masked and aggregated up to the district. In other words, the smallest identifiable unit is each woman's district of residence. This implies that my empirical analysis can only be carried out at the district level. In order to do this, I employ a difference-in-differences strategy, looking at the evolution of various outcomes over the 6 year program period. The independent variable of interest is the intensity of treatment in each district, which is defines as the percentage of each district's rural population (at baseline) that had been approved to get a road under the program by that year. Therefore, my estimating equation is given by:

$$y_{idt} = \alpha + \mu_m + \gamma_t + \delta_d + \beta * P_{dt} + \eta Z_{idt} + \varepsilon_{idt} \tag{4}$$

where subscript i denotes an individual woman, child, or household (depending on the outcome of interest), d denotes district, m denotes month of birth, and t denotes year of birth. δ is a set of district fixed effects, γ is a set of year fixed effects and Z is a vector of individual / household control variables. P_{dt} is the variable of interest

and captures the cumulative percentage of population in each district that had benefited from the road construction program by the year of birth in question. All standard errors are clustered at the district level.[41]

2.4 Estimation Results

Before we analyze the impact of roads on maternal and child care outcomes, it might be instructive to see how various covariates are related to these health outcomes. These results are presented in Table 12. In the first 2 columns of this table, I present the mean and standard deviations of the covariates themselves. We can see that the average woman who gave birth over the survey period was almost 20 years old at the birth of her first child. Just below 50 percent of the women had any schooling, and had had just over 3 pregnancies, and just below 3 live births till the date of the survey. The households are predominantly agricultural, with two thirds of the entire sample owning agricultural land, and the average holding size is 1.94 acres. They are also quite poor, as evidenced by asset and durable good ownership, although almost all the households report having their own house.

In columns 3 and 4, I turn to an analysis of the relationship between each of these covariates and health care. In the interest of space, I limit myself to a single outcome here: the likelihood of a woman to deliver in a institutional health care facility, such as a hospital or a clinic. However, similar tables are available on request for a host of other outcomes. In looking at this table, we find that most estimates have the required sign: richer, younger, and more educated women are more likely to deliver in a hospital. Surprisingly, though, ownership of "informational" goods like radio and television is

[41] This empirical strategy is in fact identical to Aggarwal (2014), which also has outcomes aggregated up to the district.

not correlated with the likelihood of an institutional delivery.

2.4.1 Access

An analysis of the impact of roads on health outcomes is predicated on the prior that the construction of roads would lead to increased accessibility to health care facilities. Therefore, a good place to start this analysis would be to establish that the construction of roads indeed led to such an improvement in access. While there are no questions in the survey that can help me directly establish that households had greater access to health facilities in the wake of the program,[42]I am still able to look at whether households are more likely to utilize these facilities after road construction. Results are presented in Table 13. I find that when a district goes from being not connected at all, to being 100 percent connected (i.e., when the percentage of residents in a district with access to an all-weather road within 500 meters goes from 0 to a 100), there is a 19 percentage points increase in the likelihood of women delivering in a hospital, and a 6 percentage point increase in the probability that she will seek institutional ante-natal care. Both of these gains are very large, and statistically, very different from zero. These numbers represent a 60 percent and 10 percent increase respectively, over baseline utilization rates.

In addition, I am able to use a further proxy for the improvement in access: for women that do deliver in a hospital, the survey asks them how much they spent on transportation in order to get to the hospital. I summarize these in column 3 of Table 2. There is a large and statistically significant decrease of 244 Rupees in the amount spent by women in getting to the hospital. This represents an 80 percent decrease over

[42]As a matter of fact, the survey does ask questions about distance to the nearest health facility and whether it is accessible by road, they are part of only DLHS-3, and as a result available only for the cross-section. Expectedly, in the cross-section, districts with higher program intensity are those with lower density of public goods in general, including hospitals and clinics.

baseline, which translates to about a 5 percent decline in the average district, which had 6 percent of its population receive new roads under PMGSY. It is worth noting here that since this variable is recorded only for those women who deliver in hospitals, it is missing for everyone who delivers outside of the formal health care system, many of whom were presumably deterred by the exorbitant cost of getting to the hospital. Therefore, the decrease in transport cost that we witness due to program roll-out is in fact a lower bound on the transportation cost reductions that came about via this program.

However, it is worth adding here that when I analyze the household's likelihood to seek medical treatment for other diseases (in this case, diarrhea and fever), I do not find an increase. These results are presented in Table 18. While part of the reason could be that the sample of children suffering from these diseases is quite small, and perhaps too under-powerd. However, that cannot be the whole story as the point estimate for diarrhea treatment is actually negative. A potential cause behind this could be that a medical subcenter - the first step in India's public health hierarchy is usually staffed just by an auxiliary nurse and midwife (ANM). ANMs are typically trained to handle pre-, peri-, and postnatal care, and are usually not equipped to treat other diseases. Therefore, if roads only eased access to these centers, they are unlikely to improve treatment seeking for other diseases.

2.4.2 Quality

Having established that roads led to improved access, I now turn to the second part of my analysis which pertains to the quality of service received in the formal health care sector. As summarized above, the public health care system in India is fraught with deep-seated corruption, and patients often do not receive the care and services

they seek. In such a scenario, improved access is unable to lead to improved health outcomes. Therefore, in Table 14, I start by looking at various aspects of quality of care as a function of roads built. Columns 1-6 pertain to aspects of antenatal care. In column 1, I report the number of packets of iron, folate and calcium supplements received by a woman during her pre-natal checkup, and column 2 reports the number of such packets purchased from the market. Columns 3 and 4 report the binary likelihood of receipt of these packets from each of these 2 sources. Column 5 reports the likelihood that a woman was provided at least 1 of 11 services during her pre-natal period, while column 6 reports the likelihood that all of these 11 services were provided.[43] I find that once roads are constructed women are indeed more likely to receive better quality prenatal care: they are more likely to receive micronutrient supplements, and also more likely to receive a greater quantity of these. They are also more likely to buy these supplements from the market - this is in line with prior evidence from Aggarwal (2014) showing that road construction led to a greater availability of goods. I also find that women are 6 percent more likely to receive at least some kind of checkup during their pregnancy. Interestingly, I find a negative, though statistically insignificant effect on the likelihood that a woman will receive the full suite of prenatal services. This makes sense as the inclusion of women from remote areas in the formal health system will likely bring down the average utilization of high end services like say, ultrasounds, as clinics in remote areas are unlikely to have such facilities. In column 8, I also report that women are more likely to receive a tetanus shot during the prenatal period.

Access improvements also resulted in a measurable change in outcomes. This can be seen in Column 7 of Table 14 - I find that when a district moves to full connectivity, its women report a 4 percent reduction in the likelihood that they had complications

[43]This includes basic services like measurement of height, weight, and blood pressure, to slightly more advanced services like blood and urine tests, to very advanced services like an ultrasound and sonogram.

during delivery, where complications is defines as whether the woman had excessive bleeding or convulsions. Given the high probability that a woman is more likely to be aware of the fact that there were complications in her delivery when she delivers under medical supervision, this number actually represents a lower bound on the reduction in delivery complications brought about by the building of roads. Finally, I also show in column 9 of the same table that there was an 11 percentage point increase in women's likelihood of receiving timely checkup in the postnatal period. Here, timely checkup refers to whether the woman was checked by a doctor within 48 hours of delivering her child.

A major concern with interpreting these results is that it is very hard to disentangle the mechanisms at work. I hypothesize that medical care utilization improved as a result of better access to the clinics - a demand side improvement. However, it is also likely that some of the improvements came about due to potential decreases in absenteeism - if the nurse is present on a greater number of days, she is likely to assist more patients. While absence rate decreases also likely came about due to better access, this channel is a supply side one with very different policy implications.

In order to disentangle these effects, I now turn to how these quality variables changed for women who were already in the formal health care system. In order to do this, I run the same regressions as those in Table 14, but now by conditioning on those women who had access to institutional antenatal care and safe deliveries in the pre-treatment period. These results are presented in Tables 15 and 16 respectively. The first point to note in Table 15 is that even conditioning on access, women's likelihood of delivering in a hospital goes up. This could certainly be reflective of better antenatal care: for instance, perhaps, nurses are more likely to counsel patients on the importance of delivering in a hospital. On the other hand, this could still be an access effect. For example, Adhvaryu and Nyshadham (2014) show that patients with better access

to clinics are more likely to adhere to the recommended treatment for longer. What we are observing here could be a similar effect: since the time and money cost of getting to the hospital is now smaller, women are more likely to make repeat visits, including for child birth. The better access explanation is also supported by the estimates in columns 2 and 4: after road construction, women are not any more likely, either on the intensive or the extensive margin, to receive iron, folate, and calcium supplements on their prenatal visit than they were before the program was launched. However, I also find a 6 percentage point in the probability of getting some medical checkup, and a percentage point bump in the likelihood of getting a tetanus shot. These results suggest that the improved service delivery aspects were not completely absent either, although they are perhaps only part of the explanation behind better utilization.

In Table 16, I conduct the same analysis, but now while conditioning on institutional child birth, rather than prenatal care. While I do find that transport costs go down significantly, there is no evidence of service improvement for those already delivering in hospitals. As can be seen in columns 1 and 2, women are no more likely to receive timely postnatal care, and no less likely to have a complicated delivery, as compared to before. These results provide further evidence that at least some of the utilization improvements are coming from improved access, although improved service delivery cannot be completely ruled out as an explanation.

An important aspect of public health delivery in developing countries is providing adequate vaccination coverage. This is for good reason - according to public health experts, vaccinations rank second after clean water in their ability to reduce the global burden of infectious diseases. However, despite concerted national and international efforts, population coverage rates remain significantly lower than the 95 percent required to eliminate infectious diseases. In rural India, the context under study, coverage rates varied from 57 percent for the vitamin A vaccine, and 87 percent for polio in 2004

(Table 17). Therefore, it would be interesting to see if improvements in access that led to greater utilization of medical services by women, also led to a similar expansion in vaccination rates for kids. I present such an analysis in Table 17, where I analyze administration rates for a range of different vaccines that are given to children during their first year. I find very strong, positive effects across the entire gamut of vaccines: children are more likely to have a vaccination card issued by a health care facility, and also more likely to have received vaccines for polio, BCG, measles, DPT, and vitamin A. The effect sizes are large, and range from a 12 percent increase in the polio vaccination rate, to a 36 percent increase in the rate for measles. There is also some quality of service evidence, where those who receive the polio vaccine, are more likely to receive it within the first 24 hours of birth as per the recommendation of WHO.

I now look at another aspect of public health care delivery in India - the utilization of various national level schemes for disease eradication. The results from this analysis are presented in Table 19. I find that the point estimate on roads built across different regressions that look at the utilization of various schemes is positive. In addition, the estimate is statistically significant in case of blindness and tuberculosis. In the latter case, road connectivity can be a key variable determining an individual's adherence to the program. The government run tuberculosis prevention program requires that the patient visit the medical facility 3 times during the week for the first 2 months, and then once a week for the next 4-6 months. Clearly, for a patient to be able to visit the clinic so frequently, good road connectivity is key. Therefore, it makes sense that the number of people reporting being covered by the program goes up significantly (100 percent increase over baseline) as more roads are built.

2.4.3 Substitution Behavior

Another implication of better access to nearby markets is that the number of treatment facility options should weakly increase. Therefore, we can gain key insights into household preferences by looking at switching between providers. Specifically, if households switch from provider A to provider B, then B is revealed preferred to A. So, for instance, if we find that when access improves, households like to visit private providers instead of public providers, then a public policy implication might be to spend resources on providing vouchers for private clinics, instead of expanding subsidized medical care. With that in mind, I turn the readers' attention to Table 20 which analyzes precisely this kind of switching behavior. Surprisingly, I find that the program induces households to switch away from private, and towards public hospitals for both deliveries as well as prenatal care. These effects are even bigger when conditioning on prior use of institutional care.

While seemingly counter-intuitive, these results sit well with the way health care facilities are currently organized in rural India. As explained in the introduction, there is a large dearth of public clinics, which has led to a mushrooming of low-quality private providers. It has been documented that despite being aware of the quality aspect, villagers often visit these providers out of sheer convenience and proximity reasons. This phenomenon is very similar to the ones documented by Leonard (2007) and Klemick et al. (2009). However, once access improves, households choices are less constrained, taking them closer to the optimum.

2.5 Robustness & Alternative Hypotheses

The standard concern with any diff-in-diff set up is that the parallel trends assumption might be violated. Specifically, if treatment and control regions are on different trajectories then the diff-in-diff estimator will not provide credible results. In order to address these concerns, I follow the standard practice from the literature of running placebo regressions in the pre-treatment period. I present these results in Table 21. To all births between the years 1994 and 1999, I attribute the road connectivity variable from the corresponding year 10 years later (i.e., years 2004-2009), and check the impact of roads on safe deliveries and institutional antenatal care. It would be cause for concern if roads built a decade later were seen to have an impact in this specification. Fortunately, I do not find evidence of violations of the parallel trends assumption, which bolsters our confidence in the previous results.

There could be concerns that the mechanism behind the results presented above is something other than access. Notably, the PMGSY program had far-reaching consequences in the village economy, for instance, on income. Therefore, it is possible that behavior changes are being driven by income. However, the private-public substitution lays some of these concerns to rest. Given the poor state of affairs in public facilities, a greater income is usually correlated with higher use of the private sector. My results to the contrary suggest that income is not the driving factor.

Another potential concern is about improved service delivery. I provide a detailed discussion of this in Section 4.2 above. While I cannot completely rule out that utilization is improving as a result of better service and not better access, it must be borne in mind that service delivery also likely improved due to better access, even though the effects cannot be disentangled using the current data.

2.6 Conclusion

Now that we have established that roads led to large health care gains, a logical next question pertains to policy implications. While the health gains are quite large, it must also be borne in mind that roads construction is very investment-intensive. Is it possible that similar gains could have been produced through cheaper interventions like conditional cash transfers? While a definitive answer to this question will perhaps require a head to head comparison of the 2 interventions set in very similar contexts, here are a few things to consider. A road is a capital good, whose benefits accrue over several years, possibly generations. This implies that building a road would lead to better health outcomes over successive generations. The effects of cash transfers, on the other hand, often peter out as soon as the scheme is withdrawn. This makes sense from an individual rationality perspective: households are rational decision makers operating under a set of constraints. The permanent income hypothesis tells us that providing them with a one-time transfer is unlikely to change their optimization decision in the long run in any meaningful fashion. However, building a road permanently eases some of the constraints faced by the household, pushing out the optimal frontier of health care that can be attained by them.

Additionally, there are broader benefits of building roads beyond just healthcare. In a previous paper (Aggarwal, 2014) I discuss in detail how this very program led to increases in household consumption, technology adoption, and women's labor force participation rates. Taken in conjunction with the older results, the findings from this chapter suggest that road construction can have large welfare effects by improving households' access to goods and services. In addition, there is some suggestive evidence that even holding access constant, there might be service delivery improvements due to increased accessibility of public facilities by service providers.

While obvious, it must be stated here that given the large effects that good health has on individuals' educational attainment, labor supply, and income, road construction can have very large economic returns. In addition, the social externalities of good health make roads a good investment from a social perspective also.

3 Financing Businesses in Africa: The Role of Microfinance

3.1 Introduction

The law of diminishing marginal productivity dictates that scarce resources earn a high return. Why then, does capital not flow to the poor, its most productive users? This has been attributed in part to the failure of credit markets. The argument goes that the poor have so little to offer by way of collateral, and borrow such small amounts, that it is too risky and too expensive to lend to them. The ramification is that they get caught in a credit-based poverty trap, wherein they are unable to undertake profitable investments due to credit constraints and hence, remain poor. The great promise of microcredit – making joint-liability loans to small groups of poor people possessing no collateral, enabling them to make productive investments – was to be the magic bullet against poverty. Yet, a mere five years after the Nobel Peace Prize was awarded to Muhammad Yunus and the Grameen Bank, claims about microcredit's transformative power are being debated.

Supporters of microcredit still maintain that it is capable of raising incomes and consumption, empowering women, fostering a feeling of community and establishing creditworthiness and financial self-sufficiency. However, nay-sayers contend that it can lead to over-indebtedness resulting in perpetual poverty and crowds out other anti-poverty interventions. In order to understand the stakes involved in this debate, consider this: as of December 2009, of the $21.3 billion in cross-border funds committed to microcredit, $14.6 billion (68.5 percent) came from aid agencies and development institutions as grants or as highly subsidized debt (El-Zaghbi, Gähweiler and Lauer, 2011). In the absence of hard evidence definitively supporting the wealth-creation role of microcredit, it is questionable whether it makes sense to channel so much money

into it, at the cost of other, competing anti-poverty investments.

Different strands of the literature have examined the varied claims about the positive impacts of microcredit, but the evidence continues to be mixed. While most studies find that access to microcredit enables households to better smooth and enhance consumption, the picture around other claims remains murky.

We evaluate microcredit in its purported income-enhancing role – do small loans enable the poor to make productive investments? In this context, we document the low use of microcredit for business purposes in Sub-Saharan Africa (SSA), one of the frontiers in the global fight against poverty. We discuss the potential reasons behind this low usage, and examine how SSA fits in with the patterns and predictions of the academic evidence on microcredit. We also evaluate a new avatar of microfinance – microsavings. We review the literature on savings as well as the evidence from the ground to show how savings might be positioned to yield the gains that were expected from credit. Finally, we discuss the behavioral and institutional challenges that the poor face in saving money and the policy prescriptions for overcoming these challenges.

The chapter proceeds as follows: in Section 2 we review the related literature and motive for empirical analysis; Sections 3 and 4 discuss financial inclusion data from SSA, in the context of the microcredit and microsavings movements, respectively; Section 5 concludes.

3.2 Review of the Literature on Microfinance and Returns to Capital

Rigorous experimental evidence establishing a causal link (or lack thereof) between access to microcredit and growth of microenterprises is hard to come by. Selection bias prevents direct comparisons between those who borrow from microfinance institutions

(MFIs) and those who do not. Similarly, the lack of a counterfactual makes it impossible to gauge how the borrowers would have fared in the absence of credit. The first quasi-experimental study in this area is Pitt and Khandker (1998), who utilize Grameen's loan eligibility threshold of 0.5 acres of land as a discontinuity in a maximum likelihood model. While their paper focuses on consumption-related outcomes (which are large and positive, especially for women), they also look at labor supply, including self-employment hours. This effect is found to be marginally positive for women but negative for men. Since the same study finds substantial consumption gains, this might suggest that micro-credit makes people substitute away from productive work and towards leisure. That said, the findings from this paper, by themselves, must be taken with a pinch of salt as Morduch (1999) goes on to show that the eligibility threshold was not strictly enforced, invalidating the identifying assumption.

The first truly experimental evidence on this subject comes from Banerjee et al. (2014) who worked with an MFI called Spandana based in Hyderabad, India. Their experiment entails a random roll-out of MFI branches in half of 104 selected slums, with the remaining half being the control group. They find that 15-18 months after lending begins, there is a positive, albeit insignificant, difference between the profitability of existing businesses in treatment and control areas. Importantly, the rate of creation of new businesses is significantly higher with 32 percent more businesses created in treatment areas. The most interesting aspect is the heterogeneity in the treatment effect across households. Households with differential propensities to become business owners display differential rates of substitution between durable and non-durable consumption: those with an existing business increased investment without cutting back on current consumption; those with a high propensity to become business owners increased investment spending and decreased current consumption – an artifact of the high fixed cost of starting a business; those with a low propensity simply increased cur-

rent consumption with no accompanying effects on durable consumption spending. A key takeaway here is that, contrary to what was believed, providing access to credit to all will not make an entrepreneur out of everybody.

A closely related study is by Crépon et al. (2011) in rural Morocco. This intervention involved randomly offering microcredit to one out of two villages in 81 matched pairs. They find that providing access to microcredit did not lead to new business creation, only to an expansion in the scale of existing businesses. Households with no existing business at baseline merely increased consumption once they got access to credit. This again reminds us that credit, by itself, cannot spawn entrepreneurs. Like Pitt and Khandker (1998), they also find that treated households decreased their wage employment and increased their consumption of leisure, offsetting the income gains realized from the scale expansion of existing businesses. If this finding has external validity, it not only casts a shadow on the income generating potential of microcredit, but also raises longer term questions about the borrowers' ability to repay their loans and/or the possibility of chronic indebtedness.

Kaboski and Townsend (2011) also utilize village level differentials in access to credit, albeit through an entirely different channel. They study the impact of the Thai Million Baht Village Fund program, under which the government of Thailand provided a million baht to each of the country's 80,000 villages to start a rural bank. The exogenous variation stems from the fact that all villages got the same amount, irrespective of their population. As a result, there was a huge variation in the per capita expansion of credit across villages. The authors construct a structural model and use a panel of 960 households from 64 villages for estimation. They find significant increases in consumption, but no impact on average investment. Similar to the preceding two papers, this one also finds heterogeneous effects, with a small subset of households choosing to increase its investment spending. However, this increase is more than offset by a

larger subset of households that substitute towards present consumption as borrowing becomes cheap.

Karlan and Zinman (2010a, b) measure the impact of microfinance at the individual level by studying marginal loan applicants to a Manila-based urban lender that uses a credit scoring algorithm for its lending decisions. This study only targets existing microentrepreneurs (this was a qualification requirement, and the mean number of businesses held by applicant households is 1.15), so the impact on new business creation cannot be analyzed. For existing businesses, surprisingly, the findings suggest a scale contraction after getting access to microcredit. The operative channel for this seems to be the shedding of unproductive workers, but the reasons for this aren't really clear. Business profits increase for male entrepreneurs, but decline for female entrepreneurs, the target constituency of most MFIs.

The desultory evidence from these studies can be a little disconcerting after having heard poignant stories of the destitute finding freedom from poverty through microcredit. Indeed, anecdotes about the positive impact of microcredit abound in the popular press. However, it is useful to temper our expectations with the fact that isolated success stories do nothing to educate us about how something performs on average. This is equally true on the flip side: individual tales of microcredit's spectacular failure, leaving in its wake entire villages of debt-ridden farmers, who en-masse chose to default, do not address its overall performance. This is why the current body of work on microcredit, with its few but rigorous experimental studies that take into account both gainers and losers, as well as the sizeable majority who are neither, provides us with the only reliable evidence on its efficacy.

In fact, the lesson from the current literature bears repeating: large doses of microcredit might not be useful for creating new businesses, on average, due to borrower heterogeneity. This is not to say that its consumption-smoothing and risk-coping func-

tions are not valuable in themselves. In fact, Collins et al. (2009) document that just to meet these needs, the poor juggle complex financial transactions on a daily basis. However, it is possible to achieve these benefits through other innovations like micro-savings (discussed later in the chapter) and micro-insurance, which displace other pro-poor interventions to a much smaller degree.

The bigger puzzle here is that of existing businesses. Evidence has been inconclusive as to whether microcredit fosters investment in incumbent firms. This is surprising, given that limited access to finance is frequently stated as a stumbling block to business growth by entrepreneurs in developing countries; for example, 30.9 percent of firm owners in the World Bank Enterprise Survey list access to finance as a major constraint to growth. Using regulatory changes in the Indian banking sector as a natural experiment, Banerjee and Duflo (2014) also find evidence that medium-sized enterprises are stymied by credit constraints. Both of these studies include large and medium sized firms, and this handicap is even more pronounced for small firms. In fact, Beck, Demirgüç-Kunt and Maksimovic (2007) find that financing constraints impede growth by 10 percent for small firms, as against 6 percent for large firms. Worse, Sabarwal and Terrell (2009) find evidence from Latin America consistent with the fact that when women own small or medium enterprises, they are less likely than men to receive formal credit when they apply for it.

Why, then, do small firms not borrow from MFIs? One possible factor driving low usage could be that returns to capital in microenterprises are low and therefore it does not make sense for their owners to borrow money to invest in them. However, multiple pieces of evidence allow us to negate this possibility.

The first evidence comes from the literature on returns to capital in developing countries. Udry and Anagol (2006) estimate 150 to 250 percent annual returns to pineapple cultivation (more capital-intensive than the traditional crops) in Ghana. Duflo, Kremer

and Robinson (2011) also find very high returns (ranging between 52 percent and 85 percent, annualized) to the relatively low capital-intensive task of applying fertilizer to the maize crop in rural Kenya. Returns are similarly high for non-agricultural microenterprises. In a randomized control trial (RCT) involving a subset of microenterprises in Sri Lanka, de Mel, McKenzie and Woodruff (2008) find the average return on capital to be as high as 4 percent per month; high returns to capital are similarly found among a group of microenterprises in Ghana (Fafchamp et al., 2011). In a very similar intervention in Mexico, McKenzie and Woodruff (2008) find this return to be in the range of 20-33 percent per month.

The fact that business-owners do utilize other sources of money to meet their borrowing needs (money lenders, friends and family, etc.) attests to the fact that they are not unwilling to borrow. We examine this phenomenon more closely in the context of Sub-Saharan Africa (SSA) in the following section. We also evaluate financial access in SSA more broadly, in order to gain better insight into business-related financing.

3.3 Microcredit in Sub-Saharan Africa

3.3.1 Gallup World Poll database

The micro-level data that we analyze in this chapter comes from the 2008 and 2009 wave of the Gallup World Poll. The Gallup World Poll is a nationally representative survey comprising annually up to 150,000 individuals from up to 157 countries. The core Gallup World Poll questionnaire includes detailed demographic, employment, and income information, as well as self-reported perceptions, such as of personal "well-being", government, politics, and religion. The 2009 round of the poll added several new questions in SSA in order to measure financial inclusion. The measurement was done along the following three dimensions: use of bank accounts, credit allocation and

risk mitigation. We utilize this data for SSA countries in our evaluation of the role of microfinance in business-creation. We report data averaged by country over 2009 and 2010 since some countries only have data available for one of the two years and while other have data for both years.

3.3.2 Evidence on Microfinance Usage and Awareness

In the previous section, we briefly examined the current literature on microcredit and its role in creating and expanding businesses. Since most studies show less than expected utilization of microcredit, it is useful to first look at perceptions and uses of various sources of financing. The Gallup World Poll asks what sources of financing individuals would consider using to start a new business. The data show that 42.3 percent of all responders in SSA state family as the primary source of funds for potential business needs (Figure 4). Community savings groups (also known as ROSCAs – Rotating Savings and Credit Associations), through which groups of people save money together, are a popular mode of savings in parts of Africa and are cited as a source of funds by about 10 percent of those surveyed. Notably, in none of the sub-Saharan countries surveyed, does the proportion of people willing to borrow from MFIs exceed 17 percent, and the mean for all SSA countries is a meager 4.3 percent. Not all of this difference between the borrowing rates from community networks and MFIs is attributable to informal insurance and risk-sharing mechanisms, as 16 percent cite commercial banks as their potential go-to source for business funds.

It would be quite natural to wonder at this point as to why this distinction is important. After all, shouldn't the source of a loan be immaterial as long as the poor have someone to borrow from when the need arises? However, the literature draws a clear advantage of access to formal lending institutions for a number of reasons. For

instance, Collins et al. (2009) observed that microcredit is far more reliable, in terms of both availability and price, than one's informal network. Closely related to this is the fact that relatives and friends may not have much to lend if there has been an adverse shock that has affected everybody contemporaneously. Another issue that a microentrepreneur who leverages his informal network for business funds might face is that of reciprocity – having to lend money to someone else during their time of need might starve the lender's business of much needed funds. This risk of having to lend to family and friends is well documented. For instance, Baland, Guirkinger and Mali (2007) present evidence from Cameroon, where a large number of individuals borrow money (and pay interest on it) from credit cooperatives for no other reason other than to appear poor in order to avoid having to lend to family and friends.

The potential benefit from promoting access to formal lending institutions is high in SSA since there are a substantial number of small and micro enterprises. According to calculations from Schneider (2002), the informal economy accounted for 43.2 percent of GNP for SSA in 1999-2000 and 81 percent of those employed in the informal economy in SSA (excluding South Africa) are self employed (ILO, 2002). Add to this the fact that women, either by choice or by necessity, work disproportionately more in the informal sector – according to the World Bank Development Report (2004), the proportion of the female non-agricultural labor force that works in the informal sector is more than 95 percent in Benin, Chad and Mali, and more than 80 percent in Guinea and Kenya. These are the very people who run corner grocery stores and small tailoring shops – the small entrepreneurs, especially women, that microfinance set out to target. Since less than 3 percent of them borrow from MFIs today (CGAP and MIX, 2010), it is imperative for development practitioners and policy-makers to understand the reasons behind these low levels of adoption.

The Gallup data illuminates potential reasons for the low take-up of microfinance

(Figure 5). Asked if they are aware of any institutions in their community that help people obtain small business loans, 16.2 percent of the respondents stated that they had never heard of such institutions. An additional 46.2 percent stated that such institutions are not available in their community. Certainly, a percentage of those reporting that microcredit was unavailable in their community might also simply be unaware of its presence, given that some form of MFIs had reached 85 percent of all depositors and borrowers in SSA by 2009 (CGAP and MIX, 2011). When taken together, these numbers point to exceedingly low levels of awareness.

Sparse evidence from the literature also points towards awareness as part of the problem. In an intervention aimed at urban microenterprises in Sri Lanka, de Mel, McKenzie and Woodruff (2011) find that providing more information about the loan product on offer by a regional development bank doubled the proportion of firms receiving a loan. There are a couple of things worth bearing in mind about this intervention: first, the information session was combined with a decrease in the bureaucratic requirements for the loan, so the impact of information alone cannot be isolated. More importantly, the intervention entailed providing more details about the loan to clients who already knew about its availability. The SSA problem, on the other hand, centers on low awareness about the existence of MFIs and the availability of microloans as such. However, as suggested by Beck et al. (2011) financial literacy programs for households and enterprises might be able to address some of the nonfinancial constraints to borrowing, particularly in rural areas.

Another fundamental challenge that might be keeping MFIs from making deep inroads into SSA, is that borrowing from formal financial institutions, in general, is very low (Figure 6). These numbers are based on supply-side data collected by the International Monetary Fund (IMF) directly from Central Banks around the world on the number of loan accounts. SSA shows very low loan penetration; for example, the

number of loan accounts normalized by population is less than 10 percent, with the exception of a number of countries in Southern Africa. However, there is a great degree of country-level heterogeneity in this borrowing rate – the numbers range from less than 1 percent for the Central African Republic to over 40 percent for South Africa (Ardic, Heiman and Mylenko, 2011). An important caveat is that these data are supply-side indicators of financial usage and therefore do not correct for double-counting (e.g. one individual with multiple loans). Therefore, these numbers represent an upper bound on borrowing rates in these countries, and actual borrowing rates are likely even lower.

It is striking how these borrowing rates vary by per capita GDP: South Africa, Botswana, Namibia, and Swaziland, the four countries with the highest borrowing penetration, are also among the 10 richest countries in Africa, as measured by GDP (WB-WDI, 2011). Similarly, the Central African Republic and Ethiopia, countries that find themselves at the bottom of the borrowing rate rankings, are also among the 10 with the lowest per capita GDP in all of Africa. However, caution is required in interpreting this relationship, as the same factors that drive gains in income could be leading to an increase in borrowing rates. For example, one such factor might be local institutions. For instance, Mauro (1995) has shown that corruption has a pernicious effect on economic growth by lowering investment. In fact, corruption is an endemic problem in SSA. The "Corruption Perceptions Index" published by Transparency International has consistently ranked SSA as one of the most corrupt regions in the world and in 2010, 16 of the world's 30 most corrupt nations were in SSA. The region also ranks dismally in the World Bank's Doing Business index , which rates countries based on how conducive their regulatory environment is to starting and operating a local firm. The rating incorporates several parameters like ease of registering property, getting credit and enforcing contracts. A low ranking in this index is indicative of weak institutions. It is highly likely that corruption could be one of the driving forces behind the low per capita

GDP as well as the low borrowing rates in this region.

Although it is difficult to glean any other causes behind low usage of formal financial services from the Gallup survey, another potential candidate is "trust." The trust explanation is closely related to the problem of corrupt institutions that we just discussed. There are two ways in which trust, or social capital, can have an impact on the adoption of microfinance. Under the first mechanism, which is specific to microcredit, people are less likely to borrow under joint liability if there is low level of trust within their community. Cassar and Wydick (2010) provide laboratory evidence indicative of support for this hypothesis. They find a positive correlation between contribution rates and trust levels in a cross-country group lending experiment. However, the prevalence of ROSCAs in SSA suggests high levels of intra-community trust (Ardener and Burman, 1995), refuting this explanation.

The other "trust-channel" is the positive relationship between social capital and financial development in general. Guiso, Sapienza and Zingales (2004) were the first to document this phenomenon for Italy by showing that individuals hailing from high social capital areas are more likely to use checks and to have access to institutional credit. They also show that the causality is particularly strong in regions with low levels of education and weak judicial enforcement. This correlation is also highlighted by Calderon, Chong and Galindo (2002), who compiled cross-country evidence showing that a one standard deviation improvement in the trust indicators brings about an expansion in the financial market of a country that is equal in magnitude to 19 percent of GDP.

The prevalence of ROSCAs suggests that a level of individual trustiness exists in SSA, which suggests that this channel might be operating through trust in institutions. We have already discussed that the region is fraught with corruption. Banks have also not remained untainted by this systemic malaise. The banking sector in 32 SSA coun-

tries faced mild to severe crises related to solvency and non-performing assets in the late 1980s and 1990s (Caprio and Klingbiel, 2003). In several instances, the crisis was so crippling that a substantial proportion of the country's GDP was lost, and several banks had to be shut down. Here's a sampling of the extent of the losses, expressed as a percentage of the GDP of the country in question for the year of the respective crisis: Benin – 17 percent, Cote d'Ivoire – 25 percent, Mauritiana – 15 percent, Senegal – 17 percent, Tanzania – 10 percent (Caprio and Klingbiel, 2003).

Beck, Demirgüç-Kunt and Levine (2000) and Beck and Demirgüç-Kunt (2009) have also documented the extremely poor financial health of the SSA banking sector. It is also important to remember that in SSA, while the banking sector has come a long way, collective memory has not. Dupas et al. (2011) find that risk of embezzlement and unreliability of the bank are stated as reasons for low usage of savings accounts in a recent study based in Western Kenya. This may explain part of the reason why people still prefer to borrow and lend within their small circle of family and friends.

How much of the meager adoption rates are explained by the factors which we have explored above is still an open question. To some degree, this is not an SSA-specific problem since in their Hyderabad-based study Banerjee et al. (2009) also find that the introduction of an MFI to a new area leads to an increase of merely 8.3 percent in the probability of receiving a loan from a MFI. However, to the extent that trust and awareness are significant explanatory factors, it would be realistic to expect that as the presence of MFIs becomes older in the region, both of those problems might become less severe. Even in the Hyderabad study, the impacts were analyzed just 15-18 months from roll-out, and newness could certainly be driving part of the low adoption.

3.4 Savings in Sub-Saharan Africa

Meanwhile, as inconclusive evidence around credit's potential has continued to trickle in, the focus of microfinance practitioners has become much broader to include other financial services like microinsurance, micropensions, and especially microsavings. The epiphany that unleashed the shift toward microsavings is this: if the poor can borrow their way out of poverty, they can equally well save their way out of it. Having a nest egg should be as effective as a loan in relaxing credit constraints. In fact, findings from the Gallup survey confirm this reasoning (Figure 7). Asked about the most important reason why people save money, 29 percent provide a precautionary motive behind their most important reason to save, stating saving for either "a rainy day" or "in case we get sick". The second most important reason that people report saving is "to start a business" (almost 20%). These numbers suggest that almost half of the people surveyed are actually using savings for purposes that credit was either supposed to, or is billed to, serve. What is more, enabling savings neither creates the burden of debt, nor the resource diversion that credit does.

However, before this willingness to save can be harnessed towards actual gains on the ground, we need to better understand the challenges that the poor might face in setting money aside as savings. Banerjee and Duflo (2007) have documented that a huge proportion of the poor still lack access to formal banking services. Chaia et al. (2009) estimate that 80 percent of the entire adult population in SSA was unbanked at the beginning of the 2000s. Expectedly, the penetration numbers are much worse for those living below the poverty line: Gaul (2011) calculates the absolute difference between the population living below the poverty line and the population with access to financial services, and finds that the numbers are as high as 80 million for Nigeria and 48 million for Congo. While this is a somewhat crude and imprecise way to measure

financial inclusion, it does underline the fact that a vast majority of the very poor continue to be bypassed by financial institutions. Data from IMF statistics also reflects this lack of access to financial services. The number of deposit accounts as a percentage of population is a meager 19 percent on average (excluding South Africa) (Figure 8). Again, the caveat applies that these are supply-side data that do not control for multiple and dormant accounts and actual formal bank penetration is likely much lower.

The lack of access to formal financial institutions drives the poor to save in suboptimal ways. For instance, the widely prevalent practice of saving through Rotating Savings and Credit Associations (ROSCAs) in Africa comes with a significant risk of the ROSCA itself collapsing before all the members have 'won' the draw. Similarly, in an RCT based in rural Kenya, Dupas and Robinson (2013a) offered savings accounts to 163 microentrepreneurs. These accounts provided no interest and entailed a withdrawal fee, which effectively means that they had a negative interest rate. They find that 53 percent of those who were offered this account chose to save through it, implying that they could not access a better way to channel their savings. Importantly, the negative return on the accounts isn't merely an experimental gimmick. Besley (1995) documents that moneylenders in Western Africa have been successfully charging significant withdrawal fees on deposits.

The challenges presented by a lack of financial access get compounded for people who have present-biased preferences and, lacking any formal vehicles to save, just choose to consume it. However, in an RCT based in the Philippines, Ashraf, Karlan and Yin (2006) find that when offered savings accounts that require commitment, people with such preferences are more likely to sign up. Furthermore, Dupas and Robinson (2013b) find that providing informal savings mechanisms (like a lockbox) to the poor increases their investment towards preventive health, suggesting that they were making suboptimal health choices in the absence of access to a savings vehicle. This suggests

that in addition to financial access, provision of the right kind of savings technologies is also imperative in enabling savings.

In addition, even if the poor do manage to save at home on their own, they face the risk of the money being appropriated by others, like their spouse, friends or members of the extended family. This is a non-trivial risk and Jakiela and Ozier (2011) provide experimental evidence from Kenya demonstrating that participants were willing to forego expected earnings in order to conceal the size of their initial endowment so that they could avoid sharing it with those in their network. Interestingly, Brune et al. (2011) find that commitment savings accounts can also provide protection from such appropriation by minimizing access to the funds that have already been banked.

For anybody who has followed the arc along which microcredit evolved, it is natural to wonder if the evidence from the ground for microsavings supports what seems like a very promising theory on paper. So far, we have only one good quality RCT on the impact of microsavings, and the evidence from that is promising. In the Dupas and Robinson (2011a) experiment that has been mentioned earlier, we find that those who were offered accounts save more and show a significant increase in business investment and even in personal consumption expenditures. It shouldn't be excessive to conjecture here that the increase in consumption was a result of increased profits, which in turn came about due to the increase in investment. Further, the study finds a decrease in average poverty, something that RCTs of microcredit have failed to unambiguously demonstrate.

There also exists a small body of studies that looks at the impact of expanding access to banking services in general, i.e. both savings as well as credit products. Burgess and Pande (2005) and Bruhn and Love (2009) find evidence in India and Mexico, respectively, that providing access to banking to low-income clients leads to an increase in new business creation (Mexico) and to a reduction in poverty (India and Mexico).

Since credit alone has not been shown to have discernible effects on either of these outcomes, it might be possible to surmise from here that at least some of these effects stemmed from having access to dependable savings technologies.

3.4.1 How to enable savings?

The looming policy question is about how we can make savings technologies accessible to the poor. Different countries across the developing world are experimenting with novel schemes to facilitate savings. In some cases, these are being driven by the state, like in India, where the Central Bank directed all commercial banks in late 2005 to provide 'no frills' bank accounts to the poor. These accounts can be opened and operated with miniscule to no money, making it easier for the poor to save. By 2008, more than 15 million interest-paying no-frills accounts had been opened (Thyagarajan and Venkatesan, 2008). In other cases, the microsavings movement has completely bypassed the state's institutional set-up, utilizing the private sector instead. The Philippines and Kenya are great examples for that. In fact, the M-PESA service in Kenya (through which people can transfer, deposit and withdraw money using their cell phones) has become such a runaway success since it was first launched in 2007, that it now covers 70 percent of Kenyan households and processes more transactions domestically than Western Union does globally (Kendall, 2010; Mas and Radcliffe, 2010). As of today, there are more than 10 million M-PESA subscribers in the country, while only 4 million hold bank accounts (Microfinancefocus, 2011). These numbers underscore the unprecedented degree of financial inclusion that has been heralded by M-PESA and the reason why it is being hailed as a model to be emulated across the developing world. Other models are being tried out in other parts of the world: Brazil, Mexico and India, for example, are experimenting with banking correspondents, i.e.

non-bank agents such as retail stores or post offices with whom people can make their banking transactions (McKinsey & Company, 2010; Reserve Bank of India, 2006).

While these initiatives for expanding financial access are a step in the right direction, they may still prove entirely ineffectual in the face of the trust problems that we discussed earlier in this chapter: if people are unwilling to borrow from untrustworthy institutions, they are likely even less willing to entrust them with their own money. As also mentioned earlier, this problem has already surfaced in one RCT, where people did not use free savings accounts because they did not trust the bank (Dupas et al., 2011). Furthermore, we might expect this issue to be particularly acute in SSA, which lags behind the rest of the world in providing deposit insurance (Demirgüç-Kunt, Karacaovali and Laeven, 2005). In response, the Grameen Foundation has called for an institution, either a local or an international non-profit organization or a consortium of MFIs, to provide this insurance in order to win depositor confidence (Counts and Meriweather, 2008).

In the meantime, as formal savings institutions continue to evolve, it would be useful for policy-makers and aid-agencies to remember that even informal (and inexpensive) mechanisms like lockboxes have proved to be highly effective in promoting savings (Dupas and Robinson, 2011b; Kristoff, 2009).

3.5 Conclusion

This chapter reviews evidence from the literature and individual-level surveys in order to develop a better informed perspective on the pros and cons of microfinance for setting up and expanding businesses. The verdict seems to be that while microcredit is primarily useful as a consumption-smoothing and risk-management tool, microsavings

potentially has a greater role to play in wealth creation. Further, neither savings nor credit would be able to do much by way of anything in an environment that does not inspire public confidence. The world's poor desperately need financial innovations that help them save, borrow and lend and an environment that helps them do so securely.

References

[1] Aaronson, Daniel and Bhashkar Mazumder (2013). The Impact of Rosenwald Schools on Black Achievement. *Journal of Political Economy 119*(5), 821–888.

[2] Adhvaryu, Achyuta and Anant Nyshadham (2014). Returns to Treatment in the Formal Health Care Sector: Evidence from Tanzania. Working Paper.

[3] Aggarwal, Shilpa (2014). Do Rural Roads Create Pathways out of Poverty? Evidence from India. Working Paper.

[4] Al-Taiar, Abdullah, Allan Clark, Joseph C. Longenecker, and Christopher Whitty (2010). Physical Accessibility and Utilization of Health Services in Yemen. *International Journal of Health Geographics 9 (38)*.

[5] Ali, Rubaba (2011). Impact of Rural Road Improvement on High Yield Variety Technology Adoption: Evidence from Bangladesh. Working Paper, University of Maryland.

[6] Almond, Douglas and Joseph Doyle (2011). After Midnight: A Regression Discontinuity Design in Length of Postpartum Hospital Stays. *American Economic Journal: Economic Policy 3 (3)*, 1–34.

[7] Almond, Douglas, Joseph Doyle, Amanda Kowalski, and Heidi Williams (2010). Estimating Marginal Returns to Medical Care: Evidence from At-risk Newborns. *Quarterly Journal of Economics 125 (2)*, 591–634.

[8] Ardener, Shirley and Sandra Burman (1995). *Money-go-rounds: The Importance of Rotating Savings and Credit Associations for Women*. Berg.

[9] Ardic, Oya P., Maximilien Heimann, and Nataliya Mylenko (2011). Access to Financial Services and the Financial Inclusion Agenda around the World: A Cross-Country Analysis with a New Data Set. World Bank Policy Research Working Paper No. 5537.

[10] Arkolakis, Costas, Svetlana Demidova, Peter J. Klenow, and Andrés Rodríguez-Clare (2008). Endogenous Variety and the Gains from Trade. *American Economic Review: Papers and Proceedings 98*(2), 444–450.

[11] Armendáriz, Beatriz and Jonathan Morduch (2005). *The Economics of Microfinance*. MIT Press.

[12] Ashraf, Nava, Dean Karlan, and Wesley Yin (2006). Tying Odysseus to the Mast: Evidence from a Commitment Savings Product in the Philippines. *Quarterly Journal of Economics 121 (2)*, 635–672.

[13] Atkin, David (2012). Endogenous Skill Acquisition and Export Manufacturing in Mexico. Working Paper, Yale.

[14] Baland, Jean-Marie, Catherine Guirkinger, and Charlotte Mali (2011). Pretending to be Poor: Borrowing to Escape Forced Solidarity in Credit Cooperatives in Cameroon. *Economic Development and Cultural Change 60 (1)*, 1–16.

[15] Banerjee, Abhijit, Angust Deaton, and Esther Duflo (2004). Health Care Delivery in Rural Rajasthan. *Economic and Political Weekly*, 944–949.

[16] Banerjee, Abhijit and Esther Duflo (2007). The Economic Lives of the Poor. *Journal of Economic Perspectives 21 (1)*, 141–167.

[17] Banerjee, Abhijit and Esther Duflo (2014). Do Firms Want to Borrow More? Testing Credit Constraints Using a Directed Lending Program. Forthcoming, Review of Economic Studies.

[18] Banerjee, Abhijit, Esther Duflo, Rachel Glennerster, and Cynthia Kinnan (2014). The Miracle of Microfinance? Evidence from a Randomized Evaluation. Forthcoming, American Economic Journal: Applied Economics.

[19] Banerjee, Abhijit, Esther Duflo, Rachel Glennerster, and Dhruva Kothari (2010). Improving Immunization Coverage in Rural India: A Clustered Randomized Controlled Evaluation of Immunization Campaigns with and without Incentives. *British Medical Journal 340:c2220.*

[20] Banerjee, Abhijit, Esther Duflo, and Nancy Qian (2012). On The Road: Access to Transportation Infrastructure and Economic Growth in China. NBER Working Paper No. 17897.

[21] Barham, Tania and John A. Maluccio (2009). Eradicating Diseases: The Effect of Conditional Cash Transfers on Vaccination Coverage in Rural Nicaragua. *Journal of Health Economics 28 (3)*, 611–621.

[22] Baum-Snow, Nathaniel, Loren Brandt, J. Vernon Henderson, Matthew A. Turner, and Qinghua Zhang (2013). Roads, Railroads and Decentralization of Chinese Cities. Working Paper, Brown University.

[23] Baum-Snow, Nathaniel and Matthew A. Turner (2012). Transportation and the Decentralization of Chinese Cities. Working Paper, Brown University.

[24] Beck, Thorsten and Asli Demirgüç-Kunt (2009). Financial Institutions and Markets Across Countries and over Time: Data and Analysis. World Bank Policy Research Working Paper No. 4943.

[25] Beck, Thorsten, Asli Demirgüç-Kunt, and Ross Levine (2000). A new database on financial development and structure. *World Bank Economic Review 14*, 597–605.

[26] Beck, Thorsten, Asli Demirgüç-Kunt, and Vojislav Maksimovic (2007). Financial and Legal Constraints to Growth: Does Firm Size Matter? *The Journal of Finance LX (1)*.

[27] Beck, Thorsten, Samuel Munzele Maimbo, Issa Faye, and Thouraya Triki (2011). *Financing Africa: Through the Crisis and Beyond*. The World Bank, Washington D.C.

[28] Berger, Thor and Kerstin Enflo (2013). Locomotives of Local Growth: The Short- and Long-Term Impact of Railroads in Sweden. EHES Working Papers in Economic History, No. 42.

[29] Besley, Timothy (1995). Savings, Credit and Insurance. In J. Behrman and T. Srinivasan (Eds.), *Handbook of Development Economics, Volume III*.

[30] Bleakley, Hoyt and Jeffrey Lin (2012). Portage and Path Dependence. *Quarterly Journal of Economics 127*, 587–644.

[31] Broda, Christian and David E. Weinstein (2006). Globalization and the Gains from Variety. *Quarterly Journal of Economics 121*(2), 541–585.

[32] Bruhn, Miriam and Inessa Love (2009). The Economic Impact of Banking the Unbanked: Evidence from Mexico. World Bank Policy Research Working Paper No. 4981.

[33] Brune, Lasse, Xavier Giné, Jessica Goldberg, and Dean Yang (2011). Commitments to Save: A Field Experiment in Rural Malawi. World Bank Policy Research Working Paper No. 5748.

[34] Buchmueller, Thomas C., Mireille Jacobson, and Cheryl Wold (2006). How Far to the Hospital? The Effect of Hospital Closures on Access to Care. *Journal of Health Economics 25 (4)*, 740–761.

[35] Burde, Dana and Leigh L. Linden (2013). The Effect of Village-Based Schools: Evidence from a Randomized Controlled Trial in Afghanistan. *American Economic Journal: Applied Economics 5 (3)*, 27–40.

[36] Burgess, Robin, Remi Jedwab, Edward Miguel, Ameet Morjaria, and Gerard Padrø i Miquel (2013). The Value of Democracy: Evidence from Road Building in Kenya. BREAD Working Paper No. 394.

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

[38] Calderon, Cesar A., Alberto Chong, and Arturo José Galindo (2002). Development and Efficiency of the Financial Sector and Links with Trust: Cross-Country Evidence. *Economic Development and Cultural Change 51 (1)*, 189–204.

[39] Caprio, Gerard and Daniela Klingebiel (2003). Episodes of Systemic and Borderline Financial Crises. Research at the World Bank: http://go.worldbank.org/5DYGICS7B0.

[40] Casaburi, Lorenzo, Rachel Glennerster, and Tavneet Suri (2013). Rural Roads and Intermediated Trade : Regression Discontinuity Evidence from Sierra Leone. Working Paper, MIT.

[41] Cassar, Alessandra and Bruce Wydick (2010). Does Social Capital Matter? Evidence from a Five-Country Group Lending Experiment. *Oxford Economic Papers 62*, 715–739.

[42] CGAP and MIX (2010, April). Sub-Saharan Africa 2009: Microfinance Analysis and Benchmarking Report. Microfinance Information Exchange: www.themix.org.

[43] CGAP and MIX (2011, April). MIX Microfinance World: Sub-Saharan Africa Microfinance Analysis and Benchmarking Report 2010. Microfinance Information Exchange: www.themix.org.

[44] Chaia, Alberto, Aparna Dalal, Tony Goland, Maria Jose Gonzalez, Jonathan Morduch, and Robert Schiff (2009). Half the World is Unbanked. Financial Access Initiative Framing Note.

[45] Chaudhury, Nazmul and Jeffrey Hammer (2004). Ghost Doctors: Absenteeism in Rural Bangladeshi Health Facilities. *World Bank Economic Review 18 (3)*, 423–441.

[46] Chaudhury, Nazmul, Jeffrey Hammer, Michael Kremer, Karthik Muralidharan, and F.Halsey Rogers (2006). Missing in Action: Teacher and Health Worker Absence in Developing Countries. *Journal of Economic Perspectives 20 (1)*, 91–116.

[47] Cohen, Jessica and Pascaline Dupas (2010). Free Distribution or Cost-Sharing? Evidence from a Randomized Malaria Experiment. *Quarterly Journal of Economics 125 (1)*, 1–34.

[48] Cole, Shawn (2009). Fixing Market Failures or Fixing Elections? Agricultural Credit in India. *American Economic Journal: Applied Economics 1*(1), 219–250.

[49] Collins, Daryl, Jonathan Morduch, Stuart Rutherford, and Orlanda Ruthven (2009). *Portfolios of the Poor: How the World's Poor Live on Two Dollars a Day*. Princeton University Press.

[50] Counts, Alex and Patrick Meriweather (2008). ŞNew Frontiers in Micro-Savings. Grameen Foundation, Washington, DC.

[51] Crépon, Bruno, Florencia Devoto, Esther Duflo, and William Pariente (2008). Poverty, Access to Credit and the Determinants of Participation in a New Micro-credit Program in Rural Areas of Morocco. Working Paper.

[52] Currie, Janet and Jonathan Gruber (1996). Health Insurance Eligibility, Utilization of Medical Care, and Child Health. *Quarterly Journal of Economics 111 (2)*, 431–466.

[53] Das, Jishnu and Jeffrey Hammer (2005). Which Doctor? Combining Vignettes and Item Response to Measure Clinical Competence. *Journal of Development Economics 78 (2)*, 348–383.

[54] Das, Jishnu and Jeffrey Hammer (2007). Money for Nothing: The Dire Straits of Medical Practice in India. *Journal of Development Economics 83 (1)*, 1–36.

[55] Das, Jishnu and Jeffrey Hammer (2014). Quality of Primary Care in Low-Income Countries: Facts and Economics. Forthcoming, Annual Review of Economics.

[56] Das, Jishnu, Jeffrey Hammer, and Kenneth Leonard (2008). The Quality of Medical Advice in Low-Income Countries. *Journal of Economic Perspectives 22 (2)*, 93–114.

[57] Datta, Saugato (2012). The Impact of Improved Highways on Indian Firms. *Journal of Development Economics 99*(1), 46–57.

[58] de Mel, Suresh, David McKenzie, and Christopher Woodruff (2008). Returns to Capital in Microenterprises: Evidence from a Field Experiment. *Quarterly Journal of Economics 123 (4)*, 1329–1372.

[59] de Mel, Suresh, David McKenzie, and Christopher Woodruff (2011). Getting Credit to High Return Microentrepreneurs: The Results of an Information Intervention. *The World Bank Economic Review 25 (2)*.

[60] Demirgüç-Kunt, Asli, Baybars Karacaovali, and Luc Laeven (2005). Deposit Insurance around the World: A Comprehensive Database. World Bank Policy Research Working Paper No. 3628.

[61] Dhillon, R.S., M.H. Bonds, M. Fraden, D. Ndahiro, and J. Ruxin (2012). The Impact of Reducing Financial Barriers on Utilisation of a Primary Health Care Facility in Rwanda. *Global Public Health 13 (1)*, 71–86.

[62] Dizon-Ross, Rebecca, Pascaline Dupas, and Jonathan Robinson (2014). Governance and Effectiveness of Public Health Subsidies. Working Paper.

[63] Donaldson, Dave (2013). Railroads of the Raj : Estimating the Impact of Transportation Infrastructure. *American Economic Review (Forthcoming)*.

[64] Donaldson, Dave and Richard Hornbeck (2013). Railroads and American Economic Growth: A Market Access Approach. NBER Working Paper No. 19213.

[65] Dongre, Ambrish (2012). Can Conditional Cash Transfers Impact Institutional Deliveries? Evidence from Janani Suraksha Yojana in India. Working Paper.

[66] Doyle, Joseph (2011). Returns to Local-Area Emergency Health Care Spending: Using Health Shocks to Patients Far From Home. *American Economic Journal: Applied Economics 3 (3)*, 221–243.

[67] Duflo, Esther (2001). Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment. *American Economic Review 91*(4), 795–813.

[68] Duflo, Esther, Michael Kremer, and Jonathan Robinson (2011). Nudging Farmers to Use Fertilizer: Theory and Experimental Evidence from Kenya. *American Economic Review 101 (6)*, 2350–2390.

[69] Dupas, Pascaline, Sarah Green, Anthony Keats, and Jonathan Robinson (2012). Challenges in Banking the Rural Poor: Evidence from Kenya's Western Province. Forthcoming in NBER Africa Volume.

[70] Dupas, Pascaline and Jonathan Robinson (2013a). Savings Constraints and Microenterprise Development: Evidence from a Field Experiment in Kenya. *American Economic Journal: Applied Economics 5 (1)*, 163–192.

[71] Dupas, Pascaline and Jonathan Robinson (2013b). Why Don't the Poor Save More? Evidence from Health Savings Experiments. *American Economic Review 103 (4)*, 1138–1171.

[72] Durairaj, Varatharajan, Sidhartha R. Sinha, David B. Evans, and Guy Carrin (2010). Shaping National Health Financing Systems: Can Micro-Banking Contribute? World Health Report 2010, Background Paper.

[73] Duranton, Gilles, Peter M. Morrow, and Matthew A. Turner (2013). Roads and Trade: Evidence from the US. *Review of Economic Studies (Forthcoming)*.

[74] Duranton, Gilles and Matthew A. Turner (2012). Urban Growth and Transportation. *Review of Economic Studies 79 (4)*, 1407–1440.

[75] El-Zaghbi, Mayada, Barbara Gähweiler, and Kate Lauer (2011). Cross-border Funding of Microfinance. CGAP Focus Note No. 70, April 2011.

[76] Faber, Benjamin (2013). Trade Integration , Market Size , and Industrialization : Evidence from China's National Trunk Highway System. Working Paper, UC Berkeley.

[77] Feenstra, Robert C. (1994). New Product Varieties and the Measurement of International Prices. *American Economic Review 84 (1)*(3), 157–177.

[78] Friedman, Willa (2014). Antiretroviral Drug Access and Behavior Change. Working Paper.

[79] Fujiwara, Thomas (2013). Voting Technology, Political Responsiveness, and Infant Health: Evidence from Brazil. Working Paper.

[80] Gabrysch, Sabine and Oona Campbell (2009). Still too Far to Walk: Literature Review of the Determinants of Delivery Service Use. *BMC Pregnancy and Childbirth 9 (34)*.

[81] Gabrysch, S., S. Cousens, Cox J., and Campbell O.M.R. (2011). The Influence of Distance and Level of Care on Delivery Place in Rural Zambia: A Study of Linked National Data in a Geographic Information System. *PLoS Medicine 8 (1): e1000394*.

[82] Gaul, Scott (2011). Mapping africa financial inclusion Ű overview. Microfinace Information Exchange: Washington, DC.

[83] Gautham, Meenakshi, Erika Binnendijk, Ruth Koren, and David. M. Dror (2011). 'First we go to the Small Doctor': First Contact for Curative Health Care sought by Rural Communities in Andhra Pradesh & Orissa, India. *Indian Journal of Medical Research 134*, 627–638.

[84] Gill, Jennifer and David Taylor (2013). Health and Health Care in India: National Opportunities, Global Impacts. Working Paper, UCL School of Pharmacy.

[85] Gonzalez-Navarro, Marco and Climent Quintana-Domeque (2012). Paving Streets for the Poor: Experimental Analysis of Infrastructure Effects. Working Paper, University of Toronto.

[86] Goyal, Aparajita (2010). Information, Direct Access to Farmers, and Rural Market Performance in Central India. *American Economic Journal: Applied Economics 2*(3), 22–45.

[87] Guiso, Luigi, Paola Sapienza, and Luigi Zingales (2004). The Role of Social Capital in Financial Development. *American Economic Review 94 (3)*, 526–556.

[88] Handbury, Jessie and David E. Weinstein (2011). Is new economic geography right? evidence from price data. NBER Working Paper No. 17067.

[89] Hillberry, Russell and David Hummels (2008). Trade Responses to Geographic Frictions: A Decomposition using Micro-data. *European Economic Review 52*(3), 527–550.

[90] Ignacio, Mas and Dan Radcliffe (2010). Mobile Payments go Viral: M-PESA in Kenya. In *Yes Africa Can: Success Stories from a Dynamic Continent*. World Bank.

[91] ILO (International Labour Organisation) (2002). Women and Men in the Informal Economy: A Statistical Picture. Geneva, Switzerland: International Labour Organization.

[92] IMF-IFS Statistics (2011). The International Monetary Fund: Washington, DC.

[93] Jakiela, Pamela and Owen Ozier (2011). Does Africa Need a Rotten Kin Theorem? Experimental Evidence from Village Economies. Working Paper.

[94] Jayachandran, Seema (2014). Incentives to Teach Badly? After-School Tutoring in Developing Countries. Forthcoming, Journal of Development Economics.

[95] Jedwab, Remi, Edward Kerby, and Alexander Moradi (2013). Out of Africa: Colonial Railroads, White Settlement and Path Dependence in Kenya. Unpublished, George Washington University.

[96] Jedwab, Remi and Alexander Moradi (2012). Colonial Investments and Long-Term Development in Africa: Evidence from Ghanaian Railroads. Unpublished, George Washington University.

[97] Jensen, Robert (2010). The (Perceived) Returns to Education and the Demand for Schooling. *Quarterly Journal of Economics 125 (2)*, 515–548.

[98] Kaboski, Joseph and Robert Townsend (2011). A Structural Evaluation of a Large Scale Quasi-Experimental Microfinance Initiative. *Econometrica 79*, 1357–1406.

[99] Karlan, Dean and Jonathan Zinman (2010a). Expanding Credit Access: Using Randomized Supply Decisions To Estimate the Impacts. *Review of Financial Studies 23 (1)*, 433–446.

[100] Karlan, Dean and Jonathan Zinman (2010b). Expanding Microenterprise Credit Access: Using Randomized Supply Decisions to Estimate the Impacts in Manila. Working Paper.

[101] Kazianga, Harounan, Daniel Levy, Leigh Linden, and Matt Sloan (2013). The Effect of Girl- Friendly School Construction: Evaluation of the BRIGHT School Program in Burkina Faso. *American Economic Journal: Applied Economics 5 (3)*, 41–62.

[102] Keller, Wolfgang and Carol H. Shiue (2008). Tariffs, Trains, and Trade: The Role of Institutions versus Technology in the Expansion of Markets. CEPR Discussion Paper No. 6759.

[103] Kendall, Jake (2010). A Penny Saved: How Do Savings Accounts Help the Poor? Financial Access Initiative Focus Note.

[104] Kennedy, Gina L., Maria Regina Pedro, Chiara Seghieri, Guy Nantel, and Inge Brouwer (2007). Dietary Diversity Score Is a Useful Indicator of Micronutrient Intake in Non-Breast-Feeding Filipino Children. *The Journal of Nutrition 137 (2)*, 472–477.

[105] Khandker, Shahidur R., Zaid Bakht, and Gayatri B. Koolwal (2009). The Poverty Impact of Rural Roads: Evidence from Bangladesh. *Economic Development and Cultural Change 57 (4)*, 685–722.

[106] Khemani, Stuti (2004). Political Cycles in a Developing Economy: Effect of Elections in the Indian States. *Journal of Development Economics 73*, 125–154.

[107] Klemick, Heather, Kenneth L. Leonard, and Melkiory C. Masatu (2009). Defining Access to Health Care: Evidence on the Importance of Quality and Distance in Rural Tanzania. *American Journal of Agricultural Economics 91 (2)*, 347–358.

[108] Kling, Jeffrey R., Jeffrey B. Liebman, and Lawrence F. Katz (2007). Experimental Analysis of Neighborhood Effects. *Econometrica 75 (1)*, 83–119.

[109] Kristoff, Nicholas D. (2009). Sparking a Savings Revolution. Op-Ed in The New York Times, December 30, 2009.

[110] Kruger, Diane I. (2007). Coffee Production Effects on Child Labor and Schooling in Rural Brazil. *Journal of Development Economics 82 (2)*, 448–463.

[111] Lagarde, M., A. Haines, and N. Palmer (2007). Conditional Cash Transfers for Improving Uptake of Health Interventions in Low- and Middle-Income Countries: a Systematic Review. *Journal of American Medical Association 298 (16)*, 1900–1910.

[112] Leonard, Kenneth (2007). Improving Health Outcomes By Choosing Better Doctors: Evidence of Social Learning about Doctor Quality from Rural Tanzania. Working Paper.

[113] Luo, Renfu, Yaojiang Shi, Linxiu Zhang, Huiping Zhang, Grant Miller, Alexis Medina, and Scott Rozelle (2012). The Limits of Health and Nutrition Education: Evidence from Three Randomized-Controlled Trials in Rural China. *CESifo Economic Studies 58 (2)*, 385–404.

[114] Mauro, Paolo (1995). Corruption and Growth. *Quarterly Journal of Economics 110 (3)*, 681–712.

[115] May, C., K. Roth, and Panda P. (2014). Non-degree Allopathic Practitioners as First Contact Points for Acute Illness Episodes: Insights from a Qualitative Study in Rural Northern India. *BMC Health Services Research 14: 182*.

[116] McKenzie, David and Christopher Woodruff (2008). Experimental Evidence on Returns to Capital and Access to Finance in Mexico. *World Bank Economic Review 22 (3)*, 457–482.

[117] McKinsey & Company (2010). Global Financial Inclusion. McKinsey Publishing: Washington, DC.

[118] Meredith, Jennifer, Jonathan Robinson, Sarah Walker, and Bruce Wydick (2013). Keeping the Doctor Away: Experimental Evidence on Investment in Preventative Health Products. *Journal of Development Economics 105*, 196–210.

[119] Microfinancefocus (2010).

[120] Miller, Grant (2008). Women's Suffrage, Political Responsiveness, and Child Survival in American History. *Quarterly Journal of Economics 123 (3)*, 1287–1327.

[121] Morduch, Jonathan (1999). The Microfinance Promise. *Journal of Economic Literature 37 (4)*, 1569–1614.

[122] Morris, S.S., Flores F., Olinto P., and Medina J.M. (2004). Monetary Incentives in Primary Health Care and Effects on Use and Coverage of Preventive Health Care Interventions in Rural Honduras: Cluster Randomized Trial. *Lancet 364*, 2030–2037.

[123] Muralidharan, Karthik, Nazmul Chaudhury, Jeffrey Hammer, Michael Kremer, and F. Halsey Rogers (2011). Is there a Doctor in the House? Absent Medical Providers in India. Working Paper.

[124] Muralidharan, Karthik and Nishith Prakash (2013). Cycling to School: Increasing Secondary School Enrollment for Girls in India. NBER Working Paper No. 19305.

[125] Muto, Megumi and Takashi Yamano (2009). The Impact of Mobile Phone Coverage Expansion on Market Participation: Panel Data Evidence from Uganda. *World Development 37*(12), 1887–1896.

[126] Nelson, Leah K. (2011). From Loans to Labor: Access to Credit, Entrepreneurship and Child Labor. Working Paper, Michigan State University.

[127] New York Times (2012). India's Hidden Health Care Labor Force. http://india.blogs.nytimes.com/2012/11/29/indias-hidden-health-care-labor-force. Accessed on May 26, 2014.

[128] Nguyen, Kieu-Trang, Quoc-Anh Do, and Anh Tran (2012). One Mandarin Benefits the Whole Clan: Hometown Infrastructure and Nepotism in an Autocracy. Working Paper, Indiana University.

[129] Palmer, Natasha, Dirk H. Mueller, Lucy Gilson, Anne Mills, and Andy Haines (2004). Health Financing to Promote Access in Low Income Settings - How Much Do We Know? *Lancet 364 (9442)*, 1365–1370.

[130] Patil, Ashok V., K. V. Somasundaram, and R. C. Goyal (2002). Current Health Scenario in Rural India. *Australian Journal of Rural Health 10*, 129–135.

[131] Paxson, Christina and Norbert Schady (2010). Does Money Matter? The Effects of Cash Transfers on Child Development in Rural Ecuador. *Economic Development and Cultural Change 13 (1)*, 187–229.

[132] Pitt, Mark and Shahidur R. Khandker (1998). The Impact of Group-Based Credit Programs on Poor Households in Bangladesh: Does the Gender of Participants Matter? *Journal of Political Economy 106 (5)*, 958–996.

[133] Rasul, Imran and Daniel Rogger (2013). Management of Bureaucrats and Public Service Delivery: Evidence from the Nigerian Civil Service. Unpublished, UCL.

[134] Ray, S.K., S.S. Basu, and A.K. Basu (2011). An Assessment of Rural Health Care Delivery System in some Areas of West Bengal - an Overview. *Indian Journal of Public Health 55 (2)*, 70–80.

[135] Reserve Bank of India (2006). Financial Inclusion by Extension of Banking Services - Use of Business Facilitators and Correspondents. RBI Circular No. RBI/2005-06/288 DBOD.No.BL.BC. 58/22.01.001/2005-2006, RBI, New Delhi.

[136] Robertson, L., P. Mushati, J.W. Eaton, L. Dumba, G. Mavise, J. Makoni, C. Schumacher, T. Crea, R. Monasch, L. Sherr, G.P. Garnett, C. Nyamukapa, and S. Gregson (2013). Effects of Unconditional and Conditional Cash Transfers on Child Health and Development in Zimbabwe: a Cluster-Randomised Trial. *Lancet 381*, 1283–1292.

[137] Rocha, Romero and Rodrigo R. Soares (2010). Evaluating the Impact of Community-Based Health Interventions: Evidence from Brazil's Family Health Program. *Journal of Health Economics 19 (S1)*, 126–158.

[138] Rogger, Daniel (2013). The Causes and Consequences of Political Interference in Bureaucratic Decision Making: Evidence from Nigeria. Unpublished, UCL.

[139] Sabarwal, Swetlena and Katherine Terrell (2009). Access to Credit and Performance of Female Entrepreneurs in Latin America (Summary). *Frontiers of Entrepreneurship Research 29 (18)*.

[140] Schady, Norbert (2004). Do Macroeconomic Crises Always Slow Human Capital Accumulation? *World Bank Economic Review 18 (2)*, 131–154.

[141] Schneider, Friedrich (2002). Size and Measurement of the Informal Economy in 110 Countries around the World. Paper presented at the Workshop of Australian National Tax Centre, ANU. Canberra, Australia. July 17, 2002.

[142] Shah, Manisha and Bryce Millett Steinberg (2013). Drought of Opportunities: Contemporaneous and Long Term Impacts of Rainfall Shocks on Human Capital. NBER Working Paper No. 19140.

[143] Shreshtha, Slesh A. (2012). Access to the North-South Roads and Farm Profits in Rural Nepal. Working Paper, National University of Singapore.

[144] Suri, Tavneet (2011). Selection and Comparative Advantage in Technology Adoption. *Econometrica 79 (1)*, 159–209.

[145] Tarozzi, Alessandro, Aprajit Mahajan, Brian Blackburn, Dan Kopf, Lakshmi Krishnan, and Joanne Yoong (2013). Micro-Loans, Bed Nets and Malaria: Evidence from a Randomized Controlled Trial. Forthcoming, American Economic Review.

[146] Thaddeus, S. and D. Maine (1994). Too far to Walk: Maternal Mortality in Context. *Social Science and Medicine 38 (8)*, 1091–1110.

[147] Thornton, Rebecca (2008). The Demand for, and Impact of, Learning HIV Status. *American Economic Review 98 (5)*, 1829–1863.

[148] Thyagarajan, S. and Jayaram Venkatesan (2008). Cost-Benefit and Usage Behaviour Analysis of No Frills Accounts: A Study Report on Cuddalore District. Working Paper, Centre for Micro Finance.

[149] Tontisirin, Kraisid, Guy Nantel, and Lalita Bhattacharjee (2002). Food-based Strategies to Meet the Challenges of Micronutrient Malnutrition in the Developing World. *Proceedings of the Nutrition Society 61*, 243–250.

[150] Travis, Phyllida, Sara Bennett, Andy Haines, Tikki Pang, Zulfiqar Bhutta, Adnan A Hyder, Nancy R. Pielemeier, Anne Mills, and Timothy Evans (2004). Overcoming Health-Systems Constraints to Achieve the Millennium Development Goals. *Lancet 364*, 900–906.

[151] Udry, Christopher and Santosh Anagol (2006). The Return to Capital in Ghana. *American Economic Review 96 (2)*, 388–393.

[152] Volpe Martincus, Christian and Juan Blyde (2013). Shaky Roads and Trembling Exports: Assessing the Trade Effects of Domestic Infrastructure using a Natural Experiment. *Journal of International Economics 90*(1), 148–161.

[153] Volpe Martincus, Christian, Jerónimo Carballo, and Ana Cusolito (2013). Routes, Exports, and Employment in Developing Countries: Following the Trace of the Inca Roads. Unpublished, Georgetown University.

[154] Wagstaff, Adam and Mariam Claeson (2004). The Millennium Development Goals for Health: Rising to the Challenges. The World Bank, Washinton, DC.

[155] WHO (2012). Building a Future for Women and Children: The 2012 Report. World Health Organization and UNICEF.

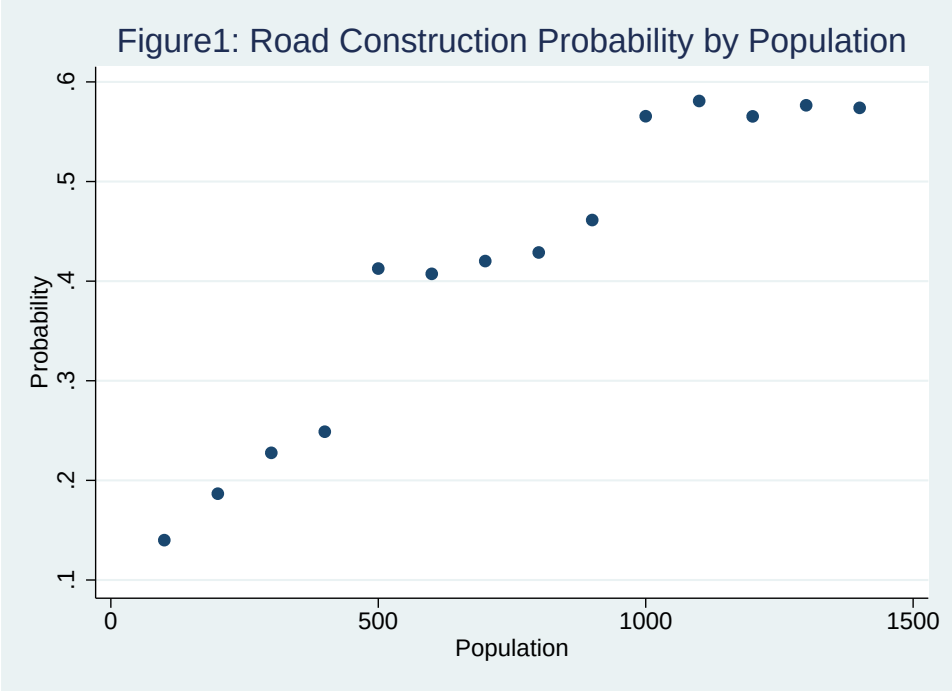
[156] World Bank (2004). World Development Report 2004: Making Services Work for Poor People. The World Bank and Oxford University Press.

[157] World Bank (2005). World Bank Development Report 2005: A Better Investment Climate for Everyone. World Bank and Oxford University Press.

[158] World Bank (2007). A Decade of Action in Transport: An Evaluation of World Bank Assistance to the Transport Sector, 1995 – 2005. Independent Evaluation Group, World Bank, Washington, D.C.

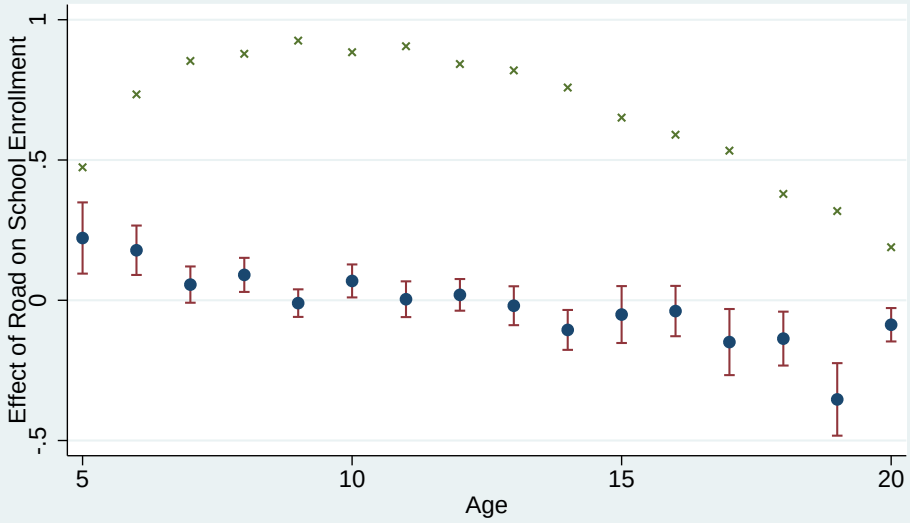
[159] World Bank (2009). *Reshaping Economic Geography*. World Development Report. World Bank, Washington, D.C.

Tables and Figures



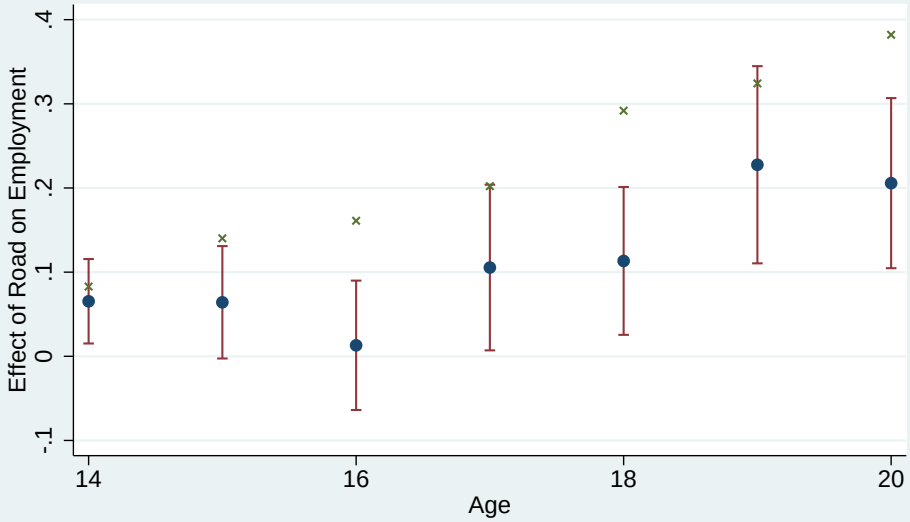
- Measures road construction probability by 2011 for villages that did not have a road in 2000

Figure 2: Effect of Road Construction on School Enrollment by Age



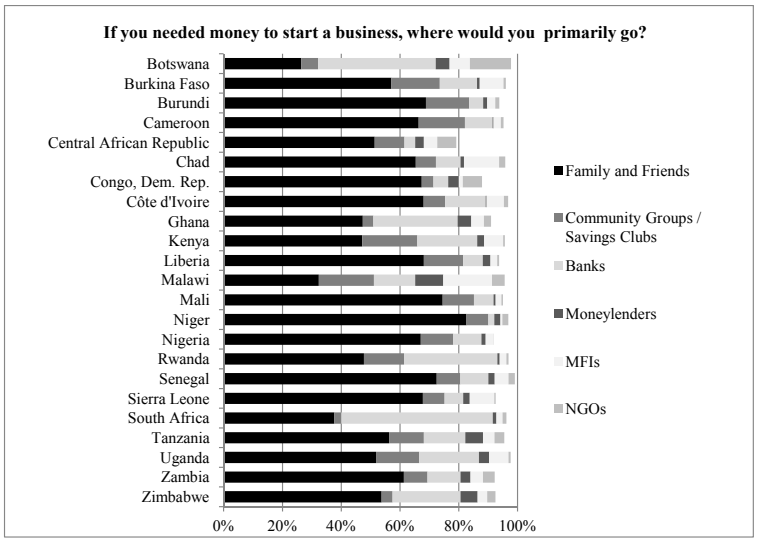
All estimates include district fixed effects.
Confidence intervals are at the 90% level.

Figure 3: Effect of Road Construction on Employment by Age



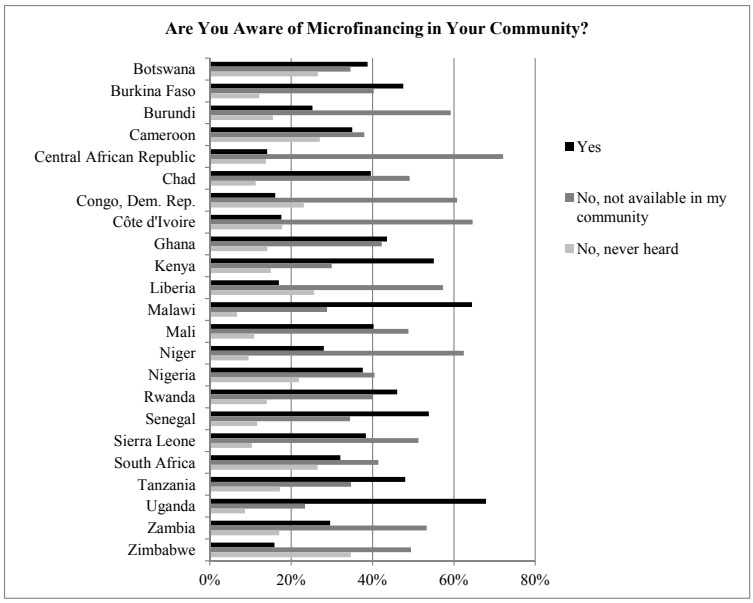
All estimates include district fixed effects.
Confidence intervals are at the 90% level.

Figure 4: Sources of Start-up Financing, by Country (average 2009-10)



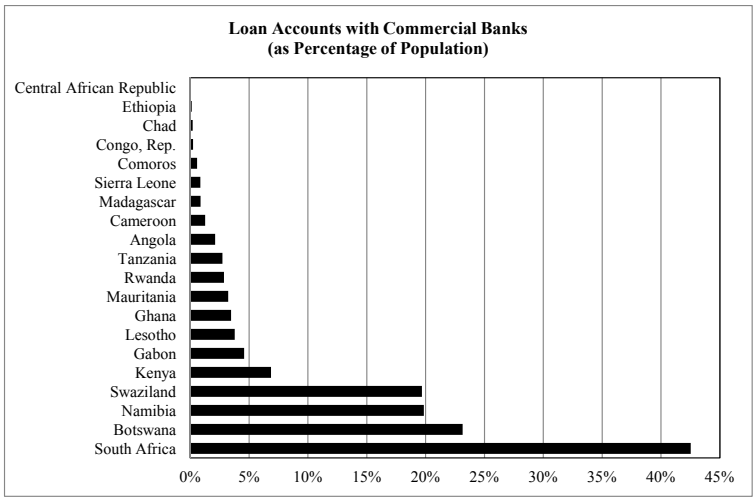
Source: Gallup World Poll 2009 and 2010.

Figure 5: Awareness of Microfinance, by Country (average 2009-10)



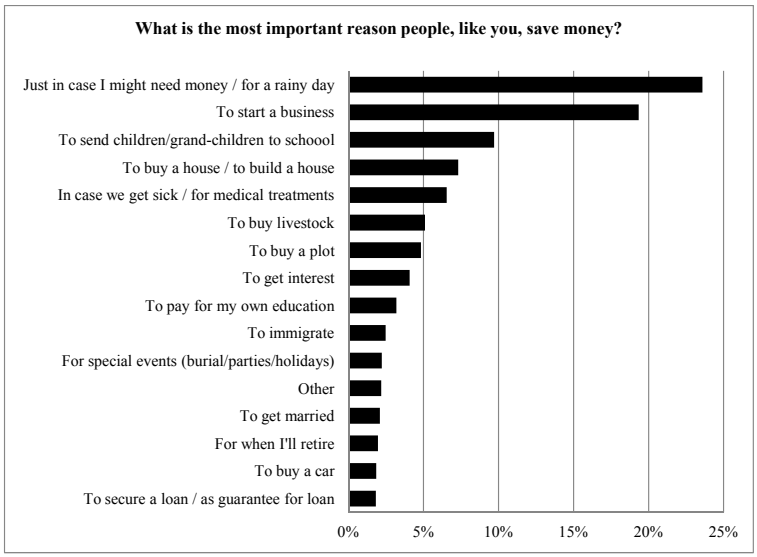
Source: Gallup World Poll 2009 and 2010.

Figure 6: Borrowing Behaviour, by Country (average 2008-09)



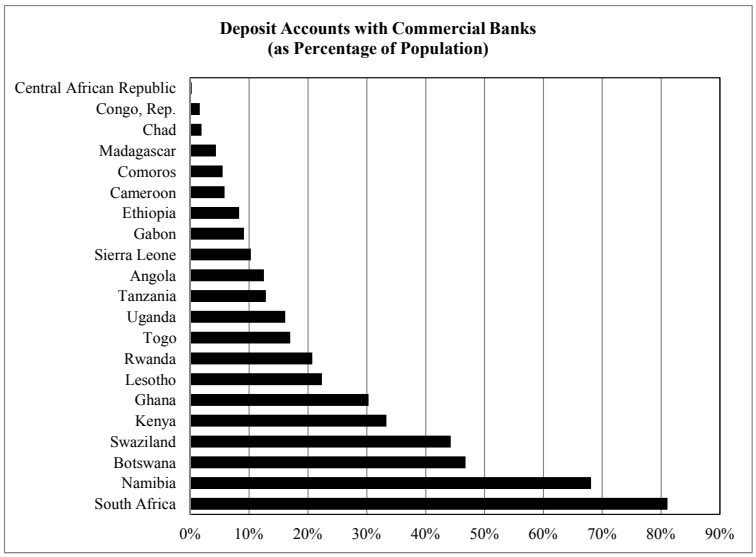
Source: IMF-IFS Statistics, 2011.

Figure 7: Reasons for Saving (average 2009-10 over SSA countries)



Source: Gallup World Poll 2009 and 2010.

Figure 8: Deposit Accounts, by Country (average 2008-09)



Source: IMF-IFS Statistics, 2011.

Table 1: Likelihood of Road Construction by Endline

	Coefficient	Std. Error	Baseline Mean
500 > p > 1000	0.261***	(0.03)	
p > 1000	0.415***	(0.06)	
Population	0.595	(0.47)	625.70
SC Population	0.004	(0.01)	0.37
Distance from Town	-0.158	(0.17)	25.29
Panchayat HQ	0.080***	(0.02)	0.08
Primary School	0.036**	(0.01)	0.79
High School	-0.016	(0.01)	0.03
Adult Literacy Center	0.007	(0.01)	0.08
Primary Health Center	-0.013	(0.01)	0.03
Commercial Bank	-0.017	(0.01)	0.05
Post Office	-0.005	(0.01)	0.23
Telephone	-0.004	(0.01)	0.26
Power Supply	0.002	(0.01)	0.71
R-squared	0.216		

Standard errors in parentheses, clustered by state

***, **, * indicate significance at 1, 5 and 10%

Sample of 272,412 villages. Includes state fixed effects

Table 2. Impact of Road Construction on Price Dispersion

Panel A: Prices Reported by Households	By Item Type						
	Cereal	Lentils	Dairy	Meat	Vegetables	Fruit	Processed Food
Roads Built	-0.84*	0.18	-3.26	-2.17*	-0.73*	-6.05	17.12
	(0.43)	(0.39)	(2.18)	(1.28)	(0.42)	(10.16)	(23.74)
Observations	1,023,709	1,041,479	308,622	542,666	2,671,503	1,031,366	790,881
R-Squared	0.07	0.17	0.05	0.06	0.01	0.07	0.00
Mean of Dep. Var.	1.90	2.90	8.71	7.22	2.10	2.49	10.37
Std Dev of Dep. Var.	3.96	3.63	32.23	13.06	2.19	5.32	24.97
Panel B: Prices Reported by Agricultural Markets	By Item Type						
	Cereal	Lentils	Oilseeds	Animals	Vegetables	Fruit	
Roads Built	66.29	-218.54	-1303.44	-1880.61	-67.05**	-179.03**	
	(70.54)	(287.00)	(912.12)	(1563.98)	(33.21)	(84.36)	
Observations	454,886	261,304	229,292	5,220	611,327	146,715	
R-Squared	0.00	0.00	0.01	0.12	0.06	0.02	
Mean of Dep. Var.	119.61	191.84	495.13	1399.27	104.94	379.75	
Std Dev of Dep. Var.	4692.68	9460.33	14410.22	1553.33	241.79	3394.63	

Standard errors in parentheses, clustered at the market level.

***, **, * indicate significance at 1, 5 and 10%

For Panel A, the dependent variable is the district-wide dispersion in the median price of each good in each category, as

For Panel B,the dependent variable is the district-wide dispersion in the mean price of each variety in each category, as reported by different markets every month

In Panel A, all specifications have time and district fixed effects, and household-level controls

In Panel B, all specifications have week, month, year, and state fixed effects

Mean of Roads Built for the period under consideration is 0.081 for panel A, and 0.056 for panel B

Table 3. Impact of Road Construction on School Enrollment

Panel A: Impact on 5-14 year-olds	Overall				Impacts by Gender					
					Girls			Boys		
	1	2	3	4	5	6	7	8	9	10
Roads Built	0.04	0.04	0.05*	0.05*	0.03	0.03	0.06*	0.05*	0.05*	0.05*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.031)	(0.031)	(0.031)	(0.027)	(0.027)	(0.029)
Pre-program Roads	0.06**	0.06**			0.05*	0.05*		0.06***	0.06***	
	(0.02)	(0.02)			(0.029)	(0.029)		(0.022)	(0.021)	
Observations	322,625	322,625	322,625	322,625	151,687	151,687	151,687	170,938	170,938	170,938
R-Squared	0.039	0.049	0.007	0.017	0.051	0.063	0.021	0.032	0.041	0.013
Baseline mean	0.8	0.8	0.8	0.8	0.77	0.77	0.77	0.83	0.83	0.83
Panel A: Impact on 14-20 year-olds										
Roads Built	-0.09**	-0.08*	-0.12***	-0.11**	-0.09*	-0.09*	-0.09*	-0.08*	-0.08*	-0.11**
	(0.04)	(0.04)	(0.04)	(0.04)	(0.046)	(0.044)	(0.048)	(0.045)	(0.044)	(0.044)
Pre-program Roads	0.00	0.00			0.01	0.00		0.00	0.00	
	(0.03)	(0.03)			(0.034)	(0.034)		(0.031)	(0.03)	
Observations	242,761	242,761	242,761	242,761	112,890	112,890	112,890	129,871	129,871	129,871
R-Squared	0.056	0.085	0.011	0.046	0.077	0.105	0.042	0.051	0.085	0.046
Baseline mean	0.46	0.53	0.46	0.46	0.37	0.37	0.37	0.53	0.53	0.53
Indiv Controls	N	Y	N	Y	N	Y	Y	N	Y	Y
District FE	N	N	Y	Y	N	N	Y	N	N	Y
State FE	Y	Y	N	N	Y	Y	N	Y	Y	N

Standard errors in parentheses, clustered at the district level

***, **, * indicate significance at 1, 5 and 10%

All specifications have time fixed effects

Mean of Roads Built: 0.052

The dependent variable is an indicator for whether the respondent reported that the child's primary occupation was going to school

Table 4. Impact of Road Construction on Employment

Panel A: Impact on 14-20 year-olds	Overall				Impacts by Gender					
					Girls			Boys		
	1	2	3	4	5	6	7	8	9	10
Roads Built	0.10***	0.09***	0.11***	0.10***	0.11***	0.10***	0.09***	0.10**	0.09**	0.12***
	(0.04)	(0.03)	(0.03)	(0.06)	(0.036)	(0.035)	(0.033)	(0.045)	(0.038)	(0.04)
Pre-program Roads	-0.01	0.13**			-0.02	-0.02		0.00	-0.02	
	(0.02)	(0.06)			(0.021)	(0.021)		(0.03)	(0.027)	
Constant					0.43***	-0.29**	-0.55***	0.48***	-0.06	-0.19
					(0.029)	(0.115)	(0.113)	(0.035)	(0.135)	(0.135)
Indiv Controls	N	Y	N	Y	N	Y	Y	N	Y	Y
District FE	N	N	Y	Y	N	N	Y	N	N	Y
State FE	Y	Y	N	N	Y	Y	N	Y	Y	N
Observations	216,225	216,225	216,225	216,225	103,993	103,993	103,993	112,232	112,232	112,232
R-Squared	0.057	0.22	0.006	0.172	0.092	0.16	0.078	0.058	0.244	0.206
Baseline mean	0.24	0.24	0.24	0.24	0.15	0.15	0.15	0.31	0.31	0.31

Panel B: Impact on Prime-Age Individuals	Impacts by Gender							
	Women				Men			
	1	2	3	4	5	6	7	8
Roads Built	0.12**	0.11**	0.09*	0.09	0.01	0.01	0.02	0.01
	(0.054)	(0.054)	(0.06)	(0.057)	(0.01)	(0.009)	(0.01)	(0.011)
Pre-program Roads	-0.12***	-0.12***			-0.02***	-0.02***		
	(0.038)	(0.037)			(0.006)	(0.006)		
Indiv Controls	N	Y	N	Y	N	Y	N	Y
District FE	N	N	Y	Y	N	N	Y	Y
State FE	Y	Y	N	N	Y	Y	N	N
Observations	187,597	187,597	187,597	187,597	186,412	186,412	186,412	186,412
R-Squared	0.137	0.222	0.004	0.103	0.014	0.049	0.001	0.036
Baseline mean	0.41	0.41	0.41	0.41	0.96	0.96	0.95	0.96

Standard errors in parentheses, clustered at the district level

***, **, * indicate significance at 1, 5 and 10%

All specifications have time fixed effects

Mean of Roads Built: 0.052

Table 5. Impact of Road Construction on Occupation Choice

A: Teenaged Boys	Agriculture	Animal Rearing	Forestry	Textile Manufacturing	Tailoring	Manufacturing	Construction	Retail
Roads Built	0.00	0.01*	0.00	0.01	0.01**	0.01	0.05**	0.01
	(0.035)	(0.008)	(0.002)	(0.006)	(0.003)	(0.009)	(0.021)	(0.011)
Observations	129,809	129,809	129,809	129,809	129,809	129,809	129,809	129,809
R-Squared	0.14	0.01	0.00	0.00	0.00	0.01	0.05	0.02
Mean of Dep. Var.	0.32	0.02	0.00	0.01	0.00	0.02	0.03	0.03
B: Teenaged Girls								
Roads Built	0.01	0.08***	-0.01*	0.01**	0.01***	0.00	0.00	0.00
	(0.034)	(0.020)	(0.004)	(0.007)	(0.004)	(0.006)	(0.006)	(0.004)
Observations	112,858	112,858	112,858	112,858	112,858	112,858	112,858	112,858
R-Squared	0.09	0.01	0.00	0.01	0.00	0.01	0.01	0.00
Mean of Dep. Var.	0.21	0.04	0.00	0.01	0.01	0.01	0.01	0.00
C: Prime-Aged Women								
Roads Built	-0.03	0.10***	-0.01*	0.01**	0.00	-0.01	0.00	0.00
	(0.048)	(0.031)	(0.003)	(0.007)	(0.004)	(0.012)	(0.019)	(0.007)
Observations	218,584	218,584	218,584	218,584	218,584	218,584	218,584	218,584
R-Squared	0.07	0.01	0.00	0.00	0.01	0.01	0.01	0.01
Mean of Dep. Var.	0.44	0.08	0.00	0.01	0.01	0.01	0.01	0.01
D: Prime-Aged Men								
Roads Built	-0.02	0.00	0.00	0.01	0.00	-0.01	0.04	0.03**
	(0.032)	(0.006)	(0.003)	(0.005)	(0.005)	(0.015)	(0.041)	(0.016)
Observations	216,355	216,355	216,355	216,355	216,355	216,355	216,355	216,355
R-Squared	0.07	0.00	0.00	0.00	0.01	0.01	0.03	0.06
Mean of Dep. Var.	0.58	0.01	0.00	0.01	0.01	0.04	0.07	0.06

Standard errors in parentheses, clustered at the district level. ***, **, * indicate significance at 1, 5 and 10%.

All specifications have time and district fixed effects, and household-level controls. Mean of Roads Built: 0.052

Table 6. Impact of Road Construction on Technology Adoption in Agriculture, 2001-2007

	All Crops	Cash Crops	Food Crops
Area under Fertilizer			
Post-period Dummy	-43.17	1,583.61***	-678.47
	(391.82)	(605.78)	(555.69)
Post * Roads Built	10,266.18***	-2,162.47	17,944.83***
	(2524.90)	(2467.75)	(3990.16)
Baseline Mean	22,281.36	7,901.07	13,936.63
Baseline Std. Dev	76,771.20	32,036.28	44,764.57
Area under Hybrid Seeds			
Post-period Dummy	692.33	1,572.23***	282.12
	(463.56)	(581.45)	(675.55)
Post * Roads Built	6,056.85**	-2,709.28	13,067.63***
	(2372.22)	(2266.51)	(3740.42)
Baseline Mean	20,187.12	6,670.74	12,905.33
Baseline Std. Dev	76,794.03	27,471.54	46,340.40
N	19,087	6,666	12,421

Clustered standard errors in parentheses. ***, **, * indicate significance at 1, 5 and 10%
Includes district fixed effects and district-level covariates
Mean of roads built over the analysis period is 0.068

Table 7. Impact of Road Construction on Consumption Basket

Panel A: Baseline & Endline Only	Impacts by Item Type											
	Food							Non-Food				
	Cereal	Lentils	Dairy	Meat	Vegetables	Fruit	Processed Food	Contraceptives	Minor Manufactures	Road Fares	Non-road Fares	Vehicles
Post Dummy	0.60***	0.52***	0.05***	0.06***	0.75***	0.06*	0.44***	0.02***	0.30***	0.17***	0.01***	0.06***
	(0.04)	(0.04)	(0.01)	(0.02)	(0.11)	(0.03)	(0.05)	(0.01)	(0.03)	(0.02)	(0.00)	(0.01)
Post * Roads Built	-0.58***	-0.36**	0.14**	0.10	0.03	0.27	0.26	0.18***	0.43***	0.28***	0.01	0.20***
	(0.17)	(0.18)	(0.06)	(0.11)	(0.45)	(0.17)	(0.26)	(0.05)	(0.14)	(0.10)	(0.02)	(0.05)
Observations	93,266	93,266	93,266	93,266	93,266	93,266	93,266	93,266	93,266	93,266	93,266	93,266
R-Squared	0.09	0.08	0.04	0.04	0.07	0.05	0.07	0.02	0.06	0.04	0.00	0.05
Mean of Dep. Var.	2.82	2.77	0.89	1.47	10.01	1.66	2.07	0.07	1.30	0.81	0.04	0.36
Std Dev of Dep. Var.	1.33	1.59	0.71	1.29	3.48	1.31	1.55	0.26	0.91	0.64	0.19	0.48
Panel B: Entire Sample Period												
Roads Built	-0.36***	-0.35**	0.10**	0.04	-0.22	0.40***	0.37*	0.17***	0.36***	0.29***	0.02	0.18***
	(0.13)	(0.15)	(0.05)	(0.08)	(0.34)	(0.14)	(0.22)	(0.04)	(0.13)	(0.08)	(0.02)	(0.05)
Observations	269,572	269,572	269,572	269,572	269,572	269,572	269,572	269,572	269,572	269,572	269,572	269,572
R-Squared	0.07	0.08	0.04	0.04	0.08	0.07	0.11	0.02	0.05	0.03	0.00	0.05
Mean of Dep. Var.	2.82	2.77	0.89	1.47	10.01	1.66	2.07	0.07	1.30	0.81	0.04	0.36
Std Dev of Dep. Var.	1.33	1.59	0.71	1.29	3.48	1.31	1.55	0.26	0.91	0.64	0.19	0.48

Notes:

Standard errors in parentheses, clustered at the district level.

***, **, * indicate significance at 1, 5 and 10%

All specifications have time and district fixed effects, and household-level controls

Mean of % Connected is 0.154 for Panel A, and 0.081 for Panel B

The dependent variable is the number of surveyed goods in each category that are consumed by the household

Table 8. Impact of Road Construction on Quantities Consumed

Panel A: Baseline & Endline Only	Impacts by Item Type						
	Food						
	Cereal	Lentils	Dairy	Meat	Vegetables	Fruit	Processed Food
Post Dummy	14.24***	15.88***	11.35***	10.10***	14.91***	7.04***	11.02***
	(0.30)	(0.49)	(0.32)	(0.43)	(0.28)	(0.41)	(0.57)
Post * Roads Built	4.56***	5.66***	-3.99***	5.47***	-4.69***	4.07**	0.08
	(1.39)	(2.18)	(1.46)	(2.03)	(1.13)	(1.79)	(2.30)
Observations	94,551	94,551	94,551	94,551	94,551	94,551	94,551
R-Squared	0.10	0.22	0.18	0.10	0.50	0.04	0.01
Mean of Dep. Var.	0.30	0.56	0.31	0.58	0.40	0.90	0.68
Std Dev of Dep. Var.	0.96	1.07	1.02	1.14	0.70	1.37	1.25
Panel B: Entire Sample Period							
Roads Built	3.81***	2.92	-20.17	3.65**	-3.67***	0.90	-3.35
	(1.12)	(1.96)	(17.07)	(1.69)	(1.30)	(5.92)	(18.68)
Observations	269,572	269,572	269,572	269,572	269,572	269,572	269,572
R-Squared	0.16	0.10	0.00	0.05	0.06	0.01	0.00
Mean of Dep. Var.	0.30	0.56	0.31	0.58	0.40	0.90	0.68
Std Dev of Dep. Var.	0.96	1.07	1.02	1.14	0.70	1.37	1.25

Notes:

Standard errors in parentheses, clustered at the district level.

***, **, * indicate significance at 1, 5 and 10%

All specifications have time and district fixed effects, and household-level controls

Mean of % Connected is 0.154 for Panel A, and 0.081 for Panel B

The dependent variable is the weighted mean of the z-score of quantity consumed

The weights are given by the share of each commodity in the median household's budget in each district in the baseline year

Table 9: Placebo Test - Program Roads on 1993-1999 Outcomes

	Enrollment		Employment		
	5-14	14-20	14-20	Adult Men	Adult Women
Post Dummy	0.03***	0.03**	-0.05***	-0.01	-0.02
	(0.01)	(0.01)	(0.01)	(0.00)	(0.02)
Post * Roads Built	-0.04	-0.07	0.06	0	0.08
	(0.05)	(0.06)	(0.07)	(0.02)	(0.07)
Observations	145,440	88,325	46,213	74,607	75,373
R-Squared	0.01	0.00	0.01	0.01	0.02
Baseline mean	0.69	0.36	0.39	0.95	0.47

Notes:

Standard errors in parentheses, clustered at the district level.

***, **, * indicate significance at 1, 5 and 10%

All specifications have time and district fixed effects, and household-level controls

Table 10: Placebo Test - Program Roads on 1993-1999 Outcomes

	Impacts by Item Type											
	Food							Non-Food				
	Cereal	Lentils	Dairy	Meat	Vegetables	Fruit	Processed Food	Contraception	Minor Manufactures	Road Fares	Non-road Fares	Vehicles
Post Dummy	0.47***	0.23***	0.05***	-0.59***	1.15***	0.30***	0.26***	0.00	0.04	-0.01	0.01**	0.04***
	(0.04)	(0.04)	(0.01)	(0.03)	(0.10)	(0.03)	(0.03)	(0.01)	(0.03)	(0.01)	(0.01)	(0.01)
Post * Roads Built	-0.12	-0.07	0.05	0.14	1.40***	0.10	-0.17	-0.04	-0.21	0.02	-0.02	-0.02
	(0.18)	(0.16)	(0.05)	(0.15)	(0.43)	(0.14)	(0.12)	(0.04)	(0.15)	(0.08)	(0.01)	(0.04)
Observations	95,134	95,134	95,134	95,134	95,134	95,134	95,134	95,134	95,134	95,134	95,134	95,134
R-Squared	0.04	0.02	0.04	0.06	0.07	0.04	0.03	0.00	0.01	0.01	0.00	0.00
Mean of Dep. Var.	2.43	2.51	0.81	1.95	8.45	1.28	0.65	0.08	1.28	0.78	0.03	0.34

Notes:

Standard errors in parentheses, clustered at the district level.

***, **, * indicate significance at 1, 5 and 10%

All specifications have time and district fixed effects, and household-level controls

The dependent variable is the number of surveyed goods in each category that are consumed by the household

Table 12: Impact of Road Construction on Employment Location (location dummy = 1 for urban, 0 for rural)

	Overall	Impacts by Group			
		14-20 Boys	14-20 Girls	Prime-Age Men	Prime-Age Women
Post Dummy	0.02***	0.03*	0.00	0.03***	0.02*
	(0.007)	(0.014)	(0.021)	(0.008)	(0.008)
Post * Roads Built	0.13***	0.12	0.36**	0.14***	0.01
	(0.038)	(0.080)	(0.179)	(0.045)	(0.062)
Observations	134,860	9,787	3,106	50,853	13,271
R-Squared	0.01	0.01	0.02	0.01	0.00
Mean of Dep. Var.	0.13	0.16	0.07	0.16	0.06

Standard errors in parentheses, clustered at the district level.

***, **, * indicate significance at 1, 5 and 10%

All specifications have time and district fixed effects, and household-level controls

Table 12. Summary Statistics & Impact on Safe Delivery of Different Covariates

	Summary Statistics		Impact	
	Mean	SD	Estimate	SE
Total Live Births	2.94	2.05	-0.85	0.02
Total Pregnancies	3.15	2.17	-0.86	0.02
Age at Survey	31.49	8.61	-7.04	0.08
Any Schooling	0.47	0.50	0.25	0.01
Age at First Birth	19.78	3.19	1.06	0.04
Toilet at Home	0.32	0.47	0.10	0.01
Household has BPL Card	0.36	0.48	-0.05	0.01
Own House	0.96	0.19	0.00	0.00
Own Bicycle	0.50	0.50	0.01	0.01
Own Radio	0.26	0.44	-0.01	0.00
Own TV	0.28	0.45	0.00	0.00
Own Agricultural Land	0.66	0.47	0.01	0.00
Acres of Land	1.94	9.13	0.11	0.05
Own Cattle	0.61	0.49	0.01	0.00
Own Goats	0.25	0.43	-0.01	0.00
Own Poultry	0.23	0.42	-0.01	0.01
Wealth Quintile	2.78	1.31	0.48	0.02

Sample is limited to those women reporting at least 1 birth since 2004
The numbers under "Impact" are the betas and standard errorsfrom individual regressions of each of the covariates on the likelihood of safe delivery

Table 13. Impact of Road Construction on Access to Services

	Safe Delivery	Institutional Ante-natal Care	Transport Cost
Roads Built by Year of Delivery	0.19***	0.06**	-244.29**
	(0.042)	(0.027)	(117.858)
Total Live Births	0.01***	-0.04***	-16.77***
	(0.002)	(0.002)	(6.105)
Total Pregnancies	-0.02***	0.02***	-1.98
	(0.002)	(0.002)	(5.515)
Age at Survey	0	0	1.20
	(0.001)	(0.001)	(1.688)
Any Schooling	0.09***	0.11***	14.63*
	(0.003)	(0.004)	(8.524)
Age at First Birth	0.01***	0.01***	3.12
	(0.001)	(0.001)	(1.914)
Toilet at Home	0.04***	0.01***	-8.75
	(0.005)	(0.004)	(10.080)
Pucca House	0.02***	0	6.14
	(0.002)	(0.002)	(6.657)
Household has BPL Card	-0.01***	0	-7.85
	(0.003)	(0.003)	(9.163)
Own House	0	0	7.17
	(0.006)	(0.005)	(14.611)
Own Bicycle	0	0	-6.39
	(0.002)	(0.002)	(8.239)
Own Radio	0	0	-7.87
	(0.002)	(0.003)	(7.247)
Own TV	-0.01**	-0.01**	5.78
	(0.003)	(0.003)	(7.692)
Own Agricultural Land	0	0	11.32
	(0.002)	(0.003)	(9.168)
Acres of Land	0	0	0.32
	(0.001)	(0.001)	(0.265)
Own Cattle	0	0	-3.05
	(0.002)	(0.003)	(8.129)
Own Goats	0	0	10.44
	(0.002)	(0.003)	(9.528)
Own Poultry	0	0	-2.16
	(0.003)	(0.003)	(12.228)
Wealth Quintile	0.06***	0.05***	6.86
	(0.002)	(0.002)	(5.226)
Constant	-0.08***	0.39***	256.21***
	(0.013)	(0.014)	(42.431)
Observations	176,559	171,348	52,420
R-squared	0.103	0.083	0.003
Number of Districts	560	560	560
Baseline Mean	0.320	0.620	318.730
Baseline SD	0.470	0.480	703.290

Standard errors in parentheses. ***, **, * indicate significance at 1, 5 and 10%
Includes District, Year of Birth, and Month of Birth Fixed Effects
The mean of roads built by year of delivery is 0.058

Table 14. Impact of Road Construction on Quality of Care

	#IFC Supp (During ANC)	#IFC Supp (All Sources)	Any IFC Supp (During ANC)	Any IFC Supp (All Sources)	Any Checkup	All Checkup	Delivery Complications	Tetanus Shot	Timely Checkup
Roads Built by Year of Delivery	6.66**	2.90	0.08**	0.13***	0.06***	-0.15	-0.04**	0.06**	0.11***
	(3.182)	(3.750)	(0.033)	(0.028)	(0.018)	(0.195)	(0.020)	(0.028)	(0.034)
Total Live Births	2.41***	-1.11***	0.04***	0	0.01***	0.12***	0	-0.04***	-0.03***
	(0.344)	(0.356)	(0.003)	(0.002)	(0.002)	(0.021)	(0.002)	(0.002)	(0.002)
Total Pregnancies	-2.62***	0.37	-0.04***	0	-0.01***	-0.19***	0	0.02***	0.02***
	(0.325)	(0.318)	(0.003)	(0.002)	(0.001)	(0.019)	(0.001)	(0.002)	(0.002)
Age at Survey	-0.45***	0.19***	-0.01***	0	0	-0.04***	-0.00**	0	0
	(0.052)	(0.068)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)
Any Schooling	9.50***	4.69***	0.11***	0.03***	0.01***	0.98***	0.01***	0.11***	0.08***
	(0.391)	(0.396)	(0.003)	(0.003)	(0.002)	(0.023)	(0.002)	(0.004)	(0.003)
Age at First Birth	1.34***	0.76***	0.01***	0	0	0.11***	0	0.01***	0.01***
	(0.082)	(0.092)	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.001)
Toilet at Home	4.35***	4.86***	0.02***	0.01***	0	0.41***	0	0.01**	0.03***
	(0.723)	(0.657)	(0.005)	(0.003)	(0.003)	(0.035)	(0.003)	(0.004)	(0.005)
Pucca House	0.10	0.96**	0	0	0	0.06***	0	0.00**	0.01***
	(0.341)	(0.389)	(0.002)	(0.002)	(0.002)	(0.017)	(0.002)	(0.002)	(0.003)
Household has BPL Card	-0.53	-1.53***	0.01**	0	0	-0.07***	0	0	-0.01***
	(0.371)	(0.381)	(0.003)	(0.002)	(0.002)	(0.018)	(0.002)	(0.003)	(0.003)
Own House	0.28	1.26*	0.01	0	0	0.05	0	0	0.01
	(0.851)	(0.711)	(0.006)	(0.005)	(0.004)	(0.036)	(0.005)	(0.006)	(0.006)
Own Bicycle	0.11	0.59	0	0	0	-0.01	0	0	0
	(0.353)	(0.402)	(0.003)	(0.002)	(0.002)	(0.016)	(0.002)	(0.002)	(0.003)
Own Radio	-0.51	-0.50	0	0	0	0.02	0	0	0
	(0.378)	(0.364)	(0.003)	(0.002)	(0.002)	(0.018)	(0.002)	(0.003)	(0.003)
Own TV	-0.28	0.11	0	0	0	-0.03**	0	-0.01***	0
	(0.395)	(0.423)	(0.003)	(0.002)	(0.002)	(0.017)	(0.002)	(0.003)	(0.003)
Own Agricultural Land	0.19	0.32	0	0	0	-0.01	0	0	0
	(0.426)	(0.391)	(0.002)	(0.002)	(0.002)	(0.017)	(0.002)	(0.003)	(0.003)
Acres of Land	0.01	0.01	0	0	0	0	0	0	0
	(0.014)	(0.019)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Own Cattle	0.46	0.07	0	0	0	0.02	0	0	0
	(0.348)	(0.398)	(0.002)	(0.002)	(0.002)	(0.016)	(0.002)	(0.002)	(0.002)
Own Goats	-0.48	-0.03	0	0	0	0	0	0	0
	(0.371)	(0.430)	(0.003)	(0.002)	(0.002)	(0.017)	(0.002)	(0.003)	(0.003)
Own Poultry	-0.27	-0.37	0	0	0	-0.03	0	0	0
	(0.628)	(0.613)	(0.003)	(0.002)	(0.003)	(0.023)	(0.003)	(0.003)	(0.004)
Wealth Quintile	4.60***	2.77***	0.05***	0.01***	0.01***	0.52***	0	0.05***	0.05***
	(0.237)	(0.245)	(0.002)	(0.001)	(0.001)	(0.017)	(0.001)	(0.002)	(0.002)
Constant	10.29***	24.48***	0.31***	0.81***	0.12***	0.43***	0.15***	0.45***	0.04***
	(1.998)	(1.932)	(0.013)	(0.011)	(0.008)	(0.086)	(0.009)	(0.013)	(0.013)
Observations	176,559	99,643	176,559	99,643	176,559	176,559	176,559	171,320	168,618
R-squared	0.028	0.020	0.059	0.005	0.004	0.143	0.001	0.082	0.066
Number of Districts	560	560	560	560	560	560	560	560	560
Baseline Mean	44.830	62.450	0.520	0.880	0.110	3.500	0.130	0.650	0.380
Baseline SD	81.250	60.310	0.500	0.320	0.310	3.900	0.330	0.480	0.490

Standard errors in parentheses. ***, **, * indicate significance at 1, 5 and 10%
Includes District, Year of Birth, and Month of Birth Fixed Effects
The mean of roads built by year of delivery is 0.058

Table 15. Changes in Care Quality for Existing ANC Users

	Safe Delivery	#IFC Supp (During ANC)	#IFC Supp (All Sources)	Any IFC Supp (During ANC)	Any IFC Supp (All Sources)	Any Checkup	All Checkup	Tetanus Shot
Roads Built by Year of Delivery	0.24***	3.22	1.66	0.03	0.09***	0.06**	-0.65***	0.03*
	(0.051)	(4.694)	(3.877)	(0.034)	(0.025)	(0.028)	(0.214)	(0.019)
Total Live Births	-0.05***	-1.70***	-1.20***	0	0	0.01**	-0.35***	0
	(0.003)	(0.495)	(0.370)	(0.003)	(0.002)	(0.002)	(0.019)	(0.001)
Total Pregnancies	0.02***	0.82*	0.40	0	0	-0.01***	0.17***	0
	(0.003)	(0.473)	(0.335)	(0.002)	(0.002)	(0.002)	(0.017)	(0.001)
Age at Survey	0	0.03	0.19***	0	0	0	0	0
	(0.001)	(0.094)	(0.073)	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)
Any Schooling	0.08***	6.30***	4.46***	0.05***	0.03***	-0.01***	0.78***	0.01***
	(0.004)	(0.563)	(0.415)	(0.004)	(0.003)	(0.003)	(0.026)	(0.001)
Age at First Birth	0.01***	0.91***	0.76***	0	0	0	0.06***	0
	(0.001)	(0.116)	(0.097)	(0.001)	(0.001)	(0.001)	(0.005)	(0.001)
Toilet at Home	0.04***	4.25***	4.87***	0.01***	0.01***	0	0.37***	0
	(0.005)	(0.915)	(0.672)	(0.004)	(0.003)	(0.004)	(0.035)	(0.001)
Pucca House	0.02***	-0.16	0.95**	-0.01***	0	0	0.03*	0
	(0.003)	(0.452)	(0.410)	(0.002)	(0.002)	(0.002)	(0.018)	(0.001)
Household has BPL Card	-0.01***	-0.62	-1.61***	0.01***	0	0	-0.09***	0
	(0.003)	(0.497)	(0.397)	(0.003)	(0.002)	(0.003)	(0.021)	(0.001)
Own House	0.01	0.45	1.40*	0.01	0	0	0.10**	0
	(0.007)	(1.124)	(0.734)	(0.005)	(0.005)	(0.006)	(0.040)	(0.003)
Own Bicycle	0	0.34	0.68	0	0	0	0	0
	(0.003)	(0.501)	(0.422)	(0.003)	(0.002)	(0.003)	(0.019)	(0.001)
Own Radio	0	-1.05*	-0.50	0	0	0	0.01	0
	(0.003)	(0.539)	(0.377)	(0.003)	(0.002)	(0.003)	(0.020)	(0.001)
Own TV	-0.01*	-0.03	0.04	0	0	0	-0.01	0
	(0.004)	(0.601)	(0.443)	(0.003)	(0.002)	(0.003)	(0.021)	(0.001)
Own Agricultural Land	0	0.74	0.36	0	0	0	0.02	0
	(0.003)	(0.631)	(0.410)	(0.003)	(0.002)	(0.003)	(0.020)	(0.001)
Acres of Land	0	0	0.02	0	0	0	0	0
	0.000	(0.018)	(0.021)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Own Cattle	0	0.91*	-0.02	0.01**	0	0.01**	0.04**	0
	(0.003)	(0.529)	(0.417)	(0.003)	(0.002)	(0.003)	(0.018)	(0.001)
Own Goats	0	-0.71	0.12	0	0	0	0	0
	(0.003)	(0.535)	(0.455)	(0.003)	(0.002)	(0.003)	(0.020)	(0.001)
Own Poultry	0	-0.34	-0.44	0	0	0	-0.02	0
	(0.004)	(0.820)	(0.637)	(0.003)	(0.002)	(0.004)	(0.025)	(0.002)
Wealth Quintile	0.06***	3.34***	2.92***	0.01***	0	-0.01***	0.47***	0.01***
	(0.002)	(0.292)	(0.258)	(0.002)	(0.001)	(0.002)	(0.014)	(0.001)
Constant	-0.02	32.67***	25.57***	0.69***	0.82***	0.25***	2.39***	0.94***
	(0.017)	(2.950)	(2.010)	(0.013)	(0.011)	(0.013)	(0.104)	(0.006)
Observations	108,670	108,670	93,287	108,670	93,287	108,670	108,670	108,652
R-squared	0.103	0.012	0.020	0.012	0.004	0.002	0.131	0.004
Number of Districts	560	560	560	560	560	560	560	560
Baseline Mean	0.460	70.910	64.110	0.810	0.890	0.170	5.630	0.970
Baseline SD	0.500	92.490	60.840	0.390	0.320	0.380	3.580	0.170

Standard errors in parentheses. ***, **, * indicate significance at 1, 5 and 10%
Includes District, Year of Birth, and Month of Birth Fixed Effects
The mean of roads built by year of delivery is 0.058

Table 16. Changes in Care Quality for Existing Safe Deliveries

	Timely Checkup	Delivery Complications	Transport Cost
Roads Built by Year of Delivery	-0.07	-0.03	-244.29**
	(0.045)	(0.034)	(117.858)
Total Live Births	-0.02***	-0.01***	-16.77***
	(0.004)	(0.003)	(6.105)
Total Pregnancies	0.01***	0.01***	-1.98
	(0.003)	(0.003)	(5.515)
Age at Survey	0	0	1.20
	(0.001)	(0.001)	(1.688)
Any Schooling	0.03***	0.01**	14.63*
	(0.005)	(0.004)	(8.524)
Age at First Birth	0	0	3.12
	(0.001)	(0.001)	(1.914)
Toilet at Home	0.01**	-0.01	-8.75
	(0.005)	(0.005)	(10.080)
Pucca House	0	0	6.14
	(0.003)	(0.003)	(6.657)
Household has BPL Card	-0.01	0.01**	-7.85
	(0.004)	(0.003)	(9.163)
Own House	0	-0.01	7.17
	(0.009)	(0.008)	(14.611)
Own Bicycle	0	0	-6.39
	(0.004)	(0.003)	(8.239)
Own Radio	0	0	-7.87
	(0.004)	(0.003)	(7.247)
Own TV	0.01	0	5.78
	(0.004)	(0.004)	(7.692)
Own Agricultural Land	0	0	11.32
	(0.004)	(0.003)	(9.168)
Acres of Land	0	0	0.32
	(0.001)	(0.001)	(0.265)
Own Cattle	0	0	-3.05
	(0.004)	(0.003)	(8.129)
Own Goats	0	0.01**	10.44
	(0.004)	(0.003)	(9.528)
Own Poultry	-0.01	-0.01	-2.16
	(0.005)	(0.004)	(12.228)
Wealth Quintile	0.02***	0	6.86
	(0.002)	(0.002)	(5.226)
Constant	0.63***	0.18***	256.21***
	(0.019)	(0.017)	(42.431)
Observations	62,221	63,404	52,420
R-squared	0.013	0.002	0.003
Number of Districts	560	560	560
Baseline Mean	0.810	0.140	318.730
Baseline SD	0.390	0.350	703.290

Standard errors in parentheses. ***, **, * indicate significance at 1, 5 and 10%
Includes District, Year of Birth, and Month of Birth Fixed Effects
The mean of roads built by year of delivery is 0.058

Table 17. Impact of Road Construction on Children's Immunization

	Vaccination Card	BCG	Polio	DPT	Measles	Vitamin A	Timely Polio
Roads Built by Year of Delivery	0.09***	0.12***	0.11***	0.12**	0.24***	0.16**	0.10**
	(0.032)	(0.041)	(0.039)	(0.047)	(0.062)	(0.065)	(0.040)
Total Live Births	-0.02***	-0.02***	-0.01***	-0.03***	-0.02***	-0.02***	-0.01**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Total Pregnancies	0	0	0	0	0	0	-0.01**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Age at Survey	0	0	0	0	0	0	0
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Any Schooling	0.08***	0.07***	0.03***	0.08***	0.08***	0.08***	0.04***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Age at First Birth	0	0	0	0	0	0	0
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Toilet at Home	-0.01***	-0.01**	0.01*	-0.01**	0	0	0.01**
	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.006)
Pucca House	0	0	0.01***	0	0	0	0
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Household has BPL Card	0.01***	0.01***	0	0.01***	0	0	0
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
Own House	0	-0.01***	0	-0.02***	-0.01**	-0.01	0.01
	(0.005)	(0.005)	(0.004)	(0.005)	(0.006)	(0.006)	(0.009)
Own Bicycle	0	0.01**	0	0.01***	0	0	0
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
Own Radio	0	0	0.01**	0	0	0	0.00
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)
Own TV	0	0	0	0	0	0	0
	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)
Own Agricultural Land	0	0	0	0	0	0	0
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
Acres of Land	0	0	0	0	0	0	0
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Own Cattle	0	0	0	0	0	0	0.01**
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
Own Goats	0.01*	0	0	0	0	0	0
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.004)
Own Poultry	0	0	0	0	0	0	0
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)
Wealth Quintile	0.04***	0.03***	0.01***	0.04***	0.04***	0.04***	0.03***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Girl Child	-0.01***	-0.02***	0	-0.02***	-0.02***	-0.01***	-0.01***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Constant	0.60***	0.71***	0.81***	0.64***	0.62***	0.49***	0.44***
	(0.013)	(0.012)	(0.011)	(0.013)	(0.014)	(0.014)	(0.017)
Observations	212,477	212,500	212,500	212,500	212,500	212,500	109,234
R-squared	0.060	0.068	0.038	0.105	0.241	0.176	0.018
Number of Districts	560	560	560	560	560	560	560
Baseline Mean	0.730	0.800	0.870	0.740	0.660	0.570	0.580
Baseline SD	0.450	0.400	0.340	0.440	0.470	0.500	0.490

Standard errors in parentheses. ***, **, * indicate significance at 1, 5 and 10%
Includes District, Year of Birth, and Month of Birth Fixed Effects
The mean of roads built by year of delivery is 0.058

Table 18. Changes in Treatment Seeking for Other Diseases

	Incidence		Treatment	
	Diarrhea	Fever	Diarrhea	Fever
Roads Built by Year of Survey	-0.03	0.06	-0.03	0.06
	(0.037)	(0.044)	(0.077)	(0.060)
Roads at Baseline	-0.03	0.03	0.06	0.13***
	(0.027)	(0.028)	(0.044)	(0.038)
Total Live Births	-0.02***	-0.03***	-0.01***	-0.01**
	(0.002)	(0.002)	(0.006)	(0.004)
Total Pregnancies	0.02***	0.02***	0.01***	0.00
	(0.002)	(0.002)	(0.005)	(0.004)
Age at Survey	0	0	0	0
	(0.001)	(0.001)	(0.001)	(0.001)
Any Schooling	0.01***	0.01***	0.02***	0.02***
	(0.002)	(0.003)	(0.007)	(0.006)
Age at First Birth	0	0	0	0
	(0.001)	(0.001)	(0.002)	(0.001)
Toilet at Home	0	0.02***	0	0.02**
	(0.003)	(0.005)	(0.011)	(0.008)
Pucca House	0	0	0.01	0.01
	(0.002)	(0.002)	(0.006)	(0.005)
Household has BPL Card	0	0	0.01	0
	(0.002)	(0.002)	(0.007)	(0.005)
Own House	-0.01**	0	0.02	-0.01
	(0.004)	(0.006)	(0.017)	(0.013)
Own Bicycle	0	-0.01*	-0.02**	-0.01
	(0.002)	(0.003)	(0.007)	(0.006)
Own Radio	0	0	0.01	0.01
	(0.002)	(0.003)	(0.008)	(0.006)
Own TV	0	0	0.01	0
	(0.002)	(0.003)	(0.008)	(0.006)
Own Agricultural Land	0	0	0.01	0.01*
	(0.002)	(0.003)	(0.008)	(0.006)
Acres of Land	0	0	0	0
	(0.001)	(0.001)	(0.001)	(0.001)
Own Cattle	0	0	0	-0.02***
	(0.002)	(0.002)	(0.007)	(0.005)
Own Goats	0.01**	0.01*	0.01	0.01
	(0.003)	(0.003)	(0.008)	(0.006)
Own Poultry	0	-0.01	0	0
	(0.002)	(0.004)	(0.010)	(0.008)
Wealth Quintile	-0.01***	-0.01***	0.02***	0.03***
	(0.001)	(0.002)	(0.004)	(0.003)
Child is Female	-0.01***	-0.01***	-0.03***	-0.03***
	(0.001)	(0.002)	(0.006)	(0.005)
Constant	0.40***	0.62***	0.48***	0.07
	(0.036)	(0.050)	(0.090)	(0.056)
Observations	206,595	206,595	24,734	42,492
R-squared	0.020	0.016	0.017	0.024
Number of States	26	26	26	26
Baseline Mean	0.080	0.170	0.680	0.690
Baseline SD	0.270	0.370	0.470	0.460

Standard errors in parentheses. ***, **, * indicate significance at 1, 5 and 10%
Includes District, Year of Birth, and Month of Birth Fixed Effects
The mean of roads built by survey date is 0.082

Table 19. Participation in Other Health Programs

	Blindness	Malaria	Tuberculosis	Leprosy	Others
Roads Built by Year of Survey	0.02*	0.02	0.01**	0	0.09
	(0.008)	(0.052)	(0.004)	(0.004)	(0.088)
Roads at Baseline	0.01**	0.02	0	0	0.05
	(0.005)	(0.040)	(0.003)	(0.002)	(0.042)
Toilet at Home	0	0	0	0	0
	(0.001)	(0.003)	(0.001)	0.000	(0.006)
Pucca House	0	0	0	0	0
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Household has BPL Card	0	-0.01***	0	0	0
	(0.001)	(0.003)	(0.001)	(0.001)	(0.002)
Own House	0	-0.01	0	0	0.02***
	(0.001)	(0.006)	(0.001)	(0.001)	(0.006)
Own Bicycle	0	0.01***	0	0	0.02***
	(0.001)	(0.005)	(0.001)	(0.001)	(0.004)
Own Radio	0.00***	0.02***	0	0	0
	(0.001)	(0.004)	(0.001)	(0.001)	(0.002)
Own TV	0	-0.01***	0	0	-0.01**
	(0.001)	(0.003)	(0.001)	(0.001)	(0.005)
Own Agricultural Land	0	0.02***	0	0	0
	(0.001)	(0.005)	(0.001)	(0.001)	(0.003)
Acres of Land	0	0	0	0	0
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Own Cattle	0	0	0	0	0.01*
	(0.001)	(0.005)	(0.001)	(0.001)	(0.003)
Own Goats	0	0.01***	0	0	0
	(0.001)	(0.003)	(0.001)	(0.001)	(0.003)
Own Poultry	0	0.03***	0	0	-0.04***
	(0.001)	(0.006)	(0.001)	(0.001)	(0.007)
Wealth Quintile	0	0	0	0	0
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Constant	-0.01	0.11***	0	0	0.04
	(0.007)	(0.042)	(0.004)	(0.003)	(0.065)
Observations	407,796	407,796	407,796	407,796	407,796
R-squared	0.001	0.010	0	0	0.010
Number of States	26	26	26	26	26
Baseline Mean	0.030	0.100	0.010	0	0.120
Baseline SD	0.180	0.300	0.100	0.060	0.320

Standard errors in parentheses. ***, **, * indicate significance at 1, 5 and 10%
Includes District, Year of Birth, and Month of Birth Fixed Effects
The mean of roads built by survey date is 0.082

Table 20. Substitution between Private and Public Providers

	Unconditional		Conditional	
	Pvt Hospital Delivery	Pvt Ante-natal care	Pvt Hospital Delivery	Pvt Ante-natal care
Roads Built by Year of Delivery	-0.10***	-0.06***	-0.30***	-0.09***
	(0.017)	(0.019)	(0.067)	(0.032)
Total Live Births	-0.03***	-0.04***	-0.04***	-0.04***
	(0.002)	(0.002)	(0.004)	(0.003)
Total Pregnancies	0.02***	0.02***	0.02***	0.03***
	(0.002)	(0.002)	(0.003)	(0.003)
Age at Survey	0	0	0	0
	(0.001)	(0.001)	(0.001)	(0.001)
Any Schooling	0.04***	0.08***	0.02***	0.06***
	(0.003)	(0.003)	(0.005)	(0.004)
Age at First Birth	0.01***	0.01***	0.00***	0.01***
	(0.001)	(0.001)	(0.001)	(0.001)
Toilet at Home	0.05***	0.06***	0.04***	0.06***
	(0.004)	(0.005)	(0.006)	(0.006)
Pucca House	0.02***	0.01***	0.02***	0.01***
	(0.002)	(0.002)	(0.004)	(0.003)
Household has BPL Card	-0.02***	-0.03***	-0.04***	-0.04***
	(0.002)	(0.002)	(0.004)	(0.003)
Own House	0	-0.01	-0.01	-0.01
	(0.004)	(0.005)	(0.009)	(0.006)
Own Bicycle	0	0	0	0
	(0.002)	(0.002)	(0.004)	(0.003)
Own Radio	0	0	0.01*	0.01**
	(0.002)	(0.002)	(0.004)	(0.003)
Own TV	0	-0.01***	0	-0.01**
	(0.002)	(0.002)	(0.004)	(0.003)
Own Agricultural Land	0	0	0.01*	0
	(0.002)	(0.002)	(0.004)	(0.003)
Acres of Land	0	0	0	0
	(0.001)	(0.001)	(0.001)	(0.001)
Own Cattle	0	0	0	0
	(0.002)	(0.002)	(0.004)	(0.003)
Own Goats	0	0	0	0
	(0.002)	(0.002)	(0.004)	(0.003)
Own Poultry	0	0	0	0
	(0.002)	(0.003)	(0.005)	(0.004)
Wealth Quintile	0.04***	0.05***	0.05***	0.06***
	(0.002)	(0.002)	(0.003)	(0.002)
Constant	-0.14***	-0.07***	0.08***	0.03**
	(0.011)	(0.011)	(0.021)	(0.015)
Observations	171,317	171,317	63,404	108,653
R-squared	0.072	0.087	0.057	0.072
Number of Districts	560	560	560	560
Baseline Mean	0.140	0.220	0.420	0.350
Baseline SD	0.340	0.410	0.490	0.480

Standard errors in parentheses. ***, **, * indicate significance at 1, 5 and 10%
Includes District, Year of Birth, and Month of Birth Fixed Effects
The mean of roads built by year of delivery is 0.058

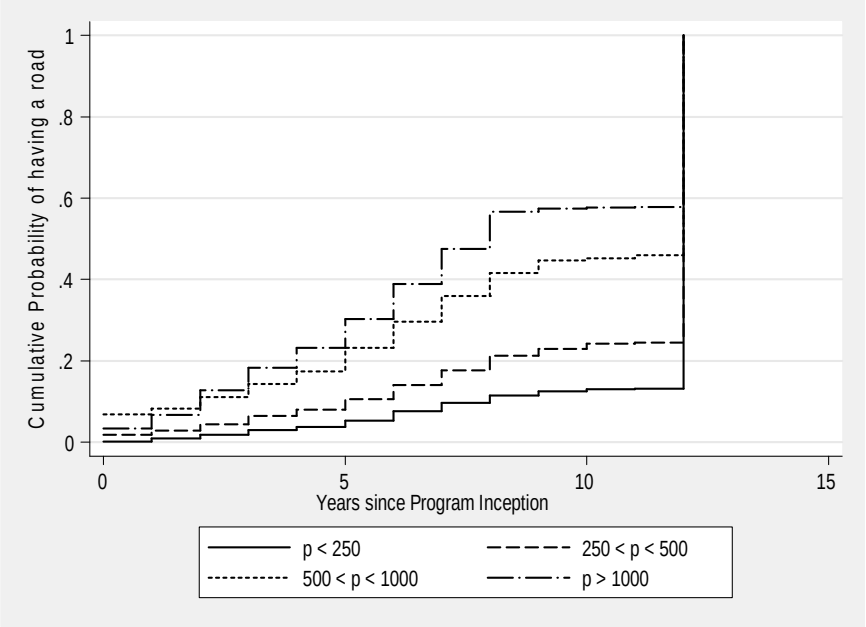
Table 21. Changes in Pre-period Access using Program Roads

	Safe Delivery	Institutional ANC
Roads Built by Year of Survey	-0.11	0.11
	(0.087)	(0.089)
Total Live Births	-0.06***	-0.05***
	(0.005)	(0.005)
Total Pregnancies	0.03***	0.03***
	(0.004)	(0.004)
Age at Survey	0.01	0.00
	(0.004)	(0.005)
Any Schooling	-0.12***	-0.15***
	(0.005)	(0.006)
Age at First Birth	0.00	0.00
	(0.004)	(0.005)
Toilet at Home	0.10***	0.07***
	(0.006)	(0.007)
Pucca House	0.05***	0.06***
	(0.003)	(0.004)
Constant	0.18***	0.67***
	(0.044)	(0.053)
		0.00
Observations	46,309	46,282
R-squared	0.076	0.063
Number of Districts	564	564
Baseline Mean	0.210	0.540
Baseline SD	0.410	0.500

Standard errors in parentheses. ***, **, * indicate significance at
Includes District, Year of Birth, and Month of Birth Fixed Effects

Appendix

A.1 CDF of Connectivity



- 12 years since program inception corresponds to being unconnected at the time this data was collected.
- This graph is based on all-India data, and does not account for state-wise differences in program implementation.

A.2 Village-level Observables at Baseline

Table A1: Summary Statistics of Connected & Unconnected Villages

Observables	Means		p value
	Connected	Unconnected	Connected = Unconnected
Total Population	929.20	625.70	0.01***
	(2345.04)	(864.47)	
SC Population	0.32	0.37	0.01***
	(3.69)	(0.81)	
Panchayat HQ	0.19	0.08	0.01***
	(0.39)	(0.27)	
Primary School	0.88	0.79	0.01***
	(0.32)	(0.41)	
High School	0.07	0.03	0.01***
	(0.26)	(0.17)	
Adult Literacy Center	0.16	0.08	0.01***
	(0.36)	(0.28)	
Primary Health Center	0.09	0.03	0.01***
	(0.29)	(0.18)	
Maternal & Child Welfare Center	0.11	0.06	0.01***
	(0.31)	(0.24)	
Commercial Bank	0.13	0.05	0.01***
	(0.33)	(0.22)	
Post Office	0.52	0.23	0.01***
	(0.71)	(0.49)	
Telegraph	0.05	0.01	0.01***
	(0.24)	(0.11)	
Telephone	0.53	0.26	0.01***
	(0.50)	(0.44)	
Power Supply	0.90	0.71	0.01***
	(0.30)	(0.46)	
Distance from Town	20.78	25.29	0.01***
	(21.45)	(27.31)	
Observations	477,917	280,210	

Standard deviations in parentheses.

A.3 Consumption during Monsoon

Table A3. Impact on Consumption Basket during Monsoon

	Cereal	Lentils	Dairy	Meat	Vegetables	Fruit	Processed Food
Monsoon Dummy	0.00	0.00	0.00	-0.01***	-0.01***	-0.01***	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Roads Built * Monsoon Dummy	0.01	0.01	0.01*	0.04***	0.02*	0.04***	0.02*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Roads Built	-0.01	-0.03**	0.02*	-0.01	-0.02	0.02**	0.03*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Observations	232,772	232,772	232,772	232,772	232,772	232,772	232,772
R-Squared	0.07	0.07	0.04	0.04	0.07	0.07	0.10
Mean of Dep. Var.	0.14	0.22	0.15	0.20	0.34	0.10	0.14

Standard errors in parentheses, clustered at the district level.

***, **, * indicate significance at 1, 5 and 10%

All specifications have time and district fixed effects, and household-level controls

Mean of % Connected Post-Program: 0.081