UNIVERSITY OF CALIFORNIA
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# Examining Development Outcomes Differentiated by Social Constructs

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by

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# ABSTRACT OF THE DISSERTATION

Examining Development Outcomes Differentiated by Social Constructs

by

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Dr. Anil Deolalikar , Chairperson

The first chapter of my dissertation analyzes Affirmative Action in higher education in India to investigate whether making access to college easier can incentivize underprivileged students in the target group to remain in school. I use a difference-in-difference strategy and find a direct effect of the policy on college enrollments and high-school completion. Using an instrumental variable (IV) strategy wherein I instrument increased access to college with this exogenous policy shock, I am able to establish a casual pathway from increase in college access to increase in school enrollments.

The second chapter presents an analytical framework that can represent Adaptive Preferences, a class of Endogenous Preferences that are dependent on the feasible opportunity set. The model is developed using an expected utility framework that assigns 'utility' to pairs of opportunity sets and preference orderings. It is then possible to show under what conditions an individual will choose to adapt (or un-adapt)their preferences. Parallel to the model I present a case study of Gendered Preferences as a case of Adaptive Preferences.

In the third chapter, which is part of a joint project with Joseph Cummins, William

Dow, and Nicholas Wilson, we analyze data from Demographic Health Surveys (DHS) in 30 Sub Saharan African (SSA) countries for the period 1986-2011 to estimate the relationship between individual fertility decisions and regional aggregates of infant mortality rate (IMR). We find evidence that regional aggregates of infant mortality have a lagged relationship to household fertility decisions. A decrease in infant mortality in a region is associated with a decline in the probability of birth for an individual woman.

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## Abstract

This paper analyzes Affirmative Action in higher education to investigate whether making access to college easier can incentivize underprivileged students in the target group to remain in school. In 2006, the central government in India passed the legislation for a 27 percent quota for a disadvantaged caste-group – the Other Backward Classes (OBC) – in all central government funded colleges. I use a difference-in-difference strategy to find a direct effect of the policy on college enrollments and high-school completion. Results reveal that the college enrollment rate for the OBC increased by 5.1 percentage points more than the other disadvantaged caste group unaffected by the policy (Scheduled Castes). Moreover, there is a significant differential increase of 4.1 percentage points in high-school completion rate for the OBC as compared to the Scheduled Castes. Dividing the OBC households by education of the household head as proxy for socioeconomic status (SES), I find that the policy impact on college enrollments is larger for OBC students from lower SES strata. Using an instrumental variable (IV) strategy wherein I instrument increased access to college with this exogenous policy shock, I find that 10 percentage points increase in college enrollment rate increases enrollment rates in school by 7 percentage points for 15-17 year olds and by 5 percentage points for 13-15 year olds.

## 1.1 Introduction

Affirmative Action is a class of policy measures aimed at alleviating rigid socioeconomic inequalities created by historical discrimination and marginalization. These imbalances are addressed by providing easier access to certain sectors like higher education, labor markets, civil services, and political ranks. Many countries, including the United States, India, Malaysia, Brazil, and South Africa, have implemented some form of Affirmative Action to correct for a legacy of oppression. Affirmative Action in India is based on castes wherein a fixed quota of seats is reserved for disadvantaged castes[1] in public institutes of higher education, public sector jobs, and elected assemblies. These policies of compensatory discrimination are controversial and highly debated, drawing fervent support as well as criticism, and yet continue to be implemented for the past 70 years. This calls for a closer examination of impacts to investigate whether these policies have been successful in improving social, economic, and educational outcomes for the underprivileged castes. A recent extension of affirmative action to another disadvantaged group of castes – Other Backward Classes (OBC) – presents an opportunity to examine whether the resulting increase in access to higher education can create incentives for students from these targeted underprivileged castes to remain in school and therefore qualify for college admissions.

In 2006, the central government passed a legislation that provides for a 27 percent quota in admissions for the Other Backward Classes(OBC) in all Central Educational Institutions (CEI), which include all higher education institutes or universities established, maintained, or aided by the central government[2]. This was done to bring high-ranking central universities, and premier colleges of technical and medical education funded by the central government – such as the Indian Institutes of Technology (IITs), All India Institute for Medical Sciences (AIIMS), and Indian Institutes of Management (IIMs) – under the ambit of affirmative action for the OBC[3]. I exploit this exogenous policy shock in access to higher education for

[1] In India, these policies are locally referred to as "Reservations". Reservations do not imply that beneficiaries are excluded from open competition for non-reserved jobs

[2] The Central Educational Institutions (Reservation in Admission) Act, 2006

[3] This information is drawn from annual rankings of higher education institutes in India published by Indian news-weeklies such as *India Today*, *The Outlook*, and *The Week*. There was no official or formal

the Other Backward Classes (OBC) to estimate the textitdownstream or *pull* effect this can have on enrollments and completion at earlier schooling levels.

A policy that provides easier access to premier institutes of higher education can effect substantial gains in educational outcomes for the targeted group[4]. In India, admission into a government funded (public) college – central or state – guarantees subsidized tuition and a chance at procuring need-based financial aid. An affirmative action policy that allows for preferential admission into premier public colleges implies a lower cost of entry to college along with perceived higher returns in the labor market in future [5]. This effectively changes the opportunity set available to the disadvantaged groups. A shift in students' perceived ability to secure admission in college as a result of the implemented quota can have a behavioral response along two margins – a *direct* effect on the targeted group of students entering college reflected in an increase in college enrollments, as well as a *spillover* effect on students who plan to go to college in the future reflected as an increase in school enrollments and high-school completion. Given the evidence for inter-generational transmission of education, both of these effects could persist well into the future and thereby transform the society into a more egalitarian one in the long run.

I use two distinct empirical strategies to flesh out the impact of increased access to college on school enrollments – especially at secondary and higher secondary (high-school) levels [6]. The first strategy is a reduced form difference-in-difference estimation that gives the differential increase in college enrollment and high school completion for the OBC due to the affirmative action policy as compared to other underprivileged social group (Scheduled castes) and non-beneficiary groups (Others). I find that college enrollments for OBC increased by 5.1 percentage points more than the Scheduled Castes (SC), and high school completion rates increased by 4.1 percentage points more than SC. When both SC

ranking of higher education institutes in India prior to 2016. The Ministry of Human Resource Development (MHRD) now publishes an Annual ranking (https://www.nirfindia.org/Home)

[4]The low-ranked castes were historically deprived of educational benefits, economic opportunities, and political positions of power, and remained socioeconomically backward.

[5]Azam (2010) finds that in India, the wage premium between tertiary and secondary graduates has been increasing and that the increase is biased toward younger age-groups.

[6]I use four rounds of the Employment-Unemployment Survey of the National Sample Surveys (NSS) in India

and the non-beneficiary group are included in the control group, the differential increase in college enrollment and high-school completion for OBC is smaller but still significant. There is heterogeneity in the policy effects by sex and location of the household (urban or rural) – the largest effect on college enrollment is observed among male students from urban households, whereas the largest effect on high-school completion is observed among female students from urban households. There are different impacts by socioeconomic status (SES) as well[7] – the largest effect of the policy on college enrollments for the OBC is observed in the lowest SES group. *This result challenges the common argument against affirmative action that the benefits are most likely captured by students from high SES households* [8]

The second strategy is an instrumental variable (IV) approach that estimates the effect of increased access to college on school enrollments for different age groups, using the policy shock as an instrument for increase in college access. The IV strategy allows me to identify the channel through which affirmative action in higher education can improve schooling outcomes for the beneficiaries – the *"pull" effect*. Results show that a 10 percentage points increase in college enrollments for a given social group increases school enrollments by 6.98 percentage points for 15-17 year olds, and by 5.2 percentage points for 13-15 year olds. There are no significant changes in school enrollments for younger students (6-13 year olds), suggesting that these students are still too young to be affected by future access to higher education.

The impacts identified in this paper can be seen as contributing along a certain margin to the broader discussion on the political economy of affirmative action. Affirmative action policies change the opportunities available to underprivileged groups and this paper provides evidence that on an average, students from these targeted groups are able to utilize these opportunities. It is the first to investigate the pan-India impact of the OBC quota implemented in Central Educational Institutions (CEI) on the educational outcomes of the intended beneficiaries. The primary contribution of this paper is establishing that there are possible *spillovers* from affirmative action in college admissions that simultaneously improve

[7] Education of household head serves as proxy for SES

[8] As of 2012, about 39 percent of students enrolled in college are from households of the lowest SES

enrollments in school and high-school completion for the beneficiary group. It is essential to recognize the possibility of such spillovers (or unintended effects) from affirmative action in a discussion of policies targeting educational attainment of minorities/underprivileged groups.

## 1.2 Background and Literature

### 1.2.1 Caste-based hierarchies and Affirmative Action in India

The Caste system is 'sui generis' of the social structure in India and of Hindus in particular. Castes are endogamous groups associated with a traditional occupation and were ranked by ritual purity which followed from their traditional occupation (De Zwart, 2000). Caste identity supersedes individual identity – members of a caste share its rank in the hierarchy irrespective of whether they choose to follow the traditional occupation of their caste. Per ancient Hindu scriptures (Vedas), these different castes are broadly classified into four categories or Varnas, which in order of their rank are as follows: Brahmin (priest and teacher), Kshatriya (ruler and warrior), Vaishya (trader), and Shudra (workers). There was an even lower group of castes considered to be outside of the Varnas and treated as 'untouchables' (referred to as 'dalits'). Members of indigenous tribes (referred to as 'adivasis') were also considered out of the Varna classification and of the lowest status in society. Considered to be impure or less pure, the 'dalits', 'adivasis', and the low-ranked 'Shudra' castes, were deprived of educational benefits, economic opportunities, and political positions of power. Perpetuated by religious sanctions this oppressive hierarchy persisted for centuries and as a result, members of the low-ranked castes remained socioeconomically disadvantaged.

After independence from the British Rule, political leaders in India acted to implement affirmative action policies in favor of the most disadvantaged social groups, the 'dalits' and 'adivasis'. A list of these groups was drawn and enumerated in two separate schedules of the Constitution of India – Schedule of Castes (Dalits), and Schedule of Tribes (Adivasis) – and the two groups are now referred to as Scheduled Castes (SC) and Scheduled Tribes (ST) respectively. India was the first country to enact legislation for affirmative action in

the form of group-based reservation of seats in public colleges, public sector jobs, and later even in elected assemblies, for the Scheduled Castes and the Scheduled Tribes. This was done with the objective of weakening the monopoly of upper castes in higher education, bureaucracy (civil services), political positions of power, and over economic resource.

These constitutionally guaranteed quotas were instituted according to the share of these groups in the population. In all colleges and jobs funded by the Central Government, 7.5 percent of seats are reserved for the ST and 15 percent of seats are reserved for the SC; in colleges and jobs funded by the different State Governments, the percentage of seats reserved for ST and SC depend on the approximate proportions of these groups in each state [9].

### 1.2.2 Affirmative Action for the Other Backward Categories (OBC)

The Constitution of India prohibits discrimination against *socially, educationally, and economically backward classes* but there were no affirmative action policies enacted for this group, mainly because at the time of ratifying the Constitution this group had not been clearly identified. Over time, the government set up two exploratory commissions to determine the identity of this group – the Kalelkar Commission in 1953, and the Mandal commission in 1978. Since caste and class are inextricably linked in India, it was no surprise that both commissions recommended caste as the most effectual criteria by which to classify these socioeconomically backward groups. Thus, emerged an administrative classification of low-ranked castes as the "Other Backward Classes" (OBC), which are separate from the Scheduled Castes (SC) and Scheduled Tribes (ST) and typically lie above the SC and ST in the caste hierarchy. It was not until 1992 that a 27 percent quota was implemented for the OBC in all jobs (but not colleges) funded by the central government. Individual state governments implemented different OBC quotas in state-funded colleges and jobs based on the approximate proportion of this group in each state.

In 2006, the central government announced a plan to extend the 27 percent quota for the OBC to all Central Educational Institutions (CEI), that is all higher education

[9] This section draws from a reading of various texts on Castes and Affirmative Action in India such as Shah (2004), Dumont (1980), Milner Jr (1994), Thorat and Neuman (2012).

institutes or universities established, maintained, or aided by the central government. This was operationalized through the Central Educational Institutions (Reservation in Admission) Act, 2006. In India, typically higher education institutes under the administration of or funded by the central government are ranked higher than state colleges [10]. These include premier institutes of professional education such as the Indian Institutes of Technology (IITs), Indian Institute of Management (IIMs), and All India Institute for Medical Sciences (AIIMS). The primary objective of this extension was to bring these top-ranked colleges and universities in the country under the umbrella of affirmative action for the OBC. The country witnessed a wave of protests and demonstrations against this policy extension and a Public Interest Litigation was filed with the Supreme Court of India, which then stayed the implementation of the OBC quota in response. Finally, in April 2008, the Supreme Court upheld the 27 per cent quota for the OBC in colleges funded by the Central Government, but maintained that the "creamy" layer be excluded from such preferential admission policies [11]. Further, as per the provisions of the Central Educational Institutions (Reservation in Admission) Act, 2006, all CEIs had to increase the number of seats such that the total number of seats available to candidates from the non-beneficiary groups remained the same even after implementing the OBC quota.

### 1.2.3 Existing Literature

There is a substantial literature around the efficacy of affirmative action policy in India, primarily focused on the reservations for the Scheduled Castes (SC) and Scheduled Tribes (ST). OBC quota is a relatively new policy and there exist fewer studies on its impact on educational and labor market outcomes. Bagde et al. (2016) examine the impact of the recent OBC quota in higher education using administrative data from 200 engineering colleges and find that the quota increases college attendance for OBC students, especially in higher quality institutions. Deshpande and Ramachandran (2015), using a difference-in-difference

[10] Based on annual rankings published in news-weeklies such as *India Today*, *The Outlook*, and *The Week*.

[11] At present, the 27 per cent OBC quota can be availed only by those whose annual family income is up to Rs 6 lakh. Those earning more are classified as the 'creamy layer' and are not eligible for affirmative action.

strategy, find that the OBC quota implemented in 1992 in public sector jobs increased the percentage of OBCs obtaining public sector jobs and finishing secondary education by 2.6 and 4 percentage points, respectively. Weisskopf (2004) finds that reservation policies at all levels of higher education both redistribute SC/ST students upward in the university quality hierarchy and attract into universities significant numbers of SC/ST students who would not otherwise pursue higher education. Frisancho and Krishna (2016) find evidence from an elite engineering college that reservation policies effectively target SC/ST students who are poorer than average displaced non-beneficiary students. Bertrand et al. (2010) examine the affirmative action in engineering colleges in one Indian state for "lower-caste" groups (SC, ST, OBC) and find that it successfully targets the financially disadvantaged: the marginal upper-caste applicant comes from a more advantaged background than the marginal lower-caste applicant who displaces him.

There is ample evidence even in the case of U.S. that affirmative action helps improve minority enrollments in colleges, especially in the higher quality schools. Epple et al. (2008) examine the consequences of affirmative action on college admissions and tuition policies in a general equilibrium framework and find that minority students pay lower tuition and attend higher-quality schools. They also show that repealing affirmative action will lead to a substantial decline of minority students in the top-tier colleges, a result supported empirically by Arcidiacono (2005). In the case of US, there is a unique opportunity to examine the effects of removing affirmative action – Long (2004) finds that after the elimination of affirmative action in California and Texas, the gap between number of SAT score reports sent by non-minority and minority students to in-state public colleges significantly widened; on the other hand Card and Krueger (2005) find no change in the SAT-sending behavior of highly qualified black or Hispanic students in either state. Hinrichs (2012) shows that the ban on affirmative action decreased underrepresented minority enrollment at selective colleges, and shifted underrepresented minority students from more selective campuses to less selective ones at the University of California (Howell (2010) finds a similar result). Domina (2007) presents evidence on how diversity programs enacted in Texas, after affirmative action

was banned, were successful in improving educational outcomes at the high school level.

There are also numerous studies that focus on the "mismatch hypothesis", the argument that affirmative action places academically unprepared students into competitive schools without the required skills and abilities. In the case of India, Bertrand et al. (2010) and Frisancho and Krishna (2016) find evidence in favor of the mismatch hypothesis, whereas Bagde et al. (2016) do not find evidence of such adverse impacts. In the U.S. context, Fischer and Massey (2007) and Rothstein and Yoon (2008) find limited or no evidence of mismatch, whereas Arcidiacono et al. (2011) show that laws banning the use of racial preferences in California public colleges lead to better match quality and higher graduation rates. There is thus a lack of consensus on the validity of the argument against affirmative action on grounds of creating a "mismatch".

This paper contributes to the existing literature by using a nationally representative household survey dataset from India to evaluate the effects of affirmative action in higher education on the educational outcomes of the targeted underprivileged caste group (OBC). A distinct contribution is to examine the spillover effects of affirmative action in college admissions on school enrollments and high-school completion among OBC students – an anticipatory behavioral response on the part of prospective college students.

## 1.3 Estimation

### 1.3.1 Data

The National Sample Survey Organization under the Ministry of statistics Planning and Implementation carries out a set of nationally representative household surveys – annual surveys using a thin sample of households, and quinquennial surveys or "thick" rounds using a larger sample and more detailed questionnaires. The quinquennial Employment-Unemployment survey of the NSS contains information on household demographics, extensive information on employment and wages, and some information on consumption and expenditure.

I use four "thick" rounds of the Employment-Unemployment Survey for the empirical analysis – the 55th round (1999-2000), the 61st round (2004-05), the 66th round (2009-10)

and the 68th round (2011-12). These surveys are carried out over a period of 10 to 11 months (for example, the 55th round was conducted during June 1999 to July 2000). Table 1 gives the sample sizes for the different rounds (the number of households and individuals). The number of Hindu households is also listed which gives an idea of how large the Hindu community is in terms of share in population (since the sample is representative of the population).

The policy being evaluated was announced in May 2006 and implemented in April 2008. This allows me use two rounds from before the policy was announced, and two rounds after the implementation.

### 1.3.2 Descriptive Statistics

Table 2 presents the share of different social groups in a representative sample [12] These proportions are largely stable over time suggesting limited mobility between these groups. OBC are the largest social group in sample and ST are the smallest, which is true of their population shares as well.

There is a clear hierarchy in socioeconomic status (SES) between the different social groups - on every indicator of SES used in this paper, "Others" (non-beneficiaries of affirmative action[13]) rank the highest and the SC/ST rank the lowest. Figure 1 shows the education of the household head for the different categories and the persistent difference in levels by social groups is clearly observable. The same can be said for Monthly Per Capita Expenditure of households (Figure 2). The percentage of households in the sample who reside in urban areas is the lowest among the ST and highest for Others (Figure 3). It is worth noting that the trends in SES over time for the different social groups are parallel, suggesting little or no convergence between the groups.

[12] I have restricted the sample to only Hindu households since the Caste system is native to Hinduism. Those among other religions listed as belonging to lower castes are so identified mainly because at some point in the past they (or their ancestors) converted to a different religion yet held on to their caste identity. It will be difficult to disentangle religion and caste as separate indicators of socioeconomic backwardness.

[13] In the administrative classification of caste groups, the non-reserved category is called the "General" category. In the dataset I use, this group is referred to as "Others"

### 1.3.3 Empirical Strategy

#### Difference-in-Difference Estimation

A direct approach to estimating the effect of the policy on the targeted group along two margins – college enrollments and high-school completion – is using a difference-in-difference framework. This strategy exploits two sources of variation: (i) whether the individual belongs to the OBC group; and (ii) whether the individual is observed before or after the policy was implemented. As discussed above, the quota of seats for OBC is at 27 per cent since 2008 which has reduced the share of seats available for Others (non-beneficiaries) without changing the share of seats for the SC/ST. However, as per the directives of the central government, institutes have been scaling up their infrastructure to increase total number of seats to not adversely affect students from non-beneficiary groups. Hence this policy should only differentially impact the OBC while the SC and Others category remain unaffected.[14].

The Estimating equation is as follows:

$$Y_{it} = \beta_1 + \beta_2 post_{it} + \beta_3 OBC_{it} + \beta_4 post_{it} OBC_{it} + \beta_5 X_{it} + s + \mu_i t$$

$Y_{it}$ is a binary indicator variable for individual 'i' at time 't', based on the outcome being considered. Individuals are restricted to the relevant age group [15] in each of the above two cases – 17 to 22 year olds for college outcomes, and 17 to 19 year olds for high school outcomes.[16] 'post' is a dummy variable that takes the value one if the observation is after the policy change, that is after 2008; 'OBC' is the dummy for caste, and takes the value one if the household belongs to OBC, 0 otherwise; $X_{it}$ is the vector of individual and household characteristics which includes the monthly per capita expenditure, years of schooling of

[14] I have dropped the Scheduled Tribes (ST) from the comparison since they do not have stable trends in educational outcomes, which could also be attributed to a small sample size. However they do follow the caste hierarchy and have the lowest levels of educational attainment, consumption expenditure, and urban residence.

[15] These are based on the typical age when individuals attend college and high-school in India

[16] The results are robust to small changes in the age groups

household head, an urban dummy, and a female dummy; $s$ are state-fixed effects; and $\mu_{it}$ is the error term clustered at the State level.

In an Ordinary Least Squares (OLS) estimation, $\beta_4$ is the coefficient of interest which shows the differential change in college enrollments/high-school completion rates for the OBC as compared to the change for the control group (SC, or SC and Others). In a subsequent analysis, I divide the sample into different sub-groups by place of residence (rural or urban) and sex and estimate a separate $\beta_4$ for each group.

The OBC are the largest social group in terms of share in population with a wide variation in the socioeconomic status of households belonging to this category (Somanathan, 2006). As was observed earlier in Figures 1 and 2, on the SES spectrum OBC lie below the Others and above the SC. It is then reasonable to expect that if the OBC group was split into subgroups based on SES, the policy impacts could be different for the different subgroups. To operationalize this idea, I use *education level of the household head* as proxy for socioeconomic status (SES) and split the sample into three parts based on whether household head has primary, secondary, or tertiary education. The difference-in-difference analysis is repeated for each of these three groups with SC and Others as both separate and combined control.

### Instrumental Variable (IV) Estimation

As argued earlier in the paper, making access to college easier provides significant incentives for students to remain in school so as to maintain eligibility for higher education. Premier public colleges in India combine lower tuition with high-quality education thereby offering an attractive higher education package for students. Due to existing socioeconomic inequalities between different caste groups, students from underprivileged castes struggle to gain entry into these premier institutes A policy that guarantees a fixed quota of seats for students from a disadvantaged caste group essentially reduces the barriers to college admission providing an incentive for students to aspire to higher education. As a result more students from targeted groups would choose to remain in school so they can compete for admission into

the premier public colleges.

The main research question here is whether easier access to college, made possible through affirmative action, causes more students to continue enrollment in school. In order to identify how access to higher education affects school enrollments, I use a Two Stage Least Squares (2SLS) model with the policy shock as an instrument for increase in access to higher education . Since the policy came in at the level of college, it can only affect school enrollments through its impact on access to college, thereby satisfying the exclusion criteria.

The first stage of the IV estimation is:

$$CollegeEnrollment_{cst} = \gamma_1 post_t + \gamma_2 OBC_{ct} + \gamma_3 post_t OBC_{ct} + \gamma_4 X_{cst} + \eta_{cst}$$

The second stage, that is the main estimating equation, is:

$$SchoolEnroll_{icst} = \beta_1 College\widehat{Enrollment}_{cst} + \beta_2 X_{icst} + \mu_{it}$$

'$CollegeEnrollment$' is the mean college enrollment rate in a social group-state-year cell, that is, the average for each social group $c$, in state $s$, and survey year $t$. '$post$' is a dummy variable that takes the value one if the observation is after the policy change, that is after 2008; '$OBC$' is the dummy for caste, and takes the value one if the household belongs to OBC, 0 otherwise; '$SchoolEnroll$' is a binary indicator for whether individual 'i' is enrolled in school in year 't'. $X$ is the vector of individual and household characteristics which includes years of schooling of household head, monthly per capita expenditure, an urban dummy, a female dummy, state fixed effects, year fixed effects, and age dummies.

The 2SLS model is estimated for different age groups of students – 6 to 10 year olds, 10-13 year olds, 13 to 15 year olds, and 15 to 17 year olds, as well as for high-school completion rates among 17 to 18 year olds. This allows me to analyze at which age or level of schooling, the increased access to college begins to significantly affect enrollments (or completion).

### Threats to Identification

This paper exploits a natural experiment to analyze the *"downstream"* or *"pull"* effect of increase in access to college. One concern might be that this is picking up the effect of social change, that is, society may be changing in a way more favorable towards OBC. In order to distinguish between that gradual social change and the effect of this policy, I examine the trends in some other socioeconomic indicators for these groups. Figures 1, 2, and 3 show the trends in education of household head, monthly per capita expenditure, and proportion of urban households in sample respectively. None of these reflect a differential trend for the OBC, one that can explain the differential gains made in higher education after the policy was implemented.

Another concern is the possibility of an textit"Ashenfelter Dip": do institutions strategically lower offers of admission/access to beneficiary students in the period between announcement (2206) and implementation (2008), which then would bias the estimates upwards. Since the quota was implemented in government or government funded colleges, it is not a likely possibility that these colleges could deliberately lower offers to OBC students. Before the quota was implemented, OBC students would have applied in the "unreserved" or "general" category (the non-beneficiaries). Admissions would then be based on test scores on a centralized exam and students being able to score above the required cut-off [17]. However, a related concern is that individual students might delay going to college and wait till after the policy has been implemented. Figure 12 shows the age distribution of college enrollments for SC and OBC for the four survey rounds. there is an upward shift in college enrollments for OBC in the post-policy rounds but the age-distribution does not change. Therefore I find no evidence in the data to suggest that individuals might be delaying the decision to enter college.

[17] Implementing the policy effectively lowers this cut-off score for OBC students

## 1.4 Results

### 1.4.1 Difference-in-Difference Estimates

#### College Enrollments

Figure 4 shows the average college enrollment rates over time for the three social groups - SC, OBC, and Others. The trends are quite parallel (especially for the SC and OBC) and after implementation of the policy the trend for OBC shifts upward. Table 3 presents the difference-in-difference estimates for college enrollments using SC and Others as control groups, both separately and together. With SC as control, the increase in college enrollment rate for the OBC is 5.1 percentage points more than the increase for SC, over a baseline mean college enrollment rate of 9.6 per cent [18]. This translates into a differential increase of about 53 per cent for the OBC . With only Others as control, there is no significant impact on college enrollment. When SC and Others are both used as control, there is an increase in college enrollments for the OBC of 1.8 percentage points more than the increase for SC and Others. Over a baseline mean of 9.6 per cent, this translates into a differential increase of about 19 per cent for the OBC.

There are heterogeneous policy impacts by location of household–rural or urban–and sex. As shown in Figure 5 for college enrollments, it appears that the largest gains are made by the group of male OBC students from urban households. Table 4 presents the OLS estimates for these heterogeneous impacts on college enrollments. There is a ***significant impact only for urban males and urban females***. The increase in college enrollment rate for male OBC students from urban households is 5.1 percentage points more than the increase for male students from SC and Others (a differential increase of about 25 per cent given a baseline mean of 20.2 per cent); the increase in college enrollment rate for female OBC students from urban households is 4.8 percentage points more than female students from SC and Others (a differential increase of about 27 per cent).

Figure 6 shows the trends in college enrollments for the different groups divided by the

[18] The college enrollment rate for the OBC in 2005 was 9.6 per cent

education level of household head. It is striking to note that the differential increase in college enrollments is quite significant in the primary and secondary education groups. This implies that students from households that do not have a history of higher education made the most gains from affirmative action. Table 5 gives the difference-in-difference estimates when the sample if restricted to urban households where the head has at most completed the primary level of education [19]. The impact is largest when the control group is SC – the increase in college enrollments for OBC is 6.9 percentage points more that for SC. The estimate when Others is the control group is smaller and less precise, but still significant at the 10 per cent level. This isn't unexpected since there are fewer households from the non-beneficiary groups (Others) that have a head who has only completed up to primary education. [20]. Table 6 gives estimates for the sample of urban households where the head has more than primary and up to secondary education. Here the impact is larger when Others is the control group rather than SC. Combining SC and Others into one control group increases the precision of the estimates.

Table 7 presents the difference-in-difference estimate when the sample consists of urban households where the head has tertiary education. What is interesting to note here is that there are no significant effects at all with either of the control groups. This implies that ***the observed differential increase in college enrollments for OBC students was largely concentrated among lower SES households.***

### High School Completion

Figure 7 shows the average high-school completion rates over time for the three social groups. Similar to the case for college enrollments, it can be seen that post 2008 (after policy was implemented) the trend in high-school completion for the OBC shifts upward, away from the parallel trend for the Sc and closer to the trend for Others. Table 8 presents the difference-in-difference estimates for high-school completion. With SC as control, the

[19] I restrict the results presented here to urban households since in the previous results it was shown that the effects are significant only for individuals from urban households. I have carried out the same analysis without restricting the sample to urban households and the pattern of results remain the same

[20] Comparing the number of observations in columns 1 and 2 in Table 5 makes this apparent

increase in high-school completion rate for the OBC is 4.1 percentage points more than the increase for SC, over a baseline mean high-school completion rate of 12.5 per cent (an differential increase of about 33 per cent) . As was the case for college enrollments, using only Others as control I find no significant effect. When SC and Others are both used as control, the increase in high-school completion rate for the OBC is 2.6 percentage points more than the increase for SC and Others (a differential increase of about 21 per cent).

Figure 8 shows the heterogeneous impacts for high-school completion by location of household and sex. Similar to college enrollments, the gains appear to be realized only in urban areas. However, in this case ***the largest gains are made by the group of urban female OBC students***. Table 9 presents the heterogeneous impacts on high-school completion. There are no significant effects in rural areas for either male or female students. The increase in high-school completion rate for male OBC students in urban areas is 6 percentage points more than the increase for male students from SC and Others (a differential increase of about 30 per cent given a baseline mean of 20.1 per cent); the increase in high-school completion for female OBC students in urban areas is 8.1 percentage points [21] more than female students from SC and Others (a differential increase of about 33 per cent).

Figure 9 shows the trends in high-school completion for the different groups divided by the education level of household head. Unlike the case for college enrollments, it appears that differential increase (especially when comparing OBC to Others) accrues more to the secondary and tertiary education groups. Table 10 lists the difference-in-difference estimates when the sample if restricted to urban households where the head has at most completed the primary level of education. The impact is significant when the control group is SC but insignificant when control group is Others. Table 11 gives the results for the sample of urban households where the head has more than primary and up to secondary education. In this case there are no significant effects irrespective of which control group is used.

When the sample consists of urban households where the head has tertiary education (Table 12), the impact is large and significant when Others is included in the control group

[21] This is the largest impact among any of the sub-groups considered

(by itself or together with SC). This implies that in higher SES groups, there is no significant differential impact on high-school completion rates for the OBC as compared to SC, but there is significant differential increase for the OBC when compared to Others. Unlike the case for college enrollments, in high-school completion the higher SES groups have larger gains from the policy.

### 1.4.2 IV Estimates

Figure 10 gives the reduced form estimates for the OLS regression of school enrollments on college access (measured by group-wise college enrollment rates), for different age-groups. As can be observed, the effect is insignificant for younger age groups, that is for students in primary or middle school. It is then increasing in age with the largest effect on school enrollments being for 15-17 year olds. The coefficient on 'HScomplete', the variable for high-school completion among 17-18 year olds, is about 0.6 – which implies that for every 10 percentage point increase in college enrollment rate for a give social group in a state, high-school completion rate increases by 6 percentage points. These reduced form estimates potentially suffer from endogeniety bias – the same factors responsible for improvements in school enrollments could be leading to increases in college enrollments.

To overcome any such endogeneity bias, I use the policy shock to instrument for increased access to college. The IV estimates of the 2SLS regression follow a similar pattern, as shown in Figure 11. The only difference is that the coefficient for high-school completion for 17-18 year olds is now smaller in magnitude than the coefficient on school enrollments for 15-17 year olds. This suggests a stronger effect of the policy on high-school enrollments than on high-school completion [22]. This is a typical outcome since enrollment rates are usually higher than completion rates.

Table 13 shows the 2SLS estimates for the different age-groups: a 10 percentage point increase in college enrollments for a social group in a state increase school enrollments for 15-17 year olds by 6.98 percentage points, and for 13-15 year olds by 5.2 percentage points.

[22] 15 to 17 is the typical age at which students are enrolled in high-school

As was observed in the previous figure, the estimates for school enrollments for students younger than 13 years is insignificant.

### Robustness Checks

As a check for robustness, I carry out three placebo tests: shift the policy timing to before 2005 when there should be no differential impacts; shift policy timing to after 2010 when the differential impacts should again be much smaller or insignificant; and thirdly restrict the sample to an older age-group (25-30 year olds) which should not be affected by the policy.

Tables 14 and 15 present the results of these Robustness checks for college enrollments and high-school completion respectively. As is expected, there are no significant effects in any of the three cases [23]. These results make the case stronger for there being positive and significant impacts of extending the OBC quota in higher education institutes funded by the central government.

## 1.5 Discussion

Affirmative action policies are widely debated since they offer preferential treatment to one or more social groups, which often entails limiting the options for another group. In the context of quotas in higher education, reserving a fixed quota of seats for an underprivileged group implies decreasing the proportion of seats available for non-beneficiary groups. These policies therefore are subject to extensive scrutiny in order to weigh their benefits against the social, political, and economic costs of implementation. In light of the many continuing debates around caste-based affirmative action (or *reservations*) in India, this paper is an attempt to highlight the positive gains from such policies to the beneficiary groups. The size of the estimated effects suggest that there were significant barriers to realizing opportunities in higher education for the underprivileged castes. Moreover, the analysis does not reveal any adverse effects on non-beneficiary groups.

[23] There is some differential increase in College enrollments for the OBC after 2010 but this is most likely continued gains attributable to the policy

The Difference-in-Difference (DID) estimates show that OBC students made significant differential gains in college enrollment and high-school completion after the 27 per cent OBC quota was implemented in colleges funded by the central government. There were no other caste-based policies being implemented at the same time, which implies that these differential changes can only be attributed to the policy of interest. The policy impacts being significant only for urban households is not unexpected since these households are favorably placed to take advantage of increased access to higher education – most colleges (especially the premier institutes) are located in urban areas; and schools in urban are of much higher quality, in terms of infrastructure and teachers. There is established evidence of gender differences in returns to schooling (Duraisamy, 2002; Gandhi Kingdon, 2002), yet female students from urban OBC households made similar differential improvements as male students, in college enrollment as well as high-school completion. A possible explanation could be that since a college education is expected to increase white-collar employment opportunities that draw more women to the labor force, easier access to college can incentivize more women to aspire to these opportunities leading to higher levels of human capital accumulation (similar to the pathway outlined in Jensen (2012)).

An interesting revelation is the differences in policy effects by the education of household head (which can be considered as a proxy for socieconomic status). A common criticism of affirmative action is that it only benefits students from higher socioeconomic strata. For the affirmative action policy being considered in this paper, OBC students from households where the head has only completed up to primary education make the highest gains in college enrollment rates. This speaks to the effective targeting achieved under this policy and makes the case for affirmative action in higher education stronger. However, a similar result is not observed in case of high-school completion rates – OBC students from both low and high SES groups make significant gains.

The Instrumental Variable estimates (IV) suggest a clear causal link between increased access to college and improvements in school enrollments of students at the ages when they start considering higher education options. There are no significant changes for students

who are in primary or middle school since they are still too young to think about college. However, for 13 to 17 year olds higher education is a nearer possibility and hence there are significant improvements in school enrollments as a result of increased access to college. In fact, these effects are increasing in age – larger for 15-17 year olds than 13-15 year olds.

Given the evidence for such a pathway, the impact of affirmative action in higher education becomes even broader with spillovers to schooling decisions. School drop-outs are a serious concern across developing countries and these drop-out rates increase with the level of schooling. If affirmative action can reduce drop-outs from school especially at higher levels of schooling, these policies then become more imperative to mitigate existing inequalities in education between different social groups.

This policy was only implemented in colleges controlled and/or funded by the central government. Each state already had its own OBC quota, determined by the proportion of OBC in that State and implemented in state-funded colleges, and these were not changed in response to the OBC quota announced by the central government[24]. Given the large effect sizes, it seems likely that this policy affected both central as well as state colleges. A reasonable explanation is that the OBC students who are able (in terms of educational background, skill, or ability) and willing to compete for seats in premier institutes are freeing up more seats in state and local colleges for other OBC students who are either not able or not willing to compete for admission in premier colleges.

## 1.6 Conclusion

The purpose of affirmative action in India was to enable inclusive development and eventually move toward a caste-less society. The constitutional provisions for positive discrimination was initially meant to continue for a period of ten years. This has been extended up to the present day through constitutional amendments. Yet, as observed in the previous sections, there has not been a significant convergence (on average) in socioeconomic outcomes for the different caste groups. However, the OBC quota implemented in 2008 seems to have

[24] except for Delhi, Rajasthan, who increased state OBC quota.

had the intended effect of increasing college enrollments among OBC students relative to students from both other beneficiary group (SC) and non-beneficiary group (Others). This affirmative action policy also had a significant *spillover* effect on high-school completion rates and school enrollments in earlier grades for the OBC. Moreover, using an IV strategy I am able to highlight a pathway from increase in college access to improvements in school enrollments. This channel of 'unintended' effects brings to light the importance of affirmative action in mitigating socioeconomic inequalities between different castes.

The legislation to extend reservations in central government colleges to OBC was meet with widespread protests and demonstrations. The objection to an OBC quota was based on the argument that it undermines merit as the basis for admissions and displaces deserving candidates from non-beneficiary groups. I have shown in this paper that not only did this policy have a significant effect on the targeted group (OBC), it was also most effective among households of lower socioeconomic status within that group. It enabled students from households without a history of higher education to realize the opportunity of a college education.

This policy can potentially affect labor market returns for the OBC, more so in the high skilled labor market. With the given data (last round is of 2012), it is too early to observe changes in labor market outcomes. A future extension of this paper will be focused on examining whether affirmative action in higher education can impact labor market outcomes for the targeted beneficiaries, and if there are any unintended effects on non-beneficiary groups.

# Chapter 2: A Model of Adaptive Preferences


## Abstract

The paper presents an analytical framework that can represent Adaptive Preferences, a class of *Endogenous Preferences* that are dependent on the feasible opportunity set. The model is developed using an expected utility framework that assigns 'utility' to pairs of opportunity sets and preference orderings. It is then possible to show under what conditions an individual will choose to adapt (or un-adapt)their preferences. I describe where the literature stands on Adaptive Preferences, mainly in the fields of Economics and Philosophy, and also present a discussion on autonomy when individuals have adaptive preferences. The model outlined in this paper preserves individual autonomy and hence does not characterize adaptive preferences as irrational. Parallel to the model I present a case study of "Gendered Preferences" as a case of Adaptive Preferences. I track the history of changes in married women's participation in the labor force in United States to see how gender roles have evolved within and outside the household over time. The case study can potentially reveal instances of social and cultural changes where the underlying mechanism was that of Adaptive Preferences.

## 2.1 Introduction

Our preferences inform the choices we make in our day-to-day lives, thus embodying our likes, dislikes, aspirations, limitations, institutional contexts, and physical,social, economic, and political realities. The machinery for analyses in mainstream economics has typically treated preferences as fixed, or "hard-wired". Furthermore, the methodological individualism in mainstream economics has been criticized for subsuming the idea of agency within the utility maximizing paradigm. Individuals however are not stagnant hollow entities devoid of context and it is an over-simplification to assume that a person is born with preferences that stay fixed over their lifetime, or that the scope of agency available to them does not directly affect their decision-making process. There exists literature, mainly at the intersection of economics and philosophy, that recognizes this oversight and advocates for considering the endogenous and institutional nature of most preferences. This paper is an attempt to start a dialogue for incorporating a type of endogenous preferences – Adaptive Preferences (AP) – into the theory of preference and choice in economics. I construct a simple analytical framework that can be used to evaluate adaptive preferences where they exist, and infer policy lessons on how to tackle these "suspect" preferences. This framework, while maintaining the ultimate decision-maker status of individuals, situates them in context of their circumstances. Subsequently, the framework can be applied to a study of historically oppressive "gendered" structures and the consequences for women's choice and agency.

Adaptive Preferences (AP) are typically defined as a specific case of endogenous preferences, that arise in response to an individual's perception of what is attainable. For Example, consider a poor uneducated woman in a patriarchal society such as that of India, who is a victim of domestic violence but comes to accept it as a part of life. In her perceived state of the world, this violence is something women have to put up with as a result of being dependent on men and having left her own family to move into her husband's home (Nussbaum, 2001). It is plausible that she "adapts" her preferences so as to not even aspire to a life free from domestic violence. Individual perceptions of the feasible opportunities could also have been distorted owing to years of oppression, marginalization, rigid social structures

and extreme social disciplining. Another example in this context is that of women's voluntary participation in female genital mutilation practiced in certain communities in Sub Saharan Africa. It can be argued that these women perpetuate such injustices against themselves because of what Khader (2013) describes as a 'near-completely distorted normative world-view'. AP can then be considered as the result of normative distortion or *"deformed desires"*.

In Amartya Sen's account of AP, individuals adapt their preferences according to what they have been able to achieve or what is perceived as attainable over prolonged periods of time. Moreover, in his critique of the utilitarian tradition of viewing welfare as "desire-fulfillment", Sen points out that if what people in oppressed circumstances want is conditioned by their presently-feasible options then no social action would seem to be called for to improve the well-being of such oppressed people who do not express dissatisfaction with their circumstances, since the measure of well-being itself is based on the adaptively formed preferences of these people (Sen, 1984, 1985). Therefore, in cases where individuals' behavior seems to further perpetuate their deprivation, we should be cautious that the underlying preferences are most likely adaptive. Most proponents of AP agree that when preferences are adaptive, any evaluation of well-being based on them has to be treated with caution. However, AP-theorists often differ in their evaluation of the underlying process through which individuals come to have AP, especially in terms of the autonomy contained in this adaptive behavior [25].

The analytical model presented in this paper essentially tries to answer the question – how do we come to have the preferences we do? According to Bowles (Bowles, 1998), preferences are not chosen in the 'usual sense of intentional action towards given ends'; Individuals come to acquire preferences as they acquire an accent or a taste for a cuisine, by an underlying process that may or may not be intentional. Once acquired, preferences are internalized and even though they may have been informed by one set of circumstances they become 'generalized reason for behavior' (Bowles, 1998). Hence preferences formed under oppressive ideologies can inform decisions even when individuals are removed or separated

[25] detailed discussion in section 3

from the source of oppression. It is neither a necessary nor a sufficient condition for the existence of Adaptive Preferences (AP) that such preferences be reversed when the feasible set expands or circumstances change (Bruckner, 2013).

In the framework in this paper, preferences are shown to be acquired through an autonomous process of deliberation given an individual's beliefs about their access to opportunities. If the individual believes that she faces a restricted opportunity set [26] then she will choose to adapt her preferences according to what she perceives as her feasible set of opportunities. The next section presents the analytical framework for Adaptive Preferences (AP) followed by a discussion on where the different authors are situated with respect to their perspective on autonomy in AP and how this paper supports the idea of adaptively formed preferences that retain autonomy. Thereafter I present a brief case-study of "gendered" preferences as a case of AP using the model developed in the paper.

## 2.2 Analytical Framework

### 2.2.1 Setup

Consider two opportunity sets, $A_0$ and $A_1$, and assume $A_1 \subset A_0$. These opportunity sets can be associated with two states of the world, State 1 and State 2, with the probability of occurrence of State 1 as $p$ and of State 2 as $(1-p)$. Further assume that an individual has an initial preference ordering, $R_0$, which is unconstrained or un-adapted; and can subsequently choose her preference ordering[27] to be $R_0$, or $R_1$, the modified or adapted preference ordering.

Suppose individuals have a rational preference relation, $\succsim$, defined over $\mathscr{P} \times \mathscr{R}$, where $\mathscr{P}$ is the set of all lotteries over $A_0$ and $A_1$, and $\mathscr{R} = \{R_0, R_1\}$. $\succsim$ is thus assumed to be a complete and transitive relation allowing comparison of any pair $(A_i, R_j)$. Let $\succsim$ be represented by a vNM Expected Utility Function, $V(A, R)$, where the opportunity set $A$ is

[26] In the model, this is shown as an expected outcome - the individual attaches a set of probabilities to realizing different opportunity sets

[27] Each preference ordering satisfies completeness and transitivity

the stochastic component and $R$ is the chosen ordering)[28].When the realized state of the world is State 1, the individual can choose to either continue with the preference ordering $R_0$, or adapt their preferences to $R_1$. Similarly, when the realized state of the world is State 2, the individual can choose to either adapt their preference ordering to $R_1$, or have the unconstrained preference ordering $R_0$.

If $U(A_i, R_j)$ is the utility from $R_j$ when the realized opportunity set is $A_i$, then the Expected utility from choosing $R_j$ can be expressed as:

$$V(A, R_j) = pU(A_0, R_j) + (1-p)U(A_1, R_j); j = 0, 1 \tag{1}$$

**Assumptions**

I assume that the bigger opportunity set will have a greater utility under either of the preference orderings:

$$U(A_0, R_0) > U(A_1, R_0); U(A_0, R_1) > U(A_1, R_1) \tag{2}$$

Given the above assumption, I further assume that individuals attain greater utility when the preference ordering and opportunity set are matched.

$$U(A_0, R_0) > U(A_0, R_1); U(A_1, R_1) > U(A_1, R_0) \tag{3}$$

### 2.2.2 The Model

**Model I: When $p$ is exogenous**

The Expected Utility under the two preference orderings are as follows -

$$V(A, R_0) = pU(A_0, R_0) + (1-p)U(A_1, R_0) \tag{4}$$

[28]The preference relation here is similar in spirit to meta-preference – preference over preferences, but differs in that the ranking is over pairs of $AxR$.

$$V(A, R_1) = pU(A_0, R_1) + (1-p)U(A_1, R_1) \tag{5}$$

**Proposition 1**

There exists a threshold probability of realizing the bigger opportunity set, $p^*$, such that:

$V(A, R_0) - V(A, R_1) \geq 0$ if $p \geq p^*$

$V(A, R_0) - V(A, R_1) < 0$ if $p < p^*$

If $p > p^*$, individual gets higher utility from choosing the un-adapted preferences. If $p < p^*$, individual gets higher utility from choosing the adapted preferences.

*The Proof is given in the Appendix*

**Model II: When $p$ is endogenous and depends on effort**

In this model the individual can exert effort $L$, $L \in [0, 1]$, to increase the probability of attaining the larger opportunity set. Therefore $p$ is now a function of $L$, $p(L)$, and assumed to be increasing and strictly concave in $L$.

$$p : [0, 1] \to [0, 1] \ , \ p'(L) > 0 \ \& \ p''(L) < 0$$

There is a dis-utility or cost of effort given by $w(L)$, assumed to be increasing and convex in $L$. The Expected Utility under the two preference orderings are as follows -

$$V(A, R_0, L) = p(L)U(A_0, R_0) + (1 - p(L))U(A_1, R_0) - w(L) \tag{6}$$

$$V(A, R_1, \hat{L}) = p(\hat{L})U(A_0, R_1) + (1 - p(\hat{L}))U(A_1, R_1) - w(\hat{L}) \tag{7}$$

Given a certain preference ordering, the individual chooses an optimal level of effort to change $p$ that maximizes the expected utility from that particular ordering.

**Assumption**

I further impose the following assumption when $p$ now depends on effort: Recall from the model where $p$ is exogenous

$$U(A_0, R_0) - U(A_1, R_0) > U(A_0, R_1) - U(A_1, R_1) \tag{8}$$

This assumption implies that the loss in utility when the unconstrained preference ordering is mis-matched with the restricted opportunity set is greater than the loss in utility when the adapted preference ordering is mis-matched with the larger opportunity set. Intuitively, if an individual has unconstrained preferences but access to a restricted set of opportunities, they will most likely suffer from frustration resulting in a larger loss in utility than if preferences are adaptive and the individual has access to a larger set of opportunities. [29]

**Lemma 1**

Suppose $L^\star$ is the optimal level of effort when preference ordering is $R_0$ and $\hat{L}^\star$ is the optimal level of effort when preference ordering is $R_1$. Under assumptions of the model,

$$L^\star > \hat{L}^\star$$

*The Proof is given in the Appendix*

**Proposition 2**

An individual will get higher expected utility from choosing the un-adapted preference ordering when:

$$\{p(L^\star)U(A_0, R_0) - p(\hat{L}^\star)U(A_0, R_1)\} - \{(1-p(\hat{L}^\star))U(A_1, R_1) - (1-p(L^\star))U(A_1, R_0)\} > w(L^\star) - w(\hat{L}^\star)$$

where $\{p(L^\star)U(A_0, R_0) - p(\hat{L}^\star)U(A_0, R_1)\}$ can be thought of as the expected utility gain

[29] I show in the Proof for Proposition 1 that this assumption is a required condition for the Model I with exogenous $p$ to be internally consistent.

from choosing $R_0$ when opportunity set is $A_0$; $\{(1-p(\hat{L}^\star))U(A_1,R_1)-(1-p(L^\star))U(A_1,R_0)\}$ as the expected utility loss from choosing $R_0$ when opportunity set is $A_1$; and $w(L^\star)-w(\hat{L}^\star)$ is the additional cost of effort from choosing $R_0$.

Therefore, individuals will choose the un-adapted preferences when the net expected utility gain is greater than the cost of effort to increase the likelihood of attaining the larger opportunity set.

*The Proof is given in the Appendix*

**Interpretation of $p$**

One possible interpretation of the probability $p$ can be that it embodies the beliefs of an individual about how likely it is for them to realize the bigger opportunity set. In the case where $p$ is exogenous, it reflects fixed beliefs about the chances of having access to a bigger opportunity set. In the case where $p$ depends on the amount of effort, beliefs could be reflected in the specific functional form of $p(L)$, that is how the individual perceives their actions being translated into higher likelihood of realizing the bigger opportunity set. This along with the dis-utility associated with effort determines which preference ordering gives a higher expected utility.

**A Note on the Cost of Effort: Future Extension**

The cost of effort described in this model is cost from trying to change the probability of realizing the larger opportunity set. It does not incorporate the costs involved in switching the preference ordering itself. It is likely that there could be psychological costs in changing one's preferences – especially if it requires overturning internalized institutional constraints and social conditioning. There might even be stigma costs associated with non-conformist behavior. In the next extension of this model, I will introduce the cost of switching preferences using a distance function which assigns a nonnegative value to pairs of preferences, indicative of the dissimilarity between two preferences. A frequently used method for measuring distances between any two preferences is by counting the number of minimal swaps necessary

to invert one into the other, for example the Kemeny distance function (Kemeny, 1959). I will use the Kemeny distance function as a measure of the costs associated with switching one's preferences.

## 2.3 Autonomy in Adaptive Preferences

Elster, in his seminal paper (Elster, 1982), derives the definition of AP from the fable of the Fox and the Sour Grapes – the fox, upon realizing that he cannot reach the grapes hanging out of reach, decides that he does not want them as they are sour. For Elster, adaptation is an unconscious process in which an agent turns away from a preference to avoid unpleasant cognitive dissonance that is associated with holding on to it - he considers the process to be non-autonomous and the resulting preferences as irrational. For Sen and Nussbaum, adaptive preferences are formed after life-long habituation to deprivation and/or oppression, and hence the individuals with AP have a completely distorted or deformed idea of well-being. According to Nussbaum (Nussbaum, 2001), "there is something wrong with the preference to put up with abuse, and it should not have the same role in social policy as the preference to protect and defend one's bodily integrity." Feminists working on rational choice theory also tend to assume that deformed desires are damaging to both rational choice and autonomous choice, or at least they are able to be produced only in contexts in which autonomy is already damaged (Superson, 2005).

On the other side of the argument are feminist philosophers who believe it possible to retain autonomy even when preferences adapt to deprivation and oppression. Friedman (2003) suggests that adapting to say an abusive relationship is in principle compatible with critical reflection that is sufficient for autonomy. Westlund (2009) also argues that women could freely and authentically be committed to norms that subordinate them. According to Khader (2012), it is possible to imagine a conception of AP that is consistent with acknowledging agency in people who perpetuate their oppression. Bridges (2006) views AP as internalized external constraints and is of the opinion that one cannot undo the social context behind such adaptation by treating these preferences as non-autonomous. According

to Bruckner (2009, 2013), preferences as prescriptive rule for making choices and are formed as a result of options or beliefs about options; even if they are adaptive, they are rational and worthy of pursuit.

Khader (2013) presents definitions for different versions of Adaptive Preferences – what she terms as 'paradigmatic' AP and 'non-paradigmatic' AP or 'look-alike' AP. 'Paradigmatic' APs are when an individual has a complete normative distortion and display deprivation-perpetuating behavior as a result. In such cases individual autonomy can be considered as mostly damaged. 'Non-Paradigmatic' AP on the other hand are cases where individuals still retain a critical perspective on a discriminatory or oppressive structure but nevertheless comply with oppressive practices. She further argues that preferences most likely lie on a spectrum between being completely damaging to autonomy and completely preserving autonomy, based on different historical and cultural contexts. For instance, women from the South might appear to be perpetuating injustice against themselves but they could still retain a critical perspective on unfair social norms. A relevant example here is that of the Pirzada women of Old Delhi who practice body veiling and seclusion. Narayan and Harding (2002) point out that these women do express some dissatisfaction with such sexist norms despite their compliance and even partial endorsement. Their motivations include a realistic assessment of their possibilities, a desire to move around anonymously and without being regarded as sex objects, the belief that unveiled women are sexually licentious, and a desire for class status (Narayan and Harding, 2002). To that end, AP theorists and policy makers should be wary of discounting the possibility of very significant value distortion as well as limited value distortion. It is important to talk about content of preferences/welfare-incompatible behavior without losing sight of individual agency contained in the underlying mechanism, and to come up with a conception of good that is substantially minimal and cross-culturally acceptable.

The model presented in this paper is autonomy-preserving – it gives individuals the liberty to deliberate over pairs of opportunity sets and preference orderings, and choose the pair that maximizes their 'utility'. It retains the traditional framework of preference

and choice in economics while allowing for institutions, history, and culture to influence individual beliefs, expectation, and therefore preferences.

## 2.4 Case Study: *"Gendered"* Preferences

The term "gendered" preferences refers to preferences differentially distributed by gender as a result of the historical imbalance of power between men and women (Levey, 2005). These preferences then work to reinforce and perpetuate the status quo of a patriarchal society. Gendered preferences that underlie and maintain patriarchy not only operate through instilling beliefs about the unequal worth of a person but are also internalized through institutional structures that teach men and women to value different things. "Gendered" social structures then restrict women's choice and agency further strengthening an oppressive power structure. These "gendered" preferences can be thought of as a case of Adaptive Preferences where women have adapted to oppressive and discriminatory institutions. As a case study in this section, I will try to describe the growth in labor force participation of married women in the United States using the model of Adaptive Preferences (AP). I will draw from Costa (2000) for a discussion of possible factors and expand it further to suggest a shift in preferences as one of the underlying mechanisms.

Women's labor force participation has been increasing consistently since the turn of the 20th century. Increasing labor force participation of women has increased the labor force participation rate of 25 to 44 year olds by about 50 percent over the 20th century. The rise in women's labor force participation and more women aspiring to a career has led to a multitude of changes in society – power relationships within a households have been altered directly affecting family formation and dissolution, and intra-household allocation of resources. There has also been a substantial growth of market substitutes for (previously) home-produced goods such as food and clothing (Costa, 2000; Goldin, 1986, 1990; Lundberg and Pollak, 1996). The largest increase in labor force participation the 20th century has been for married women, the increase concentrated after 1940. The labor force participation rate of single women older than 15 increased from about 40 percent at the turn of the 20th

century to 68 percent in 1998 . On the other hand, participation rates for married women were as low as 5 percent at the end of the 19th century and 14 percent in 1940, thereby increasing from 22 to 62 percent between 1950 and 1998 (Goldin, 1990).

This dramatic shift in married women's work for pay outside the household represents a break from past trend. At the beginning of 20th century, women worked for pay only when pushed into the labor force out of necessity – if their spouse was too ill to work, unemployed, or did not earn enough to support the family. Role of men and women in the household and in the market was still rigidly defined wherein women were primary care-givers in the households while men worked outside of the home for pay or career. Moreover, women were mainly employed in services, manufacturing or agricultural occupations with poor working conditions and long hours. With the rise of the clerical sector in 1950s which provided better working conditions, increase in college education among women, and entry of college educated women into clerical services, the social stigma associated with a working wife was somewhat diminished. The availability of market goods that could substitute for home goods also increased further weakening the rigid gendered nature of labor markets (Costa, 2000).

Since the 1970s, women began to enter the labor force not just for paid work but for a career – there was increased status attached to career tracts. By this time the relationship between a women's employment and her spouse's earnings had significantly weakened whereas the relationship between her employment and own wages did not increase commensurately. According to (Pencavel, 1998), in the period 1975-94 market work became relatively more hospitable and household activity less attractive to women for reasons beyond that provided by movement in wages. These trends suggest that it is not just market conditions but also adjustments in women's expectations and preferences that lead to eventual changes in "gendered" institutions. Women base their expectations on what they observe from mothers and grandmothers as well as on social norms about how women should "behave". For married women, the attitude of their spouse also makes a significant difference to their own perceptions of paid work or having a career. Cunningham (2008), using data from Intergenerational Panel Study of Parents and Children between 1977-1993, finds that women

who hold more egalitarian attitudes about the gendered family roles (that is, they believe household work should be equally divided between men and women) are more likely to enter paid labor force and work greater hours. He also finds that women's whose husbands contributed more routinely to household work are more likely to enter labor force. There is also some evidence of lagged adaptation in families with respect to attitudes towards family roles and participation in labor force.

To apply the model of AP in this context I have to begin with women initially having the adapted preference ordering. Owing to historically ascribed gender roles women begin with preferences adapted to the "gendered" social structures. Under this status quo, participation in paid work is not ranked high in these adapted preference orderings, with women engaging in paid work only in the presence of financial constraints. There exist institutional barriers to married women joining the labor force such as the "marriage bars" in the first part of the 20th century in school districts and firms in the United States that prohibited the employment of married women. Hostile attitudes towards working women are reflected in the low willingness of male employees to work with women and the low willingness of employers to hire women (Costa, 2000). We can suppose that under such circumstances the probability of realizing the opportunity set where working women are accorded their due respect and status is small, and the cost of effort to change that probability is large. As a result the expected utility from choosing the adapted preference ordering is higher for women.

Eventually, as more women begin to enter higher education, they can now make an effort to change the probability of larger opportunity set[30]. A college education can also change the bargaining power within the household for women – they can earn a higher wage and have control over resources, they are no longer exclusively dependent on spouse's earnings. Institutional barriers also begin to change owing to the growing popularity of the feminist movement and various anti-discrimination policies enacted by governments [31]. Hence expectations or beliefs begin to shift towards preferences for paid work. However, the

[30] Higher Education is one way opportunities expand

[31] For Example, Affirmative Action policies

shift in preferences is not immediate but occurs with a lag. As women observe the older generation gradually adapt their beliefs and expectations, they are motivated to do the same. Further, when married women have spouses who share in the household work, then it is more feasible for them to join the labor force both in terms of time constraints as well as social acceptance. It is most likely through exposure to more number of married working women that there can be a shift in the attitude of men towards their wives joining paid work or aspiring to a career. As women's own beliefs about work begin to change, when complemented by a change in the attitudes of their spouses towards rigid gender roles, they begin to change their preference ordering to one that gives a higher rank to paid work or a career.

Even though there has been a lot of improvement in terms of women's prospects for a career, continued progress will require men's willingness to share household responsibilities, especially child-rearing. The gender gap in household work-share has narrowed since 1960 but women who work still bear a disproportionate burden of household work (Costa, 2000). Breaking down "gendered" structures will also require change in the attitudes of employers as well as co-workers, pressure from social movements such as the feminist movement, and complementary policy measures to reduce discrimination in workplaces and within households.

## 2.5 Conclusion

This paper is an attempt to motivate a framework that can account for adaptive preferences using a methodology common to the field of economics. In doing so, I reflect over the different aspects of adaptive preferences present in literature, and try to preserve in this framework the most valuable among those - individual agency. An individual is not just choosing the end outcomes from a feasible set but is deliberating over different sets of preferences through an underlying cognitive process that can rank these preference orderings. An analogy would be that of a person choosing a particular type of lifestyle that is most compatible with the prevailing culture, institutions, and their physical,social, economics,

and political circumstances.

The model presents a simple expected utility setup where an individual chooses between pairs of opportunity sets and preference orderings. Uncertainty is introduced through different probabilities of realizing different opportunity sets. The model also introduces the possibility of altering these probabilities through individual effort. The framework leaves scope for policy intervention in the form of changing the way individual effort can be translated into more opportunities, as well as in altering beliefs about the probabilities of realizing opportunities through advocacy and awareness campaigns. As a case study of Adaptive Preferences, I present a discussion of "gendered" preferences and how these can be incorporated in analyzing the movements in women's labor force participation over the last century.

## 2.6 Appendix

### 2.6.1 Proof of Proposition 1

From Equations (4) and (5) we get the following -

$$V(A,R_0) - V(A,R_1) = p\{[U(A_0,R_0) - U(A_1,R_0)] - [U(A_0,R_1) - U(A_1,R_1)]\} + U(A_1,R_0) - U(A_1,R_1)$$

When $p = 0$, $V(A,R_0) - V(A,R_1) = U(A_1,R_0) - U(A_1,R_1) < 0$ (By assumption (2)))

When $p = 1$, $V(A,R_0) - V(A,R_1) = U(A_0,R_0) - U(A_0,R_1) > 0$ (By assumption (3))

Note that $[U(A_0,R_0) - U(A_1,R_0)] - [U(A_0,R_1) - U(A_1,R_1)]$ must be positive, otherwise $V(A,R_0) - V(A,R_1)$ can never be greater than zero. As $p$ increases, $p\{[U(A_0,R_0) - U(A_1,R_0)] - [U(A_0,R_1) - U(A_1,R_1)]\}$ increases. This implies that $V(A,R_0) - V(A,R_1)$ is strictly monotonic in $p$ – when $p = 0$ it is negative and thereafter increasing in $p$. Thus there is a threshold probability $p^*$ at which $V(A,R_0) - V(A,R_1) = 0$. It is positive above this value and negative below the threshold.

We can solve for this threshold probability by setting $V(A,R_0) - V(A,R_1) = 0$:

$$p^* = \frac{U(A_1,R_0) - U(A_1,R_1)}{[U(A_0,R_0) - U(A_1,R_0)] - [U(A_0,R_1) - U(A_1,R_1)]}$$

### 2.6.2 Proof of Lemma 1

To solve for the optimal effort given a certain preference ordering, first fix the preference ordering and then maximize expected utility.

Max $V(A,R_0,L) = p(L)U(A_0,R_0) + (1-p(L))U(A_1,R_0) - w(L)$ w.r.t. $L$

Max $V(A,R_1,\hat{L}) = p(\hat{L})U(A_0,R_1) + (1-p(\hat{L}))U(A_1,R_1) - w(\hat{L})$ w.r.t. $\hat{L}$

To get an interior solution, I further assume:

$p'(0)[U(A_0,R_0) - U(A_1,R_0)] - w'(0) > 0 > p'(1)[U(A_0,R_0) - U(A_1,R_0)] - w'(1)$

Solving for $L^*$ and $\hat{L}^*$ gives the following:

$$\frac{\frac{w'(L^*)}{p'(L^*)}}{\frac{w'(\hat{L}^*)}{p'(\hat{L}^*)}} = \frac{U(A_0, R_0) - U(A_1, R_0)}{U(A_0, R_1) - U(A_1, R_1)}$$

Recall the Assumption in eq.(8):

$$[U(A_0, R_0) - U(A_1, R_0)] - [U(A_0, R_1) - U(A_1, R_1)] > 0$$

This implies:

$$\frac{\frac{w'(L^*)}{p'(L^*)}}{\frac{w'(\hat{L}^*)}{p'(\hat{L}^*)}} = \frac{U(A_0, R_0) - U(A_1, R_0)}{U(A_0, R_1) - U(A_1, R_1)} > 1$$

i.e.

$$\frac{w'(L^*)}{p'(L^*)} > \frac{w'(\hat{L}^*)}{p'(\hat{L}^*)}$$

Given the assumptions $p'(L) > 0$, $p''(L) < 0$; and $w'(L) > 0$, $w''(L) > 0$, $\frac{w'(L)}{p'(L)}$ is strictly increasing in L. Therefore,

$$L^* > \hat{L}^*$$

### 2.6.3 Proof of Proposition 2

Substituting the respective optimal effort levels in to Equations (4) and (5) -

$$V(A, R_0, L^*) = p(L^*)U(A_0, R_0) + (1 - p(L^*))U(A_1, R_0) - w(L^*)$$

$$V(A, R_1, \hat{L}^*) = p(\hat{L}^*)U(A_0, R_1) + (1 - p(\hat{L}^*))U(A_1, R_1) - w(\hat{L}^*)$$

Since $L^*$ and $\hat{L}^*$ are optimal effort levels associated with each preference ordering, they are taken as fixed, or constant, when deciding between the preference orderings. Hence, $p(L^*)$

can be expressed as a constant $p^*$, and $p(\hat{L}^*)$ can be expressed as a constant $\hat{p}^*$. Similarly, $w(L^*)$ can be expressed as a constant $w^*$, and $w(\hat{L}^*)$ can be expressed as a constant $\hat{w}^*$.

An individual gets higher utility from $R_0$ when:

$V(A, R_0, L^*) - V(A, R_1, \hat{L}^*) > 0$

that is,

$$\{p^*U(A_0, R_0) + (1 - p^*)U(A_1, R_0) - w^*\} - \{\hat{p}^*U(A_0, R_1) + (1 - \hat{p}^*)U(A_1, R_1) - \hat{w}^*\} > 0$$

Given the assumptions of the model, and Lemma 1:

$p^*U(A_0, R_0) > \hat{p}^*U(A_0, R_1)$;

$(1 - \hat{p}^*)U(A_1, R_1) > (1 - p^*)U(A_1, R_0)$;

and $w^* > \hat{w}^*$.

Rearranging the difference in expected utility from $R_0$ and $R_1$:

$$\{p^*U(A_0, R_0) - \hat{p}^*U(A_0, R_1)\} - \{(1 - \hat{p}^*)U(A_1, R_1) - (1 - p^*)U(A_1, R_0)\} - \{w^* - \hat{w}^*\} > 0$$

which can be written as,

$$\{p(L^\star)U(A_0, R_0) - p(\hat{L}^\star)U(A_0, R_1)\} - \{(1 - p(\hat{L}^\star))U(A_1, R_1) - (1 - p(L^\star))U(A_1, R_0)\} > w(L^\star) - w(\hat{L}^\star)$$

that is,

{expected utility gain from $R_0$ when opportunity set is $A_0$}

$-$ {expected utility loss from $R_0$ when opportunity set is $A_1$} $>$ {additional cost of effort from $R_0$}

Or,

Net Expected Utility gain from choosing $R_0$ $>$ Additional cost of effort from choosing $R_0$

# Chapter 3: Infant Mortality and Fertility Decisions: Evidence from Sub-Saharan Africa

*(part of joint work with Joseph Cummins, William Dow, and Nicholas Wilson)*


## Abstract

In this paper we analyze data from Demographic Health Surveys (DHS) in 30 Sub Saharan African (SSA) countries for the period 1986-2011 to estimate the relationship between regional aggregates of infant mortality rate (IMR) and household fertility decisions. The objective is to link household beliefs about child survival probability with household fertility decisions. Pooling data from all countries and using a least squares specification with region and year fixed effects, we find that a 10 percent increase (decrease) in lagged IMR is associated with an increases (decrease) in the probability of giving birth by 0.6 percent off a baseline probability of 15.7 percent in urban areas, and by 0.29 percent off a baseline probability of 22.7 percent in rural areas.

## Introduction

Improvements in infant (and child) mortality have been accompanied by declining fertility all across the world – in developed and developing countries. Our study focuses on measuring the association between infant mortality and household fertility decisions while controlling for various spatial and temporal confounders. We posit that individuals base their fertility choices, among other factors, on their expectation of their infant (or child) surviving. Our paper explores this link in Sub-Saharan African (SSA) countries and estimates a lagged effect of regional infant mortality on individual fertility decisions. We find that a 10 percent decrease in the average regional infant mortality rate in the previous two years is associated with a decline of 0.6 percent in the probability of giving birth in urban areas over a mean probability of 15.7 percent, and 0.29 percent decline in probability of giving birth in rural areas over a mean probability of 22.7 percent.

There are three main theories that predict a behavioral response in parents' fertility choices to changes in expected survival probability of infants and to death of an infant. According to the replacement hypothesis (*"replacement" effect*), parents react to a child's death by raising the number of subsequent births. According to the child survival hypothesis (*"insurance"* or *"hoarding" effect*), a child's probability to survive influences the number of births – high anticipated levels of mortality are met with increase in precautionary demand for children (Chowdhury, 1988; Rosenzweig and Schultz, 1983). The theory of demographic transition also suggests a lagged causal relationship between infant mortality and the fertility rate. According to this theory, infant mortality rate declines through the process of economic development and industrialization along with a concurrent shift in the quantity-quality trade-off for parents. Thus the fertility rate eventually adjusts to the lower mortality rate.

In this paper we find a positive association between infant mortality in a given region and the probability of subsequent births, which can be interpreted within a framework of parents' expectations about child survival and how that affects fertility choices. When infant mortality declines in a given region, there could be some informational feedback to parents

who then adjust their expectation of mortality and respond by reducing the number of subsequent births. Moreover, there is a similar positive association between infant mortality and desired number of children that is suggestive of a shift in the quality-quantity trade-off whereby households are adjusting their long-term fertility choices.

## Background

Many developing countries, especially in Sub-Saharan Africa, are currently in the process of demographic transition and have undergone large changes in infant mortality and fertility over the period examined in this paper. This gives us an opportunity to see how the relationship between infant mortality and fertility is playing out now as compared to previous experiences.

There is ample empirical evidence on effect of fertility on infant and child mortality with unambiguous results – birth intervals, birth order, and mother's age at birth all have significant (negative) effects on infant and early child mortality. These results persist across countries and are robust to variations in empirical specifications and measurements. While it is widely accepted that the causal relation also works in the opposite direction – infant and early childhood mortality could also affect fertility levels and patterns – evidence of an effect of infant and child mortality on fertility has been quite ambiguous (Palloni and Rafalimanana, 1999). There are different studies that either support, or refute, one or more of the theories outlined earlier on how infant mortality affects fertility.

Chowdhury (1988) uses the Granger Causality test to investigate the relationship between infant mortality and fertility in 35 developing countries between 1947-1983. In few countries the author does not find a causal relationship; while in others there is a significant positive association between infant mortality and fertility. Moreover, in many countries there is evidence of a long and positive lag structure, which lends support to the demographic transition theory. Yamada (1985) also employs the Granger Causality test using annual data for the Western European countries and the United States, and finds that infant mortality and fertility are not independent but jointly determined. The author further

shows that the reductions in infant mortality due to an increase in per capita real income triggers a subsequent decline in fertility. This particular pathway is also encapsulated in the demographic transition theory.

Ben-Porath (1976) analyzes a retrospective survey of the birth history of married women in Israel for the period 1960-1963, and finds strong evidence for the replacement effect – experiencing the death of a child increases the number of births and reduces the intervals between births. Olsen (1980) also finds evidence supporting the replacement effect in Colombia – each death produces 0.2 new births as a direct result of the death. On the other hand, Chowdhury et al. (1976) for Pakistan and Bnagladesh, and May and Heer (1968) for India, find evidence in support of the child survival hypothesis or the hoarding effect. A counter finding in Rutstein and Medica (1978), who use data from Colombia, Costa Rica, Mexico, and Peru for 1969-1970, is that in a number of regions increase in infant mortality leads to a decrease in subsequent fertility. The authors conjecture that this could be due to an adverse health environment affecting both mother and child, leading to the death of a child as well as shortening fecundity and subsequent fertility. Moreover they observe that in a number of regions fertility is close to the natural limit, leaving little room for a replacement effect.

Rosenzweig and Schultz (1983), using data from the 1967, 1968, and 1969 National Natality Follow-back Surveys (USDHEW) in United States, find that the average number of children per mother would increase by one-sixth of a child if an infant mortality rate of 0.1 were anticipated. They argue that the positive gross correlations between infant mortality and fertility mask a negative biological effect of birth order on infant mortality and a substantial positive behavioral response of fertility to the anticipation of a higher mortality risk. Galloway et al. (1998) analyze data from Prussia between 1875 to 1910 using a two-stage least squares estimation model to deal with potential two-way causality between child mortality and fertility. When estimated with district fixed effects, the results show a significant positive relationship between child mortality and fertility. In rural districts there is almost a one-to-one association between the two variables, while the coefficient in cities is

even larger.

Palloni and Rafalimanana (1999) examine empirical evidence from Latin American countries during 1920 to 1990 to investigate the relationship between fertility and infant and child mortality at several levels of aggregation – cross-country information over several decades, yearly series of births, deaths, infant deaths, and socioeconomic indicators for selected countries, and individual reproductive histories from the DHS. They find a modest impact of mortality decline on the fertility decline that took place after 1960 in most countries.

This ambiguity in the literature suggests that the link between infant mortality and fertility is heavily context-dependent as well as sensitive to empirical specifications. In our paper, we use multiple DHS rounds from Sub-Saharan Africa to control for region and year fixed effects. This allows us to exploit the country-region-year variation to estimate individual response to changes in regional infant mortality levels.

# Estimation

## 6.1 Data

We use data from multiple survey rounds of the Demographic and Health Surveys (DHS) between 1986-2011 in 30 countries of Sub-Saharan Africa. Each country is further divided into regions that allows us to control for region fixed effects in our estimation [32].

Using the information on birth history of each woman, we construct a woman-level panel where each woman is observed retrospectively for 15 years. This also allows us to track changes in number of births, infant mortality rate, desired family size, and other variables of interest, over a continuous range of years. We restrict our sample to women who are 15-39 years of age in a particular panel year.

The data on births gives us the opportunity to construct an Infant Mortality rate (IMR) variable, or under-one mortality rate, for country $c$, region $r$, and year $t$. This variable is

[32] The DHS data used needed significant corrections in region code inconsistencies.

then merged with the woman-level panel described above. For the estimation equation, we use an average of IMR with a lag of 2 years and IMR with a lag of 3 years. That is:

$$LaggedIMR_{crt} = IMR_{cr(t-2)} + IMR_{cr(t-3)}$$

## 6.2 Descriptive Statistics

Figure 13 graphs the time-series of infant mortality rate (IMR) and the probability of birth over the years in urban and rural areas. Here the infant mortality rate (IMR) is the mean IMR in a country-region-urban-year cell and is meant to reflect a local measure of infant mortality that informs the expectations of households about survival probabilities. There is a persistent decline in both IMR and probability of birth – a trend described in numerous other studies in many developing countries over the same period. Figure 14 shows the correlation between probability of birth in a given year and lagged IMR in urban and rural areas. There is positive correlation between the two with the trend being steeper in urban than rural areas. In urban areas, a 1 percent decrease in lagged IMR is associated with about 5 percent decline in probability of birth in a year; in rural areas, a 1 percent decrease in lagged IMR is associated with about 2.55 percent decline in probability of birth in a year.

Figure 15 shows the time-series of IMR and of the desired number of children while Figure 16 shows the correlation between lagged IMR and desired number of children. The trends in probability of birth and in desired number of children are very similar as is their correlation with infant mortality. This suggests that families were changing long-term fertility choices rather than just adjusting number of births to short-term changes in infant mortality.

## 6.3 Empirical Strategy

As mentioned earlier, we are attempting to capture how expectations about survival of infants can affect fertility decisions. Suppose households form expectations about their child's health and survival in part based on what they observe in their community and region. Then the probability of whether a woman gives birth in a year will depend, among other

factors, on her expectations about the likelihood of her child surviving and hence on the locally observed IMR in the recent past. Using IMR aggregated to country-region-urban-year cells as a local measure of infant survival probability, we estimate the effect of lagged IMR on the probability of a woman giving birth in a given year.

In the case of country-specific regression, the estimating equation is:

$$Birth_{irt} = \beta_1 LaggedIMR_{rt} + \beta_2 X_{irt} + \lambda_r + \lambda_t + \mu_{irt} nt$$

$i$ is the individual woman in region $r$ and year $t$. $X$ is the set of controls which includes maternal age and age-squared, education, number of children, birth last year, and desired number of children. $\lambda_r$ is region fixed effect and $\lambda_t$ is year fixed effect. This is estimated separately for urban and rural areas.

Pooling data from all countries together, we estimate an OLS specification with country-region and country-year fixed effects:

$$Birth_{icrt} = \beta_1 LaggedIMR_{crt} + \beta_2 X_{icrt} + \lambda_{cr} + \lambda_{ct} + \mu_{icrt}$$

$i$ is the individual woman in country $c$, region $r$ and year $t$. The set of controls are the same as above, $\lambda_{cr}$ is country-region fixed effect and $\lambda_{ct}$ is country-year fixed effect. This is estimated separately for urban and rural areas.

The same analysis is repeated with desired number of children as the dependent variable. This is done to examine whether changes in infant mortality were concurrent to shifts in long-term fertility behavior of households – if they are re-evaluating the optimal family size itself and not just responding to higher probability of infant survival. For example, it is not just that if they wanted 5 surviving children, earlier they would have to give birth to 6, whereas now they only need 5 births; but also that now they only want 4 surviving children and give birth to 4.

## Results

Figure 17 and Figure 18 show the country-specific associations between lagged IMR and probability of giving birth for urban and rural areas respectively. The results are not consistent across all countries – in about a third of the them, there is no significant association between lagged IMR and probability of birth. For urban areas, there are about seven countries with a positive and statistically significant relationship between lagged IMR and probability of birth and two with a negative statistically significant association between these variables; in rural areas, there are about five countries with a positive statistically significant association and five with a negative statistically significant association between lagged IMR and subsequent birth probability.

Table 16 gives the regression estimates of the association between lagged IMR and probability of giving birth in urban and rural areas using data from all countries pooled together. The estimates show that a 10 percent increase (decrease) in lagged IMR is associated with an increase (decrease) in the probability of giving birth by 0.6 percent over a baseline probability of 15.7 percent in urban areas, and by 0.29 percentage points over a baseline probability of 22.7 percent in rural areas. These results indicate a significant but modest association between the probability of giving birth and the average of IMR over past two years in a region.

Figure 19 and Figure 20 show the country-specific associations between lagged IMR and desired number of children for urban and rural areas respectively. The results are similar as with probability of giving birth. Table 17 gives the corresponding regression estimates. The coefficient for urban areas implies that a 1 percent decrease in lagged IMR is associated with a decrease of 0.067 in the desired number of children in urban areas, and a decrease of 0.021 in the desired number of children in rural areas. This is again a significant but modest association between desired number of children and lagged IMR

## Conclusion

This paper presents new estimates of the association between infant mortality and fertility decisions in Sub-Saharan African countries during the period 1986-2011. We find a modest positive association between the probability of a woman giving birth in a given year and the average IMR in a region over the previous two years. A similar association is observed between IMR and the desired number of children. These results suggest there is some feedback between declining infant mortality and how households optimally determine their fertility choices – both short-term and long-term[33].

On one hand, we provide evidence that a decrease in infant mortality in a region leads to parents revising their expectations of infant survival and therefore reducing the subsequent number of births to meet the desired family size. This is in line with the predictions of the child survival hypothesis or "hoarding" effect. On the other hand, a simultaneous decrease in the desired number of children suggests a more long-term adjustment in the fertility behavior of households, akin to the behavioral shifts outlined in the demographic transition theory.

[33] We estimate this relationship for each country as well and find that in about a third of the countries, there is an absence of any association between infant mortality and fertility. A closer investigation reveals that these countries have experienced certain civil and political conflicts which has stalled the decline in infant mortality.

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## Figures and Tables

Figure 1: Education of Household Head

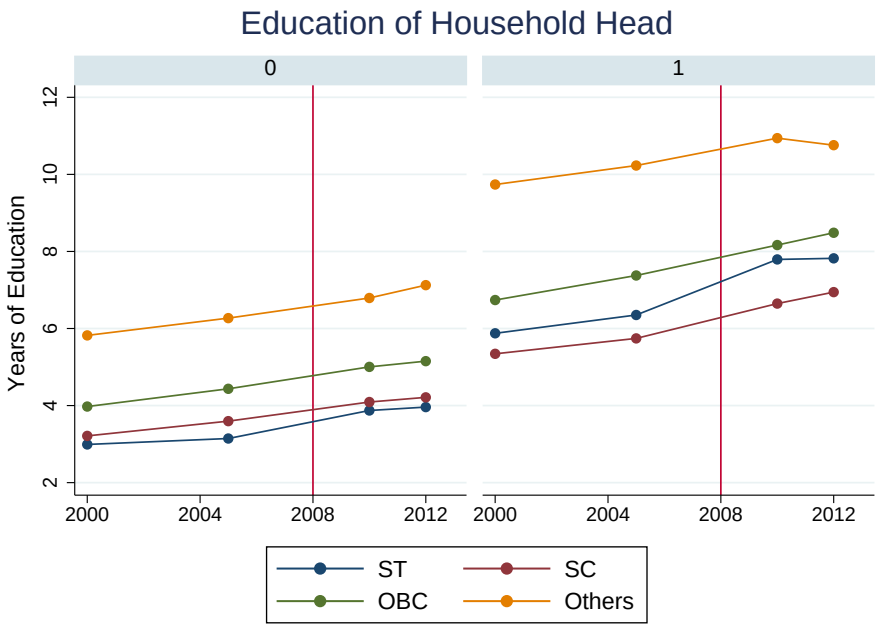



Figure 2: Monthly Per Capita Expenditure

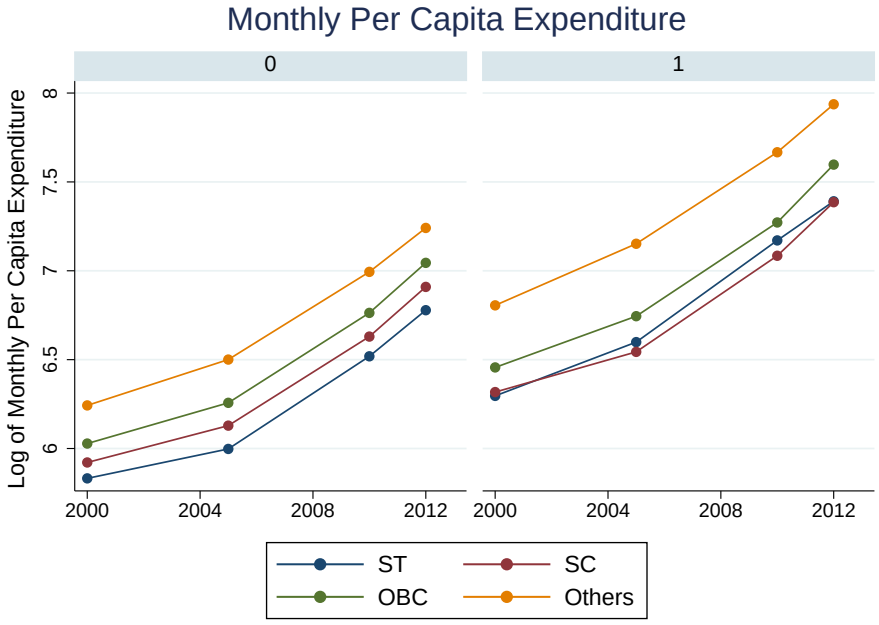


Figure 3: Percentage of Urban Households in Sample

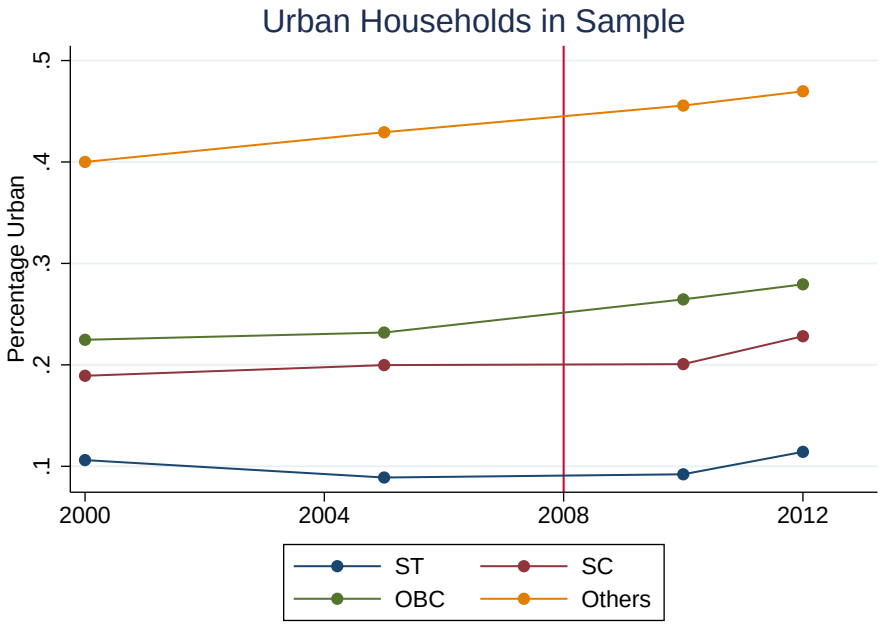



Figure 4: College Enrollment Rates: Before and After Policy

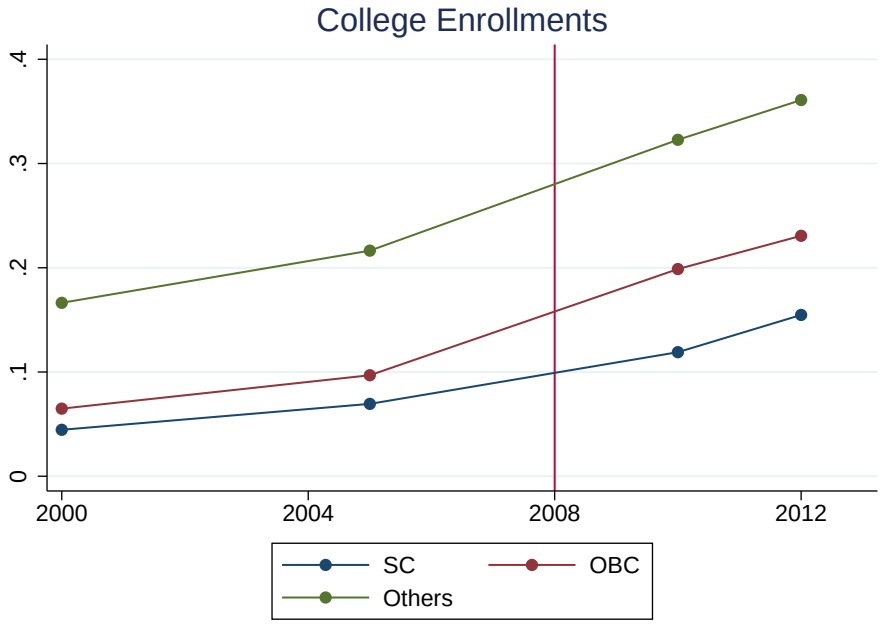


Figure 5: College Enrollment by place of residence and sex

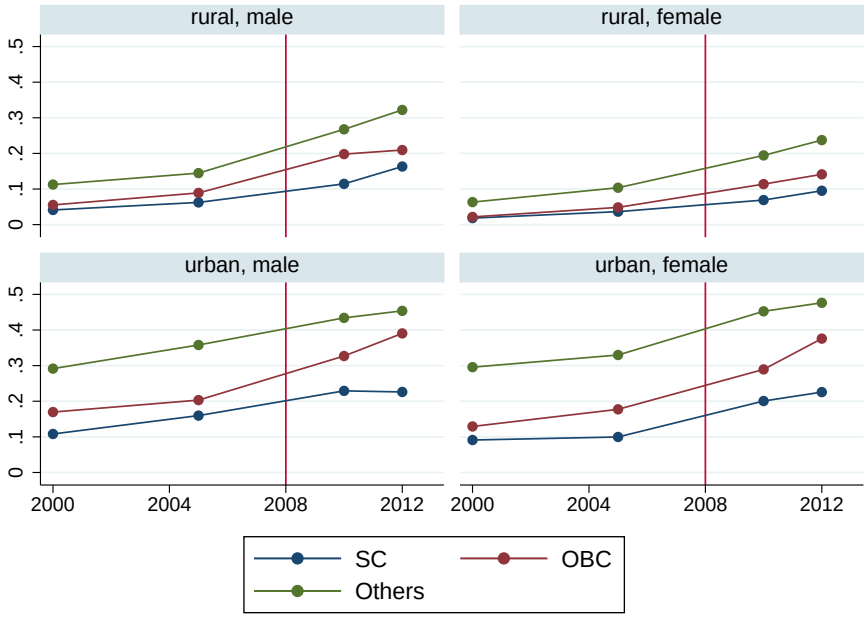



Figure 6: College Enrollment by Education level of Household Head

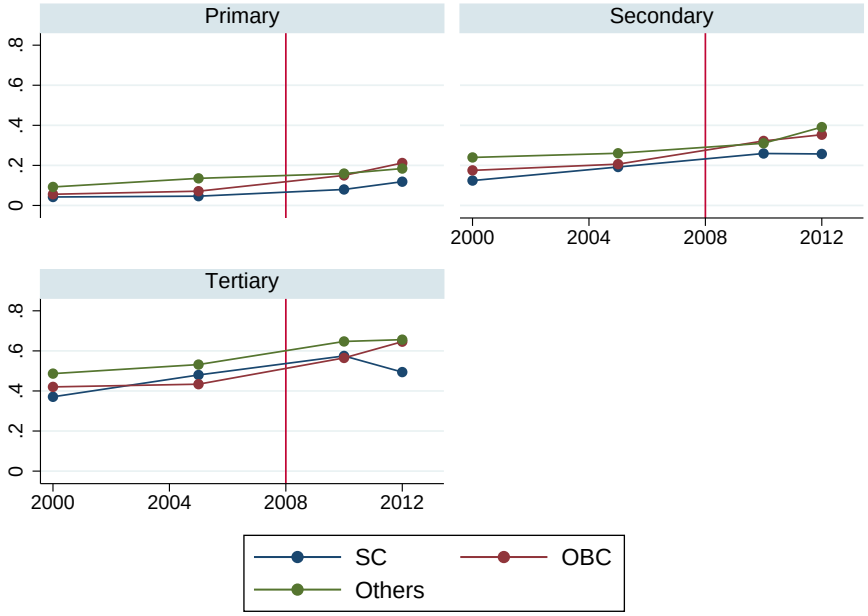


Figure 7: High-School Completion: Before and After Policy

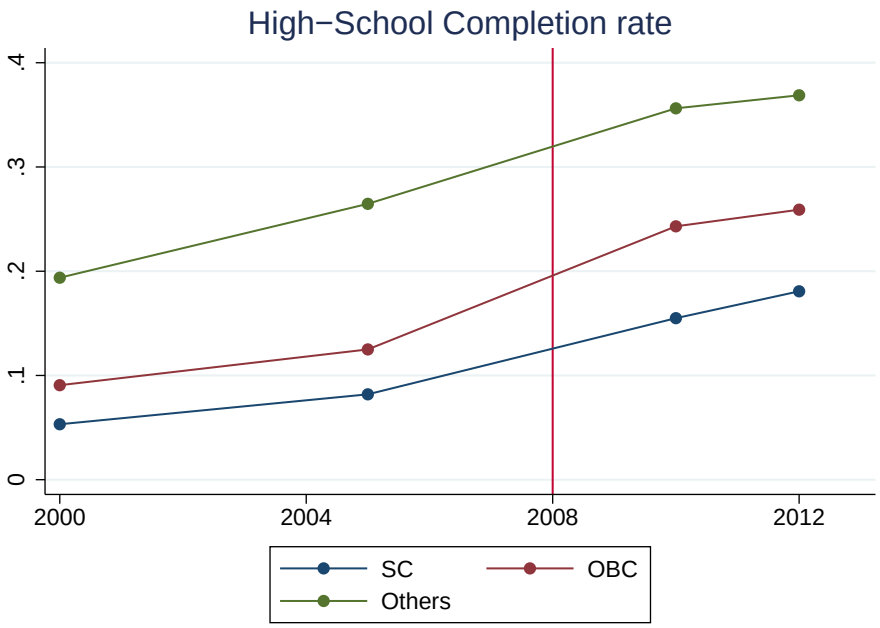



Figure 8: High-School Completion by place of residence and sex

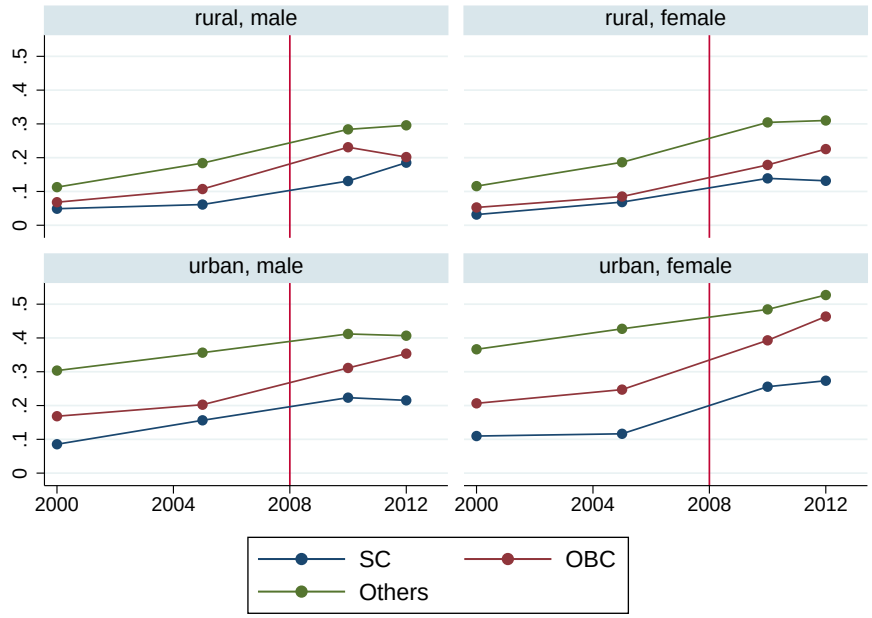


Figure 9: High-School Completion by Education level of Household Head

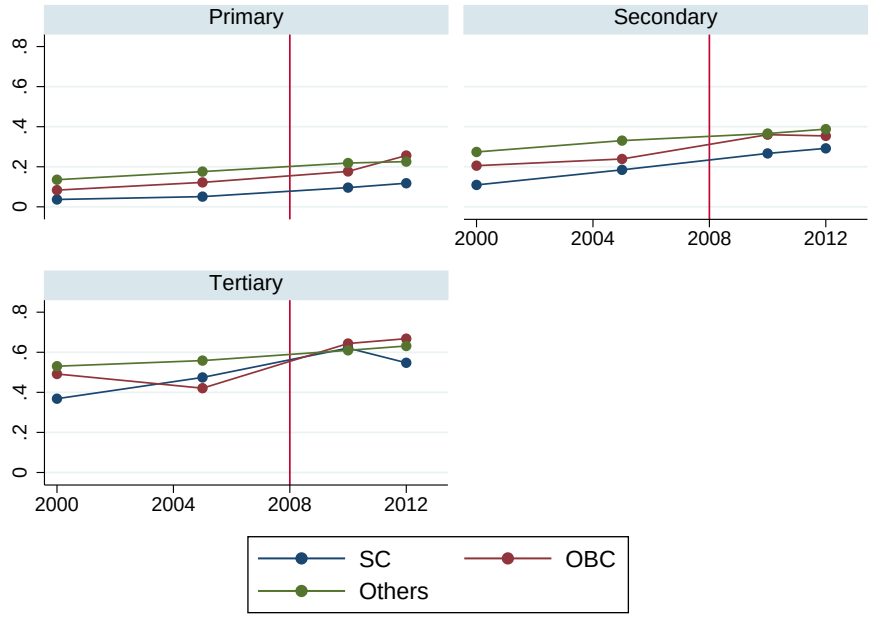



Figure 10: Effect of College Access on School Enrollment: OLS Estimates

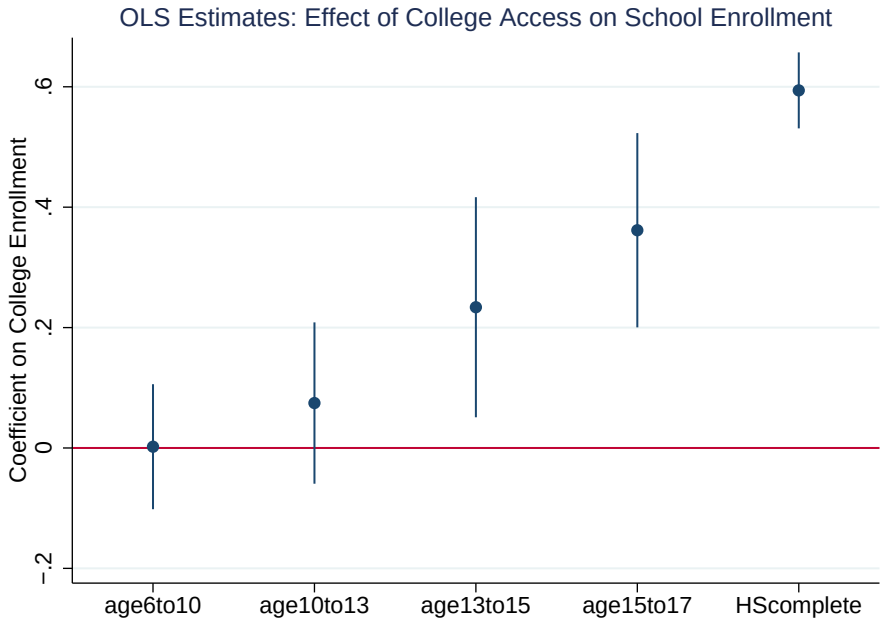


Figure 11: Effect of College Access on School Enrollment: 2SLS Estimates

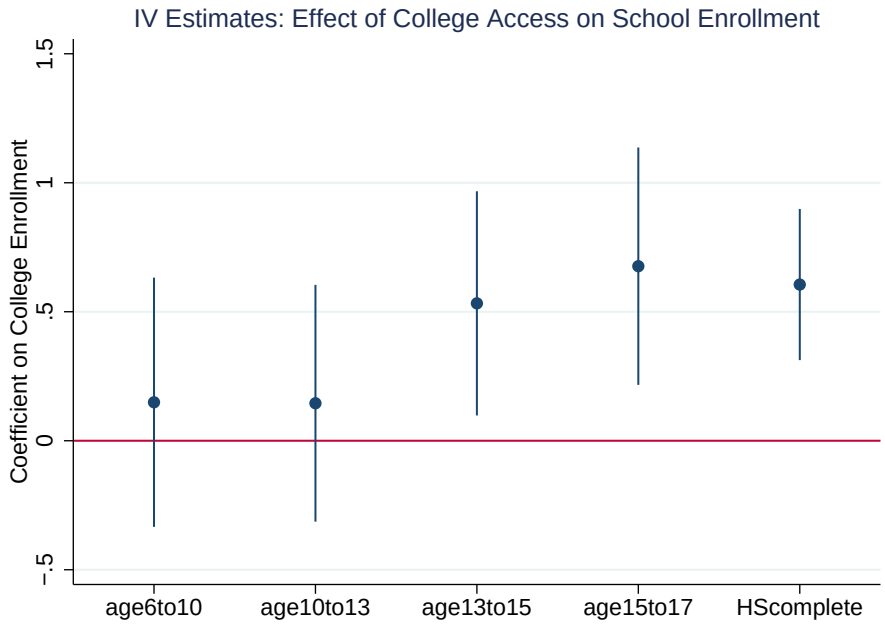



Figure 12: Age-Distribution in College Enrollments

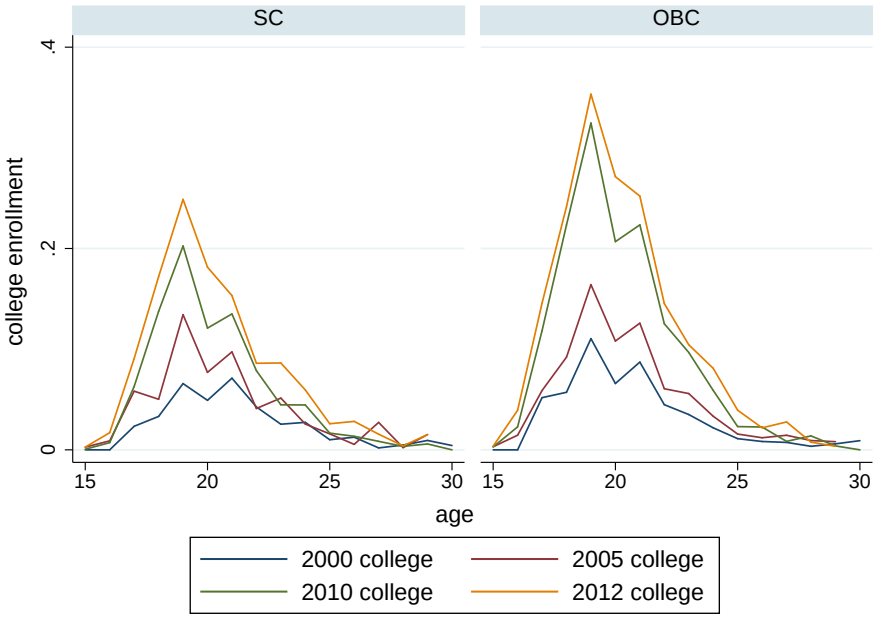
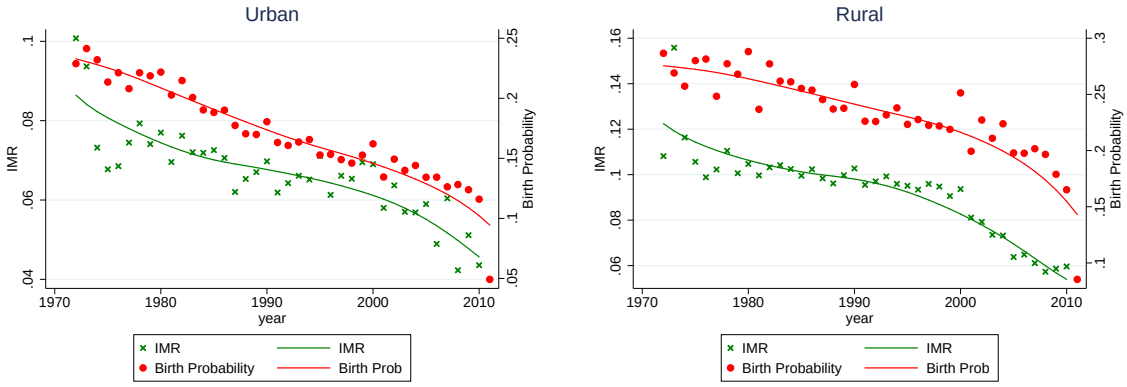
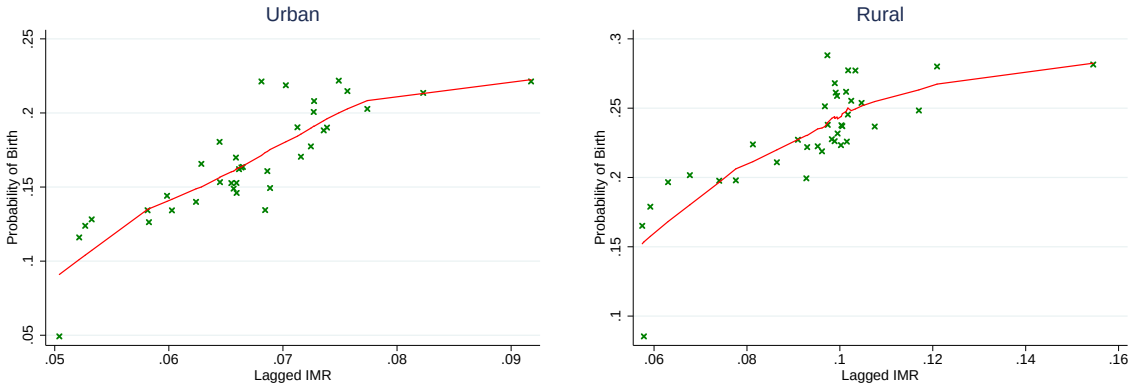


Figure 13: IMR and Probability of Birth: Time Trends



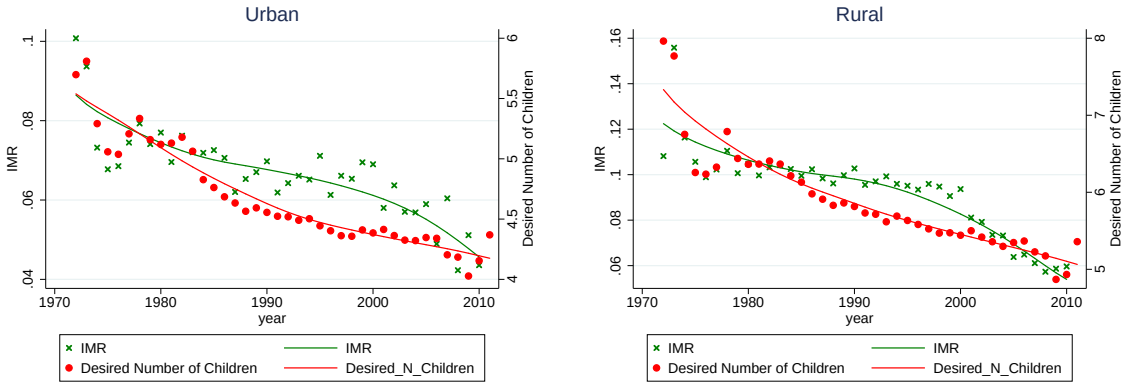

(a) Urban (b) Rural

Figure 14: Probability of Birth and Lagged IMR



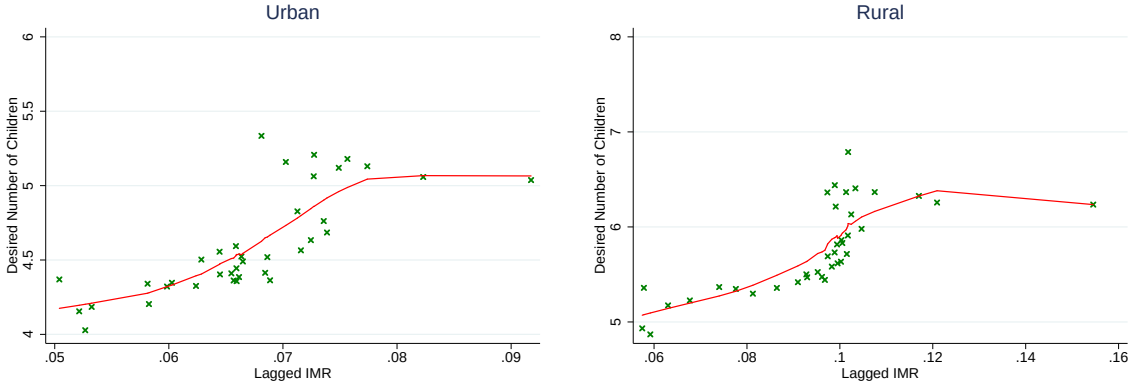

(a) Urban (b) Rural

Figure 15: IMR and Desired Number of Children: Time Trends




(a) Urban (b) Rural

Figure 16: Desired Number of Children and Lagged IMR




(a) Urban (b) Rural

Figure 17: Effect of Lagged IMR on Probability of Birth: Country-Wise (Urban)

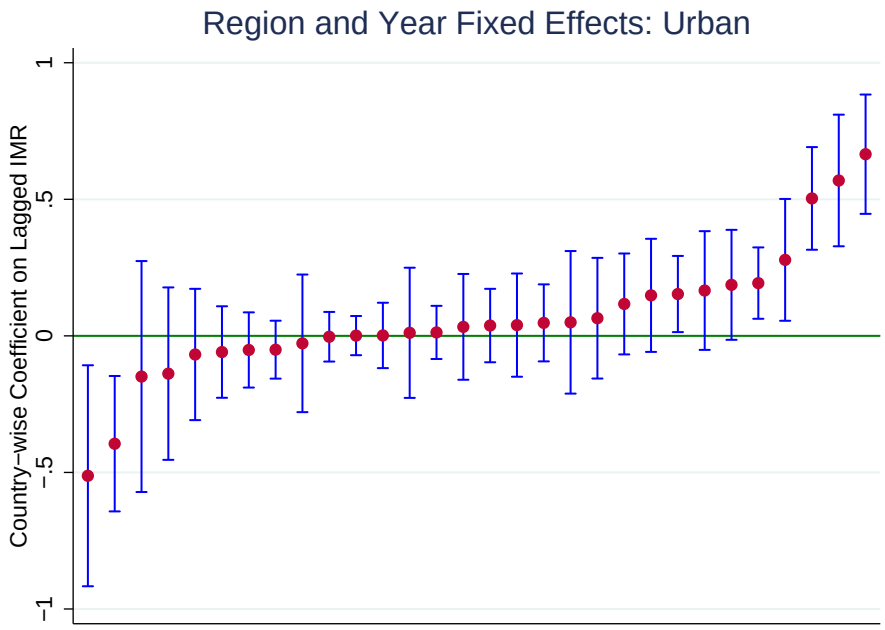



Figure 18: Effect of Lagged IMR on Probability of Birth: Country-Wise (Rural)

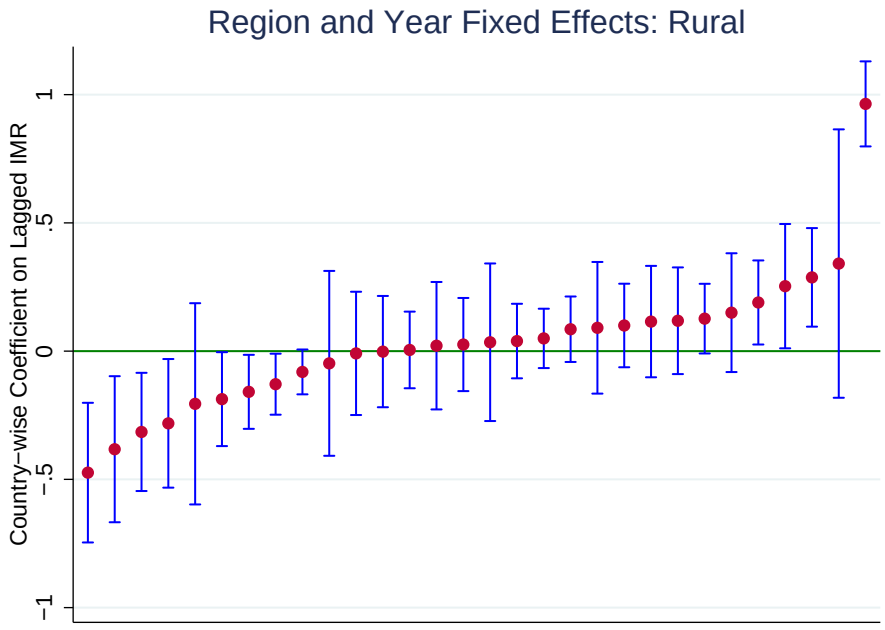


Figure 19: Effect of Lagged IMR on Desired Number of Children: Country-Wise (Urban)

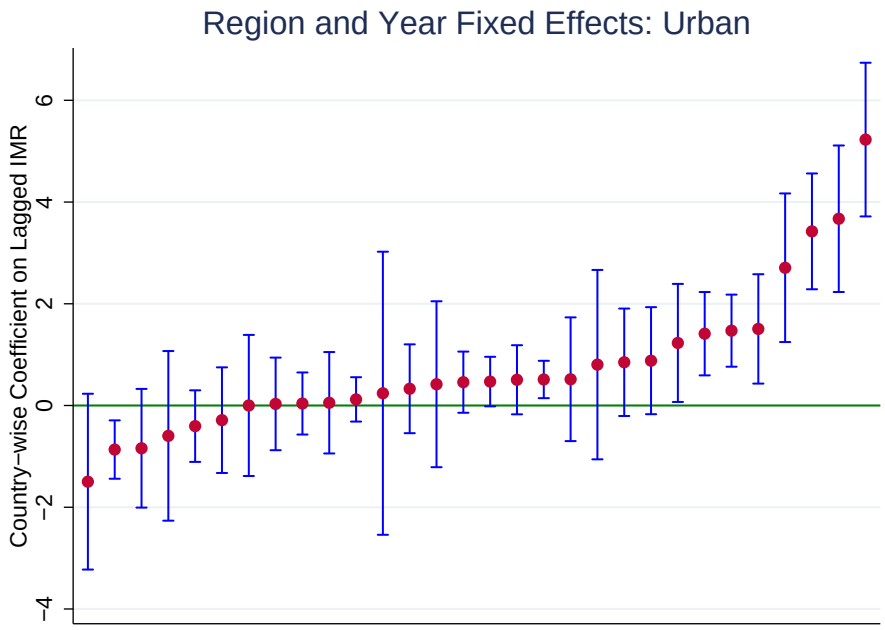



Figure 20: Effect of Lagged IMR on Desired Number of Children: Country-Wise (Rural)

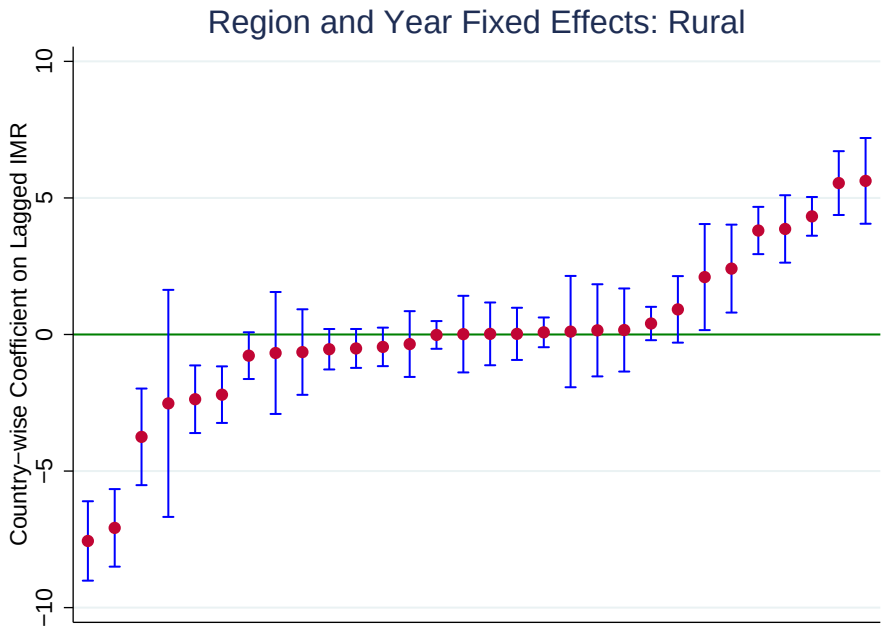


Table 1: Sample Sizes

| | 1999-2000 | 2004-05 | 2009-10 | 2011-12 |
|---|---|---|---|---|
| No. of Households | 120216 | 124586 | 100957 | 101721 |
| No. of Individuals | 594774 | 602814 | 459784 | 456999 |
| Hindu Households | 93542 | 95021 | 76949 | 77034 |

Table 2: Share of each Social Group in Sample

| | 2000 | 2005 | 2010 | 2012 |
|---|---|---|---|---|
| ST | 0.0944 | 0.0891 | 0.0916 | 0.0925 |
| SC | 0.218 | 0.223 | 0.223 | 0.218 |
| OBC | 0.383 | 0.430 | 0.430 | 0.443 |
| Others | 0.304 | 0.258 | 0.255 | 0.247 |

Table 3: Impact on college enrollment rates by different excluded groups

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | SC | Others | SC/Others |
| postxOBC | 0.051*** | -0.014 | 0.018** |
| | (0.007) | (0.013) | (0.009) |
| post | 0.017 | 0.082*** | 0.052** |
| | (0.014) | (0.026) | (0.023) |
| OBC | -0.006 | -0.038*** | -0.026*** |
| | (0.004) | (0.007) | (0.004) |
| hhedu | 0.015*** | 0.020*** | 0.020*** |
| | (0.001) | (0.001) | (0.001) |
| urban | 0.042*** | 0.070*** | 0.064*** |
| | (0.007) | (0.012) | (0.010) |
| female | -0.040*** | -0.043*** | -0.041*** |
| | (0.005) | (0.006) | (0.005) |
| logmpce | 0.072*** | 0.067** | 0.064** |
| | (0.016) | (0.027) | (0.026) |
| Observations | 106,496 | 127,070 | 162,131 |
| R-squared | 0.231 | 0.317 | 0.292 |
| State FE | Yes | Yes | Yes |
| Age dummies | Yes | Yes | Yes |
| Mean | 0.0967 | 0.0967 | 0.0967 |

Robust standard errors in parentheses

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

Sample restricted to individuals aged 17 to 22 years

Standard errors clustered at State-year level

Table 4: Impact on College Enrollment by place of residence and sex

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Rural Male | Rural Female | Urban Male | Urban Female |
| postxOBC | 0.016 | 0.001 | 0.052*** | 0.048** |
| | (0.015) | (0.011) | (0.016) | (0.018) |
| post | 0.073*** | 0.065*** | 0.026 | 0.016 |
| | (0.025) | (0.014) | (0.027) | (0.026) |
| OBC | -0.016** | -0.013*** | -0.041*** | -0.061*** |
| | (0.007) | (0.003) | (0.009) | (0.011) |
| hhedu | 0.017*** | 0.010*** | 0.030*** | 0.026*** |
| | (0.001) | (0.001) | (0.002) | (0.002) |
| logmpce | 0.049* | 0.035** | 0.085*** | 0.115*** |
| | (0.026) | (0.015) | (0.029) | (0.028) |
| Observations | 51,740 | 48,190 | 33,433 | 28,768 |
| R-squared | 0.207 | 0.157 | 0.416 | 0.414 |
| State FE | Yes | Yes | Yes | Yes |
| Age dummies | Yes | Yes | Yes | Yes |
| Mean | 0.0891 | 0.0484 | 0.202 | 0.177 |

Robust standard errors in parentheses

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

SC and Others used as Control

Sample restricted to individuals aged 17 to 22 years

Standard errors clustered at State-year level

Table 5: College Enrollment when Household Head has Primary Education

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | SC | Others | SC/Others |
| postxOBC | 0.040*** | -0.003 | 0.026*** |
| | (0.007) | (0.014) | (0.009) |
| post | 0.026** | 0.072*** | 0.044*** |
| | (0.011) | (0.019) | (0.015) |
| OBC | -0.001 | -0.025*** | -0.010*** |
| | (0.003) | (0.005) | (0.003) |
| female | -0.028*** | -0.030*** | -0.028*** |
| | (0.004) | (0.005) | (0.004) |
| logmpce | 0.044*** | 0.041*** | 0.039*** |
| | (0.011) | (0.016) | (0.015) |
| Observations | 67,177 | 63,311 | 88,172 |
| R-squared | 0.104 | 0.117 | 0.104 |
| State FE | Yes | Yes | Yes |
| Age dummies | Yes | Yes | Yes |
| Mean | 0.0488 | 0.0488 | 0.0488 |

Robust standard errors in parentheses

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

Sample restricted to individuals aged 17 to 22 years

Standard errors clustered at State-year level

Table 6: College Enrollment when Household Head has Secondary Education

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | SC | Others | SC/Others |
| | | | |
| postxOBC | 0.031* | 0.014 | 0.026 |
| | (0.017) | (0.022) | (0.017) |
| post | 0.035** | 0.061*** | 0.046** |
| | (0.016) | (0.023) | (0.020) |
| OBC | 0.016 | -0.059*** | -0.036*** |
| | (0.011) | (0.011) | (0.008) |
| female | -0.054*** | -0.041*** | -0.046*** |
| | (0.012) | (0.009) | (0.009) |
| logmpce | 0.102*** | 0.091*** | 0.094*** |
| | (0.015) | (0.022) | (0.022) |
| | | | |
| Observations | 26,695 | 38,778 | 45,943 |
| R-squared | 0.228 | 0.250 | 0.237 |
| State FE | Yes | Yes | Yes |
| Age dummies | Yes | Yes | Yes |
| Mean | 0.136 | 0.136 | 0.136 |

Robust standard errors in parentheses

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

Sample restricted to individuals aged 17 to 22 years

Standard errors clustered at State-year level

Table 7: College Enrollment when Household Head has Tertiary Education

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | SC | Others | SC/Others |
| postxOBC | 0.041 | 0.039* | 0.044** |
| | (0.028) | (0.022) | (0.020) |
| post | -0.034 | 0.026 | 0.013 |
| | (0.029) | (0.037) | (0.035) |
| OBC | -0.012 | -0.102*** | -0.086*** |
| | (0.023) | (0.017) | (0.016) |
| female | -0.100*** | -0.085*** | -0.080*** |
| | (0.018) | (0.016) | (0.015) |
| logmpce | 0.215*** | 0.153*** | 0.161*** |
| | (0.015) | (0.035) | (0.035) |
| Observations | 12,636 | 25,006 | 28,043 |
| R-squared | 0.487 | 0.530 | 0.520 |
| State FE | Yes | Yes | Yes |
| Age dummies | Yes | Yes | Yes |
| Mean | 0.346 | 0.346 | 0.346 |

Robust standard errors in parentheses

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

Sample restricted to individuals aged 17 to 22 years

Standard errors clustered at State-year level

Table 8: Impact on High-School completion rates by different excluded groups

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | SC | Others | SC/Others |
| postxOBC | 0.041*** | 0.007 | 0.026** |
| | (0.010) | (0.018) | (0.012) |
| post | 0.050*** | 0.098*** | 0.075*** |
| | (0.014) | (0.027) | (0.023) |
| OBC | 0.010* | -0.055*** | -0.026*** |
| | (0.005) | (0.009) | (0.005) |
| hhedu | 0.017*** | 0.021*** | 0.021*** |
| | (0.001) | (0.001) | (0.001) |
| urban | 0.035*** | 0.076*** | 0.062*** |
| | (0.007) | (0.012) | (0.010) |
| female | -0.009* | 0.004 | -0.001 |
| | (0.005) | (0.008) | (0.007) |
| logmpce | 0.065*** | 0.046* | 0.049* |
| | (0.015) | (0.027) | (0.026) |
| Observations | 51,112 | 60,604 | 77,514 |
| R-squared | 0.248 | 0.329 | 0.303 |
| State FE | Yes | Yes | Yes |
| Age dummies | Yes | Yes | Yes |
| Mean | 0.125 | 0.125 | 0.125 |

Robust standard errors in parentheses

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

Sample restricted to individuals aged 17 to 19 years

Standard errors clustered at State-year level

Table 9: Impact on High-School Completion by place of residence and sex

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Rural Male | Rural Female | Urban Male | Urban Female |
| postxOBC | 0.010 | 0.013 | 0.060*** | 0.081*** |
| | (0.022) | (0.018) | (0.017) | (0.023) |
| post | 0.096*** | 0.092*** | 0.036 | 0.033 |
| | (0.023) | (0.021) | (0.024) | (0.027) |
| OBC | -0.009 | -0.023*** | -0.045*** | -0.061*** |
| | (0.008) | (0.006) | (0.012) | (0.016) |
| hhedu | 0.017*** | 0.014*** | 0.030*** | 0.032*** |
| | (0.001) | (0.001) | (0.002) | (0.002) |
| logmpce | 0.032 | 0.044* | 0.054** | 0.091*** |
| | (0.022) | (0.022) | (0.025) | (0.027) |
| Observations | 25,784 | 22,083 | 16,353 | 13,294 |
| R-squared | 0.208 | 0.211 | 0.400 | 0.471 |
| State FE | Yes | Yes | Yes | Yes |
| Age dummies | Yes | Yes | Yes | Yes |
| Mean | 0.107 | 0.0852 | 0.201 | 0.246 |

Robust standard errors in parentheses

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

SC and Others used as Control

Sample restricted to individuals aged 17 to 19 years

Standard errors clustered at State-year level

Table 10: High-School Completion when Household Head has Primary Education

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | SC | Others | SC/Others |
| postxOBC | 0.034*** | -0.011 | 0.022 |
| | (0.011) | (0.025) | (0.015) |
| post | 0.051*** | 0.101*** | 0.068*** |
| | (0.013) | (0.028) | (0.019) |
| OBC | 0.020*** | -0.039*** | -0.004 |
| | (0.004) | (0.007) | (0.004) |
| female | -0.011** | -0.007 | -0.006 |
| | (0.004) | (0.006) | (0.005) |
| logmpce | 0.047*** | 0.043** | 0.042** |
| | (0.012) | (0.021) | (0.019) |
| Observations | 32,272 | 30,187 | 42,243 |
| R-squared | 0.128 | 0.148 | 0.130 |
| State FE | Yes | Yes | Yes |
| Age dummies | Yes | Yes | Yes |
| Mean | 0.0769 | 0.0769 | 0.0769 |

Robust standard errors in parentheses

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

Sample restricted to individuals aged 17 to 19 years

Standard errors clustered at State-year level

Table 11: High-School Completion when Household Head has Secondary Education

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | SC | Others | SC/Others |
| postxOBC | 0.002 | 0.027 | 0.028 |
| | (0.024) | (0.024) | (0.019) |
| post | 0.098*** | 0.084*** | 0.080*** |
| | (0.023) | (0.027) | (0.021) |
| OBC | 0.021 | -0.082*** | -0.054*** |
| | (0.014) | (0.011) | (0.010) |
| female | 0.008 | 0.029* | 0.021 |
| | (0.016) | (0.015) | (0.014) |
| logmpce | 0.086*** | 0.073*** | 0.076*** |
| | (0.015) | (0.022) | (0.021) |
| Observations | 12,832 | 18,667 | 22,092 |
| R-squared | 0.263 | 0.288 | 0.273 |
| State FE | Yes | Yes | Yes |
| Age dummies | Yes | Yes | Yes |
| Mean | 0.174 | 0.174 | 0.174 |

Robust standard errors in parentheses

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

Sample restricted to individuals aged 17 to 19 years

Standard errors clustered at State-year level

Table 12: High-School Completion when Household Head has Tertiary Education

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | SC | Others | SC/Others |
| postxOBC | 0.050 | 0.072** | 0.072** |
| | (0.050) | (0.031) | (0.032) |
| post | -0.003 | 0.033 | 0.023 |
| | (0.049) | (0.032) | (0.033) |
| OBC | 0.021 | -0.087*** | -0.070*** |
| | (0.042) | (0.022) | (0.024) |
| female | -0.019 | 0.011 | 0.006 |
| | (0.028) | (0.023) | (0.021) |
| logmpce | 0.162*** | 0.097*** | 0.110*** |
| | (0.024) | (0.032) | (0.034) |
| Observations | 6,013 | 11,761 | 13,190 |
| R-squared | 0.522 | 0.553 | 0.543 |
| State FE | Yes | Yes | Yes |
| Age dummies | Yes | Yes | Yes |
| Mean | 0.347 | 0.347 | 0.347 |

Robust standard errors in parentheses

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

Sample restricted to individuals aged 17 to 19 years

Standard errors clustered at State-year level

Table 13: Effect of College Access by different age groups: 2SLS Estimates

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Age 15-17 | Age 13-15 | Age 10-13 | Age 6-10 |
| college_iv | 0.698*** | 0.520** | 0.121 | 0.136 |
| | (0.234) | (0.222) | (0.235) | (0.245) |
| urban | -0.076** | -0.080** | -0.040 | -0.043 |
| | (0.037) | (0.031) | (0.030) | (0.035) |
| female | -0.103*** | -0.094*** | -0.086*** | -0.063*** |
| | (0.022) | (0.017) | (0.019) | (0.020) |
| hhedu | 0.029*** | 0.023*** | 0.017*** | 0.015*** |
| | (0.002) | (0.002) | (0.003) | (0.003) |
| logmpce | 0.111*** | 0.103*** | 0.101*** | 0.091*** |
| | (0.007) | (0.008) | (0.013) | (0.013) |
| Observations | 82,021 | 86,085 | 123,604 | 153,427 |
| State FE | Yes | Yes | Yes | Yes |
| Age dummies | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| F-test IV | 27.99 | 26.59 | 26.53 | 27.45 |

Robust standard errors in parentheses

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

Sample includes SC, OBC, and Others

Standard errors are clustered at State and year

Table 14: Robustness for College Enrollments: Placebo tests

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | before 2005 | after 2010 | Ages 25-30 |
| postxOBC | 0.001 | 0.011 | -0.001 |
| | (0.006) | (0.014) | (0.002) |
| post | 0.012 | -0.004 | -0.004 |
| | (0.009) | (0.013) | (0.003) |
| OBC | -0.026*** | -0.017 | -0.004*** |
| | (0.004) | (0.010) | (0.001) |
| hhedu | 0.018*** | 0.025*** | 0.002*** |
| | (0.001) | (0.002) | (0.000) |
| urban | 0.070*** | 0.045*** | 0.007*** |
| | (0.012) | (0.012) | (0.002) |
| female | -0.036*** | -0.058*** | -0.012*** |
| | (0.006) | (0.009) | (0.001) |
| logmpce | 0.053* | 0.087** | 0.011*** |
| | (0.028) | (0.034) | (0.003) |
| Observations | 93,720 | 68,411 | 136,710 |
| R-squared | 0.249 | 0.384 | 0.038 |
| State FE | Yes | Yes | Yes |
| Age dummies | Yes | Yes | Yes |
| Mean | 0.0647 | 0.198 | 0.0125 |

Robust standard errors in parentheses

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

SC and Others used as Control

Sample restricted to individuals aged 17 to 22 years

Standard errors clustered at State-year level

Table 15: Robustness for High-School Completion: Placebo tests

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | before 2005 | after 2010 | Ages 25-30 |
| postxOBC | -0.009 | 0.017 | -0.009 |
| | (0.009) | (0.020) | (0.006) |
| post | 0.028** | -0.014 | -0.002 |
| | (0.011) | (0.013) | (0.010) |
| OBC | -0.023*** | -0.022 | -0.010*** |
| | (0.005) | (0.018) | (0.004) |
| hhedu | 0.021*** | 0.025*** | 0.019*** |
| | (0.001) | (0.002) | (0.001) |
| urban | 0.070*** | 0.034*** | 0.024*** |
| | (0.011) | (0.013) | (0.007) |
| female | -0.002 | 0.006 | -0.061*** |
| | (0.009) | (0.010) | (0.005) |
| logmpce | 0.043 | 0.058** | 0.034*** |
| | (0.029) | (0.028) | (0.011) |
| Observations | 44,557 | 32,957 | 132,812 |
| R-squared | 0.263 | 0.396 | 0.193 |
| State FE | Yes | Yes | Yes |
| Age dummies | Yes | Yes | Yes |
| Mean | 0.0903 | 0.243 | 0.0650 |

Robust standard errors in parentheses

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

SC and Others used as Control

Sample restricted to individuals aged 17 to 19 years

Standard errors clustered at State-year level

Table 16: Effect of Lagged Infant Mortality on Probability of Birth: All Countries

| VARIABLES | (1) Urban | (2) Rural |
|---|---|---|
| IMR_lag | 0.060*** | 0.029* |
| | (0.015) | (0.017) |
| Education | -0.001*** | -0.001*** |
| | (0.000) | (0.000) |
| Number of Children | 0.126*** | 0.126*** |
| | (0.000) | (0.000) |
| Birth in previous year | -0.276*** | -0.339*** |
| | (0.001) | (0.001) |
| Desired No. of Children | 0.001*** | 0.002*** |
| | (0.000) | (0.000) |
| age | -0.016*** | -0.034*** |
| | (0.000) | (0.000) |
| age2 | 0.000*** | 0.000*** |
| | (0.000) | (0.000) |
| Constant | 0.402*** | 0.725*** |
| | (0.006) | (0.005) |
| Observations | 1,572,850 | 2,992,115 |
| R-squared | 0.197 | 0.220 |
| Number of country_year | 661 | 660 |
| Country-Region FE | Yes | Yes |
| Country-Year FE | Yes | Yes |
| Mean | 0.157 | 0.227 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 17: Effect of Lagged Infant Mortality on Desired Number of Children: All Countries

| VARIABLES | (1) Urban | (2) Rural |
|---|---|---|
| IMR_lag | 0.669*** | 0.206** |
| | (0.085) | (0.101) |
| Education | -0.104*** | -0.112*** |
| | (0.000) | (0.000) |
| Number of Children | 0.258*** | 0.235*** |
| | (0.001) | (0.001) |
| age | -0.079*** | -0.071*** |
| | (0.003) | (0.002) |
| age2 | 0.002*** | 0.002*** |
| | (0.000) | (0.000) |
| Constant | 5.822*** | 6.474*** |
| | (0.035) | (0.031) |
| Observations | 1,572,850 | 2,992,115 |
| R-squared | 0.203 | 0.169 |
| Number of country_year | 661 | 660 |
| Country-Region FE | Yes | Yes |
| Country-Year FE | Yes | Yes |
| Mean | 4.474 | 5.612 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1