EVALUATING FINANCIAL INCENTIVES FOR GIRLS' EDUCATION:
EVIDENCE FROM A NATURAL EXPERIMENT IN TAMIL NADU, INDIA

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EVALUATING FINANCIAL INCENTIVES FOR GIRLS' EDUCATION:
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ABSTRACT

This paper examines the effectiveness of conditioned transfers for education (CTEs) as a policy lever to improve educational outcomes for girls in traditionally marginalized social groups in India. The program evaluation literature on CTE programs in South Asia and Latin America indicates that these programs have significant, positive impacts on education. In this analysis, the implementation of a financial incentive program in Tamil Nadu in 1994 provides a natural experiment in which exposure to the schooling incentive varied across space and time. This allows careful comparison of education outcomes for treated girls to otherwise substantially identical untreated girls. Analysis of the 2005 Indian Human Development Survey shows an increase in grade completion in the treated population at the time of the advent of the program that is difficult to attribute to any factor but the program itself. Payment of 1000 rupees caused at least a 15 percentage-point increase in the propensity of scheduled caste/scheduled tribe girls to complete grade six. These results demonstrate that financial incentives can be effective at motivating greater school completion among marginalized social groups.

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I. INTRODUCTION

India's constitution, entering into force in 1950, charged the state to provide "free and compulsory education for all children until they complete the age of fourteen years" (Government of India 2008). However, the reality for millions of children across the country today is altogether different. In a recent report, the United Nations Development Programme ranked India 128th of 177 countries in terms of education performance. Its education index rating by the United Nations (UN) of only 0.62 placed India behind many of its East Asian neighbors as well as a number of African and Latin American countries (UNDP 2008a). While India has earned increasing global political recognition and impressive economic success, with its GDP growth remaining well above seven percent from 2003 to 2007 (Economist 2008), its educational outcomes vary considerably across the country's various regions and social groups.

Citing independent survey data from 2005, the UN estimated the number of out-of-school Indian children nationwide at 13.5 million nationwide, or approximately 6.9% of children of schoolgoing age. In northern Indian states, out-of-school rates were much higher, led by Bihar at 17%. Jharkhand followed with 10.9%, while the rates in Assam, West Bengal, Madhya Pradesh and Uttar Pradesh each exceeded 8%. For children of low social status, these numbers worsen to 22% of scheduled caste children in Bihar and 26% in rural Jharkand, while 16% of scheduled tribe children in West Bengal remain out of school. Meanwhile the southern states of Kerala, Karnataka, and Tamil Nadu have

succeeded in bringing their out-of-school rates below 2.1%, although these statewide figures mask key differences at the district level (UNESCO 2006a). These uneven outcomes highlight the need for innovative policies to reach those students still outside the education system.

Under recent federal programs, some progress has been made to increase literacy rates, universalize primary education, and close gender gaps in education. Yet UN statistics indicate the country is not on track to meet its pledged educational targets in the Millennium Development Goals campaign by 2015 (UNDP 2008c). India continues to face wide disparities in educational attainment, particularly affecting women in rural areas and traditionally disadvantaged populations. In addition, education levels remain particularly low among those groups formerly regarded as "untouchables." While caste discrimination was outlawed at India's independence, and despite being singled out by the central government for certain affirmative action initiatives, those of formerly low social status - now variously identified as "scheduled caste," "scheduled tribe" (SC/ST) and "other backward class" (OBCs) - have struggled to achieve educational and economic parity.

In the state of Tamil Nadu, situated in southeastern India on the tip of the subcontinent, SC/ST groups made up over twenty percent of the population at the 2001 census (Government of Tamil Nadu 2008a). While government reports in 2008 cited an overall literacy level of just over 73%, the Adi Dravidar and Tribal literacy levels were reported

around 63% and 42% respectively (Government of Tamil Nadu 2008b). Similar attainment gaps for SC/ST students are evident across India and are even more pronounced in the more populous and poorer eastern states.

Facing these sharp disparities, and with school enrollment levels at less than fifty percent for girls from SC/ST groups, in 1994 the government of Tamil Nadu instituted an incentive program to improve girls' completion rates in grades 3 through 6 (Government of Tamil Nadu 2008c). This program disbursed monthly stipends to the families of low-status girls, provided the girls attended school. This paper evaluates whether the program succeeded in increasing grade completion among these low-status students.

Similar programs elsewhere have been rigorously evaluated in the research literature. Generally, the impacts of conditioned transfers for education (CTEs) are viewed favorably. CTEs were adopted in Bangladesh in 1982 and across Latin America in the 1990s. More recently, the state of Punjab in Pakistan introduced educational sector reforms, including a female secondary school stipend. In each case, an independent evaluation demonstrated that the CTE program had a positive impact.

While the details and scale of the programs differed, countries including Mexico, Chile, Brazil, Ecuador and Nicaragua demonstrated improvement on educational indicators (Morley & Coady 2003). Bangladesh expanded its program nationwide after enrollments rose and drop-out rates fell among targeted secondary school girls. Over time girls'

enrollment more than doubled under the program (Abadzi 2003). In Pakistan, a program was found to have modest but significant impacts for girls in grades six through eight (Chaudhury & Parajuli 2006).

However, other studies express skepticism about CTEs as the most effective use of resources to promote educational attainment (de la Brière & Rawlings 2006). Concerns included overcrowding in classrooms, poor targeting, administrative incompetence, and the prioritization of attendance outcomes over learning outcomes. A further question remains as to whether gender-focused CTEs can be as effective in populations that are more heterogeneous, for example, than that of Bangladesh (Lewis & Lockheed 2006). Recent UNESCO and UNICEF reports have called for more analysis of interventions including stipend programs (Reimers *et al.* 2006; UNESCO 2006b; UNICEF 2004).

Existing evaluations demonstrate the possibility of effective intervention in areas of India where the combination of high poverty, low enrollment, and entrenched social disparities require concerted effort to achieve educational policy goals. Further research is needed to establish the case for CTEs as an effective policy tool in the Indian context. To address this gap in the literature, this paper uses data from the 2005 Indian Human Development Survey (IHDS) to examine the impact of CTEs on educational outcomes for SC/ST girls in Tamil Nadu.

Although Tamil Nadu's CTE program was not designed for a rigorous randomized evaluation based on specialized data collection, its implementation in 1994 is nevertheless useful as a natural experiment. Because the way in which the program began fortuitously created several control groups, it presents a unique opportunity to isolate the effect of the incentive program. Control groups include Tamil Nadu's SC/ST girls in school prior to the program, SC/ST girls in non-treatment districts, and non-SC/ST girls, as well as Tamil Nadu boys in similar categories. Comparing educational outcomes in the control groups to the experience of those SC/ST girls who were subject to the program permits the identification of the true effect of the intervention.

Using the IHDS subsample of survey observations for Tamil Nadu, this analysis employs probit models to test the hypothesis that financial incentives significantly increased grade completion through grade six among SC/ST girls in the targeted districts. The results show this hypothesis to be correct; the likelihood of grade completion significantly increased in the target population across all grade levels tested. Results from three probit models indicate that the payment of 1000 rupees through the academic year caused at least a 15 percentage-point increase in the propensity of SC/ST girls to complete grade six. For grades 4 and 5, the target population was over 26 percentage points more likely to complete each grade level. Analysis of the lower-level stipend returned positive, significant results as well. This increased likelihood of grade completion in the treated population at the time of the advent of the program is difficult to attribute to any factor

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but the program itself. Significant, positive effects on other student populations were also observed.

These findings are important for Indian policymakers and others interested in improving educational outcomes for marginalized girls. For the government of Tamil Nadu, this study provides empirical evidence that the incentive program appears to effectively motivate increased grade completion in the target population. For education officials in other Indian states, this study indicates that such targeted incentive programs may be useful in bringing SC/ST students elsewhere in India into the education system in greater numbers. The results of this analysis may also be of interest to policymakers elsewhere who seek to improve grade completion among traditionally marginalized populations.

This study is a valuable addition to the evaluation literature on CTE programs because it uses a natural experiment as a unique strategy to establish causation. While other incentive programs in South Asia have been independently evaluated, this study provides a qualitative evaluation specific to the Indian context. Further, unlike other CTE programs, Tamil Nadu's policy targets a specific minority demographic. This analysis demonstrates that financial incentives appear to have effectively motivated greater school completion among marginalized social groups in Tamil Nadu.

II. BACKGROUND

India's Education Policy

While India's current education policy regime has successfully raised overall enrollments, progress remains uneven across the country's diverse regions and demographics. In the majority of states, girls continue to lag behind boys in educational attainment. This disparity demands policymakers' attention, given that improving girls' access to secondary school contributes to both immediate and longer term virtuous cycles. An extensive literature documents the many wellness outcomes, such as reduced infant mortality, improved child nutrition, increased school enrollments, delayed marriage, and improved family planning practices, which are predicated on the education level of the mother. Educated girls not only tend to enjoy better economic and heath prospects themselves, but are more likely to go on to create healthier families (Lewis & Lockheed 2006; Herz & Sperling 2004). Therefore, identifying interventions to improve educational attainment for girls serves a number of India's policy goals simultaneously. These positive externalities justify concerted effort and expenditure to provide for universal education and eliminate the gender gap.

The issue of marginalized social groups' access to education presents a related policy challenge. The educational attainment of SC/ST populations in particular continues to lag (Desai & Kulkarni 2008). This poses a significant problem for the education system because, as of the 2001 national census, scheduled castes made up 16.2% and scheduled tribes represented 8.2% of India's population. Among the roughly 13.5 million primary

school-age children who remain out of school, 8% of scheduled caste children and 10% of scheduled tribe children have never attended school. Girls from scheduled tribes show the poorest rates of enrollment, which are less than 80% in every age group and decline dramatically around age 11 (Wu *et al*. 2007). Identifying effective initiatives tailored to these marginalized groups will be necessary for India to fulfill its commitments to the Millennium Development Goals. Full compliance will require universalizing primary education and eliminating gender disparities in both primary and secondary education.

Although India's central government has not followed its neighbors' examples of implementing CTEs on a national level, it has created a succession of policies over the last fifteen years to promote universal education. Responsibility for education is shared between India's central and state governments, and educational attainment varies widely across states as a result of different program structures and resource allocations. In 2000, Bihar's attendance rate for girls was only 50%, while in states like Himachal Pradesh and Kerala rates were just over 90%. In comparison, Tamil Nadu's student attendance rate was 84% (UNICEF 2006).

Education Reform Efforts

The central government revised its National Education Policy in 1992 to focus on primary enrollment. The District Primary Education Programme (DPEP), established in 1993, targeted districts where female literacy lagged substantially behind the national average and had positive if uneven initial impacts (Pandey 2000). However, the

program's scale-up did not include the randomized district selection or consistent data collection that would facilitate independent, rigorous impact evaluation. In 2001, the government introduced a further education policy, Sarva Shiksha Abhiyan (SSA), with an explicit focus on gender parity and marginalized groups. In 2003, an expansion of this policy, the National Programme for Education of Girls at Elementary Level (NPEGEL), aimed further initiatives at disadvantaged girls in primary grades. In 2002, underscoring this commitment, India's 86th constitutional amendment enshrined education as a fundamental right for all children between the ages of six and fourteen and included provisions emphasizing early childhood education as well (Government of India 2008; UNICEF 2006).

At lower levels of government, other specific education interventions have been enacted. Delhi, for example, has instituted means-tested programs to reimburse school tuition and fees (Sharma 2006). Elsewhere, initiatives have emphasized early childhood interventions (Ramachandran 2004), the hiring of para-teachers (Pandey 2006), remedial tutoring (MIT 2006), and teacher incentives (Banerjee & Duflo 2006). In addition, organizations in India's civil sector have attempted to improve education outcomes through localized programming (Pratham 2008).

Tamil Nadu's CTE Intervention

In Tamil Nadu, the state's Department of Adi Dravidar and Tribal Welfare is charged with implementing a variety of welfare programs aimed at accelerating the socio-

economic advancement of the state's SC/ST population, including education

(Government of Tamil Nadu. 2008a). Accordingly, a "Special Incentive Scheme" for

girls' education was created in 1994. Designed to encourage the enrollment and retention

of disadvantaged female students, the initiative grants cash awards of 100 rupees per

month for ten months of the year to the families of SC/ST girls studying in grade 6

statewide, excluding Chennai. In 2005, the median total income among SC/ST

households was 25,110 rupees; therefore an annual education stipend for one daughter

would amount to approximately four percent of such households' income.[1] A meeting

with a Directorate of Education employee in Tamil Nadu indicated that deposits are made

to post office accounts in the name of students and given to parents (Gopalan 2009).

Additionally, monthly stipends of 50 rupees are disbursed to families of low-caste girls

attending grades 3 to 5 in certain districts of the state regarded as "educationally

backward" (Government of Tamil Nadu 2008b). Residents in fifteen targeted districts,

namely Dharmapuri, Krishnagiri, Thiruvannamalai, Cuddalore, Villupuram,

Virudhunagar, Kancheepuram, Thiruvallur, Vellore, Salem, Namakkal, Tiruchchirappalli,

Perambalur, Karur and Nagapattinam, are eligible for this incentive program.

In 1999, these programs were expanded to include OBC girls (Government of Tamil

Nadu 2008c). In the 2008-2009 academic year, the Adi Dravidar and Tribal Welfare

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[1] According to the US Census Bureau, the real median household income in the United States was $46,326 in 2005; a comparable stipend of 4% would mean roughly $1,844 for such a household.

Department made provisions for funding 30,000 students in the grade 6 program and 60,000 in the grade 3-5 program (Government of Tamil Nadu 2008b). Although the incentives have been funded for nearly fifteen years, no impact studies of the programs are readily available. This paper contributes to the research literature on CTEs by evaluating the effectiveness of the financial incentives for girls' education in Tamil Nadu.

III. LITERATURE REVIEW

In recent years, CTEs have been the subject of a growing educational impact evaluation literature. This specific type of financial incentive for educational attainment is most often associated with Latin America, where it has been widely implemented and evaluated. Pioneered by the 1997 PROGRESA program in Mexico, over the next few years Chile, Honduras, Nicaragua, and Brazil all implemented variations of CTE programs, initially reaching over eight million children. In Mexico, cash transfers were provided to households which met a poverty criterion and whose members maintained a minimum 85% attendance rate in grades 3 through 9. In 1999 the program reached 40% of rural families in Mexico, providing an average transfer of 238 pesos, or 19.5% of the average consumption in such households. The Nicaraguan and Honduran models focused on grades 1 through 4 and also included a health component. Empirical evaluations of each program demonstrated a positive impact on schooling for children from poor households. For Mexico's PROGRESA program in particular, rigorous evaluation using difference-in-difference models was possible because of the randomized initial

implementation of the program. Now called Oportunidades, the program is expanding into urban areas of Mexico (Morley & Coady 2003).

In the South Asian context, a similarly successful CTE program was implemented in 1993 in Bangladesh. This Food for Education (FFE) program tied an in-kind food subsidy to primary school attendance. Empirical analysis of the program was performed based on multiple surveys at the school and household level, finding a double-difference estimated impact of increasing enrollment by 32.5% for participating schools. In addition, regression analysis of schooling determinants found a substantial effect, with children approximately 9% more likely to attend if an FFE school was nearby. The program was shown to increase enrollment and attendance, with a greater increase among girls (Ahmed & Ninno 2002). Other evaluations of the FFE program also identified positive impacts on schooling (Ravallion & Wodon 2000; Arends-Kuenning & Amin 2004).

A subsequent program, the Bangladesh Female Secondary School Assistance Program, used tuition stipends to motivate enrollment in secondary school. Girls entering secondary school in rural areas qualified for monthly sums, conditional on 75% attendance rates, 45% annual exam scores, and remaining unmarried until taking a secondary school certificate examination or attaining 18 years of age. Stipends increased over grades 6 through 10 from Taka 25 to Taka 60 (equivalent to $0.37– $0.88 in 2006 USD), with additional sums awarded for new books and for exam fees in upper grades (Raynor & Wesson 2006). This program had an empirically significant positive impact

on girls' enrollment (Abadzi 2003). In addition, girls' exit examination success rates in program areas increased from 39% to 58% between 2001 and 2006 (World Bank 2008b). These concerted policy efforts enabled Bangladesh to achieve the Millennium Development Goal of gender parity in education (UNDP 2008b;World Bank 2008b).

In recent years Pakistan has also implemented a CTE program specifically targeting female students. In 2003, under the Girls' Stipend Program, the Punjab state government began providing financial incentives to families, conditional on girls' school attendance. Program participants must enroll in a government girls' school between grades 6 and 8 in a target district and maintain an 80% average attendance rate to receive a stipend of Rs 200 per month. Stipends are disbursed to students' households via postal money order from a district education office. Survey data from 2001 indicate that the monthly median household consumption expenditure was Rs 5,900 (Chaudhury & Parajuli 2006); one daughter's stipend would represent approximately 3.4% of such a household's expenses. Since the program's inception, girls' secondary school enrollment has increased by 60% in the fifteen poorest districts in the state (World Bank 2008a). Using triple differencing methodology and provincial school census data from 2003 and 2005, as well as national household survey data, "a modest but statistically significant impact" was found for the program (Chaudhury & Parajuli 2006).

Although CTE programs have been generally viewed as successful, concerns have been raised about this intervention method (Reimers *et al*. 2006; Ahmed & Arends-Kuenning

2003; de la Brière *et al.* 2006). A 2006 survey of the literature concluded that incentive

effectiveness was "still an open question" (Lewis & Lockheed). Among the concerns are

the administrative challenges, including poor targeting, leakage, or poor enforcement of

conditions. In addition, increasing enrollment may strain school resources and increase

student-teacher ratios. Critics also question the emphasis on enrollment and attendance at

the potential expense of learning outcomes. A study in Uruguay identifies connections

between transfer programs and voter support, finding robust effects on the views of the

poor and raising questions about political motivations and the design of CTE programs

(Manacorda *et al.* 2009). Other interventions, such as teacher incentives and remedial

tutoring, have been promoted as alternative solutions for improving India's education

system (Banerjee *et al*. 2005; Duflo *et al*. 2008).

The present study of Tamil Nadu's targeted CTE program contributes further empirical

evidence to the debate on whether CTEs are an effective use of resources in achieving

educational policy goals. In addition, this study draws on and adds to the existing

literature on determinants of schooling for girls. For example, prior research

demonstrates that poverty and economic considerations are central to the decision to

enroll girls in school. For girls in particular, local labor market conditions and whether

mothers participate in the labor force have a significant effect (Kingdon 2002).

Eliminating school fees and providing assistance in the form of textbooks and uniforms

has been shown to positively impact enrollment (Herz & Sperling 2004). Also for

economic reasons, distance from school matters more for girls than boys in rural India,

where cultural norms may require escorts or transportation. Such costs could be offset by a CTE (Filmer 1999). These economic determinants of schooling suggest a potentially pivotal role for CTEs in influencing girls' education by compensating for opportunity costs. The results of the present evaluation may be useful to scholars and policymakers seeking a clearer understanding of the relationship between girls' schooling and families' economic circumstances.

As outlined above, the evidence for the use of CTEs to increase girls' enrollment has been encouraging in both Latin American and South Asian contexts. Evidence for the success of Tamil Nadu's CTE is important to those Indian state and central policymakers seeking to identify effective policy levers to further their stated goal of universal education. This kind of intervention could have wide application in other Indian states with substantial SC/ST populations. The existence of a wide administrative infrastructure supporting the government's ongoing programming for girl children makes it possible for such targeted incentive programs to be scaled up and incorporated into the existing federal framework of affirmative action policies, such as preferential government hiring and higher education admissions, aimed at bolstering SC/ST populations. The results of this study may also be of interest to policymakers in other developing countries tasked with devising education initiatives for similarly heterogeneous populations and historically marginalized minority groups.

This study, then, not only contributes to the CTE impact evaluation literature in general, but also focuses on the effectiveness of targeted CTEs for marginalized populations, in contrast to the wider eligibility criteria used in other countries. The design of the study, capitalizing on the natural experiment of the program's implementation in Tamil Nadu, makes it especially valuable in that strong causal conclusions may be drawn about the impact of the program on educational outcomes. These aspects are discussed more fully in the sections that follow.

IV. CONCEPTUAL MODEL

Educating girls is a priority of the Indian government and has been shown to yield an array of positive societal outcomes (Herz & Sperling 2004). However, available research presents mixed reviews of the effectiveness of different programs that increase spending, inputs, and incentives in the Indian education system. The challenge for researchers is to disentangle the many determinants of schooling consumption and thereby to identify effective ways to increase girls' access. To that end, this study examines the relationship between schooling and incentives.

Tamil Nadu's targeted conditional cash transfer program is analyzed to determine whether the presence of transfers increased the amount of schooling consumed by SC/ST girls. Based on the substantial literature described above, which documents the success

of similar incentive programs elsewhere, the financial incentives are expected to have a significant positive effect on girls' schooling in Tamil Nadu, controlling for other factors.

The existing literature supports the hypothesis that conditional cash transfers have a causal relationship with schooling. Transfers are thought to affect schooling by exerting a price effect on the calculations of parents, inducing higher consumption of schooling. Whether young girls receive schooling is the result of a complex cost-benefit analysis. The effectiveness of conditional incentives depends on offering a sufficient financial benefit to outweigh the other real or perceived costs of girls' schooling. With so many factors known to exert negative influences on girls' education consumption, demonstrating a positive, causal relationship between financial incentive programs and girls' schooling is important for policymakers interested in improving educational attainment among girls.

While reverse and simultaneous causation are possible, the design of this study helps address each problem. Reverse causation raises the possibility that schooling outcomes caused participation in the incentive program. In this instance, the treatment group is defined by eligibility in certain categories of social status and gender, which cannot be voluntarily elected, rather than being defined by receiving an incentive payment under the program. The fact that the program is targeted to a particular social group eliminates selection issues, given that being of SC/ST status is both observable and involuntary. Moreover, there is little reason to expect that 1994 was an extraordinary year for the

SC/ST population, involving any radical changes in motivations for education outside the program's incentives.

Considering simultaneous causation, it is plausible that third factors could simultaneously cause both incentives and more schooling. For example, a popular cultural shift could be taking place, placing greater value on girls' education. This could drive the implementation of programs for girls' education and at the same time increase girls' education consumption without a causal relationship between the two. Similarly, India's economic improvement could enable more government spending on girls' education at the same time that other determinants of girls' education, such as household incomes and labor returns for women, were increasing due to the economy and incentivizing more schooling among girls. Nevertheless, the existence of multiple control groups, within and outside the SC/ST group, the treated regions, and the targeted gender allow causal conclusions to be drawn because there is little reason to believe that confounding external forces would affect treatment and control groups differently.

Even so, controls are included in the present study to ensure against that possibility. These controls can be drawn from among the many factors known to influence schooling consumption, as follows:

Schooling $= f$ (**incentive eligibility**, parental characteristics, family characteristics,

environmental factors, cultural norms, education quality, student characteristics)

Parental Characteristics. Beyond the impact of incentives, which are emphasized in this study, how a family estimates the costs and benefits of schooling depends on a wide array of factors. Research shows a clear relationship between girls' education consumption and parents' background. A cross-country analysis, including India, concluded that the level of mothers' education generally exerts greater influence on children's schooling than does the level of fathers' education, although both are relevant (Filmer 2000). Higher levels of educational achievement by mothers correlate with greater education consumption by children in the household, especially for girls. A study of women's education in India concluded that the children of educated mothers study two hours more per day than the children of less educated mothers (Behrman *et al.* 1999). Since the education level among the SC/ST population of Tamil Nadu is markedly lower than statewide averages, parental education also correlates with CTE eligibility.

Beyond their education levels, the occupation of the parents can also be significant for children's education outcomes. Children of agricultural workers, for example, are more likely to be required to participate in farm labor (UNESCO 2006b). For girls in particular, whether mothers participate in the labor force may have a significant effect (Kingdon 2002). Mothers working in the labor market may require more household assistance from their daughters, which reduces girls' schooling consumption. Conversely, mothers reaping returns to their education through their employment may place a higher value on girls' participation in schooling. The strong historic association in India between caste status and traditionally assigned occupations with little remuneration is also relevant here.

Family Characteristics. A family's wealth, social status or caste, and religion can each

affect girls' schooling. United Nations statistics from across developing countries

indicate a gap of over 25% in school attendance by girls in the richest versus the poorest

quintiles of the population (2008). Despite the ban on untouchability in the Indian

constitution and decades of affirmative action policy, members of lower castes continue

to experience discrimination and living standards lagging well behind country averages

on most indicators. School enrollments among Muslim and tribal girls in India are

dramatically low and have been singled out for special focus by the government (World

Bank 2008). Research on religion and caste in the Indian context found that both remain

significant for schooling outcomes even after controlling for parental wealth and

education levels (Kingdon 2002). Caste status is the basis for CTE eligibility in the

Tamil Nadu incentive program.

Family size and sibling characteristics also may have an important impact on girls'

schooling, depending on the effect on household budgets and intra-household labor

allocation. The presence of a greater number of children, particularly sons, can multiply

school fees. Given budget constraints, this increases the likelihood that son preference

will preclude girls' schooling. The presence and number of young siblings may also

negatively impact girls' schooling by increasing the amount of household labor required,

which often is disproportionately assigned to girl children in the household (Lewis &

Lockheed 2006).

Environmental Factors. Environmental factors are also significant for schooling decisions. Enrollments of girls from rural areas lag behind those of urban girls (United Nations 2008). Tamil Nadu's incentive program specifically excludes the urban Chennai area from its grade 6 incentive and grade 3-5 incentive program. Rather, CTE eligibility is assigned to rural districts with the lowest educational outcomes. Thus residence factors into both schooling outcomes and CTE eligibility for girls. In addition, local labor market conditions, including the women's employment rate, the presence of wage discrimination against women, and child labor practices, may all exert a negative effect on girls' schooling (UNESCO 2006b). The presence of social tensions, conflict or civil unrest also may have a disproportionate effect on girls' school attendance, due to greater safety and bodily integrity concerns for female versus male students (Swainson 2006).

Cultural Norms. Similarly, cultural norms may have a greater impact on girls' schooling than boys.' For example, son preference is prevalent across South Asia and may lead to prioritization of boys' schooling over girls.' Marriage practices may also negatively impact girls' schooling where girls are expected to marry young, precluding secondary education. Dowry practices may reinforce this, where the need to save a dowry increases the opportunity costs of girls attending school rather than contributing to household income, or where dowry demands are lower for younger girls, which motivates early marriage over educational attainment. Greater concerns about girl students' modesty and chastity may also increase the indirect costs of schooling girls where safe escorts or transportation are required for their attendance (Herz & Sperling 2004).

Education Quality. There is also evidence that the characteristics of the available educational opportunities matter more for girls' schooling than for boys'. Factors than have been shown to be significant for girls' enrollment include teacher quality, teacher gender, teacher-student ratio, sanitation facilities, distance to school, flexible scheduling, and providing supplies (Banerjee & Kremer 2002, Ramachandran 2004). A cross-country study found that in India, close proximity to a school affected girls' enrollments more than boys' (Filmer 2000). Other findings confirmed that even a marginal increase in the distance to primary school lowers an Indian girl's probability of ever enrolling by 1% to 2% (Herz & Sperling 2004).

Student Characteristics. Characteristics of students themselves also impact schooling. Increasing age has a negative impact on schooling, with secondary-school-age girls much less likely to consume education. It is unclear how girls' performance in school affects their continued schooling, since available data indicates the vast majority of Indian students are promoted to the next grade level regardless of their mastery of material (Pratham 2008). Intangible characteristics such as ability and motivation also presumably affect schooling but are difficult to quantify.

The introduction of financial incentives aims to initiate a break from the general pattern of school enrollment rates over time. Empirical studies show that countries' paths to full enrollment typically proceed along an S-curve (Clemens 2004). Bounded by zero enrollment and one hundred percent enrollment, rates are initially lower among earlier

generations and older age groups. Gradually through time the rates increase, as school systems expand and more students grow into more educated parents who increasingly enroll their children. Enrollment then proceeds at an accelerating rate, until the point when the vast majority of students are enrolled and so the rate of increase in enrollment slows. At this point, those remaining outside school, at the very top of the S, are those populations who – for a variety of reasons as described in this section – are the most difficult to enroll. The Tamil Nadu program seeks to create a significant departure from the expected enrollment trends among this population by targeting SC/ST girls.

With such a wide variety of factors known to influence girls' education consumption, the value of the present study lies in its unique construction. The existence of multiple control groups allows the impact of the incentive program to be effectively isolated and evaluated even when it is clear that many observable and unobservable traits may be correlated with schooling and CTE eligibility.

V. ANALYSIS PLAN

This study draws from the literature on CTEs and the determinants of schooling in the selection of controls, while centering on the advantages that the Tamil Nadu program offers as a natural experiment. Probit models test the hypothesis that the creation of Tamil Nadu's educational incentives significantly improved grade 6 completion among SC/ST girls of age to be subject to the program. A secondary hypothesis similarly

evaluates the impact of incentives offered to ST/SC students in grades 3 through 5.

Specific definitions for variables used in this analysis appear below in Table 1.

Table 1:
Independent Variables Used in the Probit Models for Grade 6 Program Analysis

Variable	Definition	Value
abelow22	Of age to enter grade 6 after 1994	= 1 if age < 22 in 2005; = 0 if age is > = 23 in 2005
abelow20	Of age to enter grade 3 after 1994	= 1 if age < 20 in 2005; = 0 if age is > = 20 in 2005
age	Age of individual, yrs	integer
target	Member of designated social groups: scheduled caste or scheduled tribe	= 1 if member of targeted social group SC/ST; = 0 if not
region6	District of residence	= 1 if resident in treated district for grade 6 program; = 0 if not
fem	female	= 1 if female; = 0 if male
hdeduc	Head of household education level, yrs	integer
hincpc	Total annual income of the household, per capita, rupees	integer
nchildren	Number of children age 14 or younger in the household	integer

The primary model is constructed as follows:

$$\textbf{\textit{complete6}} = \beta0 + \beta1 \textit{abelow22} + \beta2 \textit{age} + u$$

where the dependent variable, *complete6*, is binary and represents whether individuals

completed grade 6 or not. In the primary model, $\beta0$ is the intercept term while the

random, unobserved error in the model is represented by *u.* The coefficient of interest is

$\beta1$, capturing the treatment effect. It indicates whether the incentive program has a

positive, significant impact for those who came of age after the program's inception. A

similar, secondary model is designed to test the effectiveness of the grade 3-5 incentive, with a corresponding dependent variable for a specific grade completion and a binary variable adjusted for the appropriate age.

By regressing this probit model on the baseline population, the target population, and control populations, the marginal effect on grade completion is identified. The two analyses focus on grade completion in grades 4, 5, and 6 among those who were of age to be subject to the grade 6 incentive program, and on grade completion in grades 3, 4, and 5 for those who were of age to be subject to the Grade 3-5 program. Although the grade 6 program aimed primarily at increasing completion of grade 6, the program's effects on completion rates for prior grades are examined also. It is expected that the existence of incentive payments at the sixth grade level would impact decisions about girls' completion rates for grades 4 and 5 as well.

Since this analysis uses survey data from 2005, those who were age 22 or older at the time the survey was conducted would have been age 11 or older in 1994. Assuming students began schooling at age 6, their enrollment decisions would already have been made for the 1994-1995 school year, unaffected by the creation of the incentive program. By contrast, those who were younger than 22 at the time of the survey would not yet have reached their sixth grade year before the program was implemented, so grade completion decisions made in this age group could have been influenced by the available incentives. Using the binary variable of interest, *abelow22*, therefore, the impact of this sudden

availability of incentives can be measured. Similarly, a binary variable is used in the secondary model to identify those who were age 20 or below at the time of the survey, and therefore of an age to be impacted by the creation of incentives for grades 3-5.

To begin, the primary model is used with the baseline population, all those in the sample between the ages of 12 and 90. The average grade completion rate for each age in that range is graphed to reveal the expected S-curve, as predicted by the literature on school enrollment. The model is then run again separately with the target population, girls who are in an eligible region and who are of SC/ST status, and who are between the ages of 12 and 50. Examining the marginal effects of this probit model allows the identification of the impact on grade completion in 1994 among this population. The completion rates for grades 4, 5 and 6 are examined to determine the program's effect. Graphing these results reveals a visible break in the expected curve, representing a sharp rise in completion rates at the time of the program's creation. This process is repeated, using the same probit model, with each control population: C1, consisting of boys in eligible regions who are of SC/ST status; C2, girls who are in eligible regions but not of SC/ST status; and C3, boys who are in eligible regions but not of SC/ST status.

In the grade 6 program analysis, only Chennai residents were ineligible for the incentive, so the sample sizes in that ineligible region are too small to permit meaningful analysis. However, in the secondary model evaluating the grade 3-5 program, further control groups are possible. These include: C4, girls who are not in eligible regions but are of

SC/ST status; C5, boys who are not in eligible regions but are of SC/ST status; C6, girls

who are neither in eligible regions nor of SC/ST status; and C7, boys who are neither in

eligible regions nor of SC/ST status.

Once results are generated for each population at each grade level, the probit models'

marginal effects reveal whether grade completion increased significantly. Further, probit

coefficients for the binary *abelow* variable of interest (capturing whether individuals

came of age at a time when they would be subject to the program or not) are used to

calculate whether any increases among the target population are statistically significantly

different from any increases among the other groups. Z-scores, obtained by subtracting

the raw coefficient on the variable of interest for a control group from that of the target

population, and then dividing by the standard error of the target population's raw

coefficient, indicate whether the incentive program is related to increases among its target

population that were significantly different from other students' grade completion.

Finally, a robustness check analysis expands the primary probit model for the grade 6

program to include several controls. This is important because the design of the probit

models only allows the measurement of the cumulative effect of all things that changed in

1994, including the creation of the incentive program but not limited to that. It is

possible that other things could have suddenly changed in 1994 for the SC/ST population

in Tamil Nadu. The added variables in the expanded model control for some of the most

fundamental factors known to affect schooling outcomes. The expanded model,

including control variables for head of household education, household income per capita, and the number of children in the household, is as follows:

$$complete6 = \beta 0 + \beta 1 abelow22 + \beta 2 age + \beta 3 hdeduc + \beta 4 hincpc + \beta 5 nchildren + u$$

These three controls, defined in Table 1 above, take into account key household factors which could vary over time. First, for instance, the education level of the head of household could have dramatically risen due to some population migration; an influx of people in 1994 from a more educated region of India could have caused a rise in enrollment rates, given that parental education levels are a great influence on enrollment. Second, the household income per capita control addresses the possibility that Tamil Nadu experienced a sudden increase in income levels in 1994, positively affecting enrollment. Third, the measure of the number of children in the household controls for the possibility of a shock to the demographic trends in Tamil Nadu, due to some kind of epidemic or population control program that also occurred in 1994. Such a shock could reduce the number of children per household and so increase the possibility for schooling all of them. Each of these household factors could potentially contribute to changes in grade completion rates, which would cause the primary probit model to overestimate the effect of the incentive program on enrollment rates.

As outlined in the previous section, an array of factors beyond the three controls discussed here also could potentially influence school completion. However, there is very little reason to think that such factors would suddenly and dramatically change in 1994, or disproportionately affect SC/ST families. These scenarios are fairly unlikely

and the expanded model addresses several potential concerns. By including and separately analyzing various control populations in comparison to SC/ST girls, the design of this study resolves such concerns about causation.

VI. DATA DESCRIPTION[2]

This analysis is based upon national survey data from the India Human Development Survey (IHDS) 2005. These data have been made available through the Inter-university Consortium for Political and Social Research, an archive of quantitative social science data maintained by the University of Michigan. The principal investigators of the IHDS 2005 were Sonalde Desai, Mitali Sen, and Reeve Vanneman of the University of Maryland and Amaresh Dubey, B.L. Joshi, and Abusaleh Shariff of New Delhi's National Council of Applied Economic Research. They conducted the survey between November 1, 2004 and October 30, 2005, funded by the National Institutes of Health.

The IHDS is a nationally representative survey and involved interviews in 41,554 households in 1,503 villages and 971 urban neighborhoods throughout India. Data were collected in two one-hour interviews in each household. These interviews included questions on the subjects of health, education, employment, economic status, marriage, fertility, gender relations, and social capital. In addition, brief reading, writing, and

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[2] Information in this section is drawn from: Inter-university Consortium for Political and Social Research. Description & Citation--Study No. 22626. http://www.icpsr.umich.edu/cocoon/ICPSR/STUDY/22626.xml

mathematics tests were administered to children between the ages of eight and eleven. The survey's response rates were "82% for the recontact sample, 98% for the new sample, and 92% for the total response rate."

The present analysis focuses on the individual-level data available for the state of Tamil Nadu. Educational outcomes are compared at the district level. The surveyed districts are Thiruvallur, Chennai, Kancheepuram, Vellore, Dharampuri, Tiruvannamalai, Namakkal, Erode, Coimbatore, Dindigul, Karur, Tiruchchirappalli, Perambalur, Ariyalur, Sivaganga, Madurai, Theni, Ramanathapuram, Thoothukkudi, Tirunelveli, Kanniyakumari, and Pondicherry. Of the 9,019 observations reported for the state, 4,492 are women. Of those, 1,245 are identified as women who belong to scheduled castes or scheduled tribes and comprise the key population for this study. The reduced size of this sub-sample is a limitation of the survey data, as is the lack of a variable specifically confirming whether and when SC/ST women received the monthly incentive stipend.

An initial examination of the data for Tamil Nadu reveals disparities in average education levels that are consistent with recent evidence presented in the literature and in government reports. While the average education level statewide was 5.61 years, the average among women was only 5.04 years. That number fell even further among the SC/ST population, for whom the average number of years of education was only 4.45. In a similar pattern, the highest education level in the household for men averaged 7.60 statewide, but only 5.85 years for SC/ST males, while the highest level among SC/ST

females in the household was a mere 3.79 years. These averages highlight the continued

educational disparities in Tamil Nadu along gender and social lines. Further descriptive

statistics are reported in Table 2.

Table 2:
Descriptive Statistics for Variables of Interest-
Comparing Tamil Nadu Subsamples

Variable	Statistical Measures					
	Subsample	Mean	Std Dev	Min	Max	N
Demographic Characteristics						
AGE < 22	Statewide	0.380	0.485	0	1	9,019
	Women	0.376	0.485	0	1	4,492
	SC & ST	0.402	0.490	0	1	2,483
AGE < 20	Statewide	0.343	0.475	0	1	9,019
	Women	0.339	0.473	0	1	4,492
	SC & ST	0.363	0.481	0	1	2,483
AGE *(years)*	Statewide	30.62	19.45	0	98	9,019
	Women	30.65	19.18	0	98	4,492
	SC & ST	28.95	18.84	0	95	2,483
Household Income per Capita *(rupees)*	Statewide	10,829	12,637	-10,097	136,350	9,019
	Women	10,569	12,468	-10,097	136,350	4,492
	SC & ST	8,451	9,164	-930	101,249	2,483
Members of household ages 0-14	Statewide	1.32	1.31	0	10	9,019
	Women	1.35	1.32	0	10	4,492
	SC & ST	1.43	1.32	0	5	2,483
Education Characteristics						
Household Head Education *(years)*	Statewide	5.82	4.75	0	15	8,994
	Women	5.81	4.77	0	15	4,478
	SC & ST	3.99	4.43	0	15	2,465
COMPLETE6 *(=1 if completed grade 6)*	Statewide	0.495	0.500	0	1	8,946
	Women	0.447	0.497	0	1	4,440
	SC & ST	0.399	0.490	0	1	2,459
COMPLETE5 *(=1 if completed grade 5)*	Statewide	0.581	0.493	0	1	9,019
	Women	0.531	0.499	0	1	4,492
	SC & ST	0.472	0.499	0	1	2,483
COMPLETE4 *(=1 if completed grade 4)*	Statewide	0.620	0.485	0	1	9,019
	Women	0.568	0.495	0	1	4,492
	SC & ST	0.509	0.500	0	1	2,483
COMPLETE3 *(=1 if completed grade 3)*	Statewide	0.653	0.476	0	1	9,019
	Women	0.599	0.490	0	1	4,492
	SC & ST	0.545	0.498	0	1	2,483

Source: Indian Human Development Survey 2005

VII. RESULTS

Grade 6 Incentive Program Analysis

The results for the probit analysis of the grade 6 incentive program are presented in Table 3. Across all three grade levels, the coefficients of interest are positive and significant for the target population of SC/ST girls. Beginning with grade 4, the data show that after 1994 SC/ST girls in eligible regions and of age to participate in the program were 26.1 percentage points more likely to complete fourth grade, at the 1% confidence level. At the same time, SC/ST boys in eligible regions were 14.6 percentage points more likely to complete fourth grade, at the 5% confidence level. Among non-SC/ST girls in the eligible regions who came of age in time for the program, this population was 7.71 points more likely to complete the fourth grade, at the 5% confidence level. Similarly, non-SC/ST boys in eligible regions and of age to be exposed were 7.46 percentage points more likely to complete the fourth grade after 1994, at the 1% confidence level.

Thus the increased likelihood of grade 4 completion after 1994 within the target population of SC/ST girls was larger than that of each control population tested. Whether this larger increase is significantly different is measured with hypothesis tests. A Z-score indicates the result of testing for whether the raw probit coefficient for the variable of interest is equal to that of the target population. The Z-score is obtained by subtracting the raw coefficient on *abelow22* for a control group from that of the target population, and then dividing the result by the standard error of the target population's coefficient.

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Table 3:
Probit Analysis of Grade 6 Incentive Program

Statistic	*Target and Control Populations*[a]				
	Baseline: All (aged 12-90)	*T1: Eligible-region SC/ST Girls* (aged 12-50)	*C1: Eligible-region SC/ST Boys* (aged 12-50)	*C2 Eligible-region Non-SC/ST Girls* (aged 12-50)	*C3: Eligible-region Non-SC/ST Boys* (aged 12-50)
GRADE 4					
Age < 22	-	0.261*** (3.95)	0.146** (2.39)	0.0771** (2.26)	0.0746*** (2.92)
Age	-0.0116*** (-34.33)	-0.189*** (-6.63)	-0.0169*** (-7.96)	-0.0129*** (-10.30)	0.00353*** (-3.69)
N	7098	732	723	1918	1897
Z-Score for Difference[b]	-	-	0.938	2.21**	1.66*
GRADE 5					
Age < 22	-	0.263*** (4.00)	0.131** (2.11)	0.0768** (2.16)	0.0858*** (3.14)
Age	0.0118*** (-34.14)	-0.0171*** (-6.00)	-0.0167*** (-7.30)	-0.0136*** (-10.18)	-0.00324*** (-3.10)
N	7317	732	723	1918	1897
Z-Score for Difference[b]	-	-	1.57	2.38**	1.647
GRADE 6					
Age < 22		0.151** (2.26)	0.0804 (1.23)	0.0865** (2.16)	0.0565* (1.66)
Age	-0.0128*** (-33.78)	-0.0211*** (-6.99)	-0.0177*** (-6.79)	-0.0166*** (-10.36)	-0.0056*** (-4.33)
N	7030	728	722	1908	1889
Z-Score for Difference[b]	-	-	1.01	0.796	1.14

*significant at .10 level   **significant at .05 level   *** significant at .01 level

Source: Indian Human Development Survey 2005

[a] The sample sizes for control populations C4 through C7, representing the ineligible populations residing in Chennai, are too small to permit meaningful analysis.
[b] Differences reported use Z-statistics testing H_0: the raw probit coefficient for the binary variable *abelow22* is equal to that on *abelow22* in column T1.

Examining the results of these hypothesis tests for grade 4 completion, as reported in the "Z-Score for Difference" line in Table 3, the increase in likelihood among eligible SC/ST girls did not differ significantly from that of SC/ST boys in the same regions. However, the increase was significantly different from that of non-SC/ST girls living in the same regions, at a confidence level of 5%. The increased likelihood of grade completion for the target population was also greater than that for non-SC/ST boys in eligible regions, although at a 10% confidence level.

Examining the likelihood of grade 5 completion among the same populations, again the data demonstrate statistically significant increases in completion likelihood. SC/ST girls in eligible regions who came of age late enough to be subject to the program had a 26.3 percentage point greater likelihood of completing grade 5, at the 1% confidence level. Meanwhile, among non-SC/ST girls in the same areas, grade completion was only 7.68 points more likely, at a 5% confidence level. Among boys in the eligible regions, SC/ST boys showed a point jump of 13.1, while non-SC/ST boys only increased their likelihood by 8.58 points, at a 1% confidence level.

Figures 1 through 5 present the results of the graphical analysis of grade 5 completion among the target and control populations. Figure 1 illustrates the average grade completion rate for each age in the sample population for Tamil Nadu between the ages of 12 and 90. Figure 2 illustrates the significantly greater completion rate for the target

population of SC/ST girls of age to be impacted by the program, plotted with the solid

line, versus the much lower outcome among the individuals who came of age prior to the

program, represented by the dotted line. Similarly, Figures 3, 4, and 5 present results for

grade completion among the control populations, again comparing outcomes for those

within each group above and below the age of 22.
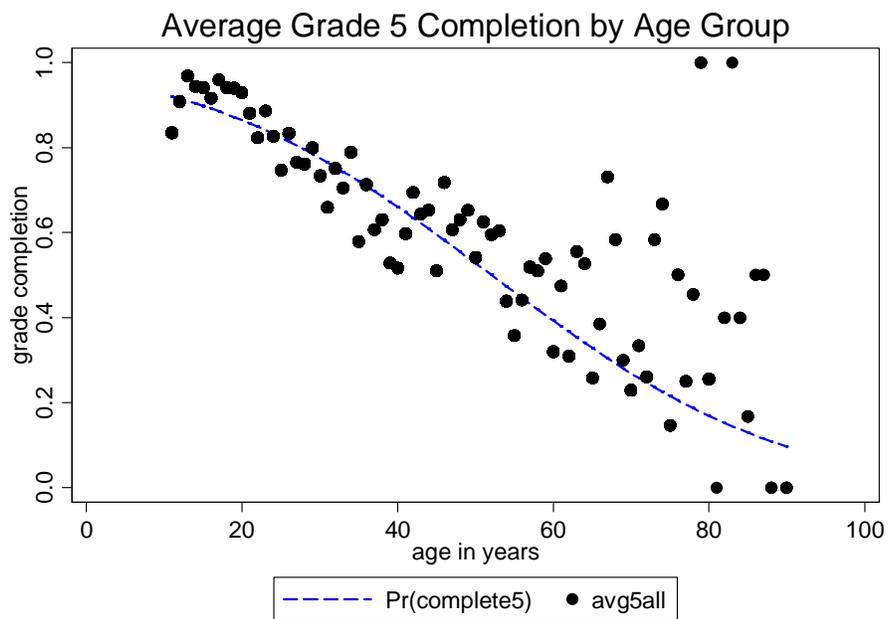
Figure 1 – Overall Population in Grade 6 Program Analysis

Average Grade 5 Completion by Age Group

Figure 2 – Target Population in Grade 6 Program Analysis

Grade 5: Eligible-region SC/ST Females
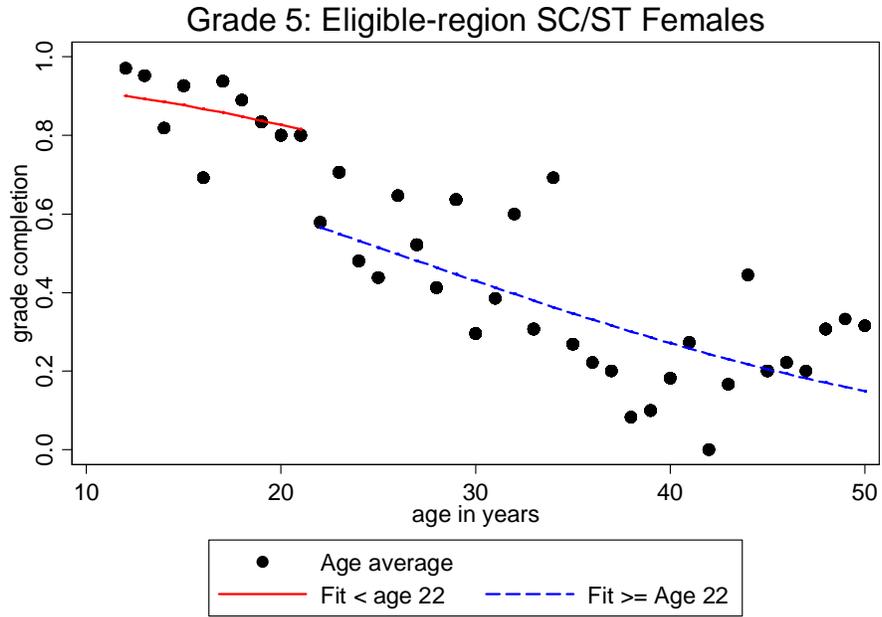
Figure 3 – Control Population C1 in Grade 6 Program Analysis

Grade 5: Eligible-region SC/ST Males
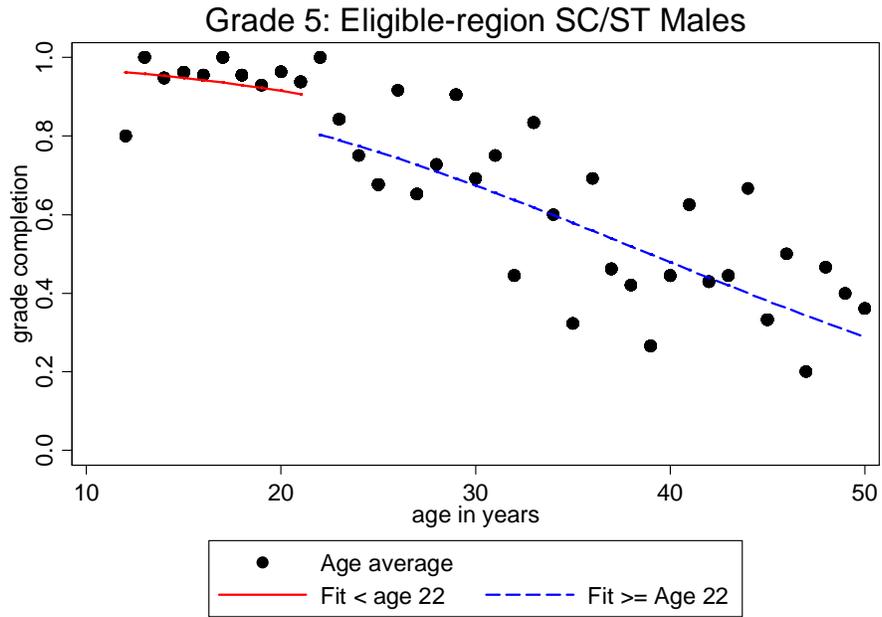
Figure 4 – Control Population C2 in Grade 6 Program Analysis

Grade 5: Eligible-region Non-SC/ST Females
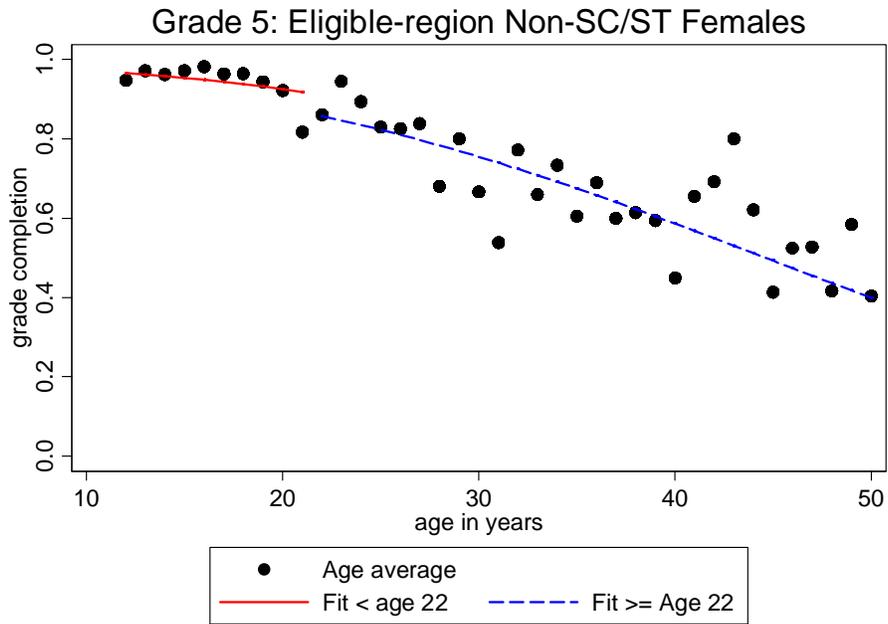
Figure 5 – Control Population C3 in Grade 6 Program Analysis

Grade 5: Eligible-region Non-SC/ST Males
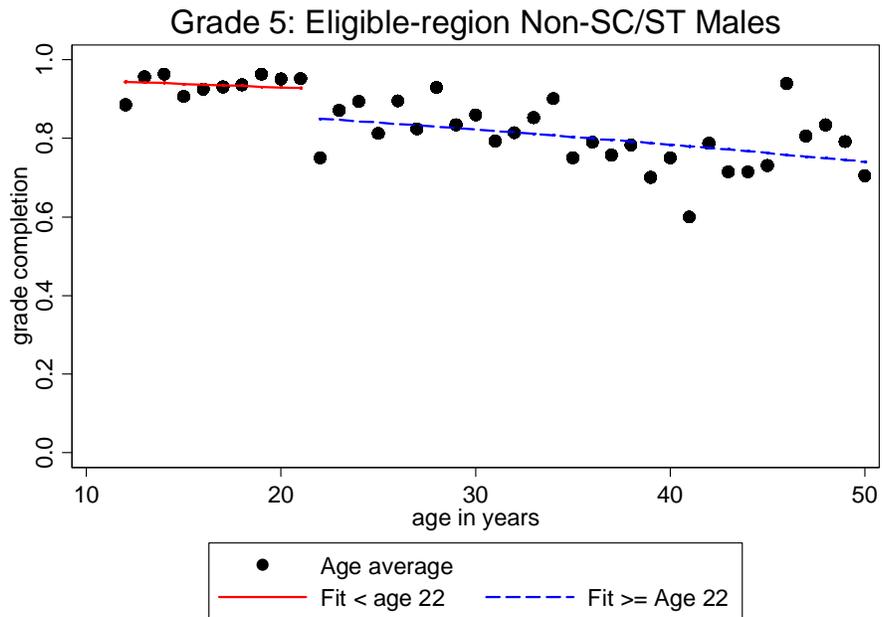
Returning to the reported "Z-score for Difference," the eighth row of results in Table 3 indicates the significance of the increases for the target population as compared to each of the other groups. With a Z-score of 2.38, the increase in completion rates among target population of SC/ST girls differed to a statistically significant degree from non-SC/ST girls in the same regions. However, for grade 5 this increase did not differ significantly from that of the boys in either control population, with Z-scores of only 1.57 for SC/ST boys of appropriate age in the eligible regions and 1.647 among non-SC/ST boys.

Grade 6 completion is the key focus of the incentive program. At the 5% confidence level the likelihood of completion among SC/ST girls in eligible regions and of age to experience the program increased by 15.1 percentage points, while among comparable non-SC/ST girls the increase in likelihood was 8.65 points. Among non-SC/ST boys in eligible regions the likelihood of grade 6 completion increased by 5.65 percentage points, significant at a 10% confidence level. Among SC/ST boys no statistically significant increase was found.

The target population evinced a statistically significant increase in likelihood of grade 6 completion. However, calculated Z-scores, testing the raw probit coefficients and presented in the final row of Table 3, indicate that increase did not significantly differ from the increases among any of the control populations for this grade level. In the cases of residents in the ineligible region of Chennai, sample sizes fewer than 60 observations prohibited meaningful analysis of grade completion among those control populations.

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Grade 3-5 Incentive Program Analysis

Turning to the regression results for the grades three to five incentive program, here again the target population demonstrates statistically significant increases in the likelihood of grade completion across all three grade levels. Also similar is the decrease in the impact on the target population in the uppermost grade level. Table 4 reports the results for the analysis of this program using the secondary probit model, where the binary variable has been adjusted to *abelow20* to reflect the younger age threshold for potential exposure to the incentive program after its creation in 1994.

Table 4:
Probit Analysis of Grade 3-5 Incentive Program

Statistic	Baseline: All (aged 11-90)	T1: Eligible-region SC/ST Girls (aged 11-50)	C1: Eligible-region SC/ST Boys (aged 11-50)	C2: Eligible-region Non-SC/ST Girls (aged 11-50)	C3: Eligible-region Non-SC/ST Boys (aged 11-50)	C4: Ineligible-region SC/ST Girls (aged 11-50)	C5: Ineligible-region SC/ST Boys (aged 11-50)	C6: Ineligible-region Non-SC/ST Girls (aged 11-50)	C7: Ineligible-region Non-SC/ST Boys (aged 11-50)
Target and Control Populations									
GRADE 3									
Age < 20		0.215**	-0.0206	0.203**	0.0199	0.194**	0.176**	0.0273	0.0473*
		(2.31)	(-0.24)	(3.46)	(0.43)	(2.30)	(2.05)	(0.75)	(1.86)
Age	0.0109**	-0.0243**	-0.0181**	-0.00854**	-0.00632**	-0.0149**	-0.0139**	-0.0116**	-0.00274**
	(-34.60)	(-7.04)	(-7.10)	(-4.40)	(-4.21)	(-4.82)	(-6.25)	(-10.39)	(-3.18)
Z-score for Difference [a]	-	-	2.49**	-1.08	1.84*	0.216	-0.909	1.74*	1.03
GRADE 4									
Age < 20		0.219**	-0.0404	0.221**	0.0381	0.210**	0.108	0.0541	0.0413
	-	(2.35)	(-0.46)	(3.68)	(0.79)	(2.51)	(1.34)	(1.44)	(1.45)
Age	-0.0115**	-0.0243**	-0.0190**	-0.00881**	-0.00697**	-0.0141**	-0.0157**	-0.0122**	-0.00357**
	(-35.14)	(-6.93)	(-7.14)	(-4.40)	(-4.44)	(-4.52)	(-6.28)	(-10.41)	(-3.71)
Z-score for Difference [a]	-	-	2.88**	-1.38	1.62	0.0674	0.739	1.38	1.44
GRADE 5									
Age < 20		0.174*	-0.0608	0.217**	0.0201	0.194**	0.0133	0.0174	0.0352
	-	(1.90)	(-0.69)	(3.52)	(0.40)	(2.32)	(0.16)	(0.44)	(1.12)
Age	-0.0115**	-0.0234**	-0.0183**	-0.00853**	-0.00697**	-0.0124**	-0.0167**	-0.0133**	-0.00361**
	(-34.28)	(-6.57)	(-6.33)	(-3.84)	(-4.07)	(-3.93)	(-6.03)	(-10.25)	(-3.31)
Z-score for Difference [a]	-	-	2.64**	-1.35	1.54	-0.0263	1.73*	1.62	1.22
N	7468	405	384	602	622	424	430	1561	1516

*significant at .10 level   **significant at .05 level

Source: Indian Human Development Survey 2005

[a] Differences reported use z-statistics testing H_0: the raw probit coefficient for the binary variable *abelow20* is equal to that on a*below20* in column T1.

The first three rows of results in Table 4 address completion in grade 3. SC/ST girls in the eligible region were 21.5 percentage points more likely to complete grade 3. Among the control populations also living in eligible regions, non-SC/ST girls had a significant increase as well and were 20.3 points more likely to complete grade 3. Neither control group of boys had significantly increased likelihoods of grade completion.

In the ineligible regions, both SC/ST girls and boys had significantly increased likelihoods of completing grade 3, with the girls 19.4 percentage points more likely and the boys 17.6 points more likely to finish the grade. Non-SC/ST girls in the ineligible regions did not have a significant change in likelihood, while non-SC/ST boys in the ineligible regions were 4.73 points more likely, though at the 10% confidence level.

Examining the Z-score test results for grade 3, the increased likelihood among the target population of SC/ST girls in eligible regions was significantly different than that of SC/ST boys in the same regions, with a Z-score of 2.49, calculated using the raw probit coefficients from the two groups and the standard error for the target group. The increased likelihood for the target population did not differ significantly from any of the other control populations, although at a lower confidence level of 10%, the difference was significant when compared to the non-SC/ST boys in eligible regions and the non-SC/ST girls in ineligible regions.

As for the results of the grade 4 analysis, presented in the middle three rows of results in Table 4, the target population was 21.9 percentage points more likely to complete grade 4, at the 5% confidence level. As with grade 3, significant increases in the likelihood of grade completion also occurred among the two control populations of non-SC/ST girls in eligible regions and SC/ST girls in ineligible regions. The non-SC/ST girls in eligible regions had a 22.1 percentage point greater likelihood of completing grade 4, while the SC/ST girls in ineligible regions had a 21 point greater likelihood, each at the 5% confidence level. Unlike in grade 3, in the grade 4 analysis the SC/ST boys in ineligible regions did not have a significant increase, nor did any of the remaining four control populations. The hypothesis testing for grade 4 yielded only one significant Z-score of 2.88, indicating that the 21.9 point greater likelihood of grade 4 completion for the target population differed significantly from only one of the control populations, namely the SC/ST boys in the eligible regions. Figures 6 through 14 below present the results for the graphical analysis for grade 4 in the grade 3-5 incentive program.

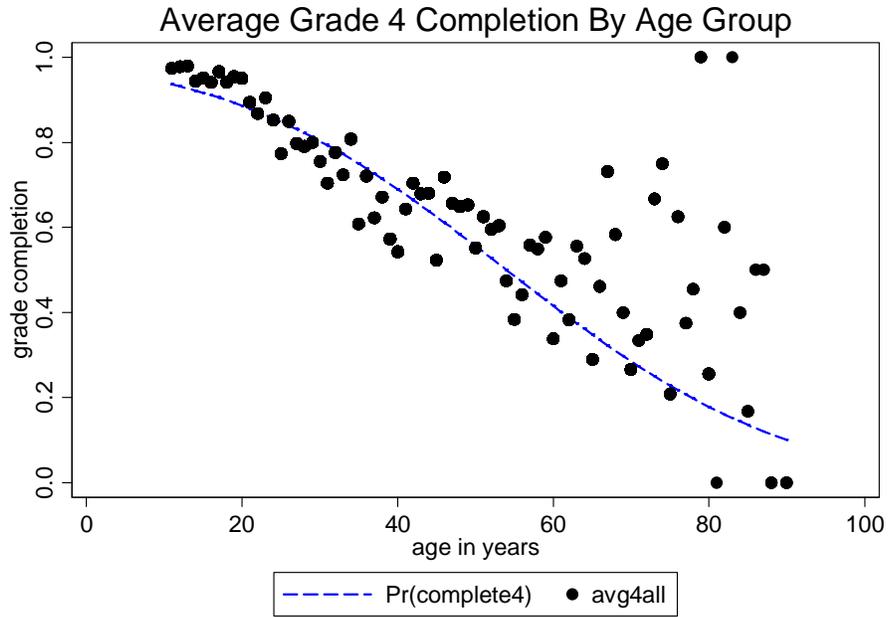**Figure 6 – Overall Population in Grade 3-5 Program Analysis**

Average Grade 4 Completion By Age Group

Figure 7 – Target Population in Grade 3-5 Program Analysis

Grade 4: Eligible-region SC/ST Females

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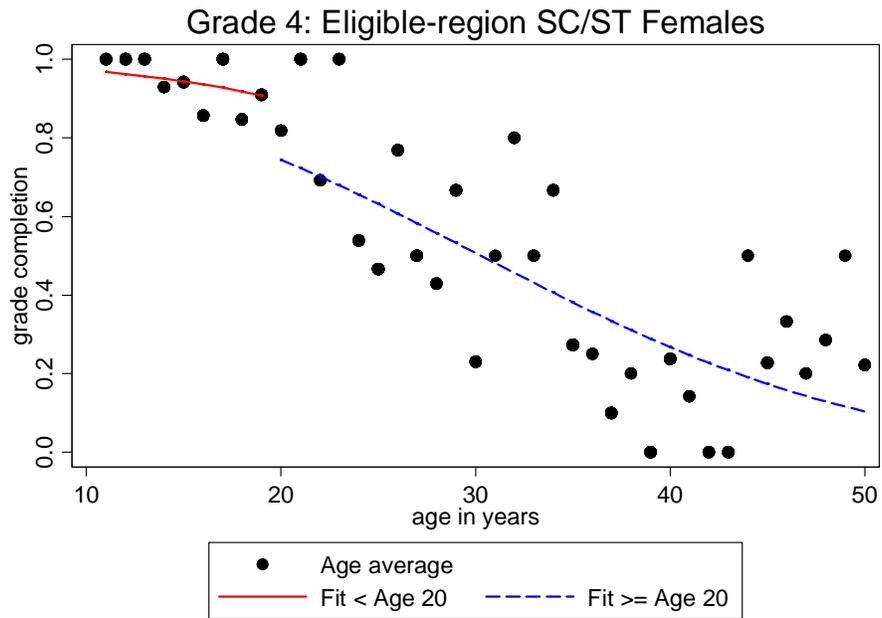
Figure 8 – Control Population C1 in Grade 3-5 Program Analysis

Grade 4: Eligible-region SC/ST Males
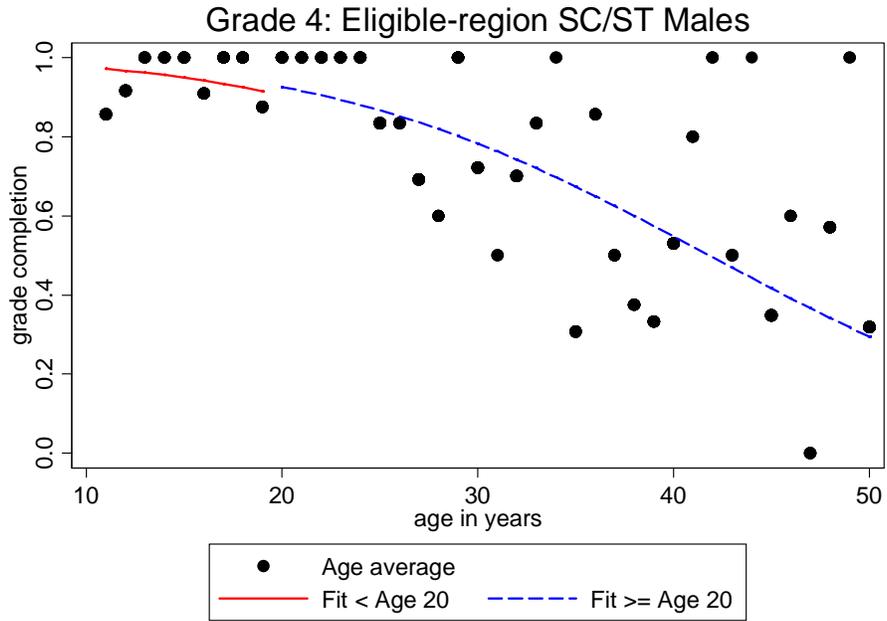
Figure 9 – Control Population C2 in Grade 3-5 Program Analysis

Grade 4: Eligible-region Non-SC/ST Females
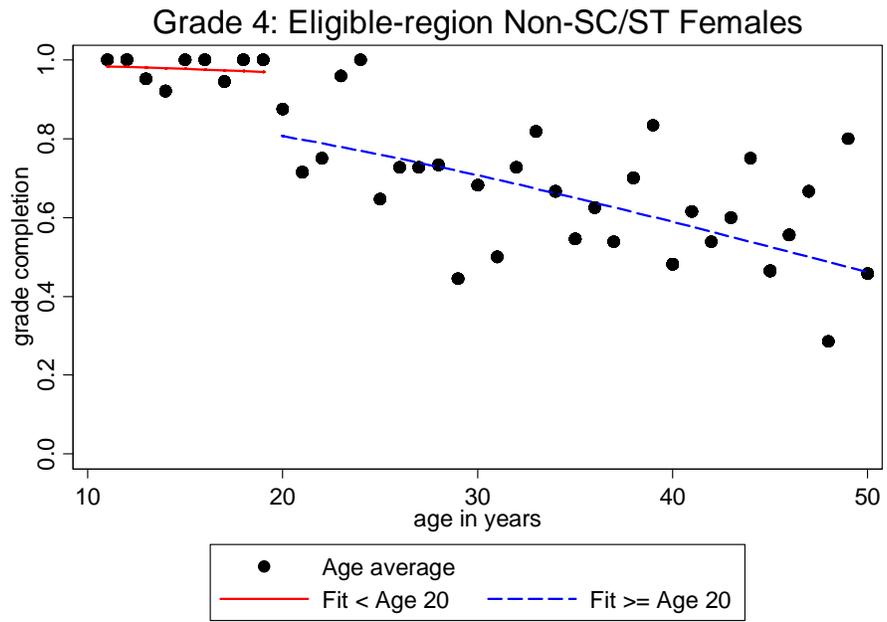
Figure 10 – Control Population C3 in Grade 3-5 Program Analysis

Grade 4: Eligible-region Non-SC/ST Males
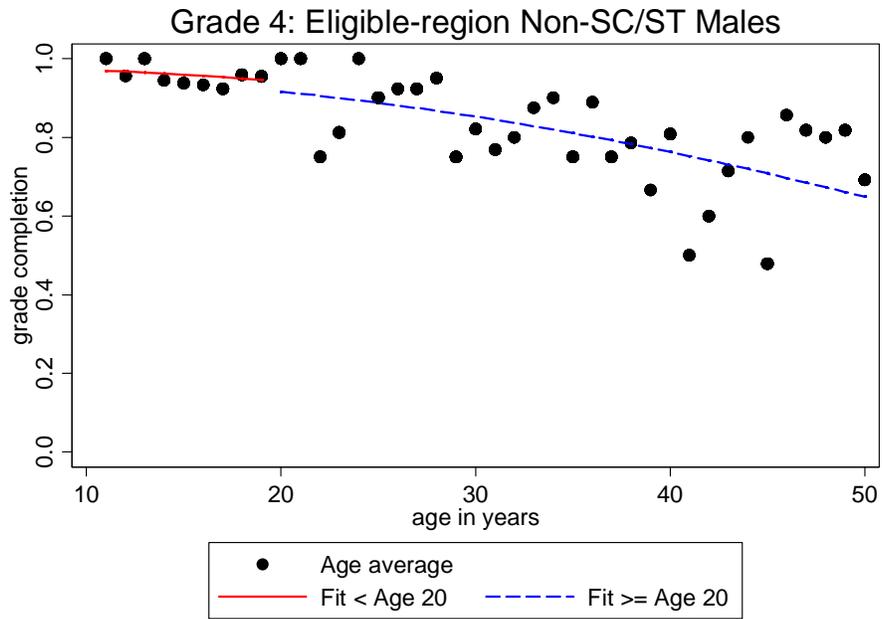
Figure 11 – Control Population C4 in Grade 3-5 Program Analysis

Grade 4: Ineligible-region SC/ST Females

46
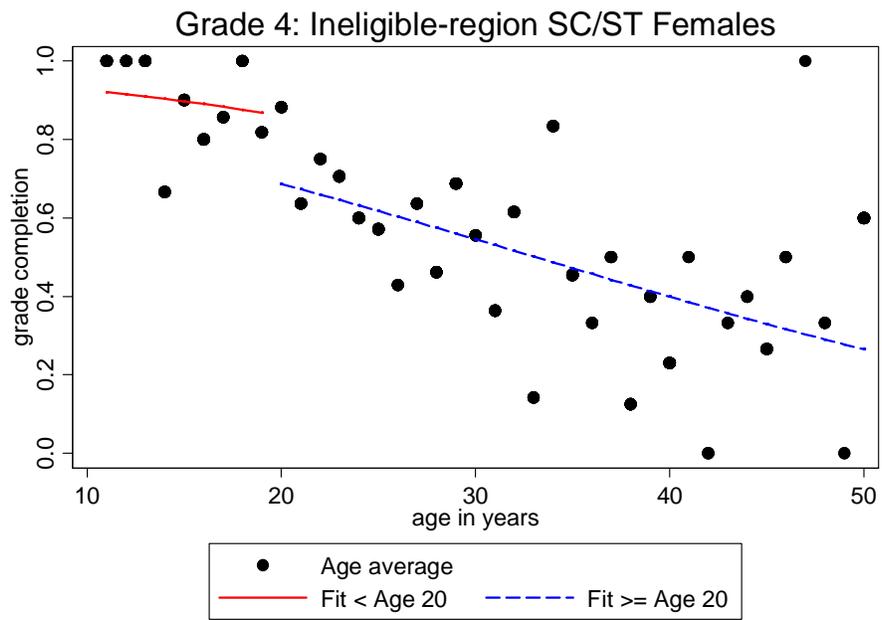
Figure 12 – Control Population C5 in Grade 3-5 Program Analysis

Grade 4: Ineligible-region SC/ST Males
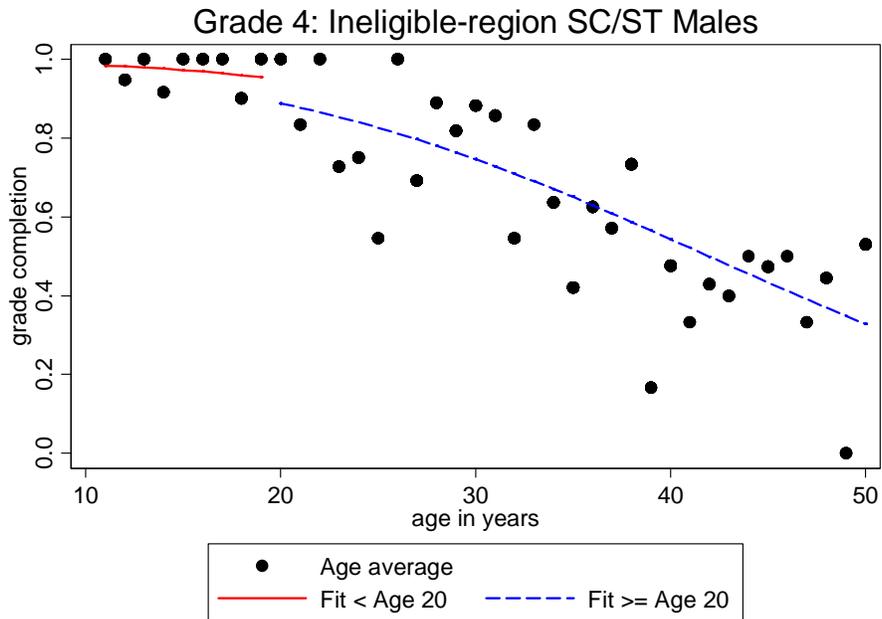
Figure 13 – Control Population C6 in Grade 3-5 Program Analysis

Grade 4: Ineligible-region Non-SC/ST Females

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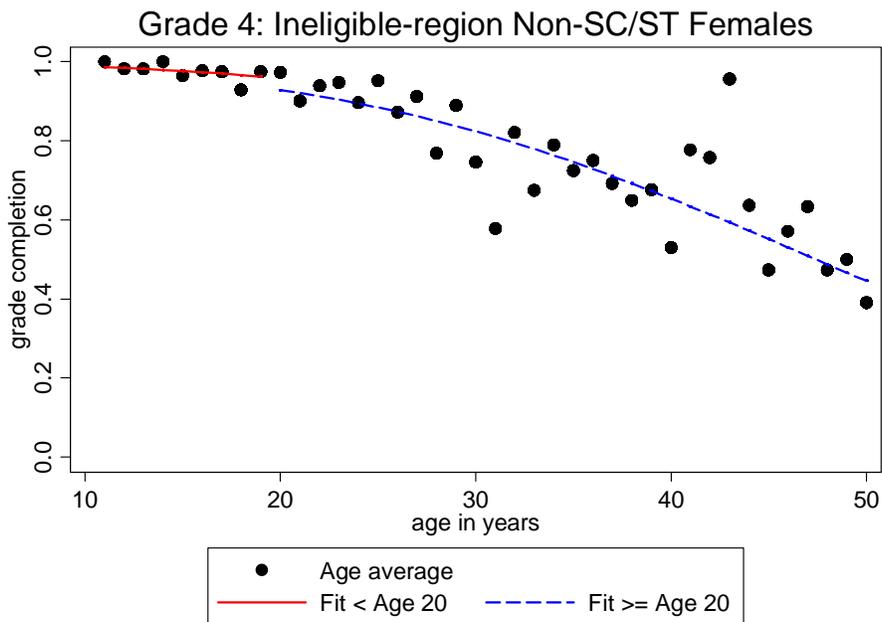
Figure 14 – Control Population C7 in Grade 3-5 Program Analysis

Grade 4: Ineligible-region Non-SC/ST Males
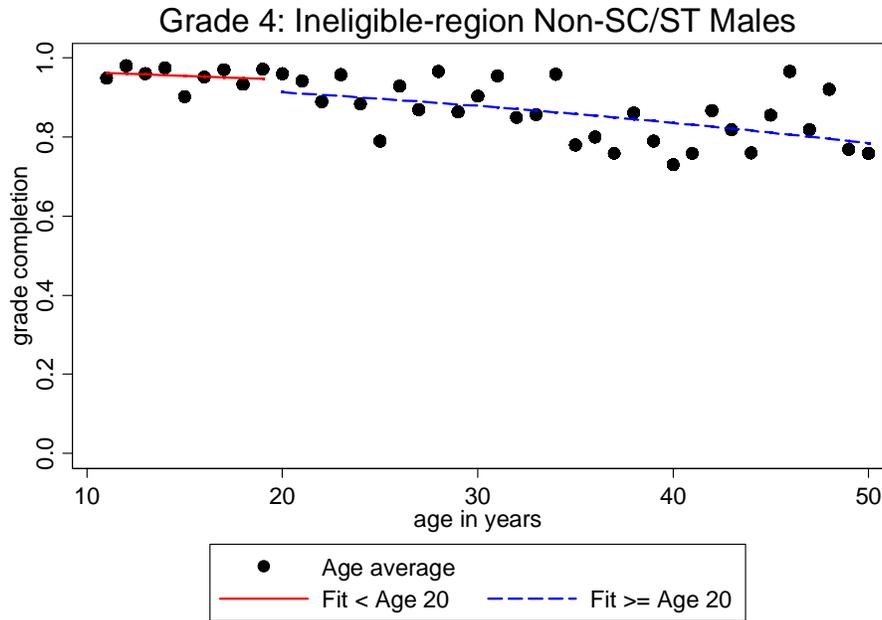
The results for the target population in the grade 5 analysis are less robust. SC/ST girls in the eligible regions were 17.4 percentage points more likely to complete grade 5, but at a lower confidence level. Again following a similar pattern to the prior grades, the C2 and C4 control populations had significantly higher likelihoods of completing grade 5. The non-SC/ST girls in the eligible regions had a 21.7 percentage point greater likelihood and the SC/ST girls in ineligible regions had a 19.4 point greater likelihood, each at the 5% confidence level. No other control populations had a significant increase in the likelihood of grade 5 completion.

The Z-scores for grade 5, presented in the final row of results in Table 4, are consistent with the prior two grades in showing that the target population had a significantly greater increase in grade completion likelihood than that of the C1 control population, SC/ST boys in the eligible regions. At a lower confidence level, the 17.4 percentage point increase in likelihood for the target population also differed from that of the C5 population, SC/ST boys in ineligible regions, with a Z-score of 1.73. Significant differences did not occur compared to the other five control groups, with Z-scores ranging between -0.0263 and 1.62.

Looking at the results for the grade 3-5 program analysis overall, the target population demonstrated increases that differed significantly from those of SC/ST boys in the eligible regions in all three grades, at 5% confidence levels. However, the target population's increases were not statistically significantly larger than those of the other female populations. The SC/ST girls in areas outside the incentive program significantly increased their likelihood of completion across all three grade levels, with 19.4 more percentage points in grade 3, 21 points in grade 4, and 19.4 points in grade 5. Non-SC/ST girls in the eligible regions increased significantly and consistently as well, with a 20.3 percentage point increase in grade 3, 22.1 points in grade 4, and 21.7 points in grade 5. The patterns of increases in completion among the male control populations were more mixed for grades 3 through 5 than under the grade 6 program.

Robustness Test Analysis

Aside from the implementation of these financial incentive programs, it is unlikely that socio-environmental factors changed radically enough in 1994 to spur these increased completion rates among Tamil Nadu's girls of SC/ST status. However, it is possible that economic or demographic changes during the mid-1990s could influence schooling outcomes. So a third regression is a robustness check on the grade 6 regression results.

Table 5 presents the results for an expanded probit model including three further variables. These variables control for the education level of the head of the household, household income per capita, and the number of children in the household. In the expanded model, both the head of household's education level and household income per capita are significant across all populations. The variable capturing the number of children in the household is significant for the overall population but returns mixed results across the other populations.

Including these controls impacts the results for female and male populations differently. In the expanded model, the target population of SC/ST girls in the eligible regions again showed a significantly increased likelihood of grade completion. These girls were 17.3 percentage points more likely to complete grade 6 in the expanded model, as compared to the 15.1-point increase reported in the third section of Table 3. Girls in the control population had a higher likelihood of grade 6 completion in the expanded model as well. These non-SC/ST girls in regions eligible for the grade 6 subsidy had a 10.6 percentage

Table 5:
Probit Analysis of Grade 6 Incentive Program-
Robustness Check with Expanded Model

Statistic	*Target and Control Populations*[a]				
	Baseline: All (aged 12-90)	**T1: Eligible-region SC/ST Girls** (aged 12-50)	*C1: Eligible-region SC/ST Boys* (aged 12-50)	*C2 Eligible-region Non-SC/ST Girls* (aged 12-50)	*C3: Eligible-region Non-SC/ST Boys* (aged 12-50)
GRADE 6					
Age < 22	-	0.173** (2.37)	0.0536 (0.74)	0.106** (2.55)	0.00671 (0.23)
Age	-0.0174** (-37.23)	-0.0242** (-7.13)	-0.0241** (-7.60)	-0.0196** (-11.23)	-0.00885** (-7.69)
Household Head Education (years)	0.0626** (35.97)	0.0390** (7.33)	0.0811** (12.46)	0.0419** (14.12)	0.0472** (19.44)
Household Income per Capita (rupees)	6.85e-06** (8.40)	8.95e-06** (2.93)	7.67e-06* (1.68)	6.25e-06** (4.35)	6.08e-06** (3.90)
Members of household ages 0-14	-0.0283** (-5.14)	-0.0241 (-1.31)	-0.0599** (-3.15)	-0.0223* (-2.31)	-0.00878 (-1.41)
N	7233	720	720	1907	1888
Z-Score for Difference[b]	-	-	*1.59*	*0.622*	*2.21**

*significant at .10 level   **significant at .05 level

Source: Indian Human Development Survey 2005

[a] The sample sizes for control populations C4 through C7, representing the ineligible populations residing in Chennai, are too small to permit meaningful analysis.
[b] Differences reported use z-statistics testing H_0: the raw probit coefficient for the binary variable *abelow22* is equal to that on *abelow22* in column T1.

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point greater likelihood of completing grade 6 in the expanded probit model, as compared to only 8.65 points greater in the primary probit model. For the male populations, the expanded model's results are smaller and remain insignificant. For the C1 population, these SC/ST boys in the eligible regions had insignificant increases under both models. For the C3 population, which in the primary probit model had a 5.65-point greater likelihood of completing grade 6 at a 10% confidence level, the inclusion of controls in the expanded model reduces those results to an insignificant increase.

As with the previous models, the Z-scores for the expanded model are reported in the final row of Table 5. A Z-score of 0.662 indicates that here again, while the target population experienced the greatest increase in likelihood of grade 6 completion among the groups, their increase did not differ significantly from that for the non-SC/ST girls in the eligible regions. However, it did differ significantly from that of the C3 population, non-SC/ST boys in eligible regions, with a Z-score of 2.21.

The expanded model's results confirm that including other household factors does not explain the significant increases in the likelihood of grade completion found in the primary and secondary probit analyses. Rather than reducing the marginal effects for the target population, the likelihood of completing grade six actually increased slightly among girl students in results of the expanded model. Therefore, the significant results of this analysis appear to be driven by the incentive program rather than these other factors, and may even slightly understate the impact on the target population's grade completion.

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Discussion

The grade 6 program appears to have been associated with substantial increases in completion rates among its target population. Each population experienced statistically significant jumps in the likelihood of completing grades 4 and 5 in 1994. Among eligible SC/ST girls, the approximately 26 percentage-point greater likelihood of completion for both grade 4 and 5 aligns with the expected response to the presence of financial incentives in those grades, as well as the increased stipend available later for grade 6.

Because both programs were implemented in 1994, it is difficult to separate the effect of the two levels of subsidy on the target population. Yet the lesser increase for grade 6, where the increased likelihood was approximately 11 percentage points less than for the lower grades, is plausible in that as girls age, their opportunity costs of attending school rise. The data may be demonstrating the waning impact of the subsidy, which while sufficient to motivate grade 5 completion may not continue to be effective through the whole of grade 6. This could be because as the stipend period drew to a close, other opportunities or demands on the girls' time outweighed the diminishing benefits of completing grade 6, particularly because there were no incentives offered to motivate continuation to the next grade. The data do not provide fractional attendance or completion information, allowing for the possibility that more target girls attended some portion of sixth grade instruction and received stipends for some period of time, but did not complete the grade and so these increases are not captured in this analysis.

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The significant increases in attendance evident among the other control populations in the eligible regions are also logical considering the altered school environment and new influences on parental decisions. In motivating significant increases in grade completion among the target population, the program could create considerable spillover effects. For SC/ST boys in particular, it is possible to envision families who previously did not enroll any of their children deciding to avail themselves of the subsidy by enrolling their daughters, which in turn influenced them to enroll their sons as well. Sending the SC/ST girls to school could change household dynamics so that more young SC/ST boys might be enrolled in school because their older sisters are in school rather than providing child care. This scenario is borne out in the grade 6 program analysis, where the data showed 14.6 percentage point and 13.1 percentage point increases in the likelihood of SC/ST boys in eligible regions completing grades 4 and 5, respectively, but then found no significant increase for grade 6. This may reflect boys being more unsupervised and becoming more independent as they age.

The results also indicate significant increases in grade completion likelihood among certain control populations. The increases are smaller among the non-SC/ST students in the eligible regions, with a general pattern of slightly more impact for the non-SC/ST girls than for the non-SC/ST boys. These increases could be due to spillover effects from the incentive program. Hypothetically, an increase in SC/ST attendance could have decreased enrollment among non-SC/ST girls due to social attitudes in the eligible regions. Families of other social status could have removed their daughters from

classrooms where increased numbers of SC/ST girls were attending. Instead, the data indicate significant increases in the likelihood of grade completion for non-SC/ST girls in eligible regions across all grade levels.

This increased attendance among non-SC/ST girls may have been indirectly motivated by the program for reasons such as resource changes, shifting attitudes or competition, following from the increased presence of SC/ST girls in school. Resources at the school could improve, for instance, if higher numbers of girl students reporting to school made teachers' attendance more regular as more parents became involved at school. Higher attendance could increase foot traffic to school, shifting parents' attitudes into trusting that girls were safer traveling to and from the classroom. Greater numbers of girls might make female students themselves feel more included or safer in larger groups in the classroom, increasing their own motivation to attend. Alternatively, increased SC/ST school attendance to public schools might spur the creation of other private schools, to which non-SC/ST families were more willing to send their daughters. These families could also feel social pressure to have better educated children than local SC/ST families, in order to compete for local reputation or in the local labor market. Publicity efforts surrounding the program, aimed at encouraging SC/ST families to participate, could also shift attitudes among non-SC/ST parents about the importance of educating girl children.

These changes, catalyzed by the program, affect non-SC/ST boys in the eligible region as well but to a lesser extent, and least by grade 6. Social considerations, in particular,

would be expected to have less impact on boys. Non-SC/ST boys generally attend school at higher rates than girls and therefore have less room for dramatic improvement after the creation of the program, as illustrated in Figure 5. In line with these expectations, results from the expanded model indicated no significant changes in grade 6 completion among the non-SC/ST boys in the eligible regions.

In the secondary analysis, the target population had significantly increased likelihoods of grade completion in all three of the lower grade levels, as expected. Non-SC/ST girls also had significant increases, which again could be due to changing circumstances as discussed above. No significant increases were evident for males in either eligible-region control group, which is unsurprising given the already high levels of attendance for males in lower grades prior to the program's creation.

In the fifteen districts ineligible for the incentives, SC/ST girls of age to be exposed to the program also experienced significant increases in the likelihood of grade completion in all three grades analyzed. It is possible that these significant increases in the likelihood of grade completion for SC/ST girls are due to parents' awareness of the new government initiative. It could be that confusion about the program's reach led them to enroll their daughters in expectation of subsidies. Alternatively, parents who are aware of the program could expect that the incentive payments would be expanded into new regions. This could lead parents to enroll their daughters in higher numbers, expecting that in future lower grade levels subsidies would become available in their district as well.

However, it is much more likely that the increase among SC/ST girls in the ineligible regions is because of their simultaneous eligibility for the grade 6 program. The stipend can be obtained only by attaining the sixth grade level and so would drive completion of the lower grades across Tamil Nadu. Since the grade 6 stipend is offered even in regions not eligible for the lower-grade subsidies, it may explain why SC/ST girls in ineligible regions had consistent increases in completion likelihood straight through grade 5.

Aside from a jump for SC/ST boys in grade 3 only, none of the other groups in the ineligible regions had significant likelihood increases in any of the lower grade levels. This possible spillover effect for SC/ST boys could be a result of the same social forces described above. As has been mentioned, more families enrolling their daughters in anticipation of a grade 6 subsidy would be more likely to also enroll their sons.

Policy Implications

These results strongly suggest Tamil Nadu's education incentive program caused a substantial increase in grade completion for its targeted population. The existence of stipends appears to have driven significant double-digit increases in the likelihood of grade completion by SC/ST girls in each grade where stipends were offered. Further, the impact on completion was not limited to the target population, but apparently extended to SC/ST boys, another population in Tamil Nadu with traditionally below-average education outcomes. Nor did the increased attendance by SC/ST students appear to drive away students of other social classes, as non-SC/ST girls' grade completion also

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increased significantly. Moreover, the significant increases in lower-grade attendance by SC/ST girls in regions eligible only for the grade 6 subsidy suggest that offering the one-tier stipend alone may be sufficient to motivate increases in marginalized girls' schooling.

These positive, significant results suggest that this education policy was an effective strategy for the state of Tamil Nadu to pursue in 1994. Beyond increasing girls' completion rates, the policy contributed to improvements among other populations. More educated girls, and a more educated population overall, are both beneficial to broader policy goals including public health, fertility management, and economic performance. The incentive programs have been maintained in Tamil Nadu and received funded in the state's 2008-2009 budget. This analysis provides quantitative support for the program's continuation.

Policymakers in other Indian states, who continue to struggle with raising grade completion, should consider this program as part of a wider education policy. This type of incentive program may be particularly relevant in states with a greater proportion of marginalized social groups. In light of the outcomes in Tamil Nadu's program, policymakers at the federal level could consider wider implementation of CTEs in India. The results of this study may also be of interest to policymakers in other countries facing similar challenges educating similarly marginalized populations.

VIII. CONCLUSION

An extensive literature on the interaction of education and human development predicts the fate of the girl who does not go to school. She will face a higher risk of poverty and of dying in childbirth. She will almost certainly marry younger and have a greater number of children, who will have higher chances of death or illness and lower chances of attending school themselves. She will contribute lower productivity and face a higher risk of labor exploitation (Herz & Sperling 2004). This is the future of millions of girls, not only in Tamil Nadu, but across India today.

Meanwhile, the debate continues about the most effective way to improve educational outcomes for these girls. Available research provides evidence that school participation, particularly for girls, depends on a nuanced set of conditions including parental characteristics, social context, local labor market conditions, school quality and location, and the gender ratio in the household. Serious still disparities exist between states' education systems and their abilities to ensure girls' access to education. Gaps in enrollment, literacy levels, test scores, and completion remain particularly pronounced in rural areas. While girls' attendance has risen in recent years, in part due to the Indian government's emphasis on universal primary education initiatives, outcomes remain stubbornly low for young women from lower socioeconomic status and disadvantaged ethnic groups.

In this complex environment, the challenge is identifying interventions that will most effectively reach the young women who are least likely to attend or complete school. By capitalizing on a natural experiment in Tamil Nadu, this study demonstrates that financial incentive policies can create significant improvement on important educational outcomes. With the policy in place awarding a stipend of 1000 rupees for the academic year (equivalent to roughly 2-3% of annual income in a typical SC/ST household in Tamil Nadu), SC/ST girls were at least 15 percentage points more likely to complete grade six. With smaller stipends for grades three through five, SC/ST girls of age to experience the program were over 20 percentage points more likely to complete grades three and four.

This analysis adds to the growing literature documenting the impact of CTE policies in South Asia. While programs in Bangladesh and Pakistan have been independently evaluated, very little qualitative data has been publicized on CTEs in the Indian context. In contrast to the programs with wider eligibility criteria evaluated in other countries, this study suggests not only that CTEs can be effectively implemented in India, but that a narrowly targeted incentive such as Tamil Nadu's can successfully reach specific marginalized populations. This is an important finding for policymakers across India as they consider effective strategies to achieve universal education. These results may also be relevant to policymakers in other regions where educating similarly marginalized populations may require targeted policy interventions.

IX. APPENDIX: Variable Construction

The state of Tamil Nadu is divided into 32 districts. The names and boundaries of some of these districts have changed since the incentive programs were implemented in 1994. In the India Human Development Survey (IHDS) 2005, data were collected in only 22 of the districts. In order to evaluate the two incentive programs, two binary region variables were created. Since the grade 6 program applied statewide excepting Chennai, the binary variable *region6* is assigned a value of 1 for individuals living outside Chennai (in the data, where STATEID2 equaled 733 and RO3 did not equal 2) and a value of 0 for individuals living in the district of Chennai (in the data, where the variable STATEID2 equaled 733 and the variable RO3 equaled 2). The binary variable *region35* is assigned a value of 1 for individuals living in districts eligible for the grade 3-5 program and a value of 0 for those living in ineligible districts.

The eligible districts were listed in a 2003 policy document as follows: Dharmapuri, Thiruvannamalai, Cuddalore, Villupuram, Virudhunagar, Kancheepuram, Thiruvallur, Vellore, Salem, Namakkal, Tiruchirapalli, Perambalur, Karur and Nagapattinam (Government of Tamil Nadu 2004). A 2008 policy document listed consistent districts, but referred to Krishnagiri as having separated from Dharmapuri and to Tiruchirapalli as its alternative Trichy (Government of Tamil Nadu 2008b). Contacts with a Tamil Nadu government official yielded no indication that district eligibility had been overhauled since its initial allocation. Paper records contemporary with the programs' creation have

since been lost (Gopalan 2009). Of the eligible districts, survey data were available in nine of them: Dharmapuri, Thiruvannamalai (spelled Tiruvannamalai in the data, coded 3306), Kancheepuram, Thiruvallur, Vellore, Namakkal, Tiruchirapalli, Perambalur, and Karur. Individuals living in these districts were assigned a value if 1 for the *region35* variable and individuals living in the other 13 districts covered by the survey were assigned a value of 1.

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