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Health Coverage and Educational Investments

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Abstract

Human capital theory posits that investments in health and education are complementary. Health investments boost education demand, thereby increasing educational expenditures. Drawing on this theory, this paper examines the impact of health coverage on three aspects of household educational investments: (a) the share of educational expenditures, (b) the level of educational spending, and (c) the probability of taking an educational loan. Using a health insurance scheme in India, this study employs a modified difference-in-difference strategy and two waves of the Indian Human Development Survey (2004-05 and 2011-12). The findings show that health insurance led to a 10 percent rise in the share of educational expenses, a 39 percent increase in per person educational spending, and a 185 percent rise in the likelihood of taking education loans. These effects are stronger for households below the poverty line. At the aggregate level, this externality translates to an additional one-tenth to one-fourth of every unit spent on the health coverage budget. All results are robust to changes in subsamples.

Keywords: Human capital investments, Health insurance, Treatment effect, Difference-in-differences

JEL Codes: C21, I13, J24

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1 Introduction

Ever since Theodore Schultz (Schultz, 1960) introduced the concept of human capital, education has become a central focus of labour research. The question of how to enhance education emerges as the key concern for academic researchers and policymakers. Though extensively researched, the focus was largely on direct investments in education and less on investments that can be leveraged through externalities. The idea of relying on externalities is intuitive, and causal empirics support this view. Investing in health coverage produces such an externality. Yet, there is little systematic empirical research establishing causal relationships or measuring the impact of investments in health coverage and education[1]. In this chapter, we examine the external effects of health coverage on educational investments.

Health coverage generates externalities in two ways. The first arises from the complementarity between health and education investments (Becker, 1974). Investments that improve health and longevity also spur educational investments. Healthy individuals tend to live longer, so they have a greater incentive to invest in education to reap the benefits over this extended lifespan (Mincer, 1958; Ben-Porath, 1967). The second arises from the price effects that free health coverage generates. Health coverage reduces the effective price of healthcare (Baicker, K. & Chandra, 2006; Finkelstein, 2007), prompting a reallocation of household consumption budgets. Whether this reallocation increases or lowers educational investment ultimately depends on whether education is a normal or inferior good and whether the income effect is stronger than the substitution effect.

Why consider externalities on educational investments? There are three reasons. Firstly, an increase in private educational expenditures alleviates the burden on governments to fund education[2]. Second, private and public expenditures on education complement each other, enhancing efficacy. Governments build schools and hire teachers, while households invest in tutoring, books, and other resources. These investments contribute to learning and reinforce each other. Third, measuring expenditures makes it easier to assess the net accounting benefits of an intervention. Coverage costs are usually in

[1]Interestingly, a large body of research shows that educational investments result in investments in health. See Grossman (1976); Grossman (2015); Meara et al. (2008); Stockwell (1963); Hinkle et al. (1968); Lleras-Muney (2005).

[2]Governments across the globe bear three-fourths of educational expenditures (UNESCO 2009, 2022). Yet, many fail to spend the UNESCO-prescribed international benchmark of 15-20 percent of GDP on education (OECD Report, 2022; UNESCO Report, 2023).

monetary terms. One can easily assess the program's net benefit if the benefit is also computed in monetary terms. Even though the change in educational expenditure here is an externality, policymakers can assess the indirect net benefit of this coverage, which may often be an important consideration in policy planning.

In this chapter, we are interested in two specific questions: (a) Does free health coverage raise a household's educational investments? And (b) Do poor families experience a greater magnitude of increase? Ideally, estimating the causal effects requires an experiment where some families are randomly exposed to health coverage, whereas others are not. Since conducting such a large-scale experiment is impractical, we turn to the Rajiv Arogyashree Health Insurance Scheme (RAHIS hereafter) as a quasi-natural experiment for this analysis. RAHIS, introduced in Andhra Pradesh (AP) in 2007, extends coverage to nearly all AP residents holding a below poverty line (BPL) card. While other state and federal programs in India also offer health coverage to the poor, RAHIS stands out for two key reasons. Firstly, compared to other coverages elsewhere, it is notably more generous and more accessible, covering a wider range of ailments, including major procedures such as heart surgery[3]. Secondly, AP's high official poverty line encompasses nearly 90 percent of the state's population, making almost all residents eligible for RAHIS. In contrast, coverage in other states is less inclusive due to lower poverty line thresholds. The advantage of RAHIS's broad coverage is that it helps mitigate a significant portion of potential selectivity bias stemming from unobserved differences between the poor and non-poor populations.

Working with RAHIS offers several additional practical advantages. Firstly, RAHIS operates as a cashless program, eliminating the need for upfront payments by patients—a boon for the financially disadvantaged who may lack ready cash, particularly for costly treatments like cardiac surgery. Given the challenges of accessing ready credit when needed, RAHIS's cashless system significantly reduces transaction costs, lowering hidden barriers to access. Secondly, the timing of RAHIS is also appropriate. Health insurance coverage in AP and other Indian states was minimal before 2007, with only 1.7 percent of families in AP and 2.5 percent in other states having access to private or public

[3]The coverage limit and the procedures covered under RAHIS is far greater than that of other federal programs such as RSBY, Chief Minister's Comprehensive Insurance Scheme (2007, Tamil Nadu), Mahatma Jyotiba Phule Jan Arogya Yojana (2012, Maharashtra), Mukhyamantri Amrutum Yojana (2012, Gujrat), Karunya Health Scheme (2012, Kerala), Vajpayee Arogyasri Yojana (2010, Karnataka), West Bengal health scheme (2008, West Bengal), and Kalaignar Kapitu Thittam (2009, Tamil Nadu).

health insurance in 2004-05[4]. This supports the requirement that both treatment and control groups must remain unaffected by treatment in the pre-treatment period. Thirdly, RAHIS covers post-discharge transport costs, reducing patients' movement costs after treatment. This provision significantly alleviates potential selectivity problems arising from differences in mobility costs across the population.

The canonical difference-in-differences (DiD) approach is well-suited for this study due to its ability to handle the 'before-after' nature of the experiment. However, we propose a slightly modified DiD approach. We argue that this method produces a more efficient estimator than the canonical DiD estimator. The proposed method, however, requires panel data, which is more stringent than the data requirement for canonical DiD, where repeated cross-section data often suffice with appropriate distributional assumptions. We apply this method to data from the 2004-05 and 2011-12 Indian Human Development Survey (IHDS) to isolate the impact of RAHIS on three educational investment variables: per capita education spending, the proportion of education in household budgets, and the prevalence of student loans. To further increase efficiency, we jointly estimate these equations in seemingly unrelated regression settings, leveraging cross-equation error restrictions. To substantiate the causal claims, we conduct various tests, including assessing parallel trends and conditional parallel trends, testing for placebo effects and spillover biases, and accounting for concomitant policies.

The results suggest that the introduction of RAHIS substantially increases educational investments in AP. On average, household per capita educational spending went up by INR 11.4 (a 39 percent increase from the 2004-05 level), the share of educational expenditure rose by 0.31 percentage points (a 10 percent increase from the 2004-05 level), and the probability of taking an educational loan increased by 3.7 percentage points (a 185 percent increase from 2004-05 level). By any standard, these are significant improvements[5].

In fact, our findings show that RAHIS's impact through the human capital mechanism dominates the impact through the consumption mechanism. In the year after RAHIS was implemented, through human capital effect, educational expenditures in the household

[4]Source: IHDS 2004-05 round

[5]Jackson et al. (2015) find that a 10 percent rise in per-pupil spending for low-income districts over 12 years led to a 0.27-year rise in completed years of schooling on average.

budget increased by 1.1 percentage points, or 36.7 percent, over 2004-05. Household education spending rises by INR 10 (33.8 percent higher than 2004-05). The probability of taking out a loan rose by 1 percentage point, or 50 percent, from 2004-05. Therefore, these results show that the lion's share of RAHIS's effect on educational investments is through the human capital mechanism.

The impact is particularly pronounced for poor families and families with school or college-going children. Among poor households, per capita educational spending rises by INR 18, the share of the education budget increases by 0.58 percentage points, and the likelihood of taking out a loan rises by 3.4 percentage points. These coefficients are nearly twice the average impact of RAHIS. Similarly, for families with school or college-going children, per capita educational spending rises by INR 10.6, the share of the education budget increases by 0.54 percentage points, and the likelihood of loan taking rises by 4.8 percentage points.

All our estimated results are robust to subsample choices and placebo tests. Regardless of how we examine the data, we arrive at the same qualitative results. AP is the only state showing a consistent and significant rise in educational investments. Even rigorous placebo tests fail to produce similar results for any other states in the control group.

The estimated impacts as externalities are substantial. In the year 2011-12, households supplemented every Indian rupee spent on RAHIS with an additional 25 Indian paisa in private educational expenditure, meaning that for every unit spent on RAHIS, households contributed an additional one-fourth. Specifically, through the human capital channel, this contribution amounted to 9 Indian paisa per rupee. This externality translates to an annual 6.7 percent increase in the total education budget of AP.

2 Background on Rajiv Aarogyasri Health Insurance Scheme (RAHIS)

Rajiv Aarogyasri Health Insurance Scheme, commonly known as Aarogyasri, is a public health insurance programme, launched by the state government of AP in India on 1st April 2007. The scheme aims to provide health coverage to poor households in AP. All

family members of a household holding a below poverty line ration card[6] are eligible to seek treatment under RAHIS, with no limit on the size of the household. The online database of the Civil Supplies Department of the government of AP is used to identify and authenticate beneficiaries. RAHIS played a pivotal role in ensuring healthcare access to the poor. By 2011-12, the scheme covered 198 lakh families (Table A.1),i.e., 90 percent of the families in AP.

The scheme was launched in two phases. The first phase of the scheme, Aarogyasri-I, was set forth on a pilot basis in three districts of AP, including Mahboobnagar, Anantapur, and Srikakulam. The scheme was subsequently extended to other districts in the second phase[7]. The method of deciding the order of districts for the implementation of the scheme is unknown as per the currently available official sources. However, a study by Fan et al. (2012) mentions that the districts were chosen based on human development indicators, with the backward ones given priority. The study notes that the districts selected in the first phase were considered the most backward and balanced in the three regions of the state - Telangana, Rayalaseema, and coastal Andhra. The second phase of the scheme, Aarogyasri-II, was launched on 17th July 2008, as a build-up on Aarogyasri-I by including additional surgical and medical diseases. Post the launch of Aarogyasri-II, it was no longer permissible for poor families to demand relief for medical purposes under the Chief Minister's Relief Fund (CMRF) as earlier.

The scheme is designed such that the state government fully pays the insurance premium to the insurance company. Each poor household is provided with insurance coverage of 2 lakh Indian rupees per annum. The hospital bill is paid by the insurance company. That is, the scheme provides end-to-end cashless service to its beneficiaries. The beneficiaries can choose any public or private empanelled hospital they like and request any treatment/therapy identified under the scheme. Additionally, the scheme includes a one-year follow-up package of cashless services, including consultation, tests, and treatment for the identified follow-up therapies. Also, the scheme distinctively covers the cost of food during treatment and the cost of transportation home post-discharge from the hospital. By 2011-12, the benefit coverage of the scheme was gradually extended to 938 identified treatments, 125 follow-up therapies, and a network of 454 empanelled hospitals,

[6]Including White Card (WAP), Antyodaya Anna Yojana card (AAY), Annapurna card (AAP)

[7]Table A.2 and Table A.3 provide details on various phases for the implementation of RAHIS. Figure 3 presents the five phases graphically.

including 98 government and 356 private healthcare providers (Table A.4,Table A.5). The beneficiaries already covered by other central government health programs[8] are not allowed to demand treatment under RAHIS for the treatment procedures covered under those programs.

Other features of the scheme include the organization of health camps to popularize the scheme and the recruitment of 'Aarogya Mithras' (a friend of health) to assist the beneficiaries. Aarogya Mithras work at the help desks of empanelled hospitals, assist the patient from arrival to discharge, and ensure that the patient receives the cash to travel back home post-discharge from the hospital. The basic information about the patient and the entire process, from primary screening to travel compensation, is recorded in an online system to maintain transparency.

3 Potential Channels

Health insurance, such as RAHIS, can influence educational investments through several routes, as shown in Figure 1. First, health insurance can extend life expectancy. With the prospect of a longer life, individuals have a higher incentive to invest more in education, as they can now reap the returns over a longer period. This phenomenon arises primarily from the complementarity between education and health (Becker, 1964).

Second, health insurance reduces the effective price of healthcare, producing income and substitution effects. The income effect increases the demand for education (assuming that it is a normal good), while the substitution effect decreases it as education becomes relatively more expensive. If the income effect dominates, educational spending rises (Card, 2008).

Third, health insurance reduces sick time, resulting in more work hours and potentially higher earnings. This is the labor supply effect. Higher earnings enable households to allocate more funds to education, assuming they view it as a normal good.

Finally, health insurance mitigates the risk of unforeseen medical expenses, thereby freeing up savings for other purposes (Bai and Wu, 2014; Wagstaff and Pradhan, 2005; Gruber and Yelowitz, 1999). This can lead to increased education spending.

[8] CGHS, ESIS, Railways

Conceptually, the health-education route is distinct from other routes. The health-education complementarity operates through an investment route, relying on the intertemporal aspects of earnings and consumption. In contrast, the other three routes primarily concern present consumption and involve budget reallocation. This distinction simplifies separating the effect of RAHIS through human capital investments from its effects through other consumption decisions. However, isolating the impacts of the three other consumption channels from one another is more challenging.

4 The Theory

Human capital investments include investments in health (Becker, 2007). Investing in one's health improves one's survival probability, thereby extending one's longevity. As longevity increases, education expenditures are likely to rise since educational investments will yield returns for a longer period of time (Becker, 1964; Mincer, 1958). Considering that free health insurance increases longevity without increasing health expenditure, it seems likely that such insurance will encourage early investment in education.

Research on health insurance focuses primarily on self-protection. People take measures not only to improve their health condition but also to avoid health shocks by using medical and nonmedical methods such as insurance (Cutler et al., 2000). In contrast, the complementarities in health insurance and education have been less explored. We demonstrate these complementarities based on the framework proposed by Becker (2007).

Consider a 2-period model (Becker, 2007) where an individual i lives for two periods (0 and 1). Let $u[.]$ denote the utility function of i. Thus, the utility of i in period 0 and period 1 are $u_i[x_0, l_0]$ and $u_i[x_1, l_1]$, respectively, where x is the expenditure on goods apart from education and l is leisure hours. Given these utilities, the present discounted value is

$$V = u[x_0, l_0] + \beta S(I) u[x_1, l_1] \tag{1}$$

where β and $S(I)$ represent the time discount rate, and probability of survival in period 1, respectively. $S(I)$ depends on whether an individual has access to insurance I such

that $\partial S(I)/\partial I > 0$, i.e., health insurance raises the probability of survival.

The budget constraint is

$$x_0 + S(I)\frac{x_1}{(1+r)} + E = w_0(1-l_0) + S(I)\frac{w_1(E)(1-l_1)}{(1+r)} \tag{2}$$

The left hand side of this equation denotes x expenditure on goods apart from education (assuming unitary prices), and E educational expenditure. The right hand side represents the total wealth accumulated from income in both periods. Here r represents the interest rate, and w_0 and $w_1(E)$ represent the wage rate in periods 0 and 1, respectively. The wage rate in period 1 is a function of education expenditure.

The optimal choice of educational expenditure emerges from the following utility maximization problem.

$$\begin{aligned} &\text{Maximize} : V = u[x_0, l_0] + \beta S(I) u[x_1, l_1] \\ &\text{subject to} : x_0 + S(I)\frac{x_0}{(1+r)} + E = w_0(1-l_0) + S(I)\frac{w_1(E)(1-l_1)}{(1+r)} \end{aligned} \tag{3}$$

The F.O.C. with respect to E is

$$S(I)\frac{\partial w_1(E)}{\partial E}\frac{(1-l_1)}{(1+r)} - 1 = 0 \tag{4}$$

The effect of I on E thus can be determined by

$$S'(I)\frac{\partial w_1(E)}{\partial E}\frac{(1-l_1)}{(1+r)} + S(I)\frac{\partial^2 w_1(E)}{\partial E^2}\frac{\partial E}{\partial I}\frac{(1-l_1)}{(1+r)} - 0 = 0 \tag{5}$$

Simplifying,

$$\frac{\partial E}{\partial I} = -\frac{S'(I)}{S(I)}\frac{\partial w_1(E)/\partial E}{\partial^2 w_1(E)/\partial E^2} \tag{6}$$

Considering the evidence on sheepskin effect in returns to education (Hungerford & Solon, 1987; Jaeger & Page, 1996), there are positive returns to schooling, i.e., $\partial w_1(E)/\partial E > 0$. Hence, the sign of $\partial E/\partial I$ depends on the sign of $\partial^2 w_1(E)/\partial E^2$. If the returns to schooling rise at an increasing rate, i.e., $\partial^2 w_1(E)/\partial E^2 > 0$, one would always stay in school and never quit school. This is unlikely to happen. Therefore, $\partial^2 w_1(E)/\partial E^2 < 0$ and the condition that $\partial E/\partial I > 0$ is satisfied.

5 Data

We draw data from two rounds (2004-05 and 2011-12) of the India Human Development Survey (IHDS). IHDS is a nationally representative household-level panel survey of about 40,000 households covering roughly 200,000 individuals. It is the first large nationwide panel survey documenting changes in the daily lives of Indian households over time. The survey covers various socio-economic indicators related to education, health, employment, social networks, gender, and family structure.

Even though IHDS started with an initial cohort of 41,554 households in 2004-05, about 2,000 households could not be located by the 2011-12 survey. To compensate, they added another 2,134 replacement households in 2011-12. To ensure a full panel, we keep only the households that appear in both survey rounds. This reduces our sample size to 40,018 households interviewed in both 2004-05 and 2011-12.

The IHDS collects detailed consumption expenditure data for each surveyed household, including education expenses. All expenditures are recorded in nominal terms at current prices. Using these figures, we define our first indicator of educational spending as follows:

$$\text{ShareEdu} = \frac{\text{Nominal Annual Education Expenditure} \times \frac{30}{365}}{\text{NPERSONS} \times \text{MPCE}}$$

, where $NPERSONS$ represents the household size, and $MPCE$ represents the monthly per capita household expenditure of the household in current prices. This variable, thus, represents a household's education expenditure as a proportion of the total household expenditure in a month. This serves as our first dependent variable.

The second dependent variable is the household's level of expenditure on education,

measured in current Indian Rupees (INR). In IHDS, all expenditures are recorded in nominal terms at current prices. To account for inflation, we convert all nominal figures to 2004-05 prices using poverty cut-off lines. The formula for this conversion is as follows:

$$\text{EduExp} = \frac{\text{Nominal Annual Education Expenditure} \times \frac{30}{365}}{\text{NPERSONS}} \times \text{DEFLATOR}$$

where DEFLATOR = 1 for the year 2004-05, and DEFLATOR = $\frac{\text{POVLINE2005}}{\text{POVLINE2012}}$ for the year 2011-12. POVLINE2005 is Tendulkar 2005 poverty cut off, and POVLINE2012 is Tendulkar 2012 poverty cut off. Thus, EduExp represents the per person expenditure on education by a household, measured in 2004-05 prices.

The third dependent variable is a binary indicator of whether a household has taken a loan for education in the past five years. It is constructed as follows:

$$\text{LoanEdu} = \begin{cases} 1, & \text{if education loan taken in the past five years} \\ 0, & \text{otherwise} \end{cases}$$

The main independent variable is the interaction between two variables: (a) a dummy variable for AP (1=AP, 0=non-AP) and (b) a dummy variable for policy year (0=2004-05, 1=2011-12). Later, in the estimation section, we will show that the coefficient of this variable is our primary focus. To minimize omitted variable bias, we include several control variables such as per capita consumption expenditure, household size, poverty status, and whether the household is headed by a female[9].

The household-level observations in all estimations are weighted using hhweight, constructed as follows:

$$\text{hhweight} = \text{SWEIGHT} \times \text{NPERSONS04} \tag{7}$$

where SWEIGHT is the household-level weight provided in the IHDS 2004-05 round, and NPERSONS04 is the household size in the year 2004-05. hhweight imparts more weight

[9] A detailed list of control variables is provided in Table A.6.

to the households with more members.

As will be seen later, we isolate the human capital effect from the budget reallocation or consumption effect. This requires controlling for life expectancy variables, which are not directly available at the household level. Due to this unavailability, we construct household-level life expectancy using age-wise life expectancy statistics from various Indian states provided by the Center for Monitoring Indian Economy (CMIE) for the years 2005 and 2010. The formula for this construction is as follows:

$$\text{LifeExp} = \sum_{k=1}^{NPERSONS} \text{LE}_{ksra} \tag{8}$$

where LifeExp is the household-level life expectancy, and LE is the life expectancy of the k^{th} household member. LE varies across age stratums (a)[10], Indian states (s), and sectors (rural or urban)(r). LifeExp, measured in years, is the sum of the life expectancies of all household members. A higher value of LifeExp indicates prolonged survival among household members.

6 Descriptive statistics

Demand for education is generally rising in India. However, after the implementation of RAHIS in 2007, household spending on education in AP has increased more sharply than in other control states without comparable health insurance schemes. As shown in Table 1, all measures of educational spending have trended upwards (see footnote in Table 1). From 2004-05 to 2011-12, the share of education in the total household budget increased by 2 percentage points in AP and by 1 percentage point in non-AP control states. This pattern holds in both rural and urban areas. The average per person spending on education rose by INR 44.7 in AP and by INR 25.1 in non-AP control states, with similar trends in rural and urban regions. Regarding educational loan-taking probability, AP experienced a 5 percentage point increase, while non-AP control states saw a 1 percentage point increase. Consistent with the other measures, the probability of educational loan-taking also rose in both rural and urban areas during this period.

[10] Less than 1 year, 1-5, 5-50,50-60, 60-70, Greater than 70

No matter which indicator we examine, the rise in educational investments has been faster in AP than in non-AP states. The last column of Table 1 presents a simple difference-in-differences analysis between AP and the control states for each indicator. This analysis reveals that the net increase in the share of education in the household budget in AP was 0.2 percentage points, representing about a 10 percentage rise (0.002 over 0.02 in 2004-05). For actual educational spending, the net rise was approximately INR 20, equating to a 67 percent increase (INR 19.6 over 29.6 in 2004-05) in average per person household spending in AP. Additionally, the probability of taking educational loans showed an almost 200 percentage rise (0.04 over 0.02 in 2004-05) during this period.

A similar pattern emerges when we divide households into poor and non-poor groups. As expected, the impact is more pronounced among poor families, who benefit more from health coverage. Table 2 shows that in both AP and non-AP control states, all three measures of educational expenditure exhibit upward trends among poor families. The last column reveals that poor families in AP experienced a significant rise in all educational investment indicators following the implementation of RAHIS. Conversely, non-poor families in AP show a declining trend in spending variables, while non-AP states show an upward trend. In terms of the probability of loan-taking, AP demonstrates a significant rise, whereas non-AP states show hardly any increase. It appears that in 2011-12, non-poor families in AP financed much of their education spending through educational loans rather than directly from the household budget. This suggests that non-poor families in AP had better access to credit during 2011-12, leading them to rely more on educational loans than on household consumption budgets.

These descriptive statistics strongly suggest that the implementation of RAHIS has increased investments in education. However, these measures are merely indicative and not causal, as they do not account for other confounding factors. Therefore, we undertake a more formal empirical analysis to identify the causal impact of RAHIS on various measures of educational spending, which we present below.

7 Estimation strategy

In 2007-2008, AP implemented health insurance policy, offering a quasi-natural experiment for our analysis. AP is the treatment state. The control states ideally would be the ones that resemble AP but did not enact similar health insurance policies during the period of analysis (2004 to 2012). States like Tamil Nadu, Karnataka, and Kerala initially seemed suitable candidates. However, they are excluded from the analysis as they have already implemented their own health insurance policies. The other states which never had such intervention differ substantially from AP in terms of their language, culture, food, infrastructure, and other policies. Table 3 illustrates the variations in observed determinants between AP and other potentially control non-AP states. Nearly all household and individual characteristics in AP differ from those in non-AP states. Therefore, directly comparing AP with these states might yield substantial biases (selectivity) due to unobserved confounders.

Controlling these observed confounders may partially alleviate selectivity biases but may not eradicate them completely. To further eliminate such biases and isolate the causal impact of the policy, we begin with a canonical DiD model. The main regression equation is as follows:

$$y_{ijt} = \alpha_j + \beta_{1j} \times AP_i + \beta_{2j} \times D2011 + \delta_j \times AP_i \times D2011 + X_{ijt}\gamma_j + h_{ij} + \epsilon_{ijt} \quad (9)$$

where i represents household identifier ($i \in \{1, 2, 3, ..., N\}$); j represents the outcome to be analyzed (j: {share of education expenditure, real expenditure on education, whether taken loan or not}); t represents time period; AP_i represents the treatment dummy; $D2011$ represents the policy year dummy; h_{ij}: represents the household fixed effect; X_{ijt} represents the vector of control variables which can be different for different outcome regression equations, $\alpha_j, \beta_j s, \delta_j, \gamma_j$ are parameters of the equation j; and ϵ_{ijt} represents the error term for household i in the year t for outcome j. The main parameters of interest are $\delta_j s$.

Estimating Equation 9 poses several challenges for parameter identification and estimation. DiD has advantages but relies on certain assumptions. First, without RAHIS,

AP and non-AP states' outcomes must trend similarly in pre- and post-policy periods. This parallel trend assumption, if violated, biases DiD estimates. Second, RAHIS should not create a placebo effect; it shouldn't trigger other policies in AP that affect household educational investments. Third, RAHIS must not impact educational investments in non-AP states; otherwise, DiD yields biased estimates. This is SUTVA. Fourth, AP should not implement other policies alongside RAHIS that affect household educational investments; failing this, DiD won't identify the true treatment effect.

7.1 Identification: Overall Impact of RAHIS

The Canonical DiD estimator yields the average treatment effect on the treated (ATT). By assuming a parallel trend, the selectivity bias is eliminated, and the causal effect on the treated group is shown. However, other biases may still exist. To see these biases, consider the Schema in Figure 2 that isolates the treatment and confounding effects.

In this diagram, TE represents the treatment effect that affects AP solely in the post-treatment period - this is the parameter of our interest. OE indicates selectivity bias, reflecting the difference in average outcomes between AP and non-AP states regardless of RAHIS. This suggests that AP may differ from non-AP control states even before the introduction of health coverage. TR denotes the trend influencing both AP's and non-AP's post-treatment outcomes. SPE signifies the spillover effect, where AP's implementation of RAHIS alters outcomes in non-AP states. CP denotes other concomitant policies in AP affecting a household's expenditures on education. Lastly, PE stands for the placebo effect, meaning households in AP may respond merely because they are receiving health coverage. NE denotes no effect.

Panel (A) displays AP's post-treatment outcome, including TE, OE, PE, CP and TR. Panel (B) illustrates AP's pre-treatment state, featuring solely OE (selectivity). Panel (C) showcases TR (trend) and SPE (spillover), representing non-AP states' post-treatment outcomes. TR indicates the change in outcome between two periods without treatment, while SPE captures the change in non-AP states' outcomes due to AP's policy implementation. Panel (D) presents non-AP states' pre-treatment outcomes devoid of these factors. Only OE is directly eliminable using the canonical DiD method. The effect of no other factor can be directly eliminated without further assumptions.

The canonical DiD method eradicates selectivity bias (OE) and obtains ATT, assuming identical trends (i.e. TR in Panel (A) = TR in Panel (C)), zero placebo effects (i.e. PE=0), and the validity of SUTVA (i.e. SPE=0). If any of these assumptions are violated, the DiD estimate of ATT becomes biased and inconsistent. As such, to identify ATT accurately, all these assumptions must be met. Below, we offer several tests to evaluate the appropriateness of the DiD framework for identifying ATT.

7.1.1 Parallel trend

By 2011, all households in AP had health coverage, making it impossible to directly test common trends. To address this, a common strategy is to demonstrate parallel trends during the pre-treatment period. However, in our case, this proves impractical since the IHDS interviews households only for one year (2004/05) before treatment, hindering the construction of pre-treatment yearly trends.

However, IHDS conducted interviews over a whole year (2004-2005). During this period, households were interviewed on seemingly randomly selected dates[11]. Leveraging this apparent randomness, we test for parallel trends in an event study-like setting. For many months, households from AP and non-AP states were randomly selected and interviewed. Hence, it is reasonable to believe that the set of households surveyed each month is anticipated to be comparable. We rely on this random assignment of interview dates to construct the difference in outcomes between AP and non-AP states over these months. Thus, we utilize the following regression equation to test this assumption.

$$y_{ik} = \delta_0 + \delta_1 AP_{ik} + \sum_{k-1} \delta_{2k} D_{ik} + \sum_{k-1} \delta_{3k} D_{ik}.AP_{ik} + \varepsilon_{ik}$$

where index i represents the household unit, and k denotes the month in the pre-policy period when the household is interviewed. y_{ik} is the outcome variable for household i in month k. D_{ik} is a month indicator variable, taking the value 1 if the month equals k, and zero otherwise. To avoid the dummy variable trap, we include $k-1$ dummies with November 2004 as the reference period. AP_{ik} is an indicator variable identifying household i residing in AP interviewed in month k. The coefficients of AP_{ik} represent

[11]The IHDS survey design does not specify any selection rule dictating the sequence of regions to be interviewed. Therefore, we operate under the assumption that the timing of interviews during the survey period was random.

the difference between AP and non-AP states. The coefficient of D_{ik} (δ_{2k}) captures the common time trends in AP and non-AP states. Given the monthly data, coefficient variation may arise from seasonality, such as festival or harvest seasons. The term ε_{ik} represents the model residual.

The coefficients of the interaction terms (δ_{3k}) show the differences in outcomes between AP and non-AP states for each month. A parallel trend means this difference is zero. Thus, the null hypothesis for parallel trends is:

$$H_0 : \delta_{31} = \delta_{31} = ... = \delta_{3(K-1)} = 0$$
$$H_A : Otherwise$$

Failure to reject the null implies that the gap in outcomes between AP and non-AP does not change across months, indicating a parallel trend.

Table 4 presents the estimates. The parameter δ_1 is positive and significant, indicating that outcomes in AP and non-AP differ, akin to selectivity bias. Table 4 also shows that none of the δ_{3k} are statistically significant at the 5 percent level, supporting the parallel trend assumption. Additionally, upon testing the joint significance of the δ_{3k} coefficients using an F-test, we find that these coefficients lack joint significance. Notably, even when incorporating time-varying household-level covariates in this equation, the individual and joint insignificance of the δ_{3k}s coefficients persist. This suggests that the outcome difference between AP and non-AP states does not change over months, indicating parallel time trends.

7.1.2 Placebo effects

The benchmark model in Equation 9 requires zero placebo effect (i.e. PE=0) to produce an unbiased and consistent estimator of ATT. This means, in and of itself, implementation of RAHIS must not trigger behavioral change among the households that can potentially affect AP's outcome. However, such assertions may not hold entirely true. Implementation of policies like RAHIS often signals policymakers' intent to invest in social and developmental causes. Consequently, households perceive these signals as a welcome change and alter their educational investments. If true, the placebo effect occurs

($PE \neq 0$), biasing the treatment effects estimate.

To determine if health coverage introduces a placebo effect, we examine another nationwide health coverage program, Rashtriya Swasthya Bima Yojana (RSBY), initiated in 2007 but not implemented in AP until 2011-12. If health coverage indeed instigates a placebo effect, one would expect households post 2007 in non-AP states to adjust their educational investments in response to RSBY. However, as we will illustrate later (see Table 11), individuals eligible for RSBY in non-AP states do not display consistent significant effects on educational investments. Thus, it is unlikely that health coverage would generate significant placebo effects that could undermine the validity of ATT.

7.1.3 Spillover effects

Treatment spillover here means RAHIS alters non-AP states' educational spending. Since RAHIS is a state policy, non-AP residents are not eligible for coverage. Even if some non-AP residents obtain BPL cards, they must migrate from their home state to AP to access healthcare in AP's empanelled hospitals.

However, if individuals from non-AP states migrate to AP seeking RAHIS benefits, it could disrupt educational spending distributions in both regions, biasing ATT estimates. To investigate, we examine Census migration data. Table 5 presents migration figures from non-AP to AP states for 2001-2006 and 2006-2011. Remarkably, the migration rate remained steady at 0.003 percent during both periods, indicating virtually no change in post-RAHIS implementation. Therefore, it seems unlikely that migration-induced spillover bias affects our analysis.

Bias may arise if individuals from non-control non-AP states, such as Tamil Nadu, Kerala, Karnataka, Madhya Pradesh, and West Bengal, migrate to AP. Notably, these states have their own health insurance schemes, which could affect migration patterns. However, as indicated in Table 5, migration rates for pre-and post-RAHIS periods stand at 0.009 percent and 0.011 percent, respectively. This consistency in migration rates suggests that RAHIS is unlikely to drive inward migration to AP. Therefore, it is improbable that migration-induced spillover bias originates from this source.

Various other state combinations also indicate a negligible change in pre-and post-RAHIS migration to AP (see other rows in Table 5). Hence, it's reasonable to conclude that

spillover bias isn't a significant concern for our estimation.

7.1.4 Other concomitant policies

Health coverage is one of the interventions. It is possible that there are other concomitant interventions or developments that may affect a household's expenditures on education. The Jawahar Bal Aarogya Raksha Yojana in 2007 and Microfinance crises occurred in 2009/2010, for example. This essentially means that many households will experience an impact on their budget. As a result, their educational expenditure may change.

To address this problem, we employed a negative control strategy. To begin, we developed propensity scores for each household and state, and compared them with households and states with similar propensity scores. Next, we identify states where there is a comparable microfinance crisis (Orissa) but no health coverage. The DiD with these states and AP determine the effects.

7.2 Isolating Human Capital Effect

The strategies outlined above identify RAHIS's direct impact on educational spending. However, they don't isolate the specific contributions of the education-health complementarity and consumption reallocation within the total estimated effects (see section 3 for a detailed discussion). In many instances, such decomposition could offer invaluable insights for policymaking across education, health, and retirement sectors.

One way to isolate the human capital effect from the consumption effect is to estimate the consumption effect and then subtract it from the total effect. Because the human capital channel works through life expectancy, one can switch off the human capital effect by controlling for the life expectancy in the regression. The data section (section 5) elaborates on the construction of the household-level life expectancy.

7.3 Precision

DiD does not require panel data. To obtain ATT estimates, repeated cross-sections suffice if the distribution of unobserved confounders remains unchanged over time. However, if panel data is available, the precision of estimates improves. Since IHDS is a panel dataset,

we enhance efficiency by using mean deviation. Appendix subsection A.1 proves that mean deviation transformation reduces error variance, thus increasing efficiency. With this transformation, our estimation equation is:

$$\Delta y_{ijt} = \alpha_j + \beta_{1j} \times \Delta AP_i + \beta_{2j} \times \Delta D2011 + \delta_j \times \Delta(AP_i \times D2011) + \Delta X_{ijt}\gamma_j + \epsilon_{ijt} \tag{10}$$

where Δ indicates the mean deviation form.

7.3.1 Seemingly unrelated regressions

As shown earlier, we have three regression equations. Estimating each individually loses estimation efficiency. Therefore, we estimate them as a system of equations in a seemingly unrelated regression to gain further efficiency by incorporating cross-equation error correlations.

8 Results

Our findings strongly support the theoretical predictions of a strong complementarity between education and health. In line with previous research (Currie & Stabile, 2006; Currie, 2009), these results indicate that the implementation of RAHIS in AP markedly increases educational expenditure, the proportion of household budgets allocated to education, and the probability of seeking educational loans. These effects are both statistically and economically significant.

Table 6 demonstrates that, on average, the RAHIS increases monthly per capita educational expenditure by INR 11.4 (in constant 2004-05 prices), holding all other factors constant. This constitutes a 38.5 percent increase over the average private education expenditure of INR 29.6 in 2004-05. Given this magnitude of effect, this translates to an additional INR 1,157.3 crores (in 2011-12 prices) of private educational expenditure each year for AP[12]. From the introduction of RAHIS until the survey (2007-2011), AP allocated INR 3275 crores (in 2011-12 prices) to RAHIS coverage[13]. This implies the

[12]Population of AP in 2011 = 8.46 crores (Data from Population Census 2011 India). Total externality = 11.4*8.46*12 = 1157.3 crores.

[13]Budget 2007-08 = INR 50 crores; Budget 2008-09 = INR 450 crores; Budget 2009-10 = INR 925 crores; Budget 2010-11 = INR 925 crores; Budget 2011-12 = INR 925 crores. The RAHIS budget allocations are from AP's budget

externality amounts to at least 35.3 percent of the total RAHIS budget[14]. In 2011–12, this externality translates to an additional 25 Indian paisas complementing every extra rupee spent on RAHIS[15]. Additionally, every year, this externality is equivalent to a 6.7 percent rise in the entire state of AP's education budget[16]. By any standard, this is significant.

RAHIS also affects intra-household budget allocation, implying a higher importance of education. According to Table 6, on average, the proportion of household budgets allocated to educational expenditures increases by 0.31 percentage points, rising from 3 percent to 3.31 percent—a 10.3 percentage surge. Considering that households typically allocate a modest portion of their budget to education, a 10 percentage increase solely due to a specific health program underscores the robust complementarity between education and health.

Even when funds are scarce, households resort to credit markets (formal or informal) to finance education in response to the newly introduced health coverage. As shown in Table 6, the implementation of RAHIS increases the probability of obtaining an education loan by 3.7 percentage points, representing a 185 percent rise from the 2 percent level in 2004-05. This notable change in behavior highlights the pressing requirement for a more streamlined credit market for educational loans, which is currently operating somewhat inefficiently.

8.1 Impact of Human Capital

The estimated causal impact is substantial. However, the DAG diagram suggests this impact may not be entirely due to the human capital effect. Changes in consumption might also influence educational expenses. Since the human capital investment effect (education-health complementarity) operates through life expectancy, we can measure the impact of consumption by holding life expectancy constant. section 5 explains how

documents available at: https://ysraarogyasri.ap.gov.in/documents/d/guest/doc61, https://www.ysraarogyasri.ap.gov.in/documents/d/guest/doc34, https://apfinance.gov.in/pbs-2007-middle.html, https://rb.gy/mp9dhk and https://apfinance.gov.in/pbs-2009-middle.html

[14]This represents the minimum level of externality. The actual externality also includes the effect of RAHIS in the years preceding the 2011–12 survey round. However, due to the unavailability of data for those years, we are unable to estimate its impact during that period.

[15]1157.3/RAHIS Budget 2011-12

[16]Budget 2011-12 for School Education Department = INR 14,025 crores; Budget 2011-12 for Higher Education = INR 3,337 crores. Data obtained from: https://s3.ap-south-1.amazonaws.com/apfinance.gov.in/uploads/Previous/budget-speech-2011-12-eng.pdf

to construct household-level life expectancy data. With this control, we can interpret the causal coefficient as the effect of consumption alone. By subtracting this consumption effect from the coefficient estimates in Table 7, we can determine the impact on education spending due to the human capital effect.

Table 7 shows the results of this regression representing the consumption effect. The results are mixed. The share of educational spending declined. The level of educational spending did not get significantly affected. As far as the households' spending from their own budget, RAHIS lowered the share of educational spending due to the consumption effect. With respect to the educational loan, RAHIS increased the probability of taking such a loan.

After accounting for these effects, we determine the impact on educational investments from education-health complementarity or the human capital effect (see Table 7). The estimates indicate that per person education spending increases by INR 10, a rise of 33.9 percent. The share of spending on education increases by 1.1 percentage points, representing a 36.7 percent rise. Additionally, the probability of taking educational loans rises by 0.9 percentage points, a 45 percent increase. These figures show that the human capital effect is comparable to, and sometimes stronger than, the benchmark effects.

8.2 Robustness Check

In the section on data and estimation, we discuss the rationale for selecting the specification and subsample. However, to verify the robustness of the results, we reran the analysis with different subsamples and specifications. Estimates from this robustness exercise support the qualitative results, indicating that the results are, by and large, invariant to a variety of specifications and datasets.

8.2.1 Inclusion of the smaller states and union territories

Earlier, the benchmark analysis left out smaller states (in the north-east and union territories) from the comparison group to make the treatment and control groups comparable. Smaller states often lack administrative authority or face political instability, which affects their decisions and outcomes, such as education spending. These issues can

also make it hard to introduce programs like free health coverage, as seen in AP. Without these states, the benchmark specification may not produce fully representative estimates. To verify this assertion, we included the smaller states in the comparison group and conducted the analysis again. Interestingly, their inclusion had a minimal impact on the results. As Row 1 in Table 9 shows, the implementation of RAHIS led to an increase in education expenditures by INR 10.4, a 0.32 percentage point rise in the share of education spending, and a 3.7 percentage points increase in the likelihood of taking education loans. As such, these findings are virtually identical to the benchmark analysis results.

8.2.2 Big states as comparison groups

Delivery is a crucial aspect of healthcare provision. It crucially relies on the administrative setup of states that implement the program. Providing effective healthcare services in a big state is much harder than in a smaller one. To see if the size of control states affects the effectiveness of RAHIS, we ran the benchmark analysis again using only large population states like Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan as the comparison group. The main results stay mostly the same, although some show a stronger effect than expected. As shown in Row 2 of Table 9, the introduction of RAHIS increases educational expenditures by about INR 15.7 or by 53 percent, and the likelihood of taking a loan goes up by 3.7 percentage points. However, the share of education only goes up by 0.17 percentage points, which is nearly half of what was found in the benchmark analysis. It's interesting to see that even though there is a big increase in actual spending in RAHIS, the share of educational spending does not go up as much.

8.2.3 Testing for SUTVA violation

We detect some signs of SUTVA violations, but they do not appear to be significant enough to alter our benchmark findings. As mentioned earlier, a concern in this analysis is that RAHIS might encourage people to move from other states to AP. If these migrants are inclined to spend differently on education than other AP residents, the spending patterns of AP and the migrants' origin states might change, and we might expect a greater impact on educational investments, the SUTVA violation. To explore this empirically, we designate Orissa and Chhatisgarh, neighboring states, as the control states because migration is likely to be less costly from these states. The results are detailed

in Row 3 of Table 9. We observe some provisional indications of SUTVA violations. The estimated effects are stronger for two of the three outcome variables. Education expenditure increased by INR 19, and the expenditure share rose by 0.44 percentage points. This represents approximately 67 percent and 47 percent increments compared to the educational expenditure and share of expenditure estimates from the benchmark models, respectively. However, the effects on loan uptake remain consistent. Therefore, it's plausible that individuals from Orissa and Chhatisgarh migrated to AP to capitalize on the policy.

After a thorough examination, we determine that these violations will not significantly impact the estimates from the benchmark regression. To confirm this claim, we remove Orissa and Chhatisgarh from the control group in the benchmark. If the SUTVA violation was significant, we would expect the impact of RAHIS on the outcome measures to noticeably decrease compared to the benchmark. If not, we can confidently assert the robustness of the benchmark findings. This regression analysis (Row 4 in Table 9) indicates that education spending increased by INR 11, while the share of education spending and the likelihood of taking out an educational loan rose by 0.30 and 3.7 percentage points, respectively. Since these results closely match those from the benchmark, we can conclude that including Orissa and Chhattisgarh, two control states that could potentially cause SUTVA violations, in the control group does not confound the benchmark outcomes.

8.2.4 Health coverage or concomitant policy

Another potential threat to identification arises if AP implemented other concomitant policies that could affect education spending. During this period, we identified two such policies: the Jawahar Bal Aarogya Raksha Yojana (JBARY) and the Microfinance Crisis (MC). Both could potentially influence household educational investments and hence confound inferences regarding the impact of RAHIS.

Confounding due to JBARY, 2010

JBARY provides free nutritious food and health checkups for children in government schools. This intervention may improve children's health and reduce household medical expenses. Improved health can lead to increased educational spending through the human

capital channel. The freed-up resources might be used for further education funding. Thus, implementing JBARY in AP could potentially introduce a positive bias to the DID estimate of RAHIS. JBARY was introduced on November 14, 2010. Interviews for IHDS-II in AP took place between January and October 2011. This short time gap means there's little room for bias. To make sure that is the case, we looked at households whose children only went to private schools and couldn't get JBARY. Even without JBARY, RAHIS significantly improved all three educational outcomes (see Row 8 of Table 9). This result remains robust even after accounting for the number of household members attending private schools in the benchmark regression (see Row 13 of Table 9).

Confounding due to Microfinance crisis, 2010

Another suspected confounding factor is the Microfinance Crisis of 2010, just a year before the IHDS 2011-12 survey. This crisis halted microfinance loans, impacting the poor's borrowing capacity. States with many microfinance clients felt the shock more than others. AP was one of these states, with 1.5 percent of its population taking loans. Other affected states included Karnataka, Tamil Nadu, West Bengal, and Orissa, with loan penetration rates of 0.6 percent, 0.9 percent, 0.6 percent, and 0.8 percent, respectively (Srinivasan, 2010). Despite the administrative chaos, these statistics suggest a statewide major impact is unlikely, minimally confounding the impact of RAHIS. Nevertheless, we examined whether this crisis contributed any significant bias to the estimated impact of RAHIS.

Even with relatively small loan penetration, some households in AP likely altered their spending due to this shock, potentially affecting their educational expenses. To isolate this effect from RAHIS's impact, we compared AP with Orissa, the only control state with high loan penetration significantly affected by the microfinance crisis.

The findings from this regression show that the qualitative results from the benchmark regression remain valid (Row 5 in Table 9). Educational spending rose by INR 14, higher than the benchmark estimate of INR 11.4. The share of the education budget also rose by 0.1 percentage points, slightly lower than the benchmark estimate. The impact on loan-taking remains the same as the benchmark regression estimate. These results indicate that adjusting for the microfinance crisis did not significantly alter the estimates. Despite the similar magnitudes of the estimated effects, some are statistically

insignificant, likely because we excluded the other 12 control states, reducing the number of observations.

8.2.5 Propensity score matched households: AP and non-AP

To check the sensitivity of results to unobserved concomitant policies, we match households in AP and non-AP regions using propensity score matching (PSM) based on a set of household-level covariates to ensure comparability between the two groups. Row 11 of Table 9 presents stronger results for matched households as compared to the benchmark results. The share of education expenditure increased by 0.5 percentage points, and education spending rose by INR 16.5. The effect of loans decreased only slightly to 3 percentage points. Hence, it appears that concomitant policies underestimate the true effect of RAHIS in benchmark results. However, it is important to note that these results are subject to the set of covariates chosen.

8.3 Placebo Check

Based on the above results, it is clear that the findings remain consistent across different specifications and subsamples of data. To further validate these results, we conducted placebo tests to determine whether the positive effect of AP is unique to AP or whether other states show similar outcomes. For this, we performed pairwise placebo tests. Each control state was designated as a placebo treatment state, with the other control states serving as the control group. The control group consisted of 13 states. In the procedure, each of these 13 states was assigned the role of a placebo treatment state, with the remaining 12 states as control states. This resulted in 13 separate regression analyses, one for each state. In none of these regressions was AP involved.

The results strongly support our hypothesis. Across all 13 regressions in Table 10, none shows a consistent increase in all three aspects of educational investments. No state has exhibited a systematic rise in these outcome variables between 2004/05 and 2011/12. In 5 of the 13 regressions, only educational expenditures have increased. In 5 of the 13 regressions, the share of expenditure has increased. 9 of the 13 regressions indicate an increase in the probability of taking out a loan. In 4 of the 13 regressions, two out of three outcome variables have shown an increase during this period. Unlike AP, no other state

has seen a statistically significant rise in all three measures of educational investment.

In addition, we conduct a placebo test using RSBY. RSBY is a central government health insurance scheme launched across India in 2007. Similar to RAHIS, RSBY provides cashless treatment to beneficiaries at empanelled hospitals. To avail treatment under RSBY, beneficiaries must hold a smart card issued by the government[17]. AP did not implement RSBY until 2011-12, while other non-AP states did[18]. We estimate the impact of RSBY on non-AP states using a dummy variable for RSBY smart card holding, which equals one if the household reports having an RSBY smart card in the 2011-12 survey, and zero otherwise. Table 11 shows that although RSBY smart card holding has a positive and significant impact on education share in non-AP states, the impact on loan taking is negative, while the impact on education share is insignificant. Hence, RSBY did not significantly raise all three measures of educational investment like RAHIS.

While RSBY is a health coverage program, its design features may undermine its effectiveness, appearing to contradict the complementarity between health coverage and educational investments. Issues include the mandatory smart card system with an annual registration/renewal fee of 30 Indian rupees per annum, challenges in distribution, poor biometric and photographic quality, and lack of requisite infrastructure like internet-enabled computers and card readers (Rajasekhar et al., 2011). Public awareness was limited, empanelled hospitals often refused treatment due to poor reimbursement rates and delays (Rajasekhar et al., 2011), and coverage was capped at 30,000 Indian rupees annually for five family members[19]. In contrast, RAHIS offers broader benefits, including 2 lakh Indian rupees coverage and no family size restrictions.

8.4 Heterogeneity

The impact of RAHIS on educational spending is significant, yet it may not be uniform across all households. This variation depends on household composition and characteristics. Households with school-going or college-going children may experience a greater shift in educational expenditures than those without. Conversely, poorer

[17]For more details, see: https://www.india.gov.in/spotlight/rashtriya-swasthya-bima-yojana#rsby4 (accessed on February 28, 2023)

[18]This article suggests that RSBY was not implemented in AP until 2011: https://www.thehindu.com/news/cities/Hyderabad/andhra-pradesh-not-utilising-rsby-kharge/article2382625.ece (accessed on June 26, 2014)

[19]Source:https://www.india.gov.in/spotlight/rashtriya-swasthya-bima-yojana#rsby4 (accessed on February 28, 2023)

households with limited means for health improvements may benefit more from RAHIS, resulting in greater impacts on their educational spending. The essential question remains whether those who need such policies the most will benefit the most from them. We discuss these two aspects of heterogeneity below.

8.4.1 Effect on households with school/college going children

No matter how we analyze it, households with school-going or college-going children experience a greater effect of RAHIS on their educational investments. As Table 9 (Row 7) shows, for households with at least one member going to school or college, the introduction of RAHIS raises their per person educational spending by INR 11, increases the share of educational spending by 0.54 percentage points, and raises the probability of taking an educational loan by 4.8 percentage points.

Specifically, households with at least one member below the age of 18 (Row 9 in Table 9) see an INR 12.7 rise in educational spending, a 0.67 percentage point increase in the share of educational spending, and a 4.3 percentage point increase in their probability of taking educational loans. Similarly, households with at least one member below the age of 24 (Row 10 in Table 9), a superset of the previous group, also see an INR 8.4 rise in educational spending, a 0.45 percentage point increase in the share of educational spending, and a 4.0 percentage point increase in their probability of taking educational loans. These sub-groups clearly experience a substantially higher impact of RAHIS than average, as expected.

8.4.2 Effect on households below poverty line

An important concern is how RAHIS impacts households below the poverty line. Educating this group is crucial. Prior studies indicate that poor people are more affected by health insurance than non-poor people. If this holds true, one would expect poor households to see a larger rise in educational investments.

Table 8 shows that RAHIS has a greater impact on educational spending in poor households. Their per person educational spending rises by INR 18.1, the share of educational spending increases by 0.58 percentage points, and the probability of taking educational loans also rises by 3.4 percentage points. All these changes are statistically

significant. The impact on spending from their own budget is substantially higher than the average reported earlier, though the impact on the probability of taking loans is similar to the rest of the population. This similarity may indicate an imperfect credit market that is not efficient enough to provide loans even when the demand is higher.

9 Conclusion

In this chapter, we estimate the impact of free health coverage (RAHIS) on educational spending and loan-taking for education, a topic rarely explored. The results show that introducing health coverage significantly affects household education on many fronts. Per person education spending increased by 39 percent, and the share of education in household budgets rose by 10 percent. Even when short on funds, households boosted their borrowing for education by 185 percent.

To put things in perspective, over the five years before the survey, INR 3275 crore was allocated to RAHIS. During this period, private household educational expenditure increased by at least INR 1,157.3 crore overall, with INR 1,015.2 crore attributed to the human capital channel. This means that 35.3 percent of the total RAHIS allocation (overall) and 30.9 percent (human capital) emerged as externalities from the health coverage.

Thus, the externality of health coverage on private educational spending is substantial. This opens significant opportunities for policymakers to consider health and education policies together, allowing for more efficient resource allocation.

Figures and Tables

Figure 1: Directed Acyclic Graph Illustrating the Causal Relationship between Health Insurance and Educational Investments

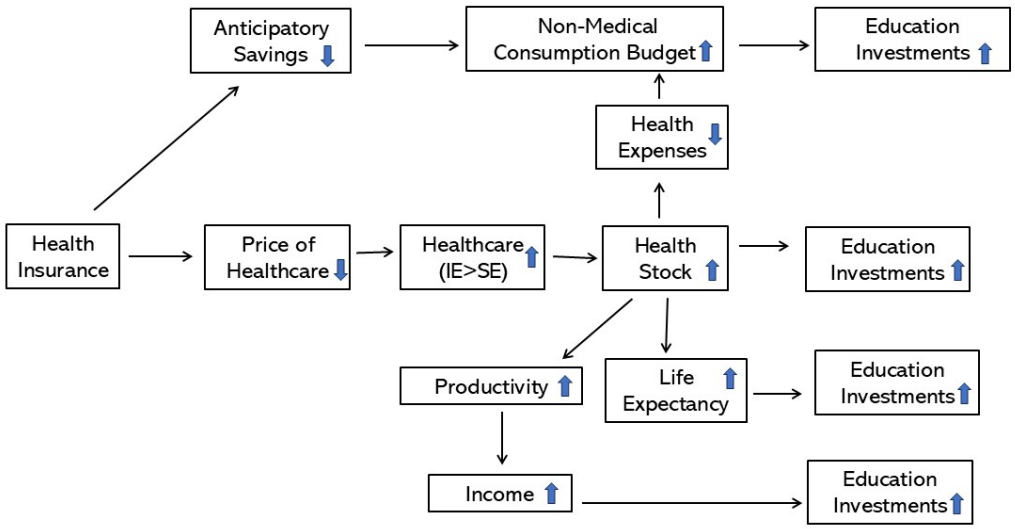
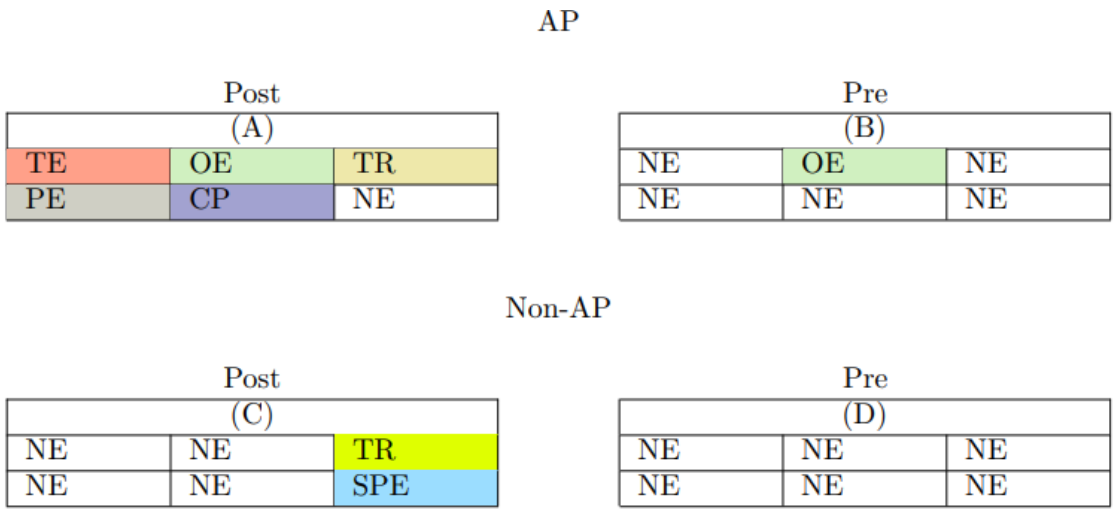


Figure 2: Treatment Effect and Various Sources of Confounding



TE = treatment effect; OE = selectivity bias; TR = trend; PE = placebo effect; NE = No effect, SPE = spillover effect, CP = Concomitant Policies

Table 1: Higher increase in average educational investments for Andhra Pradesh between 2004-05 and 2011-12 as compared to Non-AP states

		Andhra Pradesh			Non-AP			
		2004-05	2011-12	Diff	2004-05	2011-12	Diff	Diff
		(A)	(B)	(B - A)	(C)	(D)	(D - C)	(B - A) - (D - C)
Share of education in total expenditure[a]	Rural	0.03	0.04	0.01	0.03	0.04	0.01	0.002
	Urban	0.05	0.07	0.02	0.06	0.07	0.02	0.004
	Total	0.03	0.05	**0.02**	0.03	0.05	**0.01**	**0.002**
Real education expenditure[b]	Rural	20.6	62.2	41.6	20.7	39.8	19.1	22.5
	Urban	63.2	115.4	52.2	62.4	111.4	49.1	3.1
	Total	29.6	74.3	**44.7**	27.3	52.4	**25.1**	**19.6**
Proportion of loan takers[c]	Rural	0.01	0.05	0.04	0.00	0.01	0.01	0.04
	Urban	0.05	0.11	0.06	0.01	0.03	0.02	0.05
	Total	0.02	0.06	**0.05**	0.01	0.01	**0.01**	**0.04**

Notes: Weighted averages are reported, with weights applied using hhweight constructed in Equation 7. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12. 'Non-AP' states include Jammu and Kashmir, Himachal Pradesh, Punjab, Uttaranchal, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, Orissa, and Chhatisgarh. [a] Share of education in monthly per capita total consumption expenditure of the household; [b] Real monthly per capita education expenditure of the household; [c] Proportion of households that took an education loan in the past five years.

Table 2: Higher increase in average educational investments for BPL households in Andhra Pradesh between 2004-05 and 2011-12 as compared to the BPL households in Non-AP states

		Andhra Pradesh				Non-AP					
		2004-05		2011-12		2004-05		2011-12		Diff	
		APL[d]	BPL[e]	APL	BPL	APL	BPL	APL	BPL	APL	BPL
		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(C-A)-(G-E)	(D-B)-(H-F)
Share of education in total expenditure[a]	Rural	0.07	0.02	0.02	0.04	0.04	0.02	0.05	0.04	-0.06	0.00
	Urban	0.06	0.04	0.04	0.07	0.06	0.04	0.07	0.05	-0.03	0.02
	Total	0.07	0.03	0.03	0.04	0.04	0.03	0.05	0.04	**-0.05**	**0.003**
Real education expenditure[b]	Rural	38.4	16.2	23.5	29.8	22.2	10.9	32.7	21.4	-25.4	3.2
	Urban	61.8	27.5	38.1	67.9	45.9	23.3	61.6	35.5	-39.4	28.1
	Total	47.1	17.7	29.3	36.5	26.2	11.9	37.5	22.9	**-29.1**	**7.8**
Proportion of education loan takers[c]	Rural	0.00	0.00	0.10	0.04	0.00	0.00	0.01	0.01	0.09	0.03
	Urban	0.01	0.04	0.05	0.08	0.01	0.00	0.02	0.02	0.03	0.03
	Total	0.00	0.01	0.08	0.04	0.01	0.00	0.01	0.01	**0.08**	**0.03**

Notes: Weighted averages are reported, with weights applied using hhweight constructed in Equation 7. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12. 'Non-AP' states include Jammu and Kashmir, Himachal Pradesh, Punjab, Uttaranchal, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, Orissa, and Chhatisgarh. [a] Share of education in monthly per capita total consumption expenditure of the household; [b] Real monthly per capita education expenditure of the household; [c] Proportion of households that took an education loan in the past five years; [d] Above poverty line; [e] Below poverty line. To consider the poorest households, BPL sample has been restricted to below 80 percent quantile of real monthly per capita consumption expenditure.

Table 3: Assessing Covariate Balance Between Andhra Pradesh and Non-AP States Using Mean Differences

	Andhra Pradesh		Non-AP					
	2004-05	2011-12	2004-05	2011-12	Diff	P-value	Diff	P-value
	(A)	(B)	(C)	(D)	(A-C)	(E)	(B-A)-(D-C)	(F)
Avg. Monthly Per Capita HH Consumption Exp. (INR)	831.8	1314.4	658.4	943.8	173.4	<0.001	197.2	<0.001
Prop. of Poor HH	0.07	0.05	0.32	0.23	-0.24	<0.001	0.07	<0.001
Prop. of Rural HH	0.21	0.23	0.16	0.18	0.05	0.8	0.00	<0.001
Avg. HH size	5.80	4.32	8.12	5.70	-2.32	<0.001	0.94	<0.001
Prop. of Female Headed HH	0.06	0.12	0.05	0.13	0.01	0.1	-0.01	0.25
Avg. Education of HH head (years)	5.82	6.90	7.13	7.34	-1.31	<0.001	0.87	<0.001
Prop. of Brahmin HH	0.01	0.01	0.07	0.06	-0.06	0.0	0.01	<0.001
Avg. Prop of Employed HH Members	0.14	0.26	0.23	0.37	-0.09	<0.001	-0.02	<0.001
Avg. Prop of HH Members Taking Medical Treatment	0.32	0.38	0.24	0.52	0.08	<0.001	-0.22	<0.001
Avg. Prop of Ill HH Members	0.24	0.30	0.15	0.31	0.09	<0.001	-0.10	<0.001
Avg. Per Capita Workdays Lost in Past 30 Days	0.56	1.52	0.49	1.02	0.06	<0.001	0.43	0.016
Avg. Per Capita Workdays Lost in Past 12 Months	8.28	4.52	2.19	4.97	6.09	<0.001	-6.55	<0.001
Prop. of HH with Access to Pvt/Public Health Insurance	0.02	0.10	0.02	0.13	-0.01	0.0	-0.02	0.108
Avg. Share of Medical Exp. in Total HH Exp.	0.14	0.14	0.09	0.11	0.05	<0.001	-0.02	<0.001
Avg. Share of Inpatient Medical Exp. in Total HH Exp.	0.06	0.07	0.03	0.05	0.03	0.5	0.00	<0.001
Prop. of HH Owning House	0.92	0.90	0.97	0.97	-0.05	<0.001	-0.02	<0.001
Prop. of HH Owning Durable Goods	0.30	0.15	0.49	0.34	-0.19	0.6	0.01	<0.001
Prop. of HH Owning Agricultural Land	0.40	0.97	0.61	0.96	-0.22	<0.001	0.23	<0.001
Observations	1975	1975	21682	21682				

Notes: Weighted averages are reported, with weights applied using hhweight constructed in Equation 7. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12. 'Non-AP' states include Jammu and Kashmir, Himachal Pradesh, Punjab, Uttaranchal, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, Orissa, and Chhatisgarh. Variable definitions are listed in Table A.6.

Table 4: Linear Trend Model

	Education Share[a]	**Education Expenditure**[b]	**Education Loan**[c]	**Education Share**	**Education Expenditure**	**Education Loan**
			δ_{2k} **Coefficients**			
Dec 2004	-0.010***	-13.6***	0.004	-0.006***	-5.0*	0.005
Jan 2004	-0.011***	-14.6***	0.002	-0.009***	-7.2**	0.002
Feb 2005	-0.013***	-15.6***	-0.001	-0.010***	-4.7	-0.001
Mar 2005	-0.012***	-16.6***	0.002	-0.011***	-7.7**	0.002
Apr 2005	-0.009***	-16.9***	0.002	-0.003*	-1.4	0.003
May 2005	-0.012***	-19.5***	0.004	-0.007***	-4.2	0.006*
Jun 2005	-0.001	-8.7**	-0.002	0.001	0.7	-0.002
Jul 2005	-0.010***	-7.6**	-0.002	-0.012***	-5.7*	-0.003
Aug 2005	-0.007**	-8.4*	0.012**	-0.009***	-8.8*	0.011**
Sep 2005	0.004	7.5	0.002	-0.007	-2.7	-0.002
Oct 2005	-0.035	-33.9	-0.004	-0.033	-20.9	-0.004
			δ_{3k} **Coefficients**			
Dec 2004	0.012	-4.5	-0.008	-0.001	-12.8	-0.014
Jan 2004	-0.008	4.9	0.001	-0.014	-5.3	-0.001
Feb 2005	-0.019	-9.0	0.004	-0.021	-13.0	0.003
Mar 2005	-0.009	6.3	0.010	-0.019	-4.9	0.007
Apr 2005	0.001	25.0	0.015	-0.011	6.0	0.011
May 2005	-0.004	20.8	0.027	-0.022	-4.7	0.021
Jun 2005	-0.028	-15.3	0.035	-0.027	-8.1	0.035
Sep 2005	-0.028	-34.8	0.003	-0.014	-0.8	0.006
Covariates	No	No	No	Yes	Yes	Yes

Notes: Reports δ_{2k} and δ_{3k} coefficients from Equation 10. Columns (1)-(3) exclude covariates in the regression. Columns (4)-(6) include covariates listed in Table A.6. Regressions are weighted using hhweight constructed in Equation 7; ***p<0.01, **p<0.05, and *p<0.1. [a] Share of education in monthly per capita total consumption expenditure of the household; [b] Real monthly per capita education expenditure of the household; [c] Dummy variable equals 1 if household too education loan in the past five years, and otherwise 0. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12.

Table 5: Percentage of population from other Indian states migrating with their household to Andhra Pradesh (in %)

	Pre-2001	2001-2006	2006-2011
Origin State	(A)	(B)	(C)
Non-AP states	0.006	0.003	0.003
Confounder states	0.027	0.009	0.011
Confounder states, excluding south Indian states	0.016	0.007	0.009
Confounder states, excluding states bordering Andhra Pradesh	0.004	0.002	0.003

Notes: Authors' own computations using data from 1991, 2001, and 2011 Census of India. 'Non-AP' states include Jammu and Kashmir, Himachal Pradesh, Punjab, Uttaranchal, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, Orissa, and Chhatisgarh. 'Confounder' states refer to states with state-sponsored health insurance schemes, including Tamil Nadu, Maharashtra, West Bengal, Gujrat, Karnataka, and Kerala. 'South Indian' states include Kerala, Karnataka, and Tamil Nadu. 'States bordering AP' include Kerala, Karnataka, Tamil Nadu, Maharashtra, and Chhattisgarh.

Table 6: Main Results

	Coefficients		
	Edu. Share[a]	**Edu. Expenditure**[b]	**Edu. Loan**[c]
Post Dummy	0.018***	17.462***	0.006***
AP Dummy × Post Dummy	0.003**	11.368***	0.037***
Urban Dummy	0.001	6.108	0.006
Female HH Head Dummy	0.003**	-0.913	-0.010***
Highest Education of HH Head (years)	-0.001***	0.135	0.000
Poor Dummy	0.000	4.488	0.003**
Brahmin Dummy	0.003	5.982	0.006
Monthy Per Capita Consumption Exp. (INR)	0.000***	0.037***	0.000**
Household Size	0.000***	0.075	0.000**
# Employed HH Members	0.004***	4.519***	
Prop. of Employed HH Members	-0.022***	-30.385***	
# Ill HH Members	0.005***		
Prop. of Ill HH Members	-0.037***		
Ownership of House Dummy			-0.007
Ownership of Durables Dummy			0.000
Ownership of Agri. Land Dummy			0.006***
Observations		47,194	

Notes: Reports coefficient estimates for Equation 9. Row (2) reports δ coefficients for the three dependent variables - [a] Share of education in monthly per capita total consumption expenditure of the household; [b] Real monthly per capita education expenditure of the household; [c] Dummy variable equals 1 if household too education loan in the past five years, and otherwise 0. Regressions are weighted using hhweight constructed in Equation 7. ***p<0.01, **p<0.05, and *p<0.1. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12.

Table 7: Human Capital Effect

	Coefficients		
	Edu. Share[a]	**Edu. Expenditure**[b]	**Edu. Loan**[c]
Post Dummy	0.008***	9.793***	0.008***
AP Dummy × Post Dummy	-0.008***	1.305	0.028***
Life Expectancy	-0.0001***	-0.016***	-0.00001***
Life Expectancy×AP Dummy	0.000	-0.004	0.000004
Life Expectancy×Post Dummy	0.000***	0.027***	-0.00001*
Life Expectancy×Post Dummy×AP Dummy	0.000***	0.042*	0.00003
Urban Dummy	0.004	8.085	0.005
Female HH Head Dummy	0.003***	-0.461	-0.010***
Highest Education of HH Head (years)	-0.001***	0.088	0.000
Poor Dummy	-0.001	4.343	0.003***
Brahmin Dummy	0.003	6.269	0.006
Monthy Per Capita Consumption Exp. (INR)	0.000***	0.037***	0.000**
Household Size	0.000**	-0.056	0.000
# Employed HH Members	0.003***	4.319***	
Prop. of Employed HH Members	-0.017***	-28.326***	
# Ill HH Members	0.003***		
Prop. of Ill HH Members	-0.025***		
Ownership of House Dummy			-0.007
Ownership of Durables Dummy			0.000
Ownership of Agri. Land Dummy			0.006***
Human Capital Effect	0.011	10.063	0.009
Observations		47,194	

Notes: Reports coefficient estimates after controlling for 'Life Expectancy' in Equation 9. The 'Human Capital Effect' is calculated as the difference between Row (2) in this table and Row (2) in Table 6. [a] Share of education in monthly per capita total consumption expenditure of the household; [b] Real monthly per capita education expenditure of the household; [c] Dummy variable equals 1 if household too education loan in the past five years, and otherwise 0. Regressions are weighted using hhweight constructed in Equation 7. ***p<0.01, **p<0.05, and *p<0.1. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12.

Table 8: Effect of RAHIS on Poor Households

	Coefficients		
	Edu. Share[a]	**Edu. Expenditure**[b]	**Edu. Loan**[c]
Post Dummy	0.014***	10.320***	0.008***
AP Dummy × Post Dummy	0.006***	18.127***	0.034***
Urban Dummy	0.002	-3.869	-0.026***
Female HH Head Dummy	0.006***	-0.687	-0.007**
Highest Education of HH Head (years)	0.000***	0.158	0.000
Poor Dummy	-0.001	-1.847	-0.001
Brahmin Dummy	-0.001	23.340*	0.024**
Monthy Per Capita Consumption Exp. (INR)	0.000**	0.023***	0.000***
Household Size	0.001***	0.654***	0.001**
# Employed HH Members	0.003***	1.698**	
Prop. of Employed HH Members	-0.016***	-7.372	
# Ill HH Members	0.005***		
Prop. of Ill HH Members	-0.032***		
Ownership of House Dummy			0.004
Ownership of Durables Dummy			0.005**
Ownership of Agri. Land Dummy			0.005**
Observations		16,902	

Notes: Reports coefficient estimates for Equation 9 on a subsample of below poverty line households. Row (2) reports δ coefficients for the three dependent variables - [a] Share of education in monthly per capita total consumption expenditure of the household; [b] Real monthly per capita education expenditure of the household; [c] Dummy variable equals 1 if household too education loan in the past five years, and otherwise 0. Regressions are weighted using hhweight constructed in Equation 7. ***p<0.01, **p<0.05, and *p<0.1. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12.

Table 9: Robustness Checks

Robustness Test	Coefficients of AP Dummy×Post Dummy			Obs.
	Edu. Share[a]	Edu. Expenditure[b]	Edu. Loan[c]	
Outliers included in control group	0.0032**	10.379***	0.0371***	51,148
AP vs. Large States	0.0017	15.74***	0.0372***	25,933
AP vs. Neighbour States	0.0044***	18.919**	0.0319***	10,562
AP vs. Non-neighbour States	0.0029**	10.637***	0.0369***	40,571
AP vs. Orissa	0.0009	14.003	0.033***	7,948
AP vs. other states with health insurance	0.0031**	-0.895	0.0241***	32,563
Subsample: Atleast One Member Attending School/College	0.0054***	10.647**	0.0475***	29,176
Subsample: All School-Going Members Attending Private School	0.0041***	19.576***	0.0315***	25,231
Subsample: Atleast One Member Below 18 Years Age	0.0067***	12.663***	0.0431***	33,614
Subsample: Atleast One Member Below 24 Years Age	0.0045***	8.418**	0.0401***	38,586
Subsample: PSM Matched Households	0.0053*	16.551***	0.0269***	5,640
Additional Control: # HH Members Attending School/College	0.0082***	15.276***	0.037***	47,194
Additional Control: # HH Members Attending Private School	0.0043***	12.239***	0.0368***	47,194
Additional Control: # HH Members Less Than 24 Years Age	0.0034**	11.545***	0.0365***	47,194

Notes: Row 1, Rows 2–6, Rows 7–11, and Rows 12–14 report δ coefficient estimates for Equation 9 under different scenarios mentioned in Column (1): including outliers in the control group, comparing AP with a subsample of the benchmark control group, comparing a subsample of households in AP and the benchmark control group based on various household characteristics, and adding additional control variables to Equation 9, respectively. Benchmark group includes Jammu and Kashmir, Himachal Pradesh, Punjab, Uttaranchal, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, Orissa and Chhatisgarh. Outliers include Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, Assam, Goa, and all union territories. Large states include Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan. Neighbour states include Chhattisgarh and Orissa. Non-neighbour states include Jammu and Kashmir, Himachal Pradesh, Punjab, Uttaranchal, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, and Jharkhand. Other states with health insurance include Tamil Nadu, Maharashtra, Gujarat, Kerala, Karnataka, and West Bengal. [a] Share of education in monthly per capita total consumption expenditure of the household; [b] Real monthly per capita education expenditure of the household; [c] Dummy variable equals 1 if household too education loan in the past five years, and otherwise 0. Regressions are weighted using hhweight constructed in Equation 7. ***p<0.01, **p<0.05, and *p<0.1. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12.

Table 10: Placebo Test Results

	Education Share[a]		**Education Expenditure**[b]		**Education Loan**[c]		**Pos. & Significant**[d]
Placebo State	**Coeff**	**P-val**	**Coeff**	**P-val**	**Coeff**	**P-val**	
Jammu & Kashmir	0.01	0.035	22.1	0.054	0.001	0.818	No
Himachal Pradesh	-0.02	0.166	-11.1	0.661	0.006	0.729	No
Punjab	-0.01	0.055	16.1	0.029	-0.005	0.235	No
Uttaranchal	-0.015	0.000	-3.2	0.768	0.003	0.463	No
Haryana	-0.004	0.303	21.5	0.010	-0.0001	0.984	No
Delhi	0.017	0.020	61.7	0.001	0.006	0.492	No
Rajasthan	-0.002	0.120	-2.7	0.278	0.00	0.186	No
Uttar Pradesh	0.005	0.000	-3.0	0.163	-0.005	<0.001	No
Bihar	0.003	0.003	0.8	0.758	0.001	0.524	No
Jharkhand	-0.004	0.003	-3.7	0.119	-0.001	0.676	No
Orissa	0.001	0.351	-2.7	0.664	0.00	0.770	No
Chhatishgarh	-0.006	0.0001	-11.7	<0.001	0.006	0.049	No
Madhya Pradesh	-0.001	0.354	-5.9	0.005	0.004	0.147	No

Notes: Reports δ coefficient estimates for Equation 9 after replacing AP with the placebo state in Column (1) and using 12 control states from the group including Jammu and Kashmir, Himachal Pradesh, Punjab, Uttaranchal, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, Orissa, and Chhattisgarh, except for the placebo state. [d] The coefficient δ in Equation 9 is positive and significant at the 5% level for all three dependent variables. [a] Share of education in monthly per capita total consumption expenditure of the household; [b] Real monthly per capita education expenditure of the household; [c] Dummy variable equals 1 if household too education loan in the past five years, and otherwise 0. Regressions are weighted using hhweight constructed in Equation 7. ***p<0.01, **p<0.05, and *p<0.1. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12.

Table 11: Effect of RSBY on Non-AP States

	Coefficients		
	Edu. Share[a]	**Edu. Expenditure**[b]	**Edu. Loan**[c]
Post Dummy	0.017***	16.538***	0.007***
	(.0005)	(1.435)	(.0011)
RSBY Dummy × Post Dummy	.007***	0.711	-0.005***
	(.0045)	(11.807)	(.0129)
Observations	43,086		

Notes: RSBY Dummy × Post Dummy represents the effect of RSBY smart card holding on non-AP states in 2011-12. 'Non-AP' states include Jammu and Kashmir, Himachal Pradesh, Punjab, Uttaranchal, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, Orissa, and Chhatisgarh. [a] Share of education in monthly per capita total consumption expenditure of the household; [b] Real monthly per capita education expenditure of the household; [c] Dummy variable equals 1 if household too education loan in the past five years, and otherwise 0. Regressions are weighted using hhweight constructed in Equation 7. ***p<0.01, **p<0.05, and *p<0.1. Standard errors are in parentheses. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12

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Appendix A

A.1 Efficiency Considerations: Mean Deviation Form

Consider the following regression equation

$$y_{it} = \mathbf{X}_{it}\beta + \epsilon_{it} \tag{11}$$

where $\mathbf{X}$ represents the vector of explanatory variables for i, β represents the vector of coefficients; and ϵ represents the error term.

Given that we use panel data, the error decomposes into

$$\epsilon_{it} = \alpha_i + v_{it} \tag{12}$$

where α_i stands for the individual fixed effect, while v_{it} stands for idiosyncratic error. Typically, α_i accounts for a substantial portion of serial correlations. With the explanatory variables being levels and shares of educational expenditures and related variables, it is even more likely that α_i would account for a significant portion of the serial correlation.

This decomposition yields the following regression form:

$$y_{it} = \mathbf{X}_{it}\beta + \alpha_i + v_{it} \tag{13}$$

Taking the mean deviation, the equation transforms into

$$(y_{it} - \bar{y}_i) = (\mathbf{X}_{it} - \bar{\mathbf{X}}_i)\beta + (v_{it} - \bar{v}_i) \tag{14}$$

where with two period per i, $\bar{v}_i = \frac{1}{2}(v_{it} + v_{it-1})$. The standard error of β now depends on $Var(v_{it} - \bar{v}_i)$. If $Var(v_{it} - \bar{v}_i) \leq Var(v_{it})$, the estimator of β is more efficient.

A.1.1 Deriving $Var(v_{it} - \bar{v}_i)$:

The expression for variance $Var(v_{it} - \bar{v}_i)$ can be broken down to

$$Var(v_{it} - \bar{v}_i) = Var(\frac{v_{it} - v_{it-1}}{2}) \tag{15}$$

$$= \frac{1}{4}Var(v_{it}) + \frac{1}{4}Var(v_{it-1}) - 2\frac{1}{4}Cov(v_{it}, v_{it-1}) \tag{16}$$

Given that our variables are expenditure on education, share of educational expenditures, and probability of taking out an education loan, a stationarity assumption can be made. Education expenditure cannot have an unlimited upper bound as the total amount of formal education is limited. Moreover, the decision is based on a budget-constrained optimization. Therefore, for the two periods with a 7-year gap, it is reasonable to assume that v_{it} exhibits a stationary time series, implying $Var(v_{it}) = Var(v_{it-1}) = \sigma_v^2$. On the basis of these assumptions, one can now rewrite Equation 16 as follows

$$\begin{aligned} Var(v_{it} - \bar{v}_i) &= \frac{1}{4}\sigma_v^2 + \frac{1}{4}\sigma_v^2 - \frac{1}{2}Cov(v_{it}, v_{it-1}) \\ &= \frac{1}{2}\sigma_v^2 - \frac{1}{2}Cov(v_{it}, v_{it-1}) \end{aligned} \tag{17}$$

It is also safe to assume that households that value education and tend to invest more in education in one period tend to do so in the next period. Therefore, it is reasonable to assume $Cov(v_{it}, v_{it-1}) > 0$. This restriction further reduces the $Var(v_{it} - \bar{v}_i)$ to

$$Var(v_{it} - \bar{v}_i) = \frac{1}{2}\sigma_v^2 - \frac{1}{2}Cov(v_{it}, v_{it-1}) < \frac{1}{2}\sigma_v^2 < \sigma_v^2 \tag{18}$$

As such, $Var(v_{it} - \bar{v}_i) < Var(v_{it})$, implying that estimation of the mean deviation form would yield more efficient estimates of β.

Table A.1: Number of BPL Families Covered in Various Phases of RAHIS (in Lakhs)

Financial Year	**2008-09**	**2009-10**	**2010-11**	**2011-12**
Phase 1	25.27	27.66	27.47	26.67
Phase 2	48.23	52.02	49.49	49.49
Phase 3	38.45	39.52	39.52	38.44
Phase 4	36.44	36.44	35.46	38.19
Phase 5	39.80	44.91	42.86	45.46
Total	188.19	200.55	195.10	198.25

Notes: Data from YSR Aarogyasri Annual Reports; Phases refer to various groups of districts in Andhra Pradesh. Rather than launching on the same date across the entire state, RAHIS was launched in different phases at various time periods between 2007 and 2009.

Table A.2: Districts Covered in Various Phases of RAHIS

Phase 1	Mahboobnagar	Srikakulam	Anantapur		
Phase 2	Rangareddy	Nalgonda	Chittoor	West Godavari	East Godavari
Phase 3	Medak	Karimnagar	Prakasam	Kadapa	Nellore
Phase 4	Adilabad	Kurnool	Hyderabad	Visakhapatnam	Vijayanagaram
Phase 5	Nizamabad	Warangal	Khammam	Guntur	Krishna

Notes: Data from YSR Aarogyasri Annual Reports; Phases refer to various groups of districts in Andhra Pradesh. Rather than launching on the same date across the entire state, RAHIS was launched in different phases at various time periods between 2007 and 2009.

Table A.3: Launch and Renewal Dates of RAHIS in Various Phases

Financial Year	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**
Phase 1	01.04.2007	05.04.2008	05.04.2009	05.04.2010	05.04.2011
Phase 2	05.12.2007	05.12.2008	05.12.2009	05.12.2010	05.12.2011
Phase 3		15.04.2008	15.04.2009	15.04.2010	15.04.2011
Phase 4		17.07.2008	17.07.2009	17.07.2010	17.07.2011
Phase 5		17.07.2008	17.07.2009	17.07.2010	17.07.2011

Notes: Data from YSR Aarogyasri Annual Reports; Phases refer to various groups of districts in Andhra Pradesh. Rather than launching on the same date across the entire state, RAHIS was launched in different phases at various time periods between 2007 and 2009. The first date in each row represents the launch date for that particular phase, while the subsequent dates indicate the renewal dates.

Table A.4: Number of Treatments and Procedures Covered in Various Phases of RAHIS

Financial Year	**2008-09**	**2009-10**	**2010-11**	**2011-12**
Phase 1	272	942	938	938
Phase 2	330	352	938	938
Phase 3	272	942	938	938
Phase 4	330	330	352	192
Phase 5	330	330	352	192

Notes: Data from YSR Aarogyasri Annual Reports; Phases refer to various groups of districts in Andhra Pradesh. Rather than launching on the same date across the entire state, RAHIS was launched in different phases at various time periods between 2007 and 2009.

Table A.5: Number of Hospitals Empanelled Under RAHIS

Financial Year	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**
Government	13	95	97	97	98
Private	71	278	295	313	356
Total	84	373	392	410	454

Notes: Data from YSR Aarogyasri Annual Reports

Table A.6: Variable Definitions

Variable	Definition
Outcome Variables:	
Share of Education	Share of education in monthly consumption expenditure per household member on school/college tuition fees, coaching fees and educational articles
Education Expenditure	Monthly educational expenditure per household member on school/college tuition fees, coaching fees and educational articles, deflated by Tendulkar's poverty line (in INR)
Education Loan	Dummy variable equals 1 if a loan is taken by the household for educational purposes in the past 5 years, 0 otherwise
Control Variables:	
AP Dummy	Dummy variable equals 1 if the household resides in Andhra Pradesh, otherwise 0
Post Dummy	Dummy variable equals 1 if the year is 2011, otherwise 0
Monthy Per Capita Consumption Exp	Monthly consumption expenditure per household member, deflated by Tendulkar's poverty line (in INR)
Urban Dummy	Dummy variable equals 1 if the household resides in an urban location, 0 otherwise
Household Size	Total number of members in a household
Poor Dummy	Dummy variable equals 1 if the monthly consumption expenditure per household member is below Tendulkar's poverty line, 0 otherwise
Female HH Head Dummy	Dummy variable equals 1 if the household head is female, 0 otherwise
Highest Education of HH Head	Number of years of schooling of household head
Brahmin Dummy	Dummy variable equals 1 if the household belongs to Brahmin caste, 0 otherwise
# Employed HH Members	Number of household members employed in a permanent job, own business or own farm
Prop. of Employed HH Members	Proportion of household members employed in a permanent job, own business or own farm
# Ill HH Members	Number of household members receiving medical treatment for long-term illness in the past 12 months
Prop. of Ill HH Members	Proportion of household members receiving medical treatment for long-term illness in the past 12 months
Ownership of House Dummy	Dummy variable equals 1 if the household owns a house, 0 otherwise
Ownership of Durables Dummy	Dummy variable equals 1 if the household owns less than 5 durables amongst cycle/bicycle, sewing machine, generator set, mixer/grinder, motor cycle/scooter, television, cooler, clock/watch, electric fan, table/chair, cot, telephone, mobile phone, fridge/refrigerator, pressure cooker, cable/dishTV, car, A.C., washing machine, computer, laptop, credit card, microwave oven, and 0 otherwise.
Ownership of Agri. Land Dummy	Dummy variable equals 1 if the household owns agricultural land, 0 otherwise

Table A.7: Identification Strategy for Potential Confounders

Confounder	**Identification Strategy**	**Bias in $\hat{\delta}_j$ estimate**
Selectivity in BPL ration card holding	Considering the entire population of Andhra Pradesh, BPL as well as APL, as the treatment group	Subdued
State-sponsored health insurance schemes introduced in non-AP Indian states between 2004-05 to 2011-12 [a]	Excluding such states from the control group	Subdued
Debt financing of education	Including the likelihood of taking an education loan as a dependent variable and estimating the system of equations using SUREG	Subdued
Direct Benefit Transfer (DBT) educational scholarships	Controlled for as a part of household consumption expenditure	Subdued
Central government health insurance programmes introduced between 2004-05 to 2011-12 [b]	Examine if the effect of RSBY on educational investments varies between Andhra Pradesh and the control states	No
Jawahar Bal Aarogya Raksha Yojana (2010)	Examine the impact of Aarogyasri on households ineligible for JBARY	Negative
Microfinance crisis (2010)	Compare Andhra Pradesh with a subset of control states highly impacted by the crisis	Inconclusive
Rising number of school or college-going children in Andhra Pradesh	Controlling for the number of school and college-going household members in regression	Negative

Notes: [a]Such as Chief Minister's Comprehensive Insurance Scheme (2007, Tamil Nadu), Mahatma Jyotiba Phule Jan Arogya Yojana (2012, Maharashtra), Mukhyamantri Amrutum Yojana (2012, Gujrat), Karunya Health Scheme (2012, Kerala), Vajpayee Arogyasri Yojana (2010, Karnataka), West Bengal health scheme (2008, WB), and Kalaignar Kapitu Thittam (2009, TN); [b]Such as Rashtriya Swasthya Bima Yojana (2007) and Aam Aadmi Beema Yojana (2007)

Table A.8: Main Results

	Coefficients		
	Edu. Share[a]	**Edu. Expenditure**[b]	**Edu. Loan**[c]
Post Dummy	0.018***	17.462***	0.006***
	(.0005)	(1.347)	(.0010)
AP Dummy × Post Dummy	0.003**	11.368***	0.037***
	(.0013)	(3.868)	(.0039)
Urban Dummy	0.001	6.108	0.006
	(.0033)	(6.596)	(.0060)
Female HH Head Dummy	0.003**	-0.913	-0.010***
	(.0012)	(2.897)	(.0020)
Highest Education of HH Head (years)	-0.001***	0.135	0.000
	(.0001)	(.2062)	(.0002)
Poor Dummy	0.000	4.488	0.003**
	(.0006)	(2.886)	(.0011)
Brahmin Dummy	0.003	5.982	0.006
	(.0036)	(10.637)	(.0059)
Monthy Per Capita Consumption Exp. (INR)	0.000***	0.037***	0.000**
	(.0000)	(.0077)	(.0000)
Household Size	0.000***	0.075	0.000**
	(.0001)	(.3097)	(.0002)
# Employed HH Members	0.004***	4.519***	
	(.0003)	(.8979)	
Prop. of Employed HH Members	-0.022***	-30.385***	
	(.0021)	(7.224)	
# Ill HH Members	0.005***		
	(.0006)		
Prop. of Ill HH Members	-0.037***		
	(.0029)		
Ownership of House Dummy			-0.007
			(.0069)
Ownership of Durables Dummy			0.000
			(.0013)
Ownership of Agri. Land Dummy			0.006***
			(.0015)
Observations		47,194	

Notes: Reports coefficient estimates for Equation 9. Row (2) reports δ coefficients for the three dependent variables - [a] Share of education in monthly per capita total consumption expenditure of the household; [b] Real monthly per capita education expenditure of the household; [c] Dummy variable equals 1 if household too education loan in the past five years, and otherwise 0. Regressions are weighted using hhweight constructed in Equation 7. ***p<0.01, **p<0.05, and *p<0.1. Standard errors are in parentheses. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12.

Table A.9: Human Capital Effect

	Coefficients		
	Edu. Share[a]	**Edu. Expenditure**[b]	**Edu. Loan**[c]
Post Dummy	0.008***	9.793***	0.008***
	(.0009)	(2.375)	(.0015)
AP Dummy × Post Dummy	-0.008***	1.305	0.028***
	(.0031)	(9.101)	(.0082)
Life Expectancy	-0.0001***	-0.016***	-0.00001***
	(.0000)	(.0036)	(.0000)
Life Expectancy×AP Dummy	0.000	-0.004	0.000004
	(.0000)	(.0131)	(.0000)
Life Expectancy×Post Dummy	0.000***	0.027***	-0.00001*
	(.0000)	(.0050)	(.0000)
Life Expectancy×Post Dummy×AP Dummy	0.000***	0.042*	0.00003
	(.0000)	(.0246)	(.0000)
Urban Dummy	0.004	8.085	0.005
	(.0033)	(6.650)	(.0060)
Female HH Head Dummy	0.003***	-0.461	-0.010***
	(.0012)	(2.900)	(.0020)
Highest Education of HH Head (years)	-0.001***	0.088	0.000
	(.0001)	(.2057)	(.0002)
Poor Dummy	-0.001	4.343	0.003***
	(.0006)	(2.889)	(.0012)
Brahmin Dummy	0.003	6.269	0.006
	(.0036)	(10.642)	(.0059)
Monthy Per Capita Consumption Exp. (INR)	0.000***	0.037***	0.000**
	(.0000)	(.0078)	(.0000)
Household Size	0.000**	-0.056	0.000
	(.0001)	(.3135)	(.0002)
# Employed HH Members	0.003***	4.319***	
	(.0004)	(1.008)	(.0069)
Prop. of Employed HH Members	-0.017***	-28.326***	
	(.0023)	(7.801)	(.0013)
# Ill HH Members	0.003***		
	(.0006)		
Prop. of Ill HH Members	-0.025***		
	(.0031)		
Ownership of House Dummy			-0.007
			(.0069)
Ownership of Durables Dummy			0.000
			(.0013)
Ownership of Agri. Land Dummy			0.006***
			(.0015)
Human Capital Effect	0.011	10.063	0.009
Observations		47,194	

Notes: Reports coefficient estimates after controlling for 'Life Expectancy' in Equation 9. The 'Human Capital Effect' is calculated as the difference between Row (2) in this table and Row (2) in Table 6. [a] Share of education in monthly per capita total consumption expenditure of the household; [b] Real monthly per capita education expenditure of the household; [c] Dummy variable equals 1 if household too education loan in the past five years, and otherwise 0. Regressions are weighted using hhweight constructed in Equation 7. ***p<0.01, **p<0.05, and *p<0.1. Standard errors are in parentheses. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12.

Table A.10: Effect of RAHIS on Poor Households

	Coefficients		
	Edu. Share[a]	**Edu. Expenditure**[b]	**Edu. Loan**[c]
Post Dummy	0.014***	10.320***	0.008***
	(.0007)	(.9117)	(.0016)
AP Dummy × Post Dummy	0.006***	18.127***	0.034***
	(.0014)	(2.681)	(.0040)
Urban Dummy	0.002	-3.869	-0.026***
	(.0043)	(6.154)	(.0078)
Female HH Head Dummy	0.006***	-0.687	-0.007**
	(.0016)	(2.309)	(.0032)
Highest Education of HH Head (years)	0.000***	0.158	0.000
	(.0001)	(.2526)	(.0004)
Poor Dummy	-0.001	-1.847	-0.001
	(.0008)	(1.594)	(.0018)
Brahmin Dummy	-0.001	23.340*	0.024**
	(.0055)	(13.936)	(.0121)
Monthly Per Capita Consumption Exp. (INR)	0.000**	0.023***	0.000***
	(.0000)	(.0041)	(.0000)
Household Size	0.001***	0.654***	0.001**
	(.0002)	(.2437)	(.0016)
# Employed HH Members	0.003***	1.698**	
	(.0005)	(.7849)	
Prop. of Employed HH Members	-0.016***	-7.372	
	(.0029)	(5.855)	
# Ill HH Members	0.005***		
	(.0007)		
Prop. of Ill HH Members	-0.032***		
	(.0033)		
Ownership of House Dummy			0.004
			(.0096)
Ownership of Durables Dummy			0.005**
			(.0022)
Ownership of Agri. Land Dummy			0.005**
			(.0022)
Observations		16,902	

Notes: Reports coefficient estimates for Equation 9 on a subsample of below poverty line households. Row (2) reports δ coefficients for the three dependent variables - [a] Share of education in monthly per capita total consumption expenditure of the household; [b] Real monthly per capita education expenditure of the household; [c] Dummy variable equals 1 if household too education loan in the past five years, and otherwise 0. Regressions are weighted using hhweight constructed in Equation 7. ***p<0.01, **p<0.05, and *p<0.1. Standard errors are in parentheses. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12.

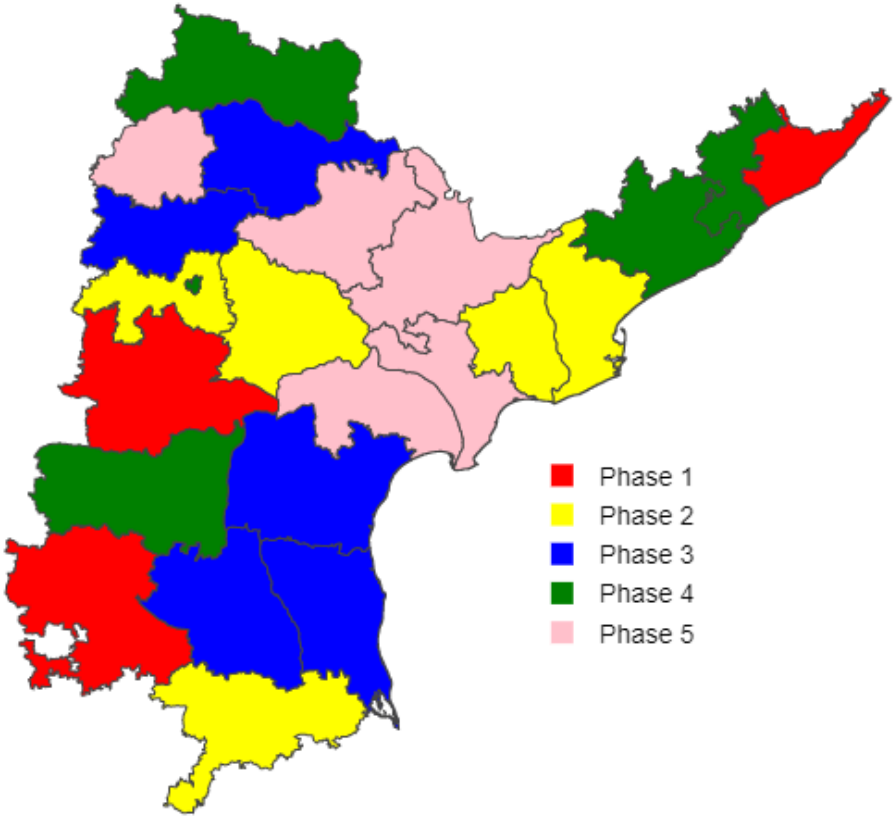
Table A.11: Robustness Checks

	Coefficients of AP Dummy×Post Dummy			
Robustness Test	**Edu. Share**[a]	**Edu. Expenditure**[b]	**Edu. Loan**[c]	**Obs.**
Outliers included in control group	0.0032**	10.379***	0.0371***	51,148
	(.0013)	(3.705)	(.0038)	
AP vs. Large States	0.0017	15.74***	0.0372***	25,933
	(.0017)	(3.918)	(.0048)	
AP vs. Neighbour States	0.0044***	18.919**	0.0319***	10,562
	(.0015)	(8.680)	(.0042)	
AP vs. Non-neighbour States	0.0029**	10.637***	0.0369***	40,571
	(.0014)	(3.575)	(.0040)	
AP vs. Orissa	0.0009	14.003	0.033***	7,948
	(.0018)	(11.701)	(.0049)	
AP vs. other states with health insurance	0.0031**	-0.895	0.0241***	32,563
	(.0013)	(3.888)	(.0037)	
Subsample: Atleast One Member Attending School/College	0.0054***	10.647**	0.0475***	29,176
	(.0018)	(4.978)	(.0059)	
Subsample: All School-Going Members Attending Private School	0.0041***	19.576***	0.0315***	25,231
	(.0017)	(5.092)	(.0047)	
Subsample: Atleast One Member Below 18 Years Age	0.0067***	12.663***	0.0431***	33,614
	(.0016)	(4.083)	(.0050)	
Subsample: Atleast One Member Below 24 Years Age	0.0045***	8.418**	0.0401***	38,586
	(.0014)	(3.784)	(.0045)	
Subsample: PSM Matched Households	0.0053*	16.551***	0.0269***	5,640
	(.0027)	(5.937)	(.0064)	
Additional Control: # HH Members Attending School/College	0.0082***	15.276***	0.037***	47,194
	(.0013)	(3.871)	(.0038)	
Additional Control: # HH Members Attending Private School	0.0043***	12.239***	0.0368***	47,194
	(.0013)	(3.855)	(.0039)	
Additional Control: # HH Members Less Than 24 Years Age	0.0034**	11.545***	0.0365***	47,194
	(.0013)	(3.861)	(.0039)	

Table notes on next page.

Notes for Table A.11: Row 1, Rows 2–6, Rows 7–11, and Rows 12–14 report δ coefficient estimates for Equation 9 under different scenarios mentioned in Column (1): including outliers in the control group, comparing AP with a subsample of the benchmark control group, comparing a subsample of households in AP and the benchmark control group based on various household characteristics, and adding additional control variables to Equation 9, respectively. Benchmark group includes Jammu and Kashmir, Himachal Pradesh, Punjab, Uttaranchal, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, Orissa and Chhatisgarh. Outliers include Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, Assam, Goa, and all union territories. Large states include Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan. Neighbour states include Chhattisgarh and Orissa. Non-neighbour states include Jammu and Kashmir, Himachal Pradesh, Punjab, Uttaranchal, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, and Jharkhand. Other states with health insurance include Tamil Nadu, Maharashtra, Gujarat, Kerala, Karnataka, and West Bengal. [a] Share of education in monthly per capita total consumption expenditure of the household; [b] Real monthly per capita education expenditure of the household; [c] Dummy variable equals 1 if household too education loan in the past five years, and otherwise 0. Regressions are weighted using hhweight constructed in Equation 7. ***p<0.01, **p<0.05, and *p<0.1. Standard errors are in parentheses. Data source - Authors' own computations using IHDS rounds 2004-05 and 2011-12.

Figure 3: Map of Andhra Pradesh (pre-partition in 2014): Phases for RAHIS's Implementation



Notes: Phases refer to various groups of districts in Andhra Pradesh. Rather than launching on the same date across the entire state, RAHIS was launched in different phases at various time periods between 2007 and 2009.