Government, Primary Healthcare, and Standard of Living: Evidence from Costa Rica

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Abstract

I study whether a coordinated effort by a government to increase access to healthcare through increased expenditure would bring about higher incomes at the household level. Using data from the major healthcare reform that Costa Rica underwent in 1994, which greatly increased access to primary healthcare, I explore the effects of getting local clinics in their district, as a result of the reform, on household and personal income. Based on theoretical work by Strauss and Thomas (1998) and a seminal paper by Grossman (1972), my main hypothesis is that, by producing healthier individuals, having increased access to healthcare spurs individuals to pursue better-paying jobs, thereby increasing their income. I proceed by difference-in-difference, as well as by an event study specification, both of which point to a positive average impact of around 4% of getting a clinic on income.

Keywords: National Government Health Expenditure, Health, Development, Economic Growth, Fiscal Policy

JEL Codes: H51,I150, O23

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1 Introduction

Can a government expansion of healthcare access cause changes in household income? Using data from Costa Rica, my analysis points to an increase in household income of around 4% as a result of furthering access to primary healthcare. This comes to add to the literature that has studied the mechanisms and direction of the relationship between healthcare spending, health, and economic development.

At the macroeconomic level, there is evidence of a two-sided relationship between economic growth and healthcare spending through improved health and life expectancy. Using data from 48 African countries, Somé, Pasali, and Kaboine (2019) [30] established that healthcare spending increases life expectancy and promotes economic growth. In turn, with data from rich, middle, and low-income countries, Acemoglu and Johnson (2007) [2] found that increased life expectancy promotes economic growth. Moreover, from a panel of ten countries, Bloom, Canning, and Sevilla (2004) [9] concluded that health of the workforce stimulates economic growth. Furthermore, Alhowaish (2014) [3] showed a relationship of Granger causality of economic growth on healthcare spending.

At the microeconomic level, the focus of my analysis, there is evidence of a relationship between household income and individual health. Fichera (2015) [14] observed that increases in income reduce illness, while Contoyannis and Dooley (2010) [11] noted that socioeconomic status as children affects health as young adults. Meanwhile, Case, Lubtsky and Paxson (2002) [10] found that health in children is positively correlated with household income. Additionally, Strauss and Thomas (1998) [31] laid theoretical groundwork to a causal positive impact of health on wages, while Thomas and Frankenberg (2002), in their Bulletin of the World Health Organization article [32] shared empirical results suggesting nutrition as a link between healthier workers and higher wages.

Adding health insurance into the discussion, from a panel of 100 countries, Moreno-Serra and Smith (2012) [23] established that broader health insurance coverage leads to better access to healthcare and improved health, particularly for lower income groups. And even whole populations can benefit economically from healthcare, as McDermott, Cornia, and Parsons (1991) concluded that getting a hospital in a rural community makes "significant economic contributions to the community they serve" [21].

We can therefore observe that, in one direction, higher income results in better health. I want to more deeply understand how the relationship holds in the opposite direction. We do know that adequate health insurance results in better care, which promotes improved health [23], which translates into higher wages at the micro level, with theory [31] and weaker empirical results [32], though so far this chain of events has not been studied as a whole. All of this made me wonder if this process could be explained by a government intervention. In particular, I wanted to know if a coordinated effort by a government to increase access to healthcare through increased expenditure, using data from Costa Rica, would bring about higher incomes at the household level. This would come to strengthen Thomas and Frankenberg's conclusions [32] through a different channel, provide further empirical evidence for Strauss and Thomas's theoretical model, and advance the understanding on government interventions in the healthcare sector in the context of universal health insurance.

There is already some evidence connecting access to healthcare to individuals' health level. For instance, it is known that bigger distances to healthcare clinics are correlated with worse health outcomes. Croke et al (2020) [12] studied a reform in Ethiopia that built almost 3,000 government clinics and its impact on maternal utilization and birth outcomes. They found increased prenatal care of 0.38 visits and a 7.2% increase in deliveries in-place per every new clinic opened within 5km. Additionally, focusing on the construction of maternity facilities in Malawi, Quattrochi et al (2020) [27] established that bigger distances to the clinics are related to lower healthcare utilization and higher under-five mortality. And similarly, using data from India, Kumar, Dansereau, and Murray (2014) [19] observed that women living farther from health facilities are less likely to give birth there. Each extra kilometer to the nearest clinic is associated with a 4.4% decrease in the probability of giving birth in-facility.

Finally, there has also been important previous work on whether health interventions can cause changes in income, just as educational interventions like building schools in Indonesia did for those in treatment [13]. In their 'Worms at Work' paper (2016) [5], Baird, Hicks, Kremer, and Miguel studied the long-term effects of a deworming intervention in Kenya (cf. Kremer and Miguel (2004) [22]). They found that men who were exposed to the treatment as children worked 17 % more hours and that overall, incomes were on average 26.9% higher. Moreover, they concluded that the financial returns to deworming of 32% more than make up for the cost of the program, underscoring the economic potential interventions like these have.

With near-universal health insurance, Costa Rica provides an ideal case study to test the hypotheses of this project, as it allows me to skip the step of changing the health insurance status quo and start the analysis at changes in healthcare availability. A place where access to healthcare is determined by physical availability [20], not its affordability, Costa Rica underwent a healthcare reform in the mid-1990s that greatly expanded access to primary healthcare. Did this have an impact on household income? My analysis concludes an increase in household income of around 4% as a result of furthering access to primary healthcare.

2 Background

Before 1994, the management of the Costa Rican healthcare sector was shared between the Ministry of Health and the Social Security Administration [34]. The former was established in 1922 and, from its inception, its functions were focused on prevention and education, along with the provision of some basic medical care. The latter came to be in 1941 and it was designed to provide healthcare and pensions to all workers, minors, pregnant women, and the poor, funded by a combination payroll taxes, employer taxes, and government contributions. For over fifty years they would share this partial overlap of functions.

The 1980s brought with the economic downturn both a steep increase in national debt and deep austerity measures, including cuts to healthcare spending [17]. This resulted in a decrease in service quality and patient satisfaction. As a response, in 1994 the government decided to enact a major reform to the healthcare system, switching all preventative, public health, and medical treatment responsibilities from the Ministry of Health to the Social Security Administration *(CCSS)*, centralizing both funding and decision-making in order to improve efficiency. For comparison, achieving a similar level of integration in the United States would require merging the Centers for Disease Control and Prevention (CDC) with the Department of Veterans' Affairs (VA), and the Centers for Medicare and Medicaid Services [25].

The reform divided the country into 104 areas of 40.000 to 100.000 people each, where it would establish small clinics responsible for approximately 4.500 people [25] led by teams comprised of a physician, a nurse, a community health worker, a pharmacist, and a clerk in charge of detailed health data collection [33]. (The first teams were established at already-existing clinics, to be followed by building more clinics.) This would provide patients with a first point of contact to healthcare, combining both preventative, acute, and chronic support, increasing the depth and breadth of care. These clinics received the name of *EBAIS*, which stands for *Equipos Básicos de Atención Integral en Salud*, Spanish for "Integrated Teams of Basic Comprehensive Healthcare".

As a result of this reform, and despite being a middle-income country, as defined by the World Bank [6], Costa Rica now exhibits improved health outcomes while spending less than most of the world [25] both per capita and as a proportion of real gross domestic product: Costa Rica spends only about \$970 per person per year, compared to $\$1,061$ in the rest of the world (measured in US \$ of 2014), and 9.3% of GDP, compared to 9.9%. Moreover, maternal, infant, and under-five mortality indicators are low and have decreased steadily over the last quarter century, as established in his seminal papers on the Costa Rican healthcare reform by Dr Luis Rosero-Bixby (2004) [28], [29]. Also, life expectancy in Costa Rica is now nearly five years higher than the rest of Latin America, and almost eight years more than the world average. In fact, in the Western Hemisphere, only Chile and Canada have a higher life expectancy [24]. This gives Costa Rica the unlikely honor of having become a public health “positive deviant” [25].

The main policy implication of the reform was that the proportion of the national population with access to primary care (that is, within 4 km of their home [29]) went from 25% to 93% in the first twelve years alone. In 2014, the *EBAIS* clinics provided three-quarters of all medical consultations and covered the medical needs of 80% of all national patients, giving some much-needed relief to hospitals [25]. It was learning about this increase in access that piqued my interest, making me wonder whether, in addition to public health improvements, any increases in household standard of living could be attributed to the reform.

3 Data

My main source of data is the *Encuesta de Hogares de Propósitos Múltiples (EHPM)*, or “Multiple Purpose Household Survey”, an annual, nationally-representative survey of Costa Rican households given by the Costa Rican Statistics and Censuses Institute (*INEC*) between 1987 and 2008. This provides me with a twenty-two-year pooled cross-section of household data of $30,000$ to $50,000$ observations per year that includes their district, number of people per household, age, education, personal and household income, as well as marital and insurance status of each member, among others. Moreover, in order to ensure that income variables are comparable across time, I use the Consumer Price Index (CPI), as calculated by the Costa Rican Central Bank *(BCCR)*, in order to normalize incomes into constant July 2015 *colones*, the local currency. Additionally, to minimize the effect of outliers I winsorize the income data, substituting the extreme values beyond the 5th and 95th percentiles with the values at those percentiles.

In order to determine the districts that benefited from the healthcare reform, I use the Social Security Administration’s Annual Memories *(Memorias Institucionales de la CCSS)* to record, year by year, the districts where new *EBAIS* clinics were built or opened from 1995 to 2008. This serves as a complement to the *EBAIS* district data from 1995 to 2001 kindly shared with me by Dr Luis Rosero-Bixby.

From among all the $892,317$ observations, I focus on the households located in districts that did not already have a source of primary healthcare prior to the reform, like a hospital or clinic. Because the location of those is endogenous, using them would obscure the results of the analysis of the reform. Table 1 shows summary statistics for the remaining $313,977$ observations: $157,176$ individuals who lived in households whose district either never got an *EBAIS* clinic or before it gets one, along with $154,377$ who lived in districts that got an *EBAIS* as a result of the reform. These will constitute the comparison and treatment groups, respectively. In terms of districts, that corresponds to 262 who "always" had a clinic, 59 that "never" did, and 152 that got one "later", as seen in Figure 1.

Both groups are distributed mostly evenly with regards to number of observations, with around 155,000, as well as to number of people per household, with around 5. There is some difference in the proportions of males and females, with the control group having about 5 percentage points more in each, although this could be attributed to the relatively large number of observations in the treatment group where sex is unknown, 13%. There is also a difference in age, with people in the treatment group being approximately 40 years old, as opposed to 30 in the control. Both groups are fairly similar in years of education, with the treatment group having on average only 0.4 years more. Finally, given an average exchange rate of 528 Costa Rican *colones* per US dollar at the time (recall income data is expressed in colones of July 2015), households in the comparison group had a monthly income of around $1040, compared to $1,000 in the treatment. Similarly, average personal monthly income in the comparison group was $205, compared to $211 in the treatment.

4 Empirical Strategy

The 1994 Costa Rican healthcare reform has been thoroughly studied from a public health perspective, as exemplified by the seminal work by Dr Luis Rosero-Bixby [28] [29]. However, approaching it from an economic point of view would provide a more unique outlook, establishing the causal link, if any, that the government healthcare reform had on variables of interest in the Costa Rican economy. In particular, I wish to uncover the treatment effect of having increased access to primary healthcare on household and personal income, with the study of education left for my second paper. This comes to add to the literature on the household effects of building infrastructure, like Duflo's paper of schools in Indonesia (2001) [13], and on non-health effects of health reforms, like Miguel and Kremer's 'Worms at work' paper (2016) [22].

The rationale behind this pursuit is that having increased access to primary healthcare would bring about better health outcomes, which in turn translates into higher-quality workers. That is, healthier individuals would make for workers that could aspire to higher-paying jobs. Given universal health insurance, therefore, it is the *availability* of healthcare, and not its *affordability*, that is the limiting factor in receiving care.

I pursue a difference-in-difference approach, which will constitute the central part of the empirical analysis. I estimate the effect on both personal and household income Y_{idt} for household i in district d at year t of $Clinic_{dt}$, an indicator for a district d having a clinic as a result of the reform at time t that did not have any source of primary healthcare beforehand, as well a matrix of controls X, year fixed effects λ_t, and district fixed effects γ_d. It should also be noted that I am only studying districts that did not already have a clinic before 1995, as the placement of those previously-established clinics is endogenous. That way I can better assess the difference in outcomes as a result of the healthcare reform, despite its quasi-experimental nature.

The equation estimated is

$$Y_{idt} = \alpha Clinic_{dt} + X'_{it}\beta + \lambda_t + \gamma_d + \epsilon_{idt} \tag{1}$$

where the coefficient of interest is α, the treatment effect on the treated. Also, for all regressions, heteroskedasticity-robust standard errors are clustered at the district level [8].

I should acknowledge two limitations of this approach: First, that the decision of where to open the *EBAIS* clinics was not random, as the government gave priority to lower-income areas, so making a case for identification will be an important step in the process. And second, that there is a growing literature about potential pitfalls in the use of difference-in-difference, as exemplified by the Duflo, Bertrand, and Mulhanaithan (2004) paper [8], which warns about the potential inconsistency of the resulting standard errors. Moreover, if using more than two periods'-worth of data, a more recent working paper by Goodman-Bacon (2019) [15] calls into question the interpretation of the coefficient of interest as an average treatment effect on the treated, suggesting instead that it is a weighed average of all two-period difference-in-difference coefficients.

Finally, I am also interested in analyzing the long-term effects, if any, that the healthcare reform had on income. To that end, I will use an event-study specification, given all the years'-worth of data available (8 before and 14 after the passing of the reform). My goal will be to measure how having a clinic in a treated district affected household and personal income after a varying number of years.

The equation to estimate is

$$\begin{aligned} Y_{idt} = &\alpha_1 Clinic_{dt} + X'_{it}\beta + \lambda_t + \gamma_d \\ &+ \sum_{t=-21}^{12} \eta_t \cdot YearsElapsed_{dt} + \epsilon_{idt} \end{aligned}$$

where $YearsElapsed_{dt}$ measures the number of years since a treated district was treated, normalizing comparison group values to -30.

4.1 Identification strategy

To justify the use of difference-in-difference and an event study [1], I check for parallel trends in the income variables. A first intuition, providing a necessary but not sufficient condition for identification, is to look graphically at the trends in income before treatment. I would want for the slopes to be fairly similar because, if they were not, then income definitely would not follow parallel trends and I could not use difference-in-difference. Figures 3 and 4 show, using a non-parametric method for household income, as well as linear regression for personal income, that the trends for the treatment and comparison groups do appear to be parallel.

The graphs provide only suggestive evidence of parallel trends. Given that treatment was staggered and there is no single pre- and post-intervention period for the treatment group, I also follow the methodology suggested by Autor (2003) [4], cited in Pischke (2005) [26], as a more formal test of the identification assumption. In it, he introduces to the regression yearly dummies that are interacted with the treatment variable. The desired result is that the only coefficients to be statistically significant should be those post-intervention.

The model becomes

$$Y_{idt} = X'_{it}\beta + \lambda_t + \gamma_d + \sum_{1987}^{2008} \beta_t Clinic_{dt} Year_t + \epsilon_{idt} \tag{2}$$

where $Year_t$ is a dummy variable corresponding to what year it is.

The test of the difference-in-difference assumption would require that all β_t be indistinguishable from 0 for the years prior to treatment and that the $Clinic * Year$ variables be jointly insignificant pre-intervention. I would only want and expect for coefficients post-intervention to be positive and statistically significant.

Figure 2 shows the results of this test graphically, with the point estimates along with bars with their standard errors. Rather surprisingly, because of how the treatment variable was built, no coefficients are reported prior to the beginning of the reform, 1994. Nevertheless, this also implies that, vacuously, no pre-intervention coefficient is statistically significant, so the parallel trends assumption is not violated and we may proceed. Additionally, for years after the intervention, the estimates for most years are significantly different from 0, as shown by the 95% confidence intervals. The yearly effects vary between $20,000$ and $40,000$ real *colones*, or about \$38 to \$76, with a mean household income of around \$1020.

Similarly, Figure 6 shows comparable results in percentages. Again, no results are reported prior to 1994 but most of the post-intervention coefficients are positive and statistically significant. Yearly estimates compared to the reference year (1994) range from 2% to 8%, again showing significant positive results post-intervention and no significant estimates pre-intervention.

5 Mechanism

In order to justify the proposed positive causal relationship between an increase in access to healthcare and increases in income as a result of the 1994 Costa Rican healthcare reform, I will rely on Strauss and Thomas' formulation [31] of Michael Grossman's seminal 1972 model [16] on the link between health and wages.

Here is the intuition behind the results of the model: Increased access to primary healthcare would bring about better health outcomes. This translates into higher-quality/healthier workers. Healthier individuals would make for workers that could aspire to higher-paying jobs. Given universal health insurance, therefore, it is the *availability* of healthcare (Lindelow, 2005) [20] and not the *ability* to pay for it, that is the limiting factor in receiving care.

(For a full account of the theory, see Appendix A.)

Therefore, under this theoretical framework, I would expect for incomes to go up as a result of the healthcare reform.

6 Results

The difference-in-difference estimation yielded a positive and highly statistically significant change in income as a result of the healthcare reform. Table 3 shows the effect of getting an *EBAIS* on treated districts. Adding district and time fixed effects, as well as controlling for age, education, insurance type, and marital status, among others, getting an *EBAIS* led to an increase of around 17,000 real *colones* (about \$33 of 2015), a positive and statistically significant increase in average household income as a result of the reform, however modest, compared to the average monthly income of around \$1,022. Without district fixed effects, the estimate is negative but insignificant, a loss of about 76,000 *colones* or around \$145 in monthly household income.

Table 4 confirms these results: the treatment effect on the treated is positive (4%), as hypothesized, and highly statistically significant. This specification also controls for the same variables, as well as district and time fixed effects. On the other hand, as was the case in the analysis in levels, without district fixed effects the estimate is negative but insignificant, a decrease of 14% in household income. This reinforces the importance of the district fixed effects, since the reform happened at the district level.

Next, Table 5 displays the changes in personal income levels as a result of the healthcare reform. The two specifications, without and with district fixed effects, respectively, present either negative or small and positive changes in personal income from getting an *EBAIS*. Nevertheless, both changes prove to be statistically insignificant. Without district fixed effects, the "effect" of the reform was a decrease of around 7,100 real *colones* or about \$13. Meanwhile, by adding district fixed effects, the negative result disappears, changing sign, to about 535 *colones*, or around \$1.

Correspondingly, Table 6 reports the percent changes in personal income as a result of the reform, using the inverse hyperbolic sine transformation [7], as some individuals report zero income (so the logarithm would not be defined). It suggests a statistically insignificant decrease of 0.2% in personal income as a result of the healthcare reform using time fixed effects. Without them, the resulting percent change is also a small, negative and insignificant -0.4%.

This leads me to believe one of two things: first, that combined with the results from Table 5 discussed above, getting an *EBAIS* does not appear to have had a positive effect on individuals; or second, more interestingly, that there might be something special about families in Costa Rica that make them able to achieve feats impossible or at least impractical for individuals. Given the collaborative nature of families in Costa Rica, I am led toward the latter.

Finally, I share the results of the event-study specification. Table 7 reports the estimates for the effects on households of having been treated with a clinic in their district over several years, both before and after. As expected, the bulk of the pre-intervention coefficients, small and positive as well as negative, are insignificant. Although a couple of those coefficients are indeed significant, which would be indicative of selection, an F-test fails to reject that all the pre-intervention coefficients are jointly insignificant. In addition, as a result of getting an *EBAIS* clinic in their district, I find positive and highly statistically significant increases in the household income ranging from $19,000$ to $54,000$ *colones*, or between \$36 and \$102 of 2015, up to 10 years post-intervention. This corresponds to an increase of between 3% and 7% with respect to the year of treatment. Figure 7 helps visualize these same results.

For personal income, I find statistically significant percent increases up to ten years post-intervention averaging around 19%. There are four instances of estimates pre-intervention being statistically significant, but one more time an F-test fails to reject the null that the pre-intervention coefficients are jointly insignificant. Similarly, looking at results in levels, I find increases ranging from $6,500$ to $12,000$ *colones*, or \$12 to \$23 of 2015, and an F-test also fails to reject the null. That provides evidence for the strength of my event study results on personal income.

7 Robustness checks

As I explain in the Empirical Strategy section, the identification assumption of difference-in-difference, parallel trends in income, does seem to hold. First, I find suggestive evidence by graphing the trends for the treatment and control groups in Tables 3 and 4. Then, I perform a stronger test by adding time dummies and interacting them with the treatment variable. Despite the lack of reported coefficients pre-intervention, as seen in Figure 5, this vacuously indicates a lack of significant coefficients pre-intervention, providing further evidence for parallel trends.

One aspect I am unable to address stems from a recent paper by Kahn-Lang and Lang (2020) [18] suggests that the plausibility of parallel trends is greater if the treatment and control groups start at similar *levels*, and not just follow similar trends. Nevertheless, given the quasi-experimental nature of the reform, my treatment and control groups do start at different levels, which might weaken the argument for parallel trends.

An important decision I made in my empirical analysis was to only focus on those households that did not already have a source of primary healthcare before the reform. That reduced the number of observations to about a third, from 892,317 to 311,553, and households in districts that eventually get a clinic constitute my treatment, while those that never do are my comparison. Going forward, it would be worthwhile to also repeat the analysis, but this time with the same treatment group but using the previously discarded observations as comparison, to check if the results are qualitatively similar.

8 Conclusion

Costa Rica underwent a major healthcare reform starting in the 1990s that greatly expanded access to primary healthcare through its new *EBAIS* clinics. As a result the reform, now three-quarters of all medical consultations happen at an *EBAIS*. The stated goal of the reform was improving access and quality of care, which would result in better health indicators. Rosero-Bixby [28] showed just that: child mortality went down by 8%, deaths by transmissible illnesses decreased by 14% and deaths by chronic diseases shrank by 2%, among others.

This paper discussed the possibility that this reform would also have the unintended beneficial effect of increasing household or personal incomes. My contention, stemming from Grossman's model of healthcare demand [16], was that better access to healthcare would result in healthier people who could aspire to better paying jobs, thus increasing their income. (This is dependent on better access necessarily implying more usage of healthcare, as in the case in Costa Rica, which has near-universal health insurance.) My analysis found that, as result of getting a clinic in their district stemming from the reform that created the *EBAIS*, household income in Costa Rica went up around 4%.

The success that the Costa Rican reform had opens up the possibility that this healthcare model could be exported to other nations. This analysis gives statistical evidence of the positive effects that increased access to healthcare given health insurance could have on income, thereby increasing societal welfare.

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Tables

Table 1: Summary statistics.

Characteristic	**Control**, N = 157,176[1]	**Treatment**, N = 154,377[1]	**p-value**[2]
# of people	5.09 (2.21)	4.80 (2.06)	<0.001
Sex			<0.001
Male	75,160/157,176 (48%)	67,147/154,377 (43%)	
Female	75,791/157,176 (48%)	66,566/154,377 (43%)	
Unknown	6,225/157,176 (4.0%)	20,664/154,377 (13%)	
Age	30 (24)	40 (29)	<0.001
Years of education	5.4 (4.3)	5.8 (4.0)	<0.001
Household income	549,560 (439,842)	529,473 (427,635)	<0.001
Personal income	108,573 (170,556)	111,668 (168,079)	<0.001

[1] Mean (SD); n/N (%)

[2] Wilcoxon rank sum test; Pearson's Chi-squared test

Table 2: Leads and lags in treatment for personal income

	Personal income
Clinic ∗ Year = 1987	$-9,556.57^{***}$ (3,283.04)
Clinic ∗ Year = 1988	$-4,454.21$ (3,391.80)
Clinic ∗ Year = 1989	$-7,535.81^{**}$ (3,450.44)
Clinic ∗ Year = 1990	$-7,324.24^{**}$ (3,333.72)
Clinic ∗ Year = 1991	$-2,803.38$ (3,509.64)
Clinic ∗ Year = 1992	$-1,234.78$ (3,294.36)
Clinic ∗ Year = 1993	-201.89 (3,361.97)
Clinic ∗ Year = 1995	-769.62 (3,215.02)
Clinic ∗ Year = 1996	$-1,277.23$ (3,250.06)
Clinic ∗ Year = 1997	$-5,246.05$ (3,226.25)
Clinic ∗ Year = 1998	$-5,355.11^{*}$ (3,200.60)
Clinic ∗ Year = 1999	$-6,614.79^{**}$ (3,060.76)
Clinic ∗ Year = 2000	$-3,064.60$ (3,097.56)
Clinic ∗ Year = 2001	$-7,423.00^{**}$ (3,155.37)
Clinic ∗ Year = 2002	$-5,423.03^{*}$ (3,076.27)
Clinic ∗ Year = 2003	$-4,023.14$ (3,052.63)
Clinic ∗ Year = 2004	$-3,432.13$ (3,050.68)
Clinic ∗ Year = 2005	$-6,709.25^{**}$ (3,016.67)
Clinic ∗ Year = 2006	$-7,138.77^{**}$ (3,035.27)
Clinic ∗ Year = 2007	$-5,537.38^{*}$ (2,999.98)
Clinic ∗ Year = 2008	$-8,398.67$ (3,040.24)
N	311,553
Adjusted R^2	0.64

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table 3: Difference-in-difference (DID) on household income in levels with FE

Variable	Mean	Std Dev
Household Income	539,607.02	433,951.91

	Household Income	
	(1)	(2)
Clinic=1	$-76,279.10$	$17,607.43^{***}$
	(1,775.32)	(2,573.48)
District FE	No	Yes
N	311,553	311,553
Adjusted R^2	0.28	0.39

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table 4: DID on household income in percentages with FE

Variable	Mean	Std Dev
Household Income	539,607.02	433,951.91

	log(Household Income)	
	(1)	(2)
Clinic=1	−0.14	0.04***
	(0.003)	(0.005)
District FE	No	Yes
N	311,553	311,553
Adjusted R^2	0.30	0.42

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table 5: DID on personal income in levels with FE

Variable	Mean	Std Dev
Personal Income	110,106.69	169,339.93

	Personal Income	
	(1)	(2)
Clinic=1	$-7,082.06$	534.51
	(511.66)	(800.05)
District FE	No	Yes
N	311,553	311,553
Adjusted R^2	0.61	0.61

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table 6: DID on personal income in percentages with FE

Variable	Mean	Std Dev
Personal Income	110,106.69	169,339.93

	log(Personal Income)	
	(1)	(2)
Clinic=1	−0.002	−0.004
	(0.02)	(0.03)
District FE	No	Yes
N	311,553	311,553
Adjusted R^2	0.62	0.62

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table 7: Event study on Household Income

	Levels	Percentages
	(1)	(2)
Years since treatment = -10	$-27,237.37^{***}$ (10,252.59)	-0.02 (0.02)
Years since treatment = -9	$-39,320.32^{***}$ (9,811.79)	-0.08^{***} (0.02)
Years since treatment = -8	$-40,300.53^{***}$ (9,768.55)	-0.09^{***} (0.02)
Years since treatment = -7	$-12,572.15$ (9,635.70)	-0.02 (0.02)
Years since treatment = -6	$-5,978.89$ (9,512.25)	-0.05^{**} (0.02)
Years since treatment = -5	13,652.79 (9,471.34)	-0.01 (0.02)
Years since treatment = -4	$-1,641.41$ (9,350.43)	-0.01 (0.02)
Years since treatment = -3	$-6,375.87$ (9,205.84)	-0.03^{*} (0.02)
Years since treatment = -2	2,067.47 (9,157.32)	-0.01 (0.02)
Years since treatment = -1	3,363.16 (9,078.79)	0.01 (0.02)
Years since treatment = 0	$26,582.86^{***}$ (8,940.07)	0.02 (0.02)
Years since treatment = 1	$26,832.45^{***}$ (8,973.41)	0.04^{**} (0.02)
Years since treatment = 2	$32,827.17^{***}$ (8,846.95)	0.03^{*} (0.02)
Years since treatment = 3	$38,254.24^{***}$ (8,650.24)	0.05^{***} (0.02)
Years since treatment = 4	$19,630.15^{**}$ (8,614.37)	0.01 (0.02)
Years since treatment = 5	10,775.00 (8,604.16)	0.02 (0.02)
Years since treatment = 6	$25,996.87^{***}$ (8,495.19)	0.03 (0.02)
Years since treatment = 7	$22,847.50^{***}$ (8,366.68)	0.01 (0.02)
Years since treatment = 8	$48,845.35^{***}$ (8,424.75)	0.07^{***} (0.02)
Years since treatment = 9	$54,300.70^{***}$ (8,398.00)	0.07^{***} (0.02)
Years since treatment = 10	$41,681.79^{***}$ (8,241.27)	0.04^{**} (0.02)
Years since treatment = 11	20,840.45 (8,436.18)	0.03^{**} (0.02)
Years since treatment = 12		
N	311,553	311,553
Adjusted R^2	0.41	0.43

Notes: ***Significant at the 1 percent level. **Significant at the 5 percent level. *Significant at the 10 percent level.

Table 8: Event study on Personal Income

	Levels	Percentages
	(1)	(2)
Years since treatment = -10	$5,760.05^{*}$ (3,118.47)	0.28^{**} (0.12)
Years since treatment = -9	732.92 (2,984.40)	0.04 (0.12)
Years since treatment = -8	−1,191.26 (2,971.24)	−0.05 (0.12)
Years since treatment = -7	$5,169.72^{*}$ (2,930.84)	0.16 (0.11)
Years since treatment = -6	4,275.94 (2,893.29)	0.07 (0.11)
Years since treatment = -5	$7,628.25^{***}$ (2,880.84)	0.25^{**} (0.11)
Years since treatment = -4	$9,133.61^{***}$ (2,844.07)	0.30^{***} (0.11)
Years since treatment = -3	$7,208.35^{***}$ (2,800.09)	0.15 (0.11)
Years since treatment = -2	$7,306.48^{***}$ (2,785.33)	0.11 (0.11)
Years since treatment = -1	$8,577.77^{***}$ (2,761.44)	0.20^{*} (0.11)
Years since treatment = 0	$12,247.28^{***}$ (2,719.25)	0.16 (0.11)
Years since treatment = 1	$8,802.78^{***}$ (2,729.39)	0.17^{*} (0.11)
Years since treatment = 2	$9,290.99^{***}$ (2,690.93)	0.17^{*} (0.10)
Years since treatment = 3	$11,615.35^{***}$ (2,631.09)	0.31^{***} (0.10)
Years since treatment = 4	$7,745.63^{***}$ (2,620.18)	0.20^{*} (0.10)
Years since treatment = 5	$6,509.76^{**}$ (2,617.08)	0.16 (0.10)
Years since treatment = 6	$8,031.94^{***}$ (2,583.93)	0.14 (0.10)
Years since treatment = 7	$6,620.32^{***}$ (2,544.85)	0.18^{*} (0.10)
Years since treatment = 8	$11,786.21^{***}$ (2,562.51)	0.25^{**} (0.10)
Years since treatment = 9	$12,363.38^{***}$ (2,554.37)	0.33^{***} (0.10)
Years since treatment = 10	$9,432.86^{***}$ (2,506.70)	0.12 (0.10)
Years since treatment = 11	6,466.10 (2,565.99)	0.02 (0.10)
Years since treatment = 12		
N	311,553	311,553
Adjusted R^2	0.64	0.62

Notes:

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Figures

Figure 1: Districts and their Status.

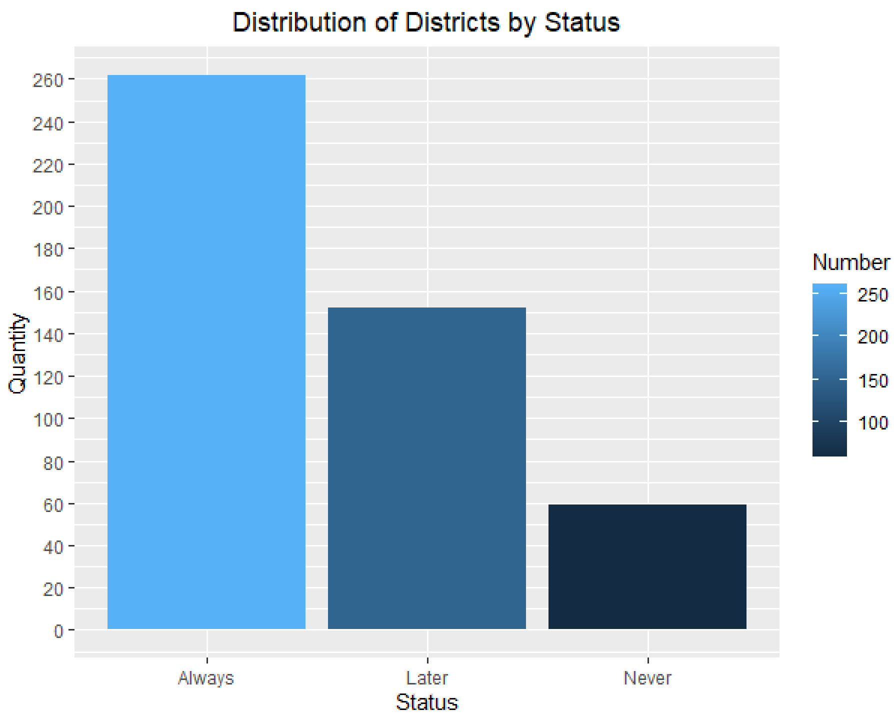

Figure 2: EBAIS built, compared to those needed to have one per every 4.500 people

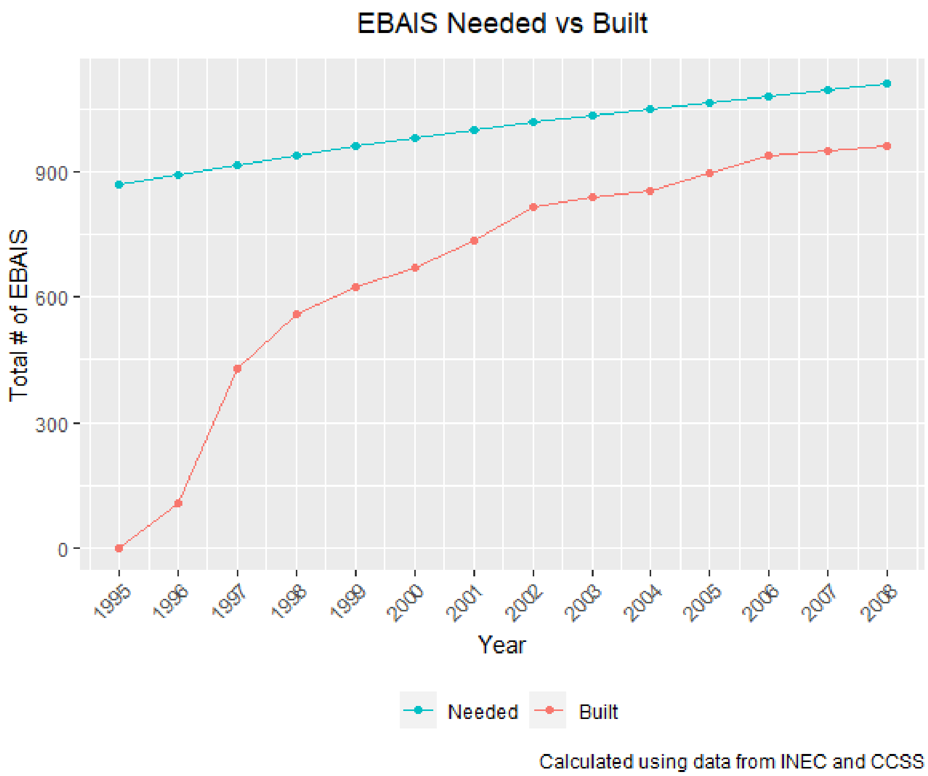

Figure 3: Pre-intervention Trends in Household Income

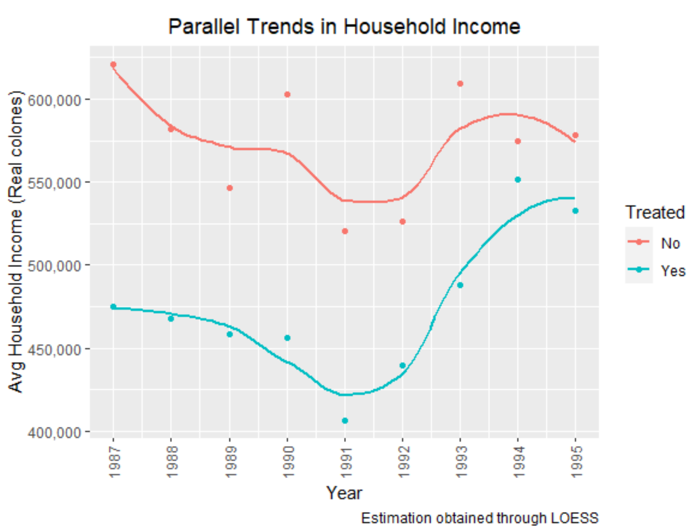

Figure 4: Pre-intervention Trends in Personal Income

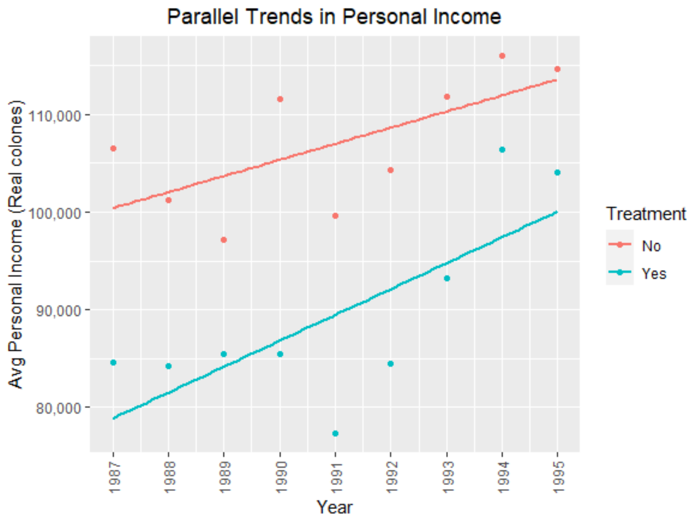

Figure 5: Parallel trends test.

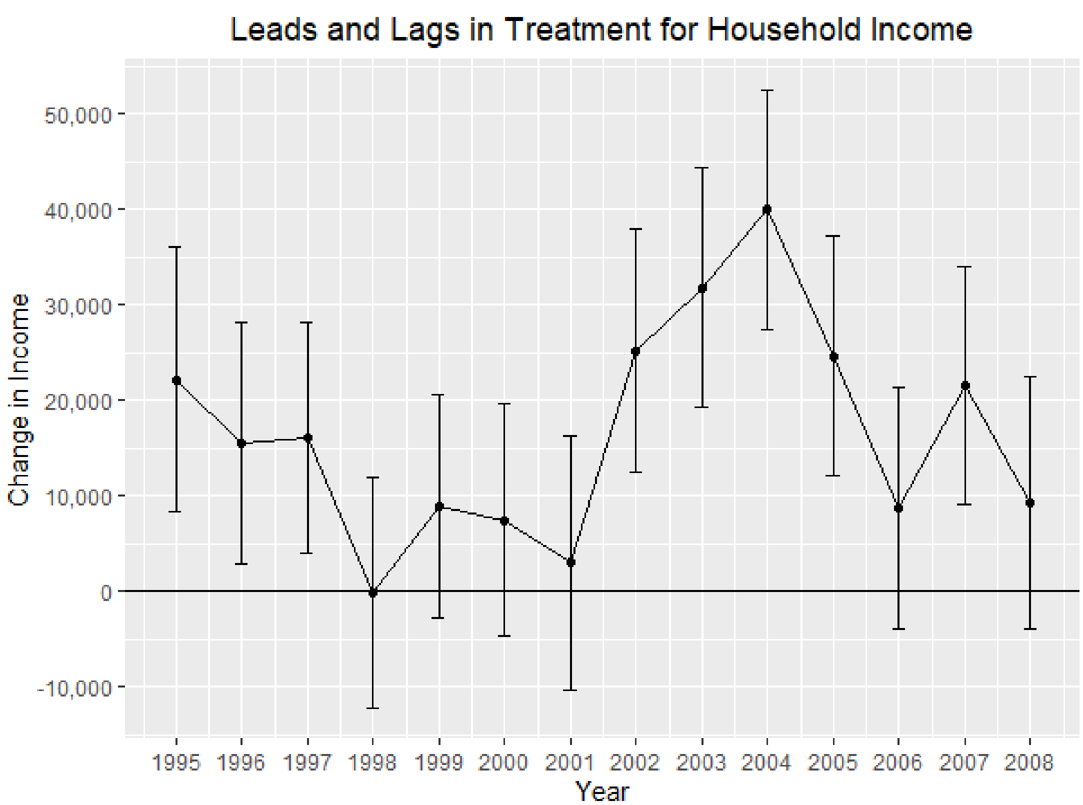

Figure 6: Parallel trends test in percentages.

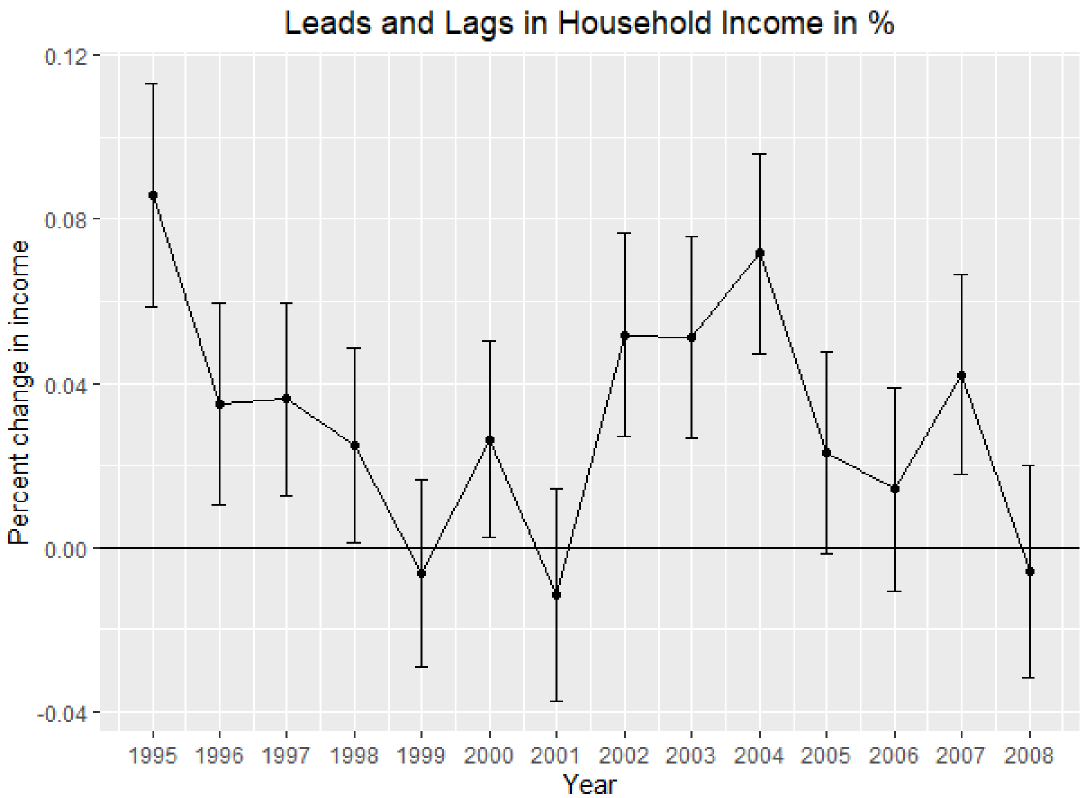

Figure 7: Household Event Study Results

Appendix A: Grossman Healthcare Demand Model

Begin with a one-person household that maximizes utility over one period. Furthermore, suppose that productivity is perfectly observed by firms and that labor markets are competitive. Let H be an individual's health vector-valued production function,

$$H = H(N, L; A, B, D, \mu, e_h) \tag{3}$$

where N represents health inputs (such as exercise, nutrition, or the healthcare reform under study) and L is labor supply. Assume that health is increasing in all inputs except perhaps labor supply. The technology behind the production of health is given by A; family background, like parental health, is in B; and environmental factors, D, incorporate aspects like sanitation infrastructure or the disease environment. Unobservables include inherent individual healthiness μ, known (at least partly) only to the individual, and an unknown measurement error e_h.

Assume the individual's real wage equals their marginal product, which is costlessly observable. Real log wage depends on health outputs H, schooling S, family background B, local community infrastructure I, unobserved factors α (like school quality), and random fluctuations e_w, which include measurement error:

$$w = w(H; A, S, B, I, \alpha, e_w) \tag{4}$$

Finally, assume that individual utility depends on labor supply L and consumption C, and that it can be conditioned on health outputs H, schooling S, family background B, and unobserved characteristics ξ, which include tastes:

$$U = U(C, L; H, S, A, B, \xi) \tag{5}$$

If the individual has non-labor income V, the budget constraint is

$$p_c C^* + p_n N = wL + V \tag{6}$$

where consumption C has been decomposed into a vector of health inputs N with price p_n and non-health consumption C^*.

Under conditions that guarantee an interior solution, the first-order condition with respect to the j-th health input N_j (see the derivation below) establishes that

$$\frac{\partial U}{\partial H}\frac{\partial H}{\partial N_j} = \lambda\left(p_n - L\left[\frac{\partial w}{\partial H}\frac{\partial H}{\partial N_j}\right]\right) \tag{7}$$

where λ is the marginal utility of income.

Proof. This comes from solving the utility maximization problem

$$\max_{C,L} U(C, L; H, S, A, B, \xi) \text{ subject to } p_c C^* + p_n N = wL + V$$

where consumption C has been decomposed into a vector of health inputs N with price p_n and non-health consumption C^*. We will therefore also write both sources of consumption as different arguments in the utility function.

We proceed by forming the Lagrangian

$$\mathcal{L} = U(C^*, N, L; H, S, A, B, \xi) + \lambda\left[wL + V - p_n N - p_c C^*\right]$$

and differentiating it with respect to the j-th health input N_j:

$$\frac{\partial \mathcal{L}}{\partial N_j} = \frac{\partial U}{\partial N_j} + \frac{\partial U}{\partial H}\frac{\partial H}{\partial N_j} + \lambda\left(L\frac{\partial w}{\partial H}\frac{\partial H}{\partial N_j} - p_n\right) = 0$$

Following Strauss and Thomas [31], we also ignore the direct impact of N_j on U in order to focus on the indirect effects through health and wages. After this, if we add the term with λ on both sides, we get the desired result.

■

By assumption, health H and wages w are increasing in N and H, respectively. So, if there were a positive change in the j-th health input N_j —as would happen if a government increased access to primary healthcare, as was the case in Costa Rica—, then both health and wages would increase. Moreover, investments in health would not only make individuals wealthier, but also incentivize the use of more that health input. As Strauss and Thomas [31] put it:

> First, if health inputs raise wages through improving health outcomes, then the shadow price of health-augmenting inputs declines, inducing greater use of those inputs. Second, the degree of decline of the health input shadow price is likely to be greater for those in worse health.

Therefore, under this theoretical framework, I expect for incomes to go up as a result of the healthcare reform.