In-Kind Benefits Benefits

Evidence from Puerto Rico

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We examine the effect of providing benefits in-kind versus in cash. We leverage a policy in Puerto Rico that converted cash benefits to in-kind nutritional assistance, holding benefit generosity constant. Using a difference-in-differences strategy, we find that providing the benefits in-kind led to significant increases in food consumption and decreases in maternal anemia, but had no impact on the rate of gestational diabetes or the incidence of low birth weight. Leveraging variation in the length of early childhood exposure to in-kind versus cash benefit provision, we find long run improvements in adolescent health.

1 Introduction

The recent surge in interest regarding universal basic income programs has revived the long-standing debate over how best to design the social safety net. A central element of this debate is whether benefits should primarily be provided in cash, where the spending decision is left to the recipient, or in kind, where much of the spending decision is made by the government. In an economic framework, the choice between these two options depends on whether household spending decisions fail to maximize the welfare of all the members of the household, as well as any externalities arising from household spending decisions. Nutritional assistance is a particularly interesting setting for investigating the tradeoffs between different benefit forms because it is a large program, providing in-kind benefits to more than 42 million Americans at a cost of more than $68 billion, in which the benefits are shared among the members of each recipient household (unlike Medicaid for example).[1] In this context, policymakers may be concerned that, under a cash benefit system, those in the household that are not the spending decision-maker (e.g. children) may not receive the optimal level of nutrition This deficit may yield substantial externalities if it translates into immediate or longer-term health effects.

In this paper, we investigate whether the form of nutritional assistance affects household food consumption patterns and, if so, whether these effects are large enough to generate improvements in health outcomes. We take advantage of a previously unexplored change in the Puerto Rican Nutritional Assistance Program (NAP) in 2001 that converted a cash benefit to one in which recipients were required to spend 75% of their benefits on approved food items. As the total value of the benefit remained fixed, this shift provides a unique opportunity to isolate the impact of providing food relative to an equivalent amount of cash in the context of a large-scale program. NAP's high participation rate, with more than one third of residents receiving assistance, make it an ideal program for observing the impact of this type of shift.

[1] USDA beneficiary and cost estimates for 2017.

While a significant body of work has demonstrated the short- and long-term effects of nutritional assistance on consumption patterns, nutrition, crime, and health, this work has focused on the *availability* of nutritional assistance and not the form of the assistance.[2] Research on the effects of the form of the benefit is significantly more limited. Evaluations of randomized cash out experiments conducted by the U.S. Department of Agriculture in the 1990s provide mixed evidence, with three out of four sites implying that a change from food stamps to cash benefits led to a reduction in food expenditures of between 18 and 28 cents for each dollar of food stamps cashed out (Fraker, Martini and Ohls, 1995; Ohls and Bernson, 1992; Whitmore, 2002).[3] More recent quasi-experimental evidence from Hastings and Shapiro (2018) indicates that even inframarginal individuals do not treat nutritional assistance benefits as fungible with cash, but instead tend to earmark benefits for food spending. In a very poor and rural context in Mexico, Cunha (2014) evaluates a randomized control trial of the government's Food Assistance Program ('PAL') in which villages were randomly assigned baskets of goods or their cash equivalents. While they find no significant difference in the overall effect of the form of the benefit on total consumption or food consumption, the point estimates suggest that in-kind provision resulted in food consumption that was 40% higher overall, with expenditures on basket items more than 200% higher.

Leveraging earlier variation in Puerto Rico in 1982, Moffitt (1989) uses a structural model to find that replacing food stamps with paper checks (equivalent to cash) had no impact of food expenditures.[4] However, this variation differed substantially from the later policy change that we examine. First, as with the Mexican and USDA experiments mentioned above, the generosity of the benefits was low and the transfer was inframarginal for most (92

[2]See, for example, Gertler (2004); Fox, Hamilton and Lin (2004); Lee and Mackey-Bilaver (2006); Whitake, Philips and Orzol (2006); Baum (2007); Hoynes and Schanzenbach (2009); Almond, Hoynes and Schanzenbach (2011); Hoynes and Schanzenbach. (2012); Hoynes, Schanzenbach and Almond (2016); Hastings, Kessler and Shapiro (2018); Barr and Smith (2018).

[3]Fraker, Martini and Ohls (1995) argue that the cash out in Alabama had no effect on food expenditures due to the significantly shorter nature of the cash out (8 months versus 4 years) and the provision of food stamp benefits separate from other benefits (in the other sites the "cash" food stamp benefits were combined with other cash transfers such as AFDC).

[4]**?** find similar results by comparing household food expenditures before and after the policy change (1977 and 1984).

percent of) households, suggesting that large differences in food expenditures should not be expected, at least under neoclassical assumptions. Second, there was substantial anecdotal evidence that food stamps were already operating as a second currency before the policy change, potentially negating any effect in practice.[5] Third, there is a strong possibility that changing selection into benefit receipt that coincided with the policy change explains the lack of changes in food consumption. During this period, there were substantial reductions in funding for the food stamp program, as well as changes in resource thresholds for eligibility and benefit generosity (Moffitt (1989)).

We make three contributions to this literature. First, we distinguish between effects of the availability of nutritional assistance and the form of the benefit in a context where the benefit is not inframarginal for the majority of recipients.[6] Second, we do so in a large-scale context with a permanent change in benefit structure; 30-40% of Puerto Ricans receive food assistance and the benefit structure changed permanently and island-wide in 2001. The effects of a system-wide and permanent shift may differ from those observed in small scale or short-term experiments if there are general equilibrium effects or the effort required to adjust household spending patterns is sufficiently costly. Finally, we provide the only estimates of which we are aware that the form of nutritional assistance, independent of the amount, can influence the effect of assistance on short- and long-term health.

We use a difference-in-differences strategy to exploit a natural experiment where Puerto Rico implemented requirements that 75% of nutritional assistance benefits be spent on approved food items. We find that this change produced dramatic nutritional improvements, with fruit and vegetable consumption increasing by 0.5 servings per day (20 percent). These nutritional improvements, in turn, yielded some contemporaneous improvements in health; maternal anemia fell by 0.3 to 0.7 pp (13 to 23 percent), but there was no effect on the

[5]Both Fox, Hamilton and Lin (2004) and Moffitt (1989) observe this point. Moffitt (1989) notes that interviews conducted at the time revealed that merchants accepted food stamps for items other than food, as well as discrepancies between reported food consumption and reported food stamp usage that suggest stamps and cash may have been interchangeable.

[6]This is particularly relevant in thinking about the potential effects of increasing the generosity of in-kind nutritional assistance outside existing ranges in the United States.

incidence of low birth weight, a marker of extreme malnourishment. Additionally, we explore whether these contemporaneous effects from the policy change translated to longer-term health improvements by leveraging variation in individuals childhood exposure to the in-kind benefits. Those who grew up after the shift, and therefore more likely to have had better nutrition in early childhood, are taller and more likely to be normal weight as adolescents.

While our results provide compelling evidence that the form of a nutritional assistance benefit can have considerable effects, the strength of the evidence is limited by the nature of the variation. The estimates rely critically on the assumption that relevant outcomes would have trended similarly in Puerto Rico and comparison states if not for the policy change in Puerto Rico. We address this concern with event studies that show similar trends in most outcomes prior to the policy change. Additionally, we find no effect on maternal diabetes, a slow developing and long-term illness that is unlikely to be affected by short-term improvements in nutrition but does reflect the a priori health of the sample population.

It is important to note that our results do not imply that in-kind benefits are necessarily welfare improving over cash. Rather, they suggest that unconstrained household spending decisions may not prioritize health, particularly of young children. To the extent that recipients of nutritional assistance are also likely to receive government-provided or subsidized healthcare (i.e. Medicaid or individual marketplace subsidies), constraining household decisions with in-kind benefits may yield a substantial fiscal externality for the government in the form of reductions in healthcare spending.

2 In-Kind Transition in Puerto Rico's Nutrition Assistance Program

In September 2001, in an effort to align more closely with federal regulations, the Puerto Rican Nutrition Assistance Program (NAP) transitioned from a 100 percent cash redeemable EBT card, to one for which 75 percent of the benefits was required to be spent on approved food items (Trippe et al., 2015). While 25 percent of the benefit remained redeemable in cash, the government for the first time made it clear that 100 percent of the benefit was intended

for food.[7] This shift came about as a result of pressure from the federal government to "align NAP more closely with the regulations that governed SNAP; specifically, regulations on what and where benefits could be used" (ADSEF, 2000). This pressure was motivated by a desire to "encourage and enforce the utilization of the benefit as established in Federal law and regulations — only for the acquisition of food". Program administrators expected this change to "dramatically reduce improper use of targeted funds" and "promote better nutrition for... participants" (ADSEF 2001b, p.7).

The newly mandated in-kind component of NAP benefits was not inframarginal for most Puerto Ricans.[8] It accounted for the majority of resources in 72 percent of recipient households, while between 35 and 40 percent of recipient households had *no other source* of income.the average Puerto Rican household spends only 18 percent (and the average welfare recipient spends only 21 percent) of their income on food, this suggests that a large portion of NAP recipients were constrained to spend more on food as a result of the 2001 benefit shift.[9],[10] The potential for trafficking of benefits to circumvent this constraint also was limited by the prior adoption of EBT cards.[11] This differed dramatically from an earlier shift from in-kind to cash benefits in Puerto Rico, where food stamps operated as a "second currency prior to the shift (Moffitt, 1989).

Anecdotal evidence also suggests that recipients expected the in-kind constraint to bind, with many claiming that the benefit shift would force them to consume additional food. As one young mother put it "I'm going to have the cupboard full, but I will not have the light to cook what I bought... That's logical, they know it, I do not have any more money... " Indeed, there is ample evidence from a number of sources that her case was not unique.[12]

[7] 25 percent was kept in cash due to concerns that some Puerto Ricans would not be able to access an approved retailer for all of their purchases.

[8] This was not the case prior to the 1980s shift from in-kind to cash benefits analyzed by Moffitt (1989).

[9] Authors' calculations using data from (Trippe et al., 2015).

[10] Average monthly benefits per person in Puerto Rico were $103 in 2003 (compared to $84 in the 50 states) according to the Government Accountability Office. In Puerto Rico, the average benefits per recipient relative to median income is more than 3 times what it is in the 50 states.

[11] Consistent with this, part of the motivation for the 2001 benefit shift was to "dramatically reduce improper use of targeted funds."

[12] Gotay, Benjamin Torres. "Empieza hoy el nuevo sistema de uso del PAN." *El Nuevo Dia* 1 Sep. 2001

Consistent with recipient expectations, food industry revenue estimates at the time imply a roughly 40 to 60 percent increase in food expenditures for NAP recipients as a result of the benefit shift.[13]

Reports from after the benefit shift also indicate that the food assistance was not inframarginal. Surveys of NAP recipients indicate that despite the requirement to spend 100 percent of their benefit on food (including the 25 percent cash component), only 32 percent report using any of the cash benefit on food, suggesting at least 68 percent were constrained.[14] Similarly, EBT expenditure data from after the benefit shift indicate that while over 60 percent of NAP recipients spend roughly 75 percent of their benefit on food (the in-kind share of the benefit), only 6 percent spend something in between 80 and 99 percent of their benefit on food.[15] This level of bunching suggests that many households were constrained in their expenditures on food.

3 Data

We explore the contemporaneous nutritional effects of the shift from cash to in-kind NAP benefits using the Behavioral Risk Factor Surveillance System (BRFSS). Following Almond, Hoynes, and Schanzenbach (2011), we use Vital Statistics Natality data to explore whether any observed nutritional improvements translate into health improvements during the critical window surrounding childbirth. Finally, we use the Youth Risk Behavior Survey

(translated to English).

[13]The president of the Association of Marketing, Industry and Food Distribution (MIDA) indicated that "the economic boom experienced by the food industry is the result of a fundamental factor: the modifications to the Nutritional Assistance Program (PAN) under the formula 75-25 through the Family Card." A MIDA report suggests that the benefit shift increased food sector revenue by $300 to $400 million, 22.5 to 30 percent of the total PAN budget. Given that roughly 80 percent of benefits were spent on food after the shift, we obtain a rough estimate of the increase in food expenditure among recipients by dividing the $300 to $400 million by the implied amount spent on food prior to the shift, calculated as the amount of total PAN expenditures spent on food (0.8*$1335 million), minus the estimated increase in food sector revenue ($300 to $400 million). Romn, Miguel Daz. "Prspera la industria de alimentos." 22 Oct. 2001 (translated to English).

[14]Rosado-Gonzlez, R., Puerto Rico Department of the Family, Administration for Socioeconomic Development of the Family (ADSEF). (2008). PANECO pregunta. Trujillo Alto, PR: RRG Universe and Assoc.

[15]Trippe et al. (2015) "Examination of Cash Nutrition Assistance Program Benefits in Puerto Rico." Prepared by Insight Policy Research under Contract No. AG-3198-C-14-0006. Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service.

(YRBS) to look for long run health effects on teenagers who experienced early childhood exposure to in-kind rather than cash NAP benefits.

3.1 Behavioral Risk Factor Surveillance System

The BRFSS is a health survey collected by the CDC through phone interviews. It is the largest continuously collected health survey in the world, and collects information on health-related behaviors, conditions, and services. The survey asks a limited set of nutrition-focused food consumption questions, which we use as proxies for food consumption as a whole. Our key food consumption outcomes are (1) daily servings of fruits and vegetables, and (2) daily servings of fruit juice.[16],[17],[18] Our sample includes the BRFSS data collected from all 50 states and Puerto Rico in 1998, 2000, 2002, 2003, and 2005; these are the years in which the key questions about fruit and vegetable consumption were included in the core survey. There are an average of over 230,000 observations per year, with roughly 4,000 per year in Puerto Rico.

3.2 Vital Statistics Natality Data

We use Vital Statistics Natality data for the same period.[19] The Vital Statistics Natality data are collected from birth certificates of children born in every state (and Puerto Rico) by the CDC. Our main maternal and infant health outcomes are binary indicators for infant low birth weight, mother's diabetes, and mother's anemia. Anemia is ex-ante the most likely outcome to reveal a positive health impact from nutrition changes produced by the switch to in-kind benefits. Iron deficiency is the most common cause of anemia worldwide

[16]The "daily servings of fruits and vegetables variable is created by the CDC and based on individuals combined reported consumption of fruit (excluding juice), potatoes, carrots, green salad, and all other vegetables.

[17]Although fruit juice consumption is sometimes reported in longer time horizons in the survey, we have adjusted all consumption variables to the level of daily intake.

[18]To account for a small number of unrealistic outliers in reported consumption, we top code each consumption response to be equal to the 99th percentile response for that variable. Respondents who refused to answer consumption questions or indicated that they did not know how much they consumed were coded as missing; these missing observations account for 3% of the data.

[19]Vital Statistics Natality data doesn't include any state level geographic identifiers after 2004.

and dietary changes, specifically increases in consumption of iron rich foods or use of iron supplements, are the most common form of iron-deficiency anemia prevention and treatment (Habershon, 1863; Camaschella, 2015). The incidence of low birth weights could also be affected by the changes in food consumption, but is less likely in this setting because of the relatively low levels of extreme malnourishment in Puerto Rico in recent decades.[20] Finally, we examine diabetes as a placebo test. Diabetes is generally understood to be a slow developing, progressive, and long-term illness that is closely linked with long-term over-consumption of certain food. It is therefore unlikely that constrained increases in food consumption would have any effect on diabetes in the short run. [21]

The data also include month and year of birth, state or territory of birth, mother's race, mother's education, plurality of birth, and order of birth, which we use as control variables. There are an average of 2 million observations per year, with an average of roughly 55,000 births per year occurring in Puerto Rico.

3.3 Youth Risk Behavior Survey

The Youth Risk Behavior Survey (YRBS) is a biannual CDC survey of high school students across the United States. It collects information on the health and behaviors of adolescents and contains an average of 89,000 observations per survey year during our sample period, with roughly 2,300 observations occurring in each survey year in Puerto Rico.[22] We use the 2009-2017 surveys and focus our analyses on individuals born between 1994 and 2003. Our key outcomes of interest are student height and a binary variable indicating if

[20]Risk of low birth weight has been shown to increase when mothers suffer from extremely poor nutrition when they become pregnant or from caloric deprivation during the third trimester of pregnancy. But, the same studies found no effect of moderately poor nutrition or caloric deprivation in the first two trimesters (de Bernab et al., 2004).

[21]While a balanced diet can decrease the risk of developing diabetes, the largest benefits come from decreasing consumption of saturated fat and cholesterol (Schoenaker et al., 2016). Decreases in total energy intake has even had some success at reversing diabetes (Lim et al., 2011).

[22]Not every state is included in each survey year, but at least 44 states are included in each year of our sample. Puerto Rico is included in the 2009, 2015, and 2017 surveys.

students are normal weight for their age and gender.[23]

3.4 Summary Statistics and Data Limitations

Table 1 displays summary statistics from each of the datasets mentioned above. It shows some substantial differences between Puerto Rico and comparison states. While infant and adolescent characteristics are similar, levels of income and education, as well as fruit and vegetable consumption are much lower in Puerto Rico, even relative to the poorest states. These level differences do not affect the internal validity of our difference-in-differences approach so long as the trends in these outcome variables do not differ substantially. However, the extent to which the marginal benefit of additional nutrition is greater in Puerto Rico than in other states, due to these level differences, will affect the generalizability of our results to other contexts.

An important limitation of our data sources is that none of them allow us to directly identify those eligible for or enrolled in Puerto Ricos NAP program. Therefore, our main specifications use the full sample of data available in each year, which means that many Puerto Rican individuals are included who did not participate in NAP. As a result, we estimate an average treatment effect for all Puerto Ricans that incorporates both direct effects on the treated as well as potential spillover effects on non-participants. Spillover effects are likely given the high participation rate (30-40%) of Puerto Ricans in NAP.

4 Empirical Strategy

We explore how exposure to in-kind benefits relative to equivalent cash benefits affects food consumption and health. We use a difference-in-differences design, estimating the following equation:

$$F_{ist} = \alpha_s + \lambda_t + \beta(PR_s * Post_t) + \gamma X_{ist} + \epsilon_{ist}, \tag{1}$$

[23]These calculations are based off BMI and are equivalent to measuring the probability that a student is not underweight, overweight, or obese.

where F_{ist} is a measures of the food consumption or health of individual i in state (or territory) s in year t. The terms α_s and λ_t are state and year fixed effects. X_{ist} are individual covariates, including age indicators interacted with gender for regressions with BRFSS and YRBS data, and mother's race, plurality of birth, and birth order for regressions with natality data. $PR_s * Post_t$ is an interaction term that equals one for observations in Puerto Rico after Puerto Rico's nutrition assistance program began requiring benefits to be spent on approved food items.[24]

In the analysis of adolescent outcomes, we follow Hoynes, Schanzenbach and Almond (2016), who find that food stamps has the largest long run effects for children exposed from age 0-5. We define treatment as the fraction of the first 5 years of life that the adolescent spent under the in-kind benefits policy. In other words, $PR_s * Post_t$ is replaced with $Frac5_t$, where $Frac5_t$ is the estimated fraction of an individual's life from birth to age five that occurred after the in-kind benefits policy change. This variable is zero for untreated Puerto Ricans (born before 1996), between zero and one for partially treated Puerto Ricans (born 1996-2001), and equal to one for Puerto Ricans who were exposed to the policy from birth (born after 2001). Standard errors are clustered at the state/territory level.

The coefficient of interest, β, provides an estimate of the effect of in-kind benefits, relative to cash benefits, on each outcome variable. These estimates can be interpreted as causal if Puerto Rico and the comparison states would have maintained similar trends if not for Puerto Rico's policy change. We assess this assumption for each outcome with event studies that show year-by-year differences between Puerto Rico and the comparison states (controlling for individual covariates and state/territory and year fixed effects). We find no evidence of differential trends prior to the policy change.

We also conduct supplementary analyses using a synthetic control approach, which constructs the comparison group from a weighted average of the outcomes of other states.

[24]The official change happened in September 2001, but there was a ramp up period through the end of 2001. Given this and data constraints (2001 is not available in the BRFSS and YRBS data is limited to year of birth), we set 2002 as the first post year.

Puerto Rico has lower levels of fruit and vegetable consumption than the rest of the United States, limiting our ability to conduct a standard synthetic control analysis since no linear combination of states is equivalent to Puerto Rico. To overcome this, we de-mean the data using each states pre-period outcome levels, and then create the synthetic control based on those demeaned outcomes.[25] Synthetic control estimates of food consumption, based on each state's deviation from the mean, are similar in magnitude to our main results. We discuss this estimation strategy and the results in more detail in Appendix B.

4.1 Threats to Internal Validity

The primary internal validity concern for our empirical strategy is that Puerto Rico implemented the benefit change when food consumption was increasing and Puerto Rican's were becoming healthier for some other reason. For example, Puerto Rico may have adopted the benefit shift as part of a larger initiative to improve a variety of services for mothers and young children. If this were the case, we might observe improved nutrition and health due to a comprehensive effort to help these cohorts and not because of the benefit shift. However, the cause of the shift was not internally motivated. In fact, it came about as a result of pressure from the U.S. mainland to "align NAP more closely with the regulations that governed SNAP; specifically, regulations on what and where benefits could be used" (ADSEF, 2000). This pressure was motivated by a desire to "encourage and enforce the utilization of the benefit as established in Federal law and regulations only for the acquisition of food." The externally motivated benefit shift is consistent with the evidence provided in Figure 1, which demonstrates a flat trend in fruit and vegetable consumption followed by a sharp jump between 2000 and 2002.

Still, it is possible that the benefit shift coincided with another shock that generated improvements in nutrition and health around or after the point of the benefit shift. To address this concern we conducted an extensive review of Puerto Rican policies and events during this time period.[26] We uncovered few policy shifts or events that seem likely to have

[25] We subtract each states pre-2001 average consumption levels from each observation from that state.

[26] This task was undertaken with the assistance of a Puerto Rican legal researcher with extensive experience

generated the observed results. The greatest potential confounds are the 2001 recession and migration out of Puerto Rico.

While the 2001 recession coincides with the timing of the benefit shift, it seems unlikely to have generated our results as it had similar effects on Puerto Rico and our sets of comparison states. If anything, the recession was somewhat more pronounced in Puerto Rico, which we would expect to negatively affect nutrition and birth outcomes. Regardless, the recession was rather short lived and thus seems unlikely to account for the persistent effects we observe.

Another potential source of confounding variation is differential migration out of Puerto Rico. Migration out of Puerto Rico could yield spurious estimates of improvements in nutrition and health if impoverished families or mothers began leaving the island in greater numbers around the time of the benefit shift. While out-migration did increase somewhat in the early 2000s, the numbers can account for only a tiny fraction of our observed effects. Further, there was no "jump" in out migration that occurred around 2001 that could account for the observed improvements in food consumption and birth outcomes.

5 Results

We employ the difference-in-difference strategy discussed above to estimate the impact of the form of nutritional benefits on food consumption, mother and infant health, and adolescent health outcomes using a variety of data sources. We find that the transition to in-kind benefits in Puerto Rico improved measures of nutrition and mothers health, and yielded long-run effects on the adolescent health of those who experienced early childhood after the shift in benefits.

5.1 Effects on Food Consumption

We find evidence of substantial improvements in nutrition from in-kind relative to cash benefits. While we observe limited measures of food consumption, these results are consistent with economic theory and anecdotal evidence. In columns 1 and 2 of Table 2, we

searching Spanish-language periodicals and reports.

present estimates of Equation 1 using data from BRFSS. We find that fruit and vegetable consumption increased by 0.53-0.56 servings per day (21%) as a result of the transition to in-kind benefits, while fruit juice consumption increased by 0.23 servings per day (28%). These results are robust to changes in the construction of the comparison group, as well as the use of the synthetic control method (method (Appendix Figures A1-A4). The internal validity of our difference-in-differences strategy is supported by event studies that demonstrate a flat (or slightly downward) trend in fruit and vegetable and fruit juice consumption prior the benefit transition, and a large increase just afterward (Figure 1).

The large magnitudes of these nutrition effects is consistent with the large increases in revenue reported by food industry in Puerto Rico after the transition to in-kind benefits. We can inflate our estimates by the fraction of the population enrolled in NAP to estimate the effect on consumption among benefit recipients. Given that 30-40 percent of Puerto Ricans were receiving benefits during this time period, our estimates imply an increase of 1.5 servings of fruit and vegetables per day, which represents a consumption increase of over 50 percent, within the range of the 40 to 60 percent increase in food expenditures expected based on the industrys revenue changes.[27]

5.2 Contemporaneous Effects on Health

We use natality data to explore whether the nutritional improvements from the transition to in-kind benefits were substantial enough to yield observable improvements in the contemporaneous health of mothers and newborn children. Specifically, we estimate the effect of the transition to in-kind benefits on the incidence of diabetes and anemia among mothers and the incidence of low birth weight among newborn children. As discussed above, anemia is ex-ante the most likely outcome to reveal a positive health impact from the switch to in-kind benefits, given the prevalence of iron deficiency and the short-term responsiveness to dietary changes. The incidence of low birth weights could also be affected by changes in food consumption, but this is less likely to be observed, given the relatively low levels of

[27]We return to a discussion of magnitude below.

extreme malnourishment in Puerto Rico during the 1990s and 2000s.

In columns 3 and 4 of Table 2, we present estimates of Equation 1 for low birth weight and maternal anemia. We find no robust evidence of significant effects on low birth weight, but a substantial reduction in maternal anemia of 0.35-0.67 pp (13-23 percent). Table **??** shows that these results are robust to the inclusion of birth and mother covariates. As with the nutrition results, the validity of the maternal anemia estimates is supported by event studies that demonstrate a flat trend in maternal anemia prior to the benefit transition and a relative decrease in Puerto Rican maternal anemia afterward (Figures A7, and A8).[28] The event studies for low birthweight suggest caution in interpreting the difference-in-difference estimates for this outcome, given the lack of parallel trends in the pre-period (Figures A7, and A8).

In columns 5 of Table 2, we present estimates of Equation 1 for maternal diabetes primarily as a placebo test. While diabetes reflects underlying nutrition and health, it is generally understood to be a slow developing, progressive, and long term illness and is unlikely to be affected by short-term changes in food consumption. An estimated effect on maternal diabetes would therefore likely reflect differences in the composition of mothers rather than a change in nutrition from the transition to in-kind benefits. We find no effect on maternal diabetes, providing additional evidence that the transition to in-kind benefits did, in fact, produce the estimated effects on mothers anemia.

5.3 Long-Run Health Effects on Children

Given the observed contemporaneous effects of the transition to in-kind benefits on food consumption and maternal health, a natural question is whether these effects persist. If so, this could suggest an important role for nutrition in explaining the long-run effects on young children of the rollout of food stamps observed by Hoynes, Schanzenbach and Almond (2016). The YRBS data on high school students age 14-18 enable us to explore the long-run health

[28] Due to data restrictions, we are not able to explore heterogeneous treatment effects by education level in the natality data. The natality data includes information on mothers' education level, but a number of states changed the coding of these variables in 2003 and 2004. Because the timing of the change coincides with the post treatment period in this study, we don't conduct any health effect analysis by education subgroups.

effects that the transition to in-kind benefits had on young children. Following Hoynes, Schanzenbach and Almond (2016), we define our treatment variable as the proportion of time an individual was exposed to the in-kind benefits policy from age 0-5. Columns 6 and 7 of Table 2 show our results using this exposure measure. We find that additional exposure to in-kind benefits in early childhood results in increased height and the likelihood of being classified as normal weight in adolescence. For each year of in-kind benefit exposure from age 0 to 5, height increases by 0.04 to 0.06 inches and the likelihood of being normal weight in high school increases 1 pp. Relative to those who never received in-kind benefits during this critical period, exposure for the first five years of life results in an increase in adolescent height of $\frac{1}{6}$ to $\frac{1}{3}$ of an inch and a 5pp (7%) increase in normal weight.

Figures 7 and 10 provide graphical evidence of the effects, demonstrating the relationship between the age at exposure to in-kind benefits and height or normal weight in adolescence. Given the nature of treatment, the presentation is somewhat non-standard, following Hoynes, Schanzenbach and Almond (2016). The horizontal axis presents the number of years between the transition to in-kind benefits (2001) and an individual's year of birth. Those individuals with a value of 0 or less are "fully treated" in that the in-kind benefits were available from the year of their birth onward. Moving to the right, the age at transition to in-kind benefits increases, and therefore childhood in-kind benefit exposure decreases. As observed in the figure, the earlier in an individual's life that the transition to in-kind benefits occurred (and nutrition improved), the larger the increase in height or likelihood of being of normal weight in adolescence. The effects on height and weight in adolescence are largest at or prior to conception and decrease between conception and age 5. Consistent with our estimates representing a causal effect of the transition to in-kind benefit provision, the timing of the transition prior to conception has no effect on the size of the reduction (i.e., the effect of the availability of in-kind benefits is the same for those born one or two years after the transition).[29]

[29]Unfortunately, the timing of the policy change and the availability of data limits our ability to explore effects on cohorts born more than one or two years after the transition.

When combined with previous results, these results suggest that increases in food consumption during early childhood translate into improved health through adolescence.

5.4 Magnitude of Effects

In the absence of spillover effects on non-recipients from the transition to in-kind benefits, the effect of the transition on recipients could be obtained by inflating our results by the fraction of the population enrolled in NAP to estimate average effects for recipients. Given that 30-40 percent of Puerto Ricans were receiving benefits during this time period, this implies an average treatment effect for recipients of 1.5 servings of fruits and vegetables per day, which represents an over 50 percent increase in consumption. Similar calculations suggest reductions in maternal anemia of 1-1.7 percentage points (30-50 percent) as well as substantial increases in height (7-12 percent) and the likelihood of being normal weight (14-18 percent) among recipients.

However, it is unlikely that those receiving NAP were the only ones affected by the transition to in-kind benefits. Puerto Rico is more densely populated than any state, and has a culture that puts a strong focus on family and community. Since the shift in NAP policy constrained roughly 1 out of every 3 people to purchase more food, we expect that a non-trivial portion of that food would be shared with family and neighbors, either through direct gifts of food or by sharing prepared meals with individuals outside the household.

It is also possible that the policy change had substantial general equilibrium effects, such as impacting food prices, the types of foods supplied/consumed, and the location of sellers. Indeed, anecdotal evidence suggests that the policy change had meaningful implications for food distributors across Puerto Rico. One newspaper wrote that,"the commercial food sector, which lobbied intensely [in favor of the in-kind restrictions], has registered significant increases in sales, product of the captive market that provide 75% of the $1.8 billion that the PAN distributes annually in Puerto Rico. A specific estimate of how much sales have risen was not available, but the head of the Socioeconomic Development Administration (Adsef) of the Family, Gretchen Coll, says it is 'very much.'"The large-scale shift may have led to

broader changes in the availability of different foods and/or consumption patterns.

Heterogeneity in the effect of the shift in NAP policy by education level provides further support for spillovers onto non-recipients. In Table 7, we find meaningful increases in food consumption at every education level, including individuals with college degrees who have low rates of NAP eligibility (though the magnitudes of these effects are smaller than for lower levels of education).[30] Even after accounting for higher average consumption of fruits and vegetables among individuals college graduates, these estimates imply a TOT that is twice as large for college graduates as would be expected if NAP recipients in this group were affected similarly as NAP recipients with only a high school diploma. This suggests a substantial spillover of the NAP policy change onto non-recipients with higher levels of education.

The presence of spillover effects has important implications for how we interpret the reduced form and scaled effects of the shift to in-kind benefits. While we discuss above the average treatment effects for recipients implied by NAP participation rates, these inflated estimates are only accurate under the assumption of no spillover effects and are biased upward when spillovers are present. Because spillovers are likely, our main specifications and results focus on the reduced form effect of the policy shift for the population, accounting for direct effects for NAP recipients as well as any spillover and general equilibrium impacts.

6 Discussion and Conclusion

While prior evidence suggests that the FSP increased food consumption and improved short- and long-term health outcomes, it is not clear whether these effects were driven, at least partially, by constraining households' consumption decisions, or whether an equivalent increase in income would have generated the same effects. To shed light on this question, we leverage a natural experiment where Puerto Rico converted a cash benefit to one in which recipients were required to spend 75% of their benefits on approved food items. This allows

[30]Estimates using the 2000 Puerto Rico census suggest that about 13% of those with bachelor's degrees had incomes below the federal poverty line (FPL), compared to 48% of those with only a high-school degree and 63% of high school drop outs.

us to examine the impact of constraining household consumption decisions in the absence of any shock to overall income.

Using a difference-in-differences strategy, we find that providing the benefits in-kind increases fruit and vegetable consumption by 0.5 servings per day (20 percent). These improvements in nutrition led to decreases in maternal anemia of 0.3-0.7 pp (13-23 percent) and resulted in those who grew up after the shift being taller and more likely to be normal weight as adolescents.

Our results conflict somewhat with a body of work that suggest more modest effects of the form of nutritional assistance on food expenditures or health. Most of these results can be reconciled when one considers the degree to which program participants' food consumption levels are constrained by the generosity of the in-kind benefit. Given the lack of a binding constraint and the subsequent minimal effects on food consumption and nutrition it is perhaps not surprising that prior studies were unable to detect effects on health. Unlike in most prior cash out evaluations, the majority of benefit recipients in Puerto Rico were constrained by the shift to in-kind benefits. This resulted in large increases in food consumption and subsequent improvements in health.

While the results provide compelling evidence that the form of the benefit can matter, the analyses are not without limitations. First, the strength of the evidence is limited by the nature of the variation. The estimates rely critically on a comparison of outcomes across time in Puerto Rico and how those outcomes evolved relative to outcomes in sets of comparison states in the U.S. While we are unaware of other policy changes or events that could have generated these effects, we present the results with this caution in mind. Second, it is important to emphasize that the results do not imply that in-kind benefits are welfare improving over cash, but rather that individual spending may not prioritize health, particularly of young children, under a cash-based system. This may have additional implications for the long run costs of cash vs in-kind benefits, particularly when low income individuals have medical costs that are covered or subsidized by the government. A more

holistic understanding of the costs and benefits of provision of benefits in-kind or in cash is outside the scope of this work.

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7 Figures and Tables

Table 1: Summary Statistics

	(1) All Comparison States	(2) 10 Poorest States	(3) Puerto Rico
Panel A: BRFSS			
Female	0.60	0.63	0.64
Age	48.68	48.77	49.15
Daily Servings of Fruit and Vegetables	3.83	3.71	2.97
Daily Servings of Fruit Juice	0.65	0.61	0.90
Income Below 10k	0.05	0.07	0.36
Income Above 50k	0.35	0.29	0.05
Graduated High School	0.96	0.93	0.78
Graduated College	0.31	0.26	0.22
Observations	1,829,113	308,772	29,924
Panel B: Natality			
Mother's Diabetes	0.03	0.03	0.02
Mother's Anemia	0.02	0.03	0.03
Low Birth Weight	0.08	0.09	0.11
Plural Birth	0.03	0.03	0.02
Observations	27,591,343	3,574,871	389,729
Panel C: YRBS			
Female	0.51	0.52	0.50
Age	15.77	15.79	15.74
Hispanic	0.19	0.18	0.20
Weight (lbs)	146.91	150.45	147.04
Normal Weight	0.67	0.62	0.65
Height (in)	66.57	66.60	66.33
Observations	449,867	57,916	7,412

Note: Table presents descriptive statistics for each data set used in analysis. Statistics are shown separately for all states, the 10 poorest states, and Puerto Rico as indicated by column titles.

Table 2: Main Outcomes

	BRFSS		Natality			YRBS	
	(1) Fruit and Vegetables	(2) Fruit Juice	(3) Low Birth Weight	(4) Mother's Anemia	(5) Mother's Diabetes	(6) Normal Weight	(7) Height in Inches
Panel A: All States							
PR*Post	0.5306***	0.2290***	0.0005*	-0.0035***	-0.0006	0.0385***	0.1904***
	(0.0167)	(0.0046)	(0.0003)	(0.0008)	(0.0006)	(0.0034)	(0.0464)
Observations	1,236,218	1,219,453	27,555,353	26,350,409	27,294,011	454,397	454,397
Panel B: 10 Poorest States							
PR*Post	0.5576***	0.2253***	-0.0008	-0.0067***	-0.0001	0.0514***	0.3216**
	(0.0546)	(0.0120)	(0.0007)	(0.0016)	(0.0007)	(0.0054)	(0.1021)
Observations	222,938	217,407	3,924,711	3,769,091	3,899,538	57,501	57,501
PR Pre-Treatment Average	2.67	0.81	.11	.03	.02	0.68	65.46

Note: Each coefficient is the result of a separate regression. Panel A displays the results when all states are included in the comparison group, while panel B restricts the comparison group to include only the 10 poorest states. Outcomes are indicated by column titles, with the data source for each outcome indicated by its multi-column header. All standard errors are clustered at the state level. Significance levels indicated by: * ($p<0.10$) **($p<0.05$), ***($p<0.01$).

Table 3: Natality - With or without controls

	(1) No Controls	(2) All Controls
Panel A: Low Birthweight		
Low Birthweight: Poor States	-0.0003	-0.0008
	(0.0009)	(0.0007)
Low Birthweight: All States	0.0004*	0.0005*
	(0.0002)	(0.0003)
Panel B: Anemia		
Anemia: Poor States	-0.0068***	-0.0067***
	(0.0016)	(0.0016)
Anemia: All States	-0.0037***	-0.0035***
	(0.0008)	(0.0008)
Panel B: Diabetes		
Diabetes: Poor States	-0.0018	-0.0001
	(0.0012)	(0.0007)
Diabetes: All States	-0.0016**	-0.0006
	(0.0008)	(0.0006)

Note: Each coefficient is the result of a unique regression, where the outcome variable and comparison set is indicated by the row label. Both columns include state and year fixed effects. The second column also includes all controls used in our main analysis (education level, birth month, race, plural birth, and birth order). Standard errors are clustered at the state level. Significance levels indicated by: * ($p<0.10$) **($p<0.05$), ***($p<0.01$).

Table 4: Natality by Marital Status

	(1) Low Birth Weight	(2) Anemia	(3) Diabetes
Panel A: All States			
PR*Post*Married	-0.001***	-0.007***	0.001
	(0.000)	(0.001)	(0.001)
PR*Post*(Married or Cohabiting)	-0.001***	-0.004***	-0.001
	(0.000)	(0.001)	(0.001)
PR*Post*(Not Married)	0.002***	-0.000	-0.001*
	(0.001)	(0.001)	(0.000)
PR*Post*(Not Married or Cohabiting)	0.005***	-0.000	-0.000
	(0.001)	(0.001)	(0.000)
Panel B: 10 Poorest States			
PR*Post*Married	-0.002**	-0.009***	0.001
	(0.001)	(0.001)	(0.001)
PR*Post*(Married or Cohabiting)	-0.001*	-0.007***	-0.000
	(0.001)	(0.001)	(0.001)
PR*Post*(Not Married)	0.000	-0.004	-0.001
	(0.001)	(0.003)	(0.001)
PR*Post*(Not Married or Cohabiting)	0.002*	-0.004	0.000
	(0.001)	(0.003)	(0.001)
PR Pre-Treatment Average	.11	.03	.02

Note: This table shows Natality results by marital status. Each coefficient is the result of a separate regression. Outcomes, comparison groups, and marital status are indicated by column titles, panel labels, and row labels respectively. All standard errors are clustered at the state level. Significance levels indicated by: * ($p<0.10$) **($p<0.05$), ***($p<0.01$).

Table 5: BRFSS by Marital Status

	(1) All	(2) Married	(3) Married or Cohabiting	(4) Not Married	(5) Not Married or Cohabiting
Panel A: All States					
Daily Servings of Fruits & Vegetables	0.531***	0.445***	0.458***	0.637***	0.480***
	(0.017)	(0.017)	(0.016)	(0.019)	(0.017)
Daily Servings of Fruit Juice	0.229***	0.219***	0.225***	0.243***	0.221***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Observations	1,219,453	666,219	696,818	549,617	1,017,215
Panel B: 10 Poorest States					
Daily Servings of Fruits & Vegetables	0.558***	0.472***	0.480***	0.662***	0.504***
	(0.055)	(0.045)	(0.046)	(0.066)	(0.052)
Daily Servings of Fruit Juice	0.225***	0.207***	0.215***	0.250***	0.215***
	(0.012)	(0.011)	(0.011)	(0.016)	(0.012)
Observations	217,407	114,749	118,974	102,113	180,736

Note: Significance levels indicated by: * (p<0.10) **(p<0.05), ***(p<0.01).

7.1 BRFSS Figures

Figure 1

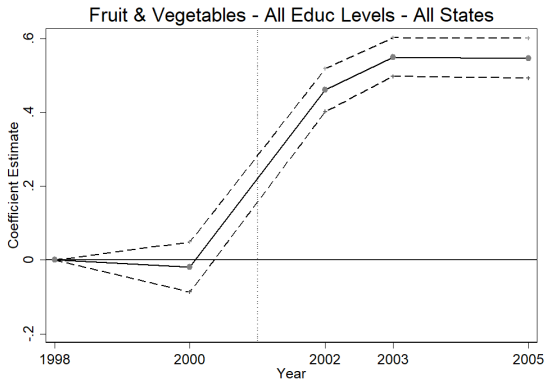


Figure 2

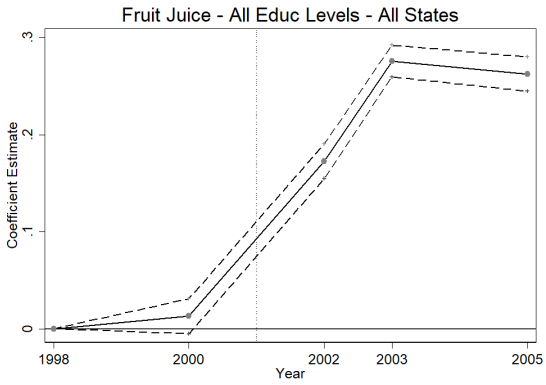


Figure 3

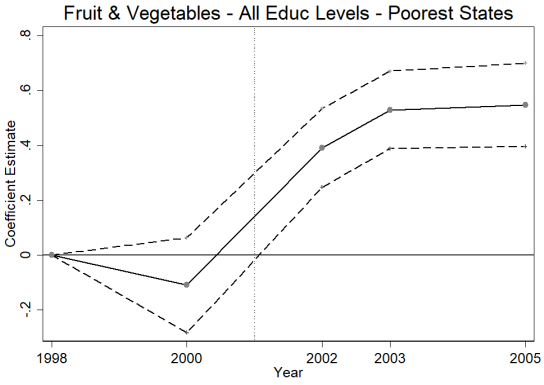
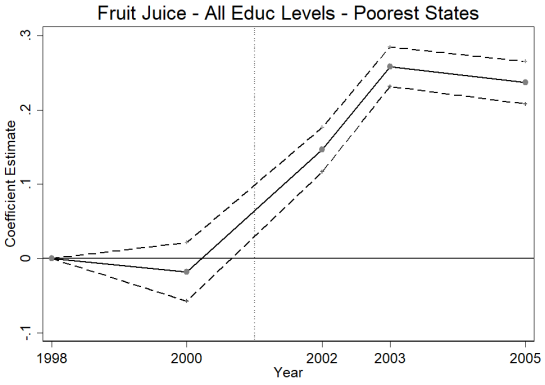


Figure 4



7.2 Natality Figures

Figure 5: Natality Outcomes: All States

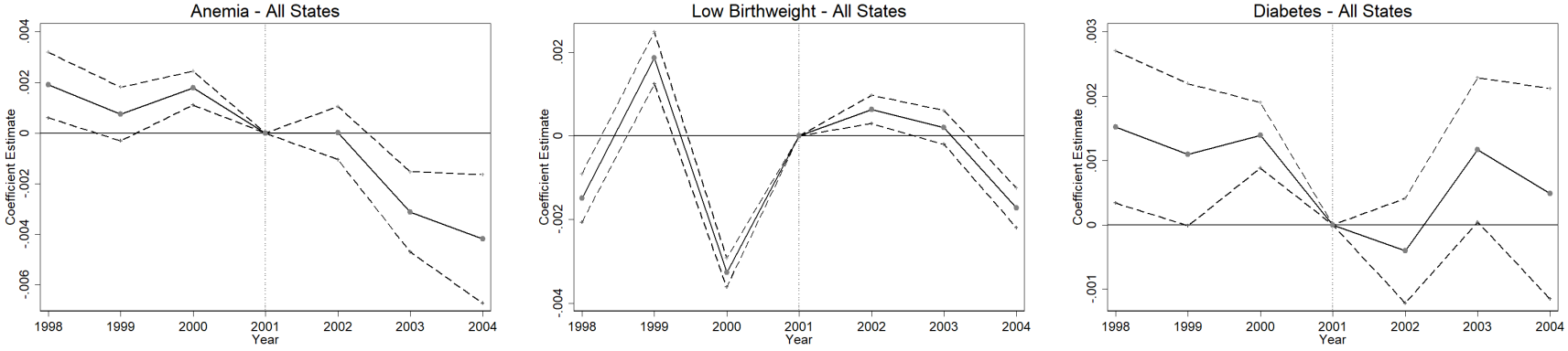
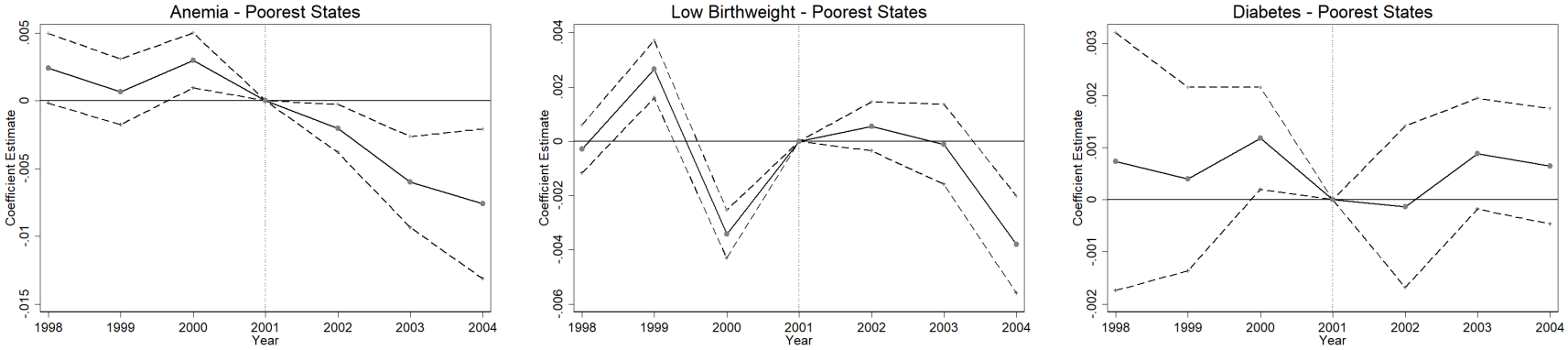


Figure 6: Natality Outcomes: 10 Poorest States



7.3 YRBS Figures

Figure 7: All States

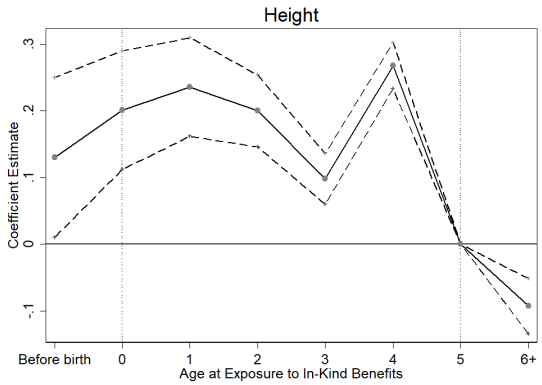


Figure 8: All States

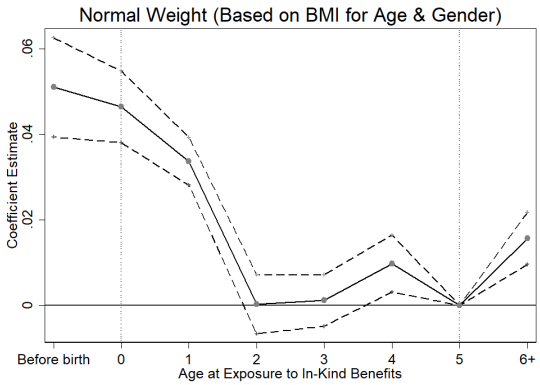


Figure 9: 10 Poorest States

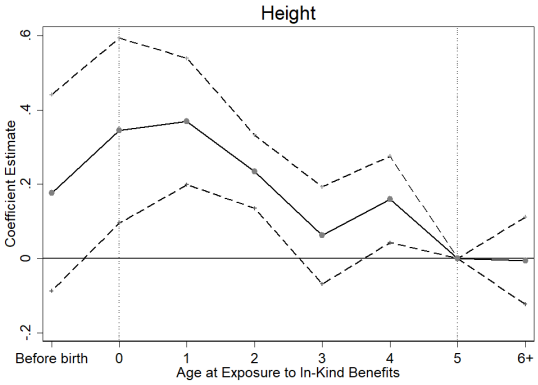
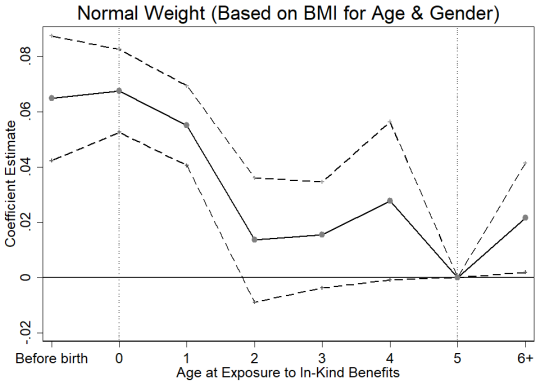


Figure 10: 10 Poorest States



A Additional Tables and Figures

Table 6: BRFSS Results by Education Level

	(1) All	(2) Dropout	(3) High School Diploma	(4) Some College	(5) Bachelor's Degree
Panel A: All States					
Daily Servings of Fruits & Vegetables	0.531***	0.587***	0.623***	0.559***	0.415***
	(0.017)	(0.019)	(0.017)	(0.018)	(0.020)
Percent Change	19.9	24.3	24.3	20.7	13.3
Daily Servings of Fruit Juice	0.229***	0.183***	0.269***	0.236***	0.216***
	(0.005)	(0.008)	(0.005)	(0.006)	(0.006)
Percent Change	28.3	25.4	33.3	27.8	24.5
Observations	1,219,453	134,941	380,692	329,336	371,905
Panel B: 10 Poorest States					
Daily Servings of Fruits & Vegetables	0.558***	0.633***	0.638***	0.567***	0.452***
	(0.055)	(0.030)	(0.051)	(0.051)	(0.080)
Percent Change	20.9	26.2	24.9	21.0	14.5
Daily Servings of Fruit Juice	0.225***	0.202***	0.267***	0.226***	0.205***
	(0.012)	(0.012)	(0.011)	(0.016)	(0.018)
Percent Change	27.8	28.1	33.0	26.6	23.3
Observations	217,407	37,256	71,225	52,943	55,463
PR Pre-Treatment Average	0.81	0.72	0.81	0.85	0.88

Note: Significance levels indicated by: * (p<0.10) **(p<0.05), ***(p<0.01).

Table 7: Natality - Composition of Births

	Education				Race		Other	
	(1) No HS Diploma	(2) HS Diploma	(3) Some College	(4) Earned BA	(5) White	(6) Black	(7) First Child	(8) Number of Births
Panel A: All States								
PR*Post	-0.032***	0.024***	0.010***	-0.003	-0.009***	0.016***	0.013***	-8780.438***
	(0.003)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(625.515)
Observations	21,461,549	21,754,521	21,461,549	21,461,549	27,981,072	27,981,072	27,836,044	364
Panel B: 10 Poorest States								
PR*Post	-0.034***	0.028***	0.004**	0.002	-0.019***	0.024***	0.019***	-7723.250***
	(0.005)	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(874.788)
Observations	3,027,519	3,062,206	3,027,519	3,027,519	3,062,206	3,062,206	3,054,231	77
PR Pre-Treatment Average	.27	.29	.23	.21	.92	.08	.43	58790

Note: Each coefficient is the result of a unique regression, where the outcome variable is indicated by the column title. Regressions include state and year fixed effects and no other controls. Regressions for education outcomes exclude 9 comparison states that adjusted their coding of education categories in the post period. Standard errors are clustered at the state level. Significance levels indicated by: * ($p<0.10$) **($p<0.05$), ***($p<0.01$).

B Synthetic Control

Table A1: Main Outcomes

	BRFSS		Natality		
	(1) Fruit and Vegetables	(2) Fruit Juice	(3) Low Birth Weight	(4) Mother's Anemia	(5) Mother's Diabetes
Demeaned Outcomes					
Puerto*Post	0.480	0.232***	0.003	-0.002	-0.001
	(0.115)	(0.038)	(0.885)	(0.256)	(0.269)
	[0.019]	[0.019]	[0.192]	[0.605]	[.904]
Not Demeaned					
Puerto*Post			0.005	-0.004*	-0.003
			(0.788)	(0.093)	(0.192)
			[0.038]	[0.349]	[0.596]
PR Pre-Treatment Average	2.7	0.8	.11	.03	.02

Note: Natality post period is defined as starting 2002. P-Values (Calculated from Post-treatment RMSE divided by Pre-treatment RMSE) are in parentheses and significance levels indicated by: * (p<0.10) **(p<0.05), ***(p<0.01). Standard Random Inference P-Values are in brackets.

B.1 BRFSS Results

Figure A1

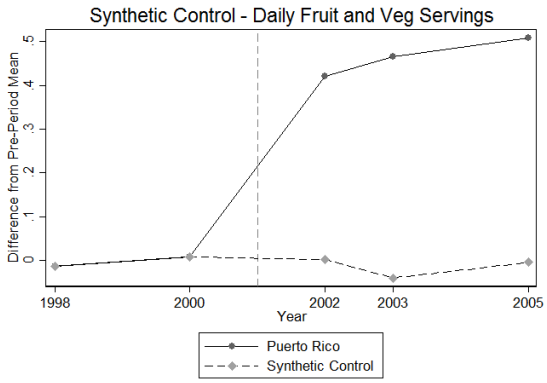


Figure A2

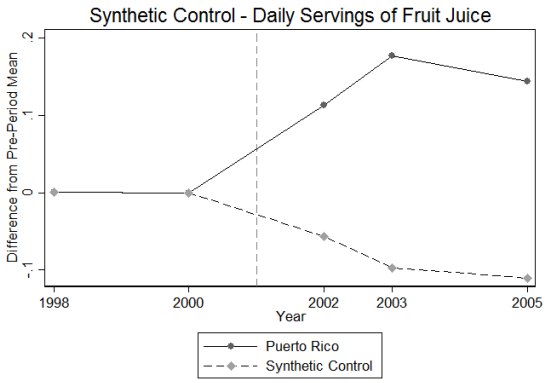


Figure A3

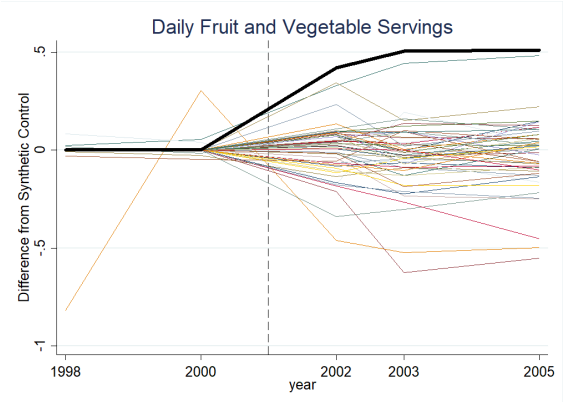
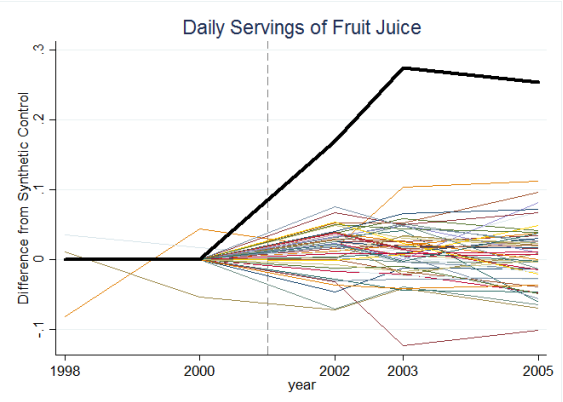


Figure A4



B.2 Natality Results

B.2.1 Demeaned Outcomes

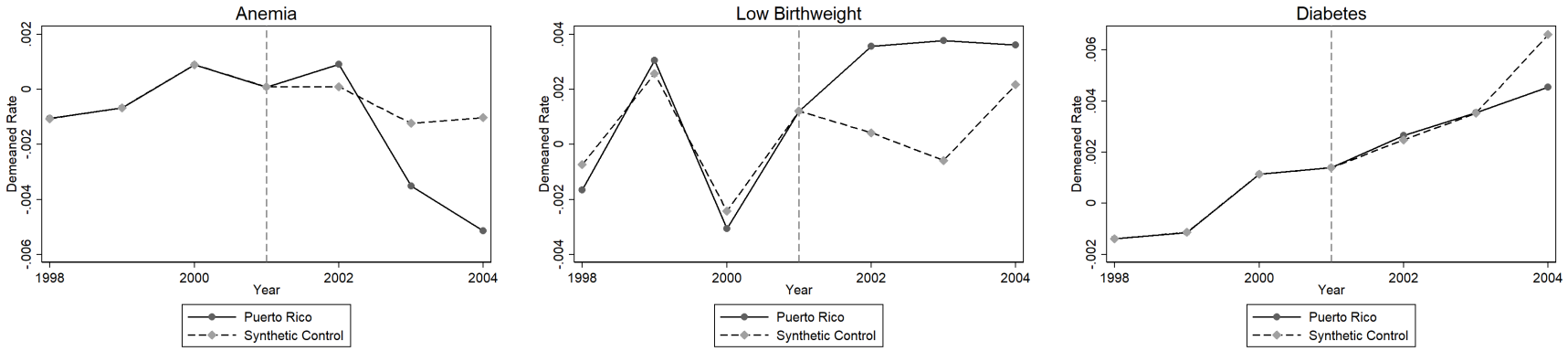


Figure A5

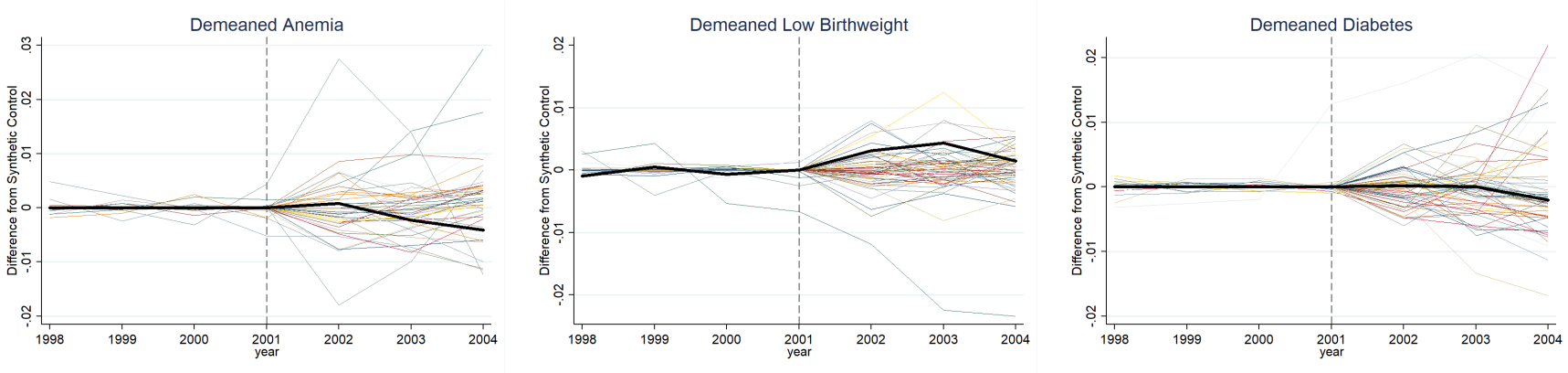


Figure A6

B.2.2 Not Demeaned Outcomes

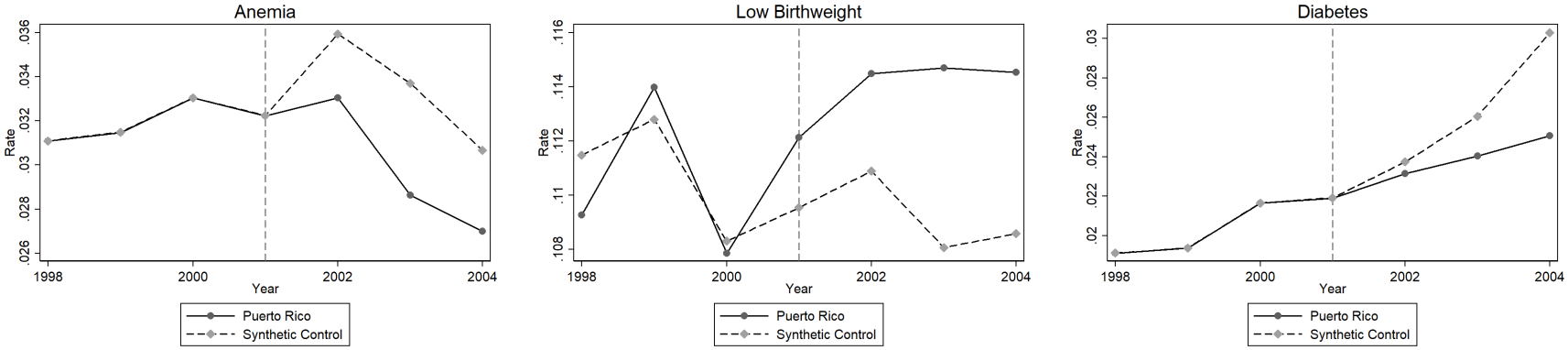


Figure A7

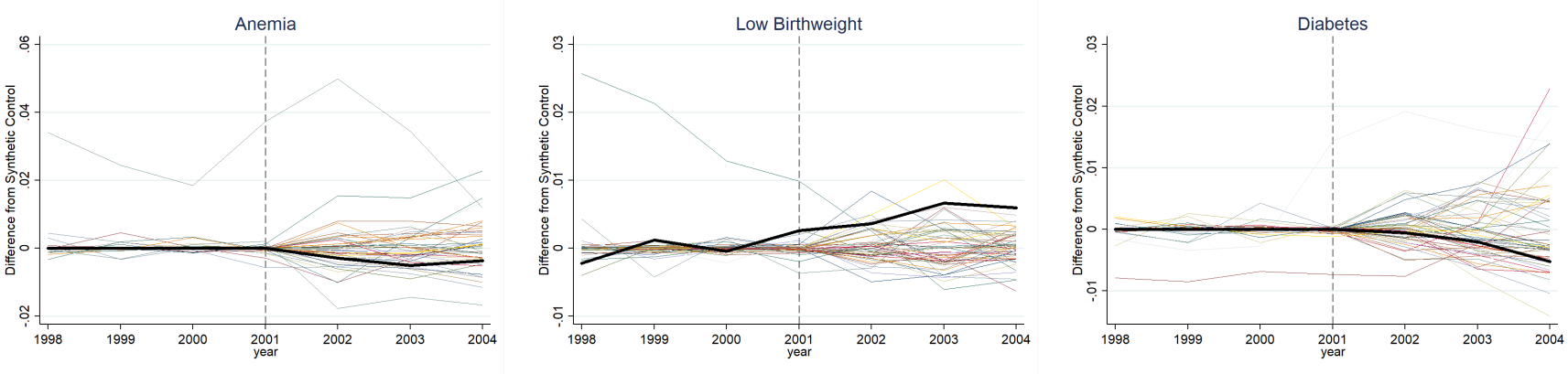


Figure A8