The Vital Role of Cash Transfers: Lessons from the Largest Energy Subsidy Reform in the Developing World

By MOHAMMADALI MOKHTARI*

This paper examines the effect of the 2010 energy subsidy reforms in Iran, which provided monthly lump-sum payments to Iranian citizens, excluding non-Iranian residents. We show that the reform generates a 17% income gap and a 12% poverty rate gap between cash and non-cash recipients, leading to a nutrition gap and changes in parental behaviors affecting children. Health data reveal a growth gap for children exposed to the reform early in life, especially among low-income groups. Counterfactual analysis shows that without transfers, cash recipients would share similar poverty rates and income distributions with non-cash recipients.

JEL: H23, H31, H51, I14, I15

Keywords: Energy subsidies, Cash Transfers, Poverty, Children's Health, Iran.

I. Introduction

Energy subsidies for fossil fuels contribute to global warming and economic distortions, resulting in regressive wealth distribution and environmental damage (Mukherjee et al., 2023). Despite the clear need for reform, reducing these subsidies often faces public resistance, leading to reversals or delays (Clements et al., 2013).[2] To mitigate adverse effects on low-income households, replacing energy subsidies with cash transfers has been proposed. However, empirical evidence on the effectiveness of these transfers in protecting low-income households following such reforms is scarce (Davis, 2014; Rentschler & Bazilian,

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[2] Reversals or delays have been observed in Bolivia (2010), Cameroon (2008), Nigeria (2012), Venezuela (1989), and Yemen (2005). Recent protests include the Yellow Vest movement in Europe (2018) and demonstrations in Iran, Ecuador, and Zimbabwe (2019).

2017; Todd et al., 2015). This paper aims to bridge the research gap by focusing on the 2010 Iranian reform, the largest of its kind.

In December 2010, Iran underwent its most extensive subsidy reform, significantly reducing energy subsidies and raising energy and bread prices by a factor of 1.6 to 9. To counterbalance this increase, the government introduced a universal, unconditional cash transfer of $45 per month ($90 adjusted for purchasing power parity, PPP) to each Iranian citizen, while 3% of the population, mostly non-Iranian residents, were excluded from these cash transfers[3]. We analyze the broad outcomes for these two groups to understand how the disparities in cash transfers affect them. Additionally, we create counterfactual scenarios to understand the income distribution of 97% of cash recipients in the absence of these transfers. The counterfactual analysis indicates that, without cash transfers, the poverty rates and income distributions of 97% of cash recipients would be similar to those of the 3% non-cash recipients. Employing a difference-in-differences (DiD) method on a rich panel dataset detailing income sources and food expenditures, we examine households' income and nutrition before and after the reform. Our analysis reveals significant disparities in outcomes between these two groups after the reform. Exclusion from cash transfers leads to a 17% decrease in real incomes and a 12% increase in the poverty rate among non-cash recipients. Our findings suggest a possible explanation for the protests by the lower-income group in November 2019 following a similar reform with less generous income compensation.

We also use a comprehensive health dataset from the Urban Health Equity Assessment and Response Tool (HEART) to determine the reform's impact on children's health. Higher exposure to the reform in early life leads to a divergence in weight and height between Iranian and non-Iranian children, with a more significant impact on height.

We explore the household responses to the lump-sum transfers using quantitative data to measure the amount and composition of calorie intake and qualitative questions to assess the extent of starvation felt over the last month.

[3] These households explicitly reported not receiving cash transfers in one dataset and being non-Iranian in another dataset. Without using this fact, we show later that they are almost identical.

Non-cash recipients experience as much as a 14% decrease in nutritional intake and are more likely to suffer from severe calorie deficits, defined as consuming fewer than 1,500 calories daily. This calorie deficit is consistent with the findings from a qualitative analysis of another survey, showing that these households are more likely to suffer from starvation and a lack of food. These effects persist even when we match the two groups on broad socio-economic factors and control for confounders. Additionally, we observe changes in the health behaviors of households. There is a significant increase in childbirths outside hospitals among non-cash recipients, while vaccination rates, as a free health service in the country, remain consistent before and after the reform.

Our study contributes to two key areas of research: First, to the implications of energy subsidy reforms and the substitution of cash transfers for energy subsidies, and second to the expanding field of how early-life economic circumstances shape child outcomes. In the context of energy subsidy reforms, the role of cash transfers as a safety net is crucial in understanding the barriers to reforming energy subsidies, particularly fossil fuel subsidies (Gupta et al., 2014; Mukherjee et al., 2023; Sala-i-Martin et al., 2008). To the best of our knowledge, this is the first paper to study the broad outcomes for two groups—cash recipients and non-cash recipients—following the transition from energy subsidies to cash transfers.

Our study adds to the literature on economic shocks around birth and their effects on children, with increasing evidence indicating that early-life economic shocks have significant, long-lasting effects on health and human capital formation (Almond & Currie, 2011; Heckman, 2000, 2012; Currie, 2009, 2020; Strauss & Thomas, 1998). While the existing literature robustly demonstrates the impact of parental exposure to income shocks on children's health and human capital, few studies investigate how income shocks affect parents' nutrition and investments in children (Almond et al., 2018; Currie, 2020; Mokhtari, 2023). Our study uses detailed data to document how household behavior changes and how these changes affect investment in children after a significant income shock, particularly in developing countries. To provide context, we briefly review the existing literature on the impact of economic shocks and interventions on child health and development. For instance, the US food stamp program positively impacts birth weights (Almond & Currie, 2011). In contexts like Norway and Ghana, economic

booms disproportionately benefit low-income families, resulting in improved health outcomes for children (Løken et al., 2012; Adhvaryu et al., 2019). Conversely, job losses during pregnancy lead to lower birth weights, demonstrating the adverse effects of economic downturns on child health (Lindo, 2011; Carlson, 2015).

Height is widely recognized as a critical indicator of health and human capital (Case & Paxson, 2008; Deaton, 2007; Deaton & Arora, 2009; Vogl, 2014). In Iran, few studies examine the long-term effects of early-life malnutrition on this measure. Karimi et al. (2021) find that in-utero exposure to Ramadan fasting negatively affects adolescent heights. Dadgar et al. (2020) examine the effects of the 1941-1943 famine and find that individuals exposed to the famine during early life experience significant reductions in height.

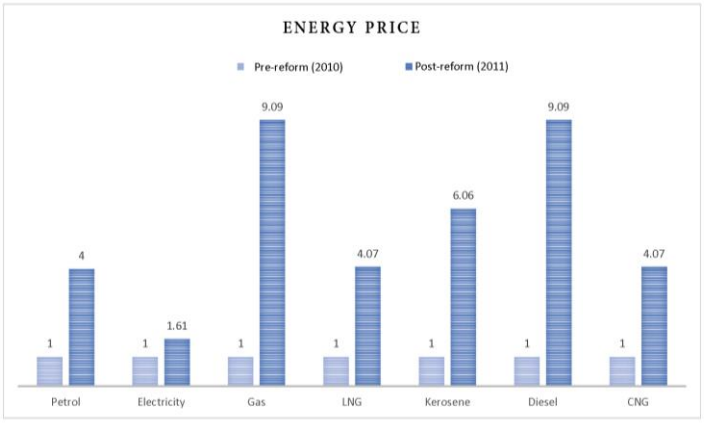
II. Context

A. Energy Subsidies Reform Plan of Iran in 2010

Energy subsidies have long been crucial in Iran's economy, with gasoline heavily subsidized. Following the Islamic Revolution, these subsidies grew to over 20% of GDP, making Iran the world's least energy-efficient country (Guillaume et al., 2011). Various governments attempted to eliminate these subsidies, but significant changes were implemented only during President Ahmadinejad's tenure. In December 2010, he discontinued energy and bread subsidies in a historic move, pledging monthly cash compensation to citizens. This plan was "the biggest surgery" in half a century and "one of the largest undertakings in Iran's economic history." As we will discuss in the last section, according to the International Energy Agency (2023), in 2023, Iran leads globally in fossil fuel subsidies at 36% of GDP. It ranks second in absolute terms at 120 billion USD. The stylized fact underscores the urgency and motivation for this study. Figure 2 summarizes the price changes and inflation after the reform. Panel A depicts the changes in energy prices. Panel B depicts monthly inflation in the months preceding the December 2010 reform. During the first quarter of 2011, energy prices rose unexpectedly, causing monthly inflation from 1% to more than 3%. The unexpected inflation

after the reform, generate an income shock for households without cash transfers compensation scheme.

Panel A. Energy price before and after the reform



Panel B. Monthly inflation around the reform

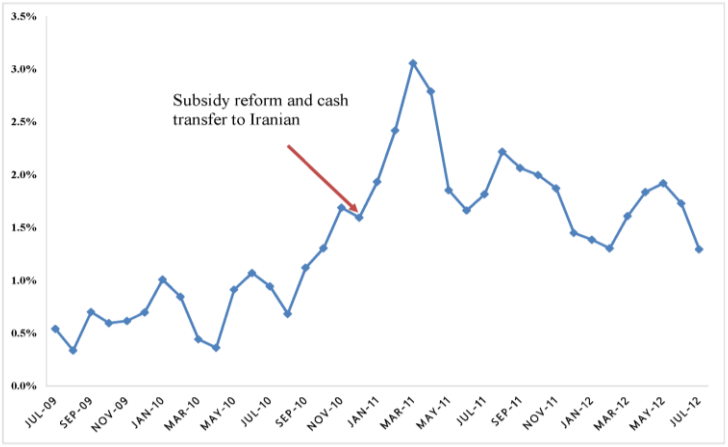


FIGURE 1. ENERGY SUBSIDY REFORM, 2010 IRAN, PRICE ADJUSTMENT AND MONTHLY INFLATION AFTER THE REFORM.

Notes: Panel A shows the change in energy prices. Panel B shows the monthly inflation rate in urban areas around the time of reform.

Source: Statistical Center of Iran.

Cash transfers. The cash transfers constituted approximately 45 US dollars, or 90 USD PPP, per person per month. By 2011, the program's first full year, about 75 million individuals received transfers, amounting to 6.5% of GDP. These monthly transfers, worth about 90 USD PPP per person and 28 percent of the median per capita household income, significantly boosted recipients' incomes, especially the poor. Iran's transfer program has been praised as innovative, free of leakage, and, compared to subsidized energy, a much more efficient and equitable

way to distribute the nation's natural wealth (Guillaume et al., 2011). Poverty and inequality declined in subsequent years because the poor were more than compensated for higher bread and energy prices.

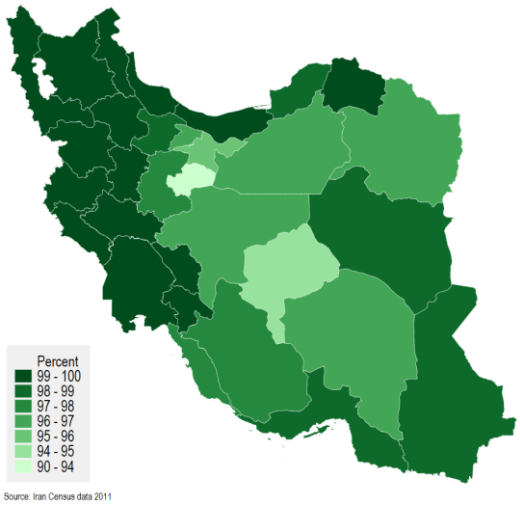
Studies have reported that cash transfer coverage ranged from 95% to 98% in the first years after the reform according to official governmental sources (Mokhtari & Ghoddusi, 2024). In our sample, weighted data shows the ratio was slightly below 97% and persistent over three years after the reform (2011- 2013). Questions arise about the remaining 3 %. The Iranian reform was designed to be universal for Iranians, at least for the first three years, except for rich people who voluntarily resigned from receiving transfers. Therefore, it is unlikely that poor Iranians did not receive transfers. We will return to this point later and, for the first time in this context, show that most of the 3% of non-cash recipients were non-Iranians residing in the country.

B. Cash transfer recipients and non-Iranian residents of Iran

Based on Iranian subsidy reforms, cash transfers are universal but only for Iranians. Being non-Iran implies not receiving cash transfers, but the inverse relation is still being determined, and we do not use it for our analysis. However, we show that the ratio of Iranians that received cash is very high and highly correlated with the ratio of Iranians in provinces of Iran. We examine the geographical distribution of non-Iranians across Iran's 31 provinces based on the 2011 census, as depicted in Figure 2, Panel A. We then analyze the percentage of cash subsidy recipients using our data set (household income and expenditure data from the same year), presented in Figure 2, Panel B.

The correlation between the share of cash recipients and the share of non-Iranians is 0.97, which is statistically significant. Despite this descriptive evidence, we take a conservative approach. In the paper, when the data do not have the nationality but receive cash or not, we report the impact of not receiving cash, which is the main subject of our study. When we have a nationality, we report it as non-Iranian, who undoubtedly does not receive cash transfers.

Panel A. Share of Iranian in the country's provinces in



Panel B. Share of cash transfer recipients in 2011

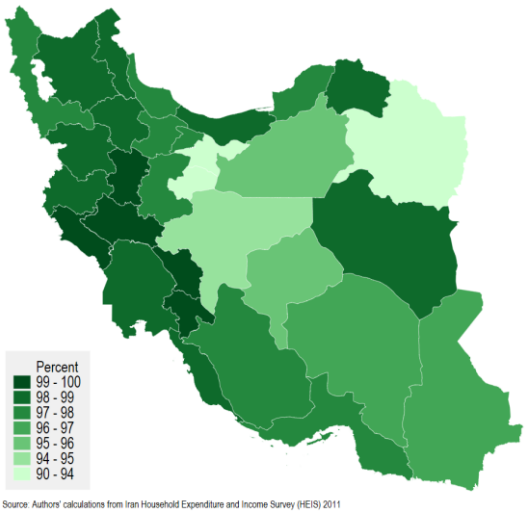


FIGURE 2. SHARE OF NON-IRANIAN RESIDENTS OF IRAN AND SHARE OF NON-CASH RECIPIENTS IN 2011

Notes: Panel A shows the share of Iranians in the country's provinces in 2011. Source: Iran Census data 2011. Panel B shows the share of cash transfer recipients in 2011. Source: Statistical Center of Iran.

III. Data

A. Household Expenditures and Income Survey (HEIS)

We use two main data sources. The first is the Household Expenditure and Income Survey (HEIS), conducted annually by the Iranian Statistical Center (SCI) since the 1960s. This nationally representative survey covers approximately 38,000 households annually, through stratified provincial and district-level sampling. Each household group is randomly divided into 12 sections and interviewed annually in a different month. The HEIS provides comprehensive data on household expenditures and incomes, including detailed information on food expenditures, costs, and quantities. This dataset has been utilized in prior studies on Iranian subsidy reform in 2010.

For our analysis, we use the entire sample from three years before (2008-2010) and three years after the reform (2011-2013). For causal analysis, we focus on an intact panel from 2010 and 2011. The 2010 HEIS, conducted before the subsidy reform, lacked cash transfer items. However, the 2011 survey included specific items for subsidy cash transfers, enabling us to identify households receiving or not receiving transfers in 2011 and link them to 2010 based on their address. HEIS is not a true panel dataset but a rotating panel. Since the survey aims not to follow households over time, even the same address may correspond to different households across years.

Constructing a reliable panel from this rotating data involved matching the household head's age, gender, and house size over the two years, minimizing measurement errors. Given the continuity in variables such as household head age and house size, mismatches across the two years are highly unlikely. However, in addition to missing households that moved from their address, there remains the possibility of missing some households due to changes in the household head caused by events such as death or divorce, which could result in the sample no longer being representative of the country. This approach resulted in a 12,527-household panel per year. To address the impact of income outliers, we excluded 258 households (2% of the panel) with daily income or expenditure exceeding $50 per capita, resulting in a final panel of 12,269 households over two years. Due to

trends in household size in Iran over time, we did not restrict the panel to households of identical sizes across years.

Several survey variables, such as income, food expenditure, and quantities, are reported at the household level and adjusted to per capita values for outcome analysis. Monetary values were converted to USD PPP using the 2010 exchange rate approximation of 10,000 Iranian Rial (IRR) to 1 USD before PPP adjustment at the end of 2010. We also adjusted for inflation using the consumer price index (CPI) ratio between the two years. Table 1 presents baseline and outcome comparisons between cash recipients and non-cash recipients before (2010) and after (2011) the reform.

In addition to address, matched households must have the same home size, age, or gender of the head (our matching criteria).

Income: As anticipated, our findings indicate an increase in real income for cash recipients, which rose from 10.36 to 11.15 USD PPP. Conversely, non-cash recipients experienced a decline in real income, dropping from 10 to 9.45 USD PPP.

Nutrition: The nutrition data shows that cash recipients had a smaller calorie intake (from 3,211 to 3,145 Kcal) than non-cash recipients (from 3,014 to 2,834 Kcal), suggesting better dietary maintenance, possibly due to cash transfers. This trend is also evident in the consumption of fats, carbohydrates, and proteins, with minimal changes for cash recipients but more pronounced decreases for non-cash recipients, particularly in carbohydrates and proteins. The widening gap in 2011, especially in calories and carbohydrates, highlights the potential vulnerability of non-cash recipients to income shocks.

TABLE 1— SUMMARY STATISTICS INTACT PANEL 2010–2011

	Panel Cash Recipient		Panel Non-cash Recipient	
	(1) 2010	(2) 2011	(3) 2010	(4) 2011
Area of Home	92.50	92.50	76.32	76.32
Age of Head	49.96	50.96	45.80	46.80
Male Head of HH	0.89	0.89	0.78	0.78
Income				
Real Income *(Daily per capita in USD PPP)*	10.36	11.15	10.00	9.45
	(7.69)	(8.23)	(8.31)	(8.49)
Amount of Food per capita daily				
Nutrition intake (Kilo Calorie)	3211	3145	3014	2834
	(2113)	(1822)	(1805)	(1841)
Fat (Grams)	91.53	91.04	89.35	86.07
	(64.11)	(61.84)	(67.00)	(62.32)
Carbs (Grams)	501.1	487.8	466.2	430.4
	(373.2)	(303.7)	(300.4)	(316.6)
Protein (Grams)	91.94	89.71	85.45	82.59
	(60.49)	(50.30)	(48.31)	(55.24)
Socio Economics				
	(0.50)	(0.50)	(0.50)	(0.50)
Family size	4.16	4.09	4.11	4.14
	(1.79)	(1.77)	(2.53)	(2.41)
Married	0.88	0.88	0.80	0.80
	(0.32)	(0.32)	(0.40)	(0.40)
Observations (HH)	12,112	12,112	157	157

Note: The panel was derived from HEIS 2010-2011 rotating panel. Monetary data are in USD and daily terms based on the dollar parity rate, and nutritional data stems from nourishment calculations and the questionnaire's 234 food types. No weights are applied in this table due to the non-representative nature of the sample from the 2010-2011 panel data.

Source: Authors' calculations using HEIS 2010–2011.

B. Health Equity Assessment and Response Tool (HEART)

This study uses the Urban HEART dataset to examine whether income shocks affect children's health. The World Health Organization (WHO) Center for Health Development conducted the second wave of the HEART project survey in 2011–2012 across cities worldwide, including Tehran. During the last quarter of 2011,

the Municipality of Tehran conducted a randomized household survey that collected data on heights, weights, health, and socioeconomic factors from 33,915 households and 118,464 individuals. Our focus is on children under six or those born after January 1, 2005. To ensure robustness, we also included data from previous cohorts. Despite instructions for accurate measurements of individuals' height and weight using machines, the data included some unacceptable values for both variables. To mitigate measurement errors, we limited our primary analysis to children's height and weight within five standard deviations, but the results are robust to different exclusion criteria and nonacceptable numbers (see Appendix). The survey also included information on nationality, district, and parents' education and occupation in four categories. Due to the small representation of non-Iranian individuals (less than 3% of the sample), some variables were missing, presenting a trade-off when including covariates. In addition to the exact date of birth, sex, and nationality available for all children born after 2005, we included a set of covariates with minimal missing data. These covariates consist of 14 dummies, covering four levels of education and occupation for the head of the household, four levels of district income, and dummies for unemployment status and home ownership. We also use these 14 covariates for robustness tests of results using matching methods by Inverse Probability Weighting (IPW) and Regression Adjustment (RA).

Our final sample size without covariates is 5,015 children, including 4,873 Iranians and 142 non-Iranians. When covariates are included, the sample size slightly decreases to 4,743 Iranians and 134 non-Iranians. We analyze the data with and without covariates.

*Adjustment for Age and Sex***:** Comparing the height and weight of children of different ages and sexes is inaccurate. To address this, we adjusted the height and weight of children below six years for age (monthly in the primary analysis and daily up to 36 months for robustness) and sex using the World Health Organization Child Growth Standards. These growth charts compare a child's height and weight against median values corresponding to age and sex, providing insights into a child's growth and nutritional status over time (WHO, 2006)[4].

[4] For more details, see the https://www.who.int/tools/child-growth-standards/.

Table 2 displays summary statistics for Iranian and non-Iranian children over two periods: 2005—2009, with minimal or no exposure to the reform, and 2010—2011, during which children were exposed to the reform either in utero or in their first year. We group them into these two periods because, as shown later, the main adverse effects are observed in the 2010, and 2011 cohorts.

TABLE 2— SUMMARY STATISTICS OF THE URBAN HEART

Variable	Iranian N = 4,873		Non-Iranian N = 142	
	(1)	(2)	(3)	(4)
Birthyear	2005—09	2010—11	2005—09	2010—11
Baselines				
Daily Age in Years	4.47	0.86	4.22	0.81
	(1.440)	(0.506)	(1.423)	(0.454)
Male	0.51	0.49	0.46	0.45
	(0.500)	(0.500)	(0.501)	(0.506)
outcomes				
Height	103.80	69.79	101.81	67.17
	(13.85)	(10.20)	(14.41)	(10.07)
Weight	17.81	8.65	17.63	8.59
	(5.094)	(2.613)	(5.831)	(2.784)
Height for Age Z-score	-0.38	-0.68	-0.47	-1.50
	(2.144)	(2.210)	(2.235)	(2.369)
Weight for Age Z-score	0.22	0.11	0.35	0.19
	(1.387)	(1.346)	(1.738)	(1.682)
Controls				
Parents Education (Levels 1 to 4)	2.06	2.07	1.57	1.76
Parents Job (Levels 1 to 4)	2.20	2.22	1.94	2.14
Owner Home	0.47	0.42	0.21	0.17
Unemployed	0.06	0.07	0.09	0.1

Note: The height and weight data are adjusted for monthly age and sex based on the reference population of WHO, and children outside five z-scores are excluded. 'Age in years' is calculated by dividing 'Age in days' by 365.25.

Source: Authors' calculations based on the Urban HEART 2011 Tehran dataset.

The average age of children is 4.47 years for Iranians and 4.22 years for non-Iranians in 2005—09, decreasing to 0.86 and 0.81, respectively, in 2010—11. The survey was conducted in the last quarter of 2011, the 2010—2011 cohort had an average age below one year. Gender distribution is consistent across groups, with

male ratios of 0.51 and 0.49 for Iranians and 0.46 and 0.45 for non-Iranians in 2005—09 and 2010—11, respectively.

For height, Iranians are slightly taller on average, with heights of 103.80 cm in 2005—09 and 69.79 cm in 2010—11, compared to non-Iranians at 101.81 cm and 67.17 cm for the same periods. The height-for-age z-scores (HAZ) show a more pronounced decline for non-Iranians, moving from -0.47 in 2005-09 to -1.50 in 2010—11, while Iranians changed from -0.38 to -0.68. For weight, Iranians averaged 17.81 kg in 2005—09 and 8.65 kg in 2010—11, while non-Iranians averaged 17.63 kg and 8.59 kg. The weight-for-age z-scores (WAZ) for Iranians changed from 0.22 to 0.11 and for non-Iranians from 0.35 to 0.19.

Covariates: As expected, non-Iranians exhibit lower levels of parental education, job quality, and homeownership rates compared to Iranians. Importantly, there are no discernible systematic differences among non-Iranians between the two periods. The younger cohorts of non-Iranians have slightly better parental education and job quality but slightly lower homeownership rates.

C. Supplementary data

In addition to the Urban HEART and HEIS datasets, our study incorporates three additional sources to broaden our analysis. Firstly, as shown in Figure 2, we utilize the 2011 Iranian census data to explore the alignment between population distribution across provinces and the locations of cash recipients. Secondly, we draw on inflation figures from Iran's Statistical Center, using the CPI to adjust income across different time for consistency. Finally, we connect the HEIS data on household expenditures and food amounts to a detailed nutritional table to understand how households adjust their diets in response to financial shifts. This table lists 234 foods in the expenditure balance sheet of the survey, including essential nutrients in three categories: fats, carbohydrates, and proteins. It calculates the calorie content of each food by summing these nutrients times the calories of each. The table is widely used in research efforts across Iran and is supported by institutions such as the Iranian Parliament Research Center.

Sample Weights: In our analysis, Urban HEART dataset does not provide weights, while the HEIS dataset includes specific weights to ensure national representation. We apply these weights when describing the entire national

sample. However, we do not use sample weights for the 2010—2011 panel data, which only represents part of the country due to the limitations of following panels that have not moved or changed head. Instead, we use the size of the households as a proxy for sample weighting.

IV. Research Design

Our study aims to identify the short-term causal effects of subsidy reform on households, focusing on those with and without cash transfers. We employ a DiD approach, analyzing mean differences in outcomes before and after the reform and using household fixed effects, enabling control over all unobserved household characteristics. On the other hand, to study children's health, we use variations in the exposure to the reform in early life among Iranians and non-Iranian children. Although both DiD models follow the same logical framework, their specifications differ slightly and are explained separately for clarity.

A. Households' response model

We use the following DiD model to assess the impact of the gap in cash transfers resulting from the reform:

$$y_{ist} = \lambda_t + \lambda_{i\ or\ (no\_cash)} + \delta D_{post\times no\_cash} + \Gamma X_{ist} + \varepsilon_{it} \qquad (1)$$

In this regression, y_{it} denotes an outcome for household or individual i, and time t. λ_t is a dummy to capture the average effect of the post-reform era, which is 2011, and $\lambda_{i\ or\ (s=no\_cash)}$ is the households fixed effect of the non-cash recipients panel or all of them on average. The parameter δ represents the average treatment effect of reform under the identification assumption that, in the absence of reform, the outcomes of cash recipients and non-recipients move in parallel. X_{ist} is a vector of potential controls for robustness checks. Household fixed effects in our model offer the advantage of controlling for time-invariant unobserved household characteristics. Additionally, two time-variant covariates may affect the outcomes: the size of households (due to events such as the marriage of children or the death of a member) and the number of students in the household (as children go to school

or graduate). Therefore, we add these two time-variant covariates to the model as controls for robustness check.

B. Health of children

Similar to our analysis of household responses, our approach to assessing the reform's impact on children's health employs the DiD with some modifications. We leverage the variation in children's exposure to the reform during their early life. Children born after December 18, 2010, experienced total exposure to the reform during their first year and in utero. Those born earlier in 2010 had an average overlap of 69% with the reform in their first year. As we consider earlier birth years, the overlap with the reform period decreases significantly. For instance, children born in 2007 experienced around 20% overlap, while those born in 2006 and 2005 had less than 20% overlap, largely escaping the reform's impact during their critical early years.

Our main specification uses the overlap ratio, which measures how much children's lives overlapped with the reform. For robustness, we also conduct a DiD event study analysis and showed each cohort's coefficient of time of birth. The overlap ratio is categorized as follows:

- A value of 1 for children born on or after the reform date (18 December 2010) indicates full exposure from birth.
- The number of days lived after the reform (survey date minus 18 December 2010) divided by their age in days for those born after 2006 but before the reform. This ratio reflects varying levels of partial exposure and allows us to test the impact of partial exposure.

- A value of 0 for children born in 2006 or earlier signifies no exposure before age five and serves as our control group.

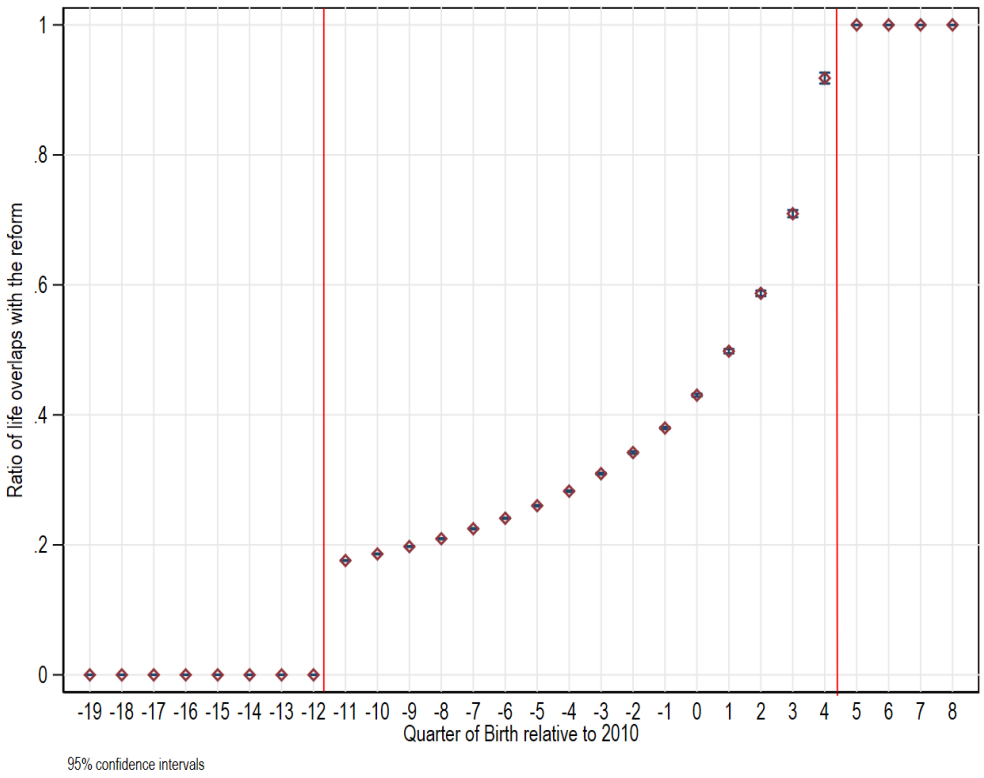


FIGURE 3. THE RATIO OF CHILDREN'S LIVES OVERLAPPED WITH THE REFORM IN THE EARLY LIFE BY CHILDREN'S BIRTH QUARTER.

Note: This figure highlights significant variation in the share of life (below age 5), coinciding with the reform period. This overlap allows us to exploit these variations across two distinct groups of Iranians and non-Iranians.

Figure 3 displays the ratio of life overlap with the reform by birth cohort, relative to 2010, showing significant variation among children's early life exposure. This spectrum allows us to create both sharp and continuous measures of exposure. The equation for the DiD analysis is as follows:

$$y_{igt} = \lambda_t + \lambda_g + \alpha \times nonIranian \times overlapratio + X_{igt}\phi + \varepsilon_{igt} \quad (2)$$

In this regression, y_{itg} denotes the outcome for children *i* in group *g*, which is distinguished as Iranian (cash recipients) or non-Iranian (non-cash recipients). λ_t, represents the quarter of birth as the time fixed effect, and λ_g represents the group fixed effect. *The overlap-ratio* in this context is interpreted as the intensity of the treatment. The parameter α is pivotal as it represents the average treatment

effect for the treated population (ATET). The identification assumption is that, without the reform, the outcomes for Iranians and non-Iranians would have moved in parallel. We predict that income shocks from the reform likely diminish parental investment, harming children's health, resulting in negative estimates of α. To further refine our model, X_i encapsulates a vector of control variables, including biological factors such as sex and exact age. Since daily age, even within quarters, correlates with weight and height, we include daily age and its quadratic form to capture potential correlations. The model also accounts for geographical disparities by including the district of residence as a fixed effect. We report both robust and district-clustered standard errors when adding district-fixed effects. Additional controls, such as parents' education, jobs, home ownership, and unemployment, do not change the estimations (the table with the full set of controls is in Appendix).

V. Results

A. Big Picture of Income Disparity

Before analyzing the panel of households, we present a comprehensive view of the country's net income distribution tree years before and after the reform for both cash and non-cash recipient groups in Figure 4. The central message in Figure 4 highlights the reform's significant positive impact on the lower end of the net income.

Panel A displays a stable income distribution three years before the reform, with a poverty rate exceeding 16% at an income threshold below $2,000 per year, or approximately $5.50 per capita per day. This 16% poverty rate before the reform notably dropped to below 10% after the reform in *Panel B*, representing the income distribution of cash recipients, accounting for 97% of the population. This shift signifies that over 5 million people escaped poverty as defined by the income threshold. This finding aligns with studies indicating that the 2010 Iranian Energy Subsidy Reform is one of Iran's most substantial poverty reduction efforts, potentially one of the largest in the developing world (Mokhtari & Ghoddusi, 2024).

In contrast, Panel C reveals a different scenario for 3% of the population who are non-cash recipients. This sub-sample, representing 2.25 to 2.4 million people, exhibits a poverty rate exceeding 20%, with conditions deteriorating further over time. The 2010 reform was designed to encompass the entire population, excluding only the wealthy and those who voluntarily opted out. However, Panel C indicates that those excluded from cash transfers are among the poorest. Assuming no demographic changes over the three years, the poverty rate in this subgroup escalated over time. This trend can be attributed to the fact that while cash recipients had financial protection against the inflationary effects of the reform, non-cash recipients lacked such a safety net and faced severe inflationary pressures without any financial buffer.

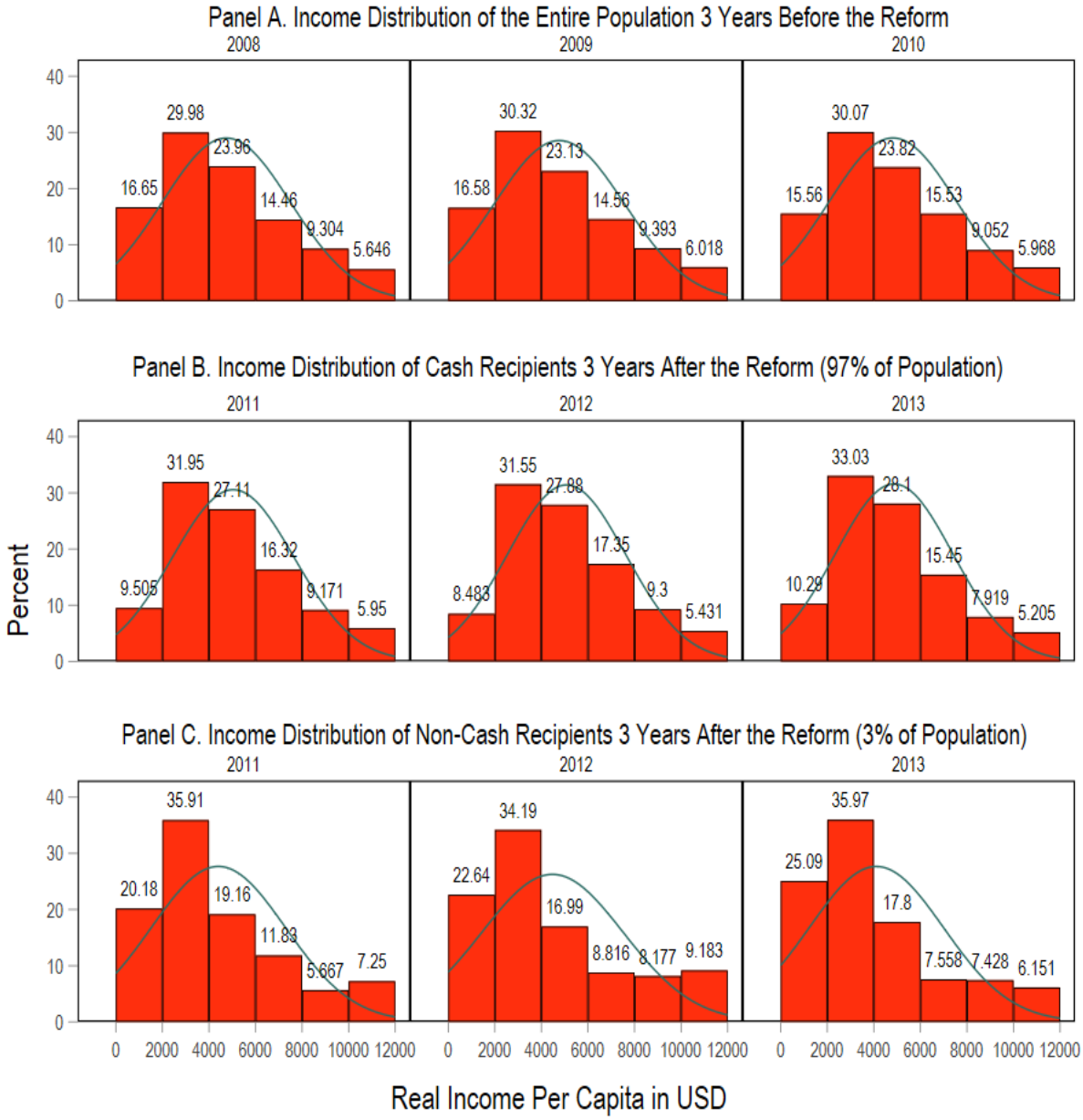


FIGURE 4. NET INCOME DISTRIBUTION OF NON-CASH RECIPIENTS AND CASH RECIPIENTS BEFORE AND AFTER THE 2010 REFORM

Note: This figure illustrates the distribution of annual net income among households, categorized as either cash or non-cash recipients, before and after the reform. The analysis deliberately excludes households reporting annual incomes above $12,000 and those with negative incomes, focusing on the most relevant income brackets. Sample weights from the Household Expenditure and Income Survey (HEIS) are applied to ensure the representativeness of the data at the national level. The dataset comprises 229,262 households, which collectively represent 900,973 individuals.

Source: Author's calculations from the Statistical Centre of Iran's HEIS 2008-2013.

B. Income shock on panel of households in 2010-11

Table 3 shows the magnitude of change in the intact panel of households from 2010-2011. Our analysis in Panel A finds that the household incomes of non-cash recipients decreased from $1.12 to $1.23 per day. Panel B shows that this drop equals a 17% reduction following the 2010 reform. Panel C reveals that this significant drop has led to an additional 12% of households falling below the daily poverty line of $5.50. Importantly, these coefficients are significant and robust across specifications.

TABLE 3. IMPACT OF REFORM ON CHANGES IN THE INCOME OF NON-CASH RECIPIENTS

	(1)	(2)	(3)	(4)
A. Income daily per capita $				
post×no-cash	-1.2***	-1.23***	-1.19***	-1.12***
	(0.39)	(0.36)	(0.32)	(0.32)
R-squared	0.004	0.09	0.83	0.83
B. Ln (Income)				
post×no-cash	-0.17***	-0.171***	-0.171***	-0.165***
	(0.043)	(0.043)	(0.045)	(0.044)
R-squared	0.015	0.117	0.867	0.87
C. Income less than 5.5$				
post×no-cash	0.119***	0.118***	0.116***	0.113***
	(0.028)	(0.035)	(0.035)	(0.035)
R-squared	0.015	0.069	0.757	0.759
Household Fixed effects	No	No	Yes	Yes
Controls (HH size+ No. of students)	No	Yes	No	Yes
Observations (HH)	24,538	24,538	24,538	24,538
Individuals	101,211	101,211	101,211	101,211

Notes: This table presents estimates of the impact of reform on household income, excluding cash transfers, relative to households with cash transfers, based on Equation (1). The regressions assigned a value of 1 to the post-reform period for 2011 Panel A presents dependent variables as income per capita in real values. Panel B reports the natural logarithm of incomes to analyze proportional changes, and Panel C identifies whether incomes fall below the $5.5 daily threshold using a dummy variable. Standard errors are clustered at the household level and are shown in parentheses. Household size is used as the sample weight.

Source: Author's calculations from the Statistical Centre of Iran's Household Expenditure and Income Survey (HEIS). ***Significant at the 1 percent level.

B. Health of Children

We provide two pieces of evidence here, with additional details available in the appendix. First, we visually examine the raw data. Following this, we present the results of the main specification. In the appendix, we conduct an event study by time of birth, perform a within-cohorts analysis for those exposed to the reform partially and fully but with different intensities, and carry out separate analyses for the 2010 and 2011 cohorts. Figure 5 presents scatter plots of children's weight and height observations with a quadratic polynomial function fitted to the data. The Y-axis displays the outcomes: raw weights in Panel A, WAZ scores in Panel B, raw heights in Panel C, and HAZ scores in Panel D. The X-axis plots the birth quarters relative to the 2010 reform. While there is slight divergence in almost all outcomes around the time of the reform, the divergence is more pronounced in height and the HAZ scores.

Table 4 presents the core findings from our DiD analysis, which examines the effects of reform on non-Iranian children. This analysis uses the 'Overlap×non-Iranian' interaction coefficient while controlling for non-Iranian status and time of birth. Including daily age in a quadratic form does not significantly change the results (the table with the full set of coefficients is in Appendix). In Panel A, the dependent variable is weight, adjusted for age and sex. The 'Overlap×non-Iranian' coefficients show a decrease in weight by just over 0.38 standard deviations, although these findings are not statistically significant. In Panel B, height adjusted for age and sex shows a more pronounced negative impact on the growth of non-Iranian children, with an average reduction exceeding 1.2 standard deviations, which is statistically significant. Finally, in Panel C, using a stunted dummy as the outcome variable, assigning 1 for children whose Height-for-Age Z-score (HAZ) is below -2, the interaction coefficient in this model shows an increase of over 0.2 in the stunting rate among children. These results suggest that all else being equal, changing the overlap ratio from 0 (2005—2006 cohort) to 1 (2011 cohort) leads to 0.38 and 1.2 standard deviation change in weight and height adjusted for age and sex and 0.2 percentage point increase in the rate of stunted children. Only results on weight are not statistically significant, possibly due to sample size or less impact of reform on weight.

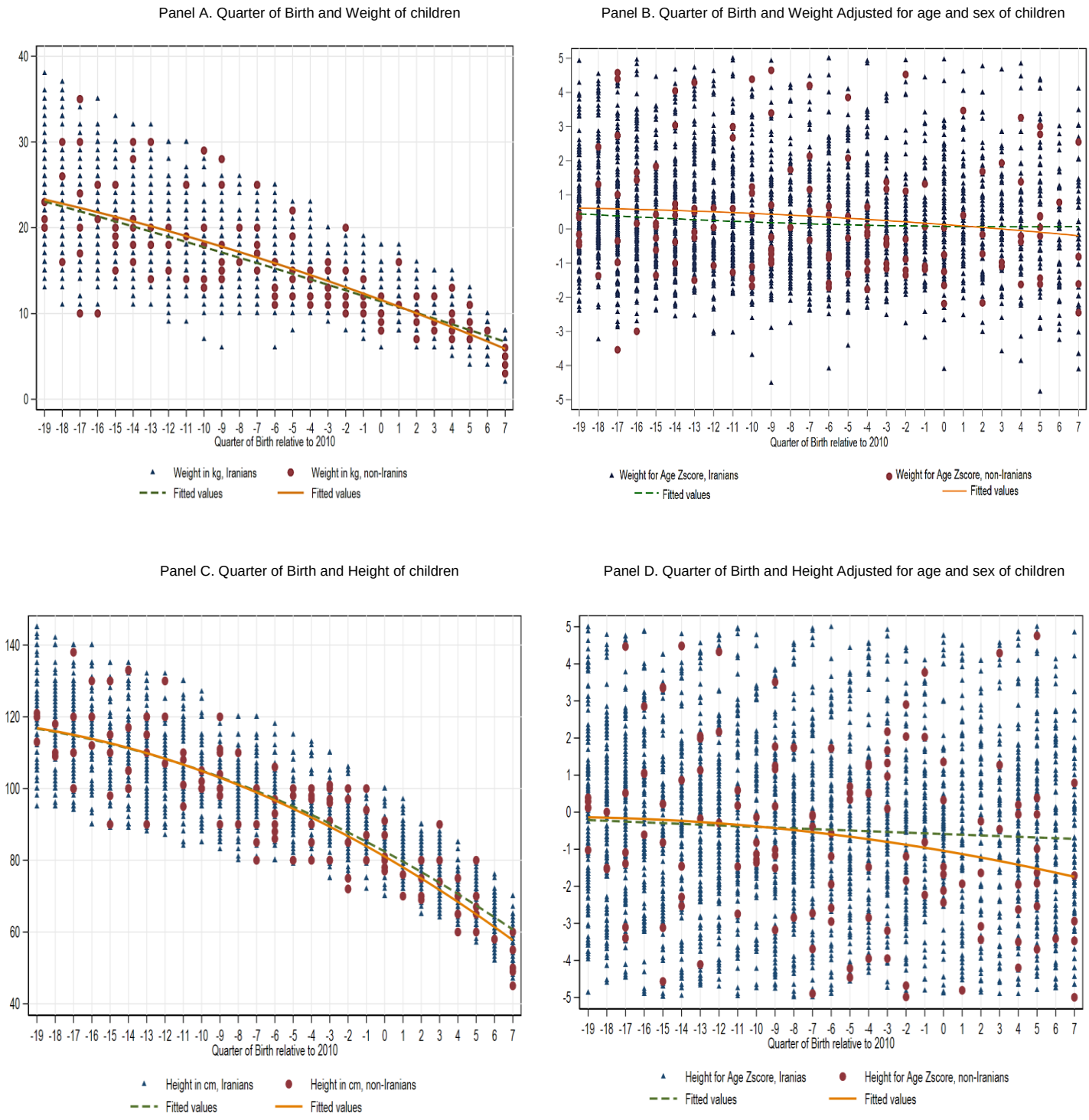


FIGURE 5. WEIGHT AND HEIGHT RELATIVE TO TIME OF BIRTH OF IRANIANS AND NON-IRANIANS

Note: A quadratic polynomial was fitted to the data based on the quarter of birth relative to the year 2010.

Source: Author's calculations from Urban Heart 2011 Tehran

TABLE 4— IMPACT OF REFORM ON NON-IRANIAN CHILDREN

	(1)	(2)	(3)	(4)
A. Weight (WAZ)				
Overlap×non-Iranian	-0.38	-0.38	-0.40	-0.39
	(0.43)	(0.43)	(0.43)	(0.43)
			[0.38]	[0.38]
B. Height (HAZ)				
Overlap×non-Iranian	-1.28**	-1.28**	-1.3**	-1.3**
	(0.61)	(0.61)	(0.60)	(0.60)
			[0.50]	[0.50]
C. Stunted (HAZ<-2)				
Overlap×non-Iranian	0.21*	0.21*	0.21*	0.21*
	(0.12)	(0.12)	(0.12)	(0.13)
			[0.098]	[0.097]
Controls and FE				
SEX + Time of Birth	Yes	Yes	Yes	Yes
Daily Age + Quadratic	No	Yes	Yes	Yes
District FE	No	No	Yes	Yes
Owner + Employment	No	No	No	Yes
Observations (HH)	5,015	5,015	5,013	5,013

Notes: This table reports estimates of the impact of reform on children's outcomes using the specification of Equation (2). Robust standard errors are in parentheses and clustered standard errors are in brackets at the district level. Asterisks indicate significance levels, with * for the 10% level and ** for the 5% level.

Source: Author's calculations based on Urban HEART 2011 Tehran

C. Heterogeneous Impact of Birth Year on Non-Iranian Subsamples

Following our main analysis, we conduct an event study for the whole sample, with results presented in the appendix. These results indicate that the most significant impact of the reform is observed in the 2010 and 2011 cohorts. To understand the dynamics of this effect on different socioeconomic groups, we perform an event study on subsamples of children. Given the limited sample size of non-Iranian children, we group cohorts biennially (2010—11, 2008—09, 2006—07, 2004—05) and restrict data division to two subsamples based on covariates. These subsamples are categorized by the gender of the children, the district's income levels (high vs. low), the educational level of parents (more than primary vs. primary and less), and house ownership status (owner vs. renter).

Figure 6 illustrates these heterogeneous effects. Panel A displays the DiD estimation coefficients for HAZ across cohorts, segmented by homeownership. Panel B illustrates the DiD estimation coefficients for HAZ across cohorts, categorized by the living district. Panel C shows the DiD estimation coefficients for HAZ, which are segmented by parental education. Lastly, Panel D presents the DiD estimation coefficients for HAZ across cohorts, distinguished by gender. This analysis helps understand how various socioeconomic and demographic factors influence the growth patterns of non-Iranian children exposed to the reform.

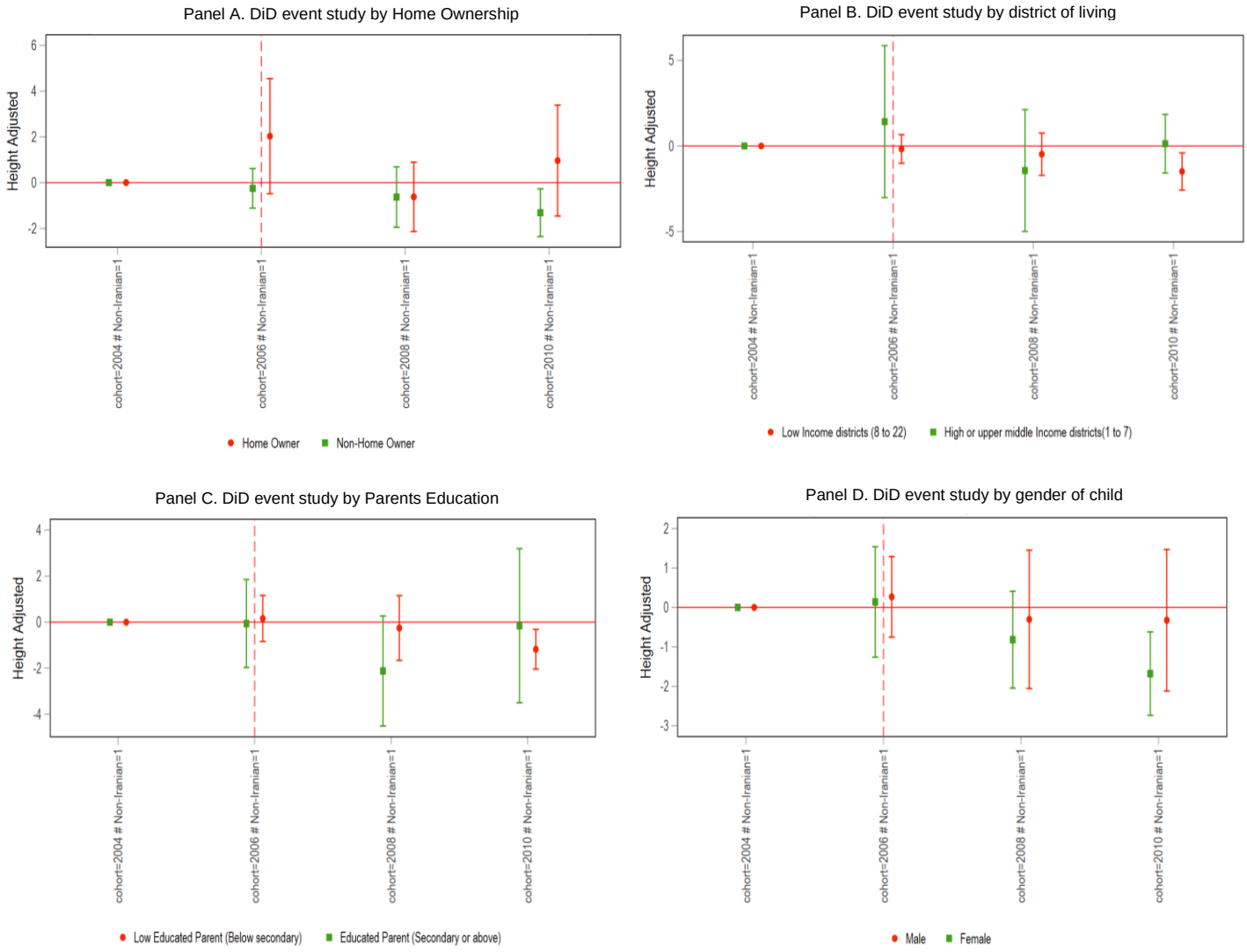


FIGURE 6. HEIGHT AND TIME OF BIRTH FOR NON-IRANIAN HOUSEHOLDS BY SOCIOECONOMIC STATUS, PARENTAL EDUCATION, AND GENDER

Notes: Panel A displays the DiD estimation coefficients for HAZ across biennial cohorts by homeownership. Panel B displays the DiD estimation coefficients for HAZ across biennial cohorts by living district. Panel C displays the DiD estimation coefficients for HAZ across biennial cohorts by parental education, proxied by the father's education level. Panel D displays the DiD estimation coefficients for HAZ across biennial cohorts by gender. For all estimations, the 2004 cohort (birth in 2004 or 2005) and Iranians are the control group. Standard errors are clustered at the district level, and 95% confidence intervals are plotted.

Source: Author's calculations from Urban Heart 2011 Tehran.

Our findings indicate that the impact of birth year is primarily driven by households with lower educational levels of the household head's father, those residing in lower-income districts, and renters. In the gender-specific analysis, the effects are more pronounced for girls, with larger and statistically significant coefficients. This divergence might stem from gender discrimination, which is notably prevalent among Afghan refugees in Iran.

D. The potential path of income shock to child health

Our study investigates why non-Iranian children born around the time of the 2010 Iranian subsidy reform have shown reduced growth compared to their peers. Our initial hypothesis centers on the reform, which excluded non-Iranians from the safety net of cash transfers, leading to a sudden drop in their income. We found that incomes fell by 17% for those who did not receive cash payments after the reform, likely varying slightly in Tehran. The central question we address in this section is how income shock influenced the behaviors of non-Iranian households and has potentially impacted their children's health.

Malnutrition: The expanding literature indicates that even mild nutritional shocks in early life can significantly affect children's health (Almond et al., 2018; Almond & Currie, 2011). We provide three pieces of evidence demonstrating the impact of the reform on household nutrition. Using the calories of 234 foods reported in last month's household expenditure balance sheet, we analyze the nutritional distribution of the sample three years before and after the reform. This analysis reveals that the proportion of people consuming fewer than 1500 calories daily (severe malnutrition) is higher among non-cash recipients than cash recipients. To establish a causal relationship similar to the income shock, we use a 2010-2011 household data panel, employing a DiD approach with fixed effects. Additionally, we use Urban HEART data from Tehran, including a food security section. By applying a matching on observables technique, we demonstrate that non-Iranian residents in Tehran suffer significantly more from malnutrition than their matched Iranian counterparts, even when we control for several socio-economic factors (see Appendix for more details).

Figure 7 illustrates calorie consumption patterns among cash versus non-cash recipients. *Panel A* establishes the baseline for calorie consumption before the

reform, with approximately 13% of the population consuming below 1,500 calories daily, indicating severe malnutrition. This figure remains stable before the reform. The pattern changes after the reform: there is a notable decrease in malnutrition for cash recipients, dropping more than two percentage points from 13% to 10.5% and 11.7% in the subsequent years. These numbers suggest an improvement in the nutritional status of cash recipients during at least the first two years post-reform. Conversely, non-cash recipients experience significant malnutrition challenges. Starting at 15% in 2011, the percentage of non-cash recipients consuming below 1,500 calories per day escalates to 22% by 2013. This increase suggests the detrimental impact of exclusion from cash transfers, highlighting the heightened food insecurity and malnutrition risks faced by non-cash recipients. The gap between cash recipients and non-cash recipients is not only in the quantity of food consumption but also in the quality and diversity of the foods they consume. We provide the distribution of the number of foods reported by cash recipients and non-cash recipients, before and after the reform, in Appendix. Before the reform, between 2008 and 2010, 14 percent of people reported consuming fewer than five types of food in their monthly expenditure. After the reform in 2010, two distinct groups emerged: cash recipients and non-cash recipients. For cash recipients, the ratio of people reporting fewer than five types of food decreased from 14 percent to less than 10 percent, and this improvement persisted from 2011 to 2013. In contrast, non-cash recipients experienced a worsening situation, with a higher ratio of people consuming fewer than five types of food, ranging from 17 to 21 percent between 2011 and 2013. This finding suggests a positive impact of cash transfers on food diversity for recipients, while non-recipients faced reduced food diversity due to financial constraints.

We also analyze a panel of households from 2010 to 2011 based on food purchases reported in last month's expenditure balance sheets. Due to heightened concerns in these groups, we focus on the entire panel and the lower distribution—subsamples with per capita daily caloric intake below 2,700 in both years. Our key outcomes include the natural logarithm of per capita daily calorie consumption to monitor changes in caloric intake, a dummy variable for nutritional intake below 1,500 calories to assess severe malnutrition, the number of foods reported on the

balance sheet to measure nutritional diversity, and the composition of food intake in terms of proteins, carbohydrates, and fats, expressed as natural logarithms of quantity. We employ the DiD model, as detailed in Equation 1, with fixed household effects to control for individual heterogeneity. To address the potential heterogeneous impacts of reforms on food expenditures, as previously noted in the literature on the 2010 Iranian reform (Mokhtari & Ghoddusi, 2024) and seasonal variations of food consumption across different segments of the distribution, we include interactions between expenditure deciles and both post-reform and seasonal survey variables in our analysis. Our findings indicate a decline in all measured nutritional metrics, with up to a 14% decrease in nutritional intake at the lower end of the distribution, resulting in a 0.12 increase in the ratio of individuals consuming less than 1,500 calories per capita per day. While the coefficients for food diversity and composition are economically significant, some are not statistically significant, likely due to our small sample size. Despite the insignificance of some coefficients, the probability of simultaneously finding all these negative coefficients by chance is nearly zero. Table 7 presents the results. The average household without cash transfers consumes fewer types of food, with protein and fat consumption reduced by 8% and 11%, respectively. The reduction in carbohydrate consumption is more pronounced, reaching up to 20% at the lower end of the distribution, and is statistically significant at the 5% level.

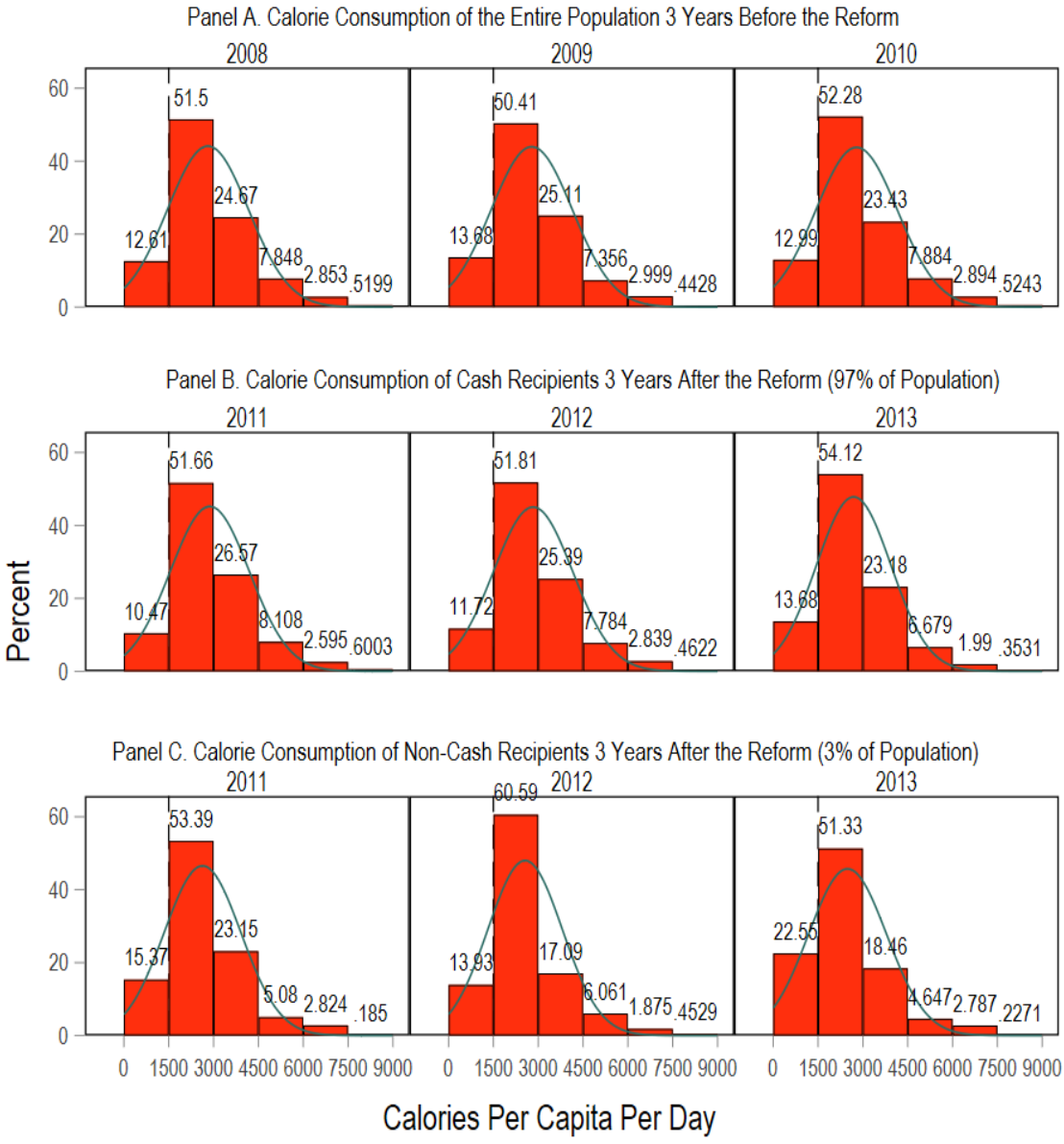


FIGURE 7. NUTRITION DISTRIBUTION OF NON-CASH RECIPIENTS AND CASH RECIPIENTS BEFORE AND AFTER THE 2010 REFORM

Note: This figure illustrates the daily nutrition distribution of households, categorized as cash and non-cash recipients, before and after the reform. Sample weights from the Household Expenditure and Income Survey (HEIS) are applied to ensure the data's representativeness at the national level. The dataset comprises 229,262 households, which collectively represent 900,973 individuals.

Source: The data regarding food quantities are derived from the Statistical Centre of Iran's Household Expenditure and Income Survey (HEIS). Calorie values are calculated using a table of 234 foods included in the

TABLE 5— IMPACT OF REFORM ON CHANGE IN NUTRITION OF NON-CASH RECIPIENTS

	(1) Full panel 2010—2011	(2) Bottom of distribution (Calories<2700 per day)
A. %Δ Nutrition (ln (Calories))		
post×no-cash	-0.06	-0.14**
	(0.047)	(0.068)
B. Malnutrition (Calories) <1500		
post×no-cash	0.054	0.12*
	(0.037)	(0.064)
C. Number of foods		
post×no-cash	-0.27	-0.32
	(0.21)	(0.28)
D. Foods Composition		
Ln (Protein)		
post×no-cash	-0.024	-0.08
	(0.046)	(0.066)
Ln (Fat)		
post×no-cash	-0.039	-0.11
	(0.068)	(0.11)
Ln (Carbo)		
post×no-cash	-0.1*	-0.21**
	(0.056)	(0.087)
Household FE+ Controls	Yes	Yes
Observations (HH)	24,538	7,188
Individuals	101,211	50,608
Number of clusters	12,269	3,596

Notes: This table shows the estimated impact of the reform on household calorie consumption. It compares households that did not receiving cash transfers to those that did, as per Equation (1). Panel A presents the dependent variables as the natural per capita calorie consumption logarithm. Panel B uses a dummy variable to examine whether per capita calorie consumption falls below the daily 1,500-calorie threshold. The regressions assigned a value of 1 to the post-reform period for 2011. Household fixed effects are included in the estimations, and standard errors are clustered at the household level. The controls used in our analysis include expenditure decile and its interactions with post-reform and season of survey variables.

Source: The data regarding food quantities are derived from the HEIS. Calorie values are calculated using a table of 234 foods included in the survey. Levels of significance are indicated by *** for 1% and ** for 5%.

Malnutrition of Non-Iranians in the urban HEART dataset: In addition to the calorie consumption gap between cash and non-cash recipients, we provide further evidence from the Urban HEART dataset in Tehran. Since we do not have panel data, we use another identification strategy, matching observable covariates between Iranian and non-Iranian households with children of the same age. We

analyze qualitative questions regarding food scarcity, focusing on households with children under 18. The survey questions address food adequacy, limited food variety due to financial constraints, eating less, and experiencing hunger in the past 30 days (the exact text of the survey questions and choices are provided in Appendix).

We conduct two analyses. The first is a straightforward comparison between Iranian and non-Iranian households, revealing that non-Iranians are significantly more likely to suffer from starvation and food shortages over the past month. This finding does not necessarily imply an impact of receiving cash after the reforms, as these disparities could also stem from differing socioeconomic conditions between Iranians and non-Iranians. To explore potential causal relationships between not receiving cash and malnutrition, we match non-Iranians with Iranians based on children's birth year and 14 socioeconomic status indicators. We use inverse probability weighting regression adjustment (IPWRA) to assess how non-Iranians experience food scarcity compared to their socioeconomically matched Iranian counterparts. The findings in Table 6 consistently indicate that non-Iranians report significantly more frequent experiences of food scarcity and starvation across a broad range of qualitative questions. The results are large even after matching, showing a 3 to 14 percentage point (20% to 50%) higher ratio of positive responses to starvation and lack of food due to financial constraints.

TABLE 6— NUTRITIONAL GAP BETWEEN IRANIANS AND NON-IRANIANS HOUSEHOLDS WITH CHILDREN

	(1) Unmatched Sample of households with children under 18	(2) Matched Sample with IPW, Regression Adjustment, ATET
Panel A.		
Outcome 1: The food you bought was not enough and you did not have money to buy more food: Most of time, sometimes		
Non-Iranian	0.22***	0.10**
	(0.02)	(0.03)
Outcome 2: The food you bought was not enough and you did not have money to buy more food: Most of time		
Non-Iranian	0.11***	0.06***
	(0.01)	(0.02)
Panel B.		
Outcome 1: Insufficient Food Due to Financial Constraints in the Last 30 Days: Most of time, sometimes		
Non-Iranian	0.23***	0.14***
	(0.02)	(0.03)
Outcome 2: Insufficient Food Due to Financial Constraints in the Last 30 Days: Most of time		
Non-Iranian	0.07***	0.03*
	(0.02)	(0.016)
Panel C.		
Outcome: Consume less food than you need because you didn't have enough money: Yes		

Non-Iranian	0.15*** (0.02)	0.07*** (0.021)
Panel D. **Outcome:** Feel hungry but could not eat due to lack of money: Yes		
Non-Iranian	0.09*** (0.01)	0.07*** (0.015)
	21,812	21,146

Note: This table illustrates differences in qualitative questions of food security surveys between Iranian and non-Iranian households with at least one child under 18 (born after 1992). All outcomes are dummies, with one for the question in the table and zero otherwise. Column 1 provides a straightforward comparison of outcomes, incorporating a fixed effect for the birth year of the child. Column 2 employs a matched sample approach using Inverse Probability Weighting and Regression Adjustment (IPWRA). The treatment model is a logistic regression including the child's birth year and 14 dummy variables representing education, occupation, district of residence, home ownership, and employment status of the household head. The outcome model is linear, incorporating all mentioned controls alongside fixed effects. standard errors are clustered at district level.

Source: Author calculations based on the Urban HEART 2011 Tehran

Health Behavior of households with children: Our urban HEART dataset, although cross-sectional, includes retrospective questions for mothers who gave birth in the last years. These questions allow us to explore how households might have altered their behaviors in response to the reform, particularly for children born slightly before and after its implementation. We focus on two available behaviors: whether the child was delivered in a hospital and whether the child received timely vaccinations.

We use a DiD approach to compare children born just before and after the reform, as outlined in Equation 3. The variables in the model are structured similarly to those in Equation 1. "Post" refers to births occurring after December 18, 2010. The model incorporates fixed effects for time and nationality, includes controls, and accounts for district-level fixed effects. The coefficient α represents our causal estimate under the identification assumption that, in the absence of reform, outcomes for both Iranians and non-Iranians would move in parallel.

$$behavior_{igt} = \lambda_t + \lambda_g + \alpha \times nonIranian \times post + X_{igt}\phi + \varepsilon_{igt} \quad (3)$$

Due to the small sample size, we report both weighted (using a matching sample of Iranians and non-Iranians) and non-weighted coefficients. Table 7 provides summary statistics on health behaviors by nationality and birth year, both before and after the reform, while Table 8 presents the DiD coefficients of the interaction terms, which are our primary interest. Our findings indicate no significant impact on the timely vaccination of children, with both Iranian and non-Iranian children

receiving vaccinations at rates exceeding 93% before and after the reform. Conversely, the incidence of childbirth outside hospitals—though rare in both populations—increased among non-Iranians; the percentage of mothers giving birth outside hospital settings rose from 7% before the reform to 11% afterward, representing a significant increase of over 50%. However, despite this substantial change, the coefficient is only statistically significant when weighted at the 10% level, likely due to the small sample size. The observed discrepancy between unchanged vaccination behaviors and changes in childbirth locations can be attributed to the accessibility of services. Vaccinations are free to all residents at local health centers ("Khane Behdasht" in Persian), supporting consistent vaccination rates regardless of economic changes. Conversely, hospital childbirth services, which are typically not free for uninsured individuals, are more susceptible to financial constraints. Therefore, our hypothesis posits that costly health behaviors, such as hospital childbirth, are likely to be affected by the reform for non-Iranians.

TABLE 7— SUMMARY STATISTICS OF HOUSEHOLD BEHAVIORS FOR CHILDREN WITH BIRTHDATES AROUND THE REFORM

Variable	Iranian N = 1,145		Non-Iranian N = 42	
	Before	After	Before	After
	(1)	(2)	(3)	(4)
Vaccination in time	0.95	0.97	0.93	0.96
	(0.011)	(0.006)	(0.067)	(0.037)
Child Birth in Hospital	0.94	0.97	0.93	0.89
	(0.012)	(0.006)	(0.067)	(0.062)

Source: Author calculations based on the Urban HEART 2011 Tehran.

TABLE 8— IMPACT OF REFORM ON HOUSEHOLD BEHAVIOR

	(1)	(2)	(3)	(4)
	Non-weighted		Weighted	
A. Child Birth in Hospital				
post×non-Iranian	-0.08	-0.09	-0.12*	-0.08*
	(0.09)	(0.09)	(0.064)	(0.063)
		[0.06]		[0.047]
SEX	Yes	Yes	Yes	Yes
District	No	Yes	No	Yes

Observations (HH)	1,187	1,186	1,152	1,152

Notes: This table reports estimates of the impact of reform on households' health behavior outcomes using the DiD. Columns 1 and 2 present simple DiD estimates, while columns 3 and 4 show results from the weighted matched sample. For matching, the inverse probability weighting method was applied, using "non-Iranian" status as the dependent variable, along with 14 dummy variables representing education, occupation, district of residence, home ownership, and the employment status of the household head to which the child belongs. Robust standard errors are in parentheses and clustered standard errors are in brackets at the district level. Asterisks indicate significance levels, with * for the 10% level and ** for the 5% level.

Source: Author calculations based on the Urban HEART 2011 Tehran.

E. Generalizability of Findings

External validity: Curiosity may arise about the generalizability of these findings to the broader Iranian population, particularly given the minor representation of non-Iranians in Iran. A pivotal question emerges: If Iranians were excluded from safety net transfers, would they experience similar adverse effects as non-Iranians? To address this, we compare the income distribution of Iranian households without cash transfers to non-Iranian households excluded from the subsidy reform. Our analysis suggests that Iranian households would likely face similar adverse effects, especially among the poorer segments of the population. The magnitude of the income shock at the bottom of the distribution indicates that the exclusion from cash subsidies would significantly impact household income.

We present the income distribution of cash recipients in the absence of transfers alongside non-cash recipients in our study. Additionally, in the appendix, we conduct a similar analysis using our household panel data from 2010-2011. Household income is derived from various sources, as reported in the HIES. Since the 2011 reforms, detailed data on transfer receipts have enabled us to simulate scenarios in which cash transfers are absent for cash recipients' income. Our analysis in Figure 8 shows that, without these transfers, the income distribution for cash and non-cash recipients aligns closely. Specifically, approximately 20% of cash recipients (Iranians) would fall below the poverty line, defined as USD 2,000 per capita annually or USD 5.5 daily, mirroring their non-cash-receiving counterparts. These findings indicate that, in the absence of transfers, the poverty rate would be similar across the entire sample. In more technical terms, the average treatment effect observed for non-cash recipients can be extrapolated to cash recipients and the entire sample. The counterfactual analysis in a panel of

households supports this, showing that cash recipients experience a negative income shock in the absence of transfers, similar to non-cash recipients.

Assuming an annual per capita income below USD 2000 is the threshold for poverty, our panel data reveals that cash recipients exhibit a 10 percent decrease in the poverty rate after the reform, while non-cash recipients show a 2 percent increase in the poverty rate. However, if cash recipients did not receive transfers, the poverty rate would increase rather than decrease. Specifically, instead of a 10 percent decrease, we would observe a seven-percentage point increase in the proportion of people living below USD 2000 per year, or approximately USD 5.5 per day per capita. The actual income distribution and the income distributions without transfers for our 2010-11 panel are plotted in Appendix.

Both the counterfactual analysis of the sample population and the panel data raise an important alarm: the cost of exclusion from cash transfers is significant, especially for those at the bottom of the income distribution.

Long-term consequence of negative impact on height: The significant impact of the reform on children's height could have long-term economic costs for the population. Height reflects a child's immediate health status and carries profound implications for their long-term well-being and economic productivity. Extensive research, including studies by Grantham-McGregor et al. (2007) and WHO (2014), has shown that stunting in early life is linked to poorer cognitive development, lower educational performance, reduced earnings in adulthood, and an increased risk of chronic diseases. Policymakers should consider these long-term effects when implementing large reforms that may generate shocks for subpopulations excluded from or dropped from the safety net.

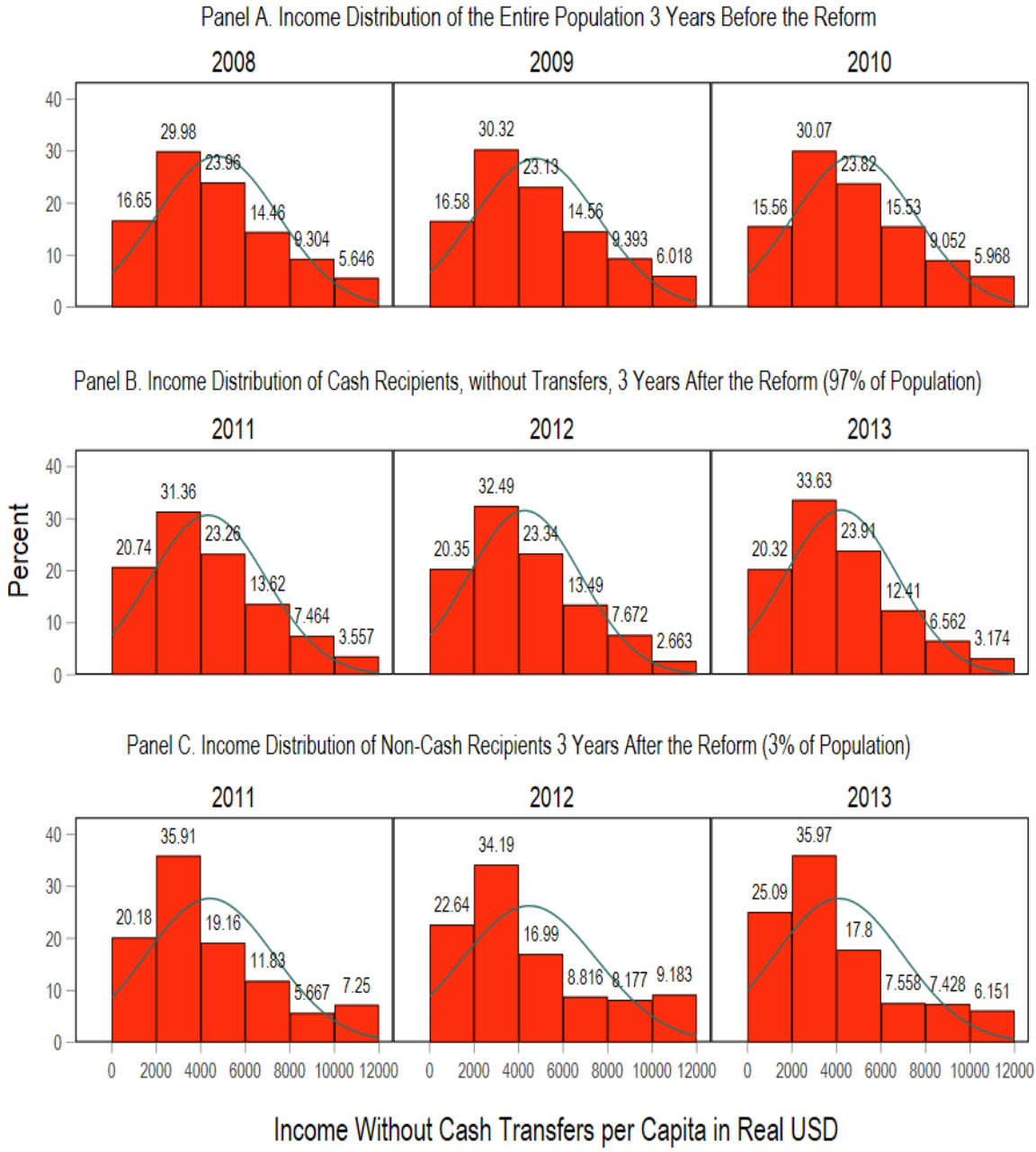


FIGURE 8. DISTRIBUTION OF NET INCOME FOR CASH AND NON-CASH RECIPIENTS, EXCLUDING CASH TRANSFERS, BEFORE AND AFTER THE 2010 REFORM

Note: This figure illustrates the distribution of annual net income among households; Panel A shows the income distribution of the whole population before the reform. Panel B shows the income distribution of cash recipients by removing cash transfers from their income balance sheet. Panel C shows the income distribution of non-cash recipients. The analysis deliberately excludes households reporting annual incomes above $12,000 and those with negative incomes, focusing on the most relevant income brackets. Sample weights from the HEIS are applied to ensure the representativeness of the data at the national level. The dataset comprises 229,262 households, which collectively represent 900,973 individuals.

Source: Author's calculations from the Statistical Centre of Iran's HEIS 2008-2013.

IV. Discussion

In this study, by analyzing two datasets, we explore the impact of the 2010 substantial cash instead of the energy subsidy reform 2010 in Iran, the most extensive of its kind. We first present several pieces of evidence indicating significant disparities between cash recipients and non-cash recipients three years before and three years after the reform. The gaps between the two groups are evident in income distribution, as well as in calorie intake and the diversity of foods consumed. Our investigation focuses on the efficacy of cash transfers in protecting households after the energy subsidies reform. We then create a counterfactual scenario by subtracting transfers from the income of cash recipients. In the absence of these transfers, 20 percent of the sample would fall below the poverty threshold of USD 2000 per capita annually, which matches the poverty rate of non-cash recipients.

Employing a DiD approach with a panel of households from 2010 (the year before) and 2011 (the year after the reform), our findings indicate a 17% income disparity in households that do not receive cash assistance, with an additional 12% descending under the daily poverty threshold of $5.50. The research further shows that children in non-protected households, especially those with birthdays around the reform period, demonstrate stunted growth. We find the impact on children's height effects derived from low-income and socioeconomic households. We suggest at least two critical factors that connect income shocks to reduced child growth: malnutrition and alterations in cost-related healthy behaviors, such as opting for out-of-hospital childbirth over no-cost services such as vaccinations. The significant income disparity and increased poverty rates among non-cash recipients highlight the crucial role of cash transfers in cushioning households against economic shocks.

Limitation: Our analysis relies on two primary data sources: the urban HEART survey, which provides rich health information but is cross-sectional, and the HEIS, a rotating panel that offers extensive data on income and expenditure. One is a country representative, and the other is restricted to Tehran. Studying the panel of households makes the sample non-representative of the entire country, preventing us from finding precise estimates of the reform's impact on the country as a whole. Additionally, this approach does not allow us to quantitatively connect

the findings of income and nutritional shocks in the panel to the health of children in Tehran. However, it is very likely that these findings are qualitatively related. Even without directly correlating the results between income shocks across the country and health outcomes for children in Tehran, each set of findings independently offers substantial insights and implications for this kind of reform. The timing of the Urban HEART survey at the end of 2011 makes it possible to evaluate only the short-term impact of reform on health of children. This limitation underscores the need for further research with larger datasets to more definitively understand the health consequences of economic policies on this vulnerable population over a more extended period. While our study provides significant insights, it is based on a specific context and time period, which may limit the generalizability of the findings. Further research is needed to explore the long-term effects of such reforms in different settings.

Policy implications: These results carry significant implications for countries in the Middle East and other regions with similar economic contexts, particularly those planning similar reforms with substantial energy subsidies. This study highlights two main lessons. First, excluding residents of non-origins from cash transfers while removing energy subsidies creates an income gap. This approach would lead to health and human capital costs, affecting even future generations of these minorities. Secondly, and perhaps more critically, governments must ensure that low-income households remain within the safety net. This research demonstrates the severe consequences of an inadequate system for identifying low-income groups; without a robust safety net, the resulting income shock can be substantial and damaging.

Political economic implications of energy subsidy reforms in Iran: Despite undergoing four rounds of reform—two without cash transfers and two with—Iran continues to allocate over $120 billion to fossil fuel subsidies, approximately 36% of its GDP. According to the International Energy Agency, this ranks second globally, surpassing China’s and India’s expenditures. The transition from energy subsidies to cash reforms in Iran highlights another critical challenge: energy prices are government-set, and due to persistently high inflation, any price increases post-reform are gradually offset by inflation. To counteract these inflationary effects, the government must periodically adjust prices and increase

cash transfers. This was precisely the scenario in November 2019 when Iran implemented a second round of subsidy-to-cash reform, resulting in the largest protests the country had seen, predominantly by individuals from impoverished areas. Despite the 2010 reform being a pro-poor redistribution—as observed in Iran in 2010—the widespread opposition among low-income groups during the 2019 reform was puzzling. The reforms of 2010 and 2019 differed significantly: the 2010 reform introduced a universal, unconditional cash transfer that did not require identifying vulnerable groups, excluding only non-Iranians or a few wealthy volunteers. However, the 2019 cash scheme targeted only 70% of the lowest-income households in Iran, creating uncertainty about eligibility for cash transfers among 30% of the population. This study suggests that the high cost of exclusion for low-income groups, coupled with broader political and economic literature indicating that the lack of clear identification of individual winners and losers creates a bias against the reform (Fernandez & Rodrik, 1991), points to a critical takeaway: without an inclusive safety net, even reforms intended as pro-poor can have adverse consequences and provoke protests from low-income groups. Ensuring an inclusive and transparent safety net is crucial for the success of subsidy reform. Our results emphasize the critical role of cash transfers in mitigating the adverse effects of such reforms in Iran for future reforms. While this paper focuses on Iran, the insights may inform related public, energy, and health economics studies, particularly in contexts involving energy subsidy reforms and social protection in other countries, especially where oil-exporting countries have large immigrant populations prone to being excluded from the safety net.

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The Vital Role of Cash Transfers: Lessons from the Largest Energy Subsidy Reform in the Developing World

APPENDIX

A. Event study, Parallel trends, and starting point of cohorts.

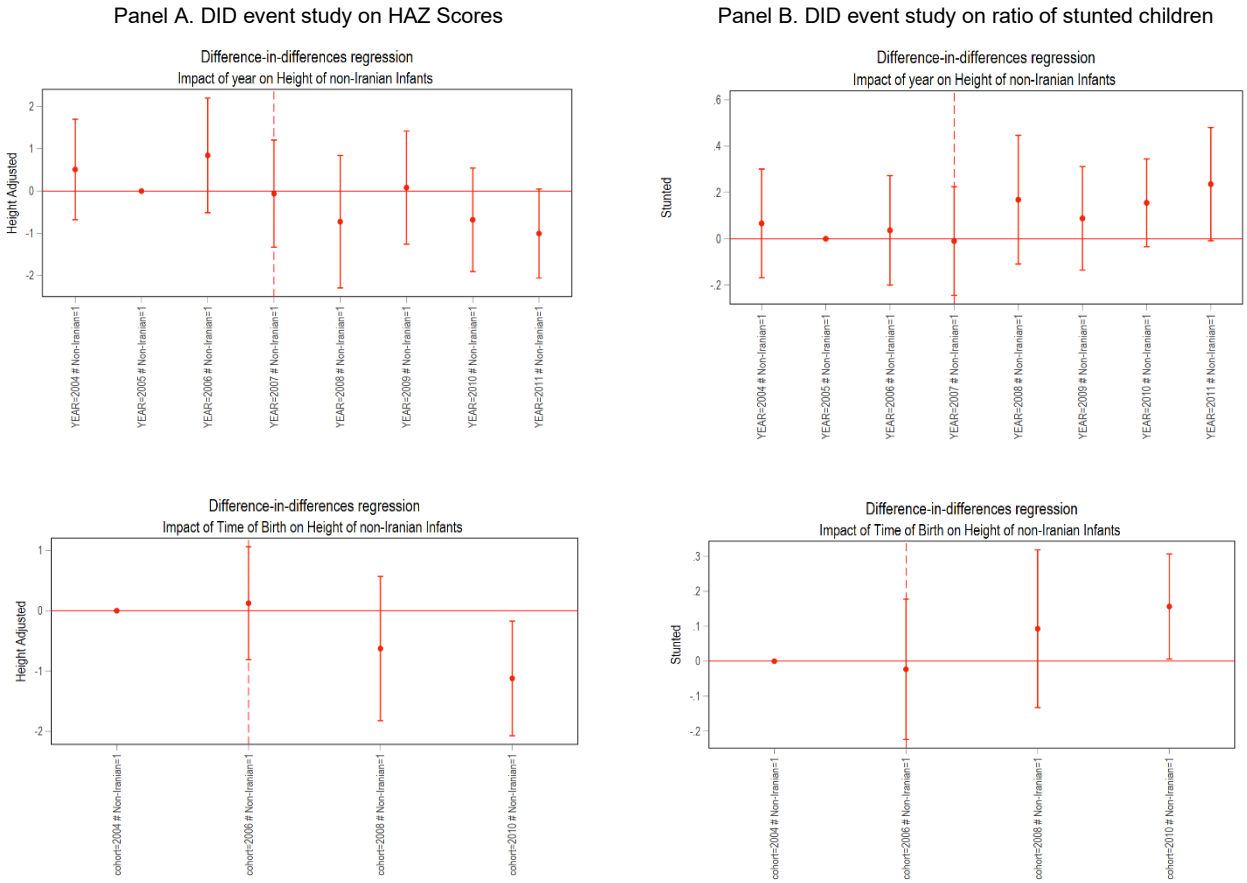

FIGURE A 1. HEIGHT AND TIME OF BIRTH OF NON-IRANIANS

Notes: Panel A displays the DiD estimation for HAZ across yearly cohorts in the upper panel and biennial cohorts in the lower panel. Panel B shows DiD estimations for the ratio of stunted children across yearly cohorts in the upper panel and biennial cohorts in the lower panel. In the yearly analysis, 2005 is the baseline and 2004 is included as the pretreatment period. In the biennial analysis, each number represents a two-year birth cohort (e.g., 2004 includes births in 2004 and 2005). Iranians are the control group for all estimations. Standard errors are clustered at the district level, and 95% confidence intervals are plotted.

Source: Author's calculations from Urban Heart 2011 Tehran.

Figure A1 shows our DiD event study across yearly and biennial cohorts, providing different robustness tests in one plot. To address concerns about the data's starting point, we include the 2004 cohort in the analysis, confirming that our control's starting point does not bias our findings. This figure also tests the assumption of parallel trends and includes coefficients for each year or period. We create four biennial combined cohorts. The analysis reveals that the DiD estimates for height and the ratio of stunted growth for the combined 2010 and 2011 cohort are statistically significant at the 5% level, with coefficients for each year (2010 and 2011) significant at the 10% level.

B. Within 2010—11 comparisons

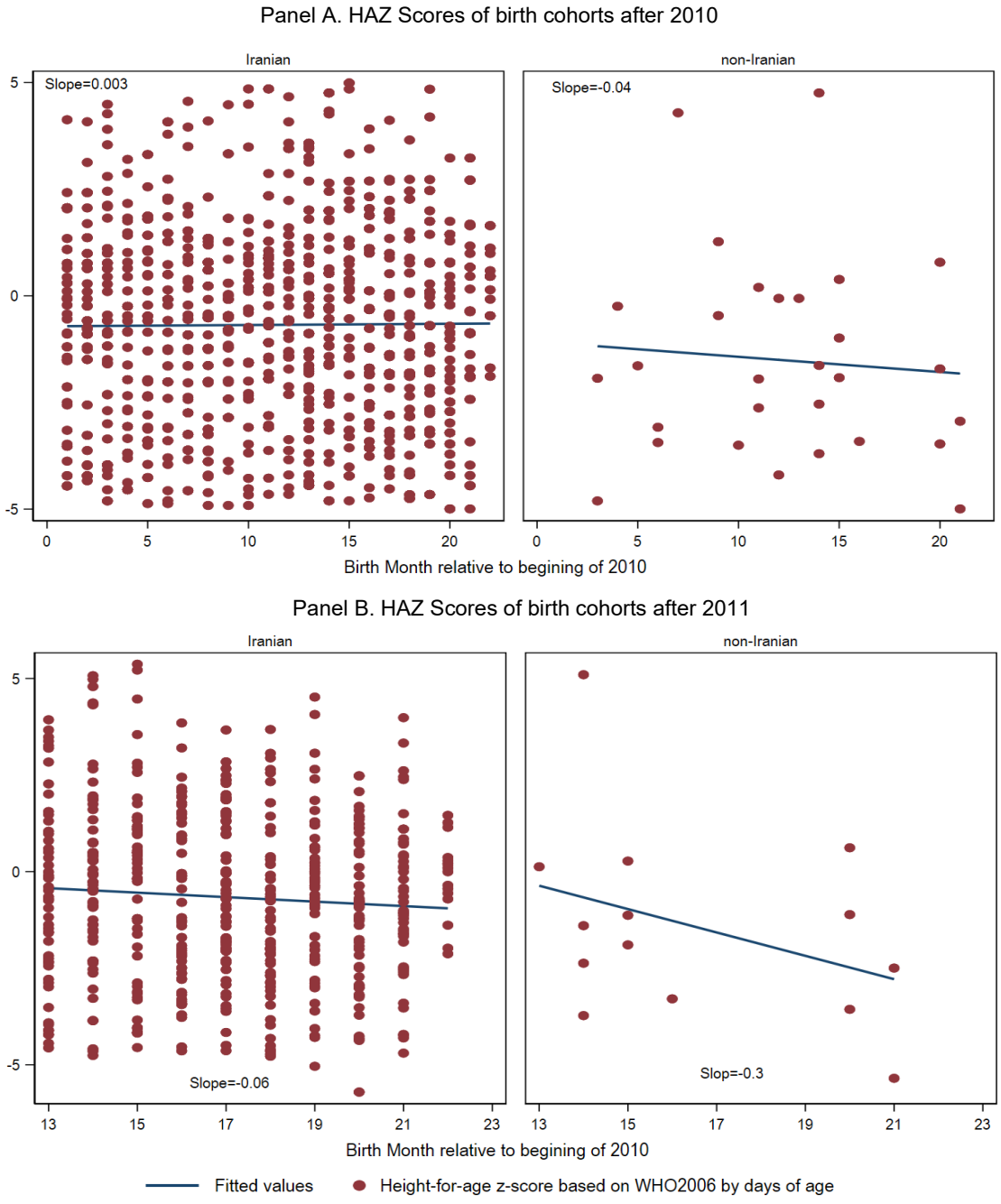

FIGURE A 2. HEIGHT AND TIME OF EXPOSURE TO REFORM IN 2010 AND 2011 COHORTS OF IRANIANS AND NON-IRANIANS.

Notes: Panel A presents HAZ for cohorts born after 2010, while Panel B displays HAZ for cohorts born after 2011. This analysis highlights the heterogeneity in treatment effects among highly exposed cohorts, suggesting that increased in-utero exposure to the reform correlates with greater differences in growth outcomes between Iranian and non-Iranian children.

Source: Author's calculations from Urban Heart 2011 Tehran.

Within high exposure cohorts comparisons: In all analyses so far, due to the limited sample size, we assigned an overlap ratio of 1 to all children born after the reform's initiation on December 18, 2010. However, treatment effects may vary based on the duration of exposure

in utero and the first year of life. While our sample size does not allow us to test these variations statistically, it does illustrate the distribution of the total treatment in 2010-2011. For example, a non-Iranian infant born in mid-2011 would have been exposed to the reform conditions for approximately seven months in utero. In contrast, children born at the start of 2011 experienced the reform for only one month in utero but throughout the first months after birth.

The extensive literature on early life shows that such variations could potentially affect their growth in terms of height and weight. To investigate these exposure scenarios further, Figure A2 presents HAZ for the most affected children (born in cohorts 2010 and 2011), based on the birth month distance from the beginning of 2010. Panel A includes data for children born after 2010, and Panel B includes data for those born after 2011. Both panels reveal a negative impact of reform exposure on child growth, with more pronounced effects in the 2011 cohort, which had more extensive in-utero exposure.

This finding underscores the variability in treatment effects within highly exposed groups, showing that more in-utero exposure leads to more significant growth disparities between Iranian and non-Iranian children. It supports the fetal origin hypothesis, indicating that even slight prenatal disruptions can substantially affect child outcomes.

C. Partially vs Fully Exposure to Reform in Early Life

Our main identification strategy uses variation in the ratio of each child's life overlapping with the reform. However, the event study shows that the most significant impacts manifest in birth cohorts of 2011 and then 2010. What about children with birthdays after 2006 and before December 18, 2010, who were only partially exposed to the reform? A curiosity may arise about comparisons between the control group, those with only partial exposure, and those with full exposure to the reform. The results show that even partial exposure matters, though the magnitude of the effect is much smaller than that of full exposure. Figure A3, Panel A, shows the HAZ for children born from early 2007 to December 2010 who have partial exposure to the reform. Panel B compares the HAZ of children fully exposed after the reform began in December 2010 with a control group from 2005, which has no exposure. The results show a larger impact in fully exposed children.

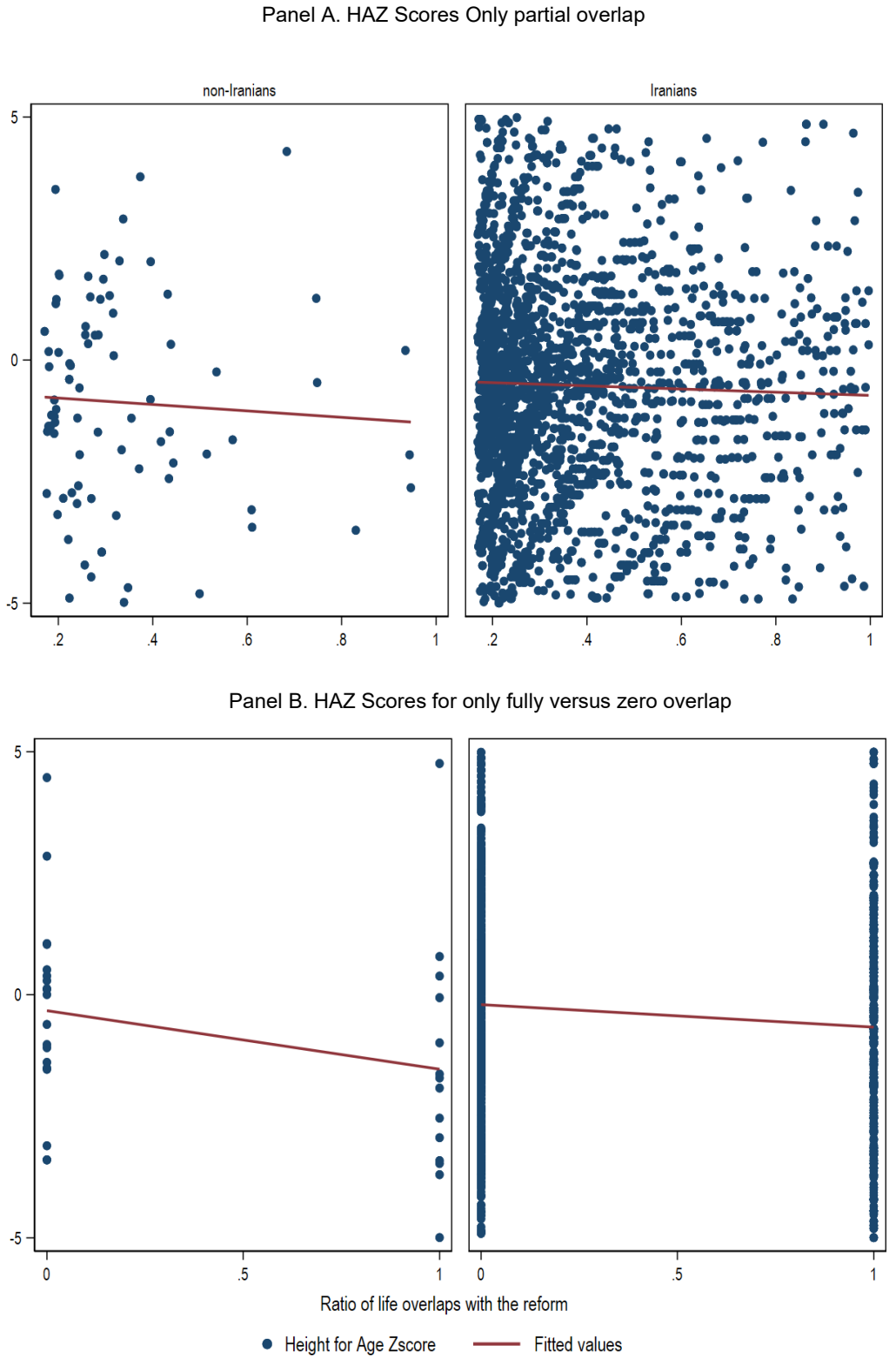

FIGURE A 3. HEIGHT AND DEGREE OF OVERLAP WITH REFORM FOR IRANIANS AND NON-IRANIANS

Notes: Panel A presents HAZ for cohorts that partially overlapped with the reform (2007—2010), and Panel B displays HAZ for those fully overlapped following the reform's initiation in December 2010, compared to our control group with zero overlap (2005—2006 cohort). This analysis aims to demonstrate that the results are influenced by both partial and full exposure to the reform, though the impacts of full overlap are more substantial.

Source: Author's calculations from Urban Heart 2011 Tehran.

D. Matching on Observables

This appendix summarizes the secondary analysis using a matching sample technique to compare similar Iranian and non-Iranian households based on wealth, income, education, and occupation variables. Given the smaller number of non-Iranians and potential data loss, we focus on five key variables available for most households: the education and occupation of the household head's father as a proxy for parental education and job, and the socio-economic disparities across different residential districts in Tehran. The districts are grouped by income levels: low-income (districts 15-21), medium-income (districts 8-14, 22), upper-medium income (districts 4-7), and high-income (districts 1-3). Our matching approach also considers home ownership and the unemployment status of the household head. We apply Inverse Probability Weighting (IPW) for a balanced comparison, targeting children under 18 years old. A logistic regression is used to calculate weights for the likelihood of being non-Iranian, using the key variables as predictors. Table A1 shows the covariate balance summary for households with children under 18. Table A2 provides the results of the main specification on the health of children in Equation 2 on the matched sample. The results are very similar to the main findings: the coefficients for weight and stunted growth are the same, while the coefficient for HAZ becomes more negative, from -1.2 to -1.7.

TABLE A 1— SAMPLE DISTRIBUTION AND COVARIATE BALANCE SUMMARY OF CHILDREN UNDER 18

	Raw		Weighted	
Observations	21,146		21,146	
Non-Iranian	587		10,608.30	
Iranian	20,559		10,537.70	
	Standardized Differences	Variance Ratios	Standardized Differences	Variance Ratios
Father's Education				
Level 2	-0.29	0.72	-0.01	0.99
Level 3	-0.15	0.63	-0.00	0.99
Level 4	-0.24	0.53	-0.01	0.98
Father's Occupation				
Level 2	-0.04	1.03	-0.01	1.00
Level 3	-0.39	0.34	-0.00	0.99
Level 4	0.01	1.04	-0.00	0.98
Income by District				
Level 2	-0.31	0.71	-0.00	0.99
Level 3	-0.29	0.53	-0.01	0.99
Level 4	-0.15	0.63	-0.00	0.99

	Raw		Weighted	
Observations	21,146		21,146	
Non-Iranian	587		10,608.30	
Iranian	20,559		10,537.70	
	Standardized Differences	Variance Ratios	Standardized Differences	Variance Ratios
Unemployment Status	0.11	1.63	0.01	1.05
Home Ownership	-0.89	0.58	-0.00	0.99

Notes: The Inverse Probability Weighting method was applied using 'non-Iranian' status as the dependent variable, along with 14 dummy variables representing education, occupation, district of residence, home ownership, and the employment status of the household head to which the child belongs.
Source: Author calculations based on the Urban HEART 2011 Tehran

TABLE A 2— IMPACT OF REFORM ON MATCHED CHILDREN

	(1)	(2)	(3)	(4)
A. Weight (WAZ)				
Overlap×non-Iranian	-0.40	-0.41	-0.41	-0.38
	(0.35)	(0.36)	(0.36)	(0.33)
			[0.29]	[0.28]
B. Height (HAZ)				
Overlap×non-Iranian	-1.73***	-1.77***	-1.85***	-1.73***
	(0.63)	(0.62)	(0.58)	(0.58)
			[0.64]	[0.57]
C. Stunted (HAZ<-2)				
Overlap×non-Iranian	0.21*	0.22**	0.23**	0.20**
	(0.11)	(0.11)	(0.11)	(0.10)
			[0.10]	[0.087]
SEX+ Time of Birth	Yes	Yes	Yes	Yes
Daily Age +Quadratic	No	Yes	Yes	Yes
District	No	No	Yes	Yes
Owner+ Employment+ Father	No	No	No	Yes
Observations (HH)	5,015	5,015	5,013	5,013

Notes: This table reports estimates of the impact of reform on children's outcomes using the specification of equation (2). The Inverse Probability Weighting method was applied using 'non-Iranian' status as the dependent variable, along with 14 dummy variables representing education, occupation, district of residence, home ownership, and the employment status of the household head to which the child belongs. Robust standard errors in parentheses and clustered standard errors in brackets at the district. Levels of significance are indicated by *** for 1 percent, ** for 5 percent, and * for the 10% level.

Source: Author calculations based on the Urban HEART 2011 Tehran

E. Food Security Survey Questions (Urban Heart 2011 Tehran)

This section details the translation of the questions used as one of the outcomes of our study on malnutrition, sourced from the Urban Heart 2011 Tehran survey. The question numbers are consistent with the main survey to help the audience in the originating country locate them easily.

A. Question 52: "In the last 30 days, was there ever a time when the food you bought was not enough and you did not have money to buy more food?"
    - Response Options: □ Does not know or does not answer □ Never □ Sometimes □ Most of the time
B. Question 53: "In the last 30 days, did you or any family member have to eat only limited (special) types of food due to lack of money?"
    - Response Options: □ Does not know or does not answer □ Never □ Sometimes □ Most of the time
C. Question 54: "In the last 30 days, did you or any family member have to skip your daily meals or reduce their amount due to lack of money to buy food?"
    - Response Options: □ Does not know □ No □ Yes
    - If yes, number of days this happened: ..... □ Does not know the day
D. Question 55: "In the last 30 days, did you personally consume less food than you need because you didn't have enough money to buy sufficient food?"
    - Response Options: □ Does not know □ No □ Yes
E. Question 56: "In the last 30 days, were you or any of your family members hungry but could not eat because of lack of money?"
    - Response Options: □ Does not know □ No □ Yes
    - If yes, number of days this happened: ..... □ Does not know the day

F. Supplementary Tables: Full Set of Coefficients, and Analysis of HAZ with Different Outlier Measures

In this appendix, we provide the full set of coefficients from the main analysis on the height of children. We identified some outliers in height and weight, such as 1 cm for height and 1 kg for weight, and excluded HAZ and WAZ values outside of 5% standard deviation. Here, we change this measure and report the coefficients for 2010-2011 with different controls and fixed effects. The coefficients for HAZ are robustly between -1.1 and -1.2 for outliers ranging within 3.5 to 5.5 standard deviations.

TABLE A 3— IMPACT OF REFORM ON HEIGHT OF NON-IRANIAN CHILDREN WITH DIFFERENT CONTROLS, AND FIXED EFFECTS

Outcome: HAZ (Height Adjusted)	(1)	(2)	(3)	(4)	(5)	(6)
NonIranian* Overlap	-1.22**	-1.24**	-1.24**	-1.25**	-1.30**	-1.30**
	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)	(0.52)
NonIranian	0.14	0.14	0.16	0.16	0.36	0.36
	(0.26)	(0.26)	(0.26)	(0.27)	(0.27)	(0.33)
Male Child	0.05	0.05	0.05	0.05	0.04	0.04
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Daily Age		-0.90	-0.90	-0.89	-0.69	-0.70
		(0.88)	(0.88)	(0.88)	(0.89)	(1.27)
AGE_SQ		0.13	0.13	0.13	0.10	0.10
		(0.10)	(0.10)	(0.10)	(0.11)	(0.14)
Dummy Home Owner			0.08	0.08	0.05	0.05
			(0.06)	(0.06)	(0.06)	(0.09)
Unemployed Head				0.15	0.05	0.05
				(0.24)	(0.24)	(0.28)
Parents Education level=2					0.05	0.05
					(0.07)	(0.09)
Parents Education level=3					0.23**	0.23
					(0.10)	(0.15)
Parents Education level=4					0.24**	0.24**
					(0.09)	(0.11)
Income District Level=2						1.66***
						(0.23)
Income District Level=3						0.00
						(.)
Income District Level=4						1.88***
						(0.21)
Constant	-0.47***	0.55	0.53	0.52	0.27	-0.40
	(0.04)	(1.83)	(1.83)	(1.83)	(1.85)	(2.48)
Observations	5,015	5,015	5,015	5,015	4,978	4,978

Notes: This table reports estimates of the impact on children's outcomes using a continuous difference-in-difference model in Equation 2 with all sets of coefficients in the model. Standard errors are robust in columns 1 to 5 and at the district level in column 6 when district income level is added to the model. Asterisks indicate significance levels, with * for the 10% level and ** for the 5% level.

Source: Author calculations based on the Urban HEART 2011 Tehran

TABLE A 4— IMPACT OF TIME OF BIRTH IN 2010-2011 ON HEIGHT OF NON-IRANIAN CHILDREN WITH DIFFERENT RESTRICTING OUTLIERS, CONTROLS, AND FIXED EFFECTS

Outcome: HAZ (Height Adjusted) Range:	(1) 5.5 std	(2) 4.5 std	(3) 4 std	(4) 3.5 std
A. Baseline				
2010-11×non-Iranian	-1.1**	-1.1***	-1.2***	-1.1***
	(0.5)	(0.3)	(0.3)	(0.3)
B. Controls				
2010-11×non-Iranian	-1.1**	-1.1***	-1.2***	-1.2***
	(0.5)	(0.4)	(0.4)	(0.3)
C. District FE				
2010-11×non-Iranian	-1.1**	-1.1***	-1.2***	-1.1***
	(0.5)	(0.3)	(0.3)	(0.3)
D. Controls + District FE				
2010-11×non-Iranian	-1.1**	-1.1***	-1.2***	-1.2***
	(0.5)	(0.4)	(0.4)	(0.3)

Notes: This table reports estimates of the impact of time of birth on children's outcomes using a simple difference-in-difference model with a dummy variable for birthdays in 2010-2011. In addition to the main analysis based on a 5-standard deviation (std) criterion, different criteria for height outliers are considered in the columns, with Height-for-Age Z-scores (HAZ) within 5.5, 4.5, 4, and 3.5 std. Controls include gender, four dummies for education, four dummies for parents' occupation, unemployment status, homeownership, and district fixed effects. standard errors are clustered at the district level. Asterisks indicate significance levels, with * for the 10% level and ** for the 5% level.

Source: Author calculations based on the Urban HEART 2011 Tehran

G. Supplementary Figures: Weight of children, Income distribution of panel 2010—11, and Food diversity before and after the reform

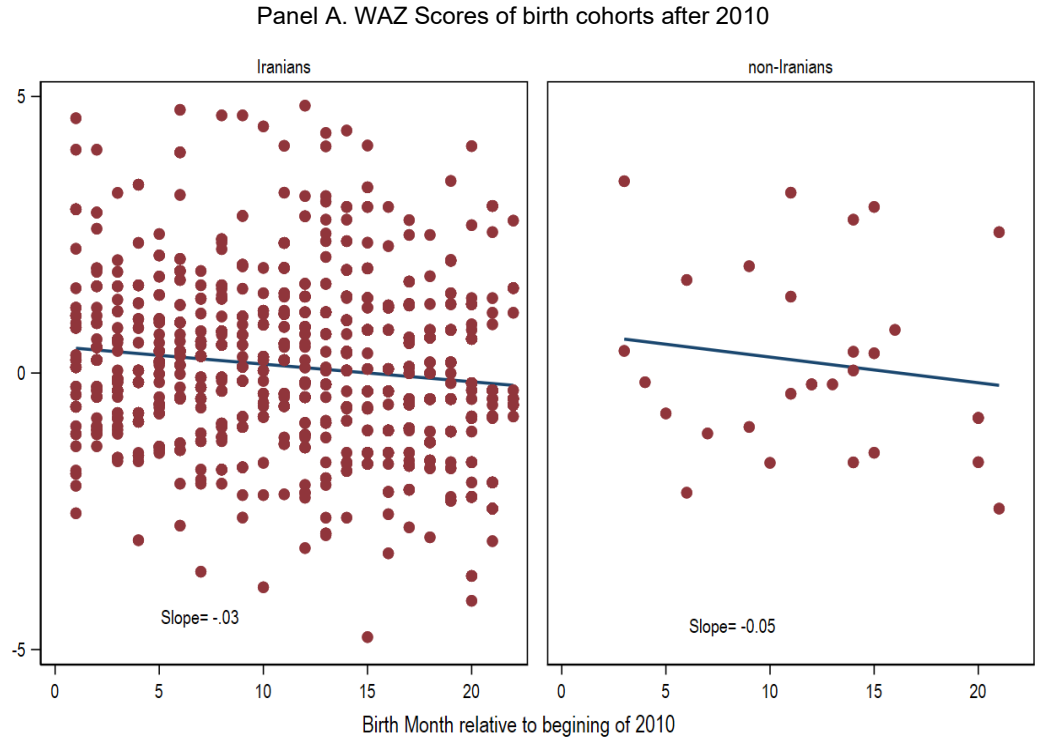

FIGURE A 4. WEIGHT AND TIME OF EXPOSURE TO THE REFORM IN 2010 AND 2011 COHORTS OF IRANIANS AND NON-IRANIANS

Notes: Panel A presents WAZ for cohorts born after 2010, while Panel B displays WAZ for cohorts born after 2011. This analysis shows that, similar to the height of children, there is a gap in the weight of Iranian and non-Iranian children born in 2010 and 2011. The gap is larger for the 2011 cohort; however, it is not statistically significant.

Source: Author's calculations from Urban Heart 2011 Tehran.

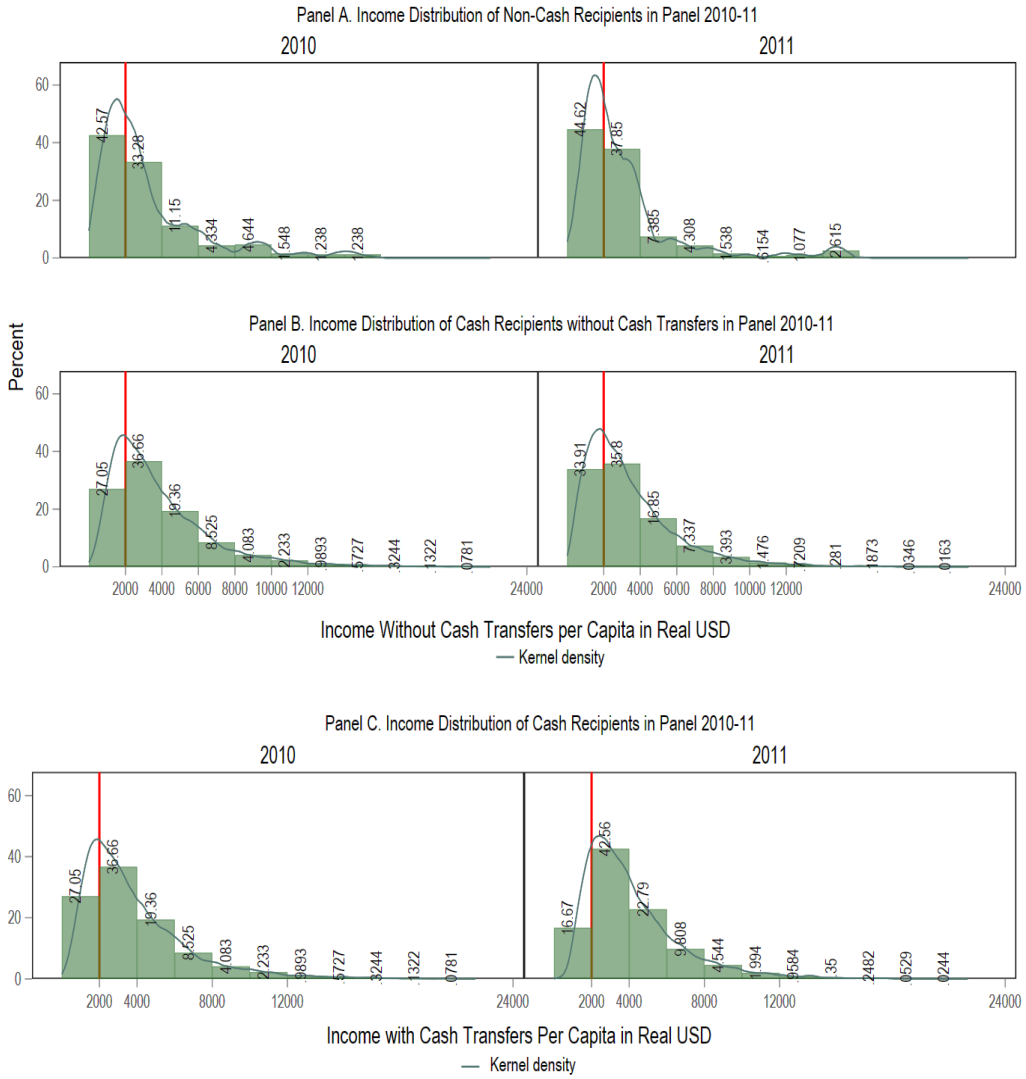

FIGURE A 5. INCOME DISTRIBUTION OF CASH RECIPIENTS AND NON-CASH RECIPIENTS BEFORE (2010) AND AFTER (2011) THE REFORM, IN THE 2010-2011 HOUSEHOLD PANEL

Note: This figure presents the income distribution of two groups of households, cash recipients and non-cash recipients, before and after the reform using the 2010-2011 household panel. Specifically. Panel A shows the income distribution of non-cash recipients. Panel B shows the income distribution of cash recipients without cash transfers (cash transfers subtracted from their net income). Panel C shows the actual income distribution of cash recipients.

Source: Author's calculations from HEIS 2010-2011.

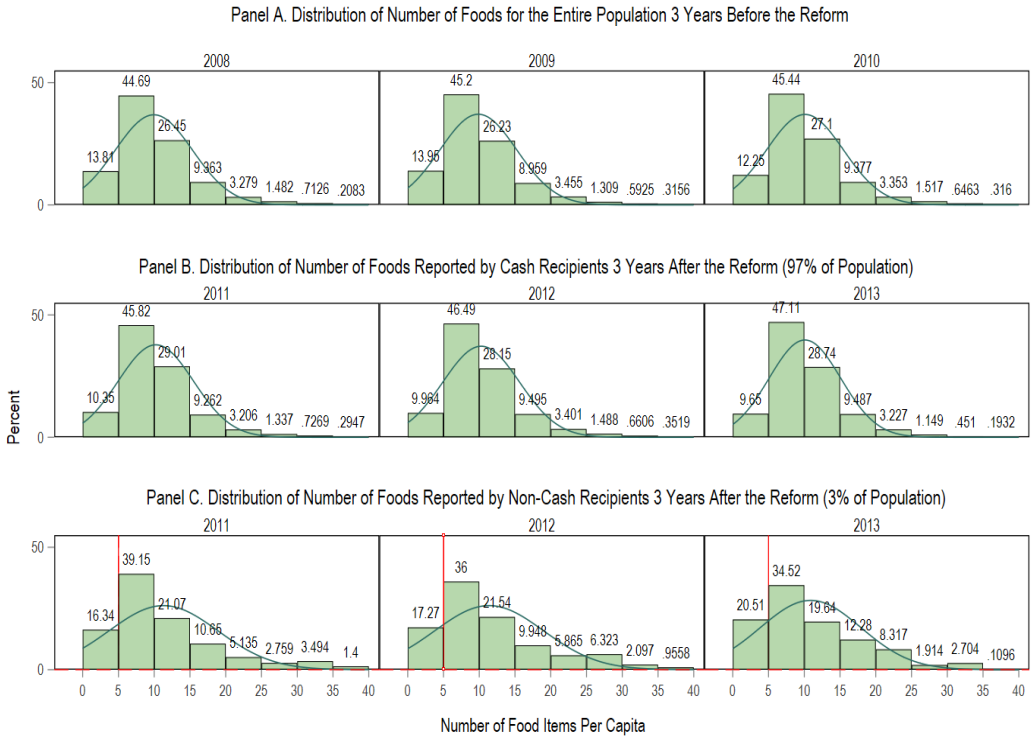

FIGURE A 6. DISTRIBUTION OF NUMBER OF FOODS REPORTED BY CASH RECIPIENTS AND NON-CASH RECIPIENTS BEFORE (208—2010) AND AFTER (2011—2013) THE REFORM.

Note: This figure presents the distribution of the number of foods reported by two groups of households, cash recipients and non-cash recipients, before and after the reform. Specifically, Panel A shows the distribution of the number of foods for the entire population 3 years before the reform. Panel B shows the distribution of the number of foods reported by cash recipients 3 years after the reform (97% of the population). Panel C shows the distribution of the number of foods reported by non-cash recipients 3 years after the reform (3% of the population).

Source: Author's calculations from HEIS 2010-2011.