HARVESTING HUNGER: OPIUM BAN AND FOOD SECURITY

Jafar Jafarov[†] and Tejendra P. Singh[‡]

ABSTRACT. When moving away from illicit crops and imposing sweeping restrictions, governments face unintended consequences, raising questions about who bears the distributional effects and how they cope with them. In April 2022, the Taliban imposed a ban on opium cultivation in Afghanistan. As opium was the main cash crop cultivated in many parts of the country, the ban upended the livelihoods of farmers and cultivators. Leveraging spatial variation in satellite-derived measures of opium cultivation along with detailed household survey data, we examine whether the ban had any effect on food security in the affected areas. Our findings from a difference-in-differences framework suggest that high food insecurity emerged in the immediate aftermath of the ban but gradually diminished over time. Results show a substantial increase in the likelihood of facing an extreme level of food insecurity – nearly a quarter of the pre-ban mean, whereby the effect is pronounced only for households unable to transition their production from opium to grains. Households cope with extreme food insecurity by reducing food consumption frequency and limiting portion sizes in the short run, selling livestock, and shifting production from opium to wheat on arable-for-grain soils in the medium run.

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JEL Classifications: D13, D31, I32, O13, Q18, R14

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1. Introduction

When governments enact broad policies to curb illegal production, the resultant unintended consequences can often be profound and unavoidable, and total social costs might even exceed benefits (Miron and Zwiebel, 1995). This phenomenon is particularly evident in efforts to restrict goods associated with negative externalities, such as policies aimed at reducing air pollution, increasing the prices of tobacco products, banning the production of illicit drugs, or, in extreme instances, conducting military operations against cartels. These policies, while well-intentioned, often produce significant negative spillover effects on other sectors (Battiston et al., 2024), trigger economic shocks for those directly impacted, and ignite social unrest and tensions. Understanding the ramifications of such policies is crucial, especially in the context of developing economies where the ripple effects of these measures can severely disrupt economic growth with the potential to exacerbate existing socioeconomic inequities. The ban on opium poppy production in Afghanistan serves as a poignant example of how these policies can lead to widespread economic and social upheaval.

During the first year following the Taliban's takeover of Afghanistan, opium cultivation in the country increased by 32% (UNODC, 2022), which brought criticism to the Taliban despite the crop being planted a year ago. In light of increasing drug production, on April 3, 2022, the Taliban supreme leader imposed a counternarcotics ban on opium poppy cultivation (its production, use, and sale) in Afghanistan, the world's largest opium supplier at that time with a predominantly agrarian economy. Opium production, moreover, constituted the largest share of the nation's agricultural output, to the extent that there are particular provinces whereby every farmer before the ban allocated at least some portion of their plots to the poppy crop (Padshah and Gibbons-Neff, 2022).

In this paper, we investigate how the April 2022 ban on opium production in Afghanistan has impacted household livelihoods, particularly their food security. For some areas of the country that are highly dependent on opium cultivation as the primary income-generating activity, the successful enforcement of this ban, i.e., the forced reduction in the area of opium poppy cultivation, might mean a tremendous decline in income. While UNODC (2023a) indicates that the 2022 opium outlaw significantly reduced farmers' income from poppy cultivation, the extent to which this ban contributes to food insecurity remains a critical empirical question.

On one hand, considering the current humanitarian situation in the country, the 2022 opium ban might have substantial short- and long-term negative consequences, i.e., result in an income shock, depriving farmers of their livelihood and disrupting their finances. Sole farmers, landowners, and businesses engaged in the processing, transporting, and trading of opium yields face immediate adverse effects of the economic shock. Mansfield (2023a) illustrates that following the ban rural economy in Afghanistan has already lost roughly $1 billion in terms of economic inactivity. Byrd (2023) adds the distributional aspect to Mansfield (2023a) estimations by arguing that the ban puts farming households at risk of malnutrition

and even hunger.

On the other hand, the UNODC (2022) report notes that opium prices surged following the April announcement of the cultivation ban, making the 2022 opium harvest the most profitable for farmers since 2017. Thus, the policy could also intensify disparities between agricultural and non-agricultural laborers, potentially widening the socioeconomic gap within rural communities (Depew et al., 2013). Given the illicit nature of the commodity and the ban's potential to exacerbate existing inequities within the agricultural sector, it remains uncertain how the income levels changed in the aftermath of the ban.

To answer the research question, we use district-level satellite-derived measures of opium cultivation (UNODC, 2023b) and designate a district to be exposed to the ban (i.e., considered a treated group) if there is any non-zero estimate of opium production either in 2020 or 2021. We then use Data in Emergencies Monitoring (DIEM) household survey data designed to gauge the extent of food security (Food and Agriculture Organization, 2023). Although the survey does not explicitly ask about whether the household is engaged in poppy farming, it collects detailed information about household characteristics, income sources and shocks, crop production and marketing, food security and consumption, and needs assistance. There are eight survey rounds, one of which is conducted in April 2022 (around the time of the ban announcement), three during the pre-ban period, and the remaining four during the post-ban period.

DIEM data on food security consist of eight questions the ranging from being *worried about not having enough food to eat* to extreme levels like *going a whole day without eating anything*. Based on these binary questions we construct the outcomes of interest reflecting the level of food insecurity. The outcomes include the raw food insecurity score (the sum of respondents' affirmative responses to each of the eight questions), extreme food insecurity (a binary variable if the respondent's raw score is five or more), household hunger scale (HHS) (standard measurement ranging from 0 to 6), average Z-Score, Anderson (2008) Z-score, and any food insecurity (a binary variable if the respondent reports affirmatively on any of the eight questions). High or extreme food insecurity is the main outcome of the interest.

Our identification strategy to uncover the causal effects of a supply-side restriction is an extension of the canonical difference-in-differences framework with district and time fixed-effects controlling for province-specific linear time trends. This empirical strategy accounts for level differences in food insecurity measures while allowing for secular shocks and differential provincial trends over the sample period. The identifying variation comes from differential exposure to the opium ban across districts over time. The main identifying assumption of the empirical framework – parallel trends – is validated through the presentation of event-study estimates.

Preliminary findings show that the likelihood of reporting extreme food insecurity in districts with poppy cultivation compared to those without increases by 17.4 percentage points in the post-ban period relative to the pre-ban period, on average. This jump in the high food insecurity is sizeable since it corresponds to nearly a 25% increase over the pre-ban mean

for the treated district respondents. The effect of the ban on other food insecurity outcomes is also economically and statistically significant, except for reporting any food insecurity, which is not statistically significant given 98% of all residents had faced food insecurity to some extent in the pre-treatment period irrespective of whether the district of residence cultivates any opium.

The event-study estimates provide evidence that the effect of the policy on food insecurity is immediate after the ban's enforcement but fades over time. Meanwhile, no significant differences in outcomes across various subpopulations are detected, suggesting that the consequences are widespread throughout the country. These conclusions are robust to a battery of robustness checks.

To mitigate the risks of food insecurity, households who were cultivating opium poppies should find viable replacements for their previous cultivation practices. Given the scarcity of resources and lack of skills, the list of potential substitutes is not rich and usually limited to growing grain, other crops, and producing other agricultural products (dairy, wool, livestock). Our observations show that respondents mainly reallocate from opium to grain on soils suitable for grain cultivation, underlying the crucial role of grain production for Afghani households in mitigating food insecurity. Therefore, it is not surprising that the respondents who experienced high food insecurity right after the ban was imposed are the residents of districts where grain cultivation is hindered by unsuitable soil conditions.

In an alternative way to cope with the threat of food hardship, exposed households sell their animals – productive assets for livestock owners and relocate within their districts (during the second post-ban phase). In the meantime, food shortage forces exposed households to substantially reduce the number of meals and limit the portions of food intake. Since the negative effect of the ban on food security eventually fades away, the majority of households during this initial post-ban period may have already transitioned their production from opium to alternative crops or adapted to the new realities of food diversity and availability. Using national price data on various commodities, we rule out price adjustment as the likely mechanism that worsens food insecurity. Instead, our estimates point to the role of negative income shock in driving the dynamics of food insecurity that we highlight in the aftermath of the opium cultivation ban.

To the best of our knowledge, we are the first to investigate the consequences of the 2022 opium cultivation ban in Afghanistan and to explore the dynamics of how households cope with food hardship in developing countries. By examining this issue, we aim to provide a deeper understanding of the socioeconomic consequences of the national ban, explore its distributional implications and households' coping strategies, and develop policy amendments.

We also contribute to the strand of literature about the negative and direct consequences of a restrictive, and, in particular, agricultural policy on food insecurity. Whilst a set of policies successfully alleviate food hardship by improving the financial status of poor households in the developing world (Gilligan et al., 2009), others not only fall short of the

target but might even have negative spillovers (Aggarwal et al., 2024; Beegle et al., 2017). Hence, understanding the coping mechanisms and production transition patterns might be crucial for shaping effective policies.

Due to relatively short periods of post-treatment data, existing literature falls short of uncovering the dynamic effects of supply-side restrictions on various outcomes. We expand this literature by showing the immediate worsening and eventual improvement in food security of the exposed households. By ruling out the role of price changes, we also provide strong evidence for negative income shock as the most likely pathway leading to the food security dynamics that we document.

The rest of this paper is organized as follows. Section 2 explains the details of policy implementation, documented changes in agricultural output, and impact on household income. In Sections 3 and 4, we discuss the employed data and illustrate the empirical strategy, respectively. Section 5 presents results and Section 6 provides discussions and concludes.

2. Background

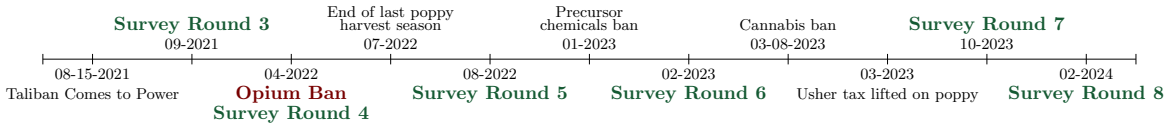
Taliban had ruled Afghanistan from 1996 to 2001. In the wake of the September 11 attack, United States (US) forces, aided by a Congressional resolution, launched "Operation Enduring Freedom" against the Taliban. The country drafted a new constitution in 2004, with national elections taking place shortly thereafter. Taliban continued its insurgency operations, often inflicting severe damage on international forces. These operations, almost entirely, were funded by *de facto* protection to opium cultivators (Peters, 2009; Shah and Mashal, 2016). Over time, the Taliban regrouped and regained control in August 2021 after most of the US forces had withdrawn from the country.

Even before the takeover, Afghani households were living in one of the world's largest humanitarian emergencies, engendered and worsened over many years of military conflicts and long-lasting poverty. The emergency is mirrored in many aspects of family livelihood, mostly in a hunger crisis, catastrophic impact on education, health, and economic growth in general. The situation has not improved in the two years since the Taliban's takeover, if not exacerbated by repressive policies. Over two-thirds of the total population require humanitarian assistance, with six million people facing extreme food insecurity – a step away from famine (HRW, 2024).

Thus, the Taliban's takeover in 2021 heralded a period of continuing humanitarian crisis. Afghan women and girls faced a more precarious situation due to increased restrictions on individual freedoms (Curry et al., 2023). Concurrently, climate change-driven frequent droughts and floods threatened the primarily agrarian economy and curtailed access to drinking and clean water. Amidst these challenges, the Taliban, citing religious beliefs, banned opium cultivation in April 2022, coinciding with the springtime poppy harvest season (Limaye, 2023; Padshah and Gibbons-Neff, 2022). No exemptions were granted for the upcoming

planting season, and harvested produce could only be sold for a short duration following the decree issued by Taliban leaders. The post-Taliban takeover timeline is reported in Figure 1.

FIGURE 1. Timeline of Opium Cultivation Policies and Survey Rounds



Despite the lack of specific enforcement data, satellite imageries provide evidence for the successful implementation of the ban. Mansfield (2023a) shows that the enforcement was indeed remarkably successful in terms of cultivation reductions (in the area under opium cultivation and tons of harvesting in 2023). UNODC (2023a), in their report on the cultivation and production trends of opium in Afghanistan after the ban, show that the cultivation area shrank from 120 thousand acres to 1000 just within a year in Helmand province, the largest opium-producing province. In Figure 2, we also show a sharp decline in the likelihood of district reporting any opium poppy cultivation immediately after the imposition of the ban). Figure 2 illustrates the spatial distribution of districts with opium cultivation across the years, where the reduction in area under opium poppy cultivation is striking.

The key role in this success was played by the Taliban's staged approach to policy implementation, evolving and intensifying over time. Authorities did not start eradicating the standing crops right after the announcement of the ban (April 2022), which would have been met with resistance from the farmers, but rather focused on the upcoming summer crops. This lack of early enforcement by the Taliban engendered skepticism about the seriousness of the ban. However, Taliban tried to curb this skepticism by publishing videos of the Ministry of Interior destroying existing crops.

Remaining concerns about the stringency of the ban may have been alleviated in October 2023 when the Taliban issued a penal code on the cultivation of opium poppy. This code results in imprisonment of up to one year if there is more than half an acre of opium cultivation with at least six months imprisonment for any cultivation by the farmer. To further instill fear in the Afghanistan farmers, the Taliban has reportedly destroyed whatever crop was discovered in the Fall 2022 planting season, and these actions appear to have become more intense since then (Sabawoon and Bjelica, 2024).

In response to the opium ban, many Afghanistan farmers began reallocating their agricultural activities from opium cultivation to grain and other crops (UNODC, 2023a) and selling their assets. This transition, however, was not uniform across the country due to differences in land ownership, soil suitability for particular crops, and occupational structures within the agricultural sector (Mansfield, 2023a). Wealthier landowners with

larger, more fertile plots would switch to grain cultivation more easily, while smallholder farmers and sharecroppers would face more significant challenges, leading to varying degrees of impact from the ban. Despite these differences, the pervasive humanitarian crisis and widespread food hardship in the country imply that the ban's effects reverberate across the entire population, making the extent of this impact on various subpopulations an empirical question.

3. Data

We construct a novel dataset by assembling the most complete sources to examine the impact of the opium cultivation ban on food security – Data in Emergencies Monitoring (DIEM) surveys for Afghanistan, Rapid Household Assessments, and the United Nations Office on Drugs and Crime (UNODC) data on opium cultivation. Detailed descriptions of each data source are provided below.

3.1. Data in Emergencies Monitoring

Data in Emergencies Monitoring (DIEM) survey (Food and Agriculture Organization, 2023), conducted by the Food and Agriculture Organization of the United Nations (FAO), collects data to assess the impact of shocks in contexts of food crisis. There are a total of eight rounds of the DIEM survey in Afghanistan, spanning from October 2020 to February 2024. These waves provide information before, during, and after the imposition of the opium cultivation ban, aiding our empirical strategy. For our analysis, we utilize six rounds of these data as we exclude the first and second rounds from the baseline estimates due to their national unrepresentativeness and inconsistency.[1] While data for the first round are unavailable, the results remain robust when incorporating data from the second round with restricted samples (Figure B12).

The survey data are collected using a two-step cluster sampling method and are weighted by demographic characteristics. In the initial step, approximately 25 clusters are selected from each province in each survey round. Surveys are representative at the province level. In the second step, around eight households were randomly selected from each cluster for face-to-face interviews. A substantial portion of the surveyed households in each round are involved in the agricultural sector. We use the district of residence for the surveyed household to merge DIEM with other data sources.

We employ DIEM data for our outcome variables and to control for potential confounders

[1] DIEM survey rounds are from October 2020, February 2021, September 2021, April 2022, August 2022, February 2023, October 2023, and February 2024. The survey round from August 2022 is the first round post-treatment. The first survey round (October 2020) corresponds to the pre-Taliban period, incorporates questions on food security that are different from standard ones and is unavailable for the majority of provinces. The second survey round (February 2021) lacks information for multiple districts and has only limited questions on food insecurity.

in the empirical specifications. Given the main interest in identifying the causal effect of the opium cultivation ban on food insecurity of the exposed households, we use survey data on questions related to food security indicators, which provide household-level information on food security over the last month, food consumption and dietary diversity over the last month, week, and 24 hours from the interview date. We also use DIEM surveys to examine the coping strategies of households lacking access to enough food for the household members and demographic information to control for household characteristics that might be correlated both with exposure to the opium cultivation ban and food security. We use this pre-determined demographic information to study if the estimated effects differ across various subpopulations that may be differentially exposed to the ban.

There are eight questions on food insecurity estimates (FIES) in the DIEM data (see Panel C of Table 1 and Appendix A.1 for more details), based on which we construct outcomes of interest reflecting the level of food insecurity. *High (or Extreme) FIES* – our primary outcome variable, is a binary variable if the respondent's raw FIES score is five or more (out of eight). The next outcome variable is the *Household Hunger Scale (HHS)*, a standard measure of food insecurity ranging from 0 to 6, constructed using the respondents' intensity of having no food to eat, sleeping hungry, and having nothing to eat during an entire day. Other outcome variables are the *Raw FIES Score* (the sum of respondents' affirmative responses to each of the eight questions in the food security panel), *Average Z-Score* (the arithmetic mean of the Z-score for each of the eight questions), *Anderson (2008) Z-score* (Z-score constructed using the generalized least-squares (GLS) weighting procedure, which sidesteps inference problems arising due to multiple hypotheses testing), and *Any FIES* (a binary variable if the respondent reports affirmatively on any of the eight questions).

Table 1 provides the summary statistics. Considering the ongoing humanitarian crisis in the country, it is noteworthy that 73% of the households had experienced some economic shock. Panel B of Table 1 demonstrates that opium had been cultivated in 48% of all districts in 2021. The assignment of the districts into the control and treated groups is detailed in Section 3.2.

Panel C of Table 1 reports statistics for eight questions on food security and outcome variables. While 96% of the respondents are worried about not being able to have enough food, 94% and 93% report an inability to eat healthily and had only limited food in the last month, accordingly, highlighting the severity of the crisis. The average raw food insecurity score for the country is 5.7 out of eight, 98% of all the households experience some food hardship, and 73% report facing extreme food insecurity.

3.2. Treatment Data

We employ multiple data sources to construct our treatment variables, primarily utilizing district-level estimates of opium cultivation in Afghanistan provided by the United Nations Office on Drugs and Crime (UNODC, 2023b), which are generated from satellite imagery. We

TABLE 1. Summary Statistics

	Mean	SD	Min	Max
Panel A: Household Characteristics				
Male Headed HH	0.922	0.268	0.00	1.00
Total HH Income (10,000 Afghani)	1.938	4.083	0.00	350.00
HH Cultivate Crops	0.486	0.500	0.00	1.00
HH Agricultural Laborer	0.083	0.275	0.00	1.00
HH Income Declined (Last Three Months)	0.695	0.460	0.00	1.00
HH Had Any Economic Shock (Last Three Months)	0.729	0.445	0.00	1.00
Panel B: Treatment				
Any Opium Cultivation in the District	0.481	0.500	0.00	1.00
Panel C: FIES				
Worried about not having enough food to eat	0.960	0.195	0.00	1.00
Unable to eat healthy and nutritious food	0.936	0.245	0.00	1.00
Ate only a few kinds of foods	0.929	0.257	0.00	1.00
Had to skip a meal	0.724	0.447	0.00	1.00
Ate less than you thought you should	0.840	0.367	0.00	1.00
No food to eat of any kind	0.579	0.494	0.00	1.00
Go to sleep at night hungry	0.454	0.498	0.00	1.00
Go a whole day & night without eating anything	0.366	0.482	0.00	1.00
Panel D: Outcomes				
High FIES	0.734	0.442	0.00	1.00
Household Hunger Scale (HHS)	1.639	1.349	0.00	6.00
Raw FIES Score	5.674	2.007	0.00	8.00
Average Z-score	0.124	0.611	-4.36	0.77
Anderson (2008) Z-score	0.007	1.003	-7.82	1.02
Any FIES	0.978	0.146	0.00	1.00

Notes: Data on food insecurity and household characteristics are derived from DIEM surveys. Opium cultivation data comes from UNODC (2023b). Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

also triangulate UNODC data with the data from Mansfield (2023b). We classify households in the districts that report any opium poppy cultivation in either 2020 or 2021 to be in the treatment group. We also develop alternative measurements for the treatment assignment, adjusting the base years and thresholds for the area under opium construction. Results remain robust across these alternate measures, as shown in Figure B5.

Figure 2 illustrates the spatial distribution of districts with opium cultivation across the years. The decline in opium cultivation from 2021 to 2022 is striking, with only a few districts continuing to cultivate opium on more than 10,000 hectares in 2022, highlighting the so-called

success of the ban (in Figure B1, we show a sharp decline in the likelihood of district reporting any opium poppy cultivation immediately after the imposition of the ban). Panel A of Figure 2 thus indicates the spatial distribution of treated and control districts, where the treated districts are those engaged in opium cultivation in 2021, while the control districts are not involved in cultivation.

In Table B1, we contrast households in control and treated districts within the DIEM dataset in the pre-treatment period, i.e., in April 2022 and earlier. The observations indicate that, on average, the statistics for both groups are nearly identical in terms of household characteristics and responses to the FIES questions and outcomes. Figure B6 shows the trends for control and treated districts for all outcome variables.

3.3. Other Data

We obtain information on weather conditions from ERA5-Land climate reanalysis data and include weather controls to gauge the potential influence of temperature, humidity, and precipitation on agricultural productivity (Hersbach et al., 2020). Data on crop suitability is derived from Fischer et al. (2021), whereby a district is designated to be suitable for a crop if it is in the top three quartiles of the crop suitability index distribution. Data on consumer price indices are derived from the National Statistic and Information Authority of Afghanistan (NSIA, 2024). Shapefiles data are from the Afghan Geodesy and Cartography Head Office.

4. Empirical Strategy

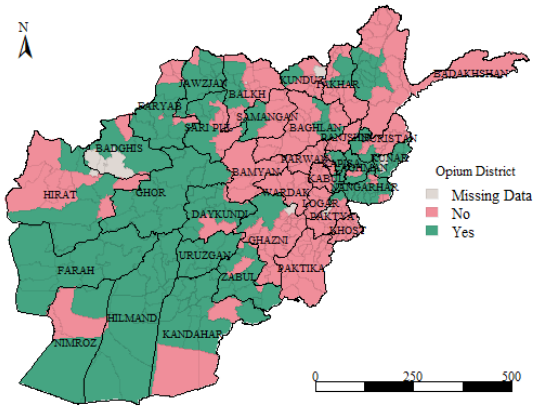
To estimate the causal effect of the opium cultivation ban on food security, we estimate the following specification.

$$y_{i(d,t)} = \alpha_{i(d)} + \alpha_{i(m(t))} + \alpha_{i(p)} \times \alpha_{i(t)} + \beta D_{i(d,t)} + \epsilon_{i(d,t)} \tag{1}$$

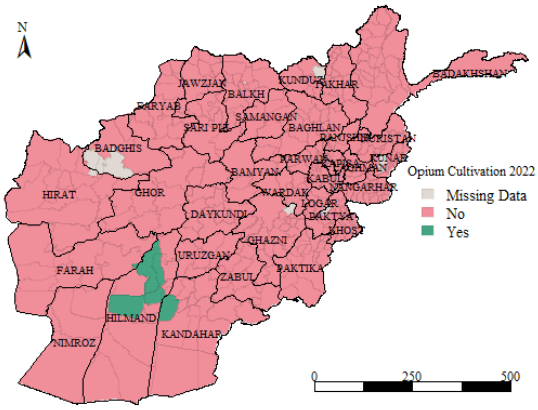
In Equation 1, $y_{i(d,t)}$ is the outcome of interest for household i residing in district d and surveyed on date t. The outcomes of interest include High FIES - primary outcome, other outcomes discussed in Panel D of Table 1, and coping strategies (discussed in section 5). $\alpha_{i(d)}$ and $\alpha_{i(m(t))}$ are district and survey month fixed-effects, respectively. While the former accounts for time-invariant characteristics correlated with both the treatment and outcome of interest, the latter controls for time-varying secular shocks. $\alpha_{i(p)} \times \alpha_{i(t)}$ are province linear time trends. By including province linear time trends, we allow the provinces to trend differentially over time. Thus, our empirical specification leverages within district variation in exposure to opium cultivation shock after accounting for secular shocks that are common across all households and province linear time trends to study the dynamics of food security measures. $D_{i(d,t)}$ is an indicator variable that takes a value of one for all households that are surveyed post-treatment in the treated districts. $\epsilon_{i(d,t)}$ is the idiosyncratic error term clustered at the

FIGURE 2. Spatial Distribution of Control and Treatment Districts

(A) Opium Cultivation in 2021



(B) Opium Cultivation in 2022



Notes: Shapefiles data are derived from the Afghan Geodesy and Cartography Head Office. Opium cultivation data are derived from UNODC (2023b), which provides annual information on the area under opium cultivation in hectares at the district-level. In the top panel, districts are categorized as cultivating opium if the area under opium cultivation is 10,000 hectares and more in the district either in 2020 or in 2021. In the bottom panel, districts are categorized as cultivating opium if the area under opium cultivation is 10,000 hectares and more in the district in 2022.

district-level (Abadie et al., 2022).

Our parameter of interest in Equation 1 is β.[2] The estimate of this parameter is the change in the average likelihood of a household reporting food insecurity from the pre- to post-treatment period in the treated districts relative to control districts. Due to the inability to ascertain whether a household cultivates opium poppy, the estimates of β are intention-to-treat (ITT) estimates.

For β to be interpreted causally, our empirical model should satisfy the parallel trends assumption. This amounts to outcomes in the treated and control districts trending similarly in the absence of the treatment. To empirically test this assumption, we estimate the following event-study specification.

$$y_{i(d,t)} = \delta_{i(d)} + \delta_{i(m(t))} + \delta_{i(p)} \times \delta_{i(t)} + \sum_{j \neq -1, j=-4}^{3} \lambda_j D_{i(d,t,j)} + \epsilon_{i(d,t)} \tag{2}$$

Equation 2 is the same as Equation 1 except that we replace the single post-treatment indicator variable ($D_{i(d,t)}$) with eight indicator variables for the time relative to treatment, $D_{i(d,t,j)}$. We omit the indicator for one period (survey wave four – April 2022) before treatment as the reference group, i.e., $j = -1$ in Equation 2.

Since our treatment turns on for all the treated units at the same time, we can abstract away from potential negative weighting issues highlighted by the recent literature (de Chaisemartin and D'Haultfœuille, 2022; Roth et al., 2023). We do not report estimates from TWFE estimation with a continuous measure of district-level opium cultivation as more interesting causal parameters relying on comparisons across different treatment doses estimated through TWFE include a selection bias with *apriori* ambiguous sign (Callaway et al., 2024). The sign of this selection bias term hinges on the distribution of treatment doses among the treated units, which is not equivalent to TWFE weights. Nonetheless, we establish the robustness of our main estimates to account for dynamic heterogeneous treatment effects with multiple periods (Sun and Abraham, 2021) in Figure B8.

We establish the validity of our research design through multiple empirical checks. Our estimates support the stable unit treatment value assumption (SUTVA) as Table B3 confirms that there are no significant changes in the composition of treated and control groups post-treatment, both for all households and the households engaged in the agricultural sector specifically. Figure 5 further demonstrates that inflationary pressures do not confound our treatment effects (see Section 5 for more details). Moreover, while acknowledging the potential for other unobserved shocks, including other reforms, to influence our outcome variables, we contend that our identification strategy adequately addresses these concerns. Such shocks are *apriori* unlikely to exert differential effects across opium and non-opium districts.

[2] We also estimate specification in Equation 1 assuming logit distribution for the dependent variable. The average marginal effect estimate from this specification is very close to our baseline estimates.

5. Results

In this section, we first discuss the main results – the effect of the opium ban in April 2022 on food security in Afghanistan and its dynamics. We then establish the robustness of our findings through a battery of empirical checks. Subsequently, we examine if the main effects vary across different subpopulations and potential mechanisms leading to the documented changes in food security measures. We conclude this section by studying how the households cope with the food insecurity they experience.

5.1. Main Results

The estimates from the specification in Equation 1 are presented in Table 2, with outcome variables detailed in Panels A through F: high or extreme FIES (food insecurity estimate), HHS (Household Hunger Scale), raw FIES score, average Z-score, Anderson (2008) Z-score, and any FIES, respectively (see Section 3.1 for details). In all panels, the explanatory variable is the interaction of an indicator for the households' residence district having opium cultivation and an indicator for the household being surveyed after the fourth survey round ($D_{i(d,t)}$). The estimate on the interaction term is interpreted as the difference in the mean of the outcome variable in opium (treated) districts compared to non-opium (control) districts in the period after the imposition of the ban relative to the pre-ban period.

Findings from column (1) of Table 2 indicate that, on average, *ceteris paribus*, households' likelihood of experiencing the extreme level of food insecurity increases by 17.4 percentage points. This is a huge increase, as it corresponds to nearly a quarter of the pre-ban mean for the treated group. The increase of 38% over the pre-ban sample mean in the hunger scale (increase of 0.6 units), which takes into account the intensity of food insecurity experienced by the respondent, also echoes how catastrophic the impact is. In par with these results, the raw FIES score and average Z-score go up by 0.9 and 0.3 units, respectively. The estimates for Anderson (2008) Z-score provide further evidence for the conclusions drawn from the preceding four variables, with a statistically significant and large increase for the respondents exposed to the opium ban. The effect of the ban on reporting any food insecurity is statistically insignificant, which is expected given that 98% of the country faces some food insecurity (see Table 1).

Figure 3 presents the estimates from the specification in Equation 2, the dynamics of the impact of the opium ban on food insecurity.[3] First, the figure shows no pre-trends in any of the outcome variables, supporting the assumption of parallel trends. We also show in Figure B12 that parallel trends assumption holds when including the limited data from the second round with restricted samples). Second, the likelihood of reporting high FIES, HSS, the raw FIES Score, average FIES Z-score, and Anderson (2008) Z-score rise in the first two rounds after the ban and fade out over time, starting from round seven of the DIEM data (October

[3] In Figure B2, we provide the event-study estimates for each of the eight questions related to food security in the DIEM survey.

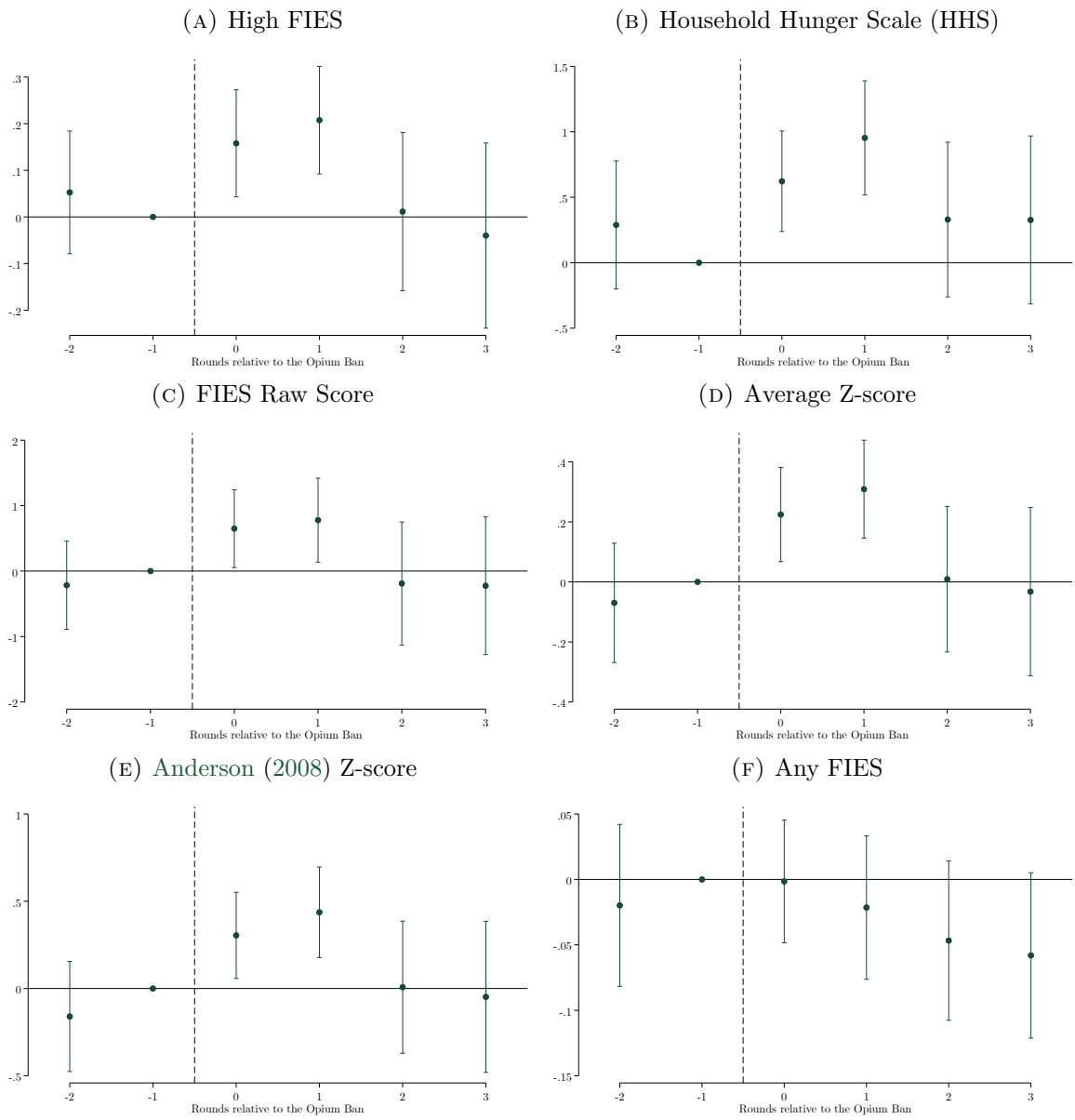
TABLE 2. Main Estimates

	Baseline	Without Weights	Include Weather Controls	Include Individual & HH Controls	All Controls
	(1)	(2)	(3)	(4)	(5)
Panel A: High FIES					
𝟙 (Opium District)	0.174***	0.208***	0.139***	0.172***	0.136***
×𝟙 (Post)	(0.051)	(0.048)	(0.049)	(0.050)	(0.048)
	[25.107]	[29.999]	[19.960]	[24.808]	[19.608]
Adj. R^2	0.166	0.190	0.173	0.170	0.178
Panel B: Household Hunger Scale (HHS)					
𝟙 (Opium District)	0.634***	0.531***	0.535***	0.629***	0.528***
×𝟙 (Post)	(0.167)	(0.161)	(0.161)	(0.166)	(0.160)
	[36.788]	[30.823]	[31.062]	[36.509]	[30.660]
Adj. R^2	0.220	0.235	0.225	0.227	0.233
Panel C: Raw FIES Score					
𝟙 (Opium District)	0.875***	0.925***	0.729***	0.868***	0.721***
×𝟙 (Post)	(0.255)	(0.237)	(0.249)	(0.252)	(0.246)
	[16.257]	[17.192]	[13.548]	[16.139]	[13.392]
Adj. R^2	0.215	0.215	0.220	0.220	0.226
N	72,650	72,650	72,650	72,650	72,650
Weights	Yes	No	Yes	Yes	Yes
Weather Controls	No	No	Yes	No	Yes
Household Controls	No	No	No	Yes	Yes

Notes: Heteroskedasticity robust standard errors clustered by the district are in parentheses. (* p<.10 ** p<.05 *** p<.01). Point estimate as a fraction of the pre-treatment mean in the treatment group is in square brackets. Each observation in all columns corresponds to a unique household. The dependent variable in Panel A is an indicator variable for the raw FIES score to be at least five. In Panel B, the dependent variable is the Household Hunger Scale (HHS). HHS is constructed using the respondents' reporting of the intensity of food insecurity for three variables. These variables relate to having no food to eat, sleeping hungry, and having nothing to eat during an entire day. HHS ranges from zero to six. In Panel C, the dependent variable is the raw Food Insecurity Experience Scale (FIES) score. The raw FIES score is the sum of affirmative responses on each FIES survey question by the household. The Independent variable of interest in each column is the interaction of an indicator for the households' residence district having opium cultivation and an indicator for the household being surveyed after the fifth survey round. A district is designated to have opium cultivation if it has any opium cultivation either in 2020 or 2021. Opium cultivation data is derived from UNODC (2023b). The fifth survey round is fielded in July and August 2022. The opium Cultivation ban is implemented in April 2022. The empirical specification differs across columns. The column header provides information on the empirical specification. In the first column, the baseline specification is estimated. In column (2), the specification excludes survey weights. Column (3) adds weather controls to the baseline specification. Weather controls are temperature and precipitation during the survey month and year. In column (4), individual and household controls are included in the baseline specification. Individual and household controls are an indicator variable for whether the household head is male, an indicator variable for whether the household head is married, and an indicator variable for the household having an unsafe water supply. Column (5) adds weather together with individual and household controls to the baseline specification. Data on food insecurity comes from the Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). Specification in each column also includes households' residence district and month of survey fixed-effects along with linear time-trends for the households' residence province.

2023, a year and half afther imposition of the ban). These dynamics indicate that households may have coped with the extreme food hardship by reallocating their production from opium to alternative crops or adapting to the new realities of food diversity and availability. Another possibility behind the effect fading out over time would be the financial assistance households receive in the meantime. However, in Figure B3, we show that there is no effect of the opium cultivation ban on the likelihood of households reporting receiving food assistance. Third, consistent with the findings in Table 2, the effect of the opium ban imposed in April 2022 on reporting any food insecurity in any post-treatment rounds is statistically insignificant.

FIGURE 3. Event-study Estimates



Notes: The dependent variable in each panel is mentioned in the panel caption. The construction of dependent variables is discussed in section 3.1. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

In Figure B4, we present the event-study estimates for four additional variables. The food consumption score (FCS) and standardized FCS, which indicate the consumption of various food groups by the household over the last seven days preceding the survey date, resonate the dynamics reported earlier with decreased score in the initial post-ban wave

followed by a fading out in the next three survey rounds. Poor food consumption score (FCS) which measures the poor diet quality is not more likely to be reported in the aftermath of the opium ban. Finally, the healthy diet measure suggests a decline in the likelihood of respondents reporting that the household consumes a healthy diet only in the first post-ban period. A diet is considered healthy if the household consumes at least four of the seven food categories on all seven days preceding the survey date.

Overall, our conclusion of the immediate worsening of food security after the opium cultivation ban with an eventual fade out is not sensitive to the exact food security measure used.

5.2. Robustness Checks

We now establish the robustness of our estimates via multiple sensitivity checks. The columns (2)-(4) in Table 2 illustrate that the baseline findings are robust to excluding survey weights, the inclusion of weather controls like temperature and precipitation, individual and household controls, which include the indicator variables on whether the household head is male, is married, and households has an unsafe water supply.

The findings are insensitive to alternate treatment definitions. Figure B5 indicates that the baseline findings remain unchanged when adjusting the treatment definition based on various measures of opium cultivation across different years and cultivation areas.

We also confirm that the likelihood of reporting high FIES in the first two post-ban rounds maintains its statistical significance and magnitude (and remains statistically insignificant in the last two post-ban rounds) when using alternate high FIES thresholds (Figure B7), dropping survey weights or using Sun and Abraham (2021) estimator (Figure B8), including household, individual and weather controls, and province and season fixed effects (Figure B9).

Moreover, certain provinces have unique characteristics that could potentially confound our estimates. One such province is Badakhshan, known for its ongoing resistance to the Taliban's authority, its distinct opium-harvesting seasons due to mountainous geography and colder climate, and its role as a key gateway to the international narcotics market for Afghan opium. Another example is Herat, where two powerful earthquakes (magnitude 6.3 on Richter scale) earthquakes struck the city of Herat on October 7 and October 11, 2023, causing 1,482 fatalities and 2,100 injuries. WHO estimated that around 43,400 people were directly affected by the earthquakes, which could confound our estimates of food security. The inclusion of international border districts also presents challenges, as these districts have the potential to engage in smuggling opium and its derivatives across borders, thereby affecting the livelihoods of residents involved in such activities. Additionally, the livelihoods of households in control districts adjacent to treated districts may also be impacted due to potential spillover effects from neighboring treated districts where opium cultivation occurs. Figure B10 demonstrates that these concerns are nlikely to alter our conclusions, as the results are robust to dropping

international border districts, control districts adjacent to treated districts, as well as the provinces of Badakhshan and Herat. Figure B11 shows that the baseline results are unaltered when dropping any of the provinces.[4]

Lastly, the concerns with limited pre-treatment periods are addressed by inclusion of the second DIEM survey round which is limited in geographical and food security measures coverage. As illustrated in Figure B12, the results remain robust even with the inclusion of data from the second survey round.

5.3. Heterogeneity

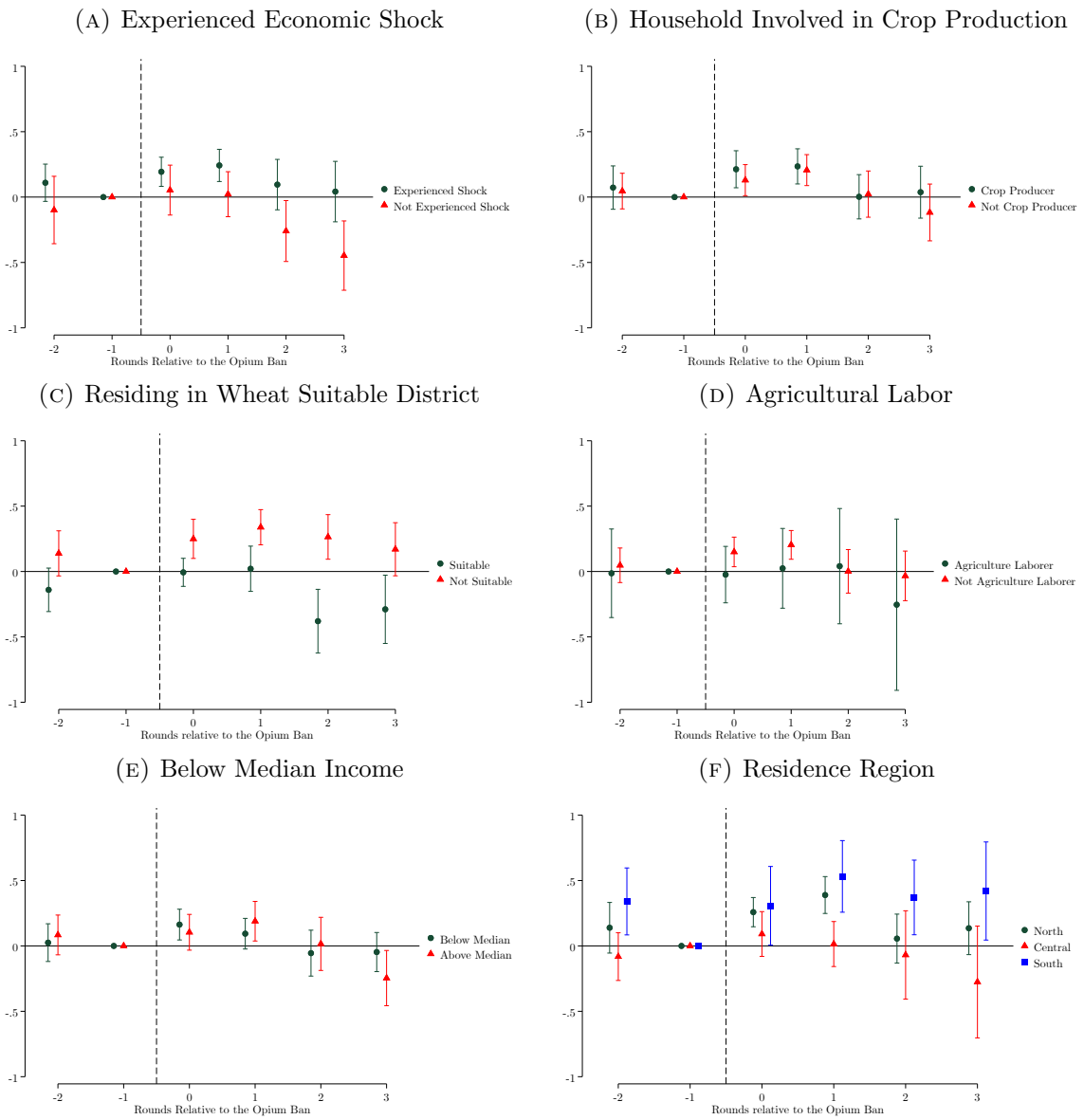
We present the event study estimates across various subpopulations in Figure 4 (see detailed classification of subpopulations in Appendix A.2). In panel A of Figure 4, we compare the dynamics of reporting extreme food insecurity between respondents who reported experiencing an economic shock and those who did not. The results indicate that households facing income shocks experienced heightened food insecurity during the first two post-ban rounds, with the effect diminishing in subsequent rounds, thereby supporting our baseline findings. In contrast, this effect is absent for those who did not report facing income shocks in the initial two post-ban rounds, whereas their likelihood of reporting extreme food hardship as a consequence of the opium ban decreases significantly after the first two rounds.

While Panel B indicates albeit statistically insignificantly difference between crop-producing and non-producing households, with both groups exhibiting similar dynamics as observed in the baseline event study, it is noteworthy that the effect for respondents involved in crop production is slightly more pronounced during the initial two rounds following the ban's imposition.

UNODC (2023a) indicates that wheat production is the most viable alternative to opium poppy cultivation, which means that the impact of the opium ban on high food hardship should be more severe for households unable to transition their production from opium to grains compared to those who can. One way to assess whether the reallocation possibility affect the food insecurity dynamics is by examining the differential effects across residents of districts where the soil is suitable for wheat production versus those where it is not. The results, presented in Panel C of Figure 4, provide strong evidence supporting this hypothesis. The findings reveal that the likelihood of reporting extreme food insecurity due to the opium ban is significantly higher and statistically significant for households residing in non-arable for grain districts. For this group, the effect increases during the first two waves following the ban, peaks in the second post-ban round, decreases but remains significant in the third round, and eventually dissipates. Conversely, not only do residents of districts with wheat-suitable lands not experience heightened incidences of extreme food insecurity, but the effect is also negative and statistically significant in the third and fourth post-ban rounds. This stark

[4] We have also estimated specification in Equation 2 by collapsing the household-level data to the district-level. Extreme food insecurity and HHS dynamics are unaltered when we use the collapse data as the analytical sample.

FIGURE 4. Heterogeneity



Notes: The dependent variable in all panels is High FIES. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024. For all point estimates the sample is split using an indicator variable. Indicator variable is presented in the figure legend. Solid lines are for the subsample where the indicator takes a value of one while the dashed lines are for the subsample where the indicator takes a value of zero. The classification of subpopulations is discussed in Appendix A.2. The district is designated to be suitable for a crop if it is in the top three quartiles of the crop suitability index distribution.

contrast underscores the potential effectiveness of reallocating production from one crop to another as a strategy to mitigate economic shocks. We further explore whether respondents who historically harvested opium have transitioned to grain production as a result of the April 2022 opium ban in section 5.5.

The findings in Panel D illustrate that the baseline effect is concentrated among non-agricultural workers only, with dynamics resembling the baseline event study results. This observation is not surprising, given that agricultural laborers, who are often daily wage workers or casual employees on farms, tend to be relatively more flexible in transitioning their work to non-opium farms as casual employees than those who own the opium poppy lands.

Panel E depicts that relatively poorer households face extreme food insecurity immediately after the ban's imposition, whereas the relatively wealthier group experience a lagged effect. In particular, respondents with above-median income report heightened food insecurity in the second post-ban round, with the effect diminishing in the third round and becoming negative and statistically significant in the final round. This pattern raises the question of whether wealthier households might be selling their assets to cope with the economic shock immediately after the ban, eventually experiencing extreme food insecurity, and then benefiting from the asset sales in the longer term. We explore this possibility further in 5.5.

Panel F highlights the observable distinctions between subpopulations across different regions, with Central Afghanistan, characterized by its predominantly urban areas, exhibiting no effect in any of the post-ban survey waves. This result aligns with expectations, as opium production is predominantly a rural activity.

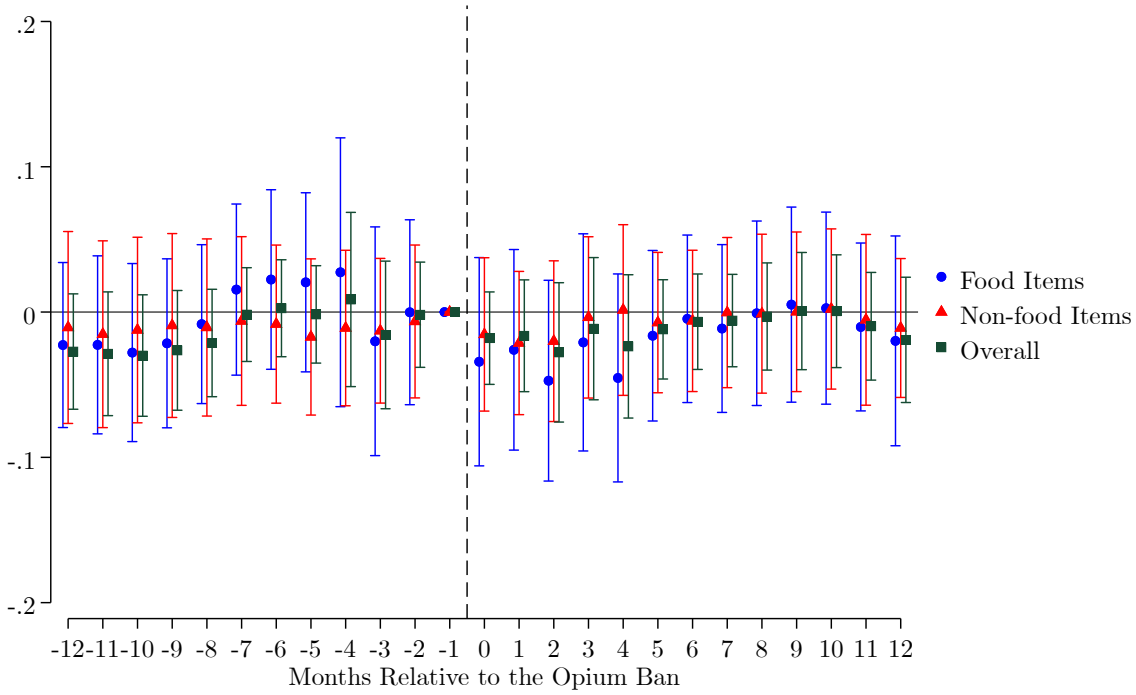
Table B2 compares the DID estimates in reporting high FIES across different subpopulations. Though the estimates are more pronounced for households who experience economic shocks and non-agriculture laborers, the heterogeneity analysis in its entirety does not illustrate significant differences across various groups, which underlines that the enitre country experienced the consequences of the opium ban to some degree in terms of achieving food security. This conclusion is further confirmed in the event studies shown in Figure B13 (heterogeneity by possession of productive assets) and Figure B14 (heterogeneity by age).

5.4. Mechanisms

The causal impact of the opium cultivation ban on food insecurity may stem from a negative income shock, increased food prices, or a combination of both. While Figure 4 provides evidence supporting the income shock pathway, Figure 5 explores the effect of the cultivation ban on price changes. Observations from this figure indicate that the ban influences neither food nor non-food item prices (see Appendix A.3 for detailed classification). Thus, we disentangle the potential mechanisms behind the estimated effects and conclude that the increased high food insecurity experienced by respondents is primarily attributable to income

shocks.

FIGURE 5. Consumer Price Index



Notes: The dependent variable is the monthly inflation rate in percentage. The base month is April 2015. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. The sample is restricted to data between April 2021 and April 2023. Overall Consumer Price Index (CPI) includes both food and non-food items. The classification of food and non-food items is discussed in Appendix A.3.

5.5. Coping Strategies

The event-study estimates on how the exposed households cope with high food insecurity are depicted in 6 (see Appendix A.4 for detailed classification of coping strategies).[5] We do not observe statistically significant changes in the sale of assets, use of savings, or borrowing money due to the April 2022 ban. These findings are expected, given that in a setting marked by an ongoing humanitarian crisis, where 98% of all households experience some degree of food insecurity, the possession of assets, access to savings, and availability of reliable sources for borrowing are highly unlikely.

However, Panel C shows that during the second and third post-ban phases, respondents were compelled to sell their animals, leading to a reduction in livestock numbers, as depicted in Panel F. The sale of productive assets like livestock may foreshadow long-term worsening in food security measures.

[5] The limitation of these tests is that the DIEM data lack the information about the coping strategies in the first three waves. Thus, to illutstrate that no pre-trends hypothesis holds,we triangulate the data on coping mechanisms with data from Rapid Household Asessments.

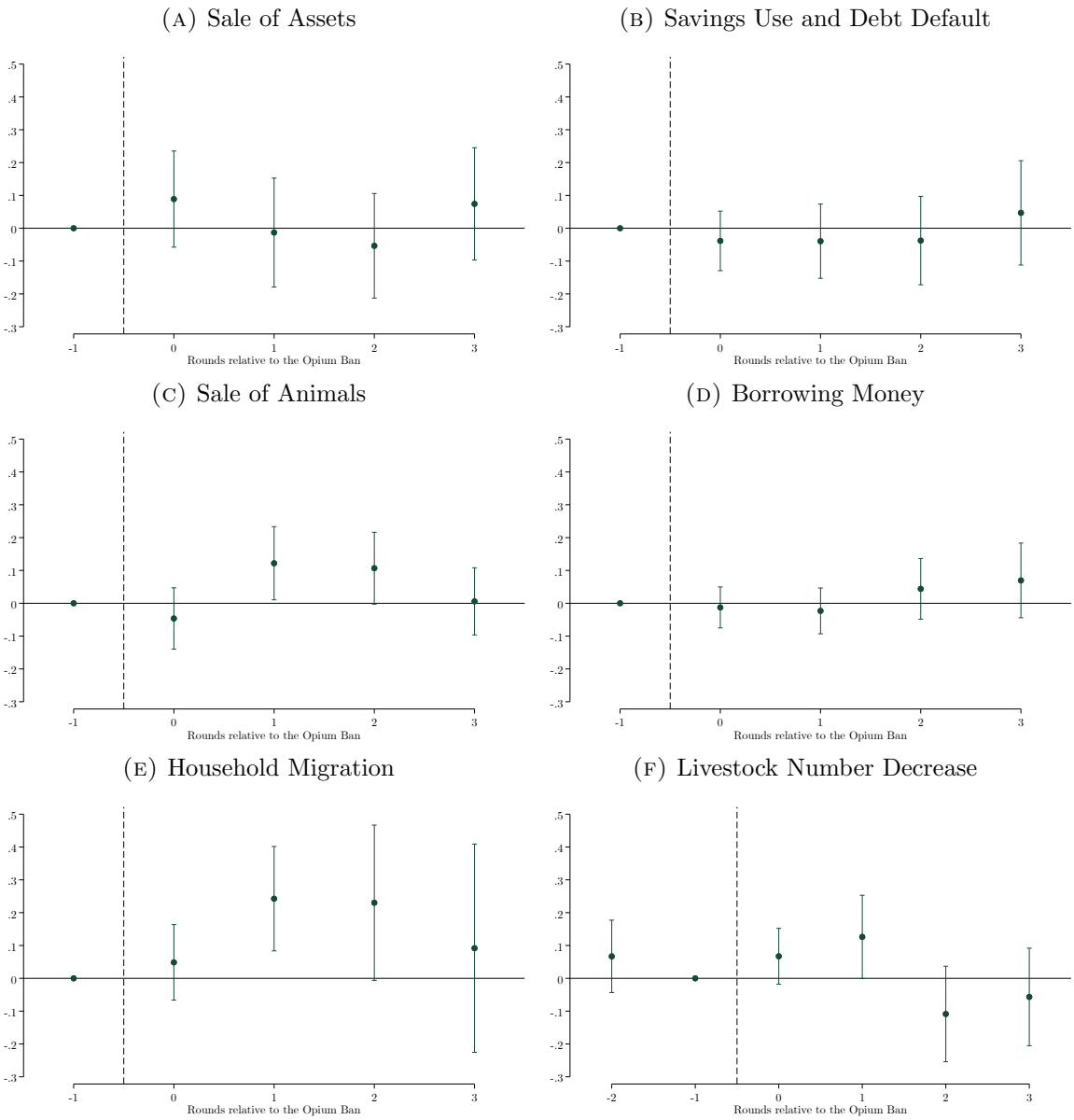
Additionally, during the same timeframe, some individuals relocated from or within their original districts of residence, indicating migration and economic adjustments in response to the ban (panel E of Figure 6). Although the migration is internal (within the country), the DIEM dataset does not specify whether it occurs within districts or across them. Such cross-district migration could confound our estimates by altering the demographic composition of the control versus treated districts, potentially violating the stable unit treatment value assumption (SUTVA). Table B3 shows that the composition of districts remains unchanged for all households and for agricultural laborers in particular. This finding aligns with Tai et al. (2022), who show that most of the internal migration in Afghanistan occurs within the same district (from rural to urban areas), driven by a strong desire to remain close to home. Taken together, this suggests that SUTVA violations due to compositional changes across the control and treatment groups are not a concern in our setting, and within district migration from rural to urban areas is a likely mechanism through which high food insecure households mitigate medium-run food insecurity.

Importantly, when faced with high food insecurity, it is anticipated that respondents would reduce the number of meals and/or limit portion sizes in an effort to conserve food for the following day or to ensure that other household members have enough to eat. This behavior is precisely what we observe. In Figure B15, we report event study estimates for coping strategies that the household pursued due to not having food or money to buy food during the seven days preceding the interview date. The estimates from these event studies indicate that households not only reduce the frequency of food consumption but also limit portion sizes during each meal (during the first two post-ban waves).

Since wheat is the next best alternative to opium poppy, the impact of the April 2022 ban on extreme food insecurity should be more pronounced for households who are unable to reallocate their production from opium to wheat. This is what we established in section 5.3, where we demonstrated that the likelihood of reporting high food insecurity is pronounced only for the residents of districts with wheat-unsuitable soils. Hereby, we analyze how households shifted their agricultural focus away from opium cultivation as a form of coping strategy. Results are shown in Figure 7. Economic adjustments are notably evident as individuals previously engaged in opium cultivation consistently displayed a preference for transitioning to grain production over other agricultural alternatives in districts suitable for grain cultivation – a trend that becomes particularly pronounced in the first and third post-ban phases.

These estimates also provide strong evidence of widespread cultivation of opium prior to the ban,as opium falls under the "Other Crops" category in the pre-ban period. A sandy loam soil, which is optimal for growing opium (U.S. Department of Justice, 1992), is also suitable for wheat cultivation. Therefore, districts with this soil type offer an effective pathway for farmers who previously cultivated opium to reallocate their agricultural land towards wheat production. The absence of such reallocation pattern across crop types in non-wheat suitable districts lends further credence to this conclusion.

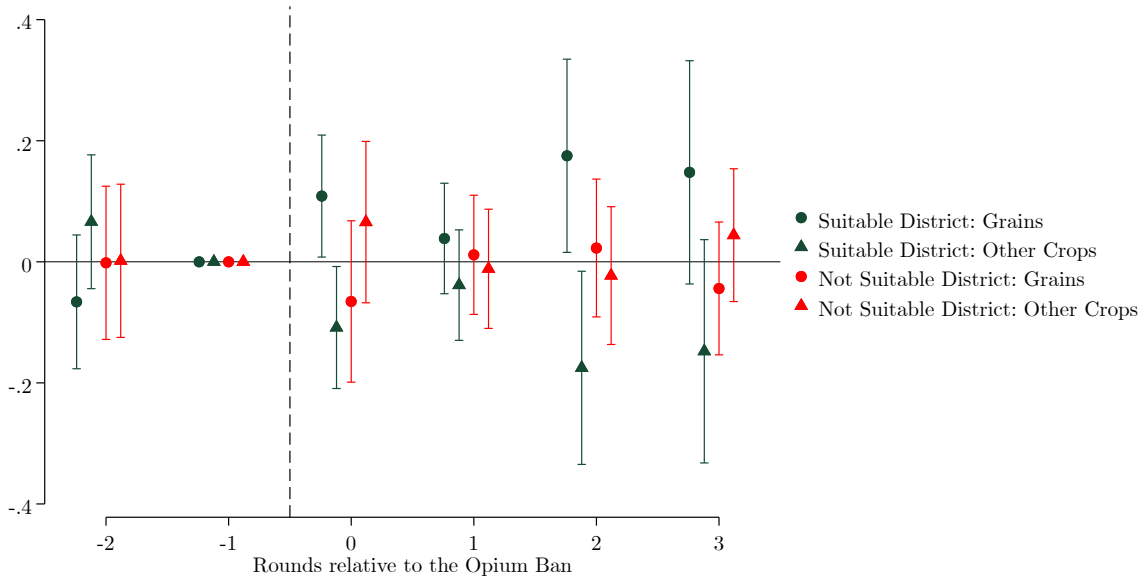
FIGURE 6. Event-study Estimates for Coping Strategies



Notes: The dependent variable in each panel is an indicator variable, discussed in A.4. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

In Figure B16, we examine if the households in the districts that previously grew opium diversified their income sources. Albeit suggestive, the estimates in this figure show strong evidence of households relying on multiple sources of income from the third post-ban survey round. The sharp increase in the likelihood of the household having multiple income sources from the third post-ban survey round relative to the survey round immediately preceding the ban overlaps the dynamic adjustment in food insecurity measures in these phases. Thus, economic adjustment through income source diversification could be a potential channel through which food insecurity dynamics play out.

FIGURE 7. Event-study Estimates for Reallocation



Notes: The dependent variable is an indicator variable for whether the household reports growing the crop. "Grains" consist of all the lentils and pulses including wheat, the remaining crops are classified as "other crops." Households' residence district is designated to be suitable for the crop if it is in the top three quartiles of the crop suitability index. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

6. Conclusion and Discussion

In this paper, we show that extreme food insecurity and household hunger scale substantially increased in the immediate aftermath of the opium cultivation ban imposed by Taliban in April 2022. Reallocation towards alternate crops along with migration and sale of productive assets lead to the observed dynamics in food insecurity measures.

The research avenues regarding the ban's aftermath are extensive. In extreme cases, as investigated in this study, poor households may sell their remaining assets and reduce food intake to combat hunger, potentially forgoing necessary medicines and worsening health

conditions over time. Household heads might cut educational expenses and decrease the number of dependents, potentially by marrying off daughters at very young ages, leading to an increase in premature marriages.[6] Over time with withering productive avenues, even middling farmers may deplete their inventories and likely follow similar strategies.

Widespread destruction of the primary income source in the aftermath of the opium cultivation ban against the backdrop of the worsening humanitarian situation in Afghanistan calls for domestic policies and international intervention in the region.[7] Given that grain is the next best alternative to opium for Afghani farmers, the ruling government or multilateral organizations, through their local affiliates, for instance, can subsidize (for a short-term) agricultural inputs along with educating displaced farmers in transitioning to the cultivation of grains. As there might be an increase in undernutrition of affected households, expansion of medical services can complement the disbursal of food to address heightened food insecurity that we document.[8]

In the long run, the consequences of the ban might lead to a more significant worsening in local well-being, further engendering political resistance, monopolization of markets, a boost in violent crime, and an increase in outmigration. Since Afghanistan was the biggest exporter of poppy and its byproducts, reduced supply as a result of the ban will presumably cause changes in prices, quantity, and quality in the opium market (legal – medicine, or illegal – narcotics) on an international level, too. We leave these questions to be addressed by future research.

[6] Data on premature marriages is available only from the sixth round onwards. Moreover, for the two rounds, six and eight, where we have non-missing information, none of the households report an instance of premature marriage. As households self-report, we suspect severe misreporting for premature marriages emanating from fear of attracting attention towards illegality of such marriages as *Sharia* law forbids marriages without the consent of the bride and groom.

[7] Empirical tests from the US, for example, point to the critical role of policies in achieving food security. These include the positive effect of subsidized lunch policy in the 20th century (Hinrichs, 2010), Supplemental Nutrition Assistance Program (SNAP) accessibility (Bartfeld and Men, 2017; Gundersen et al., 2017), the state Earned Income Tax Credit (EITC) generosity (Lenhart, 2023).

[8] Moellman and Vaughn (2024) shows that having a Medicaid-eligible child significantly alleviates the food insufficiency of the households facing extreme poverty in the United States.

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Supplementary Appendix

A. Classification of Variables

A.1. Food Insecurity Questions in DIEM

The Food Security panel of the DIEM questionnaire (Food and Agriculture Organization, 2023) consists of eight questions, each of which takes value one if the respondent answers affirmatively and zero otherwise. These questions are as follows:

1. During the last 30 days, was there a time when you or others in your household were worried about not having enough food to eat because of lack of money or other resources?

2. During the last 30 days, was there a time when you or others in your household were unable to eat healthy and nutritious food because of lack of money or other resources?

3. During the last 30 days, was there a time when you or others in your household ate only a few kinds of foods because of lack of money or other resources?

4. During the last 30 days, was there a time when you or others in your household had to skip a meal because of lack of money or other resources to get food?

5. During the last 30 days, was there a time when you or others in your household ate less than you thought you should because of lack of money or other resources?

6. In the past 30 days, was there ever no food to eat of any kind in your house because of lack of resources to get food?

7. In the past 30 days, did you or any household member ever go to sleep at night hungry because there was not enough food?

8. In the past 30 days, did you or any household member ever go a whole day and night without eating anything at all because there was not enough food?

A.2. Subpopulations

Households are classified as having experienced an economic shock if they report that during the last three months they "lost employment or working opportunities", "experienced much higher than usual food prices", "experienced much higher than usual fuel prices", "experienced external event impeding the continuation of work or business affecting all", or "experienced other economic shock". Households are classified as being involved in agricultural laborer if either of their three income sources are reported as "daily wage on

farms and other casual employment in agricultural sector". Households are classified as being below median of the income distribution using the income distribution of the round in which they are surveyed.

A.3. Food and Non-food Items

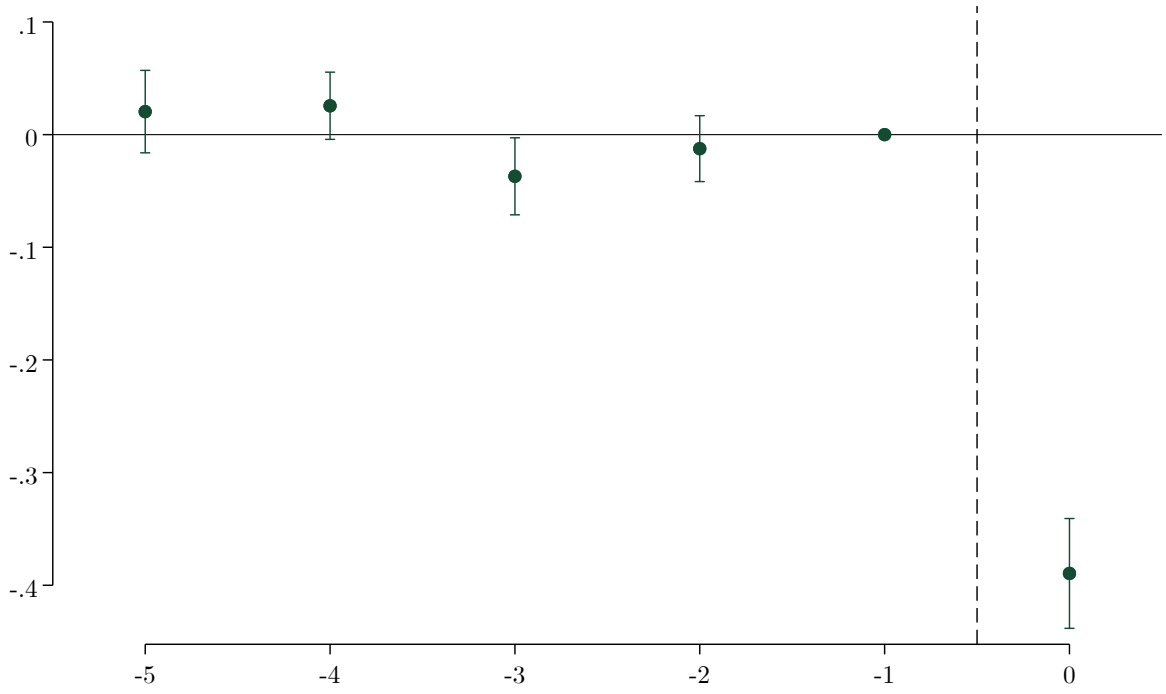
Food items encompass bread, cereals, meat, milk, cheese, eggs, oils, fruits and vegetables, sugar and sweets, spices, and non-alcoholic beverages. Non-food items include tobacco, clothing, housing, furnishing and household goods, health, transportation, communication, information and culture, education, restaurants, hotels, and other items.

A.4. Coping Strategies

Estimates labeled "Sale of Assets" are from a specification where the dependent variable is an indicator variable for whether the household sold non-productive assets in the 30 days preceding the survey date because it did not have enough food or money to feed the household members. Estimates labeled "Savings Use and Debt Default" are from a specification where the dependent variable is an indicator variable for whether the household spent savings and skipped debt payments in the 30 days preceding the survey date because it did not have enough food or money to feed the household members. Estimates labeled "Sale of Animals" are from a specification where the dependent variable is an indicator variable for whether the household sold more animals than usual in the 30 days preceding the survey date because it did not have enough food or money to feed the household members. Estimates labeled "Borrowing Money" are from a specification where the dependent variable is an indicator variable for whether the household borrowed money from a formal lender or bank or non-relatives in the 30 days preceding the survey date because it did not have enough food or money to feed the household members. Estimates labeled "Household Migration" are from a specification where the dependent variable is an indicator variable for whether the household migrated in the 30 days preceding the survey date because it did not have enough food or money to feed the household members. Estimates labeled "Livestock Number Decrease" are from a specification where the dependent variable is an indicator variable for whether the household's livestock number decreased relative to last year in the 30 days preceding the survey date because it did not have enough food or money to feed the household members.

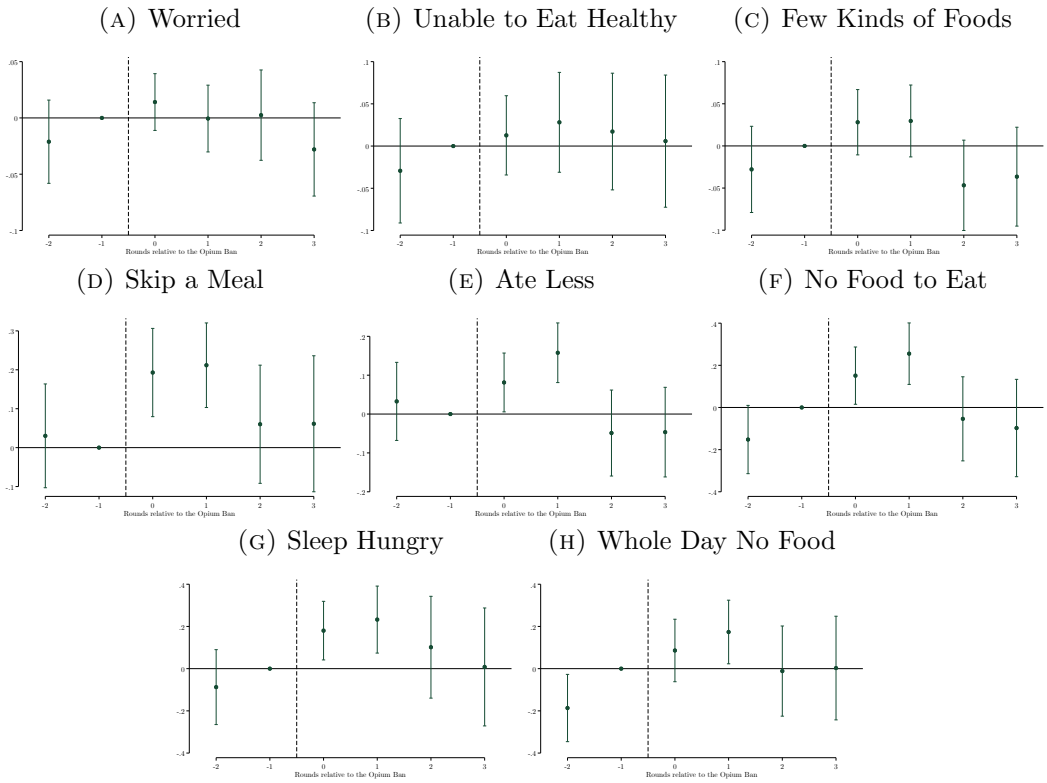
B. Figures and Tables

FIGURE B1. Any Opium Cultivation



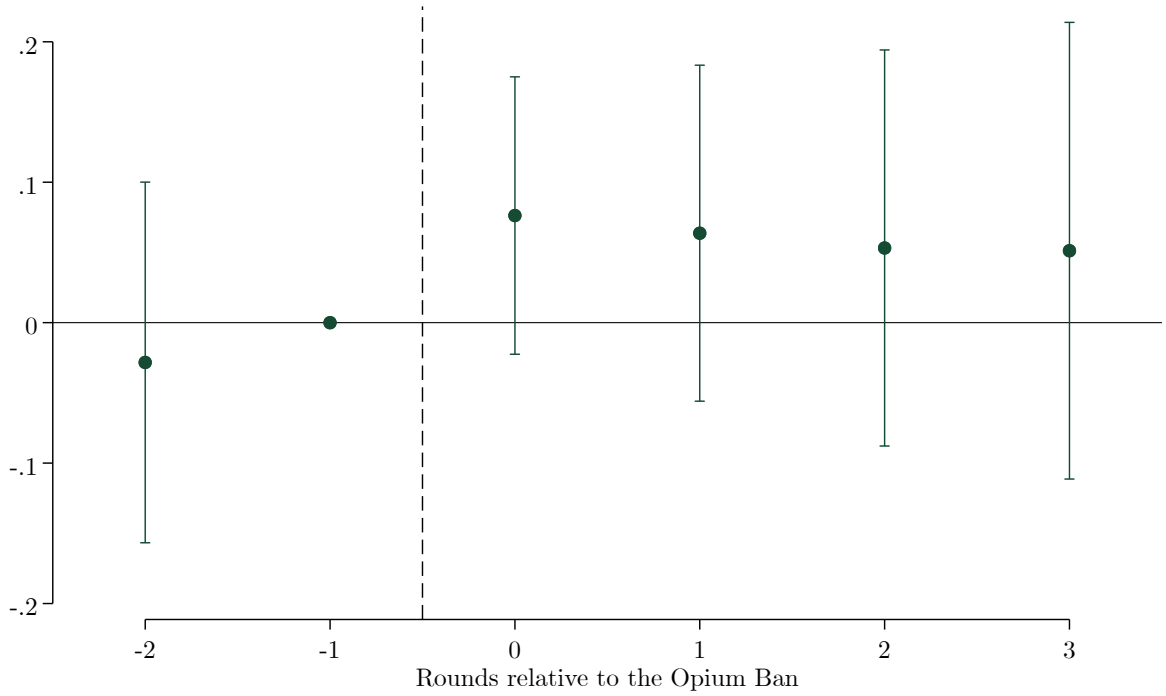
Notes: Districts are categorized as cultivating opium if there is any positive opium cultivation in the district. Opium cultivation data are derived from UNODC (2023b). These data provide annual information on the area under opium cultivation in hectares at the district-level. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted.

FIGURE B2. Event-study Estimates for All Food Insecurity Variables



Notes: Data on food insecurity are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable is an indicator variable in each sub-figure. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

FIGURE B3. Receive Food Assistance

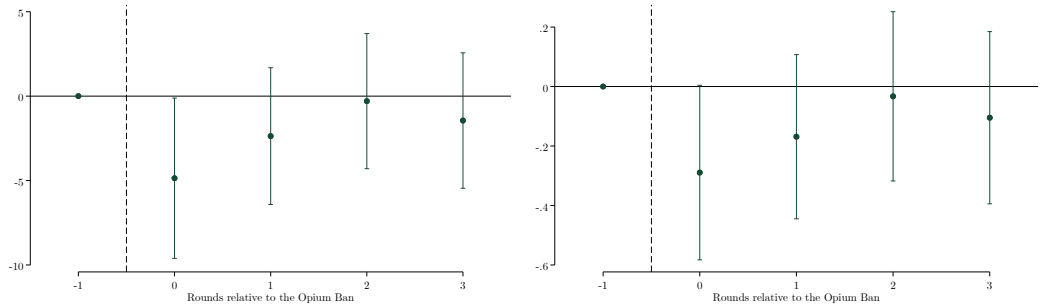


Notes: Data on the dependent variable are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable is an indicator variable for the household reporting receiving food assistance in the three months preceding the survey date. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

FIGURE B4. Food Consumption Score (FCS) and Healthy Diet

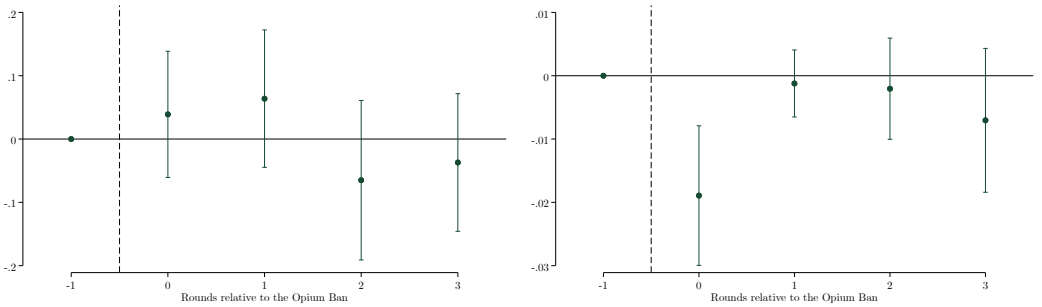
(A) Food Consumption Score (FCS)

(B) Standardized Food Consumption Score (FCS)



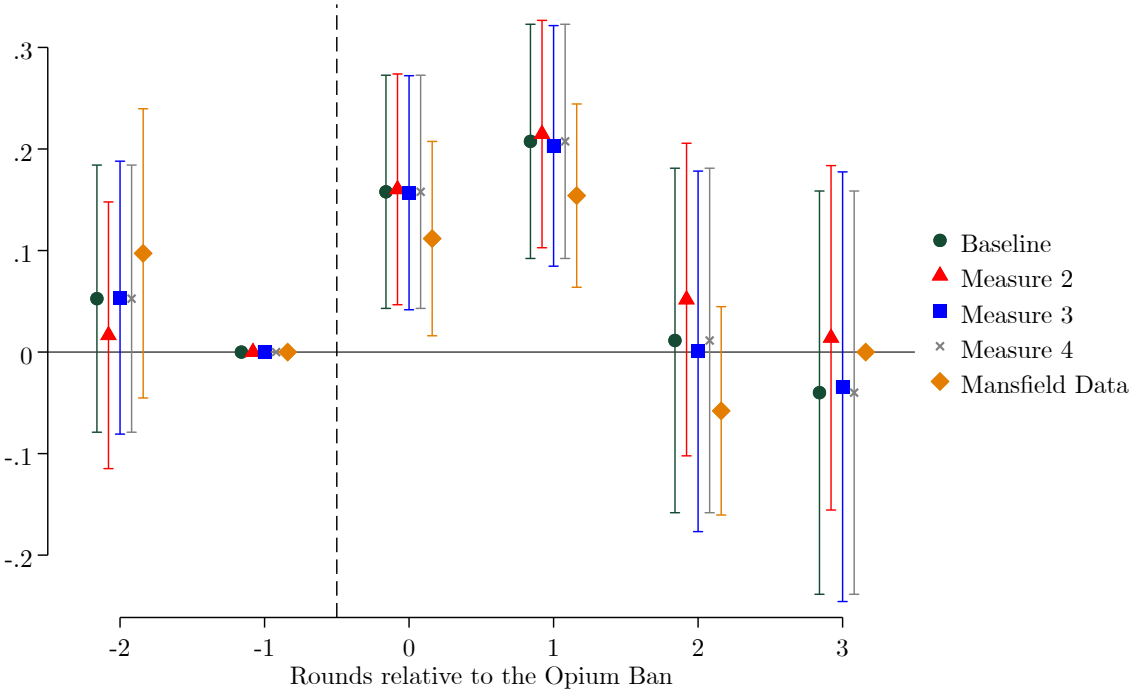
(C) Poor Food Consumption Score (FCS)

(D) Healthy Diet



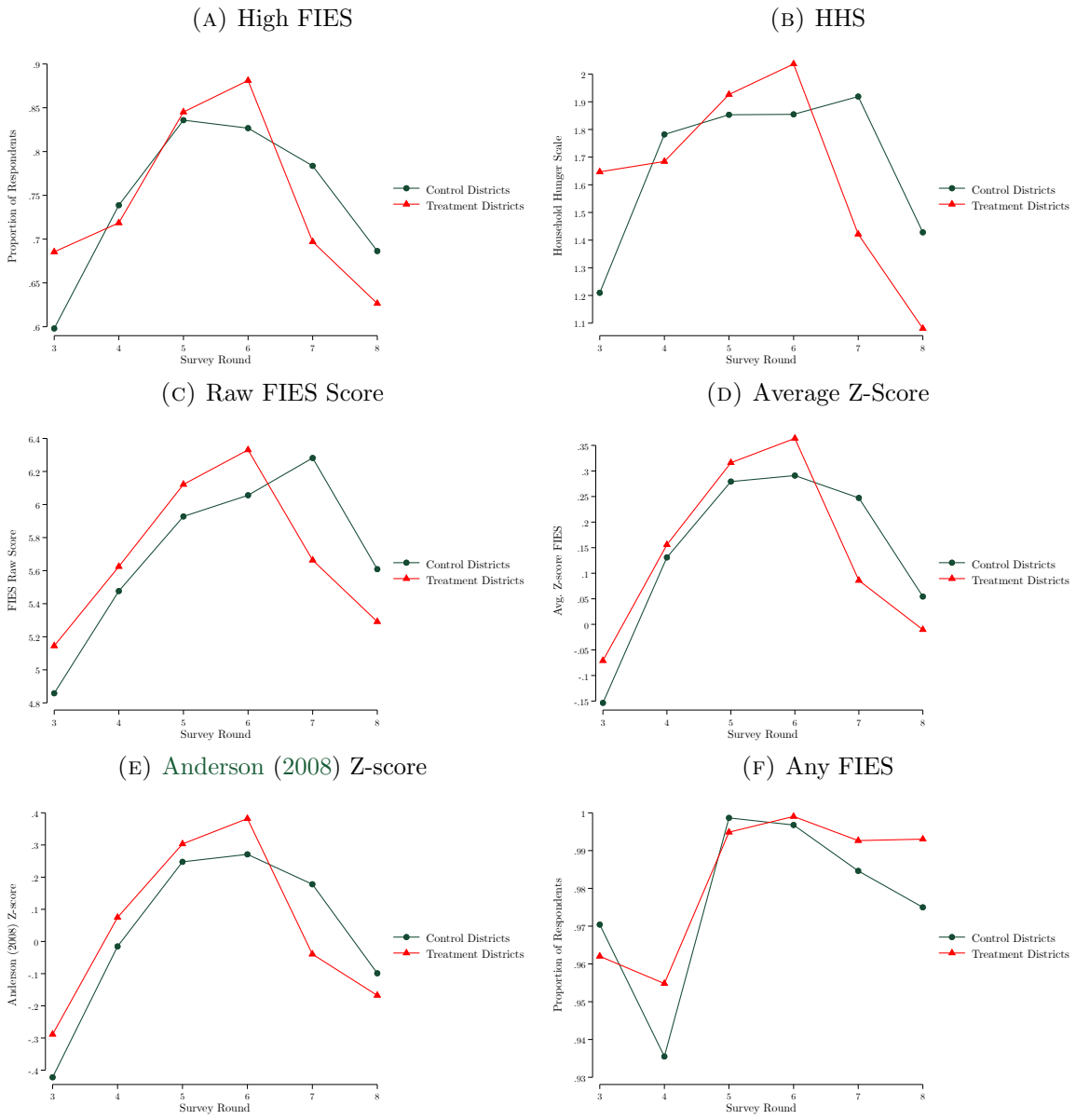
Notes: Data on food insecurity are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variables are the food consumption score (FCS), standardized FCS, an indicator variable for FCS to be less than 21, and an indicator for a healthy diet. FCS is a weighted measure based on the consumption of various food groups by the household over the seven days preceding the survey date. The dependent variable for the figure captioned "Healthy Diet" is an indicator variable for whether the household has a healthy diet for each of the seven days preceding the survey date. A diet is designated to be healthy if the household consumes at least four of the seven food categories. The seven food categories are starches, roots and tubers, pulses and nuts, vegetables or leaves, fruits, meat, eggs or fish, dairy products, sugar or sweet, and oil/fat/butter. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

FIGURE B5. Robustness to Using Alternate Cultivation Measures



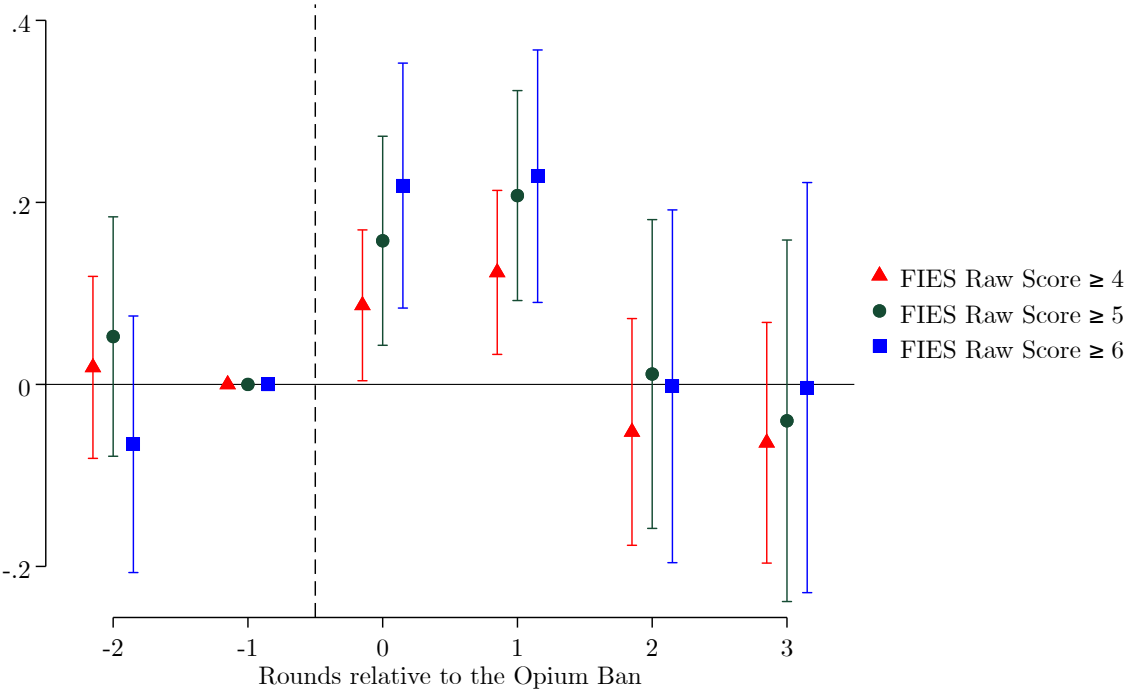
Notes: Data on food insecurity are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable is whether or not the raw Food Insecurity Experience Scale (FIES) index is above four. The raw FIES index is the sum of whether the respondent reports food insecurity on each of the eight FIES questions in the survey. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024. "Measure 2" defines a district as cultivating opium based on 2021 opium cultivation measures only. "Measure 3" defines a district as cultivating opium based on opium cultivation measures from 2019 to 2021. "Measure 4" designates a district as cultivating opium if the area under opium cultivation in the district is above the median of the area under opium cultivation distribution. "Mansfield Data" measure is derived from Mansfield (2023a).

FIGURE B6. Trends in Outcome Variables



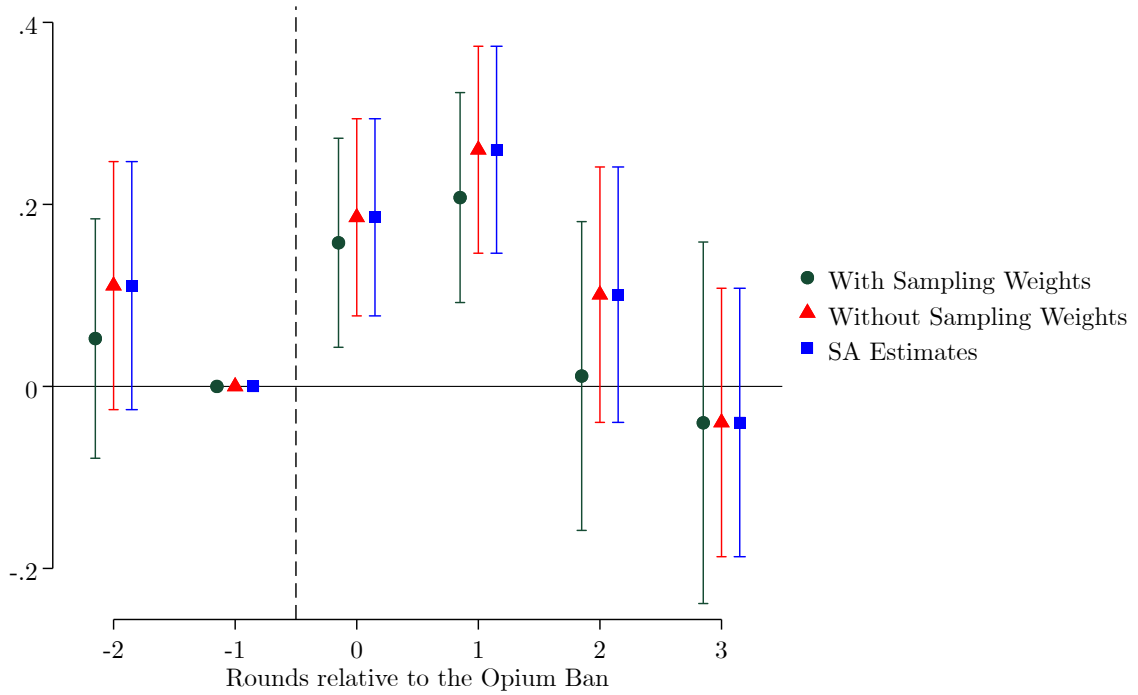
Notes: The dependent variable in each panel is mentioned in the panel label. The construction of dependent variables is discussed in section 3.1. The treatment definition is discussed in section 3.2. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

FIGURE B7. Robustness to Using Alternate High Food Insecurity Thresholds



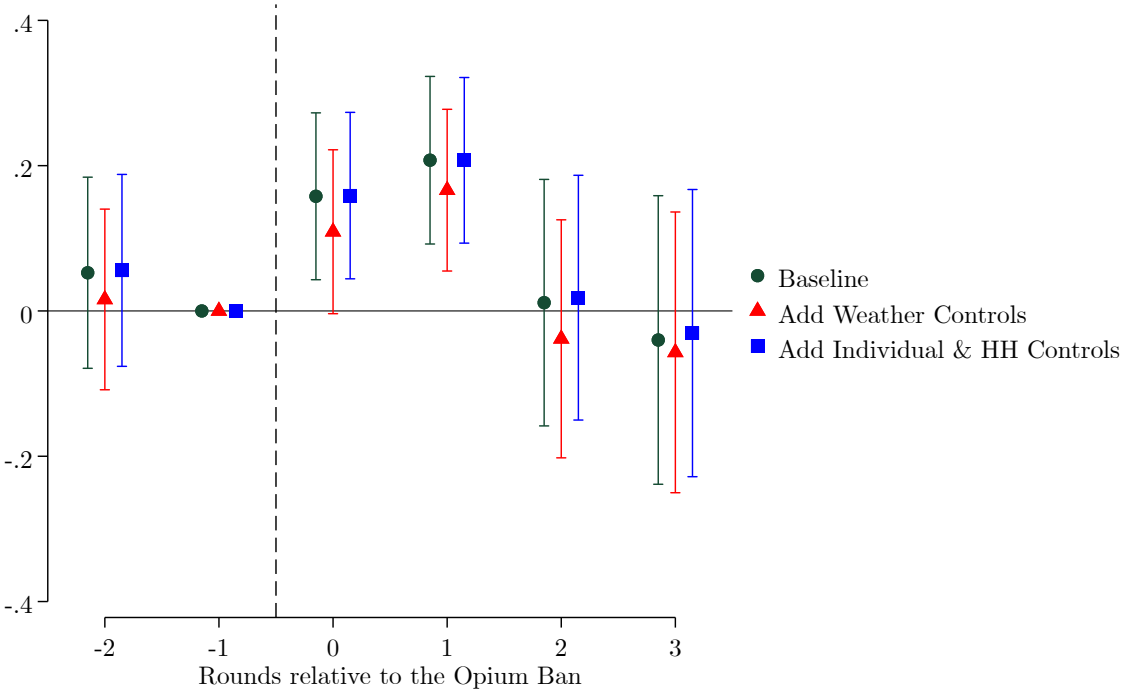
Notes: Data on food insecurity are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable is whether or not the raw Food Insecurity Experience Scale (FIES) index is above four. The raw FIES index is the sum of whether the respondent reports food insecurity on each of the eight FIES questions in the survey. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

FIGURE B8. Robustness to Using Survey Weights and Sun and Abraham (2021) Estimator



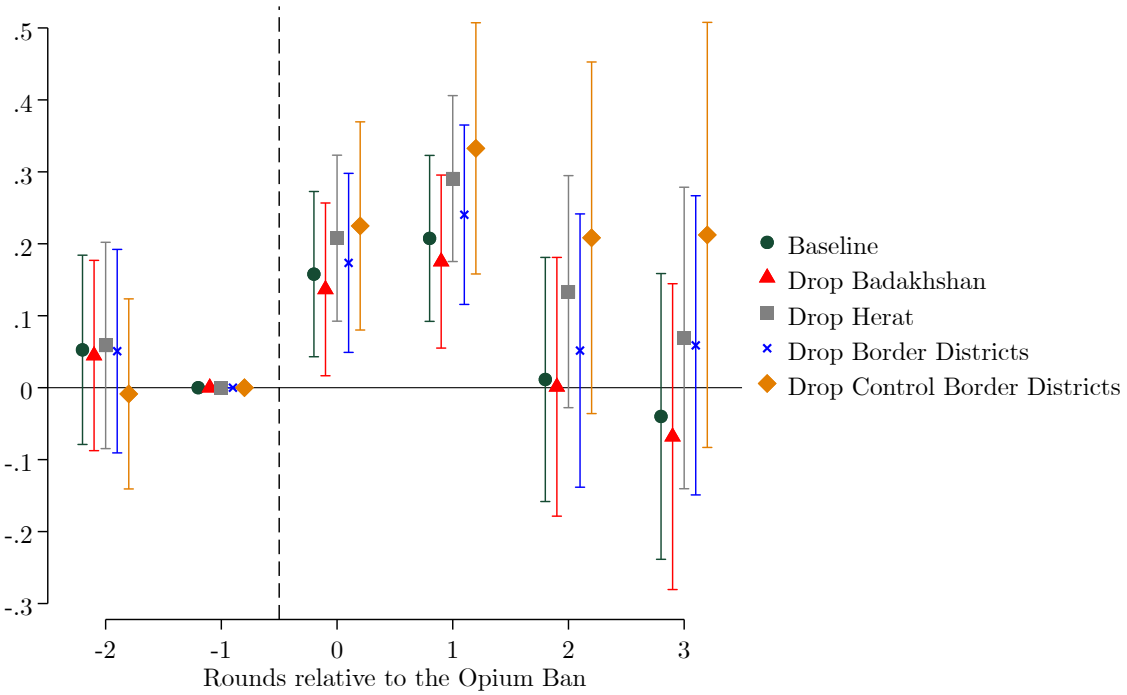
Notes: Data on food insecurity are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable is whether or not the raw Food Insecurity Experience Scale (FIES) index is above four. The raw FIES index is the sum of whether the respondent reports food insecurity on each of the eight FIES questions in the survey. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

FIGURE B9. Robustness to Using Household, Individual, and Weather Controls



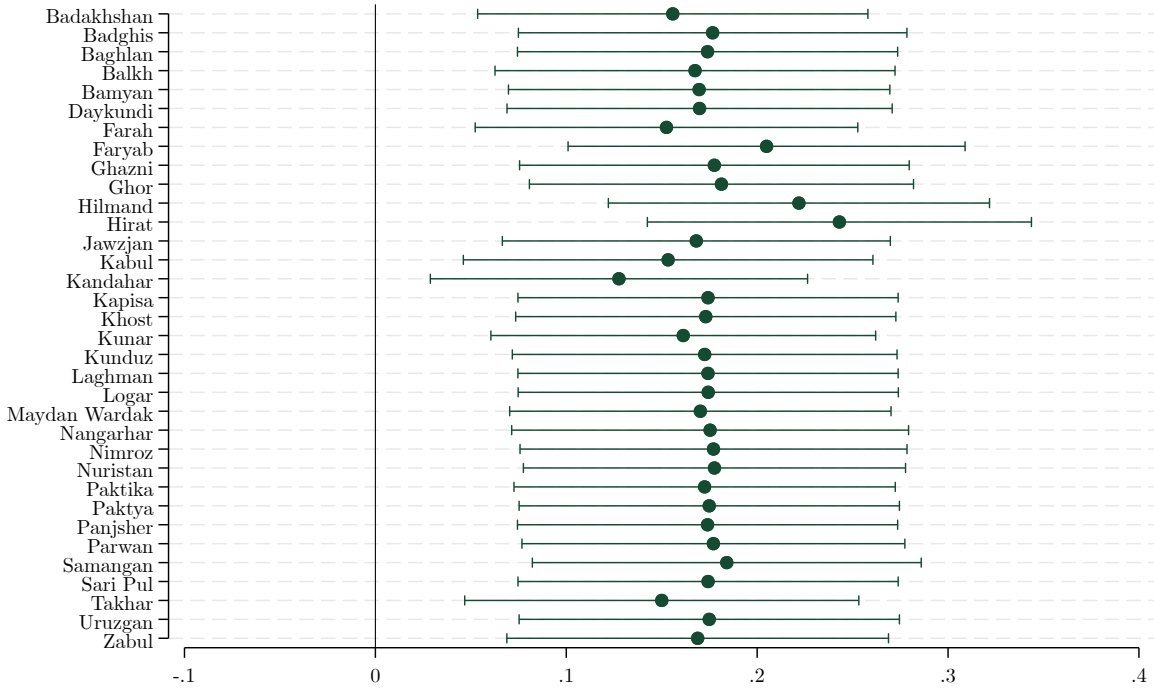
Notes: Data on food insecurity are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable is whether or not the raw Food Insecurity Experience Scale (FIES) index is above four. The raw FIES index is the sum of whether the respondent reports food insecurity on each of the eight FIES questions in the survey. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024. Weather controls are temperature and precipitation. Individual and household controls are an indicator for whether the household head is male, an indicator for whether the household head is married, and an indicator for the household having an unsafe water supply.

FIGURE B10. Robustness: Geography



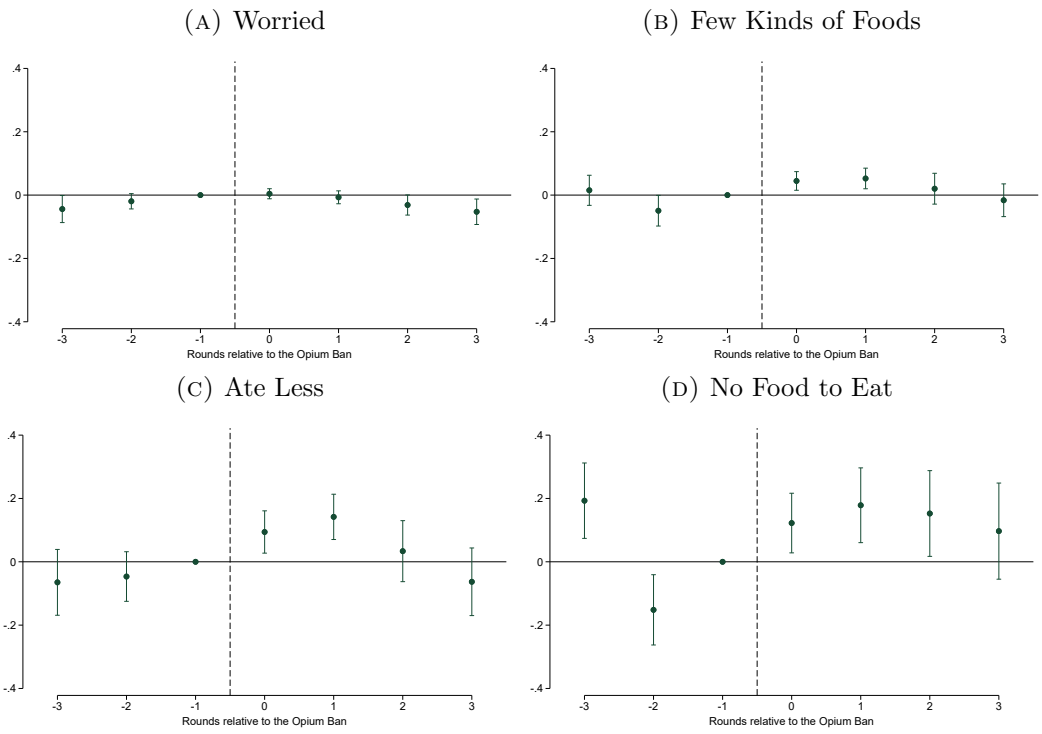
Notes: Data on food insecurity are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable is whether the raw Food Insecurity Experience Scale (FIES) index is above four. The raw FIES index is the sum of whether the respondent reports food insecurity on each of the eight FIES questions in the survey. Estimates labeled "Drop Badakshan" drop Badakshan province from the estimation sample. Estimates labeled "Drop Herat" drop Herat province from the estimation sample. The estimates labeled "Drop Border Districts" drop all the districts that border neighboring countries of Afghanistan. Estimates labeled "Drop Control Border Districts" drop control group districts that border a district that is part of the treatment group. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

FIGURE B11. Robustness: Dropping Provinces



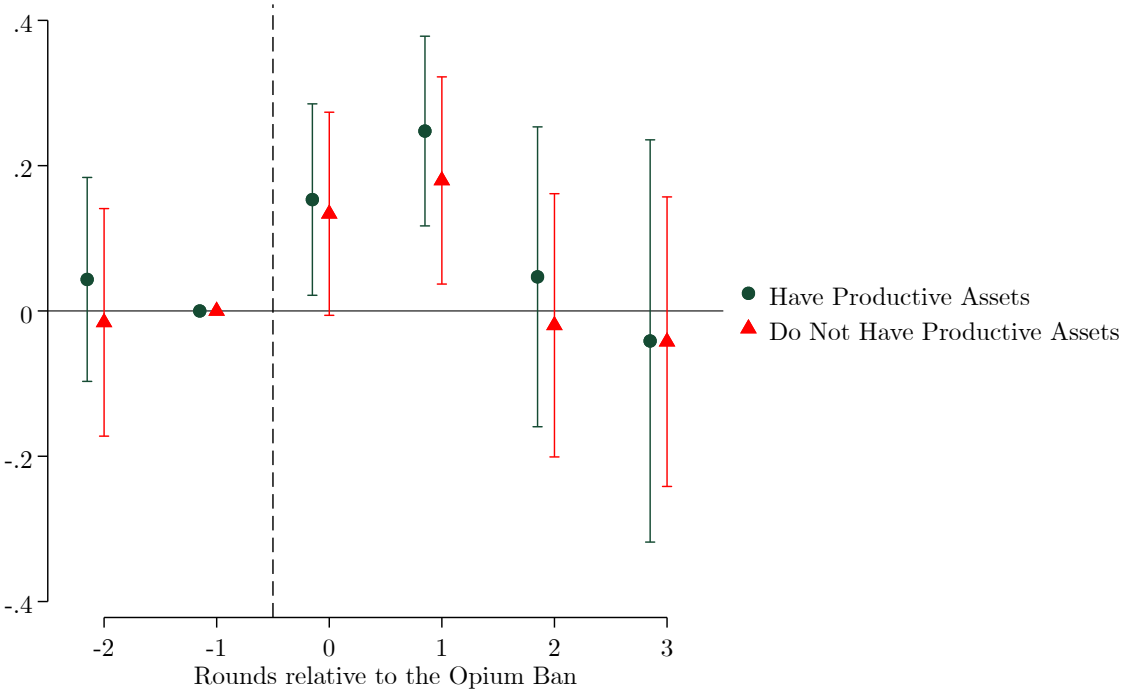
Notes: Data on food insecurity are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable is whether the raw Food Insecurity Experience Scale (FIES) index is above four. The raw FIES index is the sum of whether the respondent reports food insecurity on each of the eight FIES questions in the survey. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

FIGURE B12. Robustness: Including Round 2



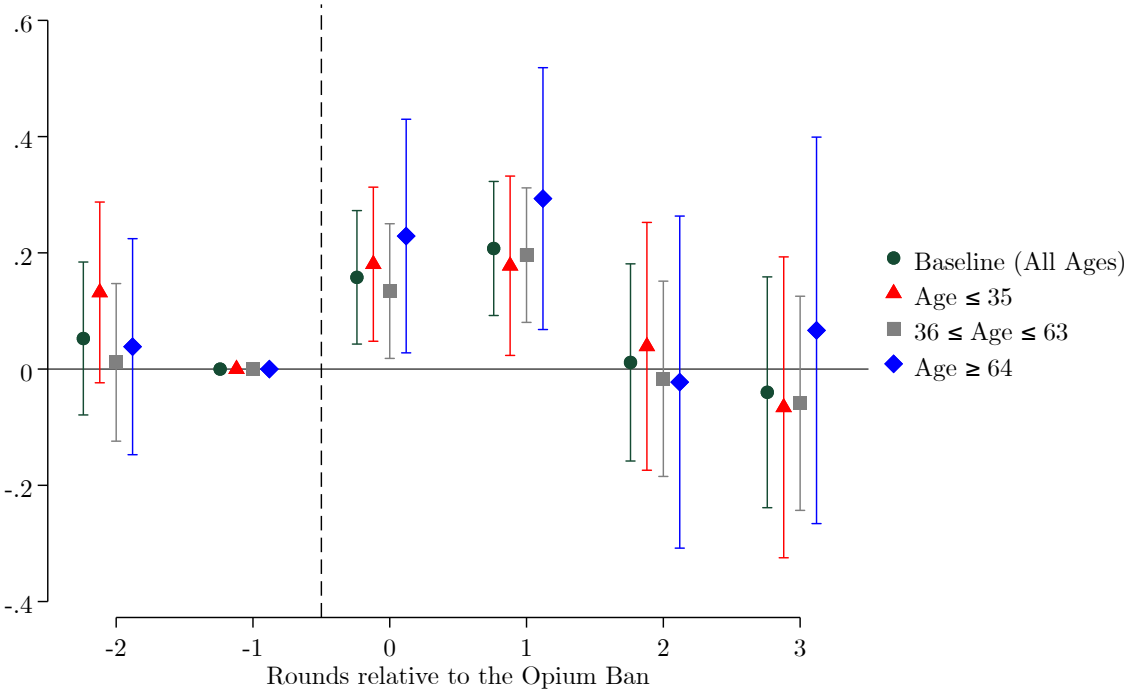
Notes: Data on food insecurity are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable is an indicator variable in each sub-figure. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round two to survey round eight. These survey rounds are conducted between February 2021 and February 2024.

FIGURE B13. Productive Assets Heterogeneity



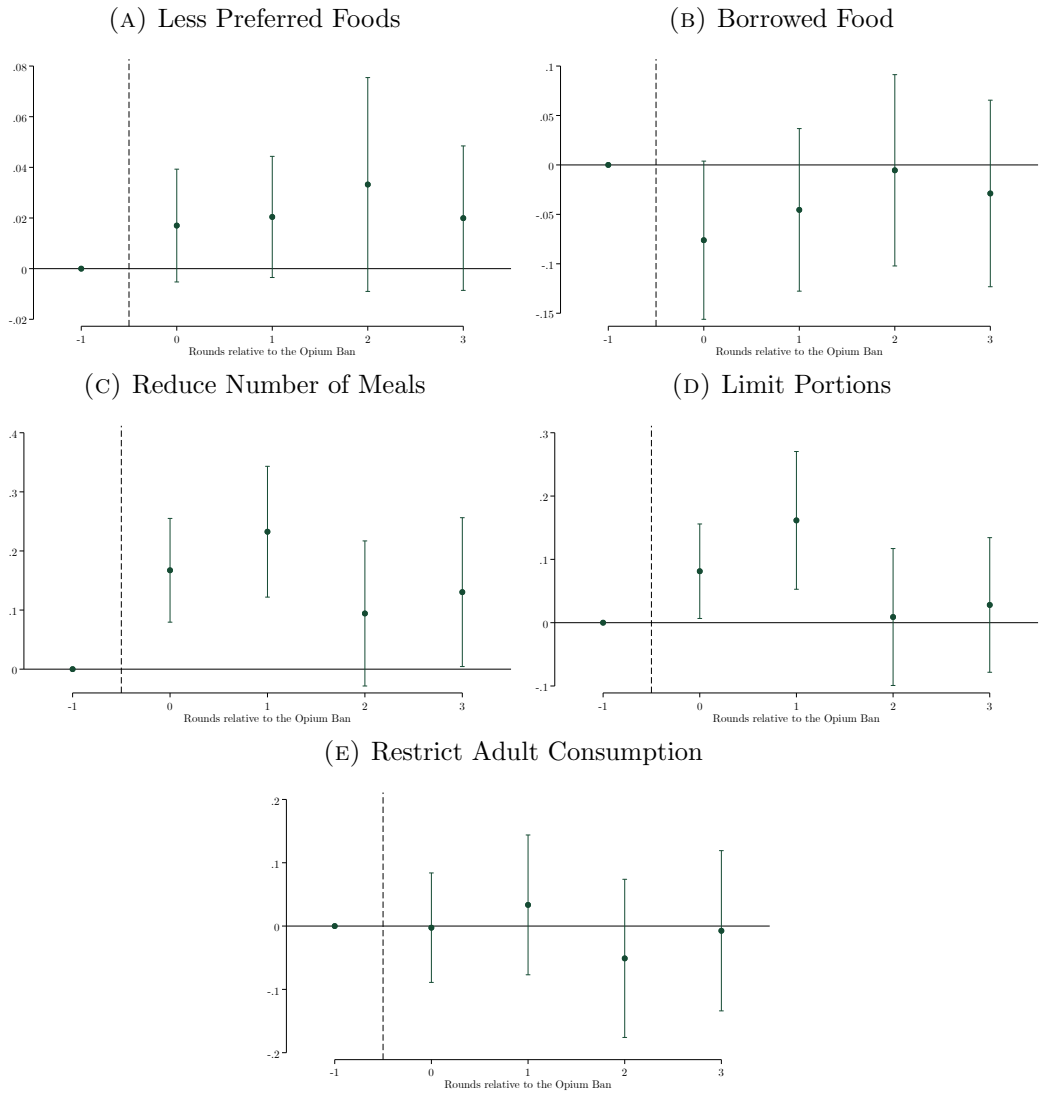
Notes: Data on food insecurity are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable is whether or not the raw Food Insecurity Experience Scale (FIES) index is above four. The raw FIES index is the sum of whether the respondent reports food insecurity on each of the eight FIES questions in the survey. Household is designated as having productive assets if they report having raised any animal. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

FIGURE B14. Age Heterogeneity



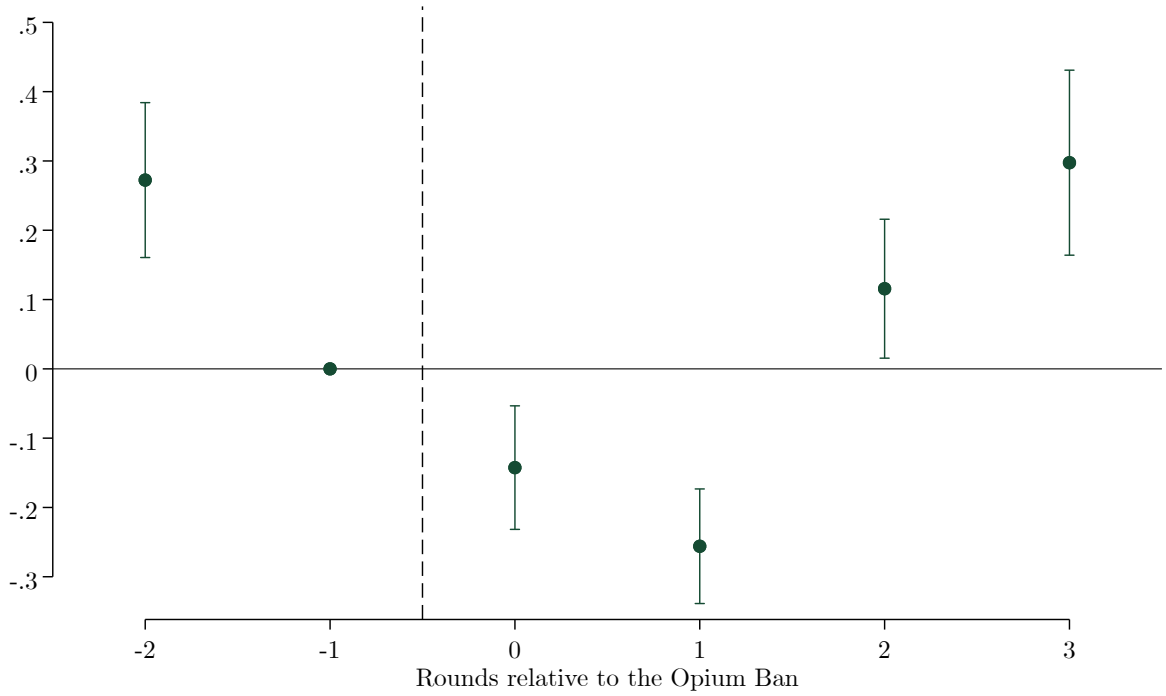
*Notes:*Data on food insecurity are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable is whether or not the raw Food Insecurity Experience Scale (FIES) index is above four. The raw FIES index is the sum of whether the respondent reports food insecurity on each of the eight FIES questions in the survey. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

FIGURE B15. Event-study Estimates for Coping Strategies due to Lack of Food or Money to Buy Food



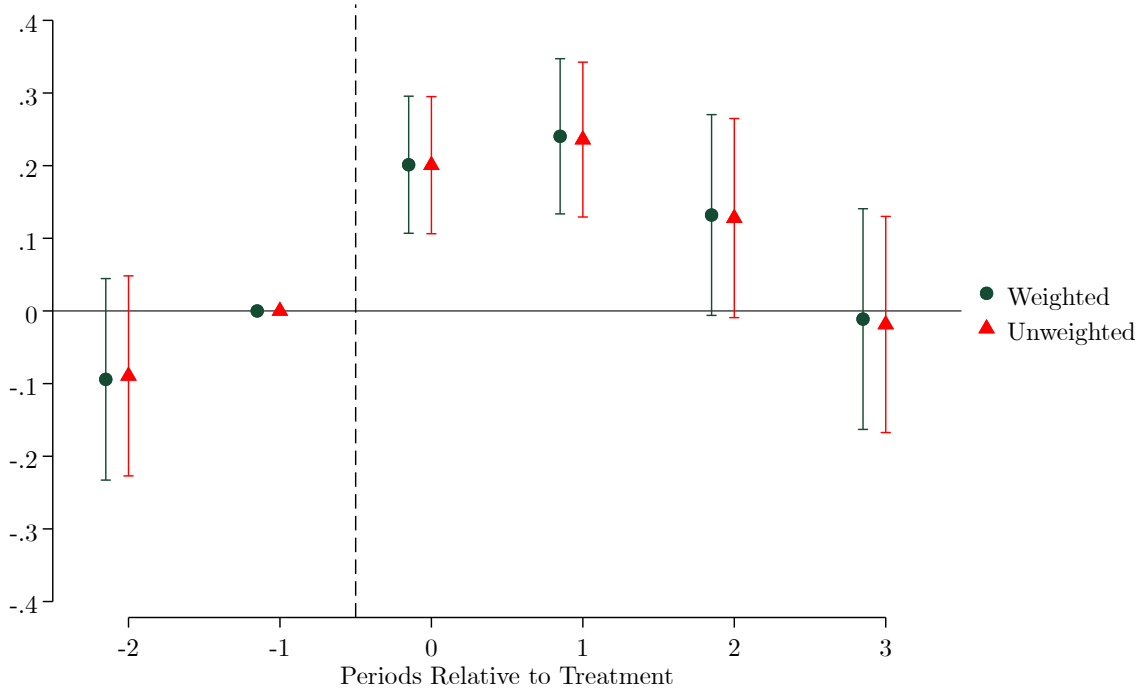
Notes: Data on dependent variables are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable in the sub-figure labeled "Less Preferred Foods" is an indicator variable for the household relying on less preferred or less expensive foods due to lack of food or money to buy food in the seven days preceding the survey date. The dependent variable in the sub-figure labeled "Borrowed Food" is an indicator variable for the household borrowing food or relying on help from a friend or relative due to lack of food or money to buy food in the seven days preceding the survey date. The dependent variable in the sub-figure labeled "Reduce Number of Meals" is an indicator variable for the household reducing the number of meals eaten in a day due to lack of food or money to buy food in the seven days preceding the survey date. The dependent variable in the sub-figure labeled "Limit Portions" is an indicator variable for the household limiting portion sizes at mealtime due to lack of food or money to buy food in the seven days preceding the survey date. The dependent variable in the sub-figure labeled "Restrict Adult Consumption" is an indicator variable for the household restricting consumption by adults so children could eat due to lack of food or money to buy food in the seven days preceding the survey date. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

FIGURE B16. Household has Multiple Sources of Income



Notes: Data on the dependent variable are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable is an indicator variable for the household reporting having at least two most important sources of income. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. Survey weights are used. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

FIGURE B17. Robustness: District-Survey Round-Survey Month Aggregation



Notes: Data on food insecurity are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). The dependent variable is whether the raw Food Insecurity Experience Scale (FIES) index is above four. The raw FIES index is the sum of whether the respondent reports food insecurity on each of the eight FIES questions in the survey. Estimates labeled "Weighted" use survey weights to aggregate outcome measures at the residence district-survey round-surevey month-level. Estimates labeled "Unweighted" do not use survey weights to aggregate outcome measures at the residence district-survey round-surevey month-level. The estimates are from the specification in Equation 2. Standard errors are clustered at the district-level. 95% confidence intervals are plotted. The sample is restricted to data from survey round three to survey round eight. These survey rounds are conducted between September 2021 and February 2024.

TABLE B1. Summary Statistics for Pre-Treatment Period

	Control Districts	Treated Districts
Panel A: Household Characteristics		
Male Headed HH	0.988	0.993
Total HH Income (10,000 Afghani)	2.437	2.164
HH Cultivate Crops	0.449	0.535
HH Agricultural Laborer	0.068	0.087
HH Income Declined in Last Three Months	0.616	0.677
HH Had Any Economic Shock in Last Three Months	0.714	0.779
Panel B: FIES		
Worried about not having enough food to eat	0.937	0.958
Unable to eat healthy and nutritious food	0.902	0.925
Ate only a few kinds of foods	0.924	0.908
Had to skip a meal	0.674	0.705
Ate less than you thought you should	0.815	0.806
No food to eat of any kind	0.425	0.431
Go to sleep at night hungry	0.318	0.357
Go a whole day & night without eating anything	0.212	0.276
Panel C: Outcomes		
High FIES	0.660	0.701
Household Hunger Scale (HHS)	1.461	1.664
Raw FIES Score	5.129	5.365
Average Z-score	-0.033	0.031
Any FIES	0.955	0.959
Number of Households	11,722	21,874

Notes: Data on food insecurity and household characteristics are derived from Food and Agriculture Organization (FAO) Data in Emergencies (DIEM). Opium cultivation data comes from UNODC (2023b). The sample is restricted to data from survey round three to survey round four, conducted between September 2021 and April 2022. Each cell reports the mean.

Table B2. Heterogeneity

	HH Produces Crop		Agriculture Labor HH		HH Experienced Economic Shocks		HH Received Food Assistance		Male Headed HH		Head Married		Below Median Income HH		Above First Quartile Wheat Suitability	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
$\mathbb{1}$ (Opium District)	0.205***	0.165***	0.071	0.164***	0.185***	0.033	0.258***	0.158***	0.168***	0.041	0.167***	0.228**	0.129**	0.185***	0.252***	0.065
$\times\mathbb{1}$ (Post)	(0.056)	(0.052)	(0.104)	(0.050)	(0.051)	(0.091)	(0.066)	(0.055)	(0.052)	(0.145)	(0.052)	(0.100)	(0.052)	(0.066)	(0.065)	(0.070)
	p-value = 0.460		p-value = 0.321		p-value = 0.276		p-value = 0.201		p-value = 0.389		p-value = 0.533		p-value = 0.422		p-value = 0.050	
Adj. R^2	0.187	0.204	0.333	0.173	0.179	0.280	0.286	0.183	0.170	0.317	0.168	0.248	0.185	0.207	0.185	0.160
N	33,591	39,059	6,017	66,633	51,902	20,748	18,163	48,798	66,762	5,858	67,389	5,171	34,623	36,511	50,886	21,764

Notes: Heteroskedasticity robust standard errors clustered by the district are in parentheses. (* p<.10 ** p<.05 *** p<.01). Each observation in all columns corresponds to a unique household. The Independent variable of interest in each column is the interaction of an indicator for the households' residence district having opium cultivation and an indicator for the household being surveyed after fourth survey round. A district has opium cultivation if it has any opium cultivation either in 2020 or 2021. The dependent variable in all the columns is High Food Insecurity Experience Scale (FIES) – whether or not the raw FIES index is above four. Subpopulations are denoted in the column header. p-value is for the test of equality of independent variable estimate across two subpopulations. Specification in each column also includes households' residence district and month of survey fixed-effects along with linear time-trends for the households' residence province. Data on crop suitability is derived from Fischer et al. (2021).

TABLE B3. Composition of Respondents

	Married Household Head	Male Respondent	Below Median Income	Permanent Resident
	(1)	(2)	(3)	(4)
Panel A: All Households				
$\mathbb{1}$ (Opium District)	-0.008	0.000	0.075	0.009
$\times\mathbb{1}$ (Post)	(0.013)	(0.017)	(0.048)	(0.008)
Adj. R^2	0.049	0.147	0.200	0.075
N	72,560	72,646	71,134	65,549
Panel B: Agriculture Households				
$\mathbb{1}$ (Opium District)	0.003	-0.002	0.063	0.007
$\times\mathbb{1}$ (Post)	(0.012)	(0.016)	(0.049)	(0.007)
Adj. R^2	0.054	0.145	0.220	0.084
N	64,586	64,663	63,162	57,784

Notes: Heteroskedasticity robust standard errors clustered by the district are in parentheses. (* p<.10 ** p<.05 *** p<.01). Each observation in all columns corresponds to a unique household. In column (1), the dependent variable is an indicator variable for the household head to be married. In column (2), the dependent variable is an indicator variable for the respondent to be male. In column (3), the dependent variable is an indicator variable for whether the household is below the median of the income distribution. The income distribution in the survey round in which the household is interviewed is used to derive the median of the income distribution. The dependent variable in column (4) is an indicator variable for whether the household is a permanent resident. The Independent variable of interest in each column is the interaction of an indicator for the households' residence district having opium cultivation and an indicator for the household being surveyed after the fifth survey round (July and August 2022). A district has opium cultivation if it has any opium cultivation either in 2020 or 2021. Specification in each column includes households' residence district and month of survey fixed-effects along with linear time-trends for the households' residence province. In Panel labeled as "Panel B", all households who do not report being involved in crop cultivation are dropped from the analytical sample.