



# FEED THE FUTURE

Iniciativa mundial del Gobierno de los EE.UU. contra el hambre y la inseguridad alimentaria

## Feed the Future Guatemala Value Chains Project

### Summary of Impact Evaluation Study\*

#### CONTEXT AND OBJECTIVES

Guatemala experiences high and continued chronic malnutrition and poverty rates, with a particular concentration around predominantly rural and indigenous areas in the Western Highlands. Agricultural development is similarly low in the region, with farmers generally cultivating small landholdings, showing low agricultural productivity, and having limited ability for capital investment and an overall lack of market opportunities, combined with a relatively weak government support.

This brief presents the main findings of the impact evaluation of USAID's Feed the Future (FTF) Guatemala Value Chains Project that aimed to increase agricultural incomes, strengthen resilience, and improve nutritional outcomes of small farmers and their families in the Western Highlands of the country. The Project was created in 2017, building on the successes and lessons learned from the previous five years of implementation of the FTF Initiative in Guatemala, and relying on four expected results: improving agricultural productivity and diversifying income generation alternatives; expanding access to markets; increasing resilience through implementation of climate-smart and nutrition sensitive agriculture; and strengthening the agriculture and food security enabling environment.

The two Implementing Partners of the Project were: Agropecuaria Popoyán (Popoyan) and Federación de Cooperativas Agrícolas de Productores de Café de Guatemala (FEDECOCAGUA). Popoyan targeted agricultural and value chain interventions among producers of flagship value chains, including multiple fruits & vegetables (F&V) as well as coffee and cardamom, across 32 municipalities within the departments of Huehuetenango, Quetzaltenango, Quiché, San Marcos, and Totonicapán. FEDECOCAGUA, in turn, promoted a market-driven approach among coffee producers, with associated nutrition and income diversification components, focusing on 24 municipalities within the departments of Huehuetenango, Quiché, and San Marcos.

The study evaluates three-year impacts on several outcomes linked to food security, nutrition, and livelihoods among Project beneficiaries, based on household data collected in November-December of 2019 and 2022. Special attention is placed to assessing effects on nutritional indicators for children, household dietary diversity, food insecurity experiences, per capita daily expenditures, intention to emigrate, and crop diversity. In addition, the study explores potential heterogeneous impacts distinguishing by Implementing Partner (Popoyan, FEDECOCAGUA) and by type of treatment received (i.e., participation in training activities linked to agricultural productivity and income generation, market access, and nutrition and food security).<sup>1</sup>

<sup>1</sup> Separate estimations are performed when distinguishing by type of treatment based on administrative data provided by the Implementing Partners as well as on self-reports of training and activities that Project beneficiaries indicate they participated in.



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## METHODOLOGY

A cluster randomized design was pursued to obtain an initial representative sample of Project beneficiaries and a corresponding comparison group (controls). In particular, a subset of clusters (communities in the case of Popoyan and farmer associations in the case of FEDECOCAGUA) were first selected from the lists of Project beneficiaries obtained in early 2019; once the clusters had been selected, any beneficiary households with at least one individual from the targeted groups (children and pregnant women) were directly included into the final household sample, together with a random sample from the remaining listed households in those communities. Control households were then mainly selected from communities in municipalities neighboring treatment municipalities that generally shared similar agroecological, socioeconomic, and market access characteristics and produced similar crops.

While the impact evaluation was planned to cover a sample of 2,000 households, a total of 2,479 households were surveyed at baseline in 2019. The initial oversampling was due to potential attrition considering the gap of three years between the baseline and endline survey. For the endline survey in 2022, the survey team attempted to visit 2,000 of the 2,479 households originally interviewed at baseline (considering the initial target sample of 2,000); a total of 1,950 households were finally interviewed at endline, out of which 1,462 households had been also interviewed in 2019, while the remaining 488 households were replacement households interviewed only in 2022.<sup>2</sup>

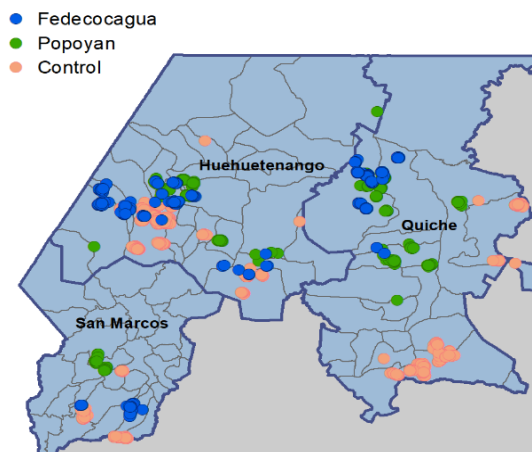
The overall full sample comprises a total of 2,967 interviewed households (1,199 beneficiaries and 1,768 controls) interviewed in 2019 and/or 2022, located across 101 communities in the departments of Huehuetenango, Quiché, and San Marcos. For outcomes measured at the household level, the analysis relies on longitudinal data from the panel of 1,462 households that were interviewed during both survey rounds, while for outcomes related to children under two years old the analysis relies on repeated cross-section data (not necessarily the same households) as not all households interviewed at baseline that had children under two years old still had children in the same age range by the time of the endline survey.

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<sup>2</sup> It is worth mentioning that households not interviewed in 2022 (i.e., 1,017 households interviewed at baseline but not at endline) is dispersed across different communities and quite comparable in terms of observable characteristics to the sample of households surveyed in both survey rounds. Most of the replacements (i.e., 488 households interviewed only at endline) were activated because some of the households interviewed in 2019 could not be found in 2022, were not available or refused to be interviewed again, and because of climatic conditions that prevented visiting again specific locations. The replacement sample are from the same communities visited in 2019 and/or from other nearby communities sharing similar characteristics to the baseline communities and share similar characteristics to the households interviewed in both rounds.



## Location of study sample



Note: The figure maps the location of all visited communities in 2019 and 2022. The location of a community is determined by taking the average coordinates across all households interviewed in it.

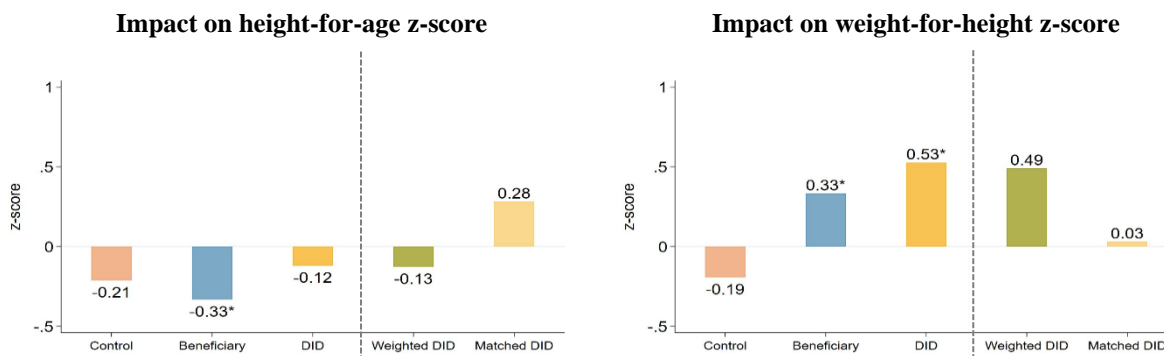
The impact evaluation strategy follows a differences-in-differences (DID) approach that compares changes in the outcomes of interest between 2019 and 2022 among the beneficiary and control group, while controlling for a wide range of household characteristics, exposure to external shocks, and location controls using a multivariate regression framework. A total of three alternative models are considered. The first model corresponds to a standard (unweighted) DID model, while the second model adjusts the standard DID model with multiple group propensity score weighting (weighted DID). The third model applies a standard DID model to a previously matched sample of beneficiaries and controls using one-to-one propensity score matching with (and without) replacement (matched DID).<sup>3</sup>

<sup>3</sup> While the differences in observable characteristics across the treatment and control group are not necessarily major, they are important enough to suggest the inclusion of a set of control variables in a regression framework and explore alternative models using weights or pre-matched samples to further assess the sensitivity of the results. The preferred model is probably the weighted DID that permits to better account for possible changes in the characteristics (including unobservables) and composition of the beneficiary and control groups over time that could affect the DID estimates. The results presented below for the matched DID model correspond to the one-to-one matched sample of beneficiaries and controls with replacement.



## MAIN FINDINGS

1. In terms of the nutritional status of children under two years old, the beneficiary group shows a larger average decrease on the height-for-age z-score (HAZ) than the control group between 2019 and 2022, but difference in the score variation between the two groups captured by the DID estimator is not statistically different from zero at conventional levels across all estimated models. On the other hand, the weight-for-height z-score (WHZ) increased among children in the beneficiary group, as opposed to the control group, which results in an overall positive impact of the Project on WHZ, but only significant when using the standard DID model (+0.53 standard deviations equivalent to a more than twofold increase in the score considering an initial (baseline) WHZ of about 0.5 standard deviations).<sup>4</sup>



Note: Children's measurements were converted to height-for-age and weight-for-height z-scores according to the World Health Organization (WHO) Growth Standards. The reported estimates are based on a multivariate linear regression analysis modeling changes in the corresponding outcomes among the beneficiary and control group using repeated cross-section data for 2019 and 2022 and accounting for household socioeconomic characteristics, exposure to shocks, and community fixed effects, with standard errors clustered by community. The number of anthropometric measurements considered in the estimations equals 1,168 (476 beneficiaries and 692 controls) for the height-for-age z-score, and 1,160 (475 beneficiaries and 685 controls) for the weight-for-height z-score. The first two bars on the left of each figure show the estimated coefficients for changes in the selected outcome among control and beneficiary groups, respectively. The third bar of each figure reports the estimated project impact on the beneficiary group based on a standard differences-in-differences (DID) model; the fourth bar reports the estimated impact based on a DID model with propensity score weighting; and the fifth bar reports the estimated impact based on DID model among a previously matched sample of beneficiaries and controls using one-to-one propensity score matching with replacement. (\*) Denote coefficients statistically significant at 90% level. The average baseline value of the modeled outcome variable is -1.90 for beneficiaries and -1.73 for controls for the figure on the left and 0.35 for beneficiaries and 0.44 for controls for the figure on the right.

2. Regarding dietary diversity and prevalence of food insecurity at the household level, two relevant outcomes that were modeled are: the household dietary diversity score (HDDS, which ranges from 0 to 12) and the prevalence of moderate/severe food insecurity (based on two questions from the Food Insecurity Experience Scale-FIES). Both the beneficiary and control group show reductions in the HDDS, but they are not significantly different across all specifications considered; a similar pattern is observed when further assessing variations in the diversity of animal source foods (ASF) and fruits & vegetables (F&V) consumed.<sup>5</sup> At the same time, an important reduction in the prevalence of moderate and/or severe food insecurity episodes is found among the beneficiary group that can be attributed to the Project, in the order of 11-16 percentage points.

<sup>4</sup> The positive impact on WHZ is though not accompanied by a reduction in the prevalence of wasting.

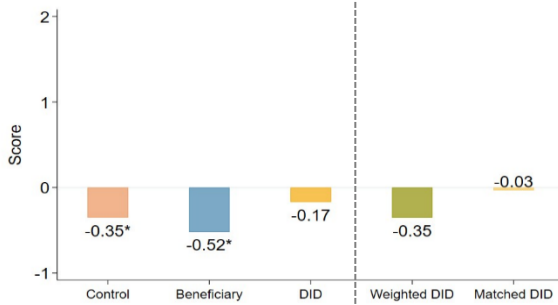
<sup>5</sup> There are also no impacts on dietary diversity measures among women of reproductive age in the household but some deterioration in the dietary diversity of children 6-23 months (mainly driven by lower consumption of legumes and nuts relative to the control group).



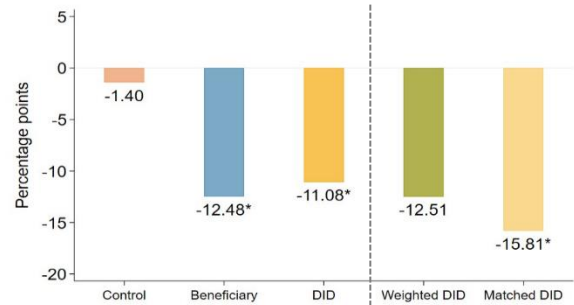
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### Impact on Household Dietary Diversity Score (0-12)



### Impact on prevalence of moderate or severe food insecurity



Note: The Household Dietary Diversity Score (HDDS) measures the number of 12 different food groups (1. Cereals and grains; 2. Roots and tubers; 3. Vegetables; 4. Fruits; 5. Meats, poultry, and offal; 6. Eggs; 7. Fish and seafood; 8. Legumes and nuts; 9. Milk and milk products; 10. Oil and fats; 11. Sugar; and 12. Miscellaneous) that a member of the household consumed over the previous 24 hours. The prevalence of moderate or severe Food Insecurity Experience indicator is based on the household reporting having experienced situations of moderate or severe insecurity experiences during the last 12 months. These situations are part of the eight Food Insecurity Experience Scale items proposed by Ballard et al. (2013). The questions related to moderate and severe insecurity refer to *if any household member ate less than they thought they should because of the lack of money or other resources*, and *if any household member were hungry but did not eat because of the lack of money or other resources*. The reported estimates are based on a multivariate linear regression analysis modeling changes in the corresponding outcomes among the beneficiary and control group using longitudinal panel data for 2019 and 2022 and accounting for household socioeconomic characteristics, exposure to shocks, and household fixed effects, with standard errors clustered by community. The first two bars of each figure show the corresponding outcome changes in the control and beneficiary groups, respectively. The third bar reports the estimated project impact on the beneficiary group based on a standard differences-in-differences (DID) model; the fourth bar reports the estimated impact based on a DID model with propensity score weighting; and the fifth bar reports the estimated impact based on DID model among a previously matched sample of beneficiaries and controls using one-to-one propensity score matching with replacement. The number of households considered in the estimations equals 1,432 (704 beneficiaries and 728 controls) for the HDDS, and to 1,452 (704 beneficiaries and 748 controls) for the prevalence of moderate and severe food insecurity indicator. (\*) Denote coefficients statistically significant at 90% level. The average baseline value of the modeled outcome variable is 6.97 for beneficiaries and 6.45 for controls for the figure on the left and 39.2% for beneficiaries and 40.4% for controls for the figure on the right.

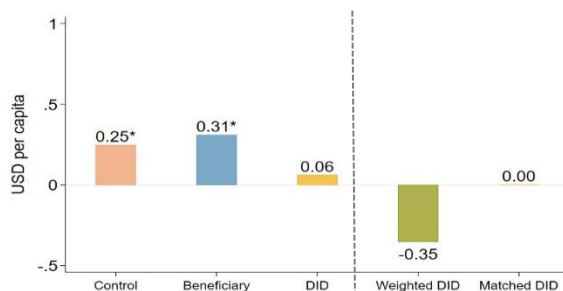
3. In terms of daily per capita expenditure, there is a larger increase among the beneficiary group (31 US cents versus 25 US cents among the comparison group), but the overall Project impact is not statistically significant. The intention to emigrate, in turn, which can be regarded as a proxy of local economic opportunities (relative to relocating), increased to a larger extent among the control group (4.5 percentage points versus 3.7 among beneficiaries), but no impact can be attributed to the Project.



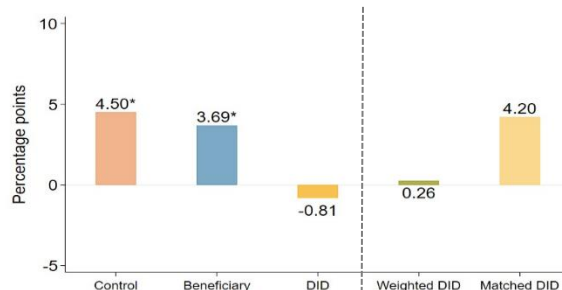
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### Impact on daily per capita expenditure (USD 2017)



### Impact on intention to emigrate over next 3 years



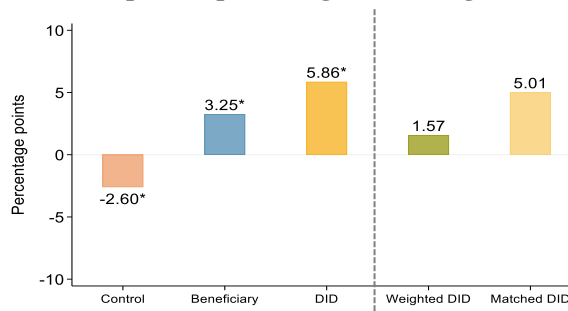
Note: The daily per capita expenditures are obtained using 2017 national prices, converted to US dollars. The intention to emigrate indicator modeled is a dichotomic variable equal to one if at least one member in the household has the intention to emigrate over the upcoming 3 years, zero otherwise (Question in survey: “Does anyone in this household has any intention to emigrate in the next 3 years?”). The reported estimates are based on a multivariate linear regression analysis modeling changes in the corresponding outcomes among the beneficiary and control group using longitudinal panel data for 2019 and 2022 and accounting for household socioeconomic characteristics, exposure to shocks, and household fixed effects, with standard errors clustered by community. The first two bars of each figure show the corresponding outcome changes in the control and beneficiary groups, respectively. The third bar of each figure reports the estimated project impact on the beneficiary group based on a standard differences-in-differences (DID) model; the fourth bar reports the estimated impact based on a DID model with propensity score weighting; and the fifth bars reports the estimated impact based on DID model among a previously matched sample of beneficiaries and controls using one-to-one propensity score matching with replacement. The number of households considered in the estimation equals 1,434 (691 beneficiaries and 743 controls) for the daily per capita expenditure, and 1,386 (668 beneficiaries and 718 controls) for the intention to emigrate indicator. (\*) Denote coefficients statistically significant at 90% level. The average baseline value of the modeled outcome variable is 1.44 for beneficiaries and 1.14 for controls for the figure on the left and 3.9% for beneficiaries and 2.0% for controls for the figure on the right.

4. Concerning agricultural production, the study finds positive impacts on the number of crops produced and on the share of households producing fruits & vegetables (F&V), although the estimated effects are only statistically significant using the standard DID model. The effect on crop variety is marginal (+0.1 units roughly equivalent to a 5% increase considering that the average farmer reported producing 2 crops at baseline), while there is a 5.9 percentage points positive impact on the share of households reporting producing F&V.

### Impact on number of crops produced



### Impact on producing fruits & vegetables



Note: The number of crops produced indicator accounts for all the crops the household reports that produces. The indicator for producing fruits & vegetables is a dichotomic variable equal to one if the household produces at least one of these crops, zero otherwise. The reported estimates are based on a multivariate linear regression analysis modeling changes in the corresponding outcomes among the beneficiary and control group using longitudinal panel data for 2019 (recalled) and 2022 (concurrent) and accounting for household socioeconomic characteristics, exposure to shocks, and household fixed effects, with standard errors clustered by community. The first two bars of each figure show the corresponding outcome changes in the control and beneficiary groups, respectively. The third bar of each figure reports the estimated project impact on the beneficiary group based on a standard differences-in-differences (DID) model; the fourth bar reports the estimated impact based on a DID model with propensity score weighting; and the fifth bar reports the estimated impact based on DID model among a previously matched sample of beneficiaries and controls using one-to-one propensity score matching with replacement. The number of households considered in the estimations equals 1,354 (688 beneficiaries and 666 controls) for both indicators. (\*) Denote coefficients statistically significant at 90% level. The average baseline value of the modeled outcome variable is 2.23 for beneficiaries and 1.97 for controls for the figure on the left and 17.6% for beneficiaries and 17.0% for controls for the figure on the right.



5. Overall, the impact evaluation results show limited improvements across different key outcomes related to food security, nutrition, and livelihoods. There are some positive effects on children's weight-for-height z-score, lower prevalence of moderate or severe food insecurity episodes, and crop diversity and production of F&V but the results are not consistent across all model specifications. No additional insights are generally found in terms of potential heterogeneous impacts by Implementing Partner or by type of intervention (Project component) relying both on administrative data and on self-reported participation by households.
6. The study additionally explores impacts in other outcomes of interest such as exclusive breastfeeding for children under 6 months, share of main crop production for sale, and possession of savings and loans from formal institutions. While there is certain variation in the evolution of some of these indicators between the beneficiary and control group, no statistically significant effects can be attributed to the Project.<sup>6</sup>
7. The lack of strong impacts of the Project does not necessarily mean that the interventions did not benefit the lives of the targeted populations. The impacts of such complex programs aimed at strengthening agricultural value chains and improving household nutrition may take longer than three years to trickle down to beneficiary households and affect the type of outcomes analyzed. A complementary process evaluation performed to one of the Project Implementing partners concluded, for example, that securing access to external markets could be critical for technology adoption and crop diversification, while limited access to credit and liquidity constraints could hinder farmers and their families from adopting some of the Project recommendations in terms of production and nutrition.
8. In addition, it is worth stressing out that the Project is evaluated in a context of multiple major global and local shocks such as the COVID-19 outbreak (March 2020), extreme weather events (tropical storms ETA and IOTA in November 2020, and Julia in October 2022), and the Russia-Ukraine conflict (February 2022) that likely affected several of the modeled outcomes (as shown also by a set of complementary studies performed by IFPRI in the region between 2020 and 2022). While an implicit assumption in the impact evaluation study is that the pandemic affected to a similar extent both beneficiary and control households and the analysis accounts for the level of exposure of the working sample to climatic shocks and the rise in input prices due to the war, still these shocks (particularly COVID-19) could have affected or reshaped the preferences and attitudes of households towards their day-to-day production, economic, financial, and intra-household decisions, thereby possibly influencing (or limiting) some of the Project intended effects or behavioral changes. More generally, such an environment may have limited the depth to which planned interventions were pursued, lowered the capacity of beneficiary households to focus on learning new techniques and practices, and their ability to put these in practice, thus overall mitigating the potential effects of the program on livelihoods. The results should thus be interpreted accordingly considering this special context.

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<sup>6</sup> For completeness, the study also reports simple before-after comparisons between beneficiary and control households on other outcomes of interest, including additional indicators linked to food insecurity, sanitation and hygiene practices, migration experiences, alternative poverty measures, and nutrition of children under 5 years old.



9. All in all, the findings suggest the importance of accompanying value-chain related interventions with nutritional interventions but certainly more work is needed to better understand the operating channels (mechanisms) through which these interventions can have a higher impact, particularly in a context of recurrent shocks. In this line, the evaluation of pilot, experimental programs with varying interventions (treatment arms) are recommended to identify what specific combination(s) of value-chain and nutrition interventions can work better. Additionally, process (performance) evaluations could help to better understand some of the results obtained, while identifying specific bottlenecks.

\*Study performed by Manuel A. Hernandez (Senior Research Fellow at IFPRI), Francisco Ceballos (Research Fellow), Cynthia Paz (Research Analyst), and Alvaro Espinoza (Consultant). We specially thank the staff of Agropecuaria Popoyan and FEDECOCAGUA for facilitating the administrative data used in the analysis and their collaboration along the study implementation, and Francisco Olivet and the team of O&M Estudios y Proyectos for their valuable collaboration in collecting the household data during the baseline and endline surveys. This study was made possible through support provided by Feed the Future through the U.S. Agency for International Development. The contents and conclusions of the study are the responsibility of the authors and do not necessarily reflect the position of the International Food Policy Research Institute (IFPRI) or the U.S. Agency for International Development. Contact email: [m.a.hernandez@cgiar.org](mailto:m.a.hernandez@cgiar.org) (Manuel A. Hernandez).