Remittances and Food Insecurity: Leveraging Innovations in modern phone surveys with traditional census and administrative data

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Abstract: Household surveys remain the cornerstone of socioeconomic measurement in low- and middle-income countries, yet improving their timeliness, cross-country comparability, and analytical value is an ongoing challenge. This paper contributes to these efforts by combining harmonized microdata from the World Bank's High-Frequency Phone Surveys (HFPS, n=16,527) to examine the causal impact of remittances on household food insecurity. Using a novel instrumental-variable approach that interacts pre-pandemic migration intensity from census and admin data with a principal-component-based household wealth index, we identify the exogenous component of remittance receipt across six middle-income countries—Philippines, Georgia, Mexico, Guatemala, Panama, and the Dominican Republic. The results show that remittances significantly reduce the likelihood of food insecurity, particularly in contexts with dense migration networks. By contrast, households reporting lower remittance inflows faced higher vulnerability, underscoring both the fragility and the protective nature of transnational income flows. Beyond substantive results, this study demonstrates the analytical potential of harmonized phone survey data for monitoring food security and income resilience in real time, and illustrates how these surveys can be supplemented with more traditional sources.

I. Introduction

Remittances are among the most important private financial flows to developing economies, often surpassing foreign direct investment and official development assistance. For millions of households, these transfers represent a key livelihood strategy that complements or replaces domestic income sources. In times of crisis, they can serve as a buffer against consumption shocks, unemployment, and poverty. Yet, the extent to which remittances protect households from food insecurity—one of the most acute manifestations of economic vulnerability—remains an open empirical question, especially when global shocks simultaneously affect both migrants abroad and their families at home.

The COVID-19 pandemic provides a unique context to examine this relationship. Lockdowns, labor market disruptions, and border closures affected both the ability of migrants to send remittances and the capacity of households to secure adequate food. While global remittance flows proved more resilient than initially expected, evidence suggests that many

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households experienced temporary or permanent reductions in transfers, with uneven consequences across countries. Understanding how remittances influence food security under such conditions is critical for evaluating their role as an informal safety net.

This paper explores the relationship between remittances and food insecurity in five middle-income countries—the Philippines, Georgia, Mexico, Guatemala, and the Dominican Republic—using the World Bank's High-Frequency Phone Surveys (HFPS) conducted during 2020–2021. These countries share relatively high emigration rates and a strong dependence on remittances, yet differ in labor market structures, social protection systems, and exposure to the pandemic. The comparative setting allows us to assess whether the food-security effect of remittances depends on contextual factors such as the depth of migration networks or household wealth levels.

Our contribution to the literature is threefold. First, we provide one of the few cross-country comparative analyses of the causal effect of remittances on food insecurity during the COVID-19 crisis. Previous studies have largely focused on single countries—most notably rural Mexico (Mora-Rivera and van Gameren, 2019) or specific migrant corridors—limiting the generalizability of results. By combining harmonized HFPS data for six countries, we highlight both the common and divergent patterns of remittance effects under similar survey designs and timing.

Second, we advance the methodological frontier by illustrating how harmonized high-frequency phone surveys can be linked with traditional census and administrative data to strengthen causal inference and enhance the policy relevance of welfare measurement. This integration is vital for our third contribution.

Third, we address the endogeneity of remittance receipt using an instrumental-variable (IV) approach that combines local migration intensity (from pre-pandemic census data) with a household wealth index constructed through principal component analysis (PCA). This strategy exploits the exogenous variation in remittance exposure due to historical migration patterns while controlling for asset-based wealth index. We argue the validity of the instrument in the text.

Our findings indicate that, across most countries, remittance-receiving households are significantly less likely to experience food insecurity, even after accounting for observable characteristics and potential endogeneity. The protective effect of remittances is strongest in settings with dense migration networks—such as the Philippines and Mexico—and weaker in countries where remittances are less institutionalized or concentrated among wealthier groups. Conversely, households that reported a reduction in remittance income during the pandemic faced a markedly higher probability of food insecurity, suggesting that the stability of transfers matters as much as their presence.

Taken together, these results underscore that remittances operate as an important coping mechanism but not a structural solution to food insecurity. They provide short-term relief but remain vulnerable to macroeconomic and health shocks that affect migrants' earning capacity abroad. The policy implication is clear: while remittances can complement domestic social protection, they cannot substitute for robust public safety nets and inclusive economic recovery strategies.

II. Literature Review

The relationship between migration, remittances, and food security has been widely studied within the framework of the New Economics of Labor Migration (NELM; Stark & Bloom

1985 [31]; Taylor et al. 2003 [32]). This approach views migration as a household strategy for risk diversification rather than a purely individual decision. Remittances, in this context, serve as an informal insurance mechanism that smooths consumption and mitigates income shocks in the absence of formal credit and insurance markets (Hoddinott 1994 [15]; Adams Page 2005 [3]; Yang 2011 [37]).

Empirical research has consistently shown that remittances contribute to poverty reduction (Acosta et al. 2008 [2]; Adams & Page 2005 [3]) and income equality (Barham & Boucher 1998 [6]), while also improving household welfare, including education and health outcomes (Berloffa & Giunti 2019 [7]; Mendola 2011 [20]). In rural settings, remittances often sustain household consumption and investment in human capital during crises (Obi et al. 2020 [22]; Ogunniyi et al. 2020 [23]). However, their developmental impact is not unambiguously positive. Critics point to the risk of dependency, reduced labor supply, or vulnerability to global shocks that interrupt income flows (Weiler et al. 2017 [35]).

Recent literature has shifted attention toward the remittances–food security nexus. Crush & Caesar (2017) [11] review this growing field, showing that remittances affect not only income but also dietary diversity, nutrition, and the ability to cope with transitory shocks. In Nepal, remittance inflows have been linked to improved calorie intake and food security (Regmi & Paudel 2017 [26]; Pyakuryal et al. 2010 [24]). In sub-Saharan Africa, non-farm income from migration has been associated with better food access (Rahman & Mishra 2019 [25]) and more resilient coping strategies during crises (Abebaw et al. 2020 [1]; Ogunniyi et al. 2020 [23]). Yet, evidence from Ghana suggests nuanced outcomes: while remittances improve food availability, they may also shift consumption toward less nutritious or processed foods (Karamba et al. 2011 [17]; Kuuire et al. 2013 [18]).

Within Latin America, research has emphasized both the protective and ambiguous roles of remittances. Studies in Mexico find that remittances cushion the impact of economic downturns and improve food expenditure patterns, particularly during crises such as the 2008 financial collapse (Vilar-Compte et al. 2014 [34]; López-Feldman & Chávez 2017 [19]).

At the conceptual level, remittances can influence food security through three principal channels. First, they raise disposable income, allowing households to purchase more or higher-quality food. Second, they relax liquidity constraints, enabling longer-term investments in productive assets that stabilize consumption. Third, they act as a buffer against shocks when domestic labor or agricultural income declines. However, the magnitude and direction of these effects depend on contextual factors—such as migration networks, the stability of remittance flows, and pre-existing wealth or inequality levels (Smith & Floro 2020 ; Smith & Wesselbaum 2022 [29]).

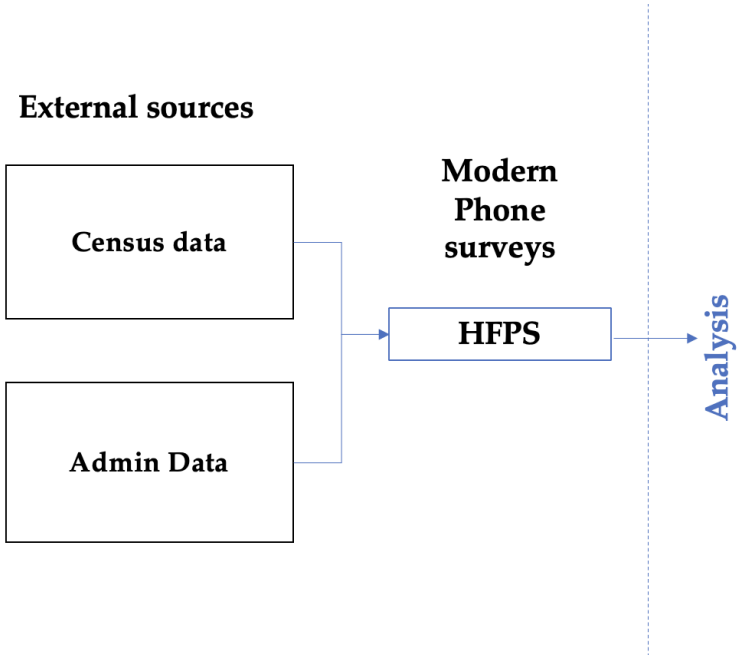
Despite extensive country-specific evidence, comparative causal analyses remain scarce. Many studies rely on cross-sectional correlations that cannot disentangle the endogeneity between migration decisions and food outcomes: wealthier households may both remit more and face lower food insecurity. Few have exploited instrumental variables or quasi-experimental designs to isolate the exogenous component of remittance exposure.

This paper contributes to filling this gap by leveraging harmonized HFPS data and an IV strategy that instruments remittance receipt through migration intensity and wealth indices derived from national censuses and household assets. This approach builds on the empirical tradition of Adams & Page (2005) [3] and Taylor et al. (2003) while incorporating recent concerns about vulnerability under systemic shocks. By analyzing six middle-income economies with varying dependence on remittances, we provide new evidence on how transnational income flows interact with local economic fragility to determine food security outcomes.

III. Data

This study combines harmonized microdata from the World Bank's High-Frequency Phone Surveys (HFPS) with external information from national censuses and administrative sources. Figure 1 summarizes the data integration process. Linking these complementary sources allows us to merge the representativeness of traditional data systems with the speed and flexibility of modern survey collection, enabling near–real-time analysis of household vulnerability and resilience across multiple countries.

Figure 1 – Data Scheme



III.1 High Frequency Phone Surveys

This paper uses data from the World Bank's High-Frequency Phone Surveys (HFPS) World Bank (2022) conducted between 2020 and 2021 in six middle-income countries — the Philippines, Georgia, Mexico, Guatemala, and the Dominican Republic. These nationally representative surveys were designed to track the socioeconomic impacts of the COVID-19 pandemic and include harmonized modules on income, employment, health, government assistance, and remittances.

The surveys were levied during the Summer of 2020 through 2021 (See the appendix for specific dates). The surveys of Mexico, Guatemala and the Dominican Republic are largely harmonized. While the ones of Georgia and The Philippines required additional steps and are not 100 percent comparable. After dropping observations that are missing or non-compliants, our sample comprises around 16 thousand observations. A table with the means of the main variables is provided below (Table 1).

Table 1 – Means table.

	Georgia	Philippines	Dom. Rep.	Mexico	Guatemala
Food Insecurity					
Food Insecure (=1)	0.24	0.39	0.33	0.19	0.22
FI Pre-Pandemic (=1)			0.21	0.10	0.14
Remittances					
Receives Remittances (=1)	0.12	0.15	0.32	0.07	0.10
Remittances Lower (=1)	0.08	0.13	0.14	0.03	0.05
Education					
Secondary Education	0.35	0.29	0.48	0.45	0.40
Tertiary Education	0.30	0.36	0.30	0.33	0.15
Demographics					
Age (years)	47.38	46.53	40.41	44.73	36.97
Woman (=1)	0.55	0.46	0.54	0.56	0.50
Urban area (=1)	0.64	0.79	0.66	0.81	0.59
Children in household	0.88	1.29	1.27	0.90	1.47
Household Finances					
Good financial situation	0.22	0.05	0.09	0.06	0.04
Some difficulty	0.46	0.13	0.31	0.33	0.37
Great difficulty	0.31	0.28	0.49	0.44	0.44
N	2042	9448	1205	2625	1207

Notes: Means calculated without weights.

Food Insecurity

Food insecurity (FI) in households in the survey is measured differently depending on the country. In LAC, the procedure is most standard, with a set of 3 questions relating to food availability and quality, plus a fourth one about past FI experience. The timeframe refers to the previous month. The questions can be seen in Table 2. The Philippines has some shared questions with LAC, but lacks the retrospective question and adds one for worrying about food.

On the other hand, Georgia uses a completely different format with the question being *In the last month how often did you not have enough money to buy the food?*, with possible answers being Every day, Several times a week, Once a week, Less often, or Never.

For the regressions, we operationalize this in one dichotomous variable: *Food Insecurity* as 1 if individuals report going without food for a day; and Moderate Food Insecurity if individuals report that their household *ran out of food* (1). The level is based on FAO recommendations, but they are not strictly the same (Cafiero, Viviani, & Nord, 2018). Additionally, for Georgia, we code the variable as 1 if the household declares having no money to buy food at least once per week.

Table 2 – Questions about Food Insecurity

Questions/Country	***GEO***	***PHL***	***DOM***	***MEX***	***GTM***
In the past 30 days...					
... worried about not having enough food to eat because of lack of money		X			
... ate less than you thought you should because of a lack of money		X			
... ran out of food because of a lack of money or other resources		X	X	X	X
... were hungry but did not eat because there was not enough money		X			
... went without eating for a whole day because of a lack of money		X	X	X	X
... are less healthy food because of lack of money			X	X	X
Right before the pandemic....					
.... ran out of food because of a lack of money or other resources			X	X	X
In the last month...*					
how often did you not have enough money to buy the food?	X				

Notes: HFPS data. * For Georgia, the question asks for the Every day, Several times a week, Once a week, Less often,Never.

Other Variables – Controls

Survey Control Variables: We include an array of demographic variables (gender, age, marital status, urban); and education variables (Primary, Secondary and Tertiary). We also include a variable that indicates financial well being.

Wealth Index:

We also include a wealth index created with Principal component analysis using several household goods/conditions (internet, washing machine, motorcycle, overcrowding, potable water and tablet/PC).

III.2 Instrument: Migration Intensity

Census-Based Data. Current research on migration highlights the strong influence of *migration networks* on both current migration flows and the receipt of remittances (Acosta, Calderón, Fajnzylber, & López, 2006; Adams & Cuecuecha, 2010; Mora-Rivera & Van Gameren, 2021). Following this literature, we construct a measure of *migration intensity* using census and administrative data from national statistical offices (NSOs) and the Integrated Public Use Microdata Series (IPUMS) (Minnesota Population Center, 2020).

Migration intensity is defined as the share of households or individuals in a given sub-national unit (municipality, province, or region) that report having a household member living abroad. The definition is consistent for most countries, except for Georgia and The Philippines, where a proxy is applied. For Georgia, is the migrants per capita at region and urban/rural level. While for The Philippines is the percentage of households declaring and *Overseas worker*.

Table 2 summarizes the secondary sources used for constructing the instrument across the six countries. The merging level varies according to data availability—from municipalities in Guatemala and Mexico to provinces in the Philippines and the Dominican Republic, and administrative regions in Georgia. The number of regions used ranges from 21 in Georgia to 725 in Mexico. The mean migration rates also differ substantially, reflecting the diverse migration contexts: from 2.3% of the population abroad in Georgia to 9.5% in the Dominican Republic. These measures were merged to the HFPS datasets by the smallest common administrative identifier, allowing the instrument to capture both geographic and network variation in migration exposure.

Table 3 – Secondary data used for the construction of the instrument

Country	Sample Year	Year	Total Regions	Mean	SD	Origin	Variable
Georgia	Region, Urban	2022	21	2.3%	0.011	Admin	Migrants per capita (NSO)
The Philippines	Province	2015	85	5.4%	0.030	Census	Overseas Workers
Guatemala	Municipality	2018	246	6.7%	0.058	Census	Households w. Migrants
Mexico	Municipality	2010	725	4.5%	0.042	Census	Households w. Migrants
Dom. Republic	Province	2010	32	9.5%	0.21	Hhld Survey	Households w. Migrants

Notes: Total regions are the total unique regions at the level of merging. Statistics are calculated using the weights of the survey.

IV. Methods

The relationship between remittances and food insecurity is potentially endogenous: households experiencing higher food insecurity may be more likely to request or receive remittances,

creating reverse causality and omitted-variable bias. To address this, we instrument remittance receipt with a measure of migration intensity at the regional (municipal or provincial) level, interacted with the household wealth index.

The idea is that historical migration networks (captured by pre-pandemic migration rates from census or household surveys) influence the likelihood of receiving remittances through social and kinship ties abroad, but do not directly affect current food insecurity once wealth and locality characteristics are controlled for. The interaction with wealth allows us to exploit heterogeneity in households' capacity to connect with migration networks.

IV.1 Empirical Framework

The objective of this paper is to estimate the causal effect of remittances on the probability of experiencing food insecurity. Although the dependent variable is binary, we estimate a linear instrumental variables model (LPM–IV) using two-stage least squares (2SLS) implemented via the `ivreg2` command in Stata. This approach provides a straightforward interpretation of coefficients as marginal effects and allows for heteroskedasticity-robust inference.

The baseline specification can be expressed as:

$$FoodInsecure_i = \alpha + \beta\, Remittances_i + X_i'\gamma + \varepsilon_i, \tag{1}$$

where $FoodInsecure_i$ is a binary variable equal to 1 if the household reports moderate or severe food insecurity, and 0 otherwise. $Remittances_i$ is a dummy variable equal to 1 if the household received remittances during the survey period, and X_i is a vector of control variables including demographic characteristics (age, gender, marital status, education, urban location), economic indicators, and country fixed effects.

Because remittance receipt may be endogenous—households facing higher food insecurity might be more likely to request support from relatives abroad—ordinary least squares (OLS) estimates of β would be biased and inconsistent. To address this, we instrument $Remittances_i$ using a measure of *migration intensity* at the regional level, interacted with the household's wealth index. This instrument captures exogenous variation in the probability of receiving remittances arising from the strength of pre-existing migration networks and differential access to them across the wealth distribution.

The first-stage equation is specified as:

$$Remittances_i = \pi_0 + \pi_1(MigrationRate_r \times WealthIndex_i) + \pi_2 Z_i' + \upsilon_i, \tag{2}$$

where $MigrationRate_r$ denotes the pre-pandemic migration rate in region or province r, $WealthIndex_i$ is the household's PCA-based wealth index, and Z_i includes the same exogenous controls as in Equation above. The interaction term $(MigrationRate_r \times WealthIndex_i)$ serves as the excluded instrument for $Remittances_i$.

Identification of β relies on two conditions. First, the *relevance condition* requires that the instrument is strongly correlated with remittance receipt; empirically, this is verified through first-stage F-statistics and partial R^2. Second, the *exogeneity condition* assumes that the instrument affects food insecurity only through remittances, not directly or through omitted channels. Since migration rates are drawn from pre-pandemic census or administrative data and measured at an aggregate regional level, they are plausibly exogenous to contemporaneous household-level shocks.

The model is estimated using survey weights and robust standard errors clustered at the regional level to account for intra-regional correlation induced by the migration instrument. The estimated coefficient $\hat{\beta}$ represents the average partial effect of remittance receipt on the probability of being food insecure.

IV.2 Validity of the instrument

Relevance of the instrument. The instrument is composed of two variables: (i) the *regional migration intensity*, measured as the share of households with at least one member living abroad prior to the pandemic, and (ii) its interaction with the household's *wealth index*, constructed through principal component analysis (PCA) from household asset ownership. The first component captures the exogenous variation in remittance exposure arising from the density of migration networks within a region, while the interaction term accounts for heterogeneity in households' ability to access and maintain such transnational ties.

Both theory and empirical evidence support the relevance of these instruments. Migration networks increase the probability that households in the same area receive remittances, as they reduce information costs and facilitate informal transfer channels (Acosta et al., 2006; Adams & Cuecuecha, 2010; Mora-Rivera & Van Gameren, 2021). Wealthier households are more likely to have previously financed migration or to possess the means to sustain migrant connections, which explains the inclusion of the interaction term.

Figure 1 shows the positive association between migration intensity and remittance incidence across countries, confirming the empirical strength of the instrument. The scatter plots display an upward trend between regional migration intensity (y-axis) and remittance receipt at the household level (x-axis). The fitted lines, with 95% confidence intervals, indicate a statistically significant and positive correlation in all countries, particularly in the Philippines and LAC, where migration networks are more mature.

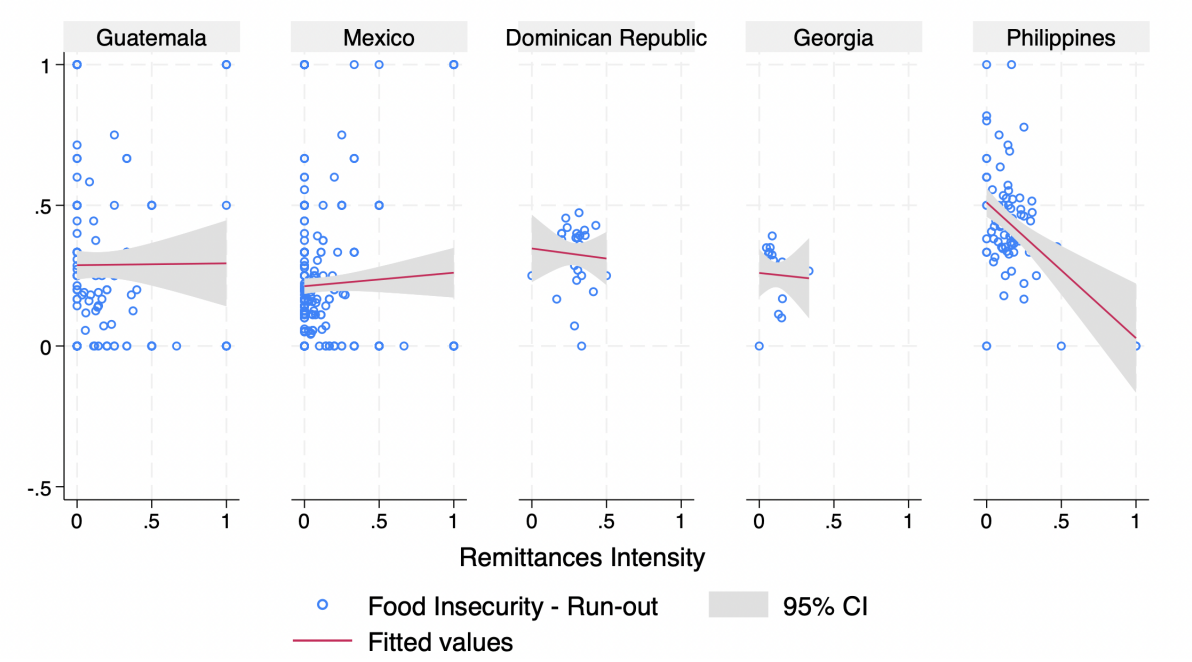
These graphical results are consistent with the first-stage estimates, where the coefficient on the interaction term ($MigrationRate_r \times WealthIndex_i$) is positive and highly significant ($p < 0.001$), and the F-statistics for excluded instruments exceed the conventional threshold of 10 in all models, confirming instrument relevance.

At the same time, the correlation Remittances and Food Insecurity seems to be less clear, as presented in Figure 2. For some countries, like the Philippines and the Dominican Republic, the relation seems negative. While for the rest, the relation seems spurious.

Exogeneity of the instrument. The exclusion restriction assumes that regional migration intensity affects household food insecurity only through remittance inflows. This assumption is supported by the fact that migration rates are derived from pre-pandemic census or administrative sources (see Table 3), and thus are not contemporaneously influenced by pandemic-related shocks or by households' current consumption or income dynamics. Moreover, because migration intensity is measured at an aggregate regional level—typically municipality or province—it captures structural migration networks rather than individual household decisions.

This temporal and spatial separation between the instrument and the dependent variable minimizes the risk of reverse causality. In line with prior studies using similar identification strategies (Adams & Cuecuecha, 2010; Mora-Rivera & Van Gameren, 2021), we therefore consider the instrument both theoretically sound and empirically strong.

Figure 2 – Remittances and Food Insecurity



V. Results

Summary statistics are reported in Table 1. Food insecurity varies widely across countries, ranging from 19% in Mexico to 39% in the Philippines. Remittance receipt also differs substantially across countries. Roughly one-third of households in the Dominican Republic report receiving remittances, compared to only 7–15% in Mexico, Guatemala, Georgia, and the Philippines. The share of households reporting a decline in remittance inflows during the pandemic is smaller—between 3% in Mexico and 14% in the Dominican Republic—indicating a relative resilience of remittance transfers, albeit with country-specific heterogeneity.

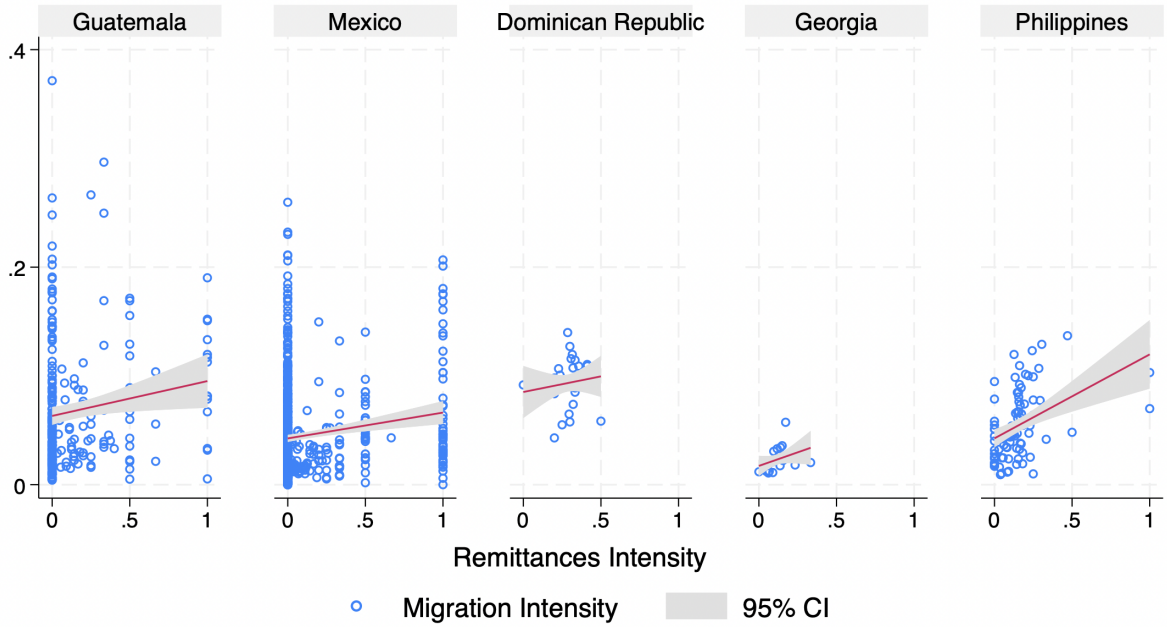
In terms of education, tertiary attainment is highest in Georgia and the Philippines (30–36%) and lowest in Guatemala (15%), while secondary education is widespread across all contexts. The demographic composition is balanced by gender, with women representing about half of respondents in every country. The average respondent is between 37 and 47 years old, lives predominantly in urban areas (59–81%), and typically reports one or more children living in the household.

Household finances reveal significant cross-country differences in perceived economic well-being. Around one-third of households in Mexico, Guatemala, and the Dominican Republic report facing “declines" in economics of the households, while Georgia (being the richest country in GDP per capita), reports the lowest.

VI. Regression Results

Regression results are presented in tables 4 to 8. The instrumental variable estimates confirm that remittances play a protective role against food insecurity, although the magnitude and statistical strength of the effect vary across countries. In the Philippines, the second-stage coefficient for remittance receipt is negative and highly significant (-1.40, $p < 0.01$), suggesting that households receiving remittances are substantially less likely to report run-

Figure 3 – Remittances and Migrant intensity: First Stage



ning out of food during the pandemic. A similar but less precisely estimated effect is found in Guatemala (-1.92, $p < 0.10$), where remittances also appear to mitigate food insecurity. In contrast, results for Georgia show no statistically significant relationship, reflecting weaker migration linkages and smaller remittance inflows in that context.

Across countries, the coefficient for *Remittances Lower* is generally positive (although not significant for several countries), indicating that households experiencing reductions in remittance income during the pandemic did exhibit systematically higher food insecurity once observable characteristics were controlled for, but this is context specific. Education and financial status emerge as consistent predictors of food security, with higher education and better self-reported financial conditions associated with lower probabilities of food deprivation. The combined evidence supports the hypothesis that remittances serve as a consumption-smoothing mechanism during economic crises, but that their impact depends on the depth of migration networks and the stability of inflows.

VII. Conclusion and Policy Recommendations

The findings underscore the dual role of remittances as both a private safety net and a source of structural vulnerability. Remittances reduce the likelihood of food insecurity, especially in countries with strong and mature migration corridors, such as the Philippines and Guatemala. However, this protective function weakens when external shocks disrupt remittance flows, as seen during the COVID-19 pandemic.

Beyond these empirical insights, the study highlights how modern phone surveys—when complemented with census and administrative data—can serve as powerful instruments for monitoring household welfare in real time. The integration of multiple data systems allows researchers to identify causal mechanisms with greater precision and to inform policy more rapidly in periods of crisis. Such approaches represent a step toward more adaptive, data-driven policymaking in low- and middle-income countries.

Policymakers should therefore avoid treating remittances as a substitute for public safety

nets. Instead, they should integrate migrant remittances into broader strategies for household resilience—by facilitating lower transfer costs, promoting financial inclusion among remittance-receiving families, and supporting savings and insurance instruments that stabilize consumption during crises. Moreover, strengthening labor market opportunities at home and formalizing remittance channels could further enhance the developmental impact of these transfers. In parallel, policies that advance technological change and promote the creation of quality jobs in sectors linked to digitalization and artificial intelligence can foster more sustainable sources of income and reduce dependence on external transfers. Finally, continuing to invest in harmonized, high-frequency survey systems like the HFPS—and in their linkage with traditional data sources—will be essential for improving the timeliness, comparability, and policy relevance of evidence on poverty, food security, and household well-being.

Table 4 – Mexico: IV regression (first stage)- Determinants of *Remittances Lower (=1)*

	Coefficient	Std. Error
Migration intensity (*migrate*)	0.365^{***}	0.115
Wealth index (*pc*1_*wealth_index*)	-0.005	0.004
migrate× wealth index	0.144^{**}	0.071
Education (ref.= Primary)		
Secondary	-0.020^{**}	0.009
Tertiary	-0.031^{***}	0.010
Age (years)	-0.00025	0.00023
Woman (=1)	0.0079	0.0069
Urban area (=1)	-0.022^{**}	0.0090
Children in household	-0.0095	0.0071
Financial status (ref.= Worse)		
Better	-0.033^{**}	0.016
Same	-0.030^{***}	0.011
Lower	-0.0048	0.010
Ran out of food before (=1)	0.0207^{+}	0.011
Constant	0.0796^{***}	0.019
t statistics and 95% CIs (from software output):	available upon request	

Notes: Dependent variable is an indicator for reporting *lower remittances* during the pandemic. Coefficients reported with robust standard errors. Significance: $^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$. The coefficient values are taken from the shared regression output: *migrate* = 0.3655 ($p = 0.002$), *pc*1_*wealth_index* = -0.0054 ($p = 0.162$), *migrate*×*wealth* = 0.1439 ($p = 0.042$), Secondary = -0.0203 ($p = 0.024$), Tertiary = -0.0307 ($p = 0.003$), Age = -0.00025 ($p = 0.274$), Woman = 0.0079 ($p = 0.251$), Urban = -0.0219 ($p = 0.015$), Children = -0.0095 ($p = 0.176$), Financial (Better) = -0.0335 ($p = 0.038$), Financial (Same) = -0.0296 ($p = 0.005$), Financial (Lower) = -0.0048 ($p = 0.637$), Ran out before = 0.0207 ($p = 0.067$), Constant = 0.0796 ($p < 0.001$).

Table 5 – IV regression (second stage): Effect of Remittances on Food Insecurity

	Coefficient	Std. Error
Receives Remittances (=1)	-0.584^{***}	0.116
Food Insecure before pandemic (=1)	0.328^{***}	0.012
Age (years)	-0.0003	0.0003
Non-married woman (=1)	0.068^{***}	0.011
Married man (=1)	-0.017	0.011
Married woman (=1)	0.041^{***}	0.011
Urban area (=1)	-0.013	0.009
Education: Up to Secondary (=1)	-0.018	0.010
Education: Tertiary (=1)	-0.070^{***}	0.012
Wealth index	-0.065^{***}	0.003
Constant	—	—
Observations	13,051	
Instrument diagnostics:		
F-statistic (excluded instruments)	169.3	
Weak ID test (Stock–Yogo)	Not weak	
Weak-instrument robust inference (Wald)	$\chi^2(1)$=29.24, $p = 0.000$	

Notes: Dependent variable is an indicator for *Food Insecure (=1)*. Coefficients are estimated using two-stage least squares (2SLS) via `ivreg2`. The endogenous regressor is the binary variable *Receives Remittances*. The instrument is the interaction of regional migration intensity with the household wealth index. All models include country fixed effects and survey weights. Robust standard errors are reported. Significance levels: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table 6 – IV regression (second stage) – Guatemala: Effect of Remittances on Food Insecurity

	Coefficient	Std. Error
Receives Remittances (=1) (*rem*)	-1.915^{+}	1.017
Remittances Lower (=1) (*rem_lower*)	1.398	1.512
Education (ref.= Primary)		
Secondary	-0.106^{**}	0.039
Tertiary	-0.188^{**}	0.060
Age (years)	−0.00062	0.0012
Woman (=1)	0.071^{**}	0.036
Urban area (=1)	−0.058	0.042
Children in household	0.012	0.037
Financial status (ref.= Worse)		
Better	0.026	0.124
Same	−0.005	0.083
Lower	0.080	0.054
Ran out of food before (=1)	0.372^{***}	0.053
Constant	0.346^{***}	0.086
Observations	1,175	
F-statistic (12, 1162)	9.28	
Centered R^2	−0.924	
Root MSE	0.578	

Notes: Dependent variable is an indicator for *Ran out of food (=1)*. Coefficients estimated using two-stage least squares (2SLS) with robust standard errors. Endogenous variables: *Receives Remittances* and *Remittances Lower*. Significance levels: $^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$. The coefficient on remittances (-1.915, $p = 0.060$) suggests that receiving remittances substantially reduces the probability of food insecurity, though the effect is only marginally significant.

Table 7 – IV regression (second stage) – Philippines: Effect of Remittances on Food Insecurity

	Coefficient	Std. Error
Receives Remittances (=1) (*rem*)	-1.397^{***}	0.286
Remittances Lower (=1) (*rem_lower*)	0.489	0.701
Education (ref.= Primary)		
Secondary	0.021	0.037
Tertiary	−0.056	0.038
Age (years)	−0.00012	0.00081
Woman (=1)	-0.026^{+}	0.015
Urban area (=1)	0.0016	0.017
Children in household	0.086^{***}	0.020
Financial status (ref.= Best)		
Same	-0.247^{***}	0.043
Lower	-0.363^{***}	0.071
Worst	-0.408^{***}	0.087
Constant	0.655^{***}	0.063
Observations	7,941	
F-statistic (11, 7929)	120.04	
Centered R^2	−0.493	
Root MSE	0.595	
Underidentification test (Anderson LM)	$\chi^2(2) = 8.53$, $p = 0.014$	

Notes: Dependent variable is an indicator for *Ran out of food (=1)*. Coefficients are estimated using two-stage least squares (2SLS) with robust standard errors. Endogenous regressors: *Receives Remittances* and *Remittances Lower*. Significance levels: $^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$. The coefficient on *Receives Remittances* (-1.397, $p < 0.001$) indicates that remittance-receiving households are significantly less likely to experience food insecurity, consistent with the protective role of international transfers. Instrument relevance confirmed by the Anderson canonical correlation LM test ($p = 0.014$).

Table 8 – IV regression (second stage) – Georgia: Effect of Remittances on Food Insecurity

	Coefficient	Std. Error
Receives Remittances (=1) (*rem*)	−6.508	7.512
Remittances Lower (=1) (*rem_lower*)	6.910	9.835
Education (ref.= Primary)		
Secondary	0.125	0.363
Tertiary	0.119	0.379
Age (years)	−0.00024	0.0026
Woman (=1)	0.073	0.131
Urban area (=1)	0.017	0.087
Children in household	0.034	0.070
Financial status (ref.= Best)		
Same	0.073	0.405
Lower	−0.088	0.644
Worst	0.226	0.711
Constant	0.307	0.571
Observations	1,938	
F-statistic (11, 1926)	4.34	
Centered R^2	−10.15	
Root MSE	1.422	
Underidentification test (Anderson LM)	$\chi^2(2) = 0.675$, $p = 0.713$	

Notes: Dependent variable is an indicator for *Ran out of food (=1)*. Estimates obtained using two-stage least squares (2SLS) with robust standard errors. Endogenous regressors: *Receives Remittances* and *Remittances Lower*. No statistically significant effects are observed; both remittance variables are imprecisely estimated, with large standard errors. The underidentification test (Anderson canonical correlation LM) yields $p = 0.713$, suggesting weak instruments in the Georgia subsample.

Significance levels: $^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

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