

## Remittances as a Private Safety Net: Evidence on Household Food Insecurity in Pakistan

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### ABSTRACT

This study examines how different types of remittances relate to household food insecurity and whether these effects vary across regions. Using nationally representative data from the PSLM 2019-2020 survey of 160,654 households, food insecurity is measured through the FIES, and households are classified as non-receiving, internal remittance recipients, external remittance recipients, or dual recipients. A logistic regression framework is applied, along with marginal effects and provincial heterogeneity analysis. The results show that remittance-receiving households are significantly less likely to experience food insecurity, with the strongest reductions associated with external and dual remittances, while internal remittances provide a smaller but still meaningful protective effect. The impact, however, is not uniform across provinces, reflecting differences in migration patterns and local conditions. These findings highlight the important role of remittances as a private safety net, while also emphasizing the need for complementary policies to address structural food security challenges.

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### INTRODUCTION

Food insecurity continues to be a major global challenge, affecting millions of households across developing and developed countries. It arises when families do not have reliable access to sufficient, safe, and nutritious food, often due to poverty, rising prices, unstable incomes, conflict, climate shocks, and weak social protection systems. When households cannot secure adequate food, the consequences extend beyond hunger. Food insecurity undermines health, reduces productivity, affects children's growth and learning, and deepens social and economic vulnerability over time (Malek et al., 2025). Recent research highlights that household resilience, access to resources, and broader institutional conditions play a critical role in shaping food security outcomes worldwide (Szabo et al., 2022).

Recent data clearly show why this relationship matters for Pakistan. According to PSLM 2019–20, about 16.44 percent of households experience moderate or severe food insecurity, while 1.80 percent face severe food insecurity nationally. Provincial figures reveal strong disparities: Punjab records 15.66 percent moderate or severe food insecurity, Sindh 17.52 percent, Khyber Pakhtunkhwa 14.44 percent, and Balochistan the highest at 23.36 percent, with severe food insecurity alone reaching 3.55 percent in Balochistan. During the same period, Pakistan has witnessed a sharp rise in remittance inflows. World Bank statistics show that remittances have grown significantly over the past two decades, increasing from relatively low levels in the early 2000s to over USD 30 billion in recent years, placing Pakistan among the world's leading remittance-receiving economies. These parallel trends raise an important policy question: do rising remittances help mitigate household food insecurity, and does their impact differ across regions and remittance types? Understanding this connection is essential for designing effective food security and social protection strategies in Pakistan.

Recent work shows that the link between remittances and food insecurity is context-specific rather than uniformly positive. At the macro level, evidence from Pakistan suggests that remittances do not automatically improve food outcomes. Habib and Didar (2025) report that rising remittance inflows coincide with higher food insecurity when corruption and weak institutions persist. Their ARDL results indicate that weak governance blocks the translation of remittance income into better food availability and access. Crisis-oriented studies add further nuance. In rural Bangladesh, Malek et al. (2025) find that remittances helped households maintain food expenditure and avoid sharp cuts in consumption during Covid-19. At the same time, remittance recipients were more likely to engage in panic buying, which points to greater liquidity but also to unequal purchasing power in periods of stress (Malek et al., 2025). Evidence from Kenya's Kakuma refugee camp shows a more modest effect. Kinyanjui (2025) finds that employment,

farm work and formal finance lower multidimensional vulnerability, including food insecurity, while remittances from abroad reduce vulnerability only slightly because camp rules, rationing and thin markets limit their impact.

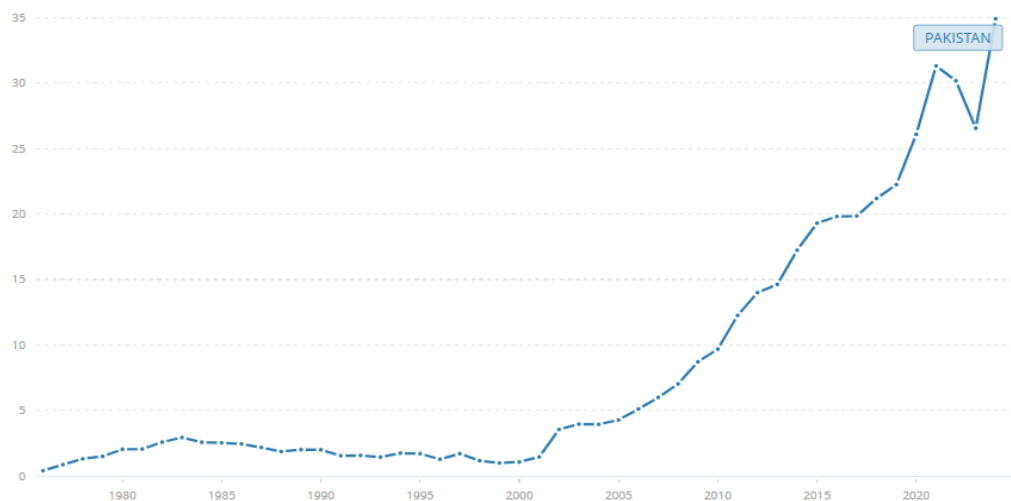


Figure 1: Dynamic pattern of external remittances; Source: World Bank (2025)

Migration-related income appears more protective in rural South Africa. The Human Ecology study shows that households with migrant labour income experienced better food security between 2019 and 2021, supported by natural resource use and own production, whereas heavy dependence on grants alone was linked with greater vulnerability (Cau & Agadjanian, 2023). Eyal and Njozela (2025) add that returning migrants reshaped household structures and, together with grants, helped many households avoid extreme hunger. Beyond emergency contexts, studies on Bangladesh and global samples highlight structural channels. Alam et al. (2025) show that remittances improve a composite index of calories, dietary diversity, and food spending and buffer income and climate shocks. Szabo et al. (2022) also find that remittance recipients are more likely to be food secure, though female-headed and poorer households remain disadvantaged. Using multi-country data, Smith and Floro (2021) show that both domestic and international remittances reduce food insecurity, with stronger effects for international transfers.

Pakistan-specific micro studies provide complementary insights. Anwar et al. (2024) show that households relying on negative coping strategies are more food insecure, and situate remittances within informal support networks. Shair et al. (2023) find that safety net beneficiaries are often food insecure because programmes target vulnerable groups, while larger benefits modestly reduce mild food insecurity. Shair et al. (2024) report higher food-insecurity risk among migrant headed households when migration is not accompanied by stable income. Related migration research shows that remittance effects are mediated by gender, agricultural investment, and institutions. Raj et al. (2025) document that in India, regular remittances can ease women's workloads, but irregular flows deepen livelihood stress. Obi et al. (2021) show that remittances in Ghana support the adoption of sustainable agricultural practices and thus indirectly strengthen food security. Historical work by Wells et al. (2021) illustrates that migrant workers have long faced poor nutrition and food shortages, underlining the role of institutional settings in shaping outcomes.

Although evidence shows that remittances can influence food security, key gaps remain. Macro studies do not capture household heterogeneity or how governance shapes outcomes (Habib & Didar, 2025). Crisis research shows both protection and inequality effects but lacks long-term insight (Malek et al., 2025). Refugee and constrained settings show only modest benefits without analysing remittance stability (Kinyanjui, 2025). Many studies also fail to distinguish internal, external, and combined remittances, despite evidence that international flows are stronger (Smith & Floro, 2021). Pakistan-focused work rarely quantifies these differences, highlighting the need for micro-level analysis of remittance types and food insecurity (Shair et al., 2023; Shair et al., 2024).

The objective of this study is to examine how different types of remittances relate to household food insecurity instead of treating remittances as a single, uniform phenomenon. Much of the existing literature focuses on total remittance inflows and overlooks important differences in the nature, stability, and potential welfare effects of various remittance sources. To address this gap, the study specifically compares four household categories: non-receiving households, households receiving internal remittances, households receiving external remittances, and households receiving both internal and external remittances. The study also considers provincial heterogeneity, recognising that

regional contexts may shape these relationships. This approach provides more meaningful evidence to guide welfare planning, food security strategies, and policy design.

## METHODOLOGY

### Data Source

This study draws on data from the Pakistan Social and Living Standards Measurement (PSLM) Survey 2019–2020, carried out by the Pakistan Bureau of Statistics. The PSLM is nationally representative and provides rich information on household characteristics, income sources, living standards, and food security indicators. For this analysis, a total of 160,654 households are included. Among them, 8,384 households receive external (international) remittances, 13,248 households receive internal (domestic) remittances, 618 households receive both internal and external remittances, while 138,404 households do not receive any remittances. These categories help capture meaningful variation in remittance flows and allow a clearer understanding of how different remittance types relate to household food insecurity.

### Key Outcome Variable

Household food insecurity is measured using the Food Insecurity Experience Scale (FIES) included in the PSLM 2019–2020 survey. The FIES consists of eight standard questions that capture households' lived experiences with food access during the past 12 months, ranging from worry about running out of food to situations of hunger and going without food for an entire day. Based on responses, households are classified into four categories: food secure, mildly food insecure, moderately food insecure, and severely food insecure. For empirical analysis, these are grouped into a binary outcome, where households facing moderate or severe food insecurity are coded as food insecure (1), while food secure and mildly food insecure households are coded as 0.

### Main Explanatory Variable: Remittance Type

The key explanatory variable in this study is remittance type. To capture meaningful variation in remittance flows, households are divided into four mutually exclusive categories: non-receiving households, households receiving internal (domestic) remittances, households receiving external (international) remittances, and households receiving both internal and external remittances. This classification helps distinguish differences in the nature and potential welfare effects of each remittance source. For empirical analysis, the non-receiving households serve as the reference category against which the effects of the other remittance groups are compared.

### Control Variables

To ensure a meaningful assessment of the relationship between remittances and food insecurity, the analysis controls for key socioeconomic and demographic characteristics. Provincial location is included as a categorical variable to capture regional differences, along with an indicator for urban and rural residence. Household size is controlled for, as larger households may face greater consumption pressure. Characteristics of the household head are also considered, including gender, age, and marital status (never married, formerly married, and currently married). These controls help account for variation in household structure, resources, and living conditions that may influence food security outcomes. Table 1 provides detail description of the outcome and key explanatory and control variables.

Table 1: Variable Definitions

| Variable                                           | Description                                                                                                                                                                                                                                          |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Food insecure                                      | Binary variable equal to 1 if the household experiences any level of food insecurity, and 0 otherwise                                                                                                                                                |
| Remittance Type (multinomial categorical variable) | A categorical variable identifying the source of household remittances with four mutually exclusive categories: (i) External remittances, (ii) Internal remittances, (iii) Both internal and external remittances, and (iv) Non-receiving households |
| External remittances                               | Category = 1 if the household receives remittances from abroad                                                                                                                                                                                       |
| Internal remittances                               | Category = 2 if household receives remittances within Pakistan                                                                                                                                                                                       |
| Both sources                                       | Category = 3 if household receives both internal and external remittances                                                                                                                                                                            |
| Non-receiving households                           | Reference category where the household receives no remittances                                                                                                                                                                                       |
| Province (multinomial categorical variable)        | Provincial location of the household coded as: 1 = KP, 2 = Punjab, 3 = Sindh, 4 = Balochistan                                                                                                                                                        |
| Urban                                              | Binary variable equal to 1 if the household is located in an urban area; 0 otherwise                                                                                                                                                                 |
| Household size                                     | Continuous variable representing the total number of household members                                                                                                                                                                               |

|                                                         |                                                                                                                                                               |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Female                                                  | Binary variable equal to 1 if the household head is female; 0 otherwise                                                                                       |
| Age of household head                                   | Continuous variable representing the age of the household head in completed years                                                                             |
| Marital Status<br>(multinomial<br>categorical variable) | Categorical classification of household head's marital status: (i) Never married, (ii) Formerly married (widowed/divorced/separated), (iii) Currently married |
| Never married                                           | Equals 1 if household head has never married                                                                                                                  |
| Formerly married                                        | Equals 1 if household head is widowed, separated, or divorced                                                                                                 |
| Currently married                                       | Equals 1 if household head is married                                                                                                                         |

### Empirical Strategy

To examine how different types of remittances relate to household food insecurity, the study adopts an econometric approach suited to the nature of the dependent variable. Since the outcome is binary (food insecure = 1, otherwise = 0), a logistic regression model is used to estimate the probability that a household experiences food insecurity conditional on remittance status and other characteristics. This approach allows the analysis to capture how the likelihood of food insecurity changes across households receiving internal remittances, external remittances, both types, and those receiving none, while accounting for relevant controls.

The general specification can be expressed as:

$$FoodInsecurity_i = f(\text{Remittance Type}_i, \text{Socioeconomic Controls}_i)$$

where the key variables of interest are remittance categories, with non-receiving households serving as the reference group. The model also includes socioeconomic and demographic controls to reduce omitted variable bias. Provincial dummies capture regional heterogeneity, while urban–rural residence helps distinguish structural differences in livelihoods and access to markets. Household-level characteristics, including household size, gender and age of the household head, and marital status, account for differences in demographic composition and vulnerability profiles.

Using this strategy allows the study to estimate marginal effects that indicate how the predicted probability of food insecurity changes with remittance type. This helps move beyond simple descriptive comparisons and provides a more rigorous and policy-relevant understanding of how internal, external, and dual remittances are associated with household food security outcomes.

Let  $FI_i$  denote the binary food insecurity outcome for household  $i$ , where

$$FI_i = \begin{cases} 1 & \text{if household } i \text{ is moderately or severely food insecure,} \\ 0 & \text{otherwise.} \end{cases}$$

We assume an underlying latent variable representation:

$$FI_i^* = \beta_0 + \beta_1 \text{External}_i + \beta_2 \text{Internal}_i + \beta_3 \text{Both}_i + \gamma' X_i + \varepsilon_i,$$

Where:

$\text{External}_i = 1$  if household  $i$  receives external remittances and 0 otherwise,

$\text{Internal}_i = 1$  if household  $i$  receives internal remittances and 0 otherwise,

$\text{Both}_i = 1$  if household  $i$  receives both internal and external remittances and 0 otherwise,

so that non-receiving households are captured by the omitted category.

$X_i$  is a vector of control variables (province dummies, urban indicator, household size, gender and age of the household head, and marital status), and  $\varepsilon_i$  is the error term.

The observed binary outcome is then:

$$FI_i = \begin{cases} 1 & \text{if } FI_i^* > 0, \\ 0 & \text{if } FI_i^* \leq 0. \end{cases}$$

For the logit specification, the conditional probability of food insecurity is:

$$P(FI_i = 1 \mid \text{External}_i, \text{Internal}_i, \text{Both}_i, X_i) = \Lambda(\beta_0 + \beta_1 \text{External}_i + \beta_2 \text{Internal}_i + \beta_3 \text{Both}_i + \gamma' X_i),$$

where  $\Lambda(\cdot)$  is the logistic cumulative distribution function:

$$\Lambda(z) = \frac{e^z}{1 + e^z}$$

## RESULTS AND DISCUSSION

### Descriptive Analysis

Table 2 presents the descriptive statistics for the main variables used in the analysis. The results indicate that approximately 82 percent of households are food secure, while around 18 percent are classified as food insecure, highlighting that food insecurity remains a significant concern for a sizeable proportion of households.

Regarding remittance status, a large majority of households (86.2 percent) do not receive any remittances. Among remittance-receiving households, 8.2 percent receive internal remittances, 5.2 percent receive external remittances, and a very small share (0.4 percent) report receiving both internal and external remittances. This distribution suggests that while remittances are an important livelihood source for some families, they are not widespread across the entire population, and most households rely on other income sources.

The provincial distribution (mean value 2.24 on a 1-4 scale) reflects a reasonably balanced representation of households across provinces. The regional breakdown shows that nearly 69 percent of households reside in rural areas, whereas 31 percent live in urban areas, indicating that the dataset is more rural-oriented, consistent with Pakistan's demographic structure.

Household characteristics show that the average household size is about 5.4 members, with considerable variation across households, as reflected by the relatively high standard deviation. This suggests potential differences in consumption needs and vulnerability levels across households of different sizes. The average age of the household head is 44 years, implying that most household heads are in their productive working age.

In terms of gender composition, households are predominantly headed by males (91.5 percent), while 8.5 percent are headed by females. This reflects broader demographic patterns but also suggests a need to consider gender-related vulnerabilities, as female-headed households are often more exposed to economic and food-related risks.

Finally, most household heads are currently married (91.4 percent), with a smaller proportion formerly married (6.7 percent) and very few never married (1.9 percent). Marital status may influence household responsibilities, economic stability, and support networks, which can in turn affect food security outcomes.

Overall, these descriptive statistics provide a clear picture of household characteristics, remittance patterns, and food insecurity prevalence, setting the foundation for the subsequent econometric analysis.

Table 2: Descriptive statistics, whole sample (N=160,654)

| Variable                      | Mean   | Std. Dev. | Min | Max |
|-------------------------------|--------|-----------|-----|-----|
| Food Insecurity Status        |        |           |     |     |
| Food secure                   | 0.824  | 0.381     | 0   | 1   |
| Food insecure                 | 0.176  | 0.381     | 0   | 1   |
| Receipt Type                  |        |           |     |     |
| External remittances          | 0.052  | 0.222     | 0   | 1   |
| Internal remittances          | 0.082  | 0.275     | 0   | 1   |
| Both sources                  | 0.004  | 0.062     | 0   | 1   |
| Non-receiving households      | 0.862  | 0.345     | 0   | 1   |
| Province (1-4)                | 2.242  | 0.854     | 1   | 4   |
| Region                        |        |           |     |     |
| Rural                         | 0.689  | 0.463     | 0   | 1   |
| Urban                         | 0.311  | 0.463     | 0   | 1   |
| Household Size                | 5.416  | 2.602     | 1   | 42  |
| Gender of Household Head      |        |           |     |     |
| Male                          | 0.915  | 0.278     | 0   | 1   |
| Female                        | 0.085  | 0.278     | 0   | 1   |
| Age of Household Head (years) | 44.254 | 13.444    | 14  | 99  |

|                   |       |       |   |   |
|-------------------|-------|-------|---|---|
| Marital Status    |       |       |   |   |
| Never married     | 0.019 | 0.137 | 0 | 1 |
| Formerly married  | 0.067 | 0.250 | 0 | 1 |
| Currently married | 0.914 | 0.281 | 0 | 1 |

Table 3 describes how household characteristics differ across the four remittance groups, and several clear patterns emerge. First, food insecurity varies strongly by remittance status. Households receiving external remittances are the most secure, with about 94 percent food secure and only 6 percent food insecure. Dual-remittance households show a very similar pattern. Internal-remittance households also have a higher share of food secure households (84.4 percent) than non-receiving households, but food insecurity among them (15.6 percent) remains noticeably higher than in the external and dual groups. Non-receiving households are the most vulnerable, with nearly 18.5 percent classified as food insecure. This simple comparison already suggests a gradient where external and dual remittance flows are associated with better food security than internal remittances and, especially, no remittances.

The distribution across provinces also differs by remittance type. External and dual remittance households have lower average province codes (around 1.6 and 1.5), which suggests they are more concentrated in specific provinces, likely those with stronger migration traditions. Non-receiving households have a higher average province code (2.32), pointing to a relatively greater presence in regions where international migration may be less common.

Regionally, all remittance recipients are more likely to live in rural areas than urban ones, particularly the dual-remittance group, where 88 percent of households are rural. This indicates that both internal and external remittances play an important role in rural livelihoods. At the same time, non-receiving households are comparatively more urban (32.9 percent urban), which may reflect different employment opportunities and migration strategies.

Household size tends to be larger among remittance-receiving households, especially those with dual remittances, whose average size exceeds seven members, compared with about 5.4 among non-receiving households. Larger families may have both higher needs and stronger incentives to send migrants.

There are also notable gender differences. A striking feature is that female-headed households are far more common among remittance recipients, especially external remittance households, where 42 percent of households are headed by women, compared with only 3.4 percent among non-receivers. This pattern is consistent with male migration and women remaining as de facto heads at origin.

Finally, remittance-receiving households tend to have older heads on average, and a higher share of formerly married heads, again suggesting that households with more complex life cycles and migration histories are more likely to depend on these income flows. Overall, the table indicates that remittance type is closely intertwined with household structure, location, and demographic characteristics, which supports the need for multivariate analysis.

Table 3: Descriptive Statistics by Remittance Status (Mean Values)

| Variable                 | External<br>(N=8,384) | Internal<br>(N=13,248) | Both<br>(N=618) | Non-receiving<br>(N=138,404) |
|--------------------------|-----------------------|------------------------|-----------------|------------------------------|
| Food Insecurity Status   |                       |                        |                 |                              |
| Food secure              | 0.936                 | 0.844                  | 0.940           | 0.815                        |
| Food insecure            | 0.064                 | 0.156                  | 0.060           | 0.185                        |
| Region                   |                       |                        |                 |                              |
| Rural                    | 0.781                 | 0.809                  | 0.880           | 0.671                        |
| Urban                    | 0.219                 | 0.191                  | 0.120           | 0.329                        |
| Household Size           | 5.944                 | 5.290                  | 7.251           | 5.388                        |
| Gender of Household Head |                       |                        |                 |                              |
| Male                     | 0.580                 | 0.613                  | 0.696           | 0.966                        |
| Female                   | 0.420                 | 0.387                  | 0.304           | 0.034                        |

|                               |        |        |        |        |
|-------------------------------|--------|--------|--------|--------|
| Age of Household Head (years) | 48.397 | 47.355 | 55.706 | 43.655 |
| Marital Status                |        |        |        |        |
| Never married                 | 0.029  | 0.021  | 0.023  | 0.018  |
| Formerly married              | 0.100  | 0.126  | 0.128  | 0.059  |
| Currently married             | 0.870  | 0.852  | 0.850  | 0.923  |

### Cross-tabulation

Table 4 presents the distribution of food insecurity across the four remittance categories. The patterns are very clear. Households receiving external remittances show the lowest incidence of food insecurity: about 93.6 percent of these households are food secure, while only 6.4 percent are food insecure. Households receiving both external and internal remittances display a very similar profile, with 94.0 percent food secure and 6.0 percent food insecure. These two groups appear to be in the most favourable position in terms of food security.

For households receiving internal remittances only, food security is still relatively high but clearly weaker compared with external and dual recipients. Around 84.4 percent of internal-remittance households are food secure, whereas 15.6 percent are food insecure. This suggests that internal remittances are associated with better food security than no remittances, but their protective effect appears smaller than that of external or combined remittances.

The most vulnerable group in this cross-tabulation is non-receiving households. Among them, only 81.5 percent are food secure, while 18.5 percent are food insecure. Given that this group is also by far the largest in the sample (138,404 out of 160,654 households), it accounts for the majority of food-insecure households in absolute numbers.

The Pearson chi-square statistic of 897.95 with a p-value of 0.000 indicates that the differences in food insecurity across remittance categories are statistically significant. In other words, food security status is not randomly distributed across the four groups; it is systematically related to remittance receipt status. While this cross-tabulation is descriptive and does not prove causality, it provides strong initial evidence that households connected to external and dual remittance flows are less likely to be food insecure than internal-remittance and especially non-receiving households. This motivates the use of multivariate models to examine whether these associations persist after controlling for other household and regional characteristics.

Table 4: Food Insecurity by Remittance Receipt Status

| Receipt Type             | Food Secure (n) | Food Secure (%) | Food Insecure (n) | Food Insecure (%) | Total   |
|--------------------------|-----------------|-----------------|-------------------|-------------------|---------|
| External remittances     | 7,846           | 93.58           | 538               | 6.42              | 8,384   |
| Internal remittances     | 11,183          | 84.41           | 2,065             | 15.59             | 13,248  |
| Both external & internal | 581             | 94.01           | 37                | 5.99              | 618     |
| Non-receiving households | 112,775         | 81.48           | 25,629            | 18.52             | 138,404 |
| Total                    | 132,385         | 82.40           | 28,269            | 17.60             | 160,654 |

Pearson chi-square (3) = 897.95, p-value = 0.000

### Regression Results

#### Baseline regression model

The stepwise modelling helps show how the link between remittance type and food insecurity holds up as more controls are added. Model 1 includes only remittance type. Model 2 adds provincial and urban-rural controls. Model 3 further adds household size. Model 4 adds full demographic controls for the household head. Model 5 reports the corresponding marginal effects (MFX) from Model 4, which translate the log-odds into changes in probability and make the results easier to interpret.

All remittance categories are compared with non-receiving households (the base group). The coefficients are in log-odds of being food insecure. In Model 4, the coefficient on external remittances is -1.103 ( $p < 0.01$ ). This means that, before converting to probabilities, the log-odds of being food insecure are 1.103 units lower for external-remittance households than for non-receiving households, holding other variables constant. In odds terms, this corresponds to

about a 67-70 percent reduction in the odds of food insecurity ( $\exp(-1.103) \approx 0.33$ ). Model 5 shows that this translates into about a 10.5 percentage-point lower probability of food insecurity ( $-0.1046$ ).

For internal remittances, the coefficient is  $-0.171$  ( $p < 0.01$ ) in Model 4. This is smaller in absolute value than for external remittances. It implies that the log-odds of food insecurity are 0.171 units lower than for non-receiving households. In odds terms, internal remittances reduce the odds of food insecurity by roughly 16-18 percent ( $\exp(-0.171) \approx 0.84$ ). The marginal effect of  $-0.0221$  indicates a reduction of about 2.2 percentage points in the probability of food insecurity relative to non-receivers.

Households receiving both external and internal remittances also show a large negative coefficient:  $-1.141$  in Model 4 ( $p < 0.01$ ). This is very similar in size to the external-only group, indicating sharply lower log-odds of food insecurity than non-receivers. The marginal effect is again about  $-0.1045$ , implying a reduction of roughly 10-11 percentage points in the probability of food insecurity.

Taken together, the four models show a stable pattern: after controlling for province, region, household size, and head characteristics, remittances are associated with substantially lower odds of food insecurity. The effect is strongest for external and dual remittances, and more modest for internal remittances, which fits the descriptive patterns.

Figure 2 visually summarizes how the coefficients on remittance types behave across the four model specifications. The vertical zero line represents no effect. All coefficients lie clearly to the left of this line, indicating that external, internal, and dual remittances are consistently associated with lower odds of food insecurity in every specification. This means that regardless of whether basic controls or full demographic controls are included, the direction of the relationship remains the same.

The plot also shows differences in magnitude. External remittances and dual remittances have large negative coefficients across all models, suggesting a strong protective association with food security. Although confidence intervals narrow slightly as controls are added, their position remains stable, reinforcing the robustness of the estimates. Internal remittances also show a negative effect, but the coefficients are noticeably closer to zero, reflecting a weaker association compared with external and dual remittances. Overall, the graphical evidence supports the regression findings: remittance-receiving households, especially those connected to external or dual remittance flows, face substantially lower risks of food insecurity than non-receiving households, and these relationships remain stable across the different model specifications.

The results clearly show that households receiving remittances are less likely to experience food insecurity than those that do not receive any transfers. External remittances have the strongest association, reducing the probability of food insecurity by about 10.5 percentage points, while internal remittances still provide protection but to a smaller extent, lowering the risk by around 2.2 percentage points. This suggests that external remittances, which are generally larger, more regular, and often linked to better-paid employment abroad, provide stronger income security and a more reliable buffer against food shortages compared with domestic transfers.

Households that receive both external and internal remittances also experience a probability reduction almost identical to external remittance households, at around 10.4 percentage points. The difference between these two groups is statistically insignificant, indicating that the additional internal transfer does not substantially add to the food security gains already achieved through external remittances. In practical terms, both external and dual remittance households enjoy similar levels of protection, while internal remittance households benefit, but to a noticeably smaller degree. These patterns reinforce the idea that the source, size, and stability of remittances matter for household food security outcomes.

Table 5: Estimates of logit regression model in log odds ratio

| Variables            | Model 1              | Model 2              | Model 3              | Model 4              | Model 5<br>MFX         |
|----------------------|----------------------|----------------------|----------------------|----------------------|------------------------|
| Remittances:         |                      |                      |                      |                      |                        |
| Non-receiving (base) |                      |                      |                      |                      |                        |
| External             | -1.198***<br>(0.045) | -1.099***<br>(0.046) | -1.099***<br>(0.046) | -1.103***<br>(0.047) | -0.1046***<br>(0.0046) |
| Internal             | -0.208***<br>(0.025) | -0.157***<br>(0.025) | -0.159***<br>(0.025) | -0.171***<br>(0.028) | -0.0221***<br>(0.0038) |
| Both                 | -1.272***            | -1.198***            | -1.190***            | -1.141***            | -0.1045***             |

|                   | (0.170)   | (0.170)   | (0.170)   | (0.171)   | (0.0153)   |
|-------------------|-----------|-----------|-----------|-----------|------------|
| Punjab            |           | 0.114***  | 0.107***  | 0.108***  | 0.0155***  |
|                   |           | (0.020)   | (0.020)   | (0.020)   | (0.0027)   |
| Sindh             |           | 0.430***  | 0.420***  | 0.399***  | 0.0592***  |
|                   |           | (0.022)   | (0.023)   | (0.023)   | (0.0032)   |
| Balochistan       |           | 0.412***  | 0.407***  | 0.396***  | 0.0607***  |
|                   |           | (0.026)   | (0.026)   | (0.026)   | (0.0039)   |
| Urban             |           | -0.402*** | -0.403*** | -0.388*** | -0.0543*** |
|                   |           | (0.015)   | (0.015)   | (0.016)   | (0.0021)   |
| Household size    |           |           | -0.007**  | 0.011***  | 0.0015***  |
|                   |           |           | (0.003)   | (0.003)   | (0.0004)   |
| Female            |           |           |           | 0.051     | 0.0029     |
|                   |           |           |           | (0.032)   | (0.0043)   |
| Age               |           |           |           | -0.011*** | -0.0016*** |
|                   |           |           |           | (0.001)   | (0.00008)  |
| Formerly married  |           |           |           | 0.430***  | 0.0647***  |
|                   |           |           |           | (0.058)   | (0.0083)   |
| Currently married |           |           |           | 0.005     | 0.0016     |
|                   |           |           |           | (0.049)   | (0.0070)   |
| Constant          | -1.482*** | -1.577*** | -1.535*** | -1.170*** |            |
|                   | (0.007)   | (0.018)   | (0.025)   | (0.054)   |            |
| Observations      | 160,654   | 160,654   | 160,654   | 160,654   | 160,654    |

Standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Using one province as the omitted base (likely KPK), the positive coefficients on Punjab (0.108), Sindh (0.399), and Balochistan (0.396) in Model 4 indicate higher log-odds of food insecurity in these provinces relative to the base, holding other factors constant. In log-odds terms, for example, a coefficient of 0.399 for Sindh means its log-odds of food insecurity are 0.399 units higher than the base province. This corresponds to about 1.49 times higher odds ( $\exp(0.399) \approx 1.49$ ). The marginal effects confirm this pattern, with increases of around 1.6 percentage points for Punjab, and about 6 percentage points for Sindh and Balochistan.

The coefficient on Urban is -0.388 ( $p < 0.01$ ), indicating that, in log-odds terms, urban households are less likely to be food insecure than rural ones. The corresponding marginal effect of -0.0543 suggests that living in an urban area is associated with about a 5.4 percentage point lower probability of food insecurity, after controlling for other variables.

The sign and size of the control variables are mostly in line with expectations: Household size has a small positive coefficient in Model 4 (0.011,  $p < 0.01$ ), meaning that each additional household member slightly increases the log-odds of food insecurity. The marginal effect is small but positive (0.0015), implying that larger households face a modestly higher probability of food insecurity.

The coefficient on Female-headed households in Model 4 is positive (0.051) but statistically insignificant, and the marginal effect is very small (0.0029). In this specification, being female-headed is not clearly associated with higher or lower food insecurity once other factors are controlled for.

Age of the household head shows a negative coefficient (-0.011,  $p < 0.01$ ), which means that older heads have lower log-odds of being food insecure. The marginal effect of -0.0016 suggests a small decline in the probability of food insecurity with each additional year of age, possibly reflecting greater experience, stability, or asset accumulation among older heads.

For marital status, the reference category is "never married." The coefficient on formerly married is positive and large (0.430,  $p < 0.01$ ), indicating that formerly married heads have higher log-odds of food insecurity compared with

never-married heads. The marginal effect (0.0647) translates to about a 6.5 percentage point higher probability of food insecurity. In contrast, currently married heads have a very small and statistically insignificant coefficient (0.005), suggesting no clear difference from never-married heads once other characteristics are taken into account.

The four logit models, together with the marginal effects, tell a consistent story. After accounting for regional, household, and demographic factors, households that receive remittances are significantly less likely to be food insecure than those that receive none, with the strongest protective effects for external and dual remittances. At the same time, provincial location, rural residence, larger household size, and being formerly married are associated with higher food-insecurity risk, while older household heads appear slightly better protected. The use of multiple model specifications and the marginal effects output strengthens confidence in these patterns and allows a more intuitive interpretation of the estimated log-odds.

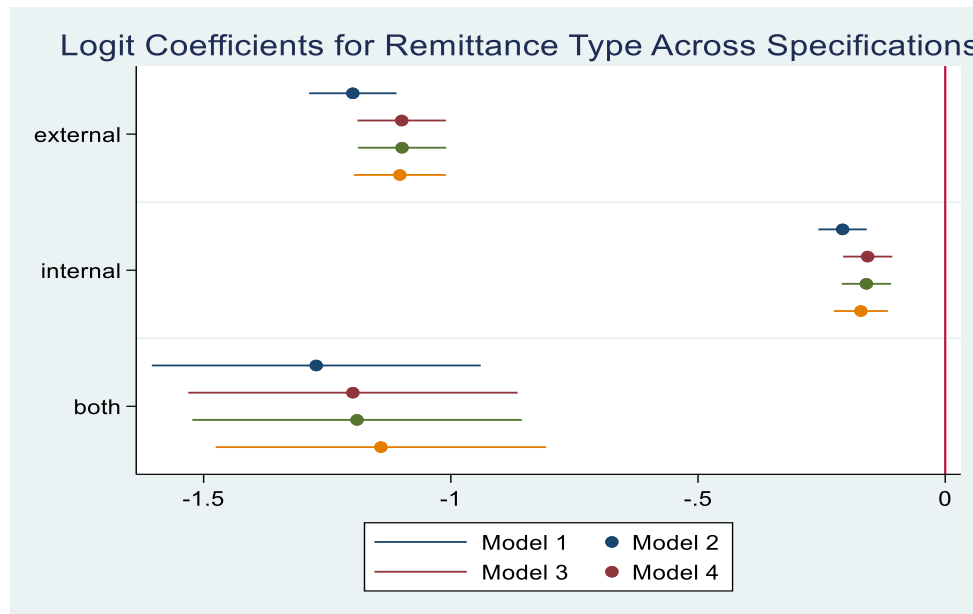


Figure 2: Coefficient plot of model 1-4 on remittances' impact on food insecurity

### **Heterogeneity analysis across provinces**

Running five separate regressions helps us see whether the link between remittances and food insecurity looks the same across the country or varies by province. Column (1) reports the national “baseline” model using all households, while columns (2)-(5) repeat the same specification separately for Khyber Pakhtunkhwa, Punjab, Sindh, and Balochistan. This step is important because migration patterns, labour markets, and living costs differ across provinces, so the protective role of remittances may not be uniform everywhere.

Across Pakistan as a whole, the logit results show that households receiving external remittances have much lower log-odds of being food insecure than non-receiving households (-1.103), which corresponds to roughly two-thirds lower odds. A very similar protective effect appears in Punjab (-1.402) and Sindh (-1.138), and again in KPK, although somewhat smaller (-0.828). In Balochistan, the coefficient on external remittances is negative but small and statistically insignificant (-0.078), suggesting no clear difference from non-receiving households there, possibly due to smaller sample size or different migration patterns.

For internal remittances, the baseline model shows a modest reduction in log-odds nationally (-0.171). This protective effect is stronger in KPK (-0.318) and Punjab (-0.292), where internal migration and domestic transfers appear to help households manage food risk. In contrast, the coefficients turn positive and significant in Sindh (0.526) and Balochistan (0.425), indicating higher log-odds of food insecurity for internal-remittance households compared with non-receivers. This pattern may reflect more distressed or low-return migration within these provinces, where internal remittances are not sufficient to offset underlying vulnerabilities.

Households that receive both external and internal remittances show large negative coefficients in the national model (-1.141) and in KPK (-1.098) and Punjab (-1.124). These values are close to those of external remittances, suggesting a similarly strong reduction in the log-odds of food insecurity relative to non-receiving households. Coefficients for dual remittances are not reported for Sindh and Balochistan, likely because the number of such households is very small in those provinces. Overall, the heterogeneity analysis indicates that the protective effect of external and dual remittances is robust in most provinces, while the role of internal remittances is more mixed and clearly depends on provincial context.

Table 6: Heterogeneity impact of remittances on food insecurity: estimates of logit regression model

| Variables            | (1)                  | (2)                  | (3)                  | (4)                  | (5)                  |
|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                      | Baseline             | KPK                  | Punjab               | Sindh                | Balochistan          |
| Remittances:         |                      |                      |                      |                      |                      |
| Non-receiving (base) |                      |                      |                      |                      |                      |
| External             | -1.103***<br>(0.047) | -0.828***<br>(0.071) | -1.402***<br>(0.072) | -1.138***<br>(0.267) | -0.078<br>(0.331)    |
| Internal             | -0.171***<br>(0.028) | -0.318***<br>(0.058) | -0.292***<br>(0.038) | 0.526***<br>(0.081)  | 0.425***<br>(0.087)  |
| Both                 | -1.141***<br>(0.171) | -1.098***<br>(0.246) | -1.124***<br>(0.238) |                      |                      |
| Punjab               | 0.108***<br>(0.020)  |                      |                      |                      |                      |
| Sindh                | 0.399***<br>(0.023)  |                      |                      |                      |                      |
| Balochistan          | 0.396***<br>(0.026)  |                      |                      |                      |                      |
| Urban                | -0.388***<br>(0.016) | -0.751***<br>(0.064) | -0.172***<br>(0.021) | -0.633***<br>(0.027) | -0.398***<br>(0.055) |
| Household size       | 0.011***<br>(0.003)  | -0.020***<br>(0.006) | 0.020***<br>(0.004)  | 0.051***<br>(0.006)  | -0.033***<br>(0.009) |
| Female               | 0.051<br>(0.032)     | -0.133*<br>(0.068)   | 0.146***<br>(0.042)  | 0.580***<br>(0.095)  | 0.336*<br>(0.202)    |
| Age                  | -0.011***<br>(0.001) | -0.008***<br>(0.001) | -0.010***<br>(0.001) | -0.012***<br>(0.001) | -0.015***<br>(0.002) |
| Formerly married     | 0.430***<br>(0.058)  | 0.539***<br>(0.153)  | 0.397***<br>(0.075)  | 0.142<br>(0.145)     | 0.260<br>(0.212)     |
| Currently married    | 0.005<br>(0.049)     | -0.045<br>(0.127)    | 0.002<br>(0.064)     | 0.077<br>(0.123)     | -0.150<br>(0.161)    |
| Constant             | -1.170***<br>(0.054) | -1.028***<br>(0.129) | -1.202***<br>(0.067) | -0.930***<br>(0.127) | -0.263<br>(0.166)    |
| Observations         | 160,654              | 28,633               | 79,674               | 37,100               | 15,236               |

Standard errors in parentheses, \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Figure 3 provides a visual summary of how the association between different remittance types and food insecurity varies across provinces. The vertical dashed line at zero represents no effect. Any coefficient to the left of this line indicates lower odds of food insecurity, while coefficients to the right indicate higher odds. The confidence intervals around each point help illustrate the precision of these estimates.

For external remittances, the coefficients for Pakistan overall, Khyber Pakhtunkhwa, Punjab, and Sindh all lie clearly to the left of zero, showing a strong and consistent negative association with food insecurity. In contrast, the Balochistan estimate is close to zero and surrounded by a wide confidence interval, suggesting that the effect there is weaker and statistically uncertain, possibly because of fewer external-remittance households or very different migration conditions.

The pattern for internal remittances is more mixed. In Khyber Pakhtunkhwa and Punjab, the coefficients are negative, indicating that internal transfers help reduce the odds of food insecurity. However, in Sindh and Balochistan, the coefficients move to the right of zero, suggesting that households relying on internal remittances in these provinces are actually more likely to face food insecurity, which may reflect lower-return or distress-driven forms of migration.

For dual remittances, the plotted provinces show consistently negative coefficients, clustered close to the All-Pakistan estimate. This suggests that households receiving both internal and external remittances tend to enjoy a strong protective effect, very similar to external remittances alone. Overall, the figure highlights clear geographic heterogeneity: while remittances generally improve food security, their strength and direction depend on the province and the type of remittance received.

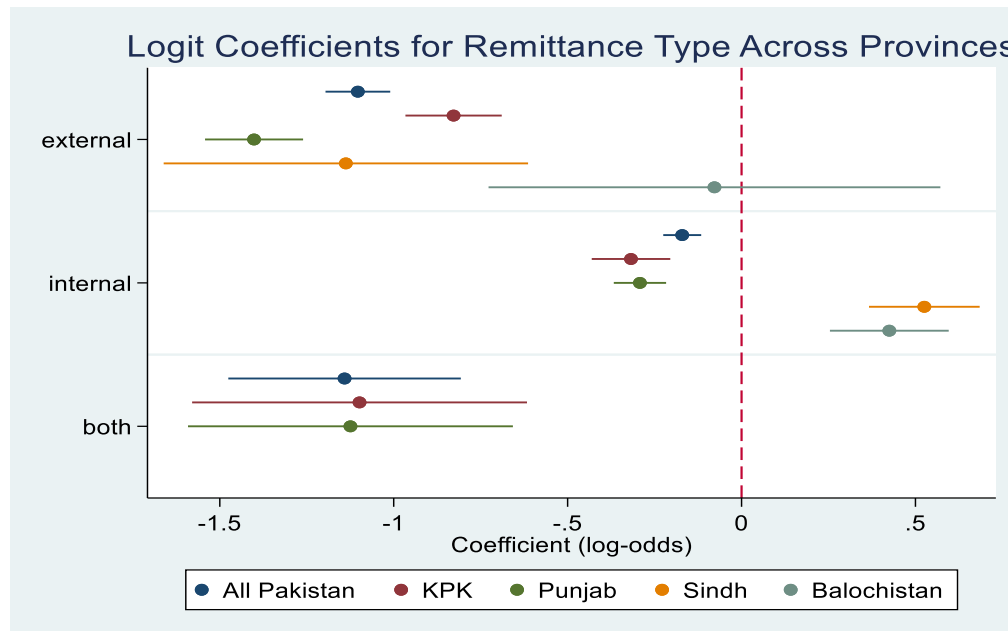


Figure 3: Heterogeneous impact of remittances on food insecurity across provinces

## CONCLUSIONS

This study set out to understand how different types of remittances relate to household food insecurity and whether these effects vary across regions. The results consistently showed that remittance-receiving households are less likely to experience food insecurity than those that receive no transfers, with particularly strong protective effects for external and dual remittances. Internal remittances also help, but to a smaller degree. The heterogeneity analysis further highlighted that the relationship is not uniform across provinces: while external and dual remittances are broadly associated with lower food insecurity in most regions, the role of internal remittances varies, proving supportive in some provinces and weaker or even adverse in others. These findings underscore that remittances function as an important private safety net, but their effectiveness depends on their type, size, stability, and provincial context. They also suggest that remittances alone cannot substitute for broader structural and policy responses aimed at improving food security. Strengthening governance, supporting income opportunities, improving rural access to markets, and ensuring targeted social protection remain essential. By distinguishing between internal, external, dual, and non-receiving households, this study contributes more nuanced evidence to the literature and provides useful guidance for policymakers seeking to align migration, remittance, and food-security strategies more effectively.

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