Informality, Food Insecurity and Intra-Household Resource Allocation: Evidence from Pakistan

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ABSTRACT

The significance of employment in alleviating household poverty and enhancing overall well-being is widely acknowledged. In Pakistan, even with the notable growth in agricultural production, the country struggles with significant levels of food insecurity, affecting approximately 20.3 percent of the population, as indicated by a 2019 global report. This research investigates the impact of informal employment on the Food Insecurity Experience Scale (FIES) and the distribution of resources within households, including categories such as food, non-food items, education, and health. Utilizing data from the Household Integrated Economic Survey (HIES) conducted in 2018-19, fractional response and ordered logit models were employed to analyze the influence of informal employment on resource allocation across various categories and household food insecurity. The findings indicated that households headed by individuals in informal employment typically allocate a more significant portion of their budget to food and health than those in formal employment. Moreover, the impact of informal employment on non-food expenses appears limited, and households with informal workers demonstrate reduced spending on education compared to their formal counterparts. Additionally, the study highlights a higher probability of severe or moderate food insecurity levels in households headed by individuals in informal employment. Comprehending employment and household welfare dynamics necessitates a thorough understanding of intra-household dynamics. This research contributes valuable insights for policymakers, aiding in identifying critical areas for expanding social protection measures for informal workers.

1.   Introduction

Employment is a crucial factor in mitigating household poverty and improving overall well-being; however, a substantial number of individuals in developing nations depend on the informal sector as a source of income and employment, primarily because of the scarcity of formal job

prospects (Hart, 1973; Maxwell et al., 2000). Informal employment accounts for approximately 61 percent of total employment worldwide, which equates to around 2 billion workers (ILO, 2020). Consequently, individuals engaged in informal employment frequently experience restricted availability of social protection benefits, and reduced labour rights encounter difficulties associated with income vulnerability (Tacoli, 2017), increasing vulnerability to household food insecurity (Crush & Frayne, 2010). Food insecurity is a state that can impact the well-being of a household, and its intensity is determined by the level and nature of the limitations they face (Ballard, Kepple, & Cafiero, 2013). Hence, a decent work agenda is critical to achieving food security[1] as SDG 8 also signifies a global focus on ensuring equitable employment opportunities for everyone.

Despite extensive endeavors to address food insecurity remains a significant impediment to global development. An essential goal stated in SDG's Agenda 2030 is eliminating global hunger; however, the reports affirm that present circumstances are unfavorable for attaining the SDG of eradicating hunger by 2030 (FAO, IFAD, & UNICEF, 2020). In 2019, Asia was home to around 381 million people, constituting over 50 percent of the global undernourished population. As an agricultural nation, Pakistan produces significant quantities of staple crops to meet domestic demand and is considered a self-sufficient country in terms of food (Bashir, Schilizzi, & Pandit, 2012b). Nevertheless, according to the latest national nutritional survey data in 2018, 36.9 percent of the population continues to experience food insecurity. Effective policy formulation and resource allocation rely on a comprehensive understanding of the population's characteristics, socio-economic circumstances, location, and extent of food insecurity (Ballard et al., 2013).

Informal workers and their families are subjected to a variety of risks and vulnerabilities compared to formal workers due to poor working conditions and a lack of social protection (OECD/ILO, 2019). Health shocks are highly unpredictable and can harm individuals' economic prospects (Gertler & Gruber, 2002). For instance, Ahmad and Aggarwal (2017) revealed that informal sectors workers are at a higher risk of health shocks and face significant financial constraints due to expensive medical treatments and lack of insurance protection then in the informal sector. Moreover, health expenditures are a primary factor contributing to poverty in numerous developing nations (Flores & O'Donnell, 2016). Health shocks intensify the poverty gap among impoverished individuals and drive non-poor individuals into poverty (Kwesiga, Zikusooka, & Ataguba, 2015). If a sudden health crisis occurs, the proportion of health expenses concerning total expenses increases, leaving households in the informal sector with inadequate funds for essential consumption (Ahmad & Aggarwal, 2017). Conversely, the informal sector yields significantly lower educational returns (Park & Qu, 2013).

At Pakistan's economic landscape which dominates by the informal sector influence various factors, including employment, socio-economic development, and revenue generation. According to the 2017-2018 Labour Force Survey, the informal sector accounts for 72% of total employment, excluding agricultural employment. One of the most significant challenges faced by those who work in informal settings is the need to address household food insecurity caused by irregular income streams (Crush & Frayne, 2010).

Despite the widespread impact of informality on the economy, there has been a notable lack of research into the intra-household-level dynamics associated with informality in Pakistan. This study endeavors to provide to the existing body of knowledge by investigating the complex relationships between informal work, household food insecurity, and intra-household resource allocation. The identified research gap emphasizes the need for a thorough examination of the impact of informal employment on the FIES and various aspects of household expenditure, such

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[1] The term food security defined as "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food, which meets their dietary needs and food preferences for an active and healthy life" by the world food summit of 1996.

as education, health, food, and non-food items. This study aims to link the research gap by bringing empirical evidence on how informal employment affects FIES and household expenditure patterns. The study intended to provide policymakers with valuable insights by shedding light on these dynamics. The findings may help policymakers identify priority areas for extending social protection measures to informal workers.

2.   Research Methodology
2.1.   Data and the Study Area

The data is obtained from the and Household Integrated Economic Survey (HIES, 2018-19) at the provincial level conducted by Pakistan Bureau of Statistics (PBS), which included 24,809 households and provided extensive information on education, employment, health, income and expenditures, food insecurity experience scale (FIES), hygiene and water sanitation, housing, information communication and technology (ICT), and population welfare. The data was collected at national and provincial levels, with a breakdown of rural and urban areas. In the urban and rural domains, 8873 (35.77%) and 15936 (64.23%) households were covered, respectively.

2.1.1.Informal Employment

Pakistan has a system of extended or joint families, which makes it evident that there is a distinct possibility of having more than one employed individual within a household. Employed individuals perhaps be engaged in either formal or informal work. Households that have multiple employed members may exhibit varying degrees of informality. Nevertheless, our objective is to analyze household which commonly employs the household head's employment sector as a metric. However, it is not uncommon for respondents in household surveys to designate the household head as the eldest member of the household, who may be either retired or unemployed. Hence, it might be unsuitable to utilize the employment of the household head for analysis. Alternatively, the study stated the household head as the individual who earns the highest income among all the working members. In traditional societies, the individual with the highest income tends to make the most significant financial contributions towards household expenses. The study has classified households as informal or formal based on whether the highest source of income is derived from informal or formal employment. The HIES (2018-19) does not indicate whether an individual is employed in the informal or formal sector. Thus, the variable of informal employment is formed based on the existing body of research (Devicienti, Groisman, & Poggi, 2009; Funkhouser, 1996; Pisani & Pagán, 2004).
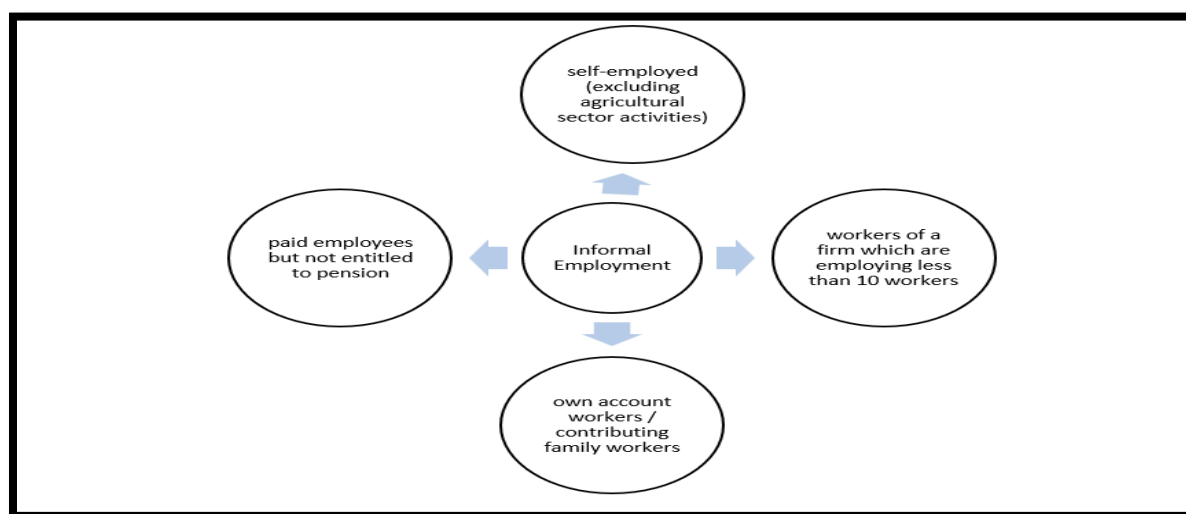
Figure 1. Layout of Informal Employment Sector

2.1.2.Food Insecurity

To evaluate the extent of food insecurity within households, we have employed the FIES, a measuring instrument created by the FAO Voices of the Hungry project (VOH). The FIES is a quantitative measure created to measure the extent of food insecurity by analyzing individuals' answers to inquiries regarding their ability to obtain an adequate amount of food. This measure is based on personal experiences and captures individuals' perceptions of having enough food (Ballard et al., 2013). It addresses the shared aspects of food insecurity in various cultures and socio-economic systems. The study utilized the respondents' answers to the complete FIES questions to assess household food insecurity. Each question refers to a distinct aspect of household food insecurity and denotes the degree of insecurity, ranging from mild to severe.

A food insecurity variable is generated by analyzing the responses provided by households to questions in the FIES survey. A value of 1 was given to each question if the household answered "yes," and 0 was assigned for any other response. The cumulative score for each household was subsequently utilized to determine their degree of food insecurity. Households were classified into 3 categories based on their score: those with a score ranging from 0 to 3 were classified as food secure, those with a score ranging from 4 to 6 were classified as moderately insecure, and those with a score ranging from 6 to 8 were classified as severely insecure which has formed a categorical variable for food insecurity.

2.1.3. Expenditures (Food, Non-food, Health and Education)

The HIES provides detailed data on household expenditures for categories such as food, non-food items, education, and health. This analysis considers these four expenditure categories as dependent variables; however, these are the ratio of total expenditures allocated to a specific category; for instance, the food expenditure variable represents the percentage of the budget allocated specifically for food consumption.

2.1.4. Explanatory Variables

Table 1 presents a comprehensive depiction and measurement of explanatory variables utilized in the study.

Table 1

Explanatory Variables

Variable	Description	Measurement
Age	household head's age	No. of years (Continuous variable)
Gender	household head's gender	Male=1; Female=0 (Dummy Variable)
Education	household head's completed years of schooling	No. of years in schooling (Continuous Variable)
Married	household head's marital status	Married=1; Otherwise=0 (Dummy Variable)
HH size	Number of individuals in the household	(Continuous Variable)
Children	The total number of children below 15 years in the household	No. of children (Discrete Variable)
Older	The total number of individuals 65 or above in the household	No. of older members (Discrete Variable)
Dependency Ratio	The ratio of dependents in the household (members below age 15 and older than age 65)	No. of dependents divided by HH size (Continuous variable)
Average Schooling	Average schooling years of all the members of a household (completed years)	No. of years (Continuous Variable)
Region	Area of residence	Rural=1; Urban=0 (Dummy Variable)
Province	Province of residence	Khyber Pakhtunkhwa=0; Punjab=1; Sindh=2; Balochistan=3

2.2. Methodology

The present study examines whether households with heads engaged in informal employment exhibit distinct spending patterns compared to households where heads are formally employed. In addition, the study also examines the degree of food insecurity in both formal and informal households. The choice of the suitable functional form for modelling the proportion of specific expenses relies on the relative significance assigned to various characteristics that one desires the function to exhibit. However, the functional form for the current analysis is specified according to the following criteria: first, the curve must be consistent for multiple types of goods; second, the curve must be able to incorporate increasing, decreasing, and constant spending tendencies across a range of expenditure levels, third, it also fulfils the additivity condition. We adhere to the methodology proposed by Guzmán et al. (2008) and employ a modified Working-Leser curve. The model is specified in the following format:

$$q_{ih} = \alpha_i + \delta_i z_h + \epsilon_{ih} \tag{1}$$

Where q_{ih} is the share of the budget which is devoted to good (i) by household (h), (z_h) is a vector that represents household characteristics which may influence expenditure behavior and ε_{ih} is an error term, dependent variables are constrained within the range of 0, since we consider them as percentages of the total expenditure allocated to good i. So, our model is $E(^{q_{ih}}/_X)$ as a logistic function:

$$E(q_{ih}/X) = \frac{\exp(X\beta)}{[1+\exp(X\beta)]} \tag{2}$$

In the context of our analysis, q_{ih} is the proportion of total expenditure allocated to each of the four expenditure categories, while X denotes the matrix comprising both dependent and control variables which ascertain that estimated values of q_{ih} fall between 1 and 0 (Papke & Wooldridge, 1996). For analysis, we formulate equation as under:

$$q_{ih} = \alpha_i + \beta_{0i}IE_h + \delta_i z_h + \epsilon_{ih} \tag{3}$$

Where, q_{ih} is share of expenditure out of total expenditure devoted to good i by household h, IE is a dummy variable that equals unity for households whose household head belongs to informal employment and zero if the household belongs to formal employment.

In addition, the food insecurity variable includes 3 categories mentioned like food secure, moderately food insecure, and severely food insecure which represent a specific order, hence an ordered logit model to examine the influence of informal employment on the occurrence of household food insecurity is more appropriate.

3. Results and Discussion

In this section, we present the outcomes that explain the impact of the household head's engagement in informal employment on both the food security status and the distribution of resources within the household.

3.1. Prevalence of Food Insecurity

Table 2 presents the occurrence of food insecurity statistics for both formal and informal households, both overall and by region (rural/urban). On a national scale, nearly 96 percent of households with formal heads can access enough food to meet their needs, while only 84 percent of households with informal heads have the same level of food security. Nevertheless, the level

of food insecurity is greater among rural informal households compared to urban informal households.

Table 2
Prevalence of Food Insecurity According to Formal and Informal Employment in Rural and Urban Areas of Pakistan

	Overall			Rural			Urban		
	formal	Informal	Total	formal	Informal	Total	formal	Informal	Total
Secure	96.12	84.62	86.45	93.77	80.43	82.1	98.15	91.21	92.64
Moderate Insecure	2.95	10.03	8.9	4.51	12.72	11.7	1.6	5.79	4.93
Insecure	0.93	5.35	4.65	1.72	6.85	6.21	0.25	3	2.43
Total	3,018	16,019	19,037	1,397	9,787	11,184	1,621	6,232	7,853

3.2. Informal Employment and Household Food Security Status

This study initially utilized ordered logistic regression, and the outcomes are presented in Table 3.

Table 3
Informal Employment and Household Food Insecurity: Ordered Logistic Regression

Predictors	Overall Coefficients	Overall Odd Ratios	Rural Coefficients	Rural Odd Ratios	Urban Coefficients	Urban Odd Ratios
Informal Head	0.450***	1.569***	0.399***	1.490***	0.645***	1.907***
	(0.105)	(0.166)	(0.125)	(0.186)	(0.203)	(0.388)
Age	0.001	1.001	0.002	1.002	-0.002	0.998
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)
Gender	0.063	1.065	-0.096	0.909	0.763***	2.145***
	(0.093)	(0.099)	(0.104)	(0.0945)	(0.207)	(0.444)
Education_HH	-0.016**	0.984**	-0.009	0.990	-0.0375**	0.963**
	(0.008)	(0.008)	(0.009)	(0.009)	(0.015)	(0.014)
Married	-0.097	0.908	-0.059	0.942	-0.129	0.879
	(0.071)	(0.065)	(0.082)	(0.0773)	(0.144)	(0.126)
HH size	-0.078***	0.925***	-0.0597***	0.942***	-0.121***	0.886***
	(0.018)	(0.017)	(0.0212)	(0.0199)	(0.035)	(0.031)
Children	0.175***	1.191***	0.147***	1.159***	0.229***	1.257***
	(0.037)	(0.044)	(0.0430)	(0.049)	(0.073)	(0.0919)
Older	-0.045	0.956	-0.098	0.906	0.113	1.119
	(0.063)	(0.061)	(0.072)	(0.0659)	(0.130)	(0.146)
Dependency Ratio	-0.127	0.881	0.124	1.132	-0.674	0.510
	(0.224)	(0.197)	(0.262)	(0.297)	(0.430)	(0.219)
Average schooling	-0.274***	0.761***	-0.273***	0.761***	-0.260***	0.771***
	(0.016)	(0.012)	(0.019)	(0.015)	(0.027)	(0.021)
Region	-0.496***	0.609***				
	(0.054)	(0.033)				
Punjab	0.627***	1.872***	0.833***	2.301***	0.082	1.085
	(0.074)	(0.138)	(0.088)	(0.202)	(0.137)	(0.148)
Sindh	0.673***	1.961***	0.945***	2.573***	-0.0252	0.975
	(0.076)	(0.149)	(0.091)	(0.234)	(0.140)	(0.136)
Balochistan	-0.127	0.880	-0.009	0.991	-0.365**	0.695**
	(0.097)	(0.0858)	(0.115)	(0.114)	(0.183)	(0.127)
Observations	19,037	19,037	11,184	11,184	7,853	7,853

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

The results from ordered logit regression analysis indicate that an informally employed household head has a significant influence on levels of food insecurity within household. An increase of one unit in informal household headship would lead to a 0.46 unit increase in the ordered log-odds of the household being classified in a higher food insecurity category than formal household headship, assuming all other variables remain constant. Hence, the employment sector is crucial in determining the food security levels within households (Cheema & Abbas, 2016). An increased fraction of household members in informal employment is related with an elevated level of food insecurity and a reduction in food expenditures (Blekking, Waldman, Tuholske, & Evans, 2020; Vu & Rammohan, 2022).

The coefficient of education attainment of household heads is negatively correlated and statistically significant, indicating that the likelihood of being in a higher food insecurity category decrease for each additional year of education that informal households attain. The correlation between higher levels of education and enhanced food security is consistent with prior research results, showcasing a positive influence. Intriguingly, age does not employ a substantial impact on the household's food insecurity level. Similarly, the gender of the household head does not appear as a significant factor influencing the household's food security level. Notably, the coefficient associated with household size is both negative and highly significant. The addition of an extra member to the household correlates with a reduction in the log odds of the household falling into the higher food insecurity category by 0.078 units. Nevertheless, this outcome is unsurprising as the empirical literature yields inconsistent findings. According to Ellis (2000), a larger household size may lead to a greater diversity of labour.

Conversely, a rise in family size leads to significant number of individuals to provide food for, which puts additional strain on the household's level of food security (Brown, Laffan, & Wight, 2008; Cheema & Abbas, 2016) which indicate a positive association between the number of children in a household and the household's food insecurity level. Specifically, an additional child in the household is linked to a 0.175 unit increase in the log odds of encountering food insecurity. On the other hand, the average educational attainment within a household demonstrates a negative significant effect on food insecurity levels. With higher educational levels, the log odds of households falling into a higher food insecurity category decrease by 0.274 units (Bashir et al., 2012b; De Muro & Burchi, 2007; Mutisya, Ngware, Kabiru, & Kandala, 2016). In addition, the analysis includes provincial dummies to account for socio-economic factors. The findings indicate that households headed by individuals engaged in informal employment in Punjab and Sindh are more prone to being classified in a severe food insecurity than the reference group of households in KP. The coefficient for Balochistan is negative and lacks statistical significance.

When examining the level of food insecurity among household heads who are informally employed, it is essential to take into account their geographical location. Individuals residing in rural areas may exhibit varying degrees of food insecurity, then those in urban settings indicating regional disparities. Households in rural regions where the household head is engaged in informal employment experience a significant effect on the levels of household's food insecurity. An increase of one unit in informal household headship would result in a higher probability of household food insecurity in rural areas than formal household headship. The results for other variables closely resemble the results for overall Pakistan.

The results for urban areas indicate that informal household holdings significantly affect the food insecurity in household. An increase of one unit in the number of informal households residing in urban areas would lead to a 1.91 unit increase in the ordered log odds of the household being classified in a higher food insecurity category. The urban area results illustrate that informal headed households headed are less probable to experience food insecurity than males, with odds of 2.15 (Cheema & Abbas, 2016; Hameed & Salam, 2020). However, the results for other variables are consistent with Pakistan's overall and rural areas.

3.2.1.Brant Test

Ordered logistic regression estimates a single equation, including all dependent variable categories. Therefore, verifying the accuracy of the one-equation model across all categories is crucial. We employed the Brant test to evaluate the assumption of proportional odds (refer to Appendix Table A3). The results states that parallel regression assumption violated for overall model. Therefore, it is convenient to utilize less restrictive multinomial logit model as an alternative. In the multinomial logit model, variables are freed from proportional odds constraint.

3.3.   Multinomial Logit Model

This study utilized the multinomial logit model because Brant's test results show parallel lines assumption violation. The results of the multinomial logit model are illustrated in Table 4. The model estimates the coefficients of all categories based on the base category, food security. Furthermore, marginal effects are estimated for each category. The results of the multinomial logit regression are nearly identical to those of the ordered logit regression in direction and significance.

Table 4
Informal employment and household food insecurity: Multinomial Logistic Regression

Predictors	Coefficients			Marginal effects	
	Moderate	Severe	Secure	Moderate	Severe
Informal Head	0.440***	0.541***	-0.037***	0.026***	0.011**
	(0.120)	(0.204)	(0.008)	(0.007)	(0.004)
Age	-0.002	0.007**	0.000	-0.000	0.000**
	(0.003)	(0.003)	(0.000)	(0.000)	(0.000)
Gender	-0.012	0.063	-0.001	-0.001	0.001
	(0.115)	(0.140)	(0.008)	(0.007)	(0.003)
Education HH	-0.007	-0.036***	0.001*	-0.000	-0.001**
	(0.009)	(0.014)	(0.001)	(0.001)	(0.000)
Married	-0.066	-0.232**	0.008	-0.004	-0.005**
	(0.084)	(0.116)	(0.006)	(0.005)	(0.002)
HH Size	-0.072***	-0.079***	0.006***	-0.004***	-0.002**
	(0.021)	(0.031)	(0.001)	(0.001)	(0.001)
Children	0.109**	0.252***	-0.011***	0.006**	0.005***
	(0.045)	(0.059)	(0.003)	(0.003)	(0.001)
Older	-0.003	-0.135	0.003	0.000	-0.003
	(0.076)	(0.104)	(0.005)	(0.005)	(0.002)
Dependency Ratio	-0.123	0.057	0.006	-0.008	0.001
	(0.270)	(0.356)	(0.018)	(0.016)	(0.007)
Average schooling	-0.235***	-0.350***	0.021***	-0.014***	-0.007***
	(0.019)	(0.029)	(0.001)	(0.001)	(0.001)
Region	-0.571***	-0.393***	0.041***	-0.034***	-0.007***
	(0.064)	(0.088)	(0.004)	(0.004)	(0.002)
Punjab	0.190**	1.305***	-0.034***	0.008*	0.026***
	(0.086)	(0.134)	(0.005)	(0.004)	(0.002)
Sindh	0.718***	0.638***	-0.055***	0.047***	0.008***
	(0.086)	(0.145)	(0.006)	(0.005)	(0.002)
Balochistan	-0.099	-0.168	0.006	-0.004	-0.002
	(0.111)	(0.181)	(0.005)	(0.005)	(0.002)
Observations	19,041	19,041	19,041	19,041	19,041

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

The multinomial logit for informal HH is significant, indicating that when the household head works informally, the household is likely to undergo moderate to severe food insecurity than household heads are formally employed. However, the marginal effects are significant for policy purposes. As a result, marginal effects are estimated for all food insecurity categories and model variables. Households with heads in informal employment are 3.7% less likely to be food secure. In comparison, they are 2.6% and 1.1% more likely to be moderately secure and severely food insecure than formal households, which is unsurprising because informal employment is associated with a greater risk of income instability and shocks (Amuedo-Dorantes,

2004; Nordman, Rakotomanana, & Roubaud, 2016). Moreover, Vu and Rammohan (2022) found a significant negative relationship between informal employment and nutritious food consumption. In informal households, achieving higher levels of education enhances the probability of the household achieving food security by 0.1%. Simultaneously, it diminishes the likelihood of the household falling into the severe and moderate food insecurity categories. The educational level of the household head emerges as a crucial factor in mitigating household food insecurity (Cheema & Abbas, 2016; Hameed & Salam, 2020; Zhou et al., 2019).

The study found that adding an additional informal worker to a household increases the probability of achieving food security by 0.6%, reducing the likelihood of experiencing moderate and severe food insecurity by 0.4% and 0.2%, respectively. Conversely, households with a higher number of children are 1.1% less likely to attain food security and 0.6% more likely to be classified in moderate and severe insecurity categories, suggesting that an increase in the household's child count correlates with a rise in non-working members, putting additional strain on food security—a finding in line with Felker-Kantor and Wood (2012).

Furthermore, a raise in the average schooling level within a household raises the probability of the household being in the food secure category by 2.1 percent. This increase diminishes the probability of the household falling into the moderate and severe insecurity categories by 1.4 percent and 0.7 percent, respectively because enhanced earning opportunities and work efficiency are associated with increased years of schooling (McMahon, 2009). It is provided that individuals with higher education are more inclined to achieve food security due to their increased purchasing power (Bashir & Schilizzi, 2013), and (Mutisya et al., 2016).

3.4.   Informal Employment and Intra-Household Resource Allocation

This study used a fractional response model to examine the effect of informal employment on intra-household resource allocation took household expenditures (food, non-food, education, and health) as a fraction of total expenditures. As a result, using a fractional response model for regression analysis makes more sense.
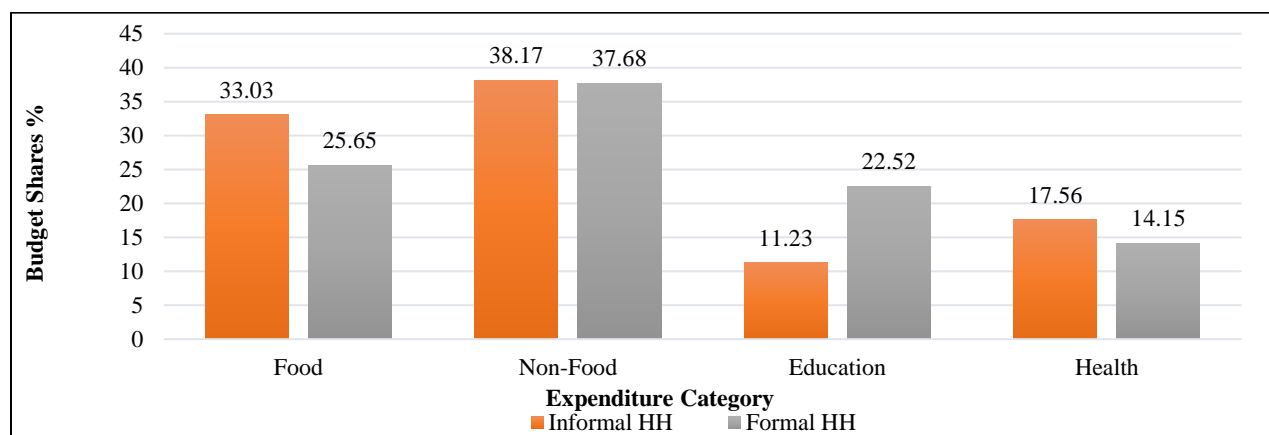
Figure 2. Percentage distribution of average budget shares based on the employment sector of the household head.

Figure 2 depicts average budget allocation shares across the four expenditure categories for household heads who work in informal and formal employment. We discover significant differences in budget allocation between informal and formal HH for food, education, and health expenditures. Households with informal employment spend a higher proportion of their average budget on food and health than households with formal employment. The difference in non-food budget allocation between the two types of household heads is minor. Furthermore, informal HH spends significantly less on education than formal HH. The average income of households in

Pakistan's formal and informal sectors has also been calculated. (See Appendix Table A4). The study findings show that formal households have a higher mean income than informal households, implying a significant wage disparity between workers in the informal and formal sectors.

The fractional response model is utilized to examine the relationship between informal/formal employment and intra-household expenditure allocations. This model is used because the dependent variables are proportional and range between zero and one. The fractional response model takes into account the bounded nature of fractional response variables (Papke & Wooldridge, 1996). The initial phase of our analysis involves estimating coefficients and odds ratios through fractional logit regression. An odds ratio exceeding one indicates that an increase in the respective variable correlates with a corresponding increase in the expenditure share for each category. Furthermore, the magnitude of the odds ratio explains the proportional shift in the odds of expenditure share for a unit increment in the corresponding variable.

Table 5 shows the coefficients and odds ratios obtained from the fractional logit regression analysis, which examines the factors influencing the allocation of budget towards food expenses by informal households compared to formal households. In addition, separate estimates of odds ratios are also calculated for rural and urban regions. Food expenditures are calculated as the proportion of total household allocations to food consumption. The estimation results suggest a significant positive correlation between household heads engaged in informal employment and higher food expenditures. The odds ratio of 1.09 suggests that for each unit increase in informal employment, there is a 9 percent increase in the probability of food expenditure share compared to households with formally employed heads. Informal employment is associated with a reduced income level and a higher poverty prevalence, as indicated by the (OECD/ILO, 2019). Multiple empirical studies have consistently shown that informal workers earn less than formal workers (Bargain & Kwenda, 2014; Baskaya & Hulagu, 2011; Nordman et al., 2016; Tansel & Acar, 2016; Williams & Gashi, 2022). Therefore, following Engel's law, households with lower incomes devote a more significant percentage of their income to food expenses. Similarly, Roy and Kundu (2022) found that informal workers allocate a more significant proportion of their total household expenditures to food compared to formal workers.

Disaggregated analysis for urban and rural reveals a positive correlation between informal household enterprises and household food expenditures. In rural settings, a single unit increase in informal employment would lead to a 7 percent rise in the likelihood of the food expenditure ratio compared to the overall household expenses. In the urban sample, the likelihood of the household ratio of food expenditures increases by 11 percent when the household head is working in informal employment. The odds ratio for the urban sample is greater than that of the rural sample because urban areas, on average, exhibit higher household expenditures than rural areas. (Ahmad, Faridi, Ahmad, & Ayub, 2021).

The odds for the non-food expenditures ratio to total expenditures are insignificant and positive for the overall sample as well as for rural and urban sample. It implies that informal sector employment does not significantly impact household non-food expenditures.

The household head being in informal employment decreases the odds of household education expenditures ratio to total expenditures by 0.90 relative to formally employed household heads. Hence, one percent increase in informal employment persistence in the household is associated with the 10 percent reduction in the odds of education expenditures ratio to total household expenditures. Moreover, informal HH decreases household education expenditures by 5 and 15 percent for rural and urban areas, respectively. In fact, the share of education expenditure to total household expenditure is considerably low because education is considered a luxury good for informal workers (Roy & Kundu, 2022).

Household head in informal employment significantly and positively affects household health expenditures. For the overall sample, a one percent increase in informal employment increases the odds of household health expenditure ratio to total expenditures by 8 percent relative to household heads employed in the formal sector. Unsurprisingly, households with informal employment are more vulnerable to health shocks and economic hardship in the form of out-of-pocket health expenditures and lack of insurance coverage than formal workers. Ahmad and Aggarwal (2017) found that 7.12 percent of informal households become poor due to out-of-pocket health expenses. Compared to formal HH, informal HH in rural areas raises the ratio of household health expenditure to total expenditures by 5%. In the urban area, the household head in informal employment increases the odds of health expenditures ratio to total expenditure by 11 percent.

Table 5
Results from Fractional Logit Regression for Expenditures (Food, non-food, Health and Education Expenditures)

Predictors	Food (Odd Ratios)	Non-Food (Odd Ratios)	Education (Odd Ratios)	Health (Odd Ratios)
Informal Head	1.088***	1.015	0.903***	1.076***
	(0.015)	(0.011)	(0.029)	(0.024)
Age	0.996***	0.997***	1.024***	0.997***
	(0.000)	(0.000)	(0.001)	(0.001)
Gender	0.986	0.927***	1.155***	1.048
	(0.018)	(0.014)	(0.059)	(0.031)
Education HH	0.989***	0.995***	1.044***	0.998
	(0.001)	(0.001)	(0.004)	(0.002)
Married	0.998	1.020*	1.039	0.958**
	(0.013)	(0.011)	(0.042)	(0.019)
HH Size	0.981***	0.962***	1.184***	0.994
	(0.003)	(0.002)	(0.009)	(0.005)
Children	1.038***	1.044***	0.804***	0.990
	(0.007)	(0.006)	(0.015)	(0.011)
Older	1.029***	1.065***	0.610***	1.136***
	(0.011)	(0.009)	(0.019)	(0.020)
Dependency Ratio	0.685***	0.608***	17.38***	0.825***
	(0.028)	(0.022)	(2.277)	(0.058)
Average Schooling	0.961***	1.007***	1.128***	0.954***
	(0.002)	(0.002)	(0.007)	(0.004)
Region	0.798***	1.085***	1.774***	0.781***
	(0.007)	(0.008)	(0.044)	(0.011)
Punjab	0.999	1.191***	1.208***	0.673***
	(0.012)	(0.011)	(0.038)	(0.012)
Sindh	1.288***	1.142***	0.948	0.561***
	(0.016)	(0.011)	(0.032)	(0.010)
Balochistan	1.417***	1.370***	0.463***	0.494***
	(0.021)	(0.017)	(0.025)	(0.013)
Observations	19,041	19,041	19,041	19,041

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.   Conclusion and Policy Implications

Informal employment remains a large and significant component of Pakistan's economy, as it is in other developing countries. According to the most recent LFS report (2020-21), informal employment accounts for 72.5% of employment in non-agricultural sectors. Despite playing an important role in household dynamics, policymakers and researchers have paid little attention to the risks and vulnerabilities associated with informal work. Consequently, the focus of this study is to examine the impact of informal employment on resource allocation within households and the extent of household food insecurity in Pakistan based on HIES dataset 2018-19. This study employed a fractional response and ordered logit models to estimate household food insecurity. However, following a violation of the proportional odds ratio in the Brant test, a multinomial model was estimated to examine the impact of informal employment on food insecurity in households.

The findings show that household heads in informal employment spend a higher percentage of their total food expenditures than those in formal employment. Interestingly, informal employment does not seem to impact non-food expenditures significantly. Furthermore, informal employment is linked with reduced household education expenditures than formal workers. Informal households devote more of their total household expenditure to health expenses than formal households. As a result, higher healthcare costs pushed 7.12 percent of informal workers into poverty (Ahmad & Aggarwal, 2017). The study also found that households with household heads working in informal jobs are more expected to experience severe or moderate food insecurity. Few studies in the existing literature specifically address the link between informality, intra-household resource allocation, and household food security.

From a policy standpoint, the study proposes that expanding formal employment opportunities would improve household resource allocation and enhance food security. Although informal sector households allocate a higher fraction of their income to food, they still face a significant risk of food insecurity. The primary obstacle informal employment encounters are the absence of legal and social safeguards, rendering them susceptible to expenses related to education and health. Our research indicates that informal workers allocate a minimal proportion of their income towards household education expenses. This may contribute to the continued prevalence of informality among future generations of informal workers. Hence, it is recommended to develop a social protection system that specifically caters to the requirements of informal workers regarding healthcare and education for their children. Our study has important policy implications for understanding the dynamics of households led by informal leaders in Pakistan and other emerging countries where a large part of population is involved in informal employment.

Author's Contribution:
Shagufta Sultana: The author conducted all the aspects of research, from conceptualization to final version of manuscript.
Conflict of Interests/Disclosures
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References

Ahmad, N., & Aggarwal, K. (2017). Health shock, catastrophic expenditure and its consequences on welfare of the household engaged in informal sector. *Journal of Public Health, 25*(6), 611-624. doi:https://doi.org/10.1007/s10389-017-0829-9

Ahmad, R., et al. (2021). Socioeconomic and Demographic Factors of Household Expenditures: A Case Study of Southern Punjab (Pakistan). *Pakistan Journal of Humanities and Social Sciences, 9*(3), 547–554. doi:https://doi.org/10.52131/pjhss.2021.0903.0159

Amuedo-Dorantes, C. (2004). Determinants and poverty implications of informal sector work in Chile. *Economic Development and Cultural Change, 52*(2), 347-368. doi:https://doi.org/10.1086/380926

Ballard, T., et al. (2013). The food insecurity experience scale: development of a global standard for monitoring hunger worldwide. *Rome, Italy: Food and Agriculture Organization*

Bargain, O., & Kwenda, P. (2014). The informal sector wage gap: New evidence using quantile estimations on panel data. *Economic Development and Cultural Change, 63*(1), 117-153. doi:https://doi.org/10.1086/677908

Bashir, M. K., & Schilizzi, S. (2013). Determinants of rural household food security: a comparative analysis of African and Asian studies. *Journal of the Science of Food and Agriculture, 93*(6), 1251-1258. doi:https://doi.org/10.1002/jsfa.6038

Bashir, M. K., et al. (2012a). The determinants of rural household food security for landless households of the Punjab, Pakistan. *Working Paper 1208, School of Agricultural and Resource Economics, University of Western Australia, Crawley, Australia.* doi:https://doi.org/10.22004/ag.econ.126035

Bashir, M. K., et al. (2012b). The determinants of rural household food security in the Punjab, Pakistan: an econometric analysis. *Working Paper1203, School of Agricultural and Resource Economics, University of Western Australia, Crawley, Australia.*

Baskaya, Y. S., & Hulagu, T. (2011). Informal-Formal worker wage gap in Turkey: Evidence from a semi-parametric approach. *Working Papers 1115, Research and Monetary Policy Department, Central Bank of the Republic of Turkey.*

Blekking, J., et al. (2020). Formal/informal employment and urban food security in Sub-Saharan Africa. *Applied Geography, 114*, 102131. doi:https://doi.org/10.1016/j.apgeog.2019.102131

Brown, N., et al. (2008). High food prices, food security and the international trading system. *A paper presented to the Informa National Food Pricing Summit, Sydney, 29-30 September 2008*

Cheema, A. R., & Abbas, Z. (2016). Determinants of food insecurity in Pakistan: Evidence from PSLM 2010-11. *Pakistan Journal of Applied Economics, 26*(2), 183-213.

Crush, J., & Frayne, B. (2010). *The Invisible Crisis: Urban Food Security in Southern Africa* (Vol. 1): African Food Security Urban Network (AFSUN). doi:https://www.africabib.org/htp.php?RID=337146497

De Muro, P., & Burchi, F. (2007). Education for rural people: a neglected key to food security. *Department of Economics-University Roma Tre.*

Devicienti, F., et al. (2009). Informality and poverty: Are these processes dynamically interrelated? Evidence from Argentina. *ECINEQ, Society for the Study of Economic Inequality Working Paper*(146) doi:http://doi.org/10.1108/S1049-2585(2010)0000018007

Ellis, F. (2000). The determinants of rural livelihood diversification in developing countries. *Journal of agricultural economics, 51*(2), 289-302. doi:http://doi.org/10.1111/j.1477-9552.2000.tb01229.x

FAO, et al. (2020). *WFP and WHO. The state of food security and nutrition in the world 2020. Transforming food systems for affordable healthy diets. Rome: FAO; 2020*. Retrieved from https://www.fao.org/3/ca9692en/CA9692EN.pdf

Felker-Kantor, E., & Wood, C. H. (2012). Female-headed households and food insecurity in Brazil. *Food Security, 4*, 607-617. doi:https://doi.org/10.1007/s12571-012-0215-y

Flores, G., & O'Donnell, O. (2016). Catastrophic medical expenditure risk. *Journal of Health Economics, 46*, 1-15. doi:http://doi.org/10.1016/j.jhealeco.2016.01.004

Funkhouser, E. (1996). The urban informal sector in Central America: Household survey evidence. *World development, 24*(11), 1737-1751. doi:https://doi.org/10.1016/0305-750X(96)00074-5

Gertler, P., & Gruber, J. (2002). Insuring consumption against illness. *American economic review, 92*(1), 51-70. doi:http://doi.org/10.1257/000282802760015603

Hameed, A., & Salam, A. (2020). Estimating the socio-economic factors of food insecurity in Pakistan: a regional level analysis. *FWU Journal of social sciences, 14*(2), 81-94.

Hart, K. (1973). Informal income opportunities and urban employment in Ghana. *The journal of modern African studies, 11*(1), 61-89. doi:https://doi.org/10.1017/S0022278X00008089

ILO. (2020). *World Employment and Social Outlook: Trends 2020*. Retrieved from Geneva: https://www.ilo.org/global/research/global-reports/weso/2020/lang--en/index.htm

Kwesiga, B., et al. (2015). Assessing catastrophic and impoverishing effects of health care payments in Uganda. *BMC health services research, 15*(1), 1-6. doi: http://doi.org/10.1186/s12913-015-0682-x

Maxwell, D. G., et al. (2000). Urban livelihoods and food and nutrition security in Greater Accra, Ghana. *International Food Policy Research Institute, 112.* doi:http://doi.org/10.2499/0896291154rr112

McMahon, W. W. (2009). *Higher learning, greater good: The private and social benefits of higher education*: JHU Press. doi:https://doi.org/10.1353/book.3416

Mutisya, M., et al. (2016). The effect of education on household food security in two informal urban settlements in Kenya: a longitudinal analysis. *Food Security, 8*, 743-756. doi:http://doi.org/10.1007/s12571-016-0589-3

Nordman, C. J., et al. (2016). Informal versus formal: A panel data analysis of earnings gaps in Madagascar. *World development, 86*, 1-17. doi:http://doi.org/10.1016/j.worlddev.2016.05.006

OECD/ILO. (2019). *Tackling Vulnerability in the Informal Economy*. Paris: OECD Publishing. doi:https://doi.org/10.1787/939b7bcd-en

Papke, L. E., & Wooldridge, J. M. (1996). Econometric methods for fractional response variables with an application to 401 (k) plan participation rates. *Journal of applied econometrics, 11*(6), 619-632. doi:https://doi.org/10.1002/(SICI)1099-1255(199611)11:6

Park, A., & Qu, X. (2013). Informality, returns to education, and labour market integration in China. *Indian Journal of Labour Economics, 56*(4)

Pisani, M. J., & Pagán, J. A. (2004). Sectoral selection and informality: A Nicaraguan case study. *Review of Development Economics, 8*(4), 541-556. doi:http://doi.org/10.1111/j.1467-9361.2004.00251.x

Roy, R., & Kundu, A. (2022). Consumption Nature of Indian Informal Workers: Engel's Law Revisited. *Asian Development Policy Review, 10*(4), 307-316. doi:https://doi.org/10.55493/5008.v10i4.4662

Tacoli, C. (2017). Food (in) security in rapidly urbanising, low-income contexts. *International journal of environmental research and public health, 14*(12), 1554. doi:http://doi.org/10.3390/ijerph14121554

Tansel, A., & Acar, E. O. (2016). *The formal/informal employment earnings gap: evidence from Turkey.* Paper presented at the Inequality after the 20th century: papers from the sixth ECINEQ meeting. doi:http://doi.org/10.1108/S1049-258520160000024006

Vu, L., & Rammohan, A. (2022). Is There an Informal Employment Penalty in Food Security? Evidence from Rural Vietnam. *The European Journal of Development Research*, 1-25. doi:http://doi.org/10.1057/s41287-021-00498-7

Williams, C., & Gashi, A. (2022). Evaluating the wage differential between the formal and informal economy: a gender perspective. *Journal of Economic Studies, 49*(4), 735-750. doi:http://doi.org/10.1108/JES-01-2021-0019

Zhou, D., et al. (2019). Factors affecting household food security in rural northern hinterland of Pakistan. *Journal of the Saudi Society of Agricultural Sciences, 18*(2), 201-210. doi:https://doi.org/10.1016/j.jssas.2017.05.003

Appendix

Table A1

Food Insecurity Experience Scale (FIES) Questions Used in the Study

Question (Recall period: last 12 months)	Domain (Theoretical Construct)	Level (Food Insecurity)
You or others in your household worried about not having enough food to eat because of a lack of money or other resources?	Uncertainty and anxiety about food	Mild
Was there a time when you or others in your household were unable to eat healthy and nutritious food because of a lack of money or other resources?	Inadequate food quality	Mild
Was there a time when you or others in your household ate only a few kinds of foods because of a lack of money or other resources?	Inadequate food quality	Mild
Was there a time when you or others in your household had to skip a meal because there was not enough money or other resources to get food?	Insufficient food quantity	Moderate
Was there a time when you or others in your household ate less than you thought you should because of a lack of money or other resources?	Insufficient food quantity	Moderate
Was there a time when your household ran out of food because of a lack of money or other resources?	Insufficient food quantity	Moderate
Was there a time when you or others in your household were hungry but did not eat because there was not enough money or other resources for food?	Insufficient food quantity	Severe (Hunger)
Was there a time when you or others in your household went without eating for a whole day because of lack of money or other resources?	Insufficient food quantity	Severe (Hunger)

Table A2

Prevalence of Food Insecurity According to Formal and Informal Employment at Provincial in Pakistan

Provinces	Employment	Secure	Moderate Insecure	Insecure	Total
	Formal	96.8	2.72	0.48	625
KP	Informal	89.79	7.61	2.6	2616
	Total	91.14	6.66	2.19	3241
	Formal	96.07	2.65	1.28	1323
Punjab	Informal	84.6	8.12	7.28	7379
	Total	86.35	7.29	6.37	8702
	Formal	96.21	2.91	0.88	791
Sindh	Informal	80.56	15.06	4.38	4363
	Total	82.96	13.19	3.84	5154
	Formal	94.62	5.02	0.36	279
Balochistan	Informal	87.24	9.09	3.67	1661
	Total	88.3	8.51	3.2	1940

Table A3
Results from Brant Test to Check the Validity of Ordered Logistic Regression

Predictors	Overall Chi2	Overall P> Chi2	Rural Chi2	Rural P> Chi2	Urban Chi2	Urban P> Chi2
All	217.06	0.000	63.97	0.000	29.61	0.005
Informal Head	0.10	0.752	0.22	0.639	1.68	0.195
Age	5.75	0.016	2.42	0.120	4.24	0.40
Gender	0.16	0.691	0.52	0.470	0.03	0.864
Education_HH	2.14	0.144	2.44	0.118	0.13	0.722
Married	1.11	0.293	0.91	0.341	0.14	0.709
HH size	0.14	0.711	0.02	0.892	0.77	0.381
Children	2.07	0.150	3.15	0.076	0.01	0.910
Older	1.18	0.277	0.45	0.505	0.80	0.372
Dependency Ratio	0.42	0.516	0.00	0.991	1.25	0.263
Average schooling	5.52	0.019	2.06	0.152	4.35	0.037
Region	6.93	0.008				
Punjab	37.15	0.000	-0.00	-999.0	0.00	1.000
Sindh	2.25	0.134	2.20	0.138	0.62	0.429
Balochistan	0.03	0.861	0.07	0.786	0.00	0.945

Table A4
Mean Formal and Informal Income of Households at Regional and Provincial Level

		Mean	Std. Err.	95% con	Interval]
	Overall	43673.04	886.9051	41934.63	45411.45
	Rural	33928.92	869.5692	32224.49	35633.35
	Urban	52070.66	1439.38	49249.34	54891.97
Formal	KP	43227.68	1713.602	39868.87	46586.49
	Punjab	45420.24	1673.777	42139.49	48700.99
	Sindh	43322.94	1240.837	40890.79	45755.09
	Balochistan	37378.19	1342.033	34747.69	40008.69
	Overall	19497.33	132.6725	19237.28	19757.38
	Rural	16043.2	120.199	15807.6	16278.8
	Urban	24921.85	270.0867	24392.45	25451.24
Informal	KP	22349.3	466.4975	21434.92	23263.68
	Punjab	20102.89	197.2676	19716.22	20489.55
	Sindh	17073.58	182.9903	16714.9	17432.25
	Balochistan	18681.98	283.2687	18126.75	19237.22