

# Coping Strategies and Inequalities during the COVID-19 Pandemic Period: Evidence from Kenya

By

Eleftherios Giovanis

and

Oznur Ozdamar

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*By*

*Eleftherios Giovanis*

*Izmir Bakircay University, Faculty of Economics and  
Administrative Sciences*

*and*

*Oznur Ozdamar*

*Izmir Bakircay University, Faculty of Economics and  
Administrative Sciences*

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# List of abbreviations and acronyms

COVID-19	Corona Virus Disease 2019
GDP	Gross Domestic Product
FAO	Food and Agriculture Organization
FE-OLS	Fixed-Effects Ordinary Least Squares
FIES	Food Insecurity Experience Scale
HFIAS	Household Food Insecurity Access Scale
IB	Independence of Base
ILO	International Labour Organization
IMF	International Monetary Fund
IV	Instrumental Variables
LSMS	Living Standard Measurement Surveys
MENA	Middle East and North Africa
PSM	Propensity Score Matching
SoL	Standard of Living
SSA	Sub-Saharan Africa
TSLS-FE	Two-State Least Squares Fixed-Effects

# Abstract

Governments worldwide have implemented stringent lockdown measures in response to the COVID-19 pandemic outbreak, which has had an adverse impact on employment, affecting people's public life, health, and wellbeing. People have witnessed job losses, cuts in wages, and a decline in their living standards and quality of life. This study aims to estimate the inequalities and wellbeing costs, demonstrating the living standards necessary to make up for people's wage reduction or job losses. In particular, we aim to explore the coping strategies used to enhance their wellbeing compared to those of households without a coping strategy. We use food insecurity as a measure of wellbeing outcomes. The empirical analysis relies on detailed household surveys from the World Bank Microdata Library. We use seven waves of the Panel COVID-19 Rapid Response Phone Survey with Households in 2020–2022 in Kenya. Also, the results highlight the potential inequalities of the COVID-19 pandemic across gender and types of workers, such as those employed in the informal sector and on temporary contracts. The findings show that specific coping strategies, such as delayed payment obligations, credit purchases, and reduced non-food consumption, are associated with larger inequalities. Regarding the gender of the head of the household, the results suggest that the disparities between female-headed households that had to cope with income and employment loss and female-headed households that did not require to follow any strategy are significantly higher compared to their male counterparts. We derive similar concluding remarks when we consider households with social security coverage and the type of employment contract.

**Key words:** Coping strategies; COVID-19; Food insecurity; Inequalities; Kenya; Panel data; Sub-Saharan region; Risks; World Bank microdata.

# 1. Introduction

COVID-19 is a global health epidemic that has compelled governments worldwide to take unprecedented measures to stop the virus's spread. These measures have included facilitating social distancing, national or local lockdowns, and other restrictions by closing schools/universities, shopping malls, bars-clubs, and businesses. People have endured wage cuts, job losses, and a sharp decline in their standard of living and wellbeing. Likewise, African nations have instituted stringent control measures, such as lockdowns, the cancellation of public events and concerts, the closure of educational and entertainment facilities, restrictions on domestic and international travel, and curfews.

In 2020, due to the COVID-19 pandemic, Africa experienced its worst recession in more than 50 years. The Gross Domestic Product (GDP) decreased by 2.1%, and the GDP per capita fell by approximately 10%. Surprisingly, economic growth increased by 4.5% in the second half of 2021 (International Monetary Fund [IMF], 2022). In 2022, however, the progress was jeopardized by the Russian invasion of Ukraine, which led to soaring food and oil prices that strained the external and fiscal balances of commodity-importing nations and exacerbated food insecurity in several African countries. The economic and food pricing shocks disproportionately affect the most vulnerable segments of the population. Together with the consequences of COVID-19 economic shocks and the risks posed by climate change, they threaten energy affordability and food security (IMF, 2022).

Food security is defined as a state in which people constantly have physical and economic access to sufficient, safe, and nutritious food and can satisfy their nutritional needs and food preferences for a balanced life. Nevertheless, despite significant efforts and achievements in the fight against poverty over the past few decades, many African countries have been experiencing economic recessions. The resulting calamitous impact has severely impacted many households' means of subsistence and income. Numerous African households live below the poverty line and are vulnerable to food insecurity (Juma et al., 2020). Although the poverty rate in Africa has decreased from 54% in 1990 to 41% in 2015 and 34% in 2020, the number of poor has increased from 278 million in 1990 to 413 million in 2015 and 445 million in 2020 as a result of rapid population growth.<sup>1</sup>

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<sup>1</sup> <https://issafrica.org/iss-today/africa-is-losing-the-battle-against-extreme-poverty#:~:text=About%2030%20million%20more%20Africans,lived%20below%20the%20poverty%20line>

The COVID-19 pandemic, one of the greatest public health threats of the last 50 years, substantially impacted African households' socioeconomic status, health, and food security (Dinyo et al., 2020). As a result of the pandemic, numerous government-led restrictions, lockdowns, and interventions have been implemented across the continent to contain the spread of the virus (Ahmadi et al., 2020; Lucero-Prisno, 2020b). These measures have severely damaged the region's food supply and exacerbated Africa's dire food security situation (Lucero-Prisno, 2020a). The various containment strategies, policies, and lockdowns have been associated with food insecurity and decreased food consumption (Hirvonen et al., 2021).

Households are not passive agents, but actively adapt to the shocks they experience to be less vulnerable to future ones. We call these methods of dealing with a difficult situation “coping strategies”. We may categorize them into two groups: those focused on food consumption and those focused on maintaining a stable income that includes livelihood-based coping strategies. Food consumption coping strategies include reducing food consumption and altering eating patterns in response to food shortages, which are short-term actions at the household level. On the contrary, livelihood-based coping strategies are long-term household measures referring to income, assets, and expenditures. Examples include using savings, reducing non-food consumption, selling assets, and borrowing from banks, financial institutions, friends, and relatives.

The motivation of this study is that the impact of shocks on household welfare can be better comprehended by looking at how people respond to economic shocks and how they adapt to them (Khan et al., 2015). Households in low-income nations often rely on informal networks and self-insurance systems to cushion themselves against severe shocks. However, these methods of dealing with adversity typically provide inadequate protection, and some have been linked to negative welfare impacts in the long run, leading to a downward spiral into poverty (Carter et al., 2007; Dabla-Norris & Gündüz, 2014; Nguyen et al., 2020). Therefore, it can be misleading to draw conclusions regarding the effect of shocks without considering shock-coping strategies. For example, it would be misleading to assume that households had adequate protection against a given shock if such protection necessitates the adoption of coping mechanisms that could eventually compromise their future wellbeing (Khan et al., 2015).

This study examines how individuals and households have dealt with employment and income losses and the role of coping strategies in food security. In addition, we intend to estimate the wellbeing costs of the employed coping strategies, i.e., the amount required for a household to achieve the same level of wellbeing as households who did not use any coping strategy. This paper may also provide insights into future studies exploring the inequalities between individuals in different households and explore the intra-household or within-household inequalities.

Overall, we find that households adopting the coping strategies of additional income-generating activities, reliance on savings, selling assets, and receiving support from friends and family experience fewer adverse effects on food security compared

with households adopting other coping strategies. These findings can be explained by the fact that households engaging in additional economic activities may earn more and buffer the adverse effects of income loss on food security because of COVID-19 lockdowns and disruptions in economic activities. Furthermore, households relying on savings may be able to accumulate more income and can be wealthier compared to households implementing other coping mechanisms, as we discuss in the next section. However, our results reveal merely correlations since endogeneity may come from omitted variable bias and reverse causality, as food insecurity may drive households to adopt various coping strategies. Thus, our results should be treated with caution.

The remainder of the paper is structured as follows. In Section 2, we present the literature review on the effects of lockdowns on health, economic outcomes, food security, and living standards during the COVID-19 pandemic. Section 3 examines the conceptual framework of coping strategies and their association with wellbeing. In Section 4 and Section 5, we describe the empirical data and the methodology, respectively; and in Section 6, we present the empirical findings. In Section 7, we discuss the conclusion and policy implications of the study.

## 2. Literature review

### COVID-19 and food insecurity

Previous research has examined the effects of income and employment loss on mental health outcomes, the standard of living, and food insecurity (McKee-Ryan et al., 2005; Howe et al., 2012). During economic recession periods, such as the COVID-19 period examined in this study, the adverse effects of income loss and unemployment can be even more persistent and severe. In an analysis of 172 English scientific papers published between 1 January 1980 and 1 April 2013, Modrek et al. (2013) discovered that unemployment had a significant and negative effect on wellbeing outcomes, particularly during economic downturns. Previous research has demonstrated that economic downturns have a substantial and adverse impact on living standards, health, and psychological wellbeing, particularly among the most vulnerable and disadvantaged groups (Zivin et al., 2011; Karanikolos et al., 2013).

The lockdowns and social distancing measures implemented during the pandemic crisis had severe economic repercussions in Africa. However, the effects vary significantly across nations, industries, and markets (Gondwe, 2020; Lakemann et al., 2020). No study has been conducted, to the best of our knowledge, on the economic impact of the COVID-19 pandemic on the wellbeing and food security of households in sub-Saharan African nations employing coping strategies. In addition, we propose a method for evaluating the costs and disparities related to wellbeing.

During the COVID-19 pandemic, Koos et al. (2020) examined critical aspects of household wellbeing in a sample of sub-Saharan African (SSA) nations. The authors used data from the World Bank high-frequency phone surveys and the World Food Programme in the Democratic Republic of the Congo, Ethiopia, Malawi, Mali, Mozambique, Niger, Nigeria, and Uganda. The report's findings indicate that households lost employment, encountered difficulties accessing healthcare systems and markets, and experienced income declines and food insecurity. Following the lockouts, employment levels dropped significantly but recovered substantially by the summer of 2020 (Koos et al., 2020). From April to October 2020, food insecurity was high, particularly in the Democratic Republic of the Congo, Mali, and Niger, where 50% of households reported insufficient food consumption.

A review of the empirical evidence on the impact of COVID-19 on food insecurity in Africa by Tabe-Ojong et al. (2022a) shows that COVID-19 was associated with food insecurity in both ex-ante and ex-post periods. In addition, their research

provides evidence that households employ various coping strategies, such as dietary modification and food rationing, to mitigate the effects of lockdowns. However, most of these coping strategies correlate negatively with food insecurity. Several studies employ ex-ante simulations to evaluate the impact of containment measures, such as lockdowns and social distancing, on food systems and security (Andam et al., 2020; Arndt et al., 2020; Jha et al., 2021; Nechifor et al., 2021). For example, Arndt et al. (2020) found that distancing measures are associated with substantial economic costs that affect food insecurity and income in South Africa, while Andam et al. (2020) demonstrate that lockdowns cause significant disruption in agri-food systems in Nigeria. COVID-19 affects crop output through labour disruptions and changes in input supply chains, which in turn affect planting area and crop production of essential grains such as maize, rice, millet, and sorghum, which form staple foods in many developing nations (Jha et al., 2021).

Most research on the effect of COVID-19 on food insecurity and consumption relies on household surveys. The Food Insecurity Experience Scale (FIES), developed by FAO, is a commonly used measure of food insecurity (Cafiero et al., 2018). This scale is based on eight questions about the experience of food insecurity, as detailed in the data section. However, because most of the surveys were conducted via mobile phones, and thus the questionnaires had to be brief, some studies utilized one or more of these eight questions. Other studies employ various measures of food insecurity, including the hunger scale, food expenditures, food prices, production and yields, household dietary diversity score, and food disruption (Abay et al., 2021; Hirvonen et al., 2021; Jha et al., 2021; Mahmud & Riley, 2021; Aggarwal et al., 2022; Dietrich et al., 2022; Tabe-Ojong et al., 2022b). Most of these studies (Dasgupta & Robinson, 2021, 2022; Rudin-Rush et al., 2022) rely on World Bank high-frequency surveys, which follow up on pre-pandemic data collected as part of the Living Standard Measurement Surveys (LSMS). Most of these studies find a strong positive correlation between food insecurity, lockdowns, and other containment measures. The outcomes for rural and urban regions are mixed. For example, Adjognon et al. (2021) found that urban households in Mali are more affected than rural households. Maredia et al. (2022) provide evidence of similar food insecurity effects in both urban and rural areas of Kenya, Nigeria, Senegal, and Zambia.

## **Coping strategies**

During the COVID-19 pandemic, households resorted to various coping strategies, including a reduction in consumption, the use of savings, and borrowing, to mitigate the impact of income shocks and employment loss caused by COVID-19 on mental health, living standards, and food security. Households have utilized coping strategies, including food-based coping strategies, such as reducing food intake and consumption (Tabé-Ojong et al., 2022a, 2022b). Another common coping strategy is support from family and friends through remittances and government aid (Abay et al., 2021; Akim et al., 2022; Dasgupta & Robinson, 2021, 2022; Maredia et al., 2022). Other coping strategies include stockpiling, reducing food quantity, quality, and variety, reducing

food diversity, selling assets and livestock, borrowing from banks, and dipping into savings (Dasgupta & Robinson, 2021, 2022; Kansime et al., 2021; Mueller et al., 2022; Tabe-Ojong et al., 2022a, 2022b; Giovanis & Ozdamar, 2023). Kansime et al. (2021) examined the relationship between coping strategies and food insecurity using data from an online survey with 442 respondents in Kenya and Uganda. According to their findings, more than two-thirds of respondents experienced income shocks during the COVID-19 pandemic crisis; in Kenya and Uganda, food-insecure households increased by 38% and 44%, respectively. Most households have experienced a decline in food security and were more likely to employ food-based coping strategies, such as reducing the number of meals per day, going without food during the day, and consuming less food overall.

Tabe-Ojong et al. (2022b) utilized information from a pre-COVID-19 survey and a phone survey conducted in the rural areas of Baringo County, Kenya, the Zambezi region of Namibia, and the Morogoro and Iringa regions of Tanzania. Coates et al. (2007) created the Household Food Insecurity Access Scale (HFIAS), which measures reductions in food intake, perceptions of food insufficiency in quantity and quality, and feelings of uncertainty regarding food access. The analysis employs the coping strategies index (Maxwell & Caldwell, 2008), which comprises five components: the reduction in food intake, the reduction in nutritious and desirable goods, the increase in food search, government support, and family support. Their findings indicate that countermeasures implemented during the COVID-19 period are associated with a 36.4% increase in food security. In general, households reduced their consumption of desirable foods and food intake.

Using data from the High-Frequency Phone Surveys on COVID-19, Dasgupta and Robinson (2021) investigated the role of coping strategies in food insecurity in nine African nations: Chad, Djibouti, Ethiopia, Kenya, Malawi, Mali, Nigeria, South Africa, and Uganda. Their analysis centres on two coping strategies. The first is borrowing from family, friends, and non-profit organizations, and the second is using savings. This study indicates that households that rely on their savings are less likely to experience food insecurity. Nonetheless, this finding is related to the economic background of those households, as wealthier households are also more likely to have more savings, which they can use to cope with a loss of income during economic recessions and shocks and to maintain their standard of living.

Nevertheless, prior research indicates that some coping strategies were insufficient to sustain households, resulting in further economic hardship, a decline in wellbeing, and persistent food insecurity. For example, Egger et al. (2021) utilized information from 30,000 respondents from 16 household surveys in nine countries. These consist of three Asian nations, Bangladesh, Nepal, and the Philippines; one Latin American nation, Colombia; and five African nations, Burkina Faso, Ghana, Kenya, Rwanda, and Sierra Leone. Overall, their study's conclusion indicates that government aid and coping strategies were insufficient to sustain the wellbeing of households.

### 3. Conceptual framework

Even though COVID-19 infection rates in sub-Saharan Africa, including Kenya, have been lower than those in other regions, economic consequences have been severe due to falling global demand and local efforts to contain the pandemic (Janssens et al., 2021). On 13 March 2020, Kenya confirmed the first case of COVID-19, prompting the country to take steps to stop the spread of the virus. On March 15th, schools were shut down, and employees were told to telecommute if possible. As a result, all international flights were suspended, and restaurants and bars were shut down. On March 27th, a curfew was imposed across the country. Nairobi, Mombasa, Kilifi, and Kwale counties were some of the most affected areas, and travel restrictions were put in place (Were, 2020).

Choices in coping mechanisms affect food security in a wide range of ways. The negative effects of a drop in income on food security may be reduced or eliminated if a family has sufficient assets, savings, or social support. People may resort to maladaptive coping mechanisms like cutting back on food intake, borrowing from banks, delaying payment obligations, and accumulating credit card debt if they lack access to adequate resources. At some point, households might deplete their productive assets as a last resort.

Following Huston's social-ecological theory (Huston, 2000), in Figure 1, we illustrate the conceptual framework of the link between coping strategies and food insecurity. The COVID-19 pandemic severely disrupted food systems worldwide prompting governments to take unprecedented measures to stop the disease's spread. As a result, this caused food price increases and unanticipated disruptions in the agri-food supply chains. Most households rely on urban food markets for their livelihoods, which ultimately threaten their ability to provide for themselves. According to Kansiime et al. (2021), retail prices increase as the level of activity at workplaces and retail stores declines. The authors found a 0.3% increase in food prices followed by a 10% drop in workplace activities.

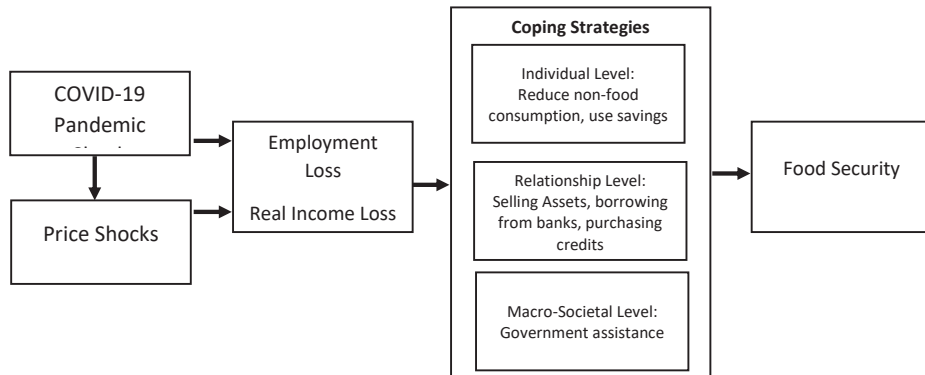
In coastal areas, maize production has plummeted by 99% leading to food shortages and a rise in food prices (De Groote, 2020). On the supply-side, food prices in wholesale and retail marketplaces may increase due to a shortage of supplies, especially in deficit markets. In addition, prices increased due to production and harvest constraints imposed by labour shortages and the lack of available inputs along the value chain. As a result of these disruptions, the quantity of goods entering urban

wholesale marketplaces, which also supply downstream retail stores, decreased, placing upward pressure on wholesale pricing (Varshney et al., 2020). Because of these constraints, retail prices in Nairobi rose between 10% and 35% between March and December 2020 (Kunyanga et al., 2023).

Thus, according to Figure 1 and the empirical evidence (Varshney et al., 2020; Kunyanga et al., 2023), the health and economic shocks caused by the lockdowns, infections, and disruption in the production and market activity because of COVID-19 have directly and indirectly decreased the income and living standards of households. The direct path refers to the decline of income, which can be attributed to unemployment and job losses, and a reduction in income because of a reduction in working hours, wages and a drop in economic activity. The indirect effect refers to the reduction of real income because of increased prices. Following the discussion in the previous section and based on Huston's social-ecological theory and the study by Sohel et al. (2022), households adopt various coping strategies to cope with income loss, which affects food insecurity. We categorize coping strategies into the individual level, which includes the reduction in consumption and use of savings, and the relationship level, which refers to coping strategies of selling assets, purchasing on credit, borrowing from banks and delaying payment obligations. The third category is the macro-societal level, which includes assistance from friends and the government.

The coping strategies employed in this study can be divided into two groups (Nguyen et al., 2020). The first group refers to self-insurance strategies that include selling durable assets, reducing consumption, depleting savings, relying on credit purchases, delaying payment obligations, and borrowing from banks and employers. The second group refers to risk-sharing strategies, which include receiving assistance or borrowing from family and friends. The literature demonstrates that formal insurance mechanisms to safeguard households against severe shocks are often inadequate in developing economies (Dercon, 2002; Heltberg et al., 2015). Therefore, families in these nations frequently resort to risk-sharing and self-insurance practices as informal shock-coping mechanisms (Dercon, 2002; Heltberg et al., 2015). When people in a community or organization plan to help one another financially when disaster strikes or pandemics spread, they engage in risk-sharing strategies, such as credit purchases, borrowing from banks and receiving assistance. Self-insurance strategies refer to the reallocation of households' resources, such as selling assets and depleting savings.

**Figure 1: Theoretical framework for the link of food insecurity and coping strategies through Huston's social-ecological theory**



Families may have various coping options available, depending on the nature of the shocks they face. To hedge against unexpected drops in income, the consumption insurance model suggests that households pool resources to mitigate the effects of economic uncertainty (Deaton, 1997). Household consumption is assumed to be fully protected in optimal risk-sharing. However, these mechanisms are not always effective and comprehensive because of moral hazard and knowledge asymmetry (Alderman & Paxson, 1994). Moreover, risk-sharing mechanisms have a restricted capacity to shield households against covariate shocks. As a result, households may resort to self-insurance coping mechanisms or reach out to friends and family outside the impacted region for help and assistance to cope with climate-related shocks (Alderman & Paxson, 1994).

Other coping methods include borrowing from financial institutions, delaying payment obligations, and buying on credit. These coping methods involve borrowing and, consequently, debt. Previous studies have attempted to disentangle the effects of economic stress, financial pressure, and wellbeing indicators, including depression, health, and food insecurity, by focusing on debt and credit card use (Drenea & Lavrakas, 2000; Solomon, 2001; Caplan & Schooler, 2007; Hojman et al., 2016; Knol et al., 2018; Brewer, 2020). It is desirable and acceptable, so people will work to strike a balance between their income and outgoings, as argued by Manning (2000). Contrariwise, acquiring additional resources results in credit overstretch and excessive spending. These are linked to a decline in health and wellbeing due to factors like depression, anxiety, marital instability, a lack of motivation to achieve life goals, and stress, among others (Drenea & Lavrakas, 2000; Grafova, 2007; O'Neill et al., 2007). Furthermore, borrowing from family and friends typically does not require interest rate payments, unlike borrowing from banks (Bond et al., 2019). Consequently, this may provide additional relief and mitigate the adverse impact of the extra financial burden on food security.

The option to borrow, meaning no credit or financial restraints, might boost economic wellbeing by facilitating more consistent and smoothing spending patterns and processes. Debt-financed spending may, therefore, be perfectly regular, as it can

lead to the optimal utility by amassing a “precautionary stock” of wealth and assets and as it might offset the influence of income volatility on consumption in some cases (Bertola et al., 2006). Debt-based spending can be considered prospective so long as the inability or lack of an option to borrow has a negative impact on welfare and wellbeing. Therefore, debt does not always have a negative impact; if handled properly, it can have a positive effect.

However, the impact of debt depends on the source of borrowing. It can vary depending on whether a person borrows from formal institutions offering loans, such as banks, finance companies, and credit unions, or from informal sources, such as family and friends. A person's ability to borrow from family and friends is a significant factor when assessing their net worth and capital accumulation and can serve as a form of financial security and income protection by supplementing their regular income (Kotlikoff & Spivak, 1981; Kinnan & Townsend, 2012; Ambrus et al., 2014).

Consumption reduction is one of the options available to debtors facing repayment that may alleviate their financial burden (Dyner & Edelberg, 2013; Kukk, 2016). On the other hand, a decrease in consumption may adversely affect health and food security (Headey et al., 2008; Dumludag, 2015; Gokdemir, 2015). Another coping strategy that can alleviate financial stress is savings, which is associated with greater wellbeing (Howell et al., 2006; Gokdemir, 2015). If household members cannot maintain pre-shock income levels, households may use their savings to sustain food security at the pre-shock level. Kansiime et al. (2021) discovered that members of savings groups in Kenya and Uganda are less likely to experience a negative economic impact due to COVID-19. Households may require additional strategies, such as selling assets to maintain pre-shock food consumption levels when savings are insufficient.

Overall, we assume that households adopting a coping strategy are more likely to be food insecure than those that do not. We argue, however, that some coping strategies may cushion food-insecure households from experiencing food insufficiency compared to the situation they could be in if they would not adopt those strategies. These include borrowing or receiving support from family and friends, using savings, and engaging in additional income-generating activities. Furthermore, they may improve their situation compared to the households that did not need to adopt any coping strategy. This is because we use fixed effects and, thus, investigate the changes within individuals and households, implying that they adopt specific coping strategies to improve their wellbeing outcomes more than the households that have not adopted any coping strategy. Finally, those coping strategies may provide a cushion to food insecurity compared to households adopting other coping mechanisms, such as borrowing from financial institutions or delaying payment obligations that create debt.

## 4. Data

The empirical analysis relies on detailed household surveys derived from the World Bank Microdata Library (<https://microdata.worldbank.org/index.php/catalog>). More specifically, we will derive the data using seven rounds-waves of the Panel Rapid Response Phone Survey in Kenya in 2020–2022. The first wave was held between May 14 and July 7, 2020, and the seventh round was conducted between the 5 November 2021 and 31 March 2022. The surveys are publicly and freely available. We should highlight that there is the eighth round available conducted between 31st of May and the 8th of July 2022. However, we prefer to exclude this wave from the empirical analysis because on 24 February 2022, Russia invaded Ukraine, and this could lead to biased estimates. In particular, the Russian invasion of Ukraine has led to dramatic increases in energy and food prices that have led to further increases in food insecurity, including in Africa (IMF, 2022). While the seventh wave was completed on 31 March 2022, we assume that the Russian invasion had no immediate impact on food prices that could have been reflected in food expenditures, food insecurity, and perceptions of wellbeing in March 2022 since the wave started on 15 November 2021.

We will use food insecurity as a measure of wellbeing. The first set of questions related to food insecurity includes dummy variables. More specifically, the first variable answers as Yes or No on whether respondents are worried the household would not have enough. The second variable asks if any adult household member, over the last 30 days, went hungry because of lack of food, answering to Yes/No. Similarly, the third variable answers Yes if the household couldn't access staple food over the last month and No (implying the household had access). The fourth variable is whether the household reduced food consumption. The last two variables refer to the type of meals and, in particular, whether the meal included meat or fish on the last day and whether the household had a meal that included eggs.

The second set of food insecurity variables is continuous. Variables include the number of days (over the past seven days) children and adults in the household have gone to bed hungry, have skipped meals, have gone an entire day without food, and whether any adult in the household went hungry because of lack of food in the last month.

Regarding living standards, we use two variables. The first is wealth, and the second is the weekly household expenditures. Concerning the wealth variable, we will construct an index of the assets belonging to the household in the current wave-round of the survey. These questions indicate whether the household has a radio, mattress, *Jiko* charcoal, refrigerator, television, computer, and laptop or tablet.

The second variable is the weekly household expenditures, expressed in Kenyan shilling (Ksh), and refer to the expenses related to food and grocery; personal and household items, such as soap and cleaning agents; assets and durables, such as livestock; electronic and kitchen equipment; vehicles and furniture; communication and local services, such as recreational activities, internet, and phone expenses. Other categories include housing expenses that refer to home repairs; rent and mortgage; energy and utilities that include firewood, electricity, and water; transport and medical services, such as tickets, petrol, tolls, hospital costs, consultation fees, and medicine. We should note that excluding the food expenditures does not affect our results. Furthermore, due to space limitations, we report the summary statistics in Appendix A.

As we mentioned earlier, we will consider a rich set of coping strategies. These include, *selling assets, receiving support from family and friends, borrowing from family and friends, engaging in additional income-generating activities, borrowing from financial institutions and banks, credit purchase, delaying payment obligations, selling harvest in advance, reducing non-food consumption, relying on savings, and receiving assistance from the government.*

## 5. Methodology

### Fixed-effects

The first step involves the estimation of the following regression:

$$y_{iht} = \beta_0 + \beta'CS_{iht} + \beta_1wealth_{ht} + \delta'X_{iht} + \mu_i + \rho_j + \theta_t + \varepsilon_{iht} \quad (1)$$

Where:  $y$  denotes the outcomes explored, which is the wellbeing outcome for individual  $i$ , household  $h$  in county (Kaunti za)  $j$  and in wave-round  $t$ . We use two measures for the wellbeing outcome as we described in the previous section (Data). Variable  $wealth$  denotes the living standards, which is constructed using the set of assets described in the data section (e.g., radio, television, etc.). More specifically, we take the factor analysis or the principal component analysis normalizing with values between 0 (low levels of wealth) and 1 (high levels of wealth). Set  $\mu_i$  captures any time-invariant unobserved effects that vary across individuals,  $\rho_j$  denotes the county fixed effects, and the time or wave fixed effects are represented by  $\theta_t$ . We will repeat regression (1), replacing the wealth index with the logarithm of the weekly household expenditures index described in the previous section, and the wages when we explore workers with and without social security and workers with a permanent or temporary employment contract in the appendix.

Vector  $X$  includes the control variables, such as age, marital status, education level, employment status, household size, and whether the area is urban or rural. The main variable of interest is CS, which represents the coping strategy taken by the household as a response to the income loss caused by the lockdowns and restrictions during the COVID-19 pandemic period, such as *receiving help from friends and family, reduced spending, selling assets or livestock; loans from friends; loans from banks*, and other strategies mentioned in the previous section. The next step is to estimate the inequalities between those who adopted a coping strategy and those who did not have to do as:

$$WBC = -dy/dx = -(\partial y/\partial CS)/(\partial y/(\partial wealth)) \quad (2)$$

Where:  $WBC$  denotes the wellbeing cost, which shows the amount of living standards proxied by wealth, household expenditures, and wages required for the

household to bring food security to the levels of those who did not have to adopt any coping strategy. The  $dy$  and  $dx$  are the first derivatives of the theoretical function, and in our case, we have the first derivative of the outcome function (e.g., food insecurity) with respect to the CS, which is the coefficients  $\beta'$  in Equation 1, over the first derivative of the outcome function with respect to the wealth (coefficient  $\beta_1$ ). In the case of household expenditures and wages, we take the first derivative of logarithms, so the marginal effects will not be derived only by coefficient  $\beta_1$ . In the case of household expenditures and wages, we take the first derivative of logarithms, so the marginal effects will not be derived only by coefficient  $\beta_1$ . As described in Appendix A1, we construct a food insecurity index. Thus, we employ the Fixed-Effects Ordinary Least Squares (FE-OLS) regressions.

We should highlight that, in the regressions, we control for the regional lockdowns. We derive the information from the COVID-19 Government Measures Dataset<sup>2</sup>. The data set considers together all the measures implemented by governments worldwide in response to the Coronavirus pandemic. The information falls within five categories: social distancing, lockdowns, public health measures, movement restrictions, and social and economic measures. While the nationwide curfew or lockdown from 7:00 PM to 5:00 AM was in place, certain counties have implemented additional measures. Thus, based on this information, we construct a categorical variable. In particular, the first category includes the counties of Nairobi, Kilifi, Mombassa, and Kwale, where a cessation of movement by road, rail or air in and out of those counties was implemented from the 6 April 2020 until July 2020. Thus, we define this category for the counties mentioned above during wave 1. The second category includes the counties of Nairobi, Mombassa, and Mandera. In these counties, for public transportation vehicles to enter or leave these zones, providers must first obtain obligatory certification from the Ministry of Health in conjunction with the Ministry of Transport. This restriction came into force in September 2020 and applied to wave 2 in our data. The third category includes the cessation of movement into and out of the counties of Nairobi, Kajiado, Machakos, Kiambu, and Nakuru.

Furthermore, no physical gathering in places of worship was allowed, operations of bars were suspended, and restaurants had to offer takeaway services only. This restriction was implemented in March 2021, and we assigned it in the fifth wave of our data. The last category includes all counties implementing the nationwide curfew, but no additional restrictions are applied. For example, while we assign the county of Mandera in the second category and wave 2, we include this county in the last category and the rest of the waves.

Another control variable is the support from the government. More specifically, the variable refers to whether the household in the 14 days before the interview has received assistance in the form of money, goods or a job through a government

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See for more details: <https://www.acaps.org/covid-19-government-measures-dataset>

programme. This question includes various programmes, such as the Kenyan National Safety Net Programme.

Finally, we include county-specific time trends to control for unobserved factors that might confound the coping strategies and eliminate exogenous factors on food security. Also, we may assume that, depending on the households and the area, the coping strategies adopted may vary during the period of the analysis. Overall, the results remain almost identical with the benchmark fixed-effects, excluding the county-specific time trends.

## 6. Empirical results

In Table 1, we report the fixed-effects estimates for the coping strategy of selling assets; however, the aim is also to show the estimated coefficients of the control variables. In Table 2, we report the fixed-effects (FE) estimates along with the IV-FE and the FE using the matched sample derived from the propensity score matching approach; in contrast, the main aim is not to identify the determinants of food insecurity. Nevertheless, the estimates and concluding remarks remain similar for the remaining coping strategies. Overall, we observe that wealthier households, expressed by the estimated coefficient of wealth index, are more likely to experience lower levels of food insecurity or equivalently higher levels of food security. We recall our food insecurity index takes values between 0 and 1, where higher levels indicate higher levels of food insecurity or lower levels of food security. Therefore, a negative of an estimated coefficient will imply higher food insecurity levels or more sustainable food security.

Similarly, households with respondents having completed a higher educational attainment experience lower levels of food insecurity compared to the reference category, which is no-formal education. Exceptions are pre-primary education that, for some reason, experience higher levels of food insecurity. Based on the data, one explanation could be that most households with no formal education work in additional agricultural and farming activities. This gives them access to food from their farming production and moderates the adverse effects of income and employment loss because of COVID-19 and lockdowns on food security. On the other hand, those with a pre-primary education work more in enterprises, while respondents with higher levels of education, such as college and university, are employed as workers in enterprises but with higher earnings. The last category of the education level refers to the graduation from Madrassa/Duksi school, as we describe in Table A1 in Appendix A. Unemployment and households in rural areas are more likely to experience higher levels of food insecurity. The age of the head of the household presents a non-linear relationship with food insecurity, where increases in age are associated with lower levels of food insecurity; and after a turning point of 53 years, the household reports higher levels of food insecurity.

**Table 1: Fixed-effects for coping strategy of selling assets and food insecurity index**

Variables	Coefficients	Variables	Coefficients
Selling Assets	0.0263*** (0.0036)	Education Level - College	-0.0916*** (0.0106)
Wealth Index	-0.0977*** (0.0102)	Education Level -University undergraduate	-0.1138*** (0.0122)
Age of the Head of Household	-0.0035** (0.0016)	Education Level - University postgraduate	-0.1468*** (0.0182)
Age of the Head of Household Squared	0.000033* (0.000017)	Education Level - Madrasa/ Duksi	0.0162 (0.0567)
Education Level (Reference Category: No Formal Education)		Unemployed (Yes)	0.0810*** (0.0038)
Education Level - Pre-primary	0.0474*** (0.0115)	Urban Area	-0.0238** (0.0112)
Education Level - Primary	-0.0129 (0.0101)	Household Size	0.0093*** (0.0009)
Education Level - Post-primary, vocational	-0.0299** (0.0132)	Number of Observations	71,358
Education Level - Secondary	-0.0378*** (0.0102)	R-Square	0.0829

Notes: Standard errors within the parentheses. \*\*\*, \*\* and \* indicate significance at the 1%, 5%, and 10% level, respectively.

In Table 2, we replicate the estimations for the rest of the coping strategies, including the coping strategy of selling assets. This ratio is the percentage change in wealth necessary for households to adopt a coping strategy to achieve the same degree of wellbeing, measured by food security, as households that have not chosen a coping strategy. In addition, we find that the ratio of the coping strategy coefficient is positive (indicating higher levels of food insecurity), and the sign of the wealth index coefficient is negative (implying lower levels of food insecurity or equivalently higher levels of food security); so the sign of the proportion of wellbeing is negative. For example, in the case of selling assets, households that choose to implement this coping strategy need an additional increase of 0.27 or 27% in wealth to achieve the same level of food security as households that have not implemented any coping strategy.

In all cases, we detect similarities in the proportion of wellbeing. An exception is the coping strategy of borrowing from banks and financial institutions, where the value found is 0.70. Furthermore, in the coping strategy of delaying payment obligations, the proportion of wellbeing is 162%. In the last regression, we find a negative sign of the no-coping strategy as expected, which takes a value of 1 if the household has not

adopted any coping strategy, and 0 if the household has adopted any coping strategy. As a result, households using no coping strategy are approximately 1.90 times as wealthy as those using any coping strategy.

Overall, we find the lowest discrepancies in the coping strategy of engaging in additional income-generating activities, reliance on savings, selling assets, and receiving support from friends and family. These findings can be explained by the fact that households engaging in additional economic activities may earn more and buffer the adverse effects of income loss on food security because of COVID-19 lockdowns and disruptions in economic activities. Furthermore, households relying on savings may be able to accumulate more income and can be wealthier compared to households implementing other coping mechanisms. The proportions of wellbeing range between 20% and 40% for the coping strategies of additional income-generating activities and reliance on savings, and they range between 70% and 180% for the remaining coping strategies. The discrepancies are significantly higher in the coping strategy of delaying payment obligations and reducing non-food consumption at 175%. The results highlight the disparities across households adopting different coping strategies and emphasize the additional costs and needs, especially of households that need to reduce non-food consumption.



In Table 3, we perform the same regressions, but we consider the logarithm of the household expenditures instead of the wealth index. In this case, household expenditures are measured on a weekly basis. Furthermore, since the expenses in monetary values are recorded in the surveys, we can also calculate the inequalities in monetary values instead of percentages as we did with the wealth index. The coefficient of household expenditures is different from that of wealth, as expected, and we take the first derivative with respect to the logarithm of the expenses.

In Table 3, we may interpret the results as the amount the households with coping strategies require to equalise their wellbeing, expressed by food security, to households without coping strategies. For example, considering the coping strategy of selling assets and the FE-OLS, we find that households adopting this strategy require compensation of 12% of their weekly household expenditures, corresponding to Ksh380 per week. In other words, they need an income increase of around Ksh380 per week for the households selling assets to equalise their food security levels to households not adopting any coping strategy.

In addition, in the last regression, which considers households who have adopted any coping strategy and households without a coping strategy, the proportion of wellbeing is 85%. This finding implies that households without coping strategies are wealthier, in terms of weekly household spending, by 85% than households with coping strategies. Alternatively, households with a coping strategy need to spend 85% more to equalise their wellbeing, measured by food security levels, to households not adopting any coping strategy. This percentage translates to Ksh2,700.

In tables 4–5, we report the FE-OLS estimates considering the other two measures of food insecurity described in the data section. In particular, in Table 4, we consider the number of days adults in the household went to bed hungry in the past seven days, and in Table 5, we perform the regressions for the children. As we present the results by gender and employment characteristics, we find, in some cases, a negative relationship between coping strategy and the number of days a family member, an adult or a child, had gone to bed hungry. More specifically, we find this negative association in the regressions of the engagement in additional income-generating activities, delaying payment obligations, selling harvest in advance, and relying on savings.

**Table 3: Regressions estimates for coping strategies and food insecurity index using household expenditures**

Variables	Coefficients	Variables	Coefficients	Variables	FE-OLS	Variables	FE-OLS
Selling Assets	0.0263*** (0.0036)	Receiving Support from Family and Friends	0.0534*** (0.0034)	Delaying Payment Obligations	0.1472** (0.0031)	Selling Harvest in Advance	0.1138*** (0.0048)
Logarithm of Household Expenditures	-0.0300*** (0.0015)	Logarithm of Household Expenditures	-0.0306*** (0.0015)	Logarithm of Household Expenditures	-0.0292*** (0.0015)	Logarithm of Household Expenditures	-0.0309*** (0.0015)
Proportion of Wellbeing Monetary Value	-0.12 380	Proportion of Wellbeing Monetary Value	-0.22 700	Proportion of Wellbeing Monetary Value	-0.67 2,125	Proportion of Wellbeing Monetary Value	-0.47 1,490
Number of Observations	71,232	Number of Observations	71,232	Number of Observations	71,232	Number of Observations	71,232
R-Square	0.0877	R-Square	0.0861	R-Square	0.1216	R-Square	0.0971
<b>Variables</b>	<b>FE-OLS</b>	<b>Variables</b>	<b>FE-OLS</b>	<b>Variables</b>	<b>FE-OLS</b>	<b>Variables</b>	<b>FE-OLS</b>
Borrowing from Family and Friends	0.1001*** (0.0046)	Engaging in Additional Income-Generating Activities	0.0321*** (0.0023)	Reducing non-Food Consumption	0.1672*** (0.0020)	Relying on Savings	0.0376*** (0.0021)
Logarithm of Household Expenditures	-0.0316*** (0.0015)	Logarithm of Household Expenditures	-0.0310*** (0.0015)	Logarithm of Household Expenditures	-0.0328*** (0.0014)	Logarithm of Household Expenditures	-0.0321*** (0.0015)
Proportion of Wellbeing Monetary Value	-0.40 1,270	Proportion of Wellbeing Monetary Value	-0.12 380	Proportion of Wellbeing Monetary Value	-0.65 2,060	Proportion of Wellbeing Monetary Value	-0.15 475
Number of Observations	71,232	Number of Observations	71,232	Number of Observations	71,232	Number of Observations	71,232
R-Square	0.0951	R-Square	0.0858	R-Square	0.1926	R-Square	0.0918
<b>Variables</b>	<b>FE-OLS</b>	<b>Variables</b>	<b>FE-OLS</b>	<b>Variables</b>	<b>FE-OLS</b>	<b>Variables</b>	<b>FE-OLS</b>
Borrowing from Financial Institutions and Banks	0.0720*** (0.0035)	Credit Purchase	0.1190*** (0.0022)	Receiving Assistance from the Government	0.1323*** (0.0053)	No Coping Strategy	-0.1916*** (0.0022)
Logarithm of Household Expenditures	-0.0303*** (0.0015)	Logarithm of Household Expenditures	-0.0318*** (0.0015)	Logarithm of Household Expenditures	-0.0483*** (0.0023)	Logarithm of Household Expenditures	-0.0304*** (0.0014)
Proportion of Wellbeing Monetary Value	-0.30 950	Proportion of Wellbeing Monetary Value	-0.48 1,520	Proportion of Wellbeing Monetary Value	-0.35 1,110	Proportion of Wellbeing Monetary Value	0.85 2,695
Number of Observations	71,232	Number of Observations	71,232	Number of Observations	71,232	Number of Observations	71,232
R-Square	0.0936	R-Square	0.1293	R-Square	0.0791	R-Square	0.1689

**Notes:** Standard errors within the parentheses. \*\*\*, \*\*, \* and \* indicate significance at the 1%, 5%, and 10% level, respectively.

Thus, for example, we find that the proportion of wellbeing in the regressions of savings is 0.18, indicating that households relying on savings are 18% better off, or households without using savings require an increase of 18% to equalise their wellbeing. More specifically, in Table 4, wellbeing is food insecurity measured by the number of days adults went to bed hungry. We derive the same concluding remarks in Table 5 for the number of days children in households have gone to bed hungry over the seven days before the interview date. In particular, we find a negative relationship between coping strategies and food insecurity in the same regressions, as in Table 4.

On the other hand, we see a positive relationship between the remaining coping strategies and food insecurity. Therefore, in the regression of the coping strategy of selling assets, in Table 4, we find the proportion of wellbeing is 0.17 and 0.30, indicating that households implementing this coping strategy require an increase in wealth by 17% to equalise the number of days for adults that have gone to bed hungry, and a rise of 30% for the food insecurity measured by the days the children have gone to bed hungry. Similarly, tables 6–7 report the same regression but include the logarithm of the weekly household expenditures instead of the wealth index. Taking the case of the coping strategy of selling assets, we find that households require an increase in wealth by 11% to equalise the number of days for adults that have gone to bed hungry. In other words, an increase of 11% in weekly household expenditures (which is used as a proxy for income) will reduce the number of days the adults will go to bed hungry. The 11% corresponds to Ksh350 or US\$3.2 per week in 2021 prices. The required increase for the children in Table 7 is 23% corresponding to Ksh730 or US\$6.7 per week.

However, as we discuss in more detail in Appendix A, the food insecurity variables in tables 4–7 are measured on the past seven days, while we construct the food insecurity index in tables 2–3 based on the last 30 days before the interview date. Moreover, the measures in table 4–7 are unidimensional, measuring only the number of days a household member went to bed hungry. On the other hand, the food insecurity index is a multidimensional variable that considers perceptions like whether or not a family is anxious about having enough food. It also considers issues related to food availability, such as whether or not people's dietary intake decreased and whether or not they had access to staple foods.

**Table 4: Regressions estimates for coping strategies and food insecurity – Number of days adults in household have gone to bed hungry (past seven days) using the wealth index**

Variables	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients
Selling Assets	0.0646*** (0.0099)					
Receiving Support from Family and Friends		0.0792*** (0.0097)				
Borrowing from Family and Friends			0.1785*** (0.0148)			
Engaging in Additional Income-Generating Activities				-0.1094*** (0.0053)		
Borrowing from Financial Institutions and Banks					0.1587*** (0.0082)	
Credit Purchase						0.1029*** (0.0252)
Wealth Index	-0.3819*** (0.0271)	-0.3856*** (0.0271)	-0.3898*** (0.0269)	-0.3877*** (0.0270)	-0.3921*** (0.0271)	-0.3872*** (0.0271)
Proportion of Wellbeing	-0.17	-0.21	-0.46	0.28	-0.40	-0.26
Number of Observations	71,176	71,176	71,176	71,176	71,176	71,176
R-Square	0.0826	0.0870	0.0841	0.0875	0.0821	0.0817
Variables	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients
Delaying Payment Obligations	-0.0213** (0.0098)					
Selling Harvest in Advance		-0.0284** (0.0117)				
Reducing non-Food Consumption			0.1872*** (0.0055)			
Relying on Savings				-0.0696*** (0.0052)		
Receiving Assistance from the Government					0.0368** (0.0182)	
No Coping Strategy						-0.1180*** (0.0068)
Wealth Index	-0.3873*** (0.0271)	-0.3874*** (0.0271)	-0.3866*** (0.0271)	-0.3793*** (0.0270)	-0.4042*** (0.0320)	-0.3908*** (0.0270)
Proportion of Wellbeing	0.055	0.07	-0.48	0.18	-0.09	0.30
Number of Observations	71,176	71,176	71,176	71,176	47,404	71,176
R-Square	0.0817	0.0818	0.0821	0.0697	0.0378	0.0863

Notes: Standard errors within the parentheses. \*\*\* and \*\* indicate significance at the 1% and 5% level, respectively.

**Table 5: Regressions estimates for coping strategies and food insecurity – Number of days children in household have gone to bed hungry (past seven days) using the wealth index**

Variables	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients
Selling Assets	0.0623*** (0.0079)					
Receiving Support from Family and Friends		0.0199*** (0.0063)				
Borrowing from Family and Friends			0.0830*** (0.0109)			
Engaging in Additional Income-Generating Activities				-0.0502*** (0.0039)		
Borrowing from Financial Institutions and Banks					0.0963** (0.0463)	
Credit Purchase						0.0718*** (0.0045)
Wealth Index	-0.2085*** (0.0196)	-0.2070*** (0.0197)	-0.2086*** (0.0196)	-0.2077*** (0.0196)	-0.2095*** (0.0197)	-0.2069*** (0.0197)
Proportion of Wellbeing	-0.30	-0.10	-0.40	0.24	-0.46	-0.35
Number of Observations	71,199	71,199	71,199	71,199	71,199	71,199
R-Square	0.0728	0.0725	0.0729	0.0736	0.0715	0.0714
Variables	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients
Delaying Payment Obligations	-0.0290*** (0.0056)					
Selling Harvest in Advance		-0.0327*** (0.0079)				
Reducing non-Food Consumption			0.0901** (0.0440)			
Relying on Savings				-0.0244*** (0.0037)		
Receiving Assistance from the Government					0.0331*** (0.0087)	
No Coping Strategy						-0.0648*** (0.0049)
Wealth Index	-0.2088*** (0.0197)	-0.2079*** (0.0197)	-0.2072*** (0.0197)	-0.2046*** (0.0196)	-0.1862*** (0.0203)	-0.2095*** (0.0196)
Proportion of Wellbeing	0.14	0.16	-0.44	0.12	-0.18	0.31
Number of Observations	71,199	71,199	71,199	71,199	47,404	71,199
R-Square	0.0717	0.0716	0.0715	0.0720	0.0289	0.0740

Notes: Standard errors within the parentheses. \*\*\* and \*\* indicate significance at the 1% and 5% level, respectively.



Logarithm of Household Expenditures	-0.0759*** (0.0050)	-0.0748*** (0.0050)	-0.0754*** (0.0051)	-0.0716*** (0.0051)	-0.0784*** (0.0058)	-0.0739*** (0.0051)
Proportion of Wellbeing Monetary Value	0.035	0.038	-0.29	0.11	-0.12	0.24
Number of Observations	110	120	920	350	380	760
R-Square	71,053	71,053	71,053	71,053	47,398	71,053
	0.0834	0.0835	0.0838	0.0856	0.0372	0.0731

Notes: Standard errors within the parentheses. \*\*\* and \*\* indicate significance at the 1% and 5% level, respectively.

**Table 7: Regressions estimates for coping strategies and food insecurity – Number of days children in household have gone to bed hungry (past seven days) using the logarithm of household expenditures**

Variables	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients
Selling Assets	0.0591*** (0.0079)					
Receiving Support from Family and Friends		0.0229*** (0.0063)				
Borrowing from Family and Friends			0.0879*** (0.0110)			
Engaging in Additional Income-Generating Activities				-0.0485*** (0.0039)		
Borrowing from Financial Institutions and Banks					0.0872** (0.0083)	
Credit						0.0976* (0.0505)
Purchase Logarithm of Household Expenditures	-0.0320*** (0.0036)	-0.0325*** (0.0036)	-0.0337*** (0.0036)	-0.0306*** (0.0036)	-0.0322*** (0.0036)	-0.0323*** (0.0036)
Proportion of Wellbeing Monetary Value	-0.23	-0.09	-0.33	0.20	-0.15	-0.17
Number of Observations	730	285	1,045	635	475	540
R-Square	71,075	71,075	71,075	71,075	71,075	71,075
	0.0581	0.0710	0.0725	0.0729	0.0708	0.0710
Variables	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients
Delaying Payment	-0.0303*** (0.0056)					
Obligations Selling Harvest in Advance		-0.0299*** (0.0078)				
Reducing non-Food Consumption			0.0855*** (0.0148)			
Relying on Savings				-0.0226*** (0.0037)		

Receiving Assistance from the Government					0.0316** (0.0146)	
No Coping Strategy						-0.0684*** (0.0049)
Logarithm of Household Expenditures	-0.0325*** (0.0036)	-0.0320*** (0.0036)	-0.0324*** (0.0036)	-0.0311*** (0.0036)	-0.0249*** (0.0032)	-0.0316*** (0.0036)
Proportion of Wellbeing Monetary Value	0.12	0.12	-0.34	0.10	-0.16	0.28
Number of Observations	380	380	1,075	315	505	885
R-Square	71,075	71,075	71,075	71,075	47,398	71,075
	0.0712	0.0710	0.0727	0.0713	0.0272	0.0732

Notes: Standard errors within the parentheses. \*\*\* and \*\* indicate significance at the 1% and 5% level, respectively.

Finally, the food insecurity index considers a household's nutritional habits and capacity, including its consumption of protein-rich foods like meat, fish, and eggs. So, as we indicated before, a family who relies on savings or delay payments may decrease the likelihood that an adult or child will go to bed hungry.

On the other hand, as shown in tables 2–3, these households are more likely to report higher degrees of food insecurity and require a greater rise in wealth to equalise their food security levels with the households that have not followed similar coping strategies. While these coping mechanisms may lessen the frequency of a family member going to bed hungry, this does not guarantee improved dietary habits or health. Thus, these coping strategies may reduce the severity of food insecurity brought on by the loss of income and work during the COVID-19 period lockdowns. Results for food security in tables 4–7 are only relevant for the past week. In contrast, the food insecurity score in Table 2 is estimated using data collected over the previous month and considers the quantity, quality, and nutritional value of food consumed.

In Appendix A, we decompose our analysis by gender. We also focus only on workers, using the logarithm of wages and performing the FE-OLS regressions by social security coverage and the type of contract. In particular, we consider the sample of workers with social security coverage versus those without social security. Similarly, we take the sample of workers with a permanent contract and compare the estimates to workers with a temporary arrangement.

However, the study has drawbacks. First, even though we attempted to address endogeneity using IV approaches, still the results should be treated with caution, and that we merely presented correlations. The second critical limitation of the study is the available data on household income. In particular, we can estimate the inequalities more accurately by recording the exact amount of income. However, the surveys do not record this information. For this reason, we used the wealth index and household

expenditures. Furthermore, we used the wages, but this implies that we limit the sample only to employed respondents. Third, while we used panel data, it would be interesting and more accurate if we had information about the coping strategies before the COVID-19 pandemic.

## 7. Conclusions

In this study, we have explored the role of various coping strategies followed during the COVID-19 pandemic in Kenya. Furthermore, we have estimated the wellbeing costs or the proportion of wellbeing that shows how much the respondents who have adopted a coping strategy require to equalise their wellbeing levels with those who have not adopted any coping strategy. The study may offer insights into the design of policies and safety nets, including unemployment benefits, health insurance, and furlough retention schemes aiming to support people during the pandemic and other types of economic recessions. The findings also reveal a need for further studies and intervention for the population, especially those with a higher stress risk, such as women, informal and temporary workers, and those implementing specific coping strategies.

In general, we found the lowest disparities in the coping strategies of engaging in new income-generating activities, relying on savings, selling assets, and getting support from friends and family. This finding can be explained by the fact that households engaged in additional economic activities may earn more and mitigate the adverse effects of income loss on food security resulting from COVID-19 lockdowns and disruptions in financial operations. Moreover, households that rely on savings may earn higher incomes and accumulate more wealth than those that utilize alternative coping mechanisms. The percentage of wellbeing range from 20% to 40% for the coping strategies of additional income-generating activities and relying on savings; and the range is from 80% to 130% for the remaining coping strategies. Nevertheless, the disparities are much more significant for the coping strategies of reducing non-food consumption (175%), delaying payment responsibilities (162%), and credit purchase (160%). The results stress the inequalities between households adopting various coping strategies and the increased expenses and needs, particularly for households that need to reduce non-food consumption.

When we limited the sample to female-headed families, households using a coping strategy require a more considerable rise in wealth to achieve the same level of wellbeing measured by the food insecurity index as female-headed households not adopting a specific coping strategy. In certain instances, there are fewer differences between female-headed households with and without coping strategies than there are between male-headed households with and without coping strategies. However, female-headed households that did not require coping strategies were 2.15 times

more affluent than those that did. The difference between male-headed families with a coping strategy and those without is 1.78. This finding highlights the discrepancies between households adopting coping strategies and the gender of the household. We derive similar concluding remarks for respondents with social security coverage and a permanent contract.

Moreover, we have shown a method that can be used to measure inequalities in wellbeing, such as food insecurity, and also can be implemented in other objective and subjective wellbeing outcomes, including life satisfaction, health outcomes, and poverty. It can also be extended and applied in future studies using panel data across various demographic and socioeconomic groups. However, the survey used in this study, developed and conducted by the World Bank in collaboration with the Kenya National Bureau of Statistics and the University of California, Berkeley, should record the exact amount of household income that will allow for more precise estimates of inequalities.

An effort to address this issue was to focus the sample of analysis on workers, as shown in tables A6–A9 in Appendix A. Nevertheless, we take only the salaries, and we ignore the household income and thus a large number of other respondents within the households, such as retired, students, people with impairments, housekeepers, and others. More specifically, the results showed respondents adopting coping strategies and having no social security coverage require an additional wage of 59% to equalise their food security levels with those without coping strategies and no social security. This percentage translates into monetary values of Ksh4,090, corresponding to US\$75 per month. The respective amount required for workers with social security in households having adopted any coping strategy to reach the food security of households without coping strategies but having social security is 53%, which corresponds to Ksh6,570 per 14 days and is equivalent to US\$60 per 14 days or US\$120 per month. Another interesting point for future studies is the wellbeing estimation exploring the inter-household and intra-household inequalities.

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# Appendixes: Online supplementary material

## Appendix A. Statistics

### ***A1. Summary statistics***

In Table A1, we report the summary statistics of the variables employed to construct the food insecurity index and the two independent variables used to estimate inter-household inequalities: coping strategies and the variables used to construct the wealth index. In Panel A, we present the 11 coping strategies and whether the household has adopted a coping strategy. The questions answer whether the household has adopted a coping strategy in the last 30 days to cope with income and employment loss in the COVID-19 period. More specifically, almost 18% of the sample has not adopted any coping strategy, while the remaining 82% has implemented at least one strategy. We observe that most households have reduced food consumption and relied on savings ranging between 34% and 36.7%, followed by engagement in additional income-generating activities at almost 30% and purchased credits at 24.14%; 11.53% has relied on support from family and friends. Other coping strategies include selling assets and delaying payment obligations at 9.63% and 10.49%, respectively, followed by borrowing from banks at 8.88%. The least adopted strategies include borrowing from family and friends at 5.41%, selling harvest in advance at 5% and receiving assistance from the government at around 4.10%.

In Panel B, we report the food insecurity variables, and in Panel B1, we present the proportions of the households facing difficulties with food consumption. In particular, based on the available data and including as many households as possible, we use six variables to construct the food insecurity index. We should highlight that variables take a value of 1 if the households face difficulties and 0 otherwise. Thus, a positive estimated coefficient sign will imply a higher level of food insecurity.

Three variables refer to food insecurity over the last month. The first answer was whether any adult in the household went hungry because of a lack of food, and almost 36.8% answered “Yes”. The second question was whether the household could not access staple food at 29.30%. The third question concerns whether respondents are worried the household would not have enough food. More than half of the respondents have expressed worriedness, at 56.57%. The fourth variable used to construct the food insecurity index is the reduction in food consumption, and 37.8% of the sample has

replied that they have experienced a drop. The following two variables refer to the lack of quality and nutrition components of food consumption that may reflect food insecurity. The first question asks whether the household had a meal, including meats or fish, on the last day, and the second asks whether the household had a meal that included eggs. About 75.63% answered that their meals did not include fish and meat, and another 81.20% had not eaten an egg over the day before the survey interview. To construct the food insecurity index, we apply the principal component analysis in the first step and take the fitted values. At this point, we may notice that considering the factor analysis make no changes in the regression estimates. In the second step, we standardize the variable, taking values between 0 and 1, where values higher and closer to 1 imply higher levels of food insecurity, and lower values indicate lower or higher levels of food insecurity.

In Panel B2, we report the food insecurity continuous variables. In particular, the first measures the number of days an adult member in the household went to bed hungry over the last week before the interview date. The second refers to the children. We should mention that there are other variables, including the number of days that adults and children in the households skipped meals over the last seven days, but the results are very close to those derived from the first two measures. The following two available variables measure the days an adult or a child has gone an entire day with no food over the last week. However, in this case, there is not enough variation. Also, we focus on other aspects due to space limitations, such as decomposing the analysis by gender and social security coverage.

In Panel C, we report the asset factors used to construct the wealth index. Our methodology is identical to that used in creating the food insecurity index. A value of 1 shows whether the household owns a specific item or asset, such as a radio, mattress, charcoal Jiko, refrigerator, television, non-mobile phone/landline and a computer, laptop or tablet, and 0 otherwise. The last two variables take a value of 1 if the household has internet access and is connected to the electricity grid. We should notice that there are two other variables in the survey, about whether the household owns a washing machine, a bed, a table, a chair, and a bicycle. However, this information is recorded only in the seventh wave. Thus, we do not include them in constructing the wealth index.

Overall, most households own a radio and a mattress, 4.80% of the sample own a refrigerator, and 5.8% own a computer, laptop or tablet. Furthermore, we show that only 0.46% of households own a non-mobile or landline phone. However, this low proportion is because most households may use a mobile phone. Nevertheless, even if we exclude this variable, our results remain robust. We also report the second measure of living standards, which is the weekly household expenditures used as a proxy for income, since surveys do not record information on the household income but only for wages.

We report the summary statistics for the central control variables in panel D. We should also point out that we control the county of residence. However, since there are 47 counties in the sample, we do not report the statistics in Table A1. In panel

D1, we present the continuous variables, and in panel D2, we report the summary statistics for the categorical variables. In panel D1, we observe that the average age of the head of the household in our sample is 45 years old. We prefer to include the age and gender of the head of the household to control for potential inequalities across gender and between households that adopt a coping strategy. The average household size is 4.2. Even though the maximum household size is 27, this is only 0.01% of the sample, while the cumulative percentage for households larger than 10 is only 1%.

Moreover, excluding these households does not affect our estimates. The survey records the wage earned in the last 14 days. We do not include this control variable since we will limit the sample only to the employed respondents. However, in Appendix A, we will report the employed respondents' estimates, considering whether the employment contract offers a permanent or fixed position and social security.

In panel D2, we report the summary statistics for the categorical variables. In most cases, the gender head of household is male at 64.74%, and the remaining 35.26% is female. The variable unemployed takes a value of 1 if the respondent is unemployed at 8.80% and 0 otherwise. In this case, 91.20% includes both employed and those not in the labour force. The following categorical variable is the education level. Most respondents completed secondary school, at 46.78%, followed by primary school at 30.18% and college at 10.82%. A tiny minority has completed the Madrassa/Duksi at 0.06%, which are Islam-centred schools. The social security coverage includes employed respondents, and we will use this variable when we limit our analysis only to employed people. Most of them (65.39%) have no social security.

We highlight that we do not report the proportions for marital status. The reason is that we have many missing values across individuals and waves. Thus, we will significantly reduce the number of observations that may likely lead to a selection bias. Nevertheless, we will present in Appendix A the regression estimates using marital status as an additional control variable. While the summary statistics do not provide detailed information, we also present the correlation matrix in Appendix A. Moreover, the regression estimates in the next section will give more insights into the study's aim.

**Table A1: Summary statistics for coping strategies, food insecurity, and wealth index**

Panel A: Coping Strategies	Yes	No	Panel A: Coping Strategies	Yes	No
Selling assets	9.63	90.37	Delaying payment obligations	10.49	89.51
Receiving support from family and friends	11.53	88.47	Selling harvest in advance	5.03	94.97
Borrowing from family and friends	5.41	94.59	Reducing non-food consumption	36.65	63.35
Engaging in additional income-generating activities	29.56	70.44	Relying on savings	34.12	65.88
Panel A: Coping Strategies	Yes	No	Panel A: Coping Strategies	Yes	No

Borrowing from financial institutions and banks	8.88	91.12	Receiving assistance from the government	4.09	95.91
Credit purchase	24.14	75.86	No coping strategy	18.07	81.93
Panel B: Food Insecurity	Yes	No	Panel B: Food Insecurity	Yes	No
Panel B1: Categorical Variables					
Any adult in household went hungry because of lack of food (last month)	36.79	63.21	Reduce Food Consumption	37.39	62.61
Household couldn't access staple food (last month)	29.30	70.70	Did any of the meals your household ate yesterday didn't include meat or fish?	75.63	24.37
Worry that the household would not have enough food (last month)	56.57	43.43	Did any of the meals your household ate yesterday didn't include eggs	81.20	18.80
Panel B2: Continuous Variables					
No. of days Adults in household have gone to bed hungry (past 7 days)	Average	Standard Deviation	Minimum	Maximum	
No. of days Children in household have gone to bed hungry (past 7 days)	0.2111	0.6709	0	7	
Panel C: Wealth and Asset Index	Yes	No	Panel C: Wealth Index	Yes	No
Radio	89.71	10.29	Non-Mobile (Landline) Phone	0.46	99.54
Mattress	93.03	6.97	Computer-Laptop-Tablet	5.78	94.22
Charcoal Jiko	72.10	27.90	Is your home physically connected to the electricity grid?	54.58	45.42
Refrigerator	4.80	95.20	Does your household have access to the internet at home?	78.48	21.52
Television	51.41	48.59			

**Table A1 (Cont.): Summary statistics**

Panel D: Control Variables and other characteristics	Average	Standard Deviation	Minimum	Maximum	
Panel D1: Continuous Variables					
Age of the Head of Household	45.051	14.148	18	100	
Household Size	4.2207	2.1207	1	27	
Weekly Household Expenditures	3,173.616	3,707.921	8	117,200	
Wage last 14 days in Kenyan shilling (Ksh)	9,470.107	7,568.315	0	100,000	
Panel D2: Categorical Variables					
	Male	Female	Unemployed	Yes	No
Gender of the Head of Household (Female)	64.74	35.26		8.80	91.20
	Urban	Rural	Social Security Coverage	Yes	No
Area	52.16	47.84	Primary	34.61	65.39
	No Formal Education	Pre-primary	University	Post- primary, vocational	Secondary
	2.89	4.90	30.18	0.99	46.78
	College	University	University	Madrasa/ Duksi	
Education Level	10.82	2.88	postgraduate	0.06	

## A2. Additional estimates

In Table A2, we show that coping mechanisms are positively correlated to food insecurity, except for the no-action, which is negatively related and indicates the household did not need to adopt any coping strategy. We observe the highest correlation for the coping strategy of reducing non-food consumption, followed by credit purchases, borrowing from family and friends, and delaying payment obligations. The correlation matrix in Table A2 also shows the positive relationship between most of the coping strategies explored and the wealth index. Exceptions include engagement in additional income-generating activities, borrowing from banks, delaying payments, receiving assistance from the government, and relying on savings.

This may indicate that wealthier households have accumulated more savings, allowing them to use those savings in recession periods. Borrowing from banks may reflect the restrictions and criteria of banks to lend to more reliable customers and wealthier that can repay the debt. Table A2 also illustrates the correlation among the coping strategies. For example, receiving support from family and friends, borrowing from family, friends or banks, selling harvest in advance, reducing non-food consumption, and government support are positively related to the coping strategy of selling assets.

On the contrary, the remaining coping mechanisms are negatively related to the propensity to adopt the coping strategy of selling assets. Households whose head is older or female are more likely to experience higher levels of food insecurity. Moreover, as expected, large families and unemployment are positively related to food insecurity. Since education level is a categorical variable, we do not report the correlation in Table A2. Furthermore, we excluded other variables, such as the social security coverage and whether the area is urban or rural, due to the space size of Table A2. The main text mentions that our regressions do not control marital status since we have missing information and observations. Nevertheless, Table A3 reports the fixed-effects estimates, including marital status. The results remain robust as in all cases the proportions of wellbeing found are very close to those reported in tables 1–2. We should notice that the estimated coefficient signs differ between the regressions in Table 2 and Table A3, which is expected because of the lower number of observations in Table A3. However, what is significant is the proportion of wellbeing, which is the increase in wealth required to improve the food security level of households with coping strategies and equalise them with the food security levels of households that have not adopted any coping strategy.

Next, we report the estimates by the gender of the household head. The motivation for performing those estimates relies on the fact that the recession has disproportionately affected female workers (ILO, 2020). Due to the COVID-19 pandemic, inequalities persist across demographic and socioeconomic groups in the African and MENA region countries, as in many other regions of the world. Women comprise most healthcare and social service workers in the region and are at the centre of the health emergency response, putting them at greater risk of contracting the virus. In most African nations, implementing containment measures to halt the spread of the pandemic has increased the amount of unpaid care work performed by women, who have had to shoulder the additional burden of homeschooling and caring for the sick and elderly. Due to regionally-specific systemic barriers associated with unequal economic opportunities and pervasive gender biases, the economic impact of the crisis is more likely to be felt by women's employment, businesses, and incomes than men. Women are overrepresented among domestic workers, agricultural workers, and small traders, who are among the informal workers most vulnerable to these threats.

In Table A4, we report the fixed-effects estimates by gender and when the outcome is the food insecurity index. Similarly, Table A5 presents the estimates considering the number of days an adult went to bed hungry in the past week. We do not report the estimates considering the food security outcome measured by the number of

days a child had to go to bed hungry, as we did in Table 4 for the total sample, as the concluding remarks remain similar. In Table A4, we observe that the proportion of wellbeing in all cases is higher in the female sample than in men. More specifically, we conclude that, when we limit the analysis to the sample of households, where the gender of the head is female, households adopting a coping strategy require a higher increase in wealth to equalise their wellbeing level, expressed by the food insecurity index, to the levels of households not adopting a coping strategy. For example, households with a female head that had to sell assets to cope with income and employment loss report a lower level of wellbeing or lower level of food security by 0.38. Thus, these households need a higher wealth level of 0.38 to reach the wellbeing levels of female-headed households that have not adopted any coping strategy. On the other hand, male-headed households that have sold assets report a lower wellbeing level at 0.23, or they require a higher wealth level by 0.23 to equalise their level of wellbeing or food security level with the wellbeing of male-headed households that have not adopted this strategy.

However, it is interesting to highlight that when we compare male and female-headed households with coping strategies, we find no significant differences in food security. More specifically, we limit our analysis only to households that have adopted a particular coping strategy, and then we compare whether there is a difference in food security. To investigate these differences, we have created a dummy that takes a value of 1 for the female-headed households adopting a specific coping strategy and a value of 0 for the male-headed households adopting the specific coping strategy. In this case, the estimated coefficients of the wealth index and the weekly household expenditures are negative and significant, as we found earlier, implying higher levels of food security. However, the estimated coefficient of the dummy explained above is insignificant in all cases, except for purchasing credits and using savings, where we found a negative coefficient implying that female-headed households adopting those coping mechanisms are better off than their male counterparts.

In Table A5, the results are mixed, as in various cases we find an insignificant relationship between the coping strategy and food insecurity. In particular, in Table A5, similar to tables 3–4, the estimated coefficient of the coping strategy shows the number of days an adult or adults have gone to bed hungry in the past days. For example, the number of days an adult member went hungry in male-headed households adopting the coping strategy of selling assets is higher by 0.0709 than in male-headed households that have not adopted this strategy.

Nevertheless, there is no difference in food insecurity in various cases between female-headed households adopting specific coping strategies and female-headed households not adopting them. These include borrowing from banks and selling harvests in advance. Nonetheless, in some cases, such as selling assets, receiving support from family and friends, engaging in additional income-generating activities, and borrowing from banks, there are lower differences among female-headed households with and without coping strategies compared to male-headed households.

The analysis in tables A4–A5 shows the inequalities between households adopting a coping strategy and those that have not adopted one for the same gender of the head of household.

We should highlight that in some cases, we find a negative relationship between the coping strategy and the number of days a member had gone to bed hungry, similar to the results in tables 3–4. Examples include reliance on savings, engagement in additional income-generating activities, delaying payment obligations, and selling harvest in advance. However, this food insecurity variable is measured on the last seven days, while the food insecurity index is constructed based on a monthly basis, such as whether a person went hungry, whether the household is worried there will not be enough food, or the household couldn't access staple food over the last 30 days. Furthermore, the index relies on the quality of food consumption, such as whether the household had a meal with fish, meat, or eggs the day before the interview. Thus, the wellbeing outcome in Table A5 captures the food insecurity only in the last seven days and does not include the quality of food. For example, a household that adopts the coping strategy of savings or delaying payment obligations may reduce the likelihood of an adult going into bed hungry compared to households that have not adopted this strategy. However, as shown in tables 1–2 and Table A4, the coping strategy is associated with a higher level of food insecurity measured in 30 days.

Furthermore, a coping strategy may reduce the number of days an adult goes to bed hungry, but it does not imply that the quality of food consumption and nutrition is enhanced as well. As in tables 3–4, the positive sign of the proportion of wellbeing highlights a higher food security level (equivalently low level of our food insecurity index). Similarly, a negative sign implies a lower level of food security or a higher food insecurity level.

The last estimate considers households that do not need to adopt any coping strategy, shown by the negative sign of the estimated coefficient, indicating that these households report lower levels of food insecurity (higher food security level). The concluding remark in Table A6 is that female-headed households that did not need to adopt any coping strategy are 2.15 times wealthier than the female-headed households that had to follow any coping strategy. The difference between male-headed households with and without adopting a coping strategy is 1.78. Therefore, the findings highlight that there are more enormous inequalities between female-headed households that had to cope with income and employment loss than female-headed households that did not require to follow any strategy.

In tables A6 and A7, we report the estimates for the food insecurity index and the number of days an adult had gone to bed hungry by the social security coverage. More specifically, in this case, we limit our sample only to workers and perform the regressions by workers with and without social security coverage. As in the case of female-headed households, we find that when we consider only the households where the worker has no social security coverage, the inequalities between households with and without coping strategies are more enormous. Exceptions are relying on savings and selling harvest in advance, and the inequalities between households with and

without coping strategies when the worker has social security coverage are broader. For example, in the case of savings, workers with security coverage adopting the particular coping strategy need an additional wage of 0.17 or 17% to reach the food security levels of the households comprising workers with security coverage that have not adopted any coping strategy. On the other hand, workers without security coverage and using savings require an additional wage of 0.12 or 12% to reach the food security level of the households without using savings.

Since we limit the sample to workers, we consider the logarithm of salary or wage instead of the wealth index. The primary justification is that the salary allows us to estimate the proportion of wellbeing and the monetary values required to equalise wellbeing, measured by the food insecurity between households with and without a coping strategy. We could apply the same for the total sample; however, the surveys employed in this study do not record any information related to household income. Moreover, if we considered the wage, we would limit the sample only to workers, as in tables A6–A7. Nevertheless, we should highlight that the concluding remarks are similar if we consider the wealth index.

As an example, we look at the estimates for the workers with no social security coverage that had to borrow from family and friends to cope with income and employment loss, which are 0.814 or 81.4% worse in terms of food security than workers that have not adopted any coping strategy. Alternatively, workers who borrowed from family and friends need an increase in their wage at 0.49 or 49% to equalise their wellbeing or food security to the households that have not adopted any coping strategy. This finding translates to a monetary value of Ksh3,400, as we derive it from the product of the wellbeing proportion or inequality–0.49 and the average wage of workers with no social security coverage. Workers with social security coverage who have borrowed from family and friends require an additional wage of 0.45 or 45%, which translates to Ksh6,430, to equalise their wellbeing or food security to households that have not borrowed from family and friends. In many cases, we find that the proportion of wellbeing or inequalities can be higher in one group. In this example, the disparities for workers without social security are higher than those with social security.

At this point, we should highlight that, when we express the inequalities in monetary values, the amount of money is higher for workers with social security. However, the interpretation is incorrect, as one group may earn a higher wage. For example, for the workers with social security, the average wage in the last 14 days is Ksh14,290, more than double the average wage of workers without social security coverage which is Ksh6,935. This finding explains the higher monetary values in our previous example, which is Ksh6,430 for the workers with social security compared to Ksh3,400, even though the proportion of the additional wage increase required in the former group is 0.45, and in the group of workers without social security coverage is 0.49. Therefore, we should consider the proportions of wellbeing or the percentage of the additional wage required to equalise the wellbeing, measured by the food insecurity in our study, as a measure of inequality, instead of the monetary values. Then,

the monetary values may serve as a guide of the money required in each group to reduce the disparities between households with and without coping strategies. Considering the average exchange rate of the US dollar to Ksh in 2020–2021, as this is the main period of our analysis, and the previous example, the amount of workers' wage with social security required to equalise their wellbeing with workers without borrowing from family and friends, corresponds to US\$59 in 14 days or US\$118 per month. Similarly, for workers without social security, the amount of Ksh3,400 equals US\$63 per month.

As we found in Table 2 of the main text and Table A5, when we decomposed the analysis by gender, we found a negative sign of the coefficient in the regression of no coping strategy. As a reminder, we assign the dummy variable with a value of 1 if the households did not need to adopt any coping strategy, implying that there was no need to adopt any coping mechanism discussed in this study. The dummy also takes a value of 0 if the household adopted any coping strategies we explored in this study. As expected, the coefficient is negative and shows that households without coping strategies enjoy a lower level of food insecurity (or higher level of food security). In our analysis of workers by social security coverage, we find that households with no social security coverage and those that have not adopted any coping strategy are enjoying a higher level of food insecurity by 0.59. In other words, households with coping strategies and no social security coverage require an additional wage of 0.59 or 59% to equalise their food security levels with those without coping strategies. This percentage translates into monetary values of Ksh4,090, corresponding to US\$37 for 14 days or US\$74 per month. The respective amount required for workers with social security in households having adopted any coping strategy is 0.53 or 53%, which corresponds to Ksh7,570 and is equivalent to US\$70 per 14 days or US\$140 per month.

Similarly, in Table A7, we report the estimates for the number of days adults went hungry to bed. For example, in the coping strategy of borrowing from family and friends, workers with social security coverage require an increase of 0.20 or 20% in their wage to equalise the food security or minimize the days the adults go to bed hungry to Ksh2,860. The disparity for households without social security and between those selling assets and those that have not used any coping strategy is 0.24 or 24%, requiring an additional amount of Ksh1,665. As we found in the previous tables, some coping strategies are associated with a reduction in the number of days adults go to bed hungry. These include the coping strategy of engaging in additional income-generating activities, credit purchases, and relying on savings. However, as we discussed earlier, these coping strategies may moderate the adverse impact of income and employment loss because of the lockdowns during the COVID-19 period on food insecurity. Still, the food security outcome in Table A7 refers to the last seven days, while the food insecurity index in Table A6 relies on the period of the previous month and the quality and nutrition of food consumption.

We follow a similar interpretation for the analysis across the type of contract, where in Table A8 we report the results using the food insecurity index described in the data section. In Table A9, we present the fixed-effects regression estimates using the number of days adults went to bed hungry in the past week before the interview

date. We decompose the analysis by workers with a permanent contract and those with a fixed, temporary or casual contract. In most cases, we find that the inequalities between the households with and without coping strategies are broader for workers with a non-permanent contract, except for the coping strategies of borrowing from banks and selling the harvest in advance.

For example, in Table A8, when we consider the coping strategy of borrowing from family and friends, the workers with a non-permanent contract in households adopting this coping strategy require an additional 64% of wage or Ksh5,090. This is the amount needed to equalise their wellbeing or the number of days adults go to bed hungry with households that have not adopted any coping strategy. This amount corresponds to US\$47 over 14 days or US\$94 per month. The additional amount for workers with a permanent contract is 56% or Ksh8,580, corresponding to US\$157 per month. In contrast, we find broader inequalities between workers with a permanent contract in households that have sold the harvest in advance to cope with income and employment loss. These are estimated at 57% or Ksh8,730, equivalent to US\$160 per month. The respective increase in the wage of workers with a non-permanent contract is 55% or Ksh4,370, equal to US\$80 per month.

In Table A9, we find disparities between workers with and without coping strategies, and the discrepancies are larger for those with no permanent contract. Exceptions are the coping strategies of borrowing from friends and family at 33% and 30%, respectively, and for workers with and without a permanent contract, delaying payment obligations at 25% and 16%, respectively. We should notice that in tables 4–7 in the main text, we find a negative relationship between food insecurity and coping strategies, such as delaying payment obligations and selling harvest in advance, while in Table A9, we find a positive relationship. This finding can be explained by the sample size and type, since in tables 4–7 we consider the total sample, while in Table A9 we limit the analysis only to workers where we have information recorded about their type of contract.

The findings also show that savings are negatively related to food insecurity, implying higher food security levels, as in tables 4–7. However, this is significant only for the workers with a permanent contract, while engaging in additional income activities is negative for both samples of workers explored. On the one hand, we find a negative relationship between food insecurity and the coping strategy of purchasing on credit for the workers with a permanent contract, but a positive relationship is found for the workers without a permanent job. Thus, the former group improve their food security levels by purchasing on credit and reducing inequalities with their counterparts who have not purchased on credit. On the other hand, workers without a permanent contract who have purchased on credit need an additional wage of Ksh875 to equalise their food security levels with those who have not adopted any coping strategy. In some cases, such as for the coping strategies of selling assets, borrowing from banks, and receiving assistance from the government, we find insignificant disparities between respondents adopting those strategies and those who have not, for workers with and without a permanent contract.

**Table A2: Correlation matrix**

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Food Insecurity Index	1.000																
(2) Wealth Index	-0.156 (0.000)	1.000															
(3) Selling Assets	0.095 (0.000)	-0.046 (0.000)	1.000														
(4) Family Support	0.107 (0.000)	-0.112 (0.000)	0.000 (0.899)	1.000													
(5) Borrowing from Family	0.193 (0.000)	-0.194 (0.000)	0.062 (0.000)	0.215 (0.000)	1.000												
(6) Additional Income Activities	0.042 (0.000)	0.080 (0.000)	-0.062 (0.000)	-0.010 (0.001)	-0.051 (0.000)	1.000											
(7) Borrow from Bank	0.074 (0.000)	0.054 (0.000)	0.114 (0.000)	-0.002 (0.569)	0.080 (0.000)	-0.073 (0.000)	1.000										
(8) Credit Purchase	0.241 (0.000)	-0.023 (0.000)	-0.002 (0.600)	0.065 (0.000)	0.096 (0.000)	0.127 (0.000)	0.023 (0.000)	1.000									
(9) Delay Payments	0.164 (0.000)	0.023 (0.000)	-0.040 (0.000)	-0.041 (0.000)	-0.017 (0.000)	0.182 (0.000)	-0.010 (0.001)	0.306 (0.000)	1.000								
(10) Sold Harvest	0.107 (0.000)	-0.001 (0.647)	0.009 (0.006)	0.005 (0.096)	-0.011 (0.001)	0.084 (0.000)	-0.018 (0.000)	0.098 (0.000)	0.162 (0.000)	1.000							
(11) Reduce Consumption	0.349 (0.000)	-0.010 (0.002)	0.041 (0.000)	0.048 (0.000)	0.008 (0.012)	-0.023 (0.000)	0.064 (0.000)	0.209 (0.000)	0.130 (0.000)	0.107 (0.000)	1.000						
(12) Savings	0.027 (0.000)	0.099 (0.000)	-0.015 (0.000)	-0.056 (0.000)	-0.046 (0.000)	0.125 (0.000)	0.062 (0.000)	0.170 (0.000)	0.204 (0.000)	0.103 (0.000)	0.137 (0.000)	1.000					
(13) Government Support	0.073 (0.000)	-0.075 (0.000)	0.078 (0.000)	0.005 (0.187)	-0.027 (0.000)	-0.103 (0.000)	0.221 (0.000)	-0.043 (0.000)	-0.059 (0.000)	-0.018 (0.000)	-0.024 (0.000)	0.137 (0.000)	1.000				
(14) No-Coping	-0.301 (0.000)	-0.002 (0.570)	-0.146 (0.000)	-0.180 (0.000)	-0.147 (0.000)	-0.285 (0.000)	-0.143 (0.000)	-0.260 (0.000)	-0.150 (0.000)	-0.101 (0.000)	-0.340 (0.000)	-0.314 (0.000)	-0.076 (0.000)	1.000			
(15) Age of the Head	0.064 (0.000)	-0.120 (0.000)	0.025 (0.000)	0.112 (0.000)	0.002 (0.593)	-0.071 (0.000)	-0.061 (0.000)	0.000 (0.905)	-0.020 (0.000)	0.038 (0.000)	0.009 (0.004)	-0.038 (0.000)	0.069 (0.000)	0.013 (0.000)	1.000		
(16) Gender Head	0.009 (0.006)	-0.003 (0.332)	-0.029 (0.000)	0.057 (0.000)	-0.005 (0.101)	0.016 (0.000)	-0.002 (0.495)	0.005 (0.099)	0.005 (0.141)	-0.005 (0.116)	-0.023 (0.000)	-0.003 (0.406)	-0.007 (0.084)	-0.024 (0.000)	-0.056 (0.000)	1.000	
(17) Unemployed	0.085 (0.000)	0.039 (0.000)	-0.018 (0.000)	0.031 (0.000)	0.025 (0.000)	0.021 (0.000)	0.015 (0.000)	0.074 (0.000)	0.031 (0.000)	-0.035 (0.000)	0.035 (0.000)	-0.007 (0.040)	-0.028 (0.000)	-0.058 (0.000)	-0.054 (0.000)	0.024 (0.000)	1.000
(18) Household Size	0.156 (0.000)	-0.091 (0.000)	0.069 (0.000)	-0.030 (0.000)	0.051 (0.000)	-0.034 (0.000)	-0.025 (0.000)	-0.003 (0.361)	-0.012 (0.000)	0.049 (0.000)	0.046 (0.000)	-0.029 (0.000)	-0.063 (0.000)	0.004 (0.215)	0.161 (0.000)	-0.097 (0.000)	-0.009 (0.011)

**Note:** P-values within the parentheses.

**Table A3: Fixed-effects estimates including marital status**

Variables	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients
Selling Assets	0.0295*** (0.0072)					
Receiving Support from Family and Friends		0.0494*** (0.0068)				
Borrowing from Family and Friends			0.0818*** (0.0091)			
Engaging in Additional Income-Generating Activities				0.0202*** (0.0044)		
Borrowing from Financial Institutions and Banks					0.0650*** (0.0063)	
Credit Purchase						0.1096*** (0.0045)
Wealth Index	-0.0887** (0.0406)	-0.0857*** (0.0206)	-0.0892*** (0.0205)	-0.0819*** (0.0207)	-0.0895*** (0.0205)	-0.0881*** (0.0204)
Proportion of Wellbeing	-0.33	-0.57	-0.92	-0.25	-0.72	-1.24
Number of Observations	23,274	23,274	23,274	23,274	23,274	23,274
R-Square	0.0770	0.0778	0.0798	0.0753	0.0896	0.1101
Variables	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients
Delaying Payment Obligations	0.1363*** (0.0062)					
Selling Harvest in Advance		0.1105*** (0.0100)				
Reducing non-Food Consumption			0.1626*** (0.0039)			
Relying on Savings				0.0301*** (0.0041)		
Receiving Assistance from the Government					0.1404*** (0.0111)	
No Coping Strategy						-0.1911*** (0.0044)
Wealth Index	-0.0865*** (0.0203)	-0.0889*** (0.0207)	-0.0979*** (0.0197)	-0.0811*** (0.0206)	-0.1060*** (0.0291)	-0.0968*** (0.0197)
Proportion of Wellbeing	-1.57	-1.24	-1.67	-0.38	-1.32	1.97
Number of Observations	23,274	23,274	23,274	23,274	13,893	23,274
R-Square	0.1034	0.0828	0.1758	0.0794	0.0588	0.1603

Notes: Standard errors within the parentheses. \*\*\* indicates significance at the 1% level.

**Table A4: Fixed-effects estimates by gender of the head of household and food insecurity index**

Variables	Males	Females	Variables	Males	Females
Selling Assets	0.0257*** (0.0045)	0.0306*** (0.0069)	Receiving Support from Family and Friends	0.0496*** (0.0048)	0.0575*** (0.0054)
Wealth Index	-0.1099*** (0.0138)	0.0792*** (0.0180)	Wealth Index	-0.1046*** (0.0136)	-0.0840*** (0.0179)
Proportion of Wellbeing	-0.23	-0.38	Proportion of Wellbeing	-0.47	-0.68
Number of Observations	46,075	25,283	Number of Observations	46,075	25,283
R-Square	0.0652	0.0855	R-Square	0.0852	0.0908
Variables	Males	Females	Variables	Males	Females
Borrowing from Family and Friends	0.0902*** (0.0059)	0.1001*** (0.0083)	Engaging in Additional Income-Generating Activities	0.0341*** (0.0029)	0.0286*** (0.0041)
Wealth Index	-0.1062*** (0.0136)	-0.0843*** (0.0178)	Wealth Index	-0.1037*** (0.0136)	-0.0784*** (0.0181)
Proportion of Wellbeing	-0.85	-1.18	Proportion of Wellbeing	-0.33	-0.37
Number of Observations	46,075	25,283	Number of Observations	46,075	25,283
R-Square	0.0884	0.0950	R-Square	0.0863	0.0866
Variables	Males	Females	Variables	Males	Females
Borrowing from Financial Institutions and Banks	0.0760*** (0.0045)	0.0673*** (0.0062)	Credit Purchase	0.1191*** (0.0030)	0.1134*** (0.0040)
Wealth Index	-0.1116*** (0.0136)	-0.0825*** (0.0180)	Wealth Index	-0.1026*** (0.0133)	-0.0848*** (0.0175)
Proportion of Wellbeing	-0.68	-0.81	Proportion of Wellbeing	-1.16	-1.34
Number of Observations	46,075	25,283	Number of Observations	46,075	25,283
R-Square	0.0902	0.0901	R-Square	0.1242	0.1227
Variables	Males	Females	Variables	Males	Females
Delaying Payment Obligations	0.1556*** (0.0039)	0.1364*** (0.0055)	Selling Harvest in Advance	0.1028*** (0.0061)	0.1161*** (0.0089)
Wealth Index	-0.1015*** (0.0134)	-0.0815*** (0.0146)	Wealth Index	-0.1032*** (0.0137)	-0.0852*** (0.0178)
Proportion of Wellbeing	-1.53	-1.68	Proportion of Wellbeing	-0.99	-1.36
Number of Observations	46,075	25,283	Number of Observations	46,075	25,283
R-Square	0.1189	0.1139	R-Square	0.0904	0.0945
Variables	Males	Females	Variables	Males	Females
Reducing non-Food Consumption	0.1692*** (0.0026)	0.1619*** (0.0037)	Relying on Savings	0.0341*** (0.0027)	0.0285*** (0.0038)
Wealth Index	-0.1048*** (0.0128)	-0.0809*** (0.0170)	Wealth Index	-0.1067*** (0.0136)	-0.0787*** (0.0180)
Proportion of Wellbeing	-1.61	-2.00	Proportion of Wellbeing	-0.32	-0.36
Number of Observations	46,075	25,283	Number of Observations	46,075	25,283
R-Square	0.1915	0.1811	R-Square	0.0869	0.0871
Variables	Males	Females	Variables	Males	Females
Receiving Assistance from the Government	0.1507*** (0.0098)	0.1328*** (0.0097)	No Coping Strategy	-0.1934*** (0.0028)	-0.1959*** (0.0042)
Wealth Index	-0.1156*** (0.0189)	-0.0928*** (0.0231)	Wealth Index	-0.1085*** (0.0130)	-0.0914*** (0.0172)
Proportion of Wellbeing	-1.30	-1.43	Proportion of Wellbeing	1.78	2.15
Number of Observations	28,893	18,511	Number of Observations	46,075	25,283
R-Square	0.0545	0.0697	R-Square	0.1682	0.1653

Notes: Standard errors within the parentheses. \*\*\*, \*\* and \* indicate significance at the 1%, 5%, and 10% level, respectively.

**Table A5: Fixed-effects estimates by gender of the head of household and number of days adults in household have gone to bed hungry (past seven days)**

Variables	Males	Females	Variables	Males	Females
Selling Assets	0.0709*** (0.0124)	0.0489*** (0.0179)	Receiving Support from Family and Friends	0.0958*** (0.0139)	0.0552*** (0.0150)
Wealth Index	-0.3552*** (0.0336)	-0.3868*** (0.0501)	Wealth Index	-0.3582*** (0.0336)	-0.3838*** (0.0501)
Proportion of Wellbeing	-0.20	-0.13		-0.27	-0.15
Number of Observations	45,981	25,195	Number of Observations	45,981	25,195
R-Square	0.0824	0.0929	R-Square	0.0833	0.0934
Variables	Males	Females	Variables	Males	Females
Borrowing from Family and Friends	0.1272*** (0.0179)	0.2028*** (0.0266)	Engaging in Additional Income-Generating Activities	-0.1124*** (0.0069)	-0.1015*** (0.0098)
Wealth Index	-0.3616*** (0.0335)	-0.3909*** (0.0499)	Wealth Index	-0.3606*** (0.0336)	-0.3834*** (0.0501)
Proportion of Wellbeing	-0.35	-0.62		0.31	0.26
Number of Observations	45,981	25,195	Number of Observations	45,981	25,195
R-Square	0.0851	0.1002	R-Square	0.0875	0.0974
Variables	Males	Females	Variables	Males	Females
Borrowing from Financial Institutions and Banks	0.1389*** (0.0123)	0.0121 (0.0163)	Credit Purchase	0.0892** (0.0430)	0.1085** (0.0455)
Wealth Index	-0.3637*** (0.0333)	-0.3864*** (0.0501)	Wealth Index	-0.3582*** (0.0337)	-0.3886*** (0.0502)
Proportion of Wellbeing	-0.38	n.s.	Proportion of Wellbeing	-0.25	-0.28
Number of Observations	45,981	25,195	Number of Observations	45,981	25,195
R-Square	0.0821	0.0925	R-Square	0.0815	0.0925
Variables	Males	Females	Variables	Males	Females
Delaying Payment Obligations	-0.0188* (0.0102)	-0.0246** (0.0107)	Selling Harvest in Advance	-0.0475*** (0.0154)	-0.0208 (0.0211)
Wealth Index	-0.3583*** (0.0337)	-0.3883*** (0.0501)	Wealth Index	-0.3589*** (0.0337)	-0.3871*** (0.0501)
Proportion of Wellbeing	0.052	0.065		0.13	n.s.
Number of Observations	45,981	25,195	Number of Observations	45,981	25,195
R-Square	0.0814	0.0927	R-Square	0.0817	0.0924
Variables	Males	Females	Variables	Males	Females
Reducing non-Food Consumption	0.1844*** (0.0068)	0.1024* (0.0538)	Relying on Savings	-0.0774*** (0.0068)	-0.0625*** (0.0092)

Wealth Index	-0.3585*** (0.0337)	-0.3866*** (0.0501)	Wealth Index	-0.3534*** (0.0336)	-0.3846*** (0.0501)
Variables	Males	Females	Variables	Males	Females
Proportion of Wellbeing	-0.51	-0.26		0.21	0.16
Number of Observations	45,981	25,195	Number of Observations	45,981	25,195
R-Square	0.0821	0.0925	R-Square	0.0847	0.0945
Variables	Males	Females	Variables	Males	Females
Receiving Assistance from the Government	0.0321* (0.0169)	0.0446** (0.0211)	No Coping Strategy	-0.1023*** (0.0084)	-0.1333*** (0.0123)
Wealth Index	-0.4002*** (0.0389)	-0.4544*** (0.0565)	Wealth Index	-0.3617*** (0.0336)	-0.3832*** (0.0498)
Proportion of Wellbeing	0.08	0.10		0.28	0.35
Number of Observations	28,893	18,511	Number of Observations	53,226	28,151
R-Square	0.0402	0.0611	R-Square	0.0866	0.0980

Notes: Standard errors within the parentheses. \*\*\*, \*\* and \* indicate significance at the 1%, 5%, and 10% level, respectively. n.s. indicates non-significant.

**Table A6: Fixed-effects estimates by social security coverage and food insecurity index**

Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)
Selling Assets	0.0211*** (0.0294)	0.0307* (0.0170)	Receiving Support from Family and Friends	0.0404** (0.0188)	0.0614*** (0.0146)
Logarithm of Wage	-0.0177** (0.0078)	-0.0302*** (0.0058)	Logarithm of Wage	-0.0172** (0.0085)	-0.0315*** (0.0064)
Proportion of Wellbeing	-0.15	-0.18	Proportion of Wellbeing	-0.26	-0.34
Monetary Value	2,140	1,250	Monetary Value	3,715	2,350
Number of Observations	5,183	7,705	Number of Observations	5,183	7,705
R-Square	0.0925	0.0760	R-Square	0.0904	0.0806
Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)

Borrowing from Family and Friends	0.0701*** (0.0186)	0.1411*** (0.0183)	Engaging in Additional Income-Generating Activities	0.0213*** (0.0113)	-0.0459*** (0.0086)
Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)
Logarithm of Wage	-0.0175** (0.0087)	-0.0330*** (0.0063)	Logarithm of Wage	-0.0188** (0.0085)	-0.0304*** (0.0063)
Proportion of Wellbeing	-0.45	-0.49	Proportion of Wellbeing	-0.14	-0.17
Monetary Value	6,430	3,400	Monetary Value	2,000	1,180
Number of Observations	5,183	7,705	Number of Observations	5,183	7,705
R-Square	0.1037	0.0941	R-Square	0.0937	0.0832
Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)
Borrowing from Financial Institutions and Banks	0.0464*** (0.0171)	0.1009*** (0.0134)	Credit Purchase	0.0609*** (0.0124)	0.1155*** (0.0096)
Logarithm of Wage	-0.0179** (0.0086)	-0.0334*** (0.0064)	Logarithm of Wage	-0.0179** (0.0084)	-0.0300*** (0.0061)
Proportion of Wellbeing	-0.29	-0.33	Proportion of Wellbeing	-0.38	-0.44
Monetary Value	4,150	2,290	Monetary Value	5,430	3,050
Number of Observations	5,183	7,705	Number of Observations	5,183	7,705
R-Square	0.0826	0.0826	R-Square	0.1087	0.1125
Delaying Payment Obligations	0.0780*** (0.0156)	0.1493*** (0.0135)	Selling Harvest in Advance	0.0863*** (0.0311)	0.1181*** (0.0249)
Logarithm of Wage	-0.0182** (0.0085)	-0.0311*** (0.0062)	Logarithm of Wage	-0.0197** (0.0087)	-0.0325*** (0.0064)
Proportion of Wellbeing	-0.48	-0.57	Proportion of Wellbeing	-0.48	-0.42
Monetary Value	6,860	3,960	Monetary Value	6,860	2,910
Number of Observations	5,183	7,705	Number of Observations	5,183	7,705
R-Square	0.0892	0.1088	R-Square	0.1039	0.0810

Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)
Reducing non-Food Consumption	0.1240*** (0.0102)	0.1801*** (0.0083)	Relying on Savings	0.0261** (0.0113)	0.0356* (0.0182)
Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)
Logarithm of Wage	-0.0184** (0.0080)	-0.0247*** (0.0056)	Logarithm of Wage	-0.0177** (0.0087)	-0.0329*** (0.0065)
Proportion of Wellbeing	-0.65	-0.83	Proportion of Wellbeing	-0.17	-0.12
Monetary Value	9,290	5,760	Monetary Value	2,430	832
Number of Observations	5,183	7,705	Number of Observations	5,183	7,705
R-Square	0.1837	0.1965	R-Square	0.0890	0.0752
Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)
Receiving Assistance from the Government	0.0242** (0.0103)	0.0439*** (0.0263)	No Coping Strategy	-0.0852*** (0.0109)	-0.1580*** (0.0110)
Logarithm of Wage	-0.0173* (0.0091)	-0.0223*** (0.0075)	Logarithm of Wage	-0.0165** (0.0077)	-0.0308*** (0.0062)
Proportion of Wellbeing	-0.16	-0.22	Proportion of Wellbeing	0.53	0.59
Monetary Value	2,290	1,525	Monetary Value	7,570	4,090
Number of Observations	4,696	6,783	Number of Observations	5,183	7,705
R-Square	0.0940	0.0639	R-Square	0.1759	0.1207

Notes: Standard errors within the parentheses. \*\*\*, \*\* and \* indicate significance at the 1%, 5%, and 10% level, respectively.

**Table A7: Fixed-effects estimates by social security coverage and number of days adults in household have gone to bed hungry (past seven days)**

Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)
Selling Assets	0.0259 (0.0367)	0.0303** (0.0149)	Receiving Support from Family and Friends	0.0553** (0.0264)	0.1212*** (0.0333)
Logarithm of Wage	-0.0280** (0.0110)	-0.1063*** (0.0156)	Logarithm of Wage	-0.0276** (0.0108)	-0.1047*** (0.0154)
Proportion of Wellbeing	n.s.	0.032	Proportion of Wellbeing	-0.21	-0.13
Monetary Value	-	222	Monetary Value	3,000	900
Number of Observations	5,183	7,699	Number of Observations	5,183	7,699
R-Square	0.0554	0.0839	R-Square	0.0585	0.0891
Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)
Borrowing from Family and Friends	0.0517* (0.0260)	0.2290*** (0.0435)	Engaging in Additional Income-Generating Activities	-0.0247** (0.0116)	-0.0902*** (0.0162)
Logarithm of Wage	-0.0280** (0.0110)	-0.1075*** (0.0154)	Logarithm of Wage	-0.0271** (0.0110)	-0.1027*** (0.0153)
Proportion of Wellbeing	-0.20	-0.24	Proportion of Wellbeing	0.095	0.101
Monetary Value	2,860	1,665	Monetary Value	1,360	700
Number of Observations	5,183	7,699	Number of Observations	5,183	7,699
R-Square	0.0602	0.0958	R-Square	0.0569	0.0913
Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)
Borrowing from Financial Institutions and Banks	0.0095 (0.0246)	0.0252* (0.0139)	Credit Purchase	-0.0260* (0.0150)	-0.0237 (0.0206)
Logarithm of Wage	-0.0279** (0.0110)	-0.1062*** (0.0155)	Logarithm of Wage	-0.0288** (0.0110)	-0.1059*** (0.0154)
Proportion of Wellbeing	n.s.	-0.03	Proportion of Wellbeing	0.095	n.s.
Monetary Value	-	210	Monetary Value	1,355	-
Number of Observations	5,183	7,699	Number of Observations	5,183	7,699

Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)
R-Square	0.0553	0.0839	R-Square	0.0568	0.0842
Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)
Delaying Payment Obligations	0.0335* (0.0172)	0.1402*** (0.0292)	Selling Harvest in Advance	0.0201 (0.0235)	0.1078** (0.0542)
Logarithm of Wage	-0.0281** (0.0110)	-0.1053*** (0.0154)	Logarithm of Wage	-0.0282** (0.0110)	-0.1066*** (0.0156)
Proportion of Wellbeing	-0.12	-0.15	Proportion of Wellbeing	n.s.	-0.12
Monetary Value	1,715	1,040	Monetary Value	-	832
Number of Observations	5,183	7,699	Number of Observations	5,183	7,699
R-Square	0.0567	0.0910	R-Square	0.0553	0.0850
Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)
Reducing non-Food Consumption	0.0084 (0.0113)	0.0531*** (0.0169)	Relying on Savings	-0.0419*** (0.0095)	0.0057 (0.0163)
Logarithm of Wage	-0.0280** (0.0110)	-0.1041*** (0.0154)	Logarithm of Wage	-0.0273** (0.0109)	-0.1064*** (0.0159)
Proportion of Wellbeing	n.s.	-0.06	Proportion of Wellbeing	0.16	n.s.
Monetary Value	-	415	Monetary Value	2,285	-
Number of Observations	5,183	7,699	Number of Observations	5,183	7,699
R-Square	0.0554	0.0864	R-Square	0.0608	0.0839
Variables	Social Security Coverage (Yes)	Social Security Coverage (No)	Variables	Social Security Coverage (Yes)	Social Security Coverage (No)
Receiving Assistance from the Government	-0.0007 (0.0069)	0.0832* (0.0431)	No Coping Strategy	-0.0266* (0.0136)	-0.1285*** (0.0216)
Logarithm of Wage	-0.0324** (0.0142)	-0.0833*** (0.0173)	Logarithm of Wage	-0.0265** (0.0109)	-0.1051*** (0.0155)
Proportion of Wellbeing	n.s.	0.11	Proportion of Wellbeing	0.11	0.14
Monetary Value	-	763	Monetary Value	1,570	970
Number of Observations	4,696	6,783	Number of Observations	5,183	7,699
R-Square	0.0591	0.0819	R-Square	0.0567	0.0913

Notes: Standard errors within the parentheses. \*\*\*, \*\* and \* indicate significance at the 1%, 5% and 10% level. n.s. indicates non-significant.

**Table A8: Fixed-effects estimates by employment contract type and food insecurity index**

Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Selling Assets	0.0156* (0.0072)	0.0303* (0.0157)	Receiving Support from Family and Friends	0.0365 (0.0243)	0.0703*** (0.0122)
Logarithm of Wage	-0.0194** (0.0078)	-0.0267*** (0.0057)	Logarithm of Wage	-0.0190** (0.0078)	-0.0257*** (0.0057)
Proportion of Wellbeing	-0.09	-0.13	Proportion of Wellbeing	n.s.	-0.31
Monetary Value	1,380	1,030	Monetary Value	-	3,832
Number of Observations	4,094	8,794	Number of Observations	4,094	2,465
R-Square	0.1309	0.0821	R-Square	0.1306	0.0893
Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Borrowing from Family and Friends	0.0949*** (0.0285)	0.1601*** (0.0159)	Engaging in Additional Income-Generating Activities	0.0283*** (0.0103)	-0.0371*** (0.0078)
Logarithm of Wage	-0.0180** (0.0075)	-0.0285*** (0.0056)	Logarithm of Wage	-0.0191** (0.0077)	-0.0250*** (0.0057)
Proportion of Wellbeing	-0.56	-0.64	Proportion of Wellbeing	-0.15	0.17
Monetary Value	8,580	5,090	Monetary Value	2,300	1,350
Number of Observations	4,094	8,794	Number of Observations	4,094	8,794
R-Square	0.1366	0.1053	R-Square	0.1356	0.0862
Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Borrowing from Financial Institutions and Banks	0.0826*** (0.0195)	0.0879*** (0.0117)	Credit Purchase	0.0760*** (0.0147)	0.0989*** (0.0085)
Logarithm of Wage	0.0196** (0.0078)	0.0282*** (0.0057)	Logarithm of Wage	-0.0189*** (0.0076)	-0.0247*** (0.0055)
Proportion of Wellbeing	-0.44	-0.35	Proportion of Wellbeing	-0.42	-0.45
Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Monetary Value	6,740	2,780	Monetary Value	6,430	3,575
Number of Observations	4,094	8,794	Number of Observations	4,094	8,794
R-Square	0.1116	0.0929	R-Square	0.1314	0.1096

Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Delaying Payment Obligations	0.1062*** (0.0184)	0.1450*** (0.0125)	Selling Harvest in Advance	0.1102*** (0.0362)	0.1312*** (0.0229)
Logarithm of Wage	-0.0171** (0.0074)	-0.0262*** (0.0057)	Logarithm of Wage	-0.0197*** (0.0078)	-0.0273*** (0.0058)
Proportion of Wellbeing	-0.60	-0.63	Proportion of Wellbeing	-0.57	-0.55
Monetary Value	9,190	5,000	Monetary Value	8,730	4,370
Number of Observations	4,094	8,794	Number of Observations	4,094	8,794
R-Square	0.1678	0.1106	R-Square	0.1452	0.0877
Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Reducing non-Food Consumption	0.1295*** (0.0122)	0.1657*** (0.0070)	Relying on Savings	0.0402*** (0.0114)	0.0107 (0.0086)
Logarithm of Wage	-0.0202*** (0.0072)	-0.0250*** (0.0052)	Logarithm of Wage	-0.0194** (0.0078)	-0.0254*** (0.0059)
Proportion of Wellbeing	-0.68	-0.75	Proportion of Wellbeing	-0.21	n.s.
Monetary Value	10,415	5,960	Monetary Value	3,215	-
Number of Observations	4,094	8,794	Number of Observations	4,094	8,794
R-Square	0.2167	0.1891	R-Square	0.1401	0.0816
Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Receiving Assistance from the Government	-0.0355 (0.0593)	0.0514*** (0.0213)	No Coping Strategy	-0.1299*** (0.0127)	-0.1686*** (0.0090)
Logarithm of Wage	-0.0185* (0.0104)	-0.0269*** (0.0062)	Logarithm of Wage	-0.0196** (0.0081)	-0.0262*** (0.0054)
Proportion of Wellbeing	n.s.	-0.21	Proportion of Wellbeing	0.65	0.73
Monetary Value	-	1,670	Monetary Value	9,960	5,800
Number of Observations	3,510	7,969	Number of Observations	4,094	8,794
R-Square	0.1498	0.0761	R-Square	0.2156	0.1341

Notes: Standard errors within the parentheses. \*\*\*, \*\* and \* indicate significance at the 1%, 5%, and 10% level, respectively. n.s. indicates non-significant.

**Table A9: Fixed-effects estimates by employment contract type and number of days adults in household have gone to bed hungry (past seven days)**

Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Selling Assets	0.0705 (0.0449)	0.0191 (0.0324)	Receiving Support from Family and Friends	-0.0055 (0.0296)	0.1303*** (0.0263)
Logarithm of Wage	-0.0149** (0.0063)	-0.0870*** (0.0136)	Logarithm of Wage	-0.0150** (0.0064)	-0.0852*** (0.0134)
Proportion of Wellbeing	n.s.	n.s.	Proportion of Wellbeing	n.s.	-0.17
Monetary Value	-	-	Monetary Value	-	1,350
Number of Observations	4,091	8,791	Number of Observations	4,091	8,791
R-Square	0.0814	0.0723	R-Square	0.0782	0.0800
Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Borrowing from Family and Friends	0.0521** (0.0239)	0.2414*** (0.0369)	Engaging in Additional Income-Generating Activities	-0.0238*** (0.0087)	-0.0794*** (0.0142)
Logarithm of Wage	-0.0143** (0.0063)	-0.0898*** (0.0136)	Logarithm of Wage	-0.0147** (0.0064)	-0.0835*** (0.0134)
Proportion of Wellbeing	-0.33	-0.30	Proportion of Wellbeing	-0.17	0.11
Monetary Value	5,055	2,380	Monetary Value	2,600	875
Number of Observations	4,091	8,791	Number of Observations	4,091	8,791
R-Square	0.0956	0.0874	R-Square	0.0808	0.0786
Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Borrowing from Financial Institutions and Banks	0.0198 (0.0216)	0.0055 (0.0248)	Credit Purchase	-0.0476*** (0.0135)	0.0284* (0.0161)
Logarithm of Wage	-0.0153** (0.0064)	-0.0870*** (0.0136)	Logarithm of Wage	-0.0149** (0.0064)	-0.0864*** (0.0135)
Proportion of Wellbeing	n.s.	n.s.	Proportion of Wellbeing	0.32	-0.04
Monetary Value	-	-	Monetary Value	4,900	320
Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Number of Observations	4,091	8,791	Number of Observations	4,091	8,791
R-Square	0.0788	0.0723	R-Square	0.0860	0.0729

Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Delaying Payment Obligations	0.0373** (0.0169)	0.1192*** (0.0265)	Selling Harvest in Advance	0.0371 (0.0316)	0.1139** (0.0477)
Logarithm of Wage	-0.0146** (0.0064)	-0.0865*** (0.0136)	Logarithm of Wage	-0.0153** (0.0063)	-0.0875*** (0.0136)
Proportion of Wellbeing	-0.25	-0.16	Proportion of Wellbeing	n.s.	-0.15
Monetary Value	3,830	1,270	Monetary Value	-	1,190
Number of Observations	4,091	8,791	Number of Observations	4,091	8,791
R-Square	0.0832	0.0777	R-Square	0.0789	0.0736
Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Reducing non-Food Consumption	0.0018 (0.0109)	0.0666*** (0.0138)	Relying on Savings	-0.0293*** (0.0096)	-0.0076 (0.0149)
Logarithm of Wage	-0.0152** (0.0064)	-0.0862*** (0.0135)	Logarithm of Wage	-0.0146** (0.0063)	-0.0861*** (0.0140)
Proportion of Wellbeing	n.s.	-0.09	Proportion of Wellbeing	0.21	n.s.
Monetary Value	-	715	Monetary Value	3,215	-
Number of Observations	4,091	8,791	Number of Observations	4,091	8,791
R-Square	0.0782	0.0771	R-Square	0.0828	0.0723
Variables	Permanent Contract	Non-Permanent Contract	Variables	Permanent Contract	Non-Permanent Contract
Receiving Assistance from the Government	-0.0097 (0.0254)	-0.0112 (0.0191)	No Coping Strategy	-0.0206* (0.0106)	-0.1157*** (0.0178)
Logarithm of Wage	-0.0156* (0.0092)	-0.0717*** (0.0141)	Logarithm of Wage	-0.0149** (0.0063)	-0.0865*** (0.0135)
Proportion of Wellbeing	n.s.	n.s.	Proportion of Wellbeing	0.14	0.15
Monetary Value	-	-	Monetary Value	2,145	1,190
Number of Observations	3,510	7,969	Number of Observations	4,091	8,791
R-Square	0.0796	0.0639	R-Square	0.0785	0.0791

Note: Standard errors within the parentheses. \*\*\*, \*\* and \* indicate significance at the 1%, 5%, and 10% level, respectively. n.s. indicates non-significant.

### **A3. Propensity score matching and instrumental variables**

To eliminate or reduce the selection bias that may come from the over-representation of a specific group of respondents (e.g., males) or because some respondents did not have to adopt any coping strategy, we will apply the propensity score matching (PSM) introduced by Rosenbaum and Rubin (1983, 1984). PSM is used to reduce the endogeneity problem coming from selection bias. More specifically, we may select food-insecure households compared to the control groups or households that have not adopted any coping strategy. Furthermore, we may select a non-representative sample, such as classifying more men and older people in the treated group compared to the control group. Therefore, we will try to match individuals and households based on socioeconomic and demographic characteristics, such as gender, age, education level, marital status, household size, district, rural or urban area, and others. We will employ the nearest neighbour matching approach, which is one of the most popular matching procedures. To obtain a high level of matching, which necessitates a large pool of controls, we will use replacement matching, which allows differently treated subjects to be matched with the same control subjects. While the calliper number is discretionary, we will use 0.1 and compare the findings using a calliper value equal to one-quarter of the standard deviation of the logit of the propensity score, as suggested by Rosenbaum and Rubin (1983), to investigate whether there are differences in the matching performance.

We prefer the nearest neighbour with replacement over other matching techniques, such as the Mahalanobis, local linear regression, kernel, and Radius matching. First, the Mahalanobis tends to work better with few covariates and covariates that are normally distributed. However, in our case, we have many covariates, more than 60, including the categorical variables of education, regional lockdowns, and counties. Moreover, not all are normally distributed, such as education and household size. On the other hand, the study by King and Nielsen (2019) shows that matching may accomplish the opposite of its intended goal by increasing imbalance, inefficiency, and bias. The authors recommend the Mahalanobis Distance Matching to overcome problems with PSM, especially those with the nearest neighbour. Concerning Kernel and local linear regression matching, a complication is we need to define a proper smoothing parameter or bandwidth, which does not have an intuitive meaning (Heckman et al., 1997; Imbens, 2004).

Furthermore, Kernel, Radius, and Mahalanobis techniques require high computational power, and it takes much longer to perform the matching. Overall, the estimates are very similar across all the matching techniques, which confirm the findings in other studies (e.g., Loureiro & Holanda, 2013). Also, the estimates should be treated with caution, and for this reason, we use instrumental variables as an alternative method, discussed in the next section.

Then, we apply an instrumental variables (IV) approach to identify the impact of coping strategy on food security and estimate the inequalities, as described in the methodology section. Instrumental variable techniques may consider income and

employment loss due to lockdowns and economic stagnation during the COVID-19 period. In particular, the decision or need to adopt a coping strategy is endogenous regarding food security status. Hence, endogeneity may come from omitted variable bias and reverse causality, as food insecurity may drive households to adopt various coping strategies. We will apply the Two-State Least Squares Fixed-Effects (TSLS-FE). In the first stage, we regress the coping strategy explored on the instruments described below. Then in the second stage, we obtain the fitted values to estimate the impact of the coping strategy on food security and take the ratio of its coefficient over the estimated coefficient of wealth to calculate the proportion of wellbeing or disparities in terms of food security.

The key to the validity of instrumental variables approaches is that we have exogenous variables strongly correlated with the endogenous variable of interest, which is the coping strategy adopted by the household, but do not directly affect the household's food security. The first set of instruments is the average value of each coping strategy at the county level and rural-urban area of the residence. While this may not be very precise compared to values aggregated at the district level, we aggregate the instrumental variables at this level due to data availability and information recorded in the surveys. Thus, we have 11 variables based on the 11 coping strategies, but we use each variable for the respective coping strategy. For example, in the regression of selling assets, we aggregate this coping strategy at the county and rural-urban level. Then we take the interaction of this variable with the dummy of regional lockdowns described earlier.

The second set of instrumental variables includes assistance from family and non-household members. The first variable is whether the households usually receive remittance from family members who work in another place or other country, and the second variable is whether, in the past 14 days, anyone in the household received a gift or assistance of money or goods from someone outside the household. As before, we aggregate the last two variables at the level of the county of residence and the rural-urban area. The third variable is the average number of coping strategies taken at the county level and in rural-urban areas. As with the first set of instruments, we interact the gifts received and the average number of coping strategies with the dummy of regional lockdowns.

Following previous studies, the justification for using these variables is that information at a higher aggregated level, in this case county level and rural-urban information, form variables that typically qualify as instrumental variables. While the county level conditions likely influence individual household decisions, each household has a negligible effect on the county level (Taylor et al., 2003; d'Errico & Pietrelli, 2017; Mora-Rivera & van Gameren, 2021; Oskorouchi & Sousa-Poza, 2021). Furthermore, aggregating at the county and rural-urban level, we can consider the network effect by taking the intensity of the coping strategies and the gifts and assistance received from family and other sources outside the household. For example, households affected by lockdowns in rural areas can be less likely to adopt coping strategies since they may have direct access to food supply (Ntaky & van den Berg,

2019) if they are producers and engage in subsistence farming compared to households in urban areas that rely on retail markets. Thus, rural farmers can access comparatively cheaper food and a variety of nutritious foods, and they may also provide support and access to food to other households in the neighbourhood or area. Also, Di Falco et al. (2011) argue that controlling for the diversity of coping strategies and support can influence the adaptation strategies to cope with food insecurity.

Moreover, using county-specific time trends, as mentioned earlier, and interacting the instrumental variables with the dummy of the regional lockdowns, allow us to exploit differences in county lockdowns that may have affected income and employment intensity and, thus, influencing the likelihood for households to adopt coping strategies adjusting for those economic challenges and to moderate the adverse impact on food insecurity. The justification is that exposure to coping strategies depends on the county and the time those lockdowns were imposed.

#### **A4. PSM and TSLS-FE estimates**

In Table A10, we present the estimates using the matched sample, following the propensity score matching and the TSLS-FE estimates for the wealth index. Despite some differences in the estimated coefficients, the most critical aspect of our regressions is the percentage of wellbeing. In all cases, we detect similarities in the proportion of wellbeing. An exception is the coping strategy of borrowing from banks and financial institutions, where the value found using the FE-OLS is 0.70, and it is significantly lower than the PSM-FE-OLS regression, which equals 77% and the TSLS-FE, which is equal to 82%. Furthermore, in the coping strategy of delaying payment obligations, the proportion of wellbeing ranges between 155% and 162% in the FE-OLS and TSLS-FE estimates, while it is approximately 128% in the PSM-FE-OLS estimates. In the last regression, we find a negative sign of the no coping strategy as expected, which takes a value of 1 if the household has not adopted any coping strategy, and 0 if the household has adopted any coping strategy. As a result, households using no coping strategy in the FE-OLS are approximately 1.90 times as wealthy as those using any coping strategy and 210% wealthier in the TSLS-FE estimates.

We reject the null hypothesis in all cases according to the weak identification F-test derived from the first-stage regression. Thus, we conclude that the instruments employed are not weak and are significantly correlated to the endogenous variables, which are the dummy variables taking a value of 1 if the household implemented a particular coping strategy and 0 otherwise. The F-statistic is higher than the rule of thumb of 10. Furthermore, according to the Hansen-J endogeneity statistic, we accept the null hypothesis of no endogeneity. However, we reject the null hypothesis of no-endogeneity at the 5% significance level in the regression of selling harvest in advance, where the F-statistic is 16.492, and its associated p-value is 0.0491. Regarding the PSM-FE-OLS estimates, in Figure A1, we illustrate the propensity scores before and after the matching. We conclude that the PSM process performs very well.

In Table A11, we perform the same regressions, but we consider the logarithm of the household expenditures instead of the wealth index, as we performed in the main text. As in Table A10, we also find similar wellbeing and monetary values proportions. Exceptions could be considered in the coping strategies of delaying payment obligations and selling harvest in advance. In particular, the ratio of wellbeing with the TSLS-FE is 59% of the weekly household expenditures, corresponding to Ksh1,870. On the other hand, the proportion of wellbeing is 65% using the PSM-FE-OLS, which is equivalent to Ksh2,060. Similarly, the estimate for the coping strategy of selling harvest in advance derived from the PSM-FE-OLS is 53 per cent, corresponding to Ksh1,680. The monetary value estimated using the TSLS-FE is Ksh1,300.

Using the findings of Table 3 and Table A11, we can compare the wellbeing costs or the amount of money required to compensate households with coping strategies with the monetary value of the assistance received by the government in terms of gifts or jobs and the assistance and support received from family and friends. While only 5.2% of the sample has received help from the government, we can still see how the wellbeing costs are compared with the support received. On the other hand, almost 21% of the sample has received support from family and friends regarding gifts and remittances received from Kenya or abroad. According to the information recorded in the survey, the average value of support received from the government in the last 14 days is Ksh2,500, and Ksh2,100 from friends. We may take the estimates of Table 3, where we consider the weekly household expenditures, and we may use the monetary values expressed in Ksh to compare with the support received. In particular, in Table 3 and the support from friends and family, we find that the wellbeing costs are Ksh700 per week or Ksh1,400 per 14 days. Therefore, considering the amount received from friends and family, it is more than required for households to adopt the coping strategy of receiving support from family and friends.

Similarly, for those who have received assistance from the government, the wellbeing costs considering the household expenditures, are Ksh2,220, which is lower than the monetary value of assistance received from the government, which is Ksh2,500. Therefore, the findings show that support from friends and family and assistance from the government are critical sources of support that may maintain food security levels. On the other hand, households that reduce non-food consumption to cope with the income and employment loss because of COVID-19 have received Ksh1,770 from family and friends and Ksh2,400 from the government in the 14 days before the interview. In Table 3, we find the wellbeing costs equal to Ksh2,060 per week or Ksh4,120 per 14 days, significantly higher than the support received. Therefore, the findings indicate that the efficiency of support received from family and government depends on the type of coping strategy adopted, and the wellbeing costs or the money households need to equalise their food security levels with the households without coping strategy.

**Table A10: Regressions estimates for coping strategies and food insecurity index using wealth index**

Variables	PSM-FE-OLS	TSLS-FE	Variables	PSM-FE-OLS	TSLS-FE
Selling Assets	0.0286*** (0.0066)	0.0304*** (0.0032)	Receiving Support from Family and Friends	0.0531*** (0.0061)	0.0546*** (0.0031)
Wealth Index	-0.0856*** (0.0259)	-0.0884*** (0.0091)	Wealth Index	-0.0921*** (0.0248)	-0.0897*** (0.0091)
Proportion of Wellbeing	-0.33	-0.34	Proportion of Wellbeing	-0.58	-0.61
Number of Observations	11,085	69,803	Number of Observations	13,060	69,803
R-Square	0.1556	0.0705	R-Square	0.1197	0.0724
Weak Identification		81.36 [0.000]	Weak Identification		148.95 [0.000]
F-Test		4.255 [0.2044]	F-Test		1.463 [0.9619]
Hansen J			Hansen J		
Endogeneity Statistic			Endogeneity Statistic		
Variables	PSM-FE-OLS	TSLS-FE	Variables	PSM-FE-OLS	TSLS-FE
Borrowing from Family and Friends	0.0852*** (0.0101)	0.0864*** (0.0042)	Engaging in Additional Income-Generating Activities	0.0204*** (0.0033)	0.0192*** (0.0021)
Wealth Index	-0.0950*** (0.0284)	-0.0889*** (0.0091)	Wealth Index	-0.0948*** (0.0155)	-0.0884*** (0.0091)
Proportion of Wellbeing	-0.90	-0.97	Proportion of Wellbeing	-0.21	-0.22
Number of Observations	10,536	69,803	Number of Observations	33,171	69,803
R-Square	0.1616	0.0747	R-Square	0.0812	0.0680
Weak Identification		96.21 [0.000]	Weak Identification		88.91 [0.000]
F-Test		5.094 [0.1651]	F-Test		10.532 [0.1040]
Hansen J			Hansen J		
Endogeneity Statistic			Endogeneity Statistic		
Variables	PSM-FE-OLS	TSLS-FE	Variables	PSM-FE-OLS	TSLS-FE
Borrowing from Financial Institutions and Banks	0.0621*** (0.0065)	0.0786*** (0.0031)	Credit Purchase	0.1020*** (0.0034)	0.0985*** (0.0021)
Wealth Index	-0.0804** (0.0378)	-0.0958*** (0.0090)	Wealth Index	-0.0836** (0.0372)	-0.0851*** (0.0089)
Proportion of Wellbeing	-0.77	-0.82	Proportion of Wellbeing	-1.22	-1.16
Number of Observations	11,147	69,803	Number of Observations	27,701	69,803
R-Square	0.2124	0.0803	R-Square	0.1843	0.1011
Weak Identification		136.45 [0.000]	Weak Identification		102.41 [0.000]
F-Test		4.683 [0.1842]	F-Test		14.532 [0.1046]
Hansen J			Hansen J		
Endogeneity Statistic			Endogeneity Statistic		

Variables	PSM-FE-OLS	TSLs-FE	Variables	PSM-FE-OLS	TSLs-FE
Variables	PSM-FE-OLS	TSLs-FE	Variables	PSM-FE-OLS	TSLs-FE
Delaying Payment Obligations	0.1369*** (0.0059)	0.1349*** (0.0028)	Selling Harvest in Advance	0.0898*** (0.0111)	0.0982*** (0.0042)
Wealth Index	-0.1064*** (0.0036)	-0.0868*** (0.0089)	Wealth Index	-0.0884** (0.0382)	-0.0887*** (0.0090)
Proportion of Wellbeing	-1.28	-1.55	Proportion of Wellbeing	-1.02	-1.11
Number of Observations	13,005	69,803	Number of Observations	6,205	69,803
R-Square	0.2109	0.0996	R-Square	0.1929	0.0760
Weak Identification		78.87 [0.000]	Weak Identification		75.11 [0.000]
F-Test			F-Test		
Hansen J		10.211	Hansen J		16.943
Endogeneity Statistic		[0.1103]	Endogeneity Statistic		[0.0491]
Variables	PSM-FE-OLS	TSLs-FE	Variables	PSM-FE-OLS	TSLs-FE
Reducing non-Food Consumption	0.1412*** (0.0027)	0.1482*** (0.0018)	Relying on Savings	0.0324*** (0.0029)	0.0392*** (0.0019)
Wealth Index	-0.0784*** (0.0131)	-0.0875*** (0.0086)	Wealth Index	-0.0891*** (0.0141)	-0.0943*** (0.0090)
Proportion of Wellbeing	-1.80	-1.70	Proportion of Wellbeing	-0.36	-0.41
Number of Observations	39,516	69,803	Number of Observations	36,068	69,803
R-Square	0.1969	0.1664	R-Square	0.1357	0.0741
Weak Identification		88.25 [0.000]	Weak Identification		69.31 [0.000]
F-Test			F-Test		
Hansen J		10.005	Hansen J		9.785
Endogeneity Statistic		[0.1126]	Endogeneity Statistic		[0.1236]
Variables	PSM-FE-OLS	TSLs-FE	Variables	PSM-FE-OLS	TSLs-FE
Receiving Assistance from the Government	0.0986* (0.0594)	0.1378*** (0.0056)	No Coping Strategy	-0.1783*** (0.0038)	-0.1758*** (0.0021)
Wealth Index	-0.0732*** (0.0138)	-0.1005*** (0.0125)	Wealth Index	-0.0906*** (0.0194)	-0.0834*** (0.0084)
Proportion of Wellbeing	-1.34	-1.37	Proportion of Wellbeing	1.96	2.10
Number of Observations	2,395	45,847	Number of Observations	19,671	69,803
R-Square	0.6769	0.0707	R-Square	0.2654	0.1453
Weak Identification		78.82 [0.000]	Weak Identification		67.23 [0.000]
F-Test			F-Test		
Hansen J		2.788	Hansen J		5.057
Endogeneity Statistic		[0.8259]	Endogeneity Statistic		[0.1129]

Notes: Standard errors within the parentheses. \*\*\*, \*\* and \* indicate significance at the 1%, 5%, and 10% level, respectively.

**Table A11: Regressions estimates for coping strategies and food insecurity index using household expenditures**

Variables	PSM-FE-OLS	TSLs-FE	Variables	PSM-FE-OLS	TSLs-FE
Selling Assets	0.0243** (0.0118)	0.0356*** (0.0032)	Receiving Support from Family and Friends	0.0504*** (0.0069)	0.0565*** (0.0031)
Logarithm of Household Expenditures	-0.0313*** (0.0056)	-0.0328*** (0.0013)	Logarithm of Household Expenditures	-0.0291*** (0.0053)	-0.0336*** (0.0014)
Proportion of Wellbeing	-0.09	-0.15	Proportion of Wellbeing	-0.26	-0.19
Monetary Value	285	475	Monetary Value	825	600
Number of Observations	10,911	69,685	Number of Observations	12,920	69,685
R-Square Weak Identification	0.1756	0.0797	R-Square Weak Identification	0.1317	0.0821
F-Test		80.83 [0.000]	F-Test		149.24 [0.000]
Hansen J		4.123 [0.2162]	Hansen J		1.120 [0.9807]
Endogeneity Statistic			Endogeneity Statistic		
Variables	PSM-FE-OLS	TSLs-FE	Variables	PSM-FE-OLS	TSLs-FE
Borrowing from Family and Friends	0.0819*** (0.0131)	0.0952*** (0.0042)	Engaging in Additional Income-Generating Activities	0.0234*** (0.0034)	0.0255*** (0.0021)
Logarithm of Household Expenditures	-0.0280*** (0.0094)	-0.0345** (0.0013)	Logarithm of Household Expenditures	-0.0191*** (0.0025)	-0.0337*** (0.0014)
Proportion of Wellbeing	-0.42	-0.35	Proportion of Wellbeing	-0.11	-0.10
Monetary Value	1,330	1,110	Monetary Value	350	315
Number of Observations	10,458	69,685	Number of Observations	33,227	69,685
R-Square Weak Identification	0.1875	0.0849	R-Square Weak Identification	0.0840	0.0776
F-Test		95.48 [0.000]	F-Test		86.93 [0.000]
Hansen J		2.260 [0.8943]	Hansen J		15.665 [0.1299]
Endogeneity Statistic			Endogeneity Statistic		
Variables	PSM-FE-OLS	TSLs-FE	Variables	PSM-FE-OLS	TSLs-FE
Borrowing from Financial Institutions and Banks	0.0587*** (0.0078)	0.0815*** (0.0031)	Credit Purchase	0.0990*** (0.0036)	0.1073*** (0.0021)
Logarithm of Household Expenditures	-0.0381*** (0.0064)	-0.0329*** (0.0137)	Logarithm of Household Expenditures	-0.0318*** (0.0028)	-0.0346*** (0.0013)
Proportion of Wellbeing	-0.26	-0.32	Proportion of Wellbeing	-0.41	-0.40
Monetary Value	825	1,015	Monetary Value	1,300	1,270
Number of Observations	11,018	69,685	Number of Observations	27,597	69,685

Variables	PSM-FE-OLS	TSLs-FE	Variables	PSM-FE-OLS	TSLs-FE
R-Square	0.2571	0.0961	R-Square	0.1898	0.1116
Weak Identification F-Test		138.31 [0.000]	Weak Identification F-Test		104.28 [0.000]
Hansen J Endogeneity Statistic		7.198 [0.4057]	Hansen J Endogeneity Statistic		11.907 [0.2186]
Delaying Payment Obligations	0.1366*** (0.0068)	0.1371*** (0.0028)	Selling Harvest in Advance	0.0433*** (0.0138)	0.1069*** (0.0043)
Logarithm of Household Expenditures	-0.0244*** (0.0050)	-0.0317*** (0.0013)	Logarithm of Household Expenditures	-0.0228** (0.0102)	-0.0338*** (0.0013)
Proportion of Wellbeing	-0.65	-0.59	Proportion of Wellbeing	-0.53	-0.41
Monetary Value	2,060	1,870	Monetary Value	1,680	1,300
Number of Observations	12,868	69,685	Number of Observations	6,080	69,685
R-Square	0.2061	0.1082	R-Square	0.2041	0.0858
Weak Identification F-Test		82.74 [0.000]	Weak Identification F-Test		72.25 [0.000]
Hansen J Endogeneity Statistic		16.213 [0.1017]	Hansen J Endogeneity Statistic		21.182 [0.0119]
Variables	PSM-FE-OLS	TSLs-FE	Variables	PSM-FE-OLS	TSLs-FE
Reducing non-Food Consumption	0.1396*** (0.0028)	0.1584*** (0.0018)	Relying on Savings	0.0351*** (0.0031)	0.0421*** (0.0019)
Logarithm of Household Expenditures	-0.0278*** (0.0020)	-0.0344*** (0.0013)	Logarithm of Household Expenditures	-0.0397*** (0.0023)	-0.0351*** (0.0013)
Proportion of Wellbeing	-0.64	-0.60	Proportion of Wellbeing	-0.12	-0.16
Monetary Value	2,030	1,900	Monetary Value	380	505
Number of Observations	39,428	69,685	Number of Observations	35,880	69,685
R-Square	0.1960	0.1772	R-Square	0.1520	0.0845
Weak Identification F-Test		88.25 [0.000]	Weak Identification F-Test		62.84 [0.000]
Hansen J Endogeneity Statistic		12.433 [0.1405]	Hansen J Endogeneity Statistic		10.345 [0.2536]
Variables	PSM-FE-OLS	TSLs-FE	Variables	PSM-FE-OLS	TSLs-FE
Receiving Assistance from the Government	0.1565*** (0.0599)	0.1462*** (0.0054)	No Coping Strategy	-0.1682*** (0.0044)	-0.1879*** (0.0021)
Logarithm of Household Expenditures	-0.0861* (0.0455)	-0.0555*** (0.0022)	Logarithm of Household Expenditures	-0.0255*** (0.0027)	-0.0314*** (0.0013)

Proportion of Wellbeing	-0.29	-0.34	Proportion of Wellbeing	0.91	0.82
Monetary Value	920	1,075	Monetary Value	2,885	2,600
Number of Observations	2,376	45,844	Number of Observations	19,542	69,685
R-Square	0.8749	0.0887	R-Square	0.2536	0.1533
Weak Identification F-Test		72.46 [0.000]	Weak Identification F-Test		72.68 [0.000]
Hansen J Endogeneity Statistic		6.392 [0.3623]	Hansen J Endogeneity Statistic		12.391 [0.1518]

Notes: Standard errors within the parentheses. \*\*\*, \*\* and \* indicate significance at the 1%, 5%, and 10% level, respectively.

## A5. Propensity score graphs

In Figure A1, we illustrate the propensity scores before and after the matching process. In particular, in the left panel for each coping strategy, we show the kernel density frequency distribution of propensity scores before the matching, and the second panel presents the kernel density after the matching process. The solid curve represents the households having adopted a coping strategy, and the dashed curve shows the households that have not adopted a certain strategy. The last figure differs, as the solid line shows the kernel density distribution of households that did not need to adopt any coping strategy, and the dashed curve illustrates the kernel density distribution of the households that have adopted any type of coping strategy. There were significant differences in the characteristics between a household with coping strategies and households that have not adopted a specific coping mechanism. We conclude, in all cases, that the nearest neighbour matching approach using a calliper of 0.1 of the standard deviation of the logit of the propensity score performs very well. Exceptions could be considered for borrowing from family and friends and receiving assistance from the government. Nevertheless, the propensity score matching significantly improves the matching.

## Appendix B

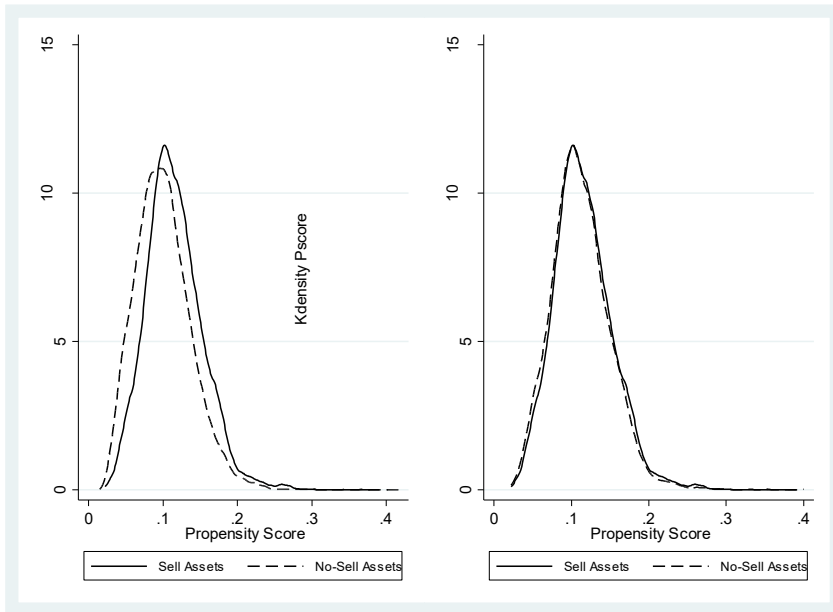
### Appendix B. Robustness checks

In this study, we use the standard of living approach (SoL) developed and applied in previous studies (Berthoud et al., 1993; Zaidi & Burchardt, 2005; Morciano et al., 2015). In our case, we measure the SoL by the food insecurity index. While the previous studies have employed household income, we use the wealth index described in the main manuscript due to unavailable data. We utilize the SoL approach to identify and estimate the inequalities between the households implementing a coping strategy and those who did not need to adopt any coping strategy. In the solid line, we represent the households adopting a coping strategy, and the dashed line represents the households that have not adopted any coping strategy. We highlight that, the curves have a negative slope, as a lower level of wealth is associated with higher levels of food insecurity. While wealth increases, food insecurity levels decline or equivalently enhance food security. This is explained because we construct the food insecurity in a way where higher values of this variable reflect higher food insecurity levels. Thus, the SoL approach suggests that the standard of living—represented by food insecurity—for a household with coping strategies will deteriorate because of the expenditures allocated to cope with employment loss and reduction in income.

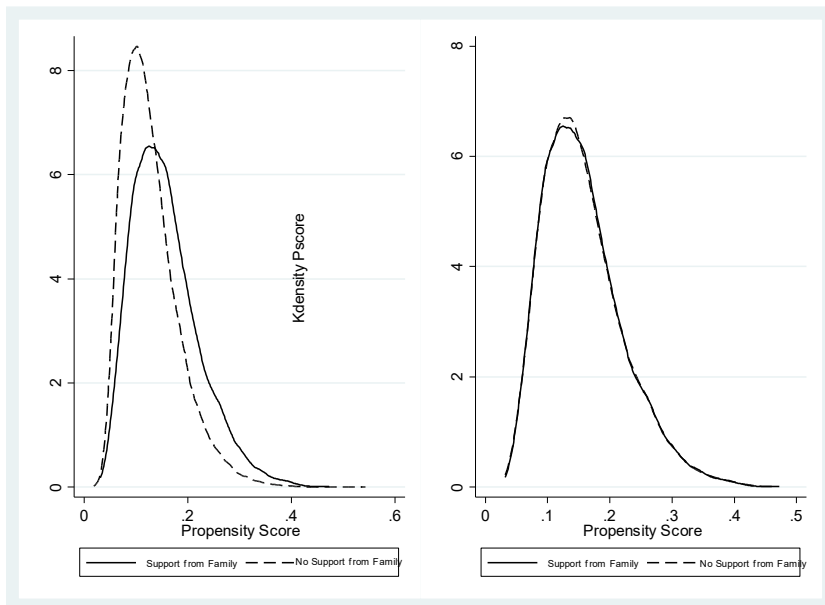
Thus, households adopting coping strategies can enjoy the same SoL, but they require a higher wealth. In Figure B1, we illustrate the theoretical framework of the SoL approach (Berthoud et al., 1993; Zaidi & Burchardt, 2005), where  $S_0$  at point C represents the food insecurity level at wealth level  $W_0$  and is represented by the solid curve of the coping strategies households (CS).  $S_1^{CS}$  is the SoL or the food insecurity level of households adopting coping strategies. This is equal to  $S_0^{NCS}$  and denotes the SoL of households that have not adopted any coping strategy (NCS) in point B. This shows how much is necessary to spend to equalise the SoL of the two types of households, represented by wealth  $W_1$  and the dashed curve NCS, which denotes No Coping Strategy (NCS). Hence, for families with coping strategies to enjoy the same level of food security, a higher wealth level  $W_1$  is needed. Figure B1 shows that food insecurity decreases with wealth for all households. Still, for the families with coping strategies, the same wealth  $W_0$  results in higher food insecurity (or lower food security levels) at point C. Conversely, households with coping strategies can achieve the same level of food security if they have higher wealth. Therefore, wealth  $W_1$  in Figure B1 represents the same food insecurity levels as wealth  $W_0$  for households that have not adopted a coping strategy, and the difference of  $W_1 - W_0$  or the distance AB gives an estimate of the additional costs of coping strategies or inequalities (Berthoud et al., 1993; Zaidi & Burchardt, 2005).

Figure A1: Propensity scores before and after matching

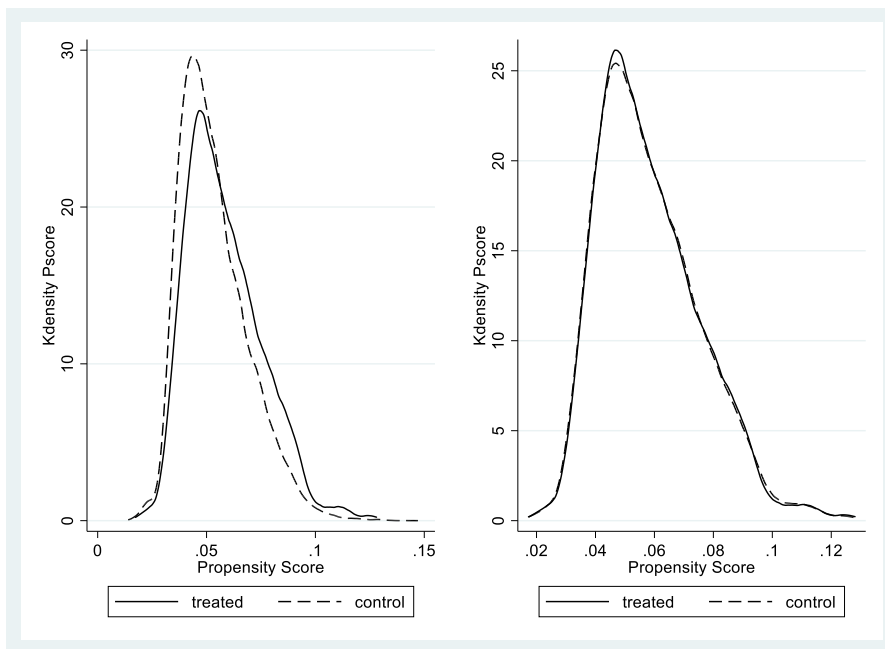
## Selling assets



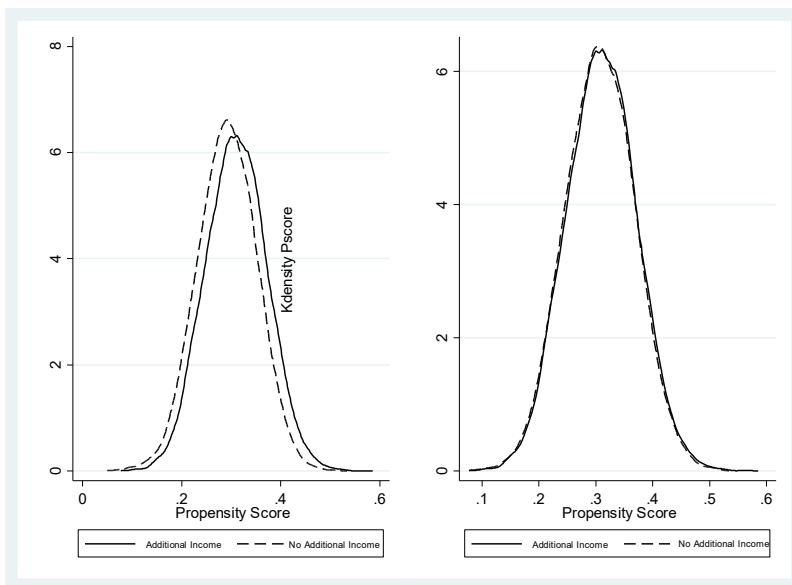
## Receiving support from family and friends



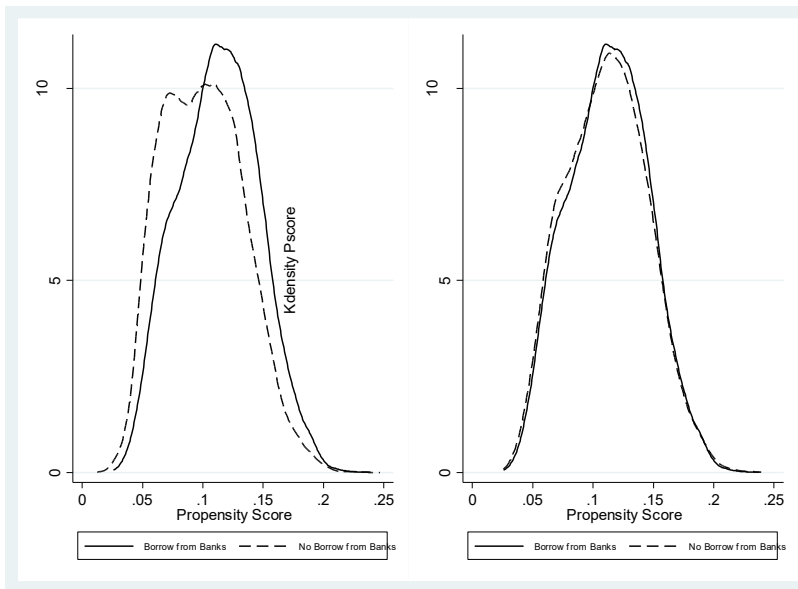
### Borrowing from family and friends



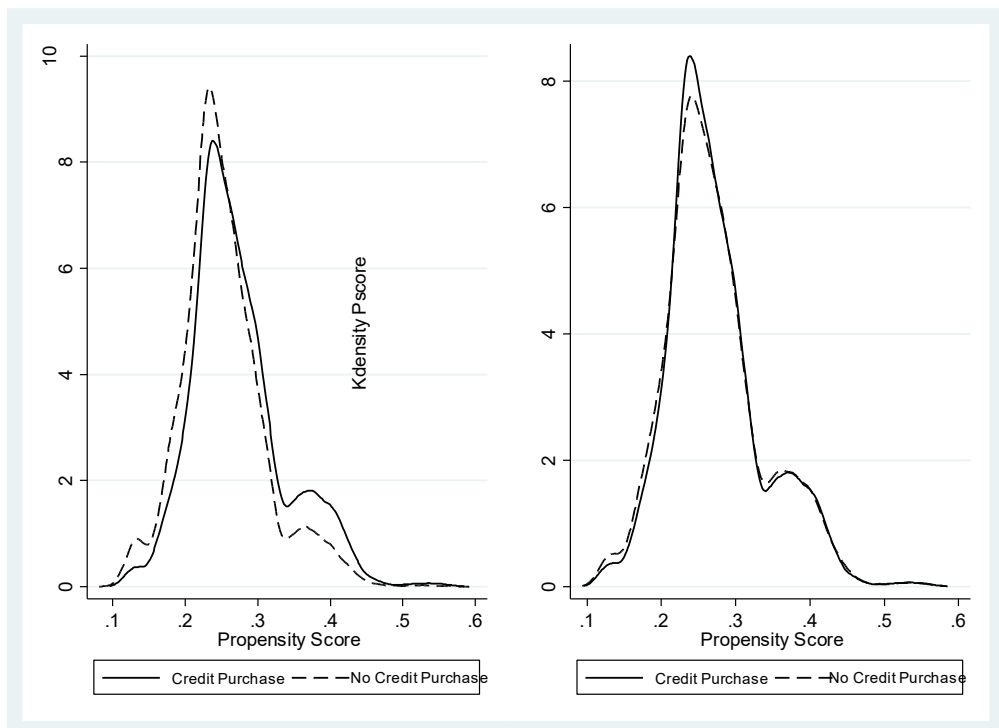
### Engaging in additional income-generating activities



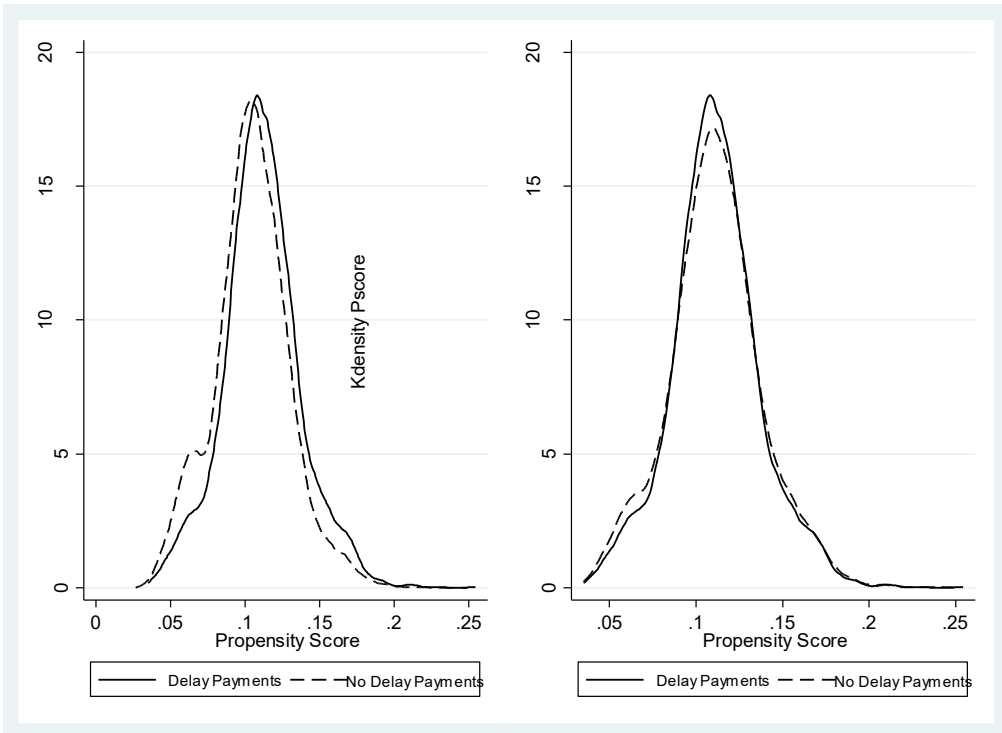
### Borrowing from financial institutions and banks



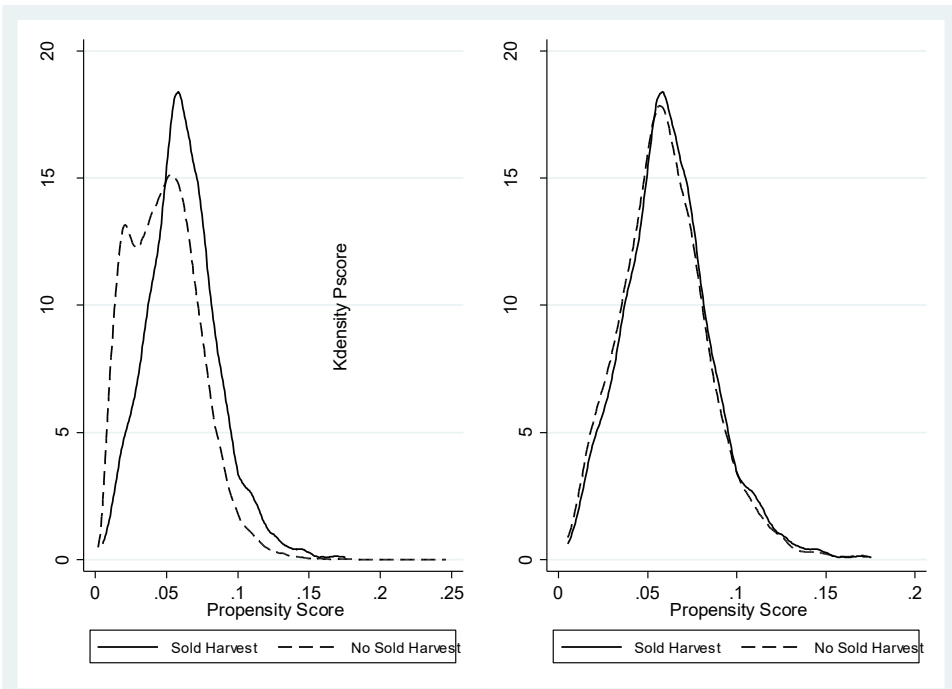
### Credit purchase



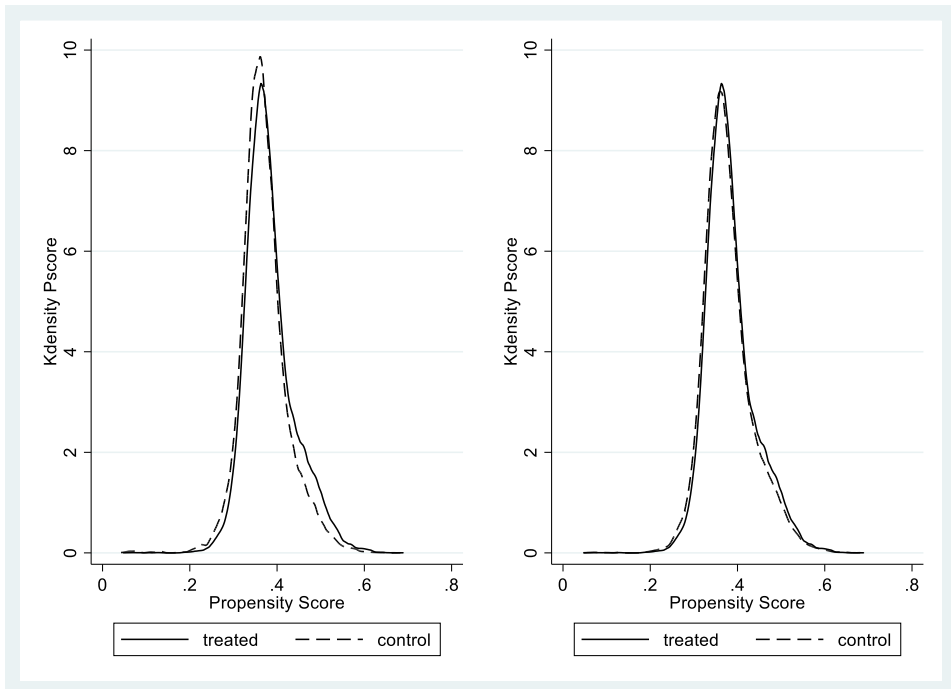
### Delaying payment obligations



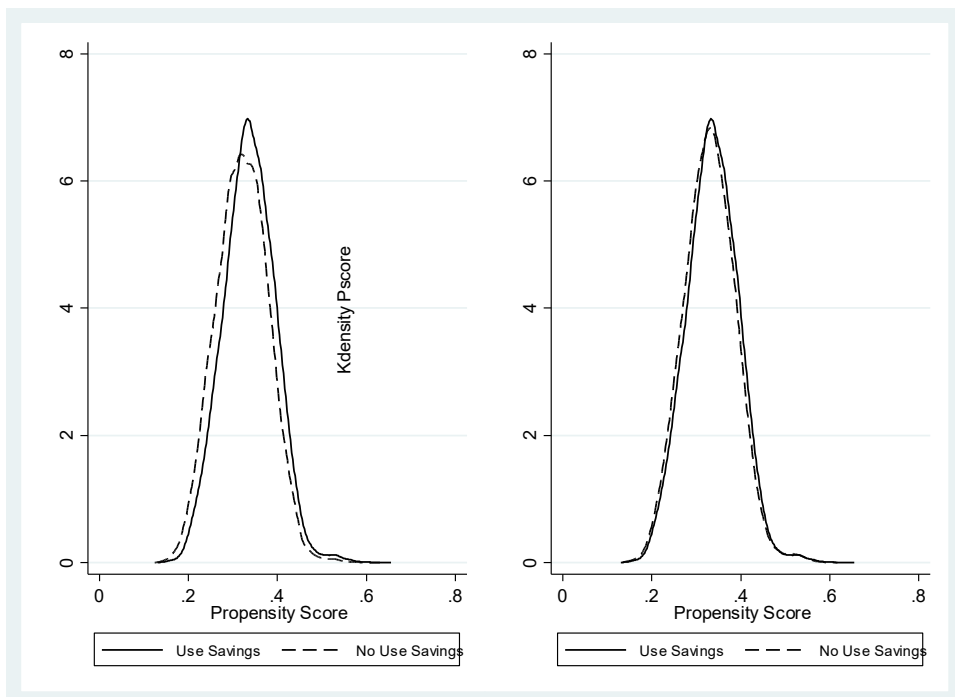
### Selling harvest in advance



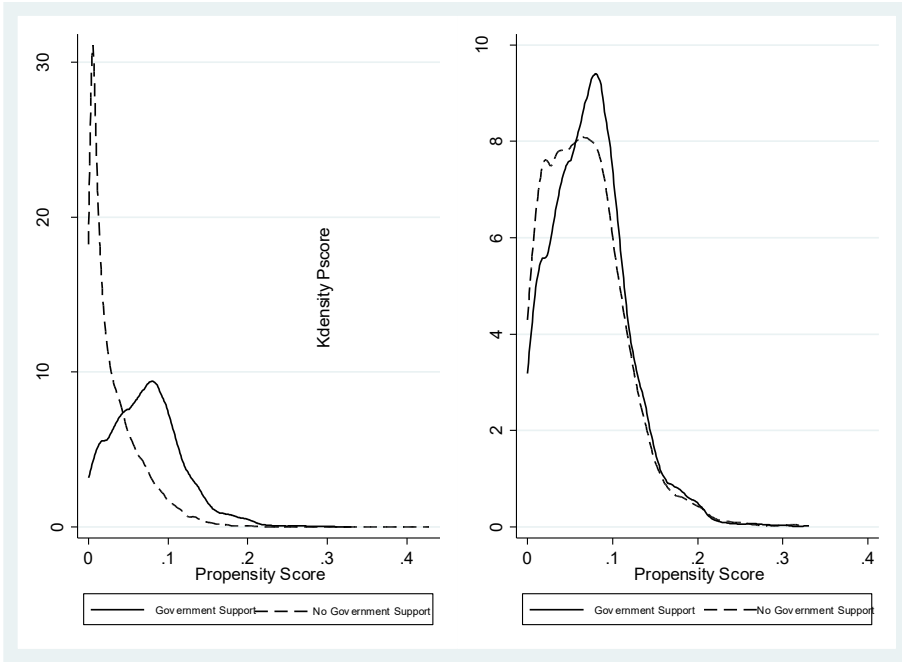
### Reducing non-food consumption



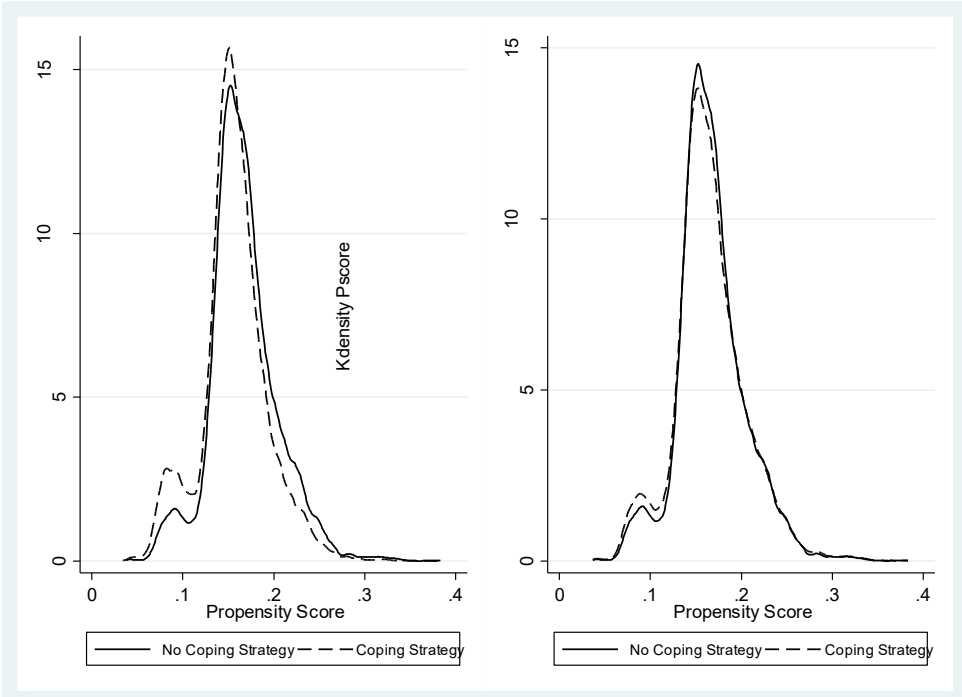
### Relying on savings

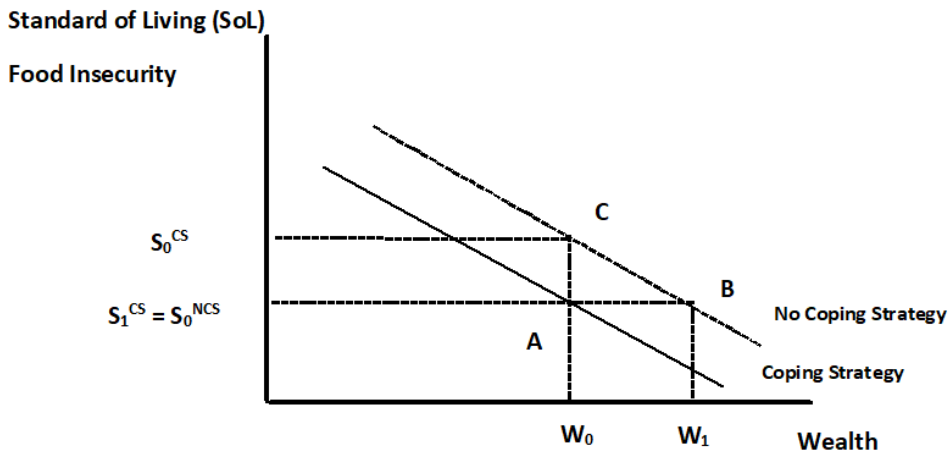


### Receiving assistance from the government



### No coping strategy

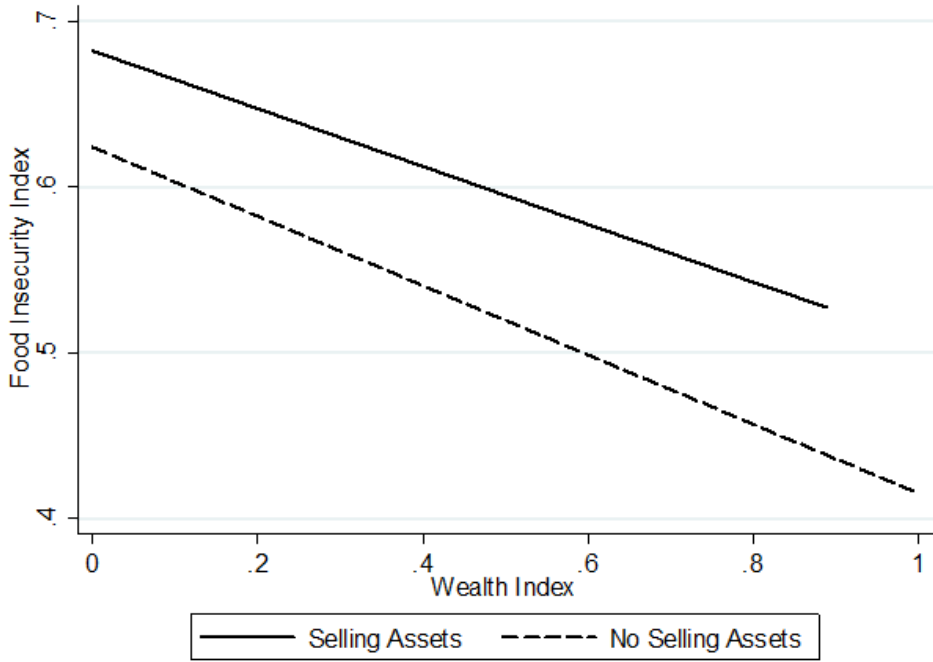


**Figure B1: Standard of living – Food insecurity and wealth by coping strategy**

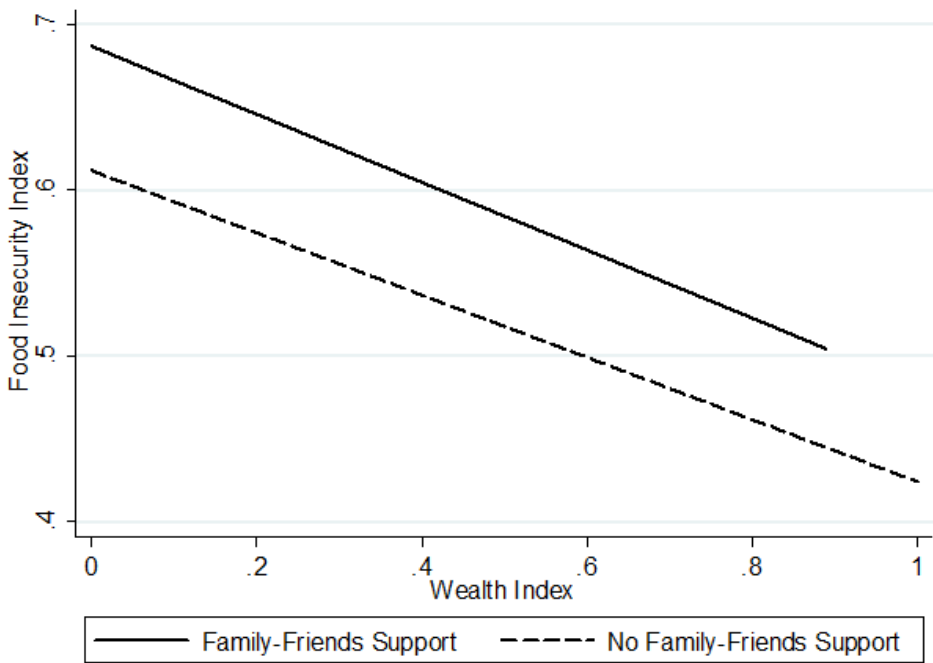
In figures B2–B12, we report the graphical inspection for testing the independence of base (IB) property, comparing households adopting a specific coping strategy and those who did not adopt any coping mechanism. On the other hand, in Figure B13, we illustrate the households that have adopted any coping strategy and households that did not require to adopt any coping strategy. We do not further explore the IB test using non-parametric estimates, estimation of vertical and horizontal distances between the reference and comparison Engel curves across the distribution of wealth, and the comparison of estimated average derivatives across Engel curves (for more detail, see: Yatchew, 1999, 2003; Perali, 2003; Giovanis et al., 2023).

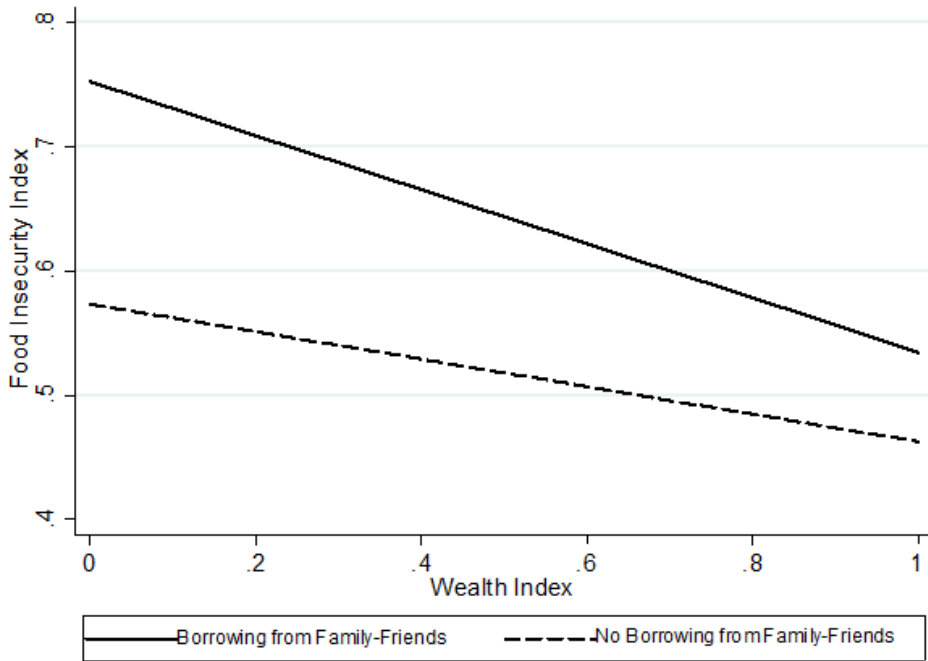
The study proposes the food insecurity and wealth indexes to establish a base-independent equivalence scale and test the IB property. In this way, we may show that coping strategy equivalence scales do not vary across wealth levels. This result may provide valuable insights to policy makers and imply practical policy implications. First, base-independent equivalence scales may allow governments to ensure the fairness of redistribution by ensuring that each member of the transfer target population achieves the same level of wellbeing, which in our case is expressed by food security. An accurate equivalence scale provides valuable information to policy makers allowing them to design transfer programmes that do not incentivize programme participants to change their household type to enhance their wellbeing and welfare level. Furthermore, accurate equivalence scales enable social evaluations, such as constructing inequality indices, to be conducted using household data. Finally, the restrictions on preferences imposed by base independence offer a convenient and integrable method for incorporating demographic data into the non-parametric estimation of Engel curves.

**Figure B2: Selling assets and wealth index**

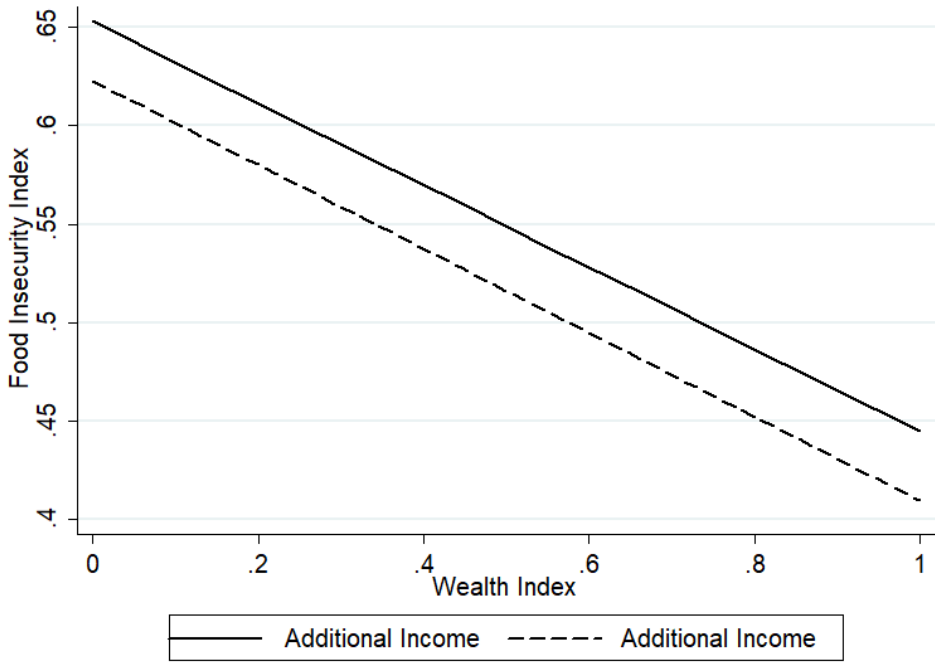


**Figure B3: Support from family/friends and wealth index**



**Figure B4: Borrowing from family/friends and wealth index**

**Figure B5: Engaging in additional income-generating activities and wealth index**



**Figure B6: Borrowing from financial institutions and banks and wealth index**

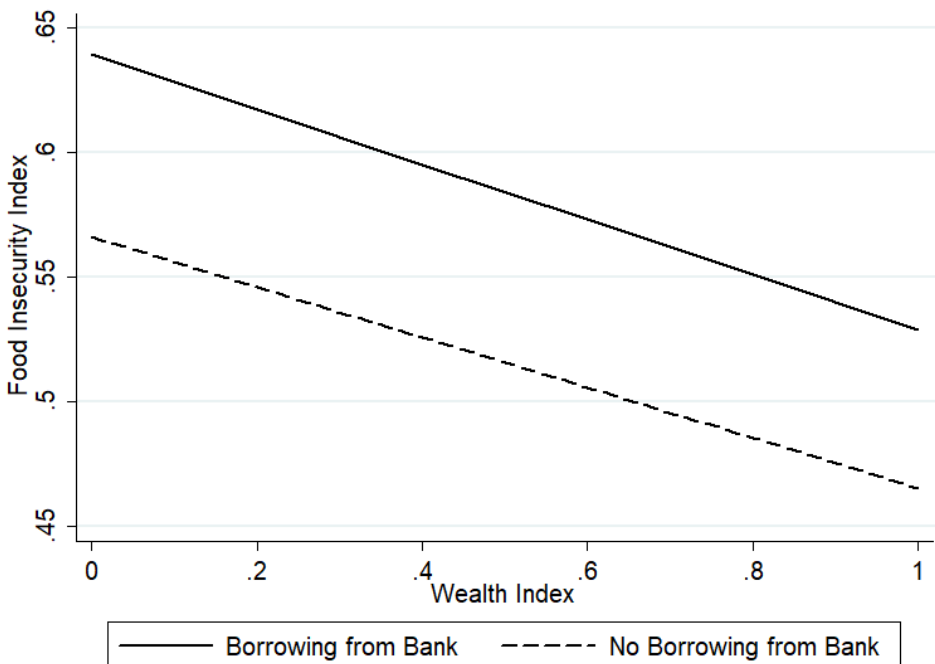
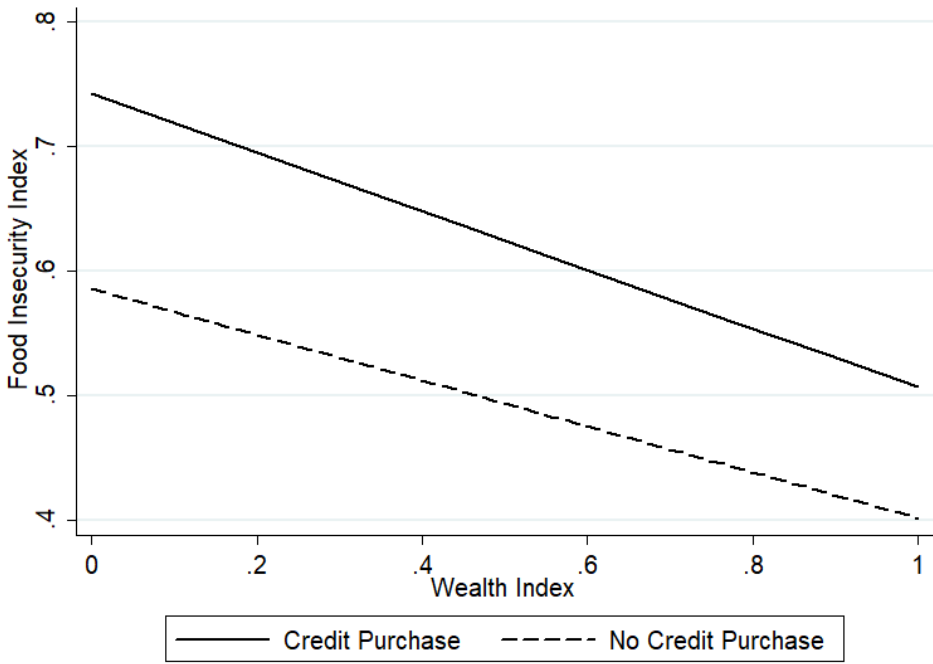
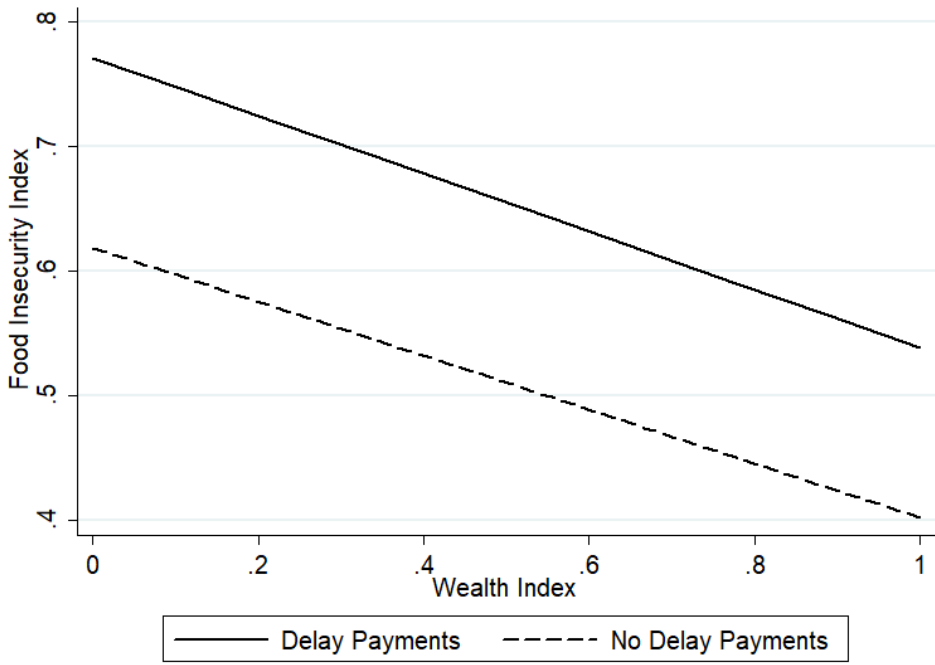


Figure B7: Credit purchase and wealth index



**Figure B8: Delaying payment obligations and wealth index**



**Figure B9: Selling harvest in advance and wealth index**

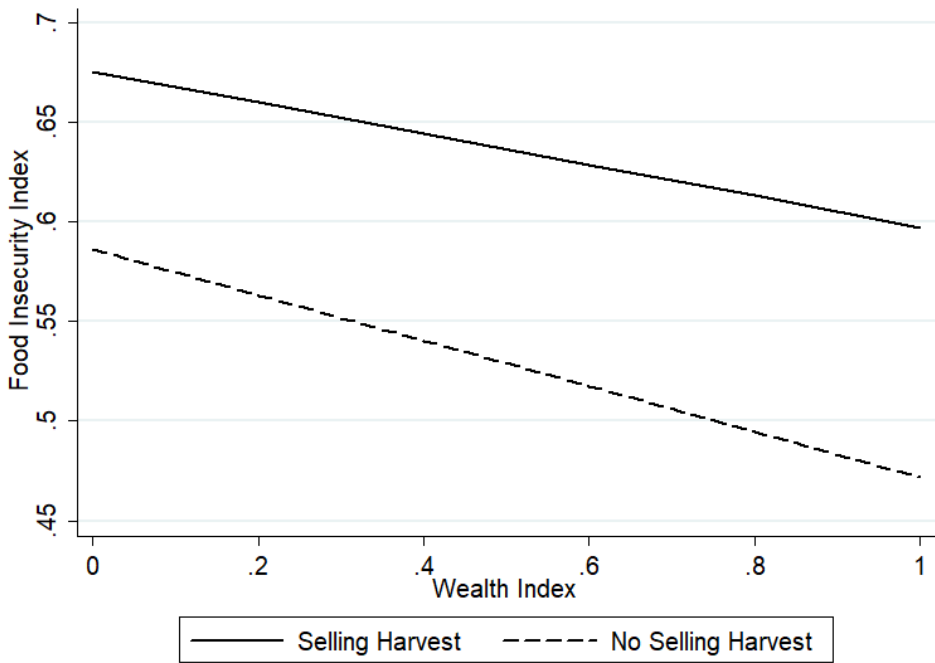


Figure B10: Reduce non-food consumption and wealth index

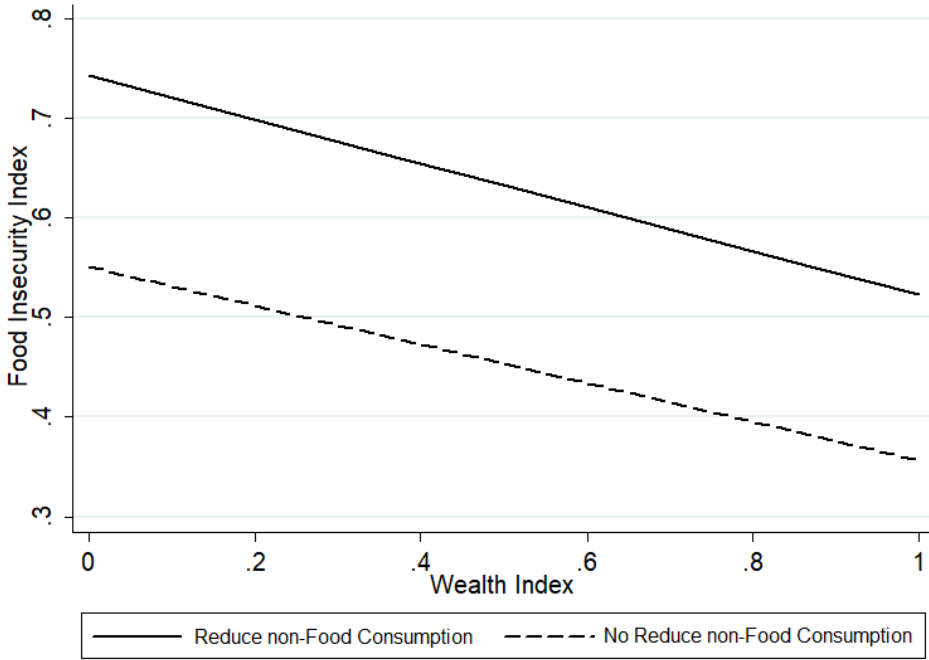
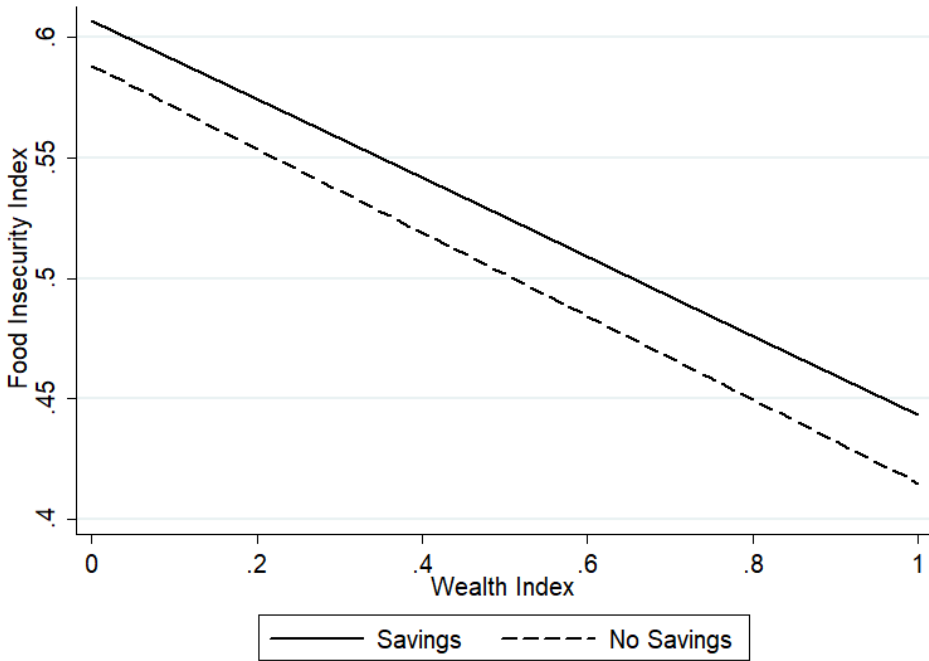
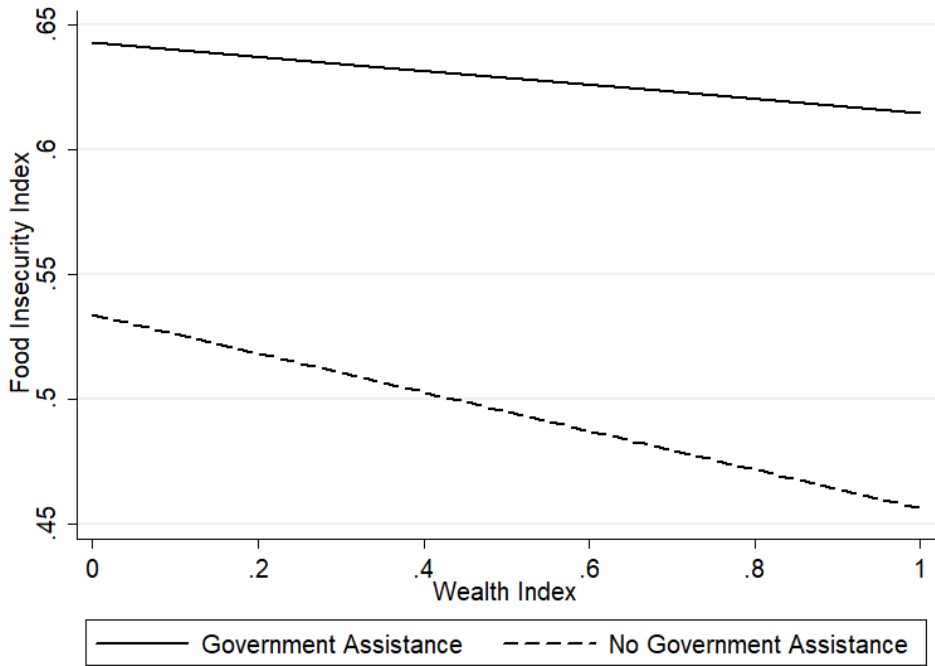


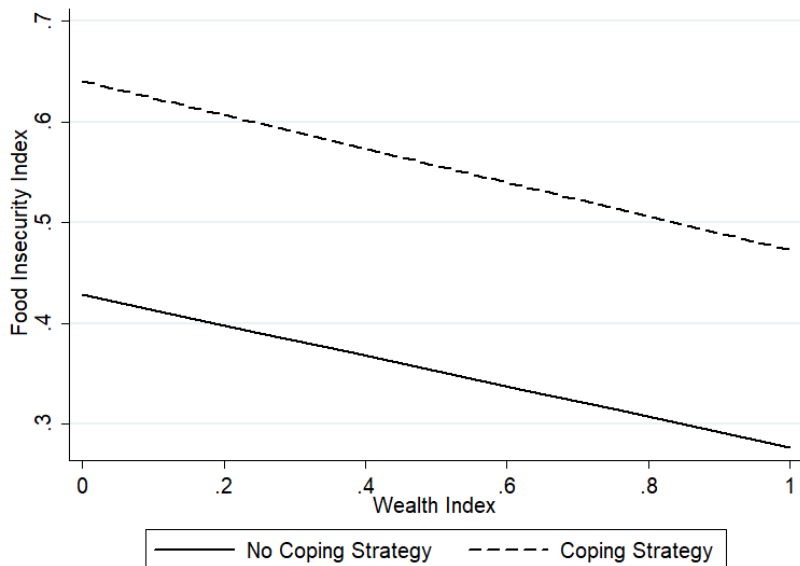
Figure B11: Relying on savings and wealth index



**Figure B12: Government assistance and wealth index**



**Figure B13: No coping strategy and wealth index**





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