Implications of COVID-19 Lockdowns on Household Hunger and Food Insecurity in South Africa's Formal and Informal Sector: Evidence from Recent Survey Data

by

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Abstract

During the strict COVID-19 lockdowns imposed by many countries around the world, most of the vital economic activities were stopped, causing severe socio-economic disruptions worldwide. Likewise, South Africa went into a strict lockdown on the 27th of March, triggering massive loss of earnings and jobs for numerous workers. Despite the rapid government response to the difficult situation, many workers reported increasing household hunger and food insecurity. A priori expectation due to the labour market segmentation theory is that informal workers were more likely to experience hunger and food insecurity relative to formal workers. The South African informal sector is highly vulnerable, generally engaged in precarious jobs for ensuring daily survival. Thus, this paper aims to identify informal workers' hunger and food insecurity outcomes during the lockdown compared to formal workers, and to understand the implications arisen. By employing a descriptive analysis followed by a logit regression, this study finds that the South African informal sector was correlated with higher probabilities of household hunger and food insecurity during the lockdown. Moreover, certain groups within both sectors, mainly casual workers and black/coloured groups, were affected more intensely by hunger and food insecurity. However, both formal and informal workers were seriously affected and encountered obstacles in accessing proper social support. Hence, the analysis suggests that prospective policy plans dealing with economic crises need to be tailored for targeting specific groups of vulnerable workers within formal and informal sectors.

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Abbreviations:

AME – Average Marginal Effect

COVID-19 – Coronavirus Disease 2019

CSG – Child Support Grant

COGTA - Department of Cooperative Governance and Traditional Affairs

GDP – Gross Domestic Product

ILO – International Labour Organization

LPV – Linear Predicted Values

MEM - Marginal Effects at Means

NIDS-CRAM – National Income Dynamics Study – Coronavirus Rapid Mobile Survey

OLS - Ordinary Least Squares

R - South African Rand (currency)

SRD – Social Relief of Distress grant

TERS-UIF - Temporary Employer Relief Scheme

UIF – Unemployment Insurance Fund

VIF - Variance Inflation Factor

1. Introduction

During the beginning of the COVID-19 pandemic, strict measures had been taken by international authorities, causing disruptions for workers and firms worldwide, especially for those who could not perform their jobs remotely. Even though both formal and informal sectors have been seriously affected, informal workers might have been disproportionately affected, due to the precarious nature of their jobs and lack of social security protection. Moreover, the negative effects of the COVID-19 pandemic were experienced strongly by workers in developing countries, such as South Africa, where the relief measures provided were not sufficient for preventing some of the most severe outcomes (ILO, 2020a). The South African government responded to the COVID-19 pandemic through a set of strict social distancing measures enacted from 27th of March onwards. South Africa's first lockdown period started with stringent directives, some of them being chronologically eased in the following months (ILO, 2020b). One major negative consequence of the lockdown was increasing hunger and food insecurity levels among numerous vulnerable workers (Wills, Van der Berg, Patel & Mpeta, 2020). However, based on the labour market segmentation theory, it is probable that the lockdown' negative effects were experienced unevenly between workers in formal and informal sectors, further deepened by race and gender differences.

The first wave of NIDS-CRAM (the National Income Dynamics Study – Coronavirus Rapid Mobile Survey) provided evidence that there was a drastic increase in household hunger and food insecurity during the lockdown. Comparisons with data from earlier surveys showed that much of the improvements in adult and child hunger from the last two decades, were clearly deteriorated due to the severe lockdown consequences (Van der Berg, Zuze & Bridgman, 2020). Moreover, numerous poor grants receiving households reported obtaining their main income from salaries, commissions and even profits from a business (often an informal business). Thus, losing the primary source of income they predominantly rely on for survival affected the households' food security levels (Wills et al., 2020).

Analysing the labour market dynamics has been viewed as a primary source for defining and measuring social and economic matters. Likewise, researchers in South Africa, have always looked to evidence from labour markets dynamics to study the most persistent problems since the end of the apartheid, especially problems concerning poverty, inequality, and unemployment. Concerning the formal/informal dynamics, previous findings indicated that there is a strong correlation between obtaining a job in the formal sector and escaping poverty, while losing a job in the formal sector is correlated with a higher risk of falling back into poverty (Cichello & Rogan, 2017).

Although employment dynamics have always been important, there can be additional insight during a crisis when the genuine efficiency of the present policies is tested. Moreover, a 2020 analysis indicated that the COVID-19 crisis differs from previous crises in multiple aspects, as well as regarding food insecurity dynamics (Clapp & Moseley, 2020). Another research indicated that hunger and food security improvements made in the last years in South Africa had been considerably diminished by the severe lockdown (Van der Berg, Zuze & Bridgman, 2020). Thus, it can be expected that during an economic downturn, the present poverty and inequality gaps between the formal and informal economy will more likely deepen even further.

1.1 Research problem and objectives

However, although earlier studies focused on a wider perspective of hunger and food insecurity are highly relevant, there seems to be a literature gap regarding formal/informal comparisons and insights on the specific groups of workers affected by hunger and food insecurity. Research focused on formal/informal differences and on the particular groups of workers affected by hunger and food insecurity during the lockdown are relevant for better targeted future policy. Therefore, departing from the previous literature, this paper aims to conduct an in-depth analysis of household hunger and food insecurity outcomes during the lockdown, focusing on informal versus formal sector and on particular groups within the sectors.

Consequently, for the purpose mentioned above, a descriptive analysis and a logit estimator were employed for analysing the NIDS-CRAM data. The descriptive analysis indicated that 30.1 percent of informal workers who did not lose their jobs completely were unable to work in April due to the strict lockdown, compared to 26.4 percent of formal workers. Additionally, 49.2 percent of informal sector workers and 34.7 percent of formal sector workers reported that their household lost the main source of income. As a result, the logit regression indicates that informal workers had a higher probability of household hunger of 24.7 percent versus 20.8 percent for formal workers, and a higher probability of food insecurity of 50.4 percent compared to 43.7 percent for formal workers. However, the proportion of hunger and food poverty are relatively large for both sectors. These findings suggest that future interventions aimed for preventing hunger and food insecurity, need to be significantly improved and better targeted for vulnerable workers within both formal and informal sectors. Having thus defined the research problem and purpose, this study aims to answer the following question:

What were the implications of COVID-19 lockdowns on household hunger and food insecurity in South Africa's formal and informal sector?

The first objective in conducting this study is to identify the probabilities of household hunger and food insecurity for the informal versus the formal sector. The second objective is to get insight into lockdowns' outcomes for various groups within formal and informal sectors. The third objective is to assess what are the implications of the analysis results from the larger perspective.

A better understanding of the formal and informal employment in the new circumstances set out by the COVID-19 crisis, is essential for assessing how the South African society responded and adapted to the new situation. Similar studies are fundamental for decision makers as the pandemic is not over yet and the COVID-19 consequences are still present. In the likelihood of future distress periods, potential disruptions should be managed in a more efficient way, for avoiding extreme outcomes. Thus, a deeper exploration of hunger and food insecurity outcomes among formal and informal employment, during the lockdown can be beneficial for better targeted policy.

The following section will present the background for the informal sector and outcomes during the COVID-19 lockdown. Section 3 will contain the theoretical framework for the study and will review previous literature of informal sector and food poverty in South Africa, both during COVID-19 and during previous crises. In section 4 a description of the data is given, as well as the variables and methodology used in the analysis. Section 5 contains the descriptive analysis, and the logit regression results, followed by section 6 with discussions of the main results and finally the conclusion.

2. Background and context

2.1 Informal economy during COVID-19

An analysis of the labour market in Africa would be incomplete without including the informal economy, which has a large proportion of the labour market, employing 86% of workers in the African continent (ILO, 2018). In comparison the informal sector in South Africa is much lower, about a third of the total workforce - approximately 5 million workers in 2020 (Stats SA, 2020). Although, the informal economy in South Africa has a small share compared to the average on the African continent, it is regarded as an important sector of the economy that has the potential to help reducing the high poverty rate of 55% and the high inequality at 63.00 GINI (World Bank, 2021). Moreover, the informal sector is related to the high levels of unemployment (29% in 2020), with numerous informal workers being at risk of falling into unemployment (Stats SA, 2020).

The COVID-19 pandemic has been considered one of the worst global crises from the last decades. The drastic measurements taken by the majority of countries have caused significant disruptions on economies and labour markets around the world. Several countries imposed strict lockdown procedures especially during the second of 2020, to avoid the spread of the virus. The strict lockdowns stopped most of the economic activities considered non-vital, further impacting other areas of the economy. The direct and indirect effects of the lockdown caused massive job loss, major income decreases, and increasing levels of poverty and hunger (ILO, 2020a).

ILO (2020a) suggested in an early report that almost 1.6 billion workers in the informal economy were significantly impacted by lockdown measures and possibly working in the hardest-hit sectors (i.e., retail, accommodation, and food services sectors). The report estimated for the first month of the crisis, a decline in earnings for informal workers of 60% globally, with the largest declines in Africa and Latin America. However, in an updated report ILO (2020b) found that the predicted working-hours decrease, and income loss were even higher for workers in developing countries than those in developed countries, especially in the informal sector. One important reason is that in developing economies, there are limited opportunities for working remotely. Also, the employment nature of informal workers is typically characterised by precarious working conditions, daily earnings, and lack of legal and social protection. Besides, ILO (2020a) cautioned about the possibility that the COVID-19 crisis could lead to an increase in informal employment and self-employment, because as businesses close or reduce staff, formal jobs will shrink.

As a response to the COVID-19 pandemic, the South African government imposed strict lockdown measures, with level 5 being the most rigid and level 1 the least rigid. The government declared lockdown level 5 between March-April 2020 (COGTA, 2020a). The first stage of lockdown was characterised by strict regulations, which required most of the non-essential sectors in the economy to interrupt their activities. As a result, workers employed in non-essential sectors were required to stay at home, and where possible to conduct their work remotely. As in most of the countries, people were allowed to leave their homes just for acquiring vital goods or services, collecting social grants or when in need of medication (COGTA, 2020a).

These restrictions caused massive distress due to income and job loss, especially for those in the informal sector, who depend on daily earnings and are not protected by any contractual agreement. Moreover, the majority of informal workers in South Africa have low value-added jobs in street trade, manufacturing or similar, and cannot conduct their work remotely (Strauss, Isaacs, Rosenberg & Passoni, 2020). Thus, it is probable that during the first COVID-19 lockdown, the vulnerable informal workers have experienced a more pronounced shock than those employed in the formal sector. However, after more than one month of level 5 lockdown, the government lowered the regulations allowing for more economic activities to be performed. The country moved to the eased level 4 lockdown, from the beginning of May, with strict health procedures and social distancing rules (COGTA, 2020b). The effects of the COVID-19 pandemic and the strict lockdown resulted in a massive contraction of the South African economy, with a negative GDP rate of - 6.96% in 2020 (World Bank, 2021).

2.2 Poverty and food insecurity during COVID-19

ILO (2020a) suggested that the rate of relative poverty was expected to increase by nearly 34 percentage points globally for informal workers. The ILO report suggested the need for urgent policy responses to protect both enterprises, and workers, particularly those operating in the informal economy. ILO estimated the COVID-19 restrictions will contribute with up to 35 million new working poor (at $3.20 per day) globally (Sumner, Hoy & Ortiz-Juarez, 2020). It is probable that a high percentage of the new working poor is attributed to informal workers in the developing world, as the strict lockdown prevented informal and casual workers from generating any type of earnings (ILO 2020a).

Similarly, the measures taken by the South African government to prevent the spread of the virus, have caused drastic consequences for both firms and workers (Ranchhod & Daniels, 2020). Although these regulations might have helped with controlling the spread of the virus, the consequences on increasing levels of poverty, particularly food poverty and hunger have been severe. Many informal workers are dependent on the income from informal jobs for basic survival needs such as food and water, as most of them do not have any income replacement or savings (Feder & Yu, 2020). As a result, several cases of protests and social strife were reported by the media, because of the difficulties of numerous South Africans to meet their basic food needs (Davis, 2020).

According to the Human Sciences Research Council survey, nearly two-thirds of the population in poor urban areas had no money to buy food, during the first two weeks of the lockdown (HSRC, 2020). The Department of Social Development indicated that the already high percentage of the population experiencing food insecurity increased to 50% during the first phase of lockdown (DSD, 2020). The government response to the difficult situation has been the distribution of food parcels which recorded a tremendous demand (Solidarity Fund, 2020). The Department of Social Development (2020) reported that during the first 3 month of lockdown food parcels had been distributed to an estimated 3.6 million people in South Africa, reaching just 12% of the people who needed them.

3. Theory and Literature review

3.1 Theoretical framework

It was broadly assumed during the 60s and 70s, that low productivity traditional economies could successfully make the transition to modern economies, based on the previous experiences of economic growth in Western Europe and North America. One of the first proponents of this view – Simon Kuznets (1956), elaborated a theory of growing inequality in the labour market, in the process of transition from traditional to modern economies, followed by a flattening and reversing of inequality over time – the theory known as "The Kuznets curve". A similar perspective was shared by W. Arthur Lewis (1954), who argued that in the long run, economic growth would generate enough modern jobs to absorb surplus labour from the traditional economy. In the process, the traditional sector comprising petty agricultural endeavours and trade production would be absorbed into the modern economy. Lewis argued that this would lead to a turning point when wages would begin to rise above the subsistence level - a situation referred to as the "Lewis Turning Point" (Lewis, 1954).

However, the positive perspective for economic growth in developing countries, was replaced by rising concerns about the persistent unemployment and poverty. As a result of the persistently growing inequality on the labour market, development economist Hans Singer (1970) argued that he does not observe signs of the "Lewis Turning Point" in most of the developing world. In contrast with the previous experiences of developed countries, growing differences on the labour markets in developing countries, gave no sign of reversing despite high rates of economic growth. The author anticipated a growing dualism in the labour market with increasing levels of casual employment and hidden unemployment, warning about the prospect of employment crises and job shortages.

Over the years, low-skilled labourers engaged in low-income and marginal activities, mostly in the traditional sector, started to be identified as the "informal sector" or the "secondary economy" (Hart, 1971; ILO, 1972). The discussion whether the increasing informal sector is being a hindrance or a support in poverty reduction and economic growth, has been widely debated by development economists over time. However, a persistent school of thought known as "the labour market segmentation theory" has been dominant in the literature.

The dual labour market hypothesis argues that informal workers are excluded from economic opportunities, due to disparities between populations' growth rates and modern employment, as well as a mismatch between peoples' abilities and the structure of modern economic opportunities (Chen, Vanek & Carr, 2004; Chen, 2012). The labour market segmentation theory indicates that the formal sector has good jobs cushioned by contractual agreements, secure working conditions, and decent wages whereas the disadvantaged informal sector has most of the times vulnerable jobs with poor working conditions and low wages (El Badaoui, Strobl & Walsh, 2008; Bargain & Kwenda, 2014). Lack of labour unions and labour market regulations, for ensuring minimum wages and safe working conditions, represents some of the major issues concerning the vulnerability of the informal sector.

The labour market segmentation theory in South Africa, had been investigated by several researchers who found disparities both between and within the formal and informal economy. While academics Heintz and Posel (2008) suggested significant wage differences and segmentation within the informal sector, Altman (2007) found several informal-formal sector linkages and proposed micro-economic

policy for 'formalizing' the informal sector. Moreover, in the South African context, it can be expected that the segmentation theory to be exacerbated by the high inequality persistent within the society. Thereby, because of the lower earnings, precarious jobs, and lack of social security, as considered in the segmentation theory, it is likely the informal economy to be greatly affected especially during an economic downturn.

Back to the context of the informal sector during the COVID-19 pandemic, a significant number of studies - especially in developing countries, had been conducted to evaluate the effect of the lockdown on labour market outcomes. These studies showed that informal workers in South Africa were affected by the global crisis more than their formal counterparts, regarding wages and worked hours (Rogan & Skinner, 2020; Benhura & Magejo, 2020). On the other hand, a handful of studies conducted analyses on hunger and food insecurity, and access to relief measures, on the labour market who retained their jobs but were unable to work (Bridgman, Van der Berg & Patel, 2020; Wills et al., 2020).

3.2 Informal economy during a crisis

Although the informal sector has been associated with higher levels of poverty as discussed earlier, there has been a general expectation that the informal sector can absorb part of the job losses from the formal sector during economic crises. The idea behind this perspective is that as companies are closing down or reducing staff, job losers will find short-term relief in the informal sector, which has a lower barrier to entry. One such example was the 1990s East Asian financial crisis, when the informal sector registered an increase in employment in some countries (Lin, 2008). However, the recorded experiences concerning the impact of crises on informal employment are rather mixed and possibly influenced by the environment in which the crisis occurs, as well as the structure of the job market in the particular country (Jutting & Laiglesia, 2009).

In contrast, an analysis on labour market dynamics during the 2008/2009 Great Recession, suggested that contrary to the expectations – i.e., informal sector absorbing recently jobless workers from the formal sector, there was actually a higher rate of job loss in the informal sector, during the immediate post-crisis phase (Verick, 2010). The study found that the South African informal sector slightly contracted during the crisis by 1.5 percent. Similarly, a later study on labour market dynamics during the 2008 crisis by Essers (2014) indicated that there was little movement into informal self-employment, from unemployed or from formal employed individuals. Likewise, Cichello, Almeleh, Mncube & Oosthuizen (2011) suggested that informal self-employment is not a free-access sector and that there are several barriers to entry. A reason could be that there seems to be a segmentation even within the South African informal sector itself (Heintz & Posel, 2008). Nevertheless, the evidence from these studies indicate that the South African informal sector is acting as a labour absorber during economic downturns.

Employment outcomes particularly during an economic downturn have been correlated with past employment experience. For instance, a study investigating the relationship between individuals' labour market experience over the period 2008-2017 and employment outcomes during the COVID-19 lockdown, found that employment status in February 2020 was strongly correlated with the employment history (Espi, Leibbrandt & Ranchhod, 2020). The results indicated that based on their employment history, individuals in unstable employment (i.e., those moving in and out of employment across time) were more likely to lose their jobs relative to the historically stable employed. It is very

likely that numerous informal workers are found in the unstable employment category, and that the outcomes during the lockdown are important, as it can affect the long-term employment prospects.

3.3 Informal sector and the poverty link

There are two key contrasting views when it comes to the informal economy, both internationally and in the South African labour market. On one hand a common perspective is that a large informal sector is an indicator of economic 'backwardness' and inefficiency while on the other hand, it has been seen as an important source of job creation and potential reduction on the poverty levels, for workers positioned on the lower margins of the labour market. In line with the latter view, recent predictions suggest that income loss in the informal economy during COVID-19 pandemic, might reverse much of the progress made in poverty reduction in the last decades (Sumner, Hoy & Ortiz-Juarez, 2020). Similar predictions suggested that poverty levels among informal workers could increase with more than 16% in the absence of monetary support, when assuming a 75% loss in earnings due to the lockdown restrictions (Bassier, Budlender, Zizzamia, Leibbrandt & Ranchhod, 2020).

The role of the informal sector in creating jobs and thus poverty reduction has been overall marginalized in South Africa, in contrast to the attention given to unemployment matter since the post-apartheid period (Kingdon & Knight, 2001). Informal workers have been seen as part of the 'second economy' which is characterized by poverty and distress, but which is fundamentally disconnected from the formal economy (Valodia & Devey, 2012). An investigation of the link between formal/informal sector earnings and poverty levels, found that around 41% of workers in the informal sector were situated below the poverty line in 2012, a much higher rate than the 17% of workers in the formal sector (Rogan & Reynolds, 2019). However, the analysis recognized its importance, as around 37% of the working poor in South Africa are gaining their livelihoods in the informal economy.

Even when the importance of the informal sector to job creation has received a larger recognition, policy responses have been often ineffective (Fourie, 2018). Some scholars have argued that the informal sector can substantially contribute to national poverty reduction (Cichello & Rogan, 2017; Fourie & Kerr, 2017). Likewise, according to the National Development Plan policy, around two million new informal employment would be necessary by 2030 for reducing the high rates of unemployment (National Planning Commission, 2013). However, Cichello and Rogan (2017) noted that the policy does not include a clear outline of how this objective will be achieved and how the informal sector will be supported in this matter. They use the poverty headcount ratio as an indicator of development, suggesting that the informal sector should be an important component of future strategies to reduce income poverty. According to their study, although South African informal employment accounts for one-third of total employment, the loss of informal earnings could result in a greater increase in national poverty levels.

3.4 The informal economy during COVID-19

The devastating effects of the COVID-19 lockdown on the informal workers were confirmed in many other developing countries. For instance, Kesar, Abraham, Lahoti, Nath & Basole (2021) investigated the lockdown consequences on employment, food security and social relief procedures among the Indian labour market. They showed that two-thirds of the informal workers lost their jobs, while those

who retained their jobs experienced drastic salary reduction or unpaid leave. Moreover, informal Indian workers also experienced a large increase in food insecurity. A similar empirical study showed that the informal workers in Burkina Faso, Mali and Senegal were more likely to experience a reduction in salaries than formal workers, due to the lockdown restrictions (Balde, Boly & Avenyo, 2020).

In South Africa, Rogan and Skinner (2020) investigated the different outcomes during the first COVID-19 lockdown, between formal and informal workers, and differences within the informal sector. The analysis is focused especially on earnings and working hours decreases, by gender and type of employment. The analysis found that 31% of informal workers and 26% of formal workers could not perform any work in April, while within the informal sector self-employed individuals were the most affected with 37% of them not reporting any earnings in April. However, those who were able to work in April, reported reductions in worked hours, and consequently reductions in earnings. For instance, informal workers saw a 32% decrease in average working hours from February to April.

Further, Rogan and Skinner (2020) found large differences within the informal economy as well, where informal self-employed individuals experienced a decrease in regular hours worked by more than 50%, which overlapped with a 60% decrease in typical earnings. Further, a significant gender gap was reported, with informal employed women experiencing a 49% decrease in regular hours worked in April, whereas the decrease for informal employed men was much lower 25%. The results on gender gap are in accord with international findings, who noted the limited capacity of women to absorb the economic shocks set out by the COVID-19 pandemic. The United Nations (2020) noted in a policy brief that women across the world have less secure jobs, most of them in the informal sector with no access to social protections, and additionally many being in single-parent households. Similarly, Horwood et al. (2021) found that household food insecurity was significantly associated with depression risk, and more likely to affect vulnerable South African women working in informal work.

Similarly, Benhura and Magejo (2020) investigated the changes in wages and hours worked for informal and formal workers in South Africa, using data from the first 2 waves of the COVID-19 lockdown. The results indicate a similar decrease in earnings for formal and informal workers between April and June. However, the study reported differences across subgroups, where wages declined more for men and urban workers who were in informal employment, compared to those in formal employment. Additionally, the authors also found that men and women informal work reported lower amounts of working hours, compared to those formally employed.

3.5 Hunger and food insecurity during the COVID-19 lockdown

An empirical study from 2020 found that poverty among job-losers increased by 29 and 17 percentage points using the food poverty line and the upper bound poverty lines (Jain, Budlender, Zizzamia & Bassier, 2020). The results indicated that the induced job loss under the lockdown, pushed more than 1.5 million job-losers into food poverty, and a lower estimation of 1.1 million income losers were pushed into food poverty. However, the impact was found to be even higher when considering that more individuals declared losing their incomes than those losing their jobs. Nevertheless, the authors noted that the poverty and food poverty estimates are approximative, as there are also other factors which could have impacted their results, such as unobservable worker characteristics and the income distribution.

Wills et al. (2020) employed a mixed method approach for analysing the South African household resource flows and food poverty during the lockdown, and the short-term policy implications leveraged by the government for social protection. The analysis found that although the government response for social protection has been beneficial, many households experienced severe food insecurity and hunger during the quarantine, indicating that social support attempts need to target households which are not covered by social protection, such as informal workers. They suggested for example, that during the first month of lockdown, 2 out of 5 adults reported that their household lost its main source of income, and 47% of the adults interviewed reported that their household ran out of money for food. Moreover, the scholars found that 21% of households reported that someone experienced hunger, during the interviewed week.

Further Wills et al. (2020), found that 42% of grant receiving households, and 36% of non-grant receiving households reported loss of the main household income source. This suggests that grant receiving households had other main sources of income. They suggest that adults in non-grant receiving households in the poorest income quintile might have been stronger impacted due to the lack of immediate support. The authors indicate that loss of the main source of income is associated with a 12% increase in household hunger. However, the study did not offer insight if the main source of income for the grant or non-grant receiving households is obtained from formal or informal work.

Scholars Van der Berg, Zuze & Bridgman (2020), suggested that there had been a drastic increase in both adult and child hunger during the first wave of COVID-19 lockdown, and that numerous households experienced shortages of money for buying food. Moreover, comparisons with statistics from previous surveys (General Household Survey) suggested that improvements made in child hunger during the last decade have been almost reversed by the severe lockdown losses. Job loss and loss of the main income source during the strict level 5 lockdown, increased the probability of household hunger. Moreover, a comparison of wellbeing between the first period of lockdown and the second period of lockdown in South Africa, suggested that the situation improved slightly in the second period, but the hunger levels remained alarmingly high, tending to be persistent (Bridgman, Van der Berg & Patel, 2020).

3.6 What social support could informal workers access?

To mitigate the drastic socio-economic impact of the lockdown on livelihoods, the South African Government has leveraged a number of temporary, emergency social support systems – social insurance, social assistance, and social relief. The immediate social policy responses to reduce the anticipated effects of job loss and incomes decrease, and to address food insecurity have been commendable (Kohler & Bhorat, 2020).

The social insurance scheme was created to assist companies in financial distress and job losers, by expanding the existing unemployment insurance fund (UIF). Thus, a COVID-19 temporary employer relief scheme (TERS-UIF) was introduced, aiming to prevent the permanent jobs loss due to temporary closure of firms (Wills et al., 2020). The insurance scheme intent was to cover a partial cost of salaries for employees for up to 3 months. However, the authors noted that this system tends to be limited in reaching workers in the informal economy, because informal workers are most likely not registered for UIF. However, on 25th of May due to the problems in accessing TERS-UIF, the regulations have

been lessened and extended, even for workers not registered for UIF (Wills et al., 2020; Bassier et al., 2021).

Because of the limitations of social insurance programmes in reaching a wider share of the population, the existing social security system was temporarily expanded (Khambule, 2020). An additional R250 per month was offered to already existing grant recipients for a period of six months. The coverage of the previously existing grants was already significant at about 18 million grants pre-lockdown (Wills et al., 2020). However, the grant system has been expanded to reach a larger segment of the population by creating the 'COVID-19 social relief of distress' (SRD) grant of R350 per month (Wills et al., 2020). Informal sector was more likely to benefit from the special COVID-19 relief grant than the formal sector, although the special grant has been much lower than the TERS-UIF benefits. However, Rogan and Skinner (2020) noted that the implementation of the COVID-19 SRD grant was ineffective, because of the complex system imposed for qualifying and accessing the grant.

Another important relief package leveraged was the Child Support Grant (CSG), which was increased with R300 per child during April and May, and with R500 per caregiver from June for five months. According to Bassier et al. (2021), more than 60% of informal workers live in a household that receives a Child Support Grant, therefore this extra support was most likely very beneficial for informal workers.

The third channel of social support during the lockdown was offered through social relief programs, provided by local governments and non-governmental institutions. At the beginning of the lockdown, the government requested the private sector and citizens to donate towards the national social relief efforts through 'The Solidarity Fund' (2020). Additionally, food relief programs were created as a short-term alternative until new government solutions were possible. Through NPOs and NGOs, the food relief programmes provided food parcels to the affected households, for assuring the basic food needs for 2/3 weeks (Solidarity Fund, 2020). Although the initiative had a wide reach, due to the high corruption, there have been coordination and communication problems between the main actors and reports of resources failing to reach the targeted groups (Gerard, Imbert & Orkin, 2020). The Department of Social Development (2020) stated that food insecurity among the South African population increased to more than 50% during the lockdown period.

However, Wills et al. (2020) argue that although the combined systems for social protection during the first wave of lockdown, reached a large share of the population there is evidence that the social support was not sufficient for assuring the basic needs for the whole period of the strict lockdown. As discussed above, this is especially worrisome for informal workers, who were more likely to face difficulties in accessing the proper social support provided, due to the lack of registration in the social security system.

4. Data and Methods

4.1 Data source

The analysis in this thesis uses data from the first wave of NIDS-CRAM (The National Income Dynamics Study: Coronavirus Rapid Mobile Survey) - a special survey designed to investigate the social and economic impacts of COVID-19 on the South African population. The survey also contains questions that permit a closer examination of the government responses to the strict lockdown.

NIDS-CRAM (2020) is a follow-up survey of a subsample of individuals from households interviewed in Wave 5 (2017) of NIDS (the National Income Dynamics Study) - a national longitudinal panel survey conducted since 2008. Both NIDS and NIDS-CRAM survey data collection and weighting procedures were conducted by the Southern Africa Labour and Development Research Unit (SALDRU). Due to COVID-19 constraints, the NIDS-CRAM survey was conducted telephonically using Computer Assisted Telephone Interviewing (CATI) software. As a result, NIDS-CRAM uses a much shorter questionnaire (in comparison to NIDS), with a duration of approximately 20 minutes to complete.

For the first wave of the NIDS-CRAM survey data was collected between 7 May - 27 June 2020, covering information from the month pre-lockdown – February, as well as the first period of lockdown from 27th of March until 30th of April. The initial sample size was about 17500 individuals, of which approximately 40% responded, giving a completed sample size of 7074 realized interviews. Both NIDS and NIDS-CRAM data were designed to be nationally representative, and therefore it is not recommended to draw solid provincial assumptions. Although the NIDS-CRAM respondents were drawn from the main NIDS panel, using their unique identifier number, researchers should be wary when making comparisons between the two datasets, as they used different data collection procedures.

4.2 Limitations of data

One of the main limitations of NIDS-CRAM data is that it is difficult to measure the true level of job loss, earnings and working hours in the informal economy between pre-lockdown and post-lockdown. The reason is that the survey identifies the type of employment that respondents had in April, but not in February. Yet, a sub-sample can be created for those who reported some type of employment in both months, and can be identified as informal workers in April. However, one should be cautious when discussing differences in earnings and hours worked between February and April.

Another limitation is that the NIDS-CRAM survey did not collect information on everyone living with the interviewed individual. However, this change in sampling was carefully considered, taking in consideration the constraints of NIDS-CRAM. However, it is possible to make careful estimations about household living conditions based on the individual level responses (Kerr, Ardington & Burger, 2020).

The weighted NIDS-CRAM survey data reflects the outcomes in 2020 for a broadly representative sample of those 18 years and older from NIDS Wave 5 in 2017 (Kerr, Ardington & Burger, 2020). Because NIDS-CRAM is a subsample researcher have been cautioned about the chance of statistical uncertainty, and should be careful of stating its representativity when interpreting and discussing

results. Therefore, researchers have been advised to use the weight, cluster and stratum variables provided with the data for more accurate estimates.

4.3 Data cleaning and variables

For the purpose of this study, individuals aged 61 and above are not included in the statistics and regressions, as they are considered retired. Also, because the interest is on formal/informal workers, the sample is restricted to active workers, and does not include unemployed or not economically active individuals (NEA). Non-responses observations, negative values or similar were coded as missing observations. After cleaning the data and keeping the interest variables for the analysis and for the targeted individuals, the final sub-sample for the analysis contains 2751 observations. This represents the main sample for both the descriptive and regression analyses. Of the 2751 sub-sample 1036 individuals were engaged in the informal sector and 1715 were engaged in the formal sector. A simple descriptive table for the main variables is given in Table A1 in the appendix.

For correctly identifying those in formal or informal employment, and the employment type within the informal sector, three questions available in the NIDS-CRAM survey were used. First, for the formal/informal self-employed respondents a question on whether their firm is registered for income tax or VAT was used. Based on this question 80% of those classified as self-employed reported not being registered for income tax or VAT in April. Second, for identifying those in formal/informal wage employment the question whether the respondent has a written contract with the employer is used.

For the main regression analysis, two binary dependent variables are used - household hunger and food insecurity. The main independent variable is the binary informal employment, with value of 1 for informal work and 0 for formal work. A full description of the main variables is given in the list of variables Table A2 in the appendix. Based on the correlation table below from Table 1, a positive relationship between informal work and hunger/food insecurity is expected. A strong positive correlation can be observed as well between hunger/food insecurity and income loss, while for access to tap water and education predictors it is expected a negative relationship. A full correlation matrix between all the variables can be found in Table A3 & A4 in the appendix.

Other binary, categorical, and continuous control variables that are used in the analysis. Several variables capturing the effects of the COVID-19 lockdown (e.g., inability to work during the lockdown, increased CSG grant) were included, along with other related to individual attributes (e.g., age, gender), as well as general social characteristics (e.g., race, education). As indicated earlier, a full presentation of all variables used in this analysis is given in Table A2 in the appendix.

It is important to state that the definition of informal work throughout this paper is used as set out by Bassier et al., (2020), based on the enlarged ILO's definition of informal work. Under this definition, the authors assume a more expansive category than the usually defined informal sector, including vulnerable workers employed in the formal sector.

Consequently, in this paper a worker is classified as informally employed, if the individual is regularly employed (wage employment) but has no written contract and is not registered with the UIF (Unemployment Insurance Fund). If the individual is self-employed or owning a business, the business is not registered for income tax or VAT. If the person is a casual worker, the individual has no written contract and is not registered in the UIF.

Because the current analysis is mainly conducted at the household level, households which contain informal workers are identified as informal households or informal-worker households. However, the respondent could be an informal worker himself, or someone co-resident with the informal worker. All the terms related to informal sector/worker throughout this paper will refer to workers as described by the definition above.

Furthermore, the term food insecurity in this paper is used to define households which were unable to access sufficient food supply, based on the individuals who reported that their household ran out of money for food during the lockdown in April 2020. Generally, the Food and Agriculture Organization and the World Food Security Committee of the United Nations, define food insecurity as the lack of availability of sufficient, safe, and nutritious food, and the ability of individuals to access it at all times (FAO, 2021). Therefore, throughout this paper the terms food insecurity/food poverty is used in a more limited way than is generally defined by the cited organizations, referring just to the lack of accessibility to proper food supply, but not to the lack of availability of it.

Table 1. Pairwise correlation between the response and explanatory variables

	Informal	Work lockout	Income loss	SRD	CSG	HH size	Tap water	Educ.	Race	Geo type	Female
Household hunger	0.164	0.099	0.233	0.004	0.090	0.078	-0.132	-0.192	-0.181	0.065	0.018
Food insecurity	0.185	0.141	0.346	0.001	0.076	0.155	-0.117	-0.257	-0.123	0.040	0.024
N	2751										

Source: Own calculations based on data from NIDS-CRAM Wave 1

4.4 Methodology

In this empirical analysis the logit link between the South African informal sector and food insecurity outcomes, during the first phase of COVID-19 lockdown, will be estimated. The hypothesis is that informal workers were more likely to experience household hunger and food insecurity (versus formal workers), due to the vulnerability of the sector such as low salaries, lack of social protection, inability to work from home during COVID-19, etc. The assumptions are mainly based on the labour market segmentation theory discussed in detail in section 3.

Van der Berg, Zuze & Bridgman (2020) employed an OLS regression model for analyzing the impact of COVID-19 on hunger and welfare outcomes for children and adults, mainly focused on individuals who lost their jobs. Although the OLS model, known as the linear probability model (LPM) when used to describe conditional probabilities, is not typically recommended when using a binary response variable, as the coefficients cannot be interpreted in the same way when using a continuous response variable. Moreover, the residuals from the linear probability model will cause heteroskedasticity and non-normality of errors, violating the BLUE (Best Linear Unbiased Estimator) assumptions of the OLS regression. Thus, the incorrectly estimated OLS will result in large standard errors and invalid hypothesis testing, causing questionable values for the estimated model (Cizek & Fitzgerald, 1999).

Considering the above mentioned OLS limitations, for the current analysis, a logistic regression model will be instead used. Logistic regression is a type of non-linear model, used to estimate the relationship between a discrete dependent variable and one or several independent variables, and to predict the probability of the outcome (binary or categorical) given the input variable (Long & Freese, 2006, p.131). Thus, this is a more suitable method for the current analysis, where both of the response variables used are binary (i.e., household hunger and food insecurity). Moreover, logistic regressions are more appropriate when using microeconomic indicators and when dealing with larger samples, since it requires more cases than OLS regression because it uses maximum likelihood estimation technique. The sample size used for this empirical analysis contains 2751 observations, which makes the logit model a good fit for the data. Additionally, using the logistic analysis over the OLS regression when the outcome is dichotomous has the advantage of eliminating the skewness characteristic in the linear probability models. Moreover, a similar logit model was used by Benhura & Magejo (2021), when analysing the wellbeing and depression symptoms among South African informal workers during wave 2 and wave 3 of COVID-19 lockdown.

By employing the logistic analysis, the attempt is to model what are the odds and for an event (i.e., household hunger and food insecurity) to occur and to estimate the effects of the explanatory variable (informal work and the control variables) on these odds. The odds of an event is a measure that compares the probability for an event to occur "success", to the probability that it does not occur "failure". When the probability of the event to occur is greater than the probability of the event to not occur the odds are positive and if the probability of success is less than the probability of failure, the odds are negative (O'Connell, 2006). The logit model uses the logarithm of the odds to compute the model, while the logistic model uses the odds ratio. Although the logit and logistic models are very similar, they differ in terms of interpretation. However, for the analysis in this paper the logit model will be used, reporting thus the log of the odds for household hunger and food insecurity among informal workers.

To identify the association between food insecurity and informal work in April 2020, an extensive descriptive analysis will be conducted, followed by an estimation of the logit model for household hunger and food insecurity outcomes. The logit model was applied to the prediction of the presence of household hunger and food insecurity based on the type of work of the respondent (informal versus formal) and controlling for certain socioeconomic and sociodemographic predictors. The selection of the predictors presented thoroughly in the previous section, is based on similar empirical analyses dealing with hunger and wellbeing outcomes for the South African adults and children, during the COVID-19 lockdown, conducted by Van der Berg, Zuze and Bridgman (2020).

The basic logit link function formula used for the regression analysis is:
$$\ln(y) = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k \quad (1)$$

where (p/1-p) - represent the odds of the outcome

p - is the expected probability of y

ln (p/1-p) - represents the log of the odds

β_0 - is the intercept

$\beta_1, \beta_2, \ldots\ldots, \beta_k$ - are k regression coefficients

$X_1 X_2, \ldots, X_k$ - are the predictors

For the current analysis the model for the first regression thus becomes:

$$ln\,(p_{hunger}) = \ln\left(\frac{p_{hunger}}{1-p_{hunger}}\right) = \beta_0 + \beta_1 informal + \beta_2 control + \cdots + \beta_k X_k \quad (2)$$

And the model for the second regression will be:

$$ln\,(p_{food\,insecurity}) = \ln\left(\frac{p_{food\,insecurity}}{1-p_{food\,insecurity}}\right) = \beta_0 + \beta_1 informal + \beta_2 control + \cdots + \beta_k X_k \quad (3)$$

In the logit model, the estimation scale is the log-odds, but because the concept of odds and log odds is more difficult to understand, one can solve for the probability p to find the relationship between the probability of having the outcome and the intercept β_0.

To transform the log-odds in probabilities, the following equation is used:

$$p = \frac{e^{\beta_0} + \beta_1 X}{1 + e^{\beta_0} + \beta_1 X} \quad (5)$$

Further, to make a better comparison between the probabilities of the event occurring or not, the average marginal effects (AME) estimates are calculated by computing each individual observation's marginal effect, and then taking the mean. The average marginal effect will actually be the difference between the predicted probabilities when the explanatory variable is true (X=1) and the predicted probabilities when the explanatory variable is not true (X=0). In the case of categorical variables, the difference between the predicted probabilities is calculated in relation with the omitted variable.

In Stata the AME are calculated using the derivatives of the probabilities using the formula:

$$\frac{\partial_p}{\partial X_1} = \frac{\beta_1 e^{\beta_0} + \beta_1 X_1 + \cdots + \beta_p X_p}{(1 + e^{-(\beta_0 + \beta_1 X_1 + \cdots + \beta_p X_p)})^2} \quad (5)$$

It is important to note that the average marginal effects (AME) are different from the Marginal effect at the Mean (MEM), which is calculating the average of each variable, and then obtains the marginal effects for the observation with all the mean values. Although MEM is often easier to calculate and interpret, AME is considered more appropriate because it also considers how the variables correlate to each other (Long & Freese, 2006, p.158-168). Thus, based on these considerations, the average marginal effects will be the selection for interpreting the empirical results in this analysis.

5. Empirical analysis

5.1 Descriptive analysis

As discussed in section 4, after cleaning and adjustments of the wave 1 NIDS-CRAM data, a sub-sample of 2751 observations remain, namely those who retained their livelihoods during the first wave of the pandemic lockdown. Among this sub-sample which makes the basis for the empirical analysis, 1036 individuals were employed in the informal sector and 1715 individuals in the formal sector. In the next section an extended descriptive analysis with visual representations is performed, for a deeper understanding of the sample, followed by the actual regression analysis.

Share of the South African informal sector

The results presented in Figure 1a, after weighting the data, shows that 35% of the total employment was in the informal sector, while 65% was in the formal sector, in April 2020. Gender wise there are equal shares of women and men employed in the formal/informal sector. These findings are in accord with previous reports from the South African Quarterly Labour Force Surveys (Stats SA, 2020). One observation that is worth mentioning, is that the informal economy has been slowly increasing over the last decade, from 29% in 2013 (Stats SA, 2020).

Further, according to the statistics presented in Figure 1b, the highest share within the informal sector (about 38%), is taken by wage employment (i.e., both employed in the informal economy or in the formal sector but without a contract). Casual workers category has a 33% share, followed by self-employed with a 29% share. Gender wise, informal wage workers have a similar share, but it is worth noticing that the share of self-employed women is higher in comparison to self-employed men - 34% versus 26%, while men have a higher share when it comes to casual work. Overall, it seems that there are no gender discrepancies regarding the shares between formal and informal sector and within the informal sector.

Figure 1. Share of the formal and informal workforce by type and gender
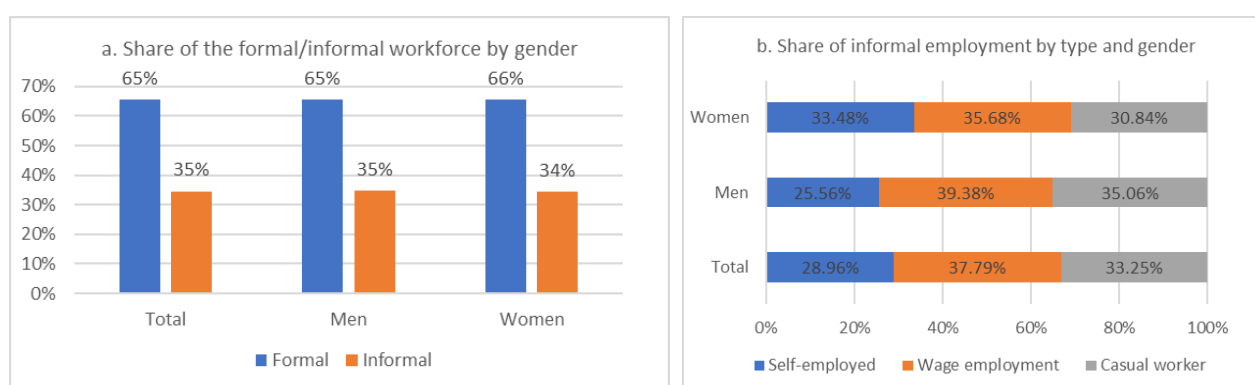
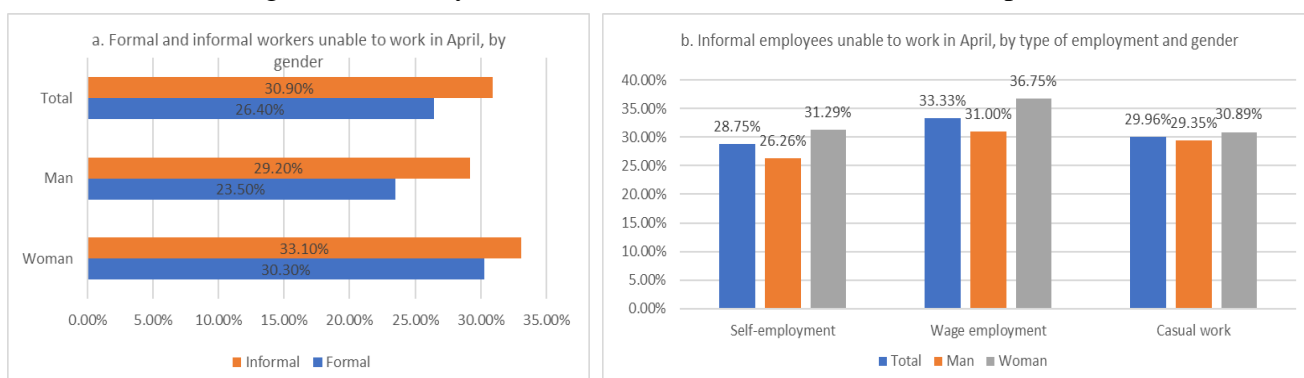Source: Own calculations based on data from NIDS-CRAM Wave 1

<u>Inability to work during the lockdown</u>

Further, the interest is on the workers who were unable to work during the first phase of the COVID-19 lockdown (i.e., those who reported zero work hours in April, but declared that they have a job they can return when the lockdown ends). It is very likely that inability to work during the lockdown has a strong association with household hunger and food security outcomes. According to the stats 28% of the total workers were unable to work during the lockdown, with informal workers having a slightly higher share of 31% than formal workers with 26%, as shown in Figure 2a. A similar difference can be observed between genders, with a higher percentage of women than men who reported zero working hours during April. However, the gender differences are even higher in the formal sector. These findings are in accord with previous studies on gender differences during the COVID-19 lockdown, as more women than men had to stay at home for childcare as the schools were closed (Casale & Posel, 2020; Casale & Shepherd, 2021).

Further, looking at the inability to work during April, within the informal sector, a few differences can be observed, as highlighted in Figure 2b. Somewhat contrary to expectations, the most affected category within the informal sector were the informal wage workers, where 33% were unable to work during the lockdown, followed by informal casual employment with 30% and informal self-employed with 29%. There is also a gender difference, more pronounced in informal wage employment with 37% of women unable to work in April, relative to 31% of men.

This pattern of wage employed workers having a higher share in inability to work during the first phase of lockdown is true within formal employment as well. 24% of formal wage employees were totally locked out, compared to 17% of the formal self-employed. However, the casual workers within the formal sector were the most affected with a share of 37% (see Figure A1 annex). Overall, it is important to notice that wage workers were extremely affected, in both the formal and informal economy, while researchers might have expected those in self-employment to be more affected. Therefore, the estimations from Figure 2 show the importance of understanding the surprising outcomes within the formal and informal sector during the lockdown, for better targeted social security policies.

Figure 2. Inability of formal & informal sector to work in April

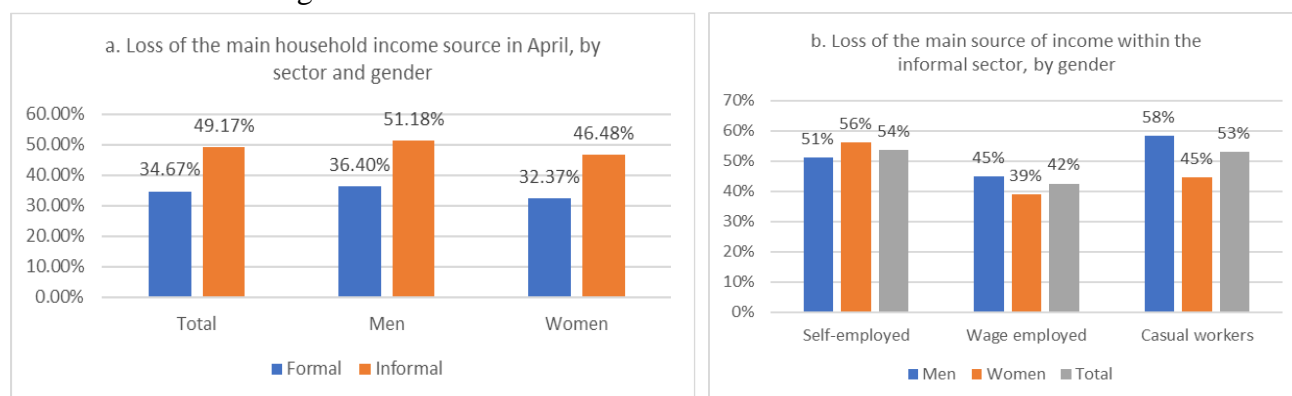Source: Own calculations based on data from NIDS-CRAM Wave 1

Loss of the main source of income

Rogan and Skinner (2020) conducted an extensive study focused on earning losses across the formal and informal sectors and showed that the average earnings loss for informal workers was 26.9%, while the calculated median loss was 60.4%. The authors suggest that the large earnings losses in informal employment, in particular at the bottom of the earnings distribution, needs more attention from policy makers as the pandemic is likely to have long-term effects on livelihoods.

Calculating the loss in earnings between February and April is unreliable due to the difference in questioning in the NIDS-CRAM survey, and beyond the scope of the present paper. However, for evidence in this study one indicator related to household losing of the main source of income will be used. This indicator will be later used as a control variable in the logit regression analysis, as it is probable to have a strong correlation with hunger and food insecurity outcomes.

Therefore, the focus here is to find the share of households who lost the main source of income among the formal and informal sector. According to the statistic in Figure 3a, almost half of the respondents in the informal sector (49%) declared their household had lost the main source of income since the lockdown started on 27 of March 2020, compared to 35% of respondents in the formal sector. Within the informal sector it seems that informal wage workers have been less affected (42%) when compared to self-employed (54%) and casual workers (53%) as indicated in Figure 3b. These findings support the evidence suggested by Rogan and Skinner (2020), who found that informal workers, in particular those in self-employment recorded substantial decreases in earnings between February and April. The prevalence of loss of the main source of income is very high among informal households and has most likely influenced food insecurity outcomes.

Figure 3. Loss of the main source of income formal/informal

Source: Own calculations based on data from NIDS-CRAM Wave 1

Household food insecurity

Further, the share of households running out of money for food (i.e., food insecurity) is investigated, as this will be one of the dependent variables used in the logit regression. As shown in Figure 4a, more than half of those in the informal sector declared that their household ran out of money to buy food in April (about 53%). The numbers are lower, but still worrisome for the formal sector, where about 33% of formal workers declared running out of money to buy food. This is not surprising, considering that informal workers are not covered by social security and the social relief introduced in May, was not

targeted towards the informal vulnerable workers. Figure 4b indicates that within the informal sector food insecurity was the highest for casual workers (66%), followed by self-employed (48%) and wage workers (44%). These findings suggest that informal self-employed workers were more vulnerable than informal wage workers, even though in a previous section evidence showed that they had a lower share of inability to work during the lockdown. Thus, the results from Figure 4 support previous research which suggested that earnings from informal work are essential for keeping households above the poverty line and avoiding food insecurity (Rogan, 2018).

Figure 4. Food insecurity among formal/informal workers

Source: Own calculations based on data from NIDS-CRAM Wave 1

Household hunger and support

This section provides an overview of the different outcomes of child and adult hunger for informal relative to formal workers, and the social support they could access. According to Figure 5a 12.06% of children and 26.16% of adults in informal households went hungry during the first lockdown. The numbers are much higher than formal households where 07.01% of children and 12.90% of adults went hungry during the first lockdown. Thus, overall household hunger levels were at 27.52% for informal workers, and 14.08% for formal workers. Therefore, according to these first statistics the number of informal households experiencing hunger during the lockdown were almost double than the formal households. Moreover, the descriptive analysis suggests a segmentation even within the informal sector with casual workers being affected more by household hunger – 38% versus 25% of self-employed and 20% of wage workers (see Figure A2 in appendix). An additional remark is that the shares of child hunger are much lower than that of adult hunger, suggesting that children were to some extent cushioned against high hunger levels. However, in the regression analysis, it will be examined more closely if the difference between informal and formal hunger outcomes is that high and if there is statistical significance for these results. Nevertheless, the numbers for food insecurity and hunger are relatively high for both sectors, given that the sample consists of employed individuals (not unemployed or not economically active).

An additional inquiry in this section is to find what type of support did the employed labour markets access during the lockdown. As discussed in the literature review section, multiple social protection channels have been leveraged for assisting income and job loss. It has been argued that informal workers were less likely to access TERS-UIF social insurance schemes due to the lack of UIF registration. Therefore, the concern here is finding to what extent the TERS-UIF reached the formal

and informal workers. According to numbers from Figure 5b income from TERS-UIF reached just about 8% of informal workers and about 15% of formal workers. These are very low percentages for both sectors, and without the prospect of receiving the relief in the near future, as the respondents' answers for "Waiting" to receive the income from TERS-UIF, was insignificant – about 0.3% of informal workers and 1.3% of formal workers. This is an inconvenient situation as TERS-UIF support could have been more effective in cushioning workers against hunger and food insecurity as its value was considerably larger - between R3500 - R6838 per month (Department of Labour, 2020).

Finally, a last inquiry is to find out what other type of support did workers receive during the first lockdown. As seen in Figure 5b, more than half of formal and informal households received at least one child support grant. Thus, the decision taken by the government to increase the Child Support Grant was crucial, especially for informal workers, who faced difficulties in accessing TERS-UIF. Regrettably, column 3 shows that only 4.8% of formal workers and 8.3% informal workers received the COVID-19 Social Relief Grant. Although many households received the COVID-19 SRD grant in the following months, it is probable that the lack of proper social support contributed to hunger and food insecurity outcomes during the first lockdown. However, as observed in Figure 5b, several households, especially informal, received food and shelter from the government, NGOs, and communities, which might have reduced the prevalence of hunger among poor households.

Figure 5. Household hunger outcomes and type of support received
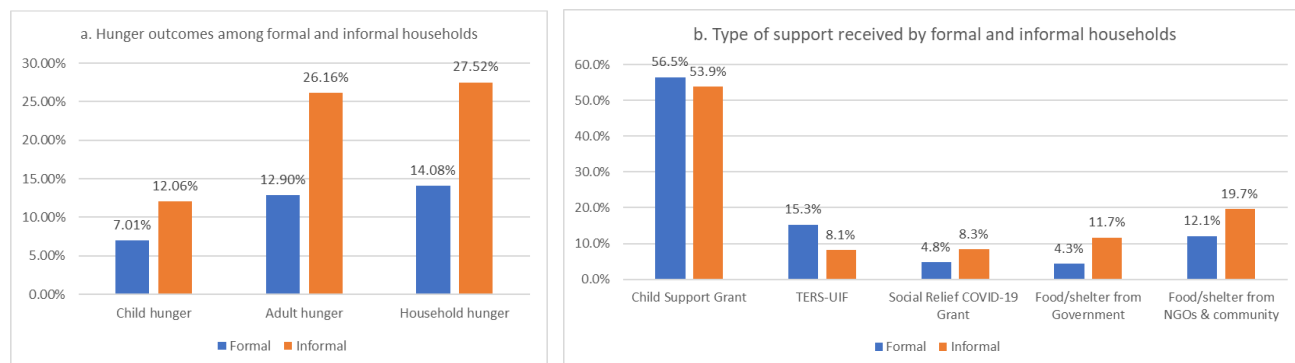
Source: Own calculations based on data from NIDS-CRAM Wave 1

5.2 Logit regression analysis

5.2.1 Household hunger

<u>Household hunger regression results</u>

Table 2 below presents the logit regression estimates for household hunger, during the first phase of COVID-19 lockdown. The interest in this section is on the log odds link between the independent and dependent variables, mainly if the relation is positive or negative. As discussed in the methods section, for an easier interpretation of the probabilities of hunger the average marginal effects (AME) will be calculated in the next step, based on the results from the logistic regression.

The first model (1) shows the relation between household hunger and informal workers, without control variables. As expected, there is a positive correlation between being in the informal sector and the odds of experiencing hunger. The coefficients can be interpreted as follows - for an informal worker (versus the formal worker) it is expected a 0.617 increase in the log-odds of household hunger, holding all other independent variables constant.

In the second model (2) three control variables related to the COVID-19 lockdown were added – "work lockout", "income loss" and the Covid "SRD grant". Results show that there is a positive correlation between the inability to work and loss of the main source of income with the log-odds of experiencing hunger. Moreover, for the two variables there is a high statistical significance at the 0.01 level. In contrast, receiving the COVID-19 SRD grant decreases the log-odds of household hunger, although there is no statistical significance. The pseudo R-squared shows that the overall model is correctly fitted, although is not very high – 5.48%.

In the third model, the education level control variable was added, as it might have an influence on the hunger outcomes. The education categories in the table are calculated in relation with the omitted category – i.e., matric education. The figures indicate higher log-odds for those with no education or lower education levels to experience hunger, while for those with post-matric education the log-odds indicate a negative relationship. The results have statistical significance for all the regressors and the overall pseudo-R² increases to 7.97%.

In the fourth model a very important control variable was added – namely the population groups. As expected, especially due to the South African racial discrepancies, being in the African or coloured/Indian population group is associated with higher log-odds of hunger outcomes in comparison to the white population group (i.e., the omitted variable). The results from the fourth model show statistical significance for all the regressors and the overall pseudo R-squared increase to 9.64%.

The fifth and sixth models show the results after controlling for living area, gender, and age. Living in the rural area and being a female, show a positive correlation with the odds of experiencing hunger, although the results are not statistically significant and adding these variables does not improve the fit of the model considerably. For a detailed analysis on rural-urban inequalities in South Africa during COVID-19 see the analysis from Visagie and Turok (2021). An important observation is that the coefficient for the informal variable gradually decreases as more control variables are added – from 0.617 in model 1 to 0.246 in model 6.

It is worth stating that the pseudo R-squared has a different computing and more complex interpretation then the R-squared used in OLS models. The pseudo R-square is not measured by computing the variance, since the logistic regression has a fixed variance. The pseudo R-squared is rather a proportion in terms of the log likelihood (Long & Freese, 2006). Although the pseudo R-squared cannot be interpreted independently or compared across datasets, it is useful in evaluating multiple models predicting the same outcome on the same dataset. Therefore, the higher pseudo R-squared from model 6 indicates that the model better fits the outcome data than the previous models.

Overall, the regression estimates indicate with good statistical significance that being in the informal sector during the first COVID-19 lockdown is associated with an increase in the log-odds of household hunger, keeping everything else constant. Moreover, the likelihood ratio chi-square (LRchi2) of 285.15 with a p-value of 0.0000 (from model 6) shows that the model as a whole fits significantly better than an empty model (i.e., a model with no predictors).

Table 2. Logit regression estimates for household hunger

VARIABLES	(1) HH hunger	(2) HH hunger	(3) HH hunger	(4) HH hunger	(5) HH hunger	(6) HH hunger
Informal	0.617***	0.498***	0.329***	0.248**	0.245**	0.246**
	(0.0925)	(0.0954)	(0.0984)	(0.0995)	(0.0995)	(0.0996)
Work_lockedout		0.377***	0.367***	0.348***	0.349***	0.336***
		(0.0973)	(0.0988)	(0.0994)	(0.0994)	(0.1000)
Income_loss		0.905***	0.834***	0.795***	0.794***	0.800***
		(0.0960)	(0.0975)	(0.0982)	(0.0982)	(0.0984)
Covid SRD grant		-0.761	-0.748	-0.754	-0.755	-0.714
		(0.785)	(0.801)	(0.808)	(0.808)	(0.810)
Education_categ = 0, No school			0.642**	0.591**	0.574*	0.489
			(0.292)	(0.293)	(0.294)	(0.310)
Education_categ = 1, No-matric			0.397***	0.408***	0.403***	0.383***
			(0.120)	(0.121)	(0.121)	(0.123)
Education_categ = 3, Post-matric			-0.631***	-0.548***	-0.549***	-0.562***
			(0.150)	(0.152)	(0.152)	(0.152)
Population group = 1, African				1.852***	1.839***	1.856***
				(0.463)	(0.463)	(0.465)
Population group = 2, Coloured				1.038**	1.041**	1.050**
				(0.490)	(0.490)	(0.491)
Geo area = 2, Rural					0.0903	0.0917
					(0.116)	(0.116)
Female						0.118
						(0.0983)
Age - years						0.000954
						(0.0210)
Age squared						2.44e-05
						(0.000238)
Constant	-1.496***	-2.026***	-1.983***	-3.663***	-3.666***	-3.806***
	(0.0624)	(0.0869)	(0.122)	(0.471)	(0.471)	(0.642)
Pseudo R-squared	0.0151	0.0548	0.0797	0.0964	0.0966	0.0973
Observations	2,751	2,751	2,751	2,751	2,751	2,751

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

Source: Own calculations based on data from NIDS-CRAM Wave 1

Predictive probabilities and Average Marginal Effects

As discussed above, because the magnitude of the indicators affecting the log-odds of household hunger are difficult to interpret from the logit estimates from Table 2, average marginal effects (AME) are calculated. Therefore, Table 3 presents the Average marginal effects calculated based on the logit model no. 6 with all control variables included. It is important to notice that predictive margins are estimated only for discrete variables, while the Average marginal effects are estimated for continuous variables as well. The predicted margins are based on the condition that the response variable has a value of 1 (household hunger = 1).

The predictive margins (i.e., predicted probabilities) presented in Table 3 can be interpreted as follows: For a worker engaged in the informal sector (Informal = 1), the probability of reporting household hunger is 0.230, while for a worker engaged in the formal sector (Informal = 0), the probability of reporting household hunger is 0.190. The difference between the predictive margins, namely the Average marginal effect is thus 0.04. Therefore, the probability for an informal worker to experience household hunger is approximately 4.00 percentage points higher than that of a formal worker, when holding all other control variables constant.

For education estimates, it can be observed that a worker without matric education increases the probability of hunger with 6.79 percentage points, while a worker with post-matric education decreases the probability of hunger with 6.69 percentage points, when compared with matric workers. As expected, a worker who lost the main source of income has a 12.5 percentage points higher probability of household hunger, than a worker who kept the main source of income. As expected, a stronger correlation with hunger experiences can be found for the African race group, where the probability of household hunger is 16.8 percentage points higher than a white worker. Moreover, the z-statistics (presented in parentheses), and the probability values indicate that the predicted probabilities have statistical significance. However, the results for rural, female and age variables do not show statistically significant correlations with household hunger. A visual representation of the plotted predictive margins for each predictor can be found in the annex – Figure A3.

Table 3. Predictive margins and AME for Household hunger,
based on the logit estimates from Table 2 (model 6)

(1) Predicted probabilities X=1 for binary Categorical included		(2) Predicted probabilities X=0 for binary Categorical omitted		(3) Average marginal effects X=1 Categorical included	
1.Informal	0.247*** (20.19)	0.Informal	0.208*** (20.82)	Informal	0.0386** (2.48)
1.Work_lockedout	0.260*** (19.20)	0.Work_lockedout	0.206*** (22.37)	Work_lockedout	0.0528*** (3.39)
1.Income_loss	0.294*** (23.42)	0.Income_loss	0.164*** (17.15)	Income_loss	0.126*** (8.45)
1.Covid SRD grant	0.131 (1.52)	0.Covid SRD grant	0.225*** (29.71)	Covid SRD grant	-0.112 (-0.88)
0.No school	0.296*** (5.33)	2.(omitted)Matric	0.211*** (13.18)	No school	0.0854 (1.46)
1.No-matric	0.276*** (22.56)	2.(omitted)Matric	0.211*** (13.18)	No-matric	0.0654*** (3.21)
3.Post-matric	0.136*** (10.56)	2.(omitted)Matric	0.211*** (13.18)	Post-matric	-0.0752*** (-3.70)
1.African	0.246*** (28.29)	3.(omitted)White	0.0528* (2.34)	African	0.193*** (7.94)
2.Coloured/Indian	0.133*** (7.10)	3.(omitted)White	0.0528* (2.34)	Coloured/Indian	0.0802** (2.75)
2.Rural	0.236*** (14.30)	1.(omitted)Urban	0.221*** (25.86)	Rural	0.0146 (0.78)
1.Female	0.233*** (21.92)	0.Female	0.215*** (19.69)	Female	0.0185 (1.20)
				Age	0.000150 (0.05)
				Age squared	0.00000384 (0.10)
N	2751	N	2751	N	2751
z statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1					

5.2.2 Household food insecurity

<u>Food insecurity regression results</u>

Table 4 presents the logit regression estimates for household food insecurity, during the first level of COVID-19 lockdown. Besides the control variables used in the previous logit regression, additional variables were added to control for household specific characteristics – such as Child Support Grant (CSG), household size and tap water accessibility.

As shown in Table 4, working in the informal sector increases the log-odds of experiencing food insecurity at the household level, when everything else remains constant. The result holds true across models, and it maintains its statistical significance at 0.01 level. However, similarly to the household hunger estimates, the coefficients for the informal predictor decrease as more controls are added.

Similarly with the previous regression, inability to work and loss of the main source of income increases the odds of household food insecurity. For the households receiving CSG and SRD grants it is expected a decrease in the log-odds of food insecurity, although the estimates do not indicate any statistical significance. The new added variable – "household size" indicates that one unit increase in household size is associated with a 0.042 increase in the log-odds of food insecurity. The additional new control variable – "tap water" shows that a household with access to tap water is associated with a decrease in the log-odds of food insecurity.

As predicted, lower education levels are associated with an increase in the odds of experiencing food insecurity. Moreover, being in the African or coloured/Indian population group increases the odds of food insecurity when compared with the white population group. Unlike the previous model, living in the rural area is associated with lower odds of food insecurity, but the estimates have no statistical significance. As in the previous regression being a woman increases the odds of household food insecurity, and this time the estimates are highly significant.

The pseudo R-squared increases from 1.69% in the first model to 12.84% in the last model, indicating at a first look that the model is correctly fit. Overall, the logit model for household food insecurity indicates with high statistical significance that being in the informal sector during the first phase of the COVID-19 lockdown is associated with an increase in the log-odds of household food insecurity.

Table 4. Logit regression estimates for household food insecurity

VARIABLES	(1) Food_insecurity	(2) Food_insecurity	(3) Food_insecurity	(4) Food_insecurity	(5) Food_insecurity
Informal	0.634***	0.479***	0.432***	0.313***	0.319***
	(0.0796)	(0.0848)	(0.0857)	(0.0894)	(0.0895)
Work_lockedout		0.426***	0.410***	0.401***	0.377***
		(0.0871)	(0.0875)	(0.0894)	(0.0900)
Income_loss		1.275***	1.261***	1.236***	1.247***
		(0.0829)	(0.0834)	(0.0855)	(0.0858)
Covid SRD grant		-0.314	-0.259	-0.160	-0.0964
		(0.593)	(0.595)	(0.622)	(0.627)
Child Support Grant		0.201	0.113	0.0440	-0.0480
		(0.162)	(0.165)	(0.166)	(0.169)
Household size			0.0542***	0.0432***	0.0425***
			(0.0139)	(0.0141)	(0.0141)
Tap water			-0.317***	-0.264**	-0.284**
			(0.111)	(0.114)	(0.116)
Education_categ = 0, No school				0.807***	0.780**
				(0.310)	(0.311)
Education_categ = 1, No-matric				0.261**	0.258**
				(0.106)	(0.107)
Education_categ = 3, Post-matric				-0.548***	-0.571***
				(0.118)	(0.119)
Population group = 1, African				0.438**	0.460**
				(0.206)	(0.207)
Population group = 2, Coloured				0.830***	0.814***
				(0.230)	(0.230)
Geo area = 2, Rural					-0.161
					(0.109)
Female = 1					0.234***
					(0.0870)
Constant	-0.393***	-1.043***	-1.015***	-1.384***	-1.455***
	(0.0492)	(0.0682)	(0.140)	(0.252)	(0.256)
Pseudo R-squared	0.0169	0.0939	0.1004	0.1258	0.1284
Observations	2,751	2,751	2,741	2,741	2,741

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

Source: Own calculations based on data from NIDS-CRAM Wave 1

Predicted probabilities for household food insecurity

In Table 5 are presented the predicted probabilities and the average marginal effects (AME) calculated based on the logit model no. 5 with all control variables included. The predicted probabilities and marginal effects are computed based on the condition that the response variable has a value of 1 (food insecurity = 1).

The predicted probabilities presented in Table 5 can be interpreted as follows: For an informal sector's worker (Informal = 1), the probability of household food insecurity is 0.504, while for a formal sector's worker (Informal = 0), the probability of household food insecurity at the household level is 0.437. Thus, the probability for an informal worker to experience household food insecurity is 6.71 percentage points higher than that of a formal worker, when holding all other parameters constant. Further, a worker who lost the main source of income has a 28.00 percentage points higher probability of household food insecurity, than a worker who kept the main source of income. Receiving the SRD and CSG grants is associated with a slight decrease in the probability of food insecurity, though the values have no statistical significance.

Access to tap water is associated with a 5.93 percentage point decrease in the probability of food insecurity, while a one unit increase in the household size is associated with a small increase in the probability of food insecurity. Similar with the previous model, higher education is associated with a lower probability of food insecurity, while lower education is associated with a higher probability of food insecurity. Surprisingly, the coloured/Indian population group has a higher probability of food insecurity than the African population. Also, women have a higher probability of reporting household food insecurity by 4.86 percentage points compared to men.

The z-statistics and the probability values from the table, indicate that most of the predicted probabilities have statistical significance. However, the results for rural, SRD and CSG do not show statistically significant correlations with household food insecurity. A visual representation of the plotted predicted probabilities of household food insecurity can be found in the annex – Figure A4.

Table 5. Predicted Probabilities and AME for food insecurity,
based on the logit model from Table 4 – model 5

(1) Predicted probabilities of food insecurity X = 1 Categorical included		(2) Predicted probabilities of food insecurity X = 0 Categorical omitted		(3) Average marginal effects X = 1 Categorical included	
1.Informal	0.504*** (34.24)	0.Informal	0.437*** (38.53)	Informal	0.0671*** (3.53)
1.Work_lockedout	0.516*** (33.34)	0.Work_lockedout	0.437*** (40.69)	Work_lockedout	0.0792*** (4.18)
1.Income_loss	0.622*** (44.43)	0.Income_loss	0.342*** (28.69)	Income_loss	0.280*** (15.03)
1.Covid SRD grant	0.443*** (3.44)	0.Covid SRD grant	0.463*** (53.15)	Covid SRD grant	-0.0199 (-0.15)
1.CSG Child grant	0.454*** (13.50)	0.CSG Child grant	0.464*** (51.32)	CSG Child grant	-0.00993 (-0.28)
1.Tap_water	0.453*** (46.83)	0.Tap_water	0.512*** (23.32)	Tap_water	-0.0593** (-2.44)
0.No schooling	0.637*** (10.41)	2.Matric (omitted)	0.469*** (25.12)	No schooling	0.167*** (2.61)
1.No-matric	0.525*** (38.16)	2.Matric (omitted)	0.469*** (25.12)	No-matric	0.0562** (2.42)
3.Post-matric	0.349*** (20.99)	2.Matric (omitted)	0.469*** (25.12)	Post-matric	-0.120*** (-4.80)
1.African	0.458*** (47.06)	3.White (omitted)	0.365*** (9.25)	African	0.0934** (2.28)
2.Coloured/Indian	0.532*** (21.43)	3.White (omitted)	0.365*** (9.25)	Coloured/Indian	0.167*** (3.63)
2.Rural	0.436*** (22.05)	1.Urban (omitted)	0.470*** (48.03)	Rural	-0.0332 (-1.49)
1.Female	0.486*** (39.75)	0.Female	0.437*** (34.13)	Female	0.0486*** (2.70)
				Household size	0.0087*** (3.02)
N	2741	N	2741	N	2741
z statistics in parentheses * p<0.1, ** p<0.05, *** p<0.01					

5.3 Logistic Regression Diagnostics

Unlike the OLS regressions, the output from the logistic regressions contain the log likelihood chi-square for the model, a measure that can give us a general indication on how the model fits the data. Although both of the logit models indicate an overall good fit of the model and statistical significance, by examining the pseudo R-squared and at the log likelihood chi-square (LR chi2), further robustness testing must be conducted. Thus, this section presents the results from four performed robustness tests, as they are the most commonly used in logit analysis. All the tests suggest good indicators for both logit analysis (model 6 for household hunger and model 5 for food insecurity) and the exact results are presented in Table 6 below.

Specification Errors test

When building a logistic regression model, the assumption is that the logit of the response variable is using a linear combination of all explanatory variables and that all the relevant variables are included. Therefore, the concern is whether the models have all the relevant predictors and if the linear combination of them is sufficient.

To check if there is any specification error a linktest was performed. The idea behind the linktest is that if the model is correctly defined, there should be no other additional predictors that are statistically significant. The linktest uses the linear predicted value (LPV) and linear predicted value squared (LPV_sq) as the predictors to rebuild the model (Long & Freese, 2006, p. 154). The LPV variable should be statistically significant, indicating that the model is properly specified. In contrast, the LPV_sq variable should not be a statistically significant predictor. Therefore, the conclusion is that both logit models do not have specification errors as the linear predicted values are statistically significant, and the squared linear predicted values are not statistically significant (Table 6, column 1).

Hosmer and Lemeshow's goodness-of-fit test

The Hosmer and Lemeshow's goodness-of-fit test is a commonly used test of model fit. The concept behind this test is that the predicted frequency of the event and observed frequency of the event should have a good match (Long & Freese, 2006, p.155). The better the predicted and observed frequency match, the larger the p-value of the test will be, and the better the fit. With a p-value of 0.6226 for the first logit model, and a p-value of 0.9200 for the second logit model it can be concluded that the test indicates that the model fits the data well (Table 6, column 2).

Multicollinearity VIF test

Multicollinearity can occur when an independent variable in the model is determined by a combination of other independent variables in the model, or when interaction terms are used. Reasonable multicollinearity (typically a value below 5.00) is common since correlations among the independent variables is an indication of collinearity. However, very large values of multicollinearity tests can produce large standard errors for the coefficients, and thus the estimated logistic regression coefficients can be highly unreliable.

To check for multicollinearity, a VIF test (variance inflation factor) is performed. VIF test indicates how much of the inflation of the standard error could be caused by collinearity. Running the VIF test after the first model is computed, shows that the majority of variables have VIF values below 5.00 and the mean VIF for the whole model is 2.79. The VIF test for the second model, shows that the majority of variables have VIF values below 5.00 and the mean VIF for the whole model is 2.50 (see Table 6, column 3). Therefore, the inference is that there is no sign of multicollinearity in either of the logit models.

The Likelihood ratio test (LR test)

The last test performed for the hunger logit model and the food insecurity logit model is the likelihood ratio (LR) test. This test generally is used to evaluate if there is statistically difference between two nested models - i.e., the first model is generated by imposing restrictions on the variables of the second model. To perform a likelihood ratio test, two models must be estimated for comparison – the first one

with a set of parameters, and a second model with all the variables from the first, and one or more other variables (Long & Freese, 2006, p.144). The idea behind the LR test is to determine if the added variables in the second model, improve the model significantly in comparison with the first model. The test can be computed for models with the same response outcome and the same number of observations. For the first logit regression model 3 was compared with the model 6 and for the second logit regression model 3 was compared with model 5 (Table 6, column 4). The results suggest that the models are significantly different, and the added variable improves both models.

Table 6. Robustness check of both logit models

Models	Link test for specification errors	Hosmer & Lemeshow goodness-of-fit test	Multicollinearity – VIF test	Likelihood ratio test
Logit 1 - Household hunger	LPV – 0 .777*** LPV sq – 0.087 (P>|z|=0.221)	Prob > chi2 = 0.6226	Mean VIF – 2.79	model.3 nested in model.6 Prob > chi2 = 0.0000
Logit 2 - Food insecurity	LPV - 0.993*** LPV sq - 0.024 (P>|z|=0.639)	Prob > chi2 = 0.9200	Mean VIF – 2.50	model.3 nested in model.5 Prob > chi2 = 0.0000

Source: Own calculations based on data from NIDS-CRAM Wave 1

6. Discussions

The results from the descriptive and econometric analyses are in line with previous research, showing that informal workers have been disproportionately affected by the COVID-19 pandemic, relative to formal workers. Besides, the analysis found new statistical evidence of differences in household hunger and food insecurity outcomes between formal and informal workers, as well as segmentation within sectors, primarily casual workers, and black/coloured vulnerable groups. Additionally, the study provided insight on the type of social relief that formal and informal workers could access during the lockdown. Thus, these findings suggest that the labour market segmentation theory holds true for the South African workforce, but there is additional segmentation within the sectors.

The key finding from the descriptive analysis is that the South African informal sector is highly vulnerable, with more than a quarter reporting household hunger and more than a half reporting food insecurity. Informal workers reported an almost double proportion of household hunger - 27.52% than 14.08% for formal workers, and a higher percentage of food insecurity - 52.55% versus 33.47% of formal workers. Both logit regression analyses confirm the high probability of hunger among formal and informal households, although the results and sectors' differences are lower when controlling for other factors. The probability of hunger among informal households is 24.7% versus 20.8% for formal workers, while the probability of food insecurity for informal households is 50.4% versus 43.7% for formal workers. The results indicate thus lower sectors' differences when controlling for other parameters, but the indicators are statistically significant. Nevertheless, even though informal workers are more vulnerable, the main finding is that hunger levels are quite high for both sectors.

An important remark based on the descriptive analysis is that the shares of child hunger (7% formal & 12% informal) are about half that of adult hunger (13% formal & 26% informal), suggesting that children were cushioned to some degree against high hunger levels. Another important observation based on the descriptive statistics is that within the informal sector casual workers have been the most affected by hunger – 38% versus 25% of self-employed and 20% of wage workers. Thus, the high disparities even within the informal sector require special considerations by the food security representatives. Moreover, a more detailed analysis on the correlation between informal sectors' segmentation and food insecurity outcomes during the COVID-19 lockdowns can be an interesting topic for scholars and future research.

Further, according to the logit estimates, there are not large differences across genders - the differences regarding hunger outcomes are not statistically significant, while the differences concerning food insecurity are relatively low. On the other hand, education levels are strongly correlated with both hunger and food insecurity outcomes at a high statistical significance level. These findings imply that access to education for both women and men is crucial for cushioning workers against hunger and food insecurity. This is particularly concerning for young informal workers, whose education levels are usually below the matric level. Although educational aspects are rather a long-term concern, the relevance of education levels during crises should be considered in policy design.

Not surprisingly, the results indicate the strong association between the worker's race group with hunger and food insecurity outcomes during the lockdown. Nothing unexpected here given the well-known racial inequalities persistent in South African society. An important observation though, is that food insecurity outcomes were even higher among the coloured/Indian population group versus the

black/African population. This is a signal for policymakers to consider targeted initiative for protecting the minorities and migrant groups as well, especially during downturns.

What is worth noticing from the results is that the rate of household hunger among both formal and informal households is approximately half of the rate of food insecurity. This suggests that the food parcels support cushioned part of the vulnerable workers during the hard lockdown. What does this suggest? The implications in this case are twofold: First, it indicates that the food support programmes developed by different organizations at the onset of the strict lockdown were crucial, especially for informal and other vulnerable workers, and are highly commendable. Second, because the rates of hunger were still considerable, it also implies that the food parcels programmes developed were not effective enough in reaching a wider share of the vulnerable workers. Therefore, policy makers in South Africa should consider that food parcel programmes are highly recommended during economic downturns, as it can be a faster way of protecting vulnerable workers until additional monetary support can be accessed. However, these types of initiatives should be improved to reach a larger share of the vulnerable workers, but also the amount of supply provided should be increased for avoiding further hunger consequences.

As discussed above, food insecurity levels were extremely high for both sectors, but especially for the informal sector. A key consideration here is that households ran out of money for food, firstly because their earnings decreased substantially and secondly because they were not able to access social security grants and support. As shown previously in Figure 5b, the COVID-19 SRD grant and the TERS-UIF support reached a quite low percentage of workers. As discussed in the literature review several obstacles were encountered by workers in accessing the proper support, such as poor collaboration and coordination between authorities, corruption and dishonest practices, and ineffective systems. The impediments were even higher for informal workers who are not registered in the social security system. Thus, better systems have to be implemented for preventing corruption and ensuring that the support provided reaches the targeted people.

Furthermore, as discussed in the literature review section, Will et al. (2020) showed that the situation regarding hunger and food insecurity during the second phase of lockdown, although showed improvements in later months, was still worrisome. This indicates that disruptions regarding hunger and food insecurity among vulnerable population groups tend to be persistent, and have to be seriously considered by policymakers. Efficient policies should also consider post-crisis initiatives and long-term recovery plans for those who are greatly affected during hard periods of distress.

An additional consideration for the high food insecurity, is the low value of social income and grants provided, which were not enough to secure the minimum of household food supply. Even though the COVID-19 SRD grant (R350 per month) was introduced, and the Child Support Grant was extended (R650 per month), the amounts are very low comparing to the TERS-UIF relief which varies between R3500 - R6838 per month, depending on a workers' previous salary. However, a higher number of formal workers could obtain the TERS-UIF relief relative to informal workers. This support might have cushioned formal workers against hunger, significantly better than the COVID-19 SRD grant accessed in a higher proportion by the informal sector. Thus, the value of the grants allocated should be considered in the context of the food poverty line, which stands at R578 per person per month (Stats SA, 2019).

6.1 Conclusion

As discussed previously, the results from this study indicate that the South African informal sector is generally more vulnerable relative to the formal sector, as suggested by the labour market segmentation theory. This hypothesis holds true in terms of hunger and food security outcomes during the COVID-19 lockdown. The analysis in this paper does not find evidence for some policymakers' assumption that the informal economy is somehow isolated from global economic volatilities, because it operates outside the economic regulations. Quite the contrary, because of the lack of proper registration on the labour market, the informal sector had difficulties in accessing the proper social support. The results in this paper are therefore an additional evidence for policymakers and authorities, about the informal sector's vulnerability, both in South Africa and internationally.

Overall, the results in this paper complement the descriptive analysis from Rogan and Skinner (2020), who found that the informal economy has been disproportionately affected by the COVID-19 pandemic in terms of wages and hours worked. The findings suggest that not only losses in earnings and hours were greater for informal workers, but also household hunger and food insecurity. The findings from both descriptive and econometric analyses, are also in line with research from Bridgman, Van der Berg & Patel (2020), who found a high prevalence of adult and child hunger during the COVID-19 lockdown for the South African population. Moreover, this paper brings additional insights and discusses the implications of household hunger and food insecurity between and within formal and informal sectors. Based on these findings, extensive research on prospective policies targeted towards vulnerable groups in the South African formal and informal sectors and practical implementation strategies, could be a valuable area of research.

To conclude, the current study found that the South African informal sector, particularly certain vulnerable informal groups such as casual workers and the black/coloured population groups, were associated with higher probabilities of household hunger and food insecurity during the first COVID-19 lockdown, with persistent consequences. Therefore, the implications are relatively straightforward: due to its general high vulnerability, amplified during economic downturns, the South African informal sector needs to be properly targeted by policymakers. Future policies, specifically directed towards informal workers are crucial for avoiding extreme hunger and food insecurity outcomes and for assuring further recovery assistance post crisis.

In conclusion, this paper effectively uncovered the research problem by presenting the theory of dual labour markets and reviewing the relevant literature on the topic of informal sectors' outcomes during economic downturns in general and specifically during COVID-19. Further, the results from the descriptive and the regression analyses provided the basis for answering the research question and accomplishing the three objectives set out in the beginning of this paper. Consequently, the first objective of identifying the probabilities of household hunger and food insecurity for the informal versus formal sector was accomplished by conducting the logit regression. Further, the second objective of getting insight into lockdowns' outcomes for various groups within formal and informal sectors was achieved by performing the descriptive analysis. Finally, the third objective of assessing what are the implications of the results was completed by discussing the larger perspective in the previous section. Thus, this study successfully answered the research question set out in the introduction.

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Appendix:

Table A 1. Summary statistics for the sub-sample used in analysis

Variables	Mean	Std.dev	Min	Max
HH hunger	.1872142	.3901543	0	1
Food insecurity	.4006052	.4901102	0	1
Informal	.3455277	.4756265	0	1
Income loss	.396773	.4893171	0	1
Work lockout	.2797115	.448939	0	1
Household size	4.48237	2.877485	1	28
Tap water	.8725362	.3335524	0	1
Education	1.924169	.9092405	0	3
Race	1.368401	.4828966	1	3
Geo type	1.150847	.3579651	1	2
SRD	.0057243	.0754561	0	1
CSG	.047558	.2128678	0	1
Female	.4296054	.4951098	0	1
Age	38.83257	11.68485	17	60
Age squared	1644.455	1001.103	289	10201
Informal type	2.04297	.7879268	1	3
TERS-UIF	1.874788	.3607257	1	3
N	2751			

Table A 2. List of variables used in the descriptive and regression analysis

Variable name	Survey question	Type	Categories
Household hunger	In the last 7 days, has anyone in your HH (adult or child) gone hungry due to lack of food?	Binary	1 = Yes 0 = No
Food insecurity	In April, did your household run out of money to buy food?	Binary	1 = Yes 0 = No
Informal sector	Constructed from workers who declared they do not have a written contract; or if self-employed they were not tax registered.	Binary	1 = Informal 0 = Formal
Income loss	Has household lost its main source of income since the lockdown started on 27th March?	Binary	1 = Yes 0 = No
Work lockout	Workers with zero working hours in April, but declared they had a job they could return to.	Binary	1 = Yes 0 = No
Household size	Number of people in household including children and babies.	Continuous	1 - 28

Tap water	Piped or tap water inside dwelling/house/in yard?	Binary	1 = Yes 0 = No
Education level	Highest school grade completed	Categorical	0 = No school 1 = No matric 2 = Matric 3 = Post matric
Race	Population group	Categorical	1 = Black/African 2 = Coloured/Indian 3 = White
Geo type	Geographical Type (2011 Census)	Categorical	1 = Urban 2 = Rural
SRD	COVID-19 Social Relief of Distress (SRD) grant received?	Binary	1 = Yes 0 = No
CSG	Child Support Grant (CSG) received?	Binary	1 = Yes 0 = No
Female	Respondent's gender	Binary	1 = Yes 0 = Male
Age	Respondent's age	Continuous	17 - 60
Informal type	Type of informal employment	Categorical	1 = Self-employed 2 = Wage worker 3 = Casual worker
TERS - UIF	Did you receive income from UIF TERS in April?	Categorical	1 = Yes 2 = No 3 = Waiting

Source: Own formation based on data from NIDS-CRAM Wave 1

Table A 3. Correlation table for household hunger and predictors

|	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
HH hunger	1.0000									
Informal	0.1281	1.0000								
Work_lockout	0.0967	0.0143	1.0000							
Income_loss	0.2084	0.1567	0.1210	1.0000						
SRD	-0.0117	0.0558	-0.0030	0.0154	1.0000					
Education	-0.1996	-0.2271	-0.0356	-0.1457	0.0025	1.0000				
Race	-0.1614	-0.1610	-0.0812	-0.1234	-0.0026	0.1769	1.0000			
Geo_type	0.0581	0.0711	0.0099	0.0417	0.0056	-0.0785	-0.1732	1.0000		
Female	0.0253	-0.0049	0.1106	-0.0097	-0.0404	0.0057	-0.0029	-0.0115	1.0000	
Age	0.0238	-0.0068	-0.0008	-0.0272	-0.0176	-0.1611	0.1416	0.0165	0.0992	1.0000

Source: Own calculations based on data from NIDS-CRAM Wave 1

Table A 4. Correlation table for food insecurity and predictors

|	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Food_insecure	1.0000											
Informal	0.1529	1.0000										
Work_lockout	0.1252	0.0140	1.0000									
Income_loss	0.3253	0.1566	0.1203	1.0000								
SRD	-0.0002	0.0558	-0.0031	0.0152	1.0000							
CSG	0.0375	0.0619	0.0293	0.0265	-0.0185	1.0000						
HH size	0.1112	0.1024	0.0430	0.0527	-0.0171	0.1211	1.0000					
Tap_water	-0.0911	-0.1001	-0.0014	-0.0579	0.0032	0.0019	-0.1706	1.0000				
Education	-0.2356	-0.2276	-0.0383	-0.1484	0.0024	-0.0830	-0.1246	0.1312	1.0000			
Race	-0.0958	-0.1612	-0.0813	-0.1238	-0.0027	-0.0818	-0.1219	0.1908	0.1752	1.0000		
Geo_type	0.0121	0.0702	0.0103	0.0422	0.0057	0.0093	0.1046	-0.1898	-0.0762	-0.1732	1.0000	
Female	0.0581	-0.0050	0.1100	-0.0106	-0.0405	0.1946	0.0824	-0.0106	0.0028	-0.0043	-0.0097	1.0000

Source: Own calculations based on data from NIDS-CRAM Wave 1

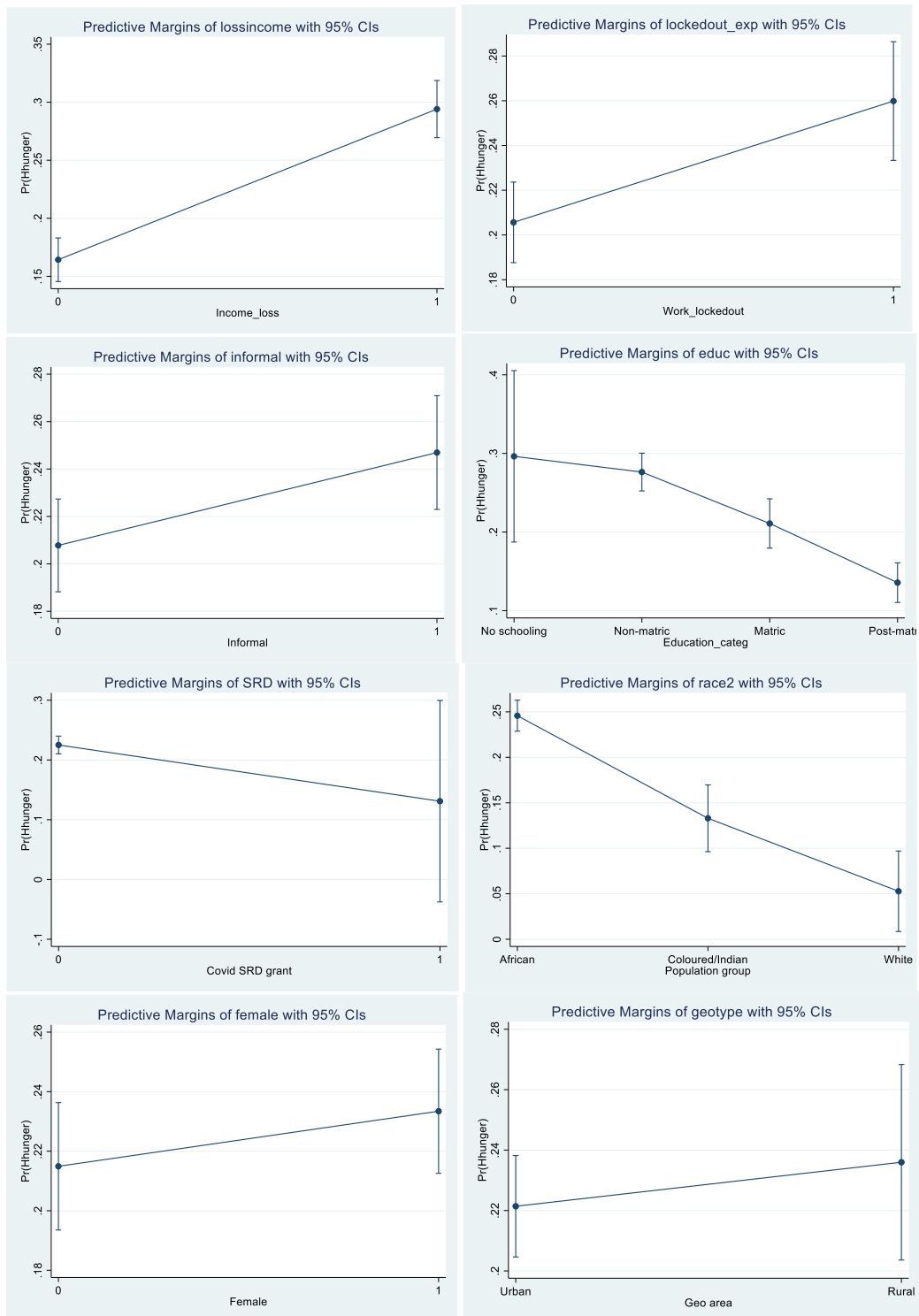## Figure A 1. Inability to work during the lockdown, within formal sector
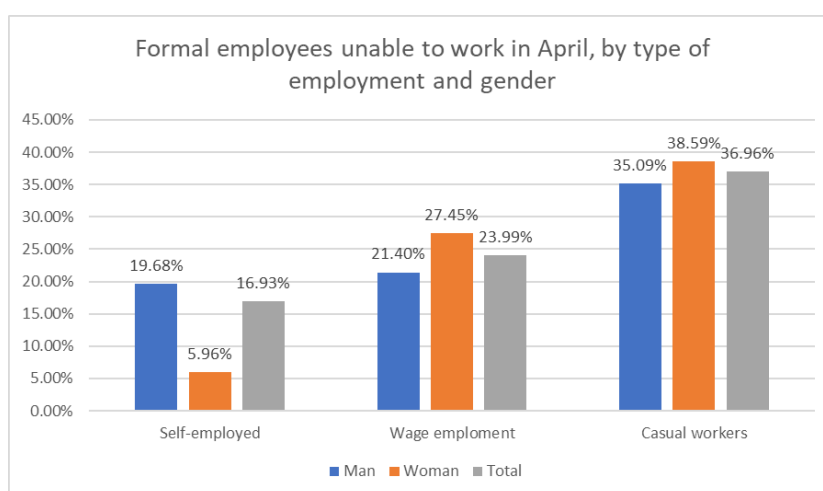
Source: Own calculations based on data from NIDS-CRAM Wave 1

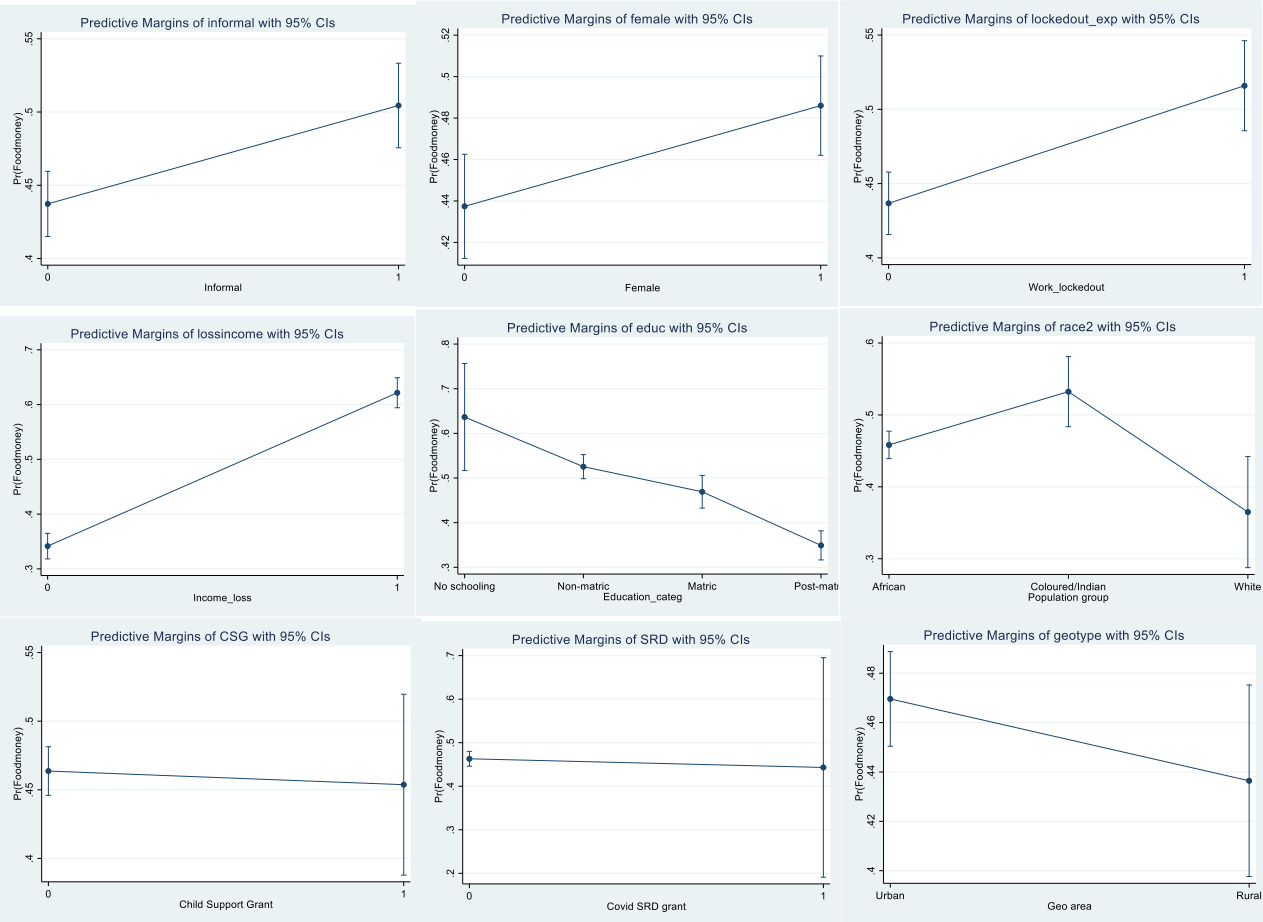## Figure A 2. Household hunger within informal sector by gender
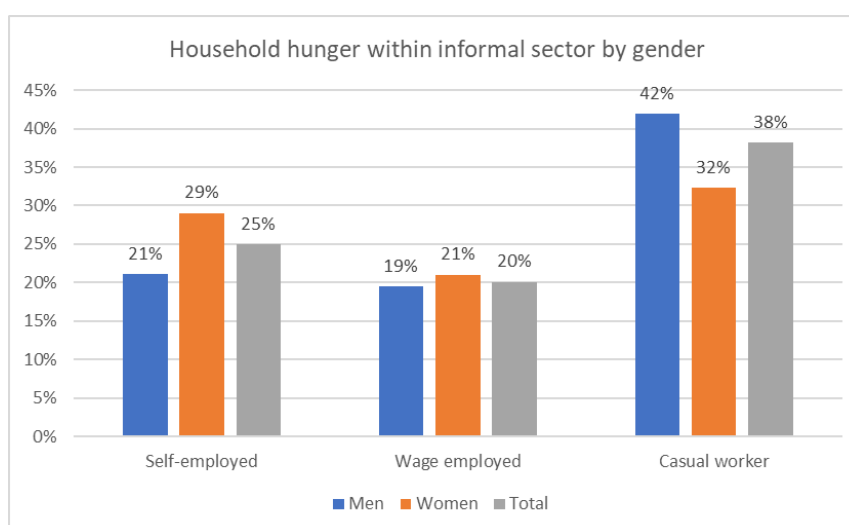
Source: Own calculations based on data from NIDS-CRAM Wave 1

Figure A 3. Margins plot of predicted margins for HH hunger

Figure A 4. Margins plot of predicted margins for food insecurity

Source: Own calculations based on data from NIDS-CRAM Wave 1