THE IMPACT OF COVID-19 PANDEMIC ON FOOD SECURITY IN SOUTH AFRICA: ONE YEAR LATER

A Research Report submitted in partial fulfilment of the
Degree of Master of Commerce (Applied Development Economics)
in the School of Economics and Finance

by

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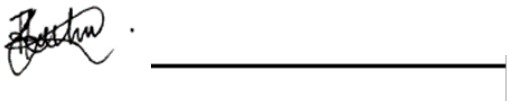
DECLARATION

I declare that this research report is my own unaided work. It is being submitted for the degree of Master of Commerce (Applied Development Economics) at the University of the Witwatersrand. It has not been submitted before for any degree or examination at any other University.



Kiana Bachu

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I would like to thank the Universe and whatever else is out there for getting me this far. I do not know how but I am thankful that I was able to get here.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

This research report used all five Waves of National Income Dynamics Study - Coronavirus Rapid Mobile Survey (NIDS-CRAM) data to answer what effect of COVID-19 has had on household food security and what factors determined whether a respondent's food outcomes have worsened during the Coronavirus (COVID-19) pandemic. This research report explored the consequences of the expanding pandemic and resultant governmental lockdown restrictions on individuals and households' food security in South Africa Food security outcomes are measured with the use of the four food security pillars - availability, accessibility, utilisation, and stability. The questions used from this survey provides indicators of employment and food security and quantitative estimates of food security outcomes using probit modelling with random effects estimation. COVID-19 is seen to have worsened individuals and households' food security with higher chances of being food insecure with decreased incomes and lower levels of education. The changes which occurred to employment and income from the shock created by COVID-19 created adverse effects in the accessibility of food. Government grants was not seen to reduce the likelihood of food insecurity which is likely due to the insufficient amount it represents. Therefore, not being able to reduce this inaccessibility to food by providing food expenditure. This study contributes to the continued discussion about the economic and social impacts of COVID-19 with focus on food security in South Africa.

Keywords: food security, COVID-19, labour market participation, welfare.
JEL Codes: D12, 012, O13, Q18.

1. Introduction

The COVID-19 pandemic may have created a "new-normal", but it is obvious to see it has only shed a bright light on the many pre-existing issues around the world. And has only hampered the target trajectories of the 2030 Sustainable Development Goals set by the United Nations to solve these issues. The impact, strain and persistence of COVID-19 has been felt and placed on almost all aspects of people's lives. From health to jobs, and to income. One important aspect is food security. Essential branches of food security from supply, distribution, demand, and consumption have been impacted from the disorder COVID-19 has created in local and international food systems and economies. Resulting in consequences of reduced food accessibility and diet diversity, rises in malnutrition, and overall increase in food insecurity (Elbehri et al., 2022). Around the world, the impact of the pandemic has revealed not only the fragility of health care systems and the severity of existent inequalities but also weaknesses in food systems, and how easily they can be severely interrupted by shocks (Bene, 2020).

It is a fine balancing act with which countries need to perform between needing to contain the pandemic and avoiding devastating predicaments to the economy and to food security. The limitations on the mobility of people have created shortages in labour causing disruptions in agricultural and food markets (Elbehri et al., 2022) and closures of restaurants and schools, restrictions of social gatherings as well as from income losses has caused shifts in food demand (Mardones et al., 2020; Wegerif, 2020). Disruptions in trade and resource flows of basic foods like wheat, rice and cereals are due to a few countries imposing restrictions on exports (Elbehri et al., 2022; Arouna, Soullier, Mendez del Villar, & Demont, 2020; Udmale, Pal, Szabo, Pramanika, & Large, 2020). The pandemic has impacted negatively on the four pillars of food security. The four pillars being food availability, food access, food utilisation, and food stability. COVID-19 is promptly and harshly affecting the accessibility of food, but availability disruptions, utilisation changes in consumer demand shifts from healthier to less nutritious and cheaper foods, instability of food prices are also seen as combined effects of the pandemic on food security (Laborde, Martin, & Vos, 2021).

COVID-19 has spread and is continuing now to spread at a very rapid pace and with an evolving nature. Inflicting significant damage to all sectors including the agriculture and food industry. The damage and losses in these two sectors, if not contained, can result in disastrous food security crises, which will be worst felt in developing countries. Owing to the importance

of this topic, with relation to the Sustainable Development Goal of food security, this study undertook an investigation on the impact of COVID-19 on food security.

2. Problem statement

This study analyses and discusses the impact of COVID-19 on food security using South Africa as a case study. There is consensus that increased food insecurity will have far-reaching impacts. Labadarios et al. (2011); Altman, Hart, and Jacobs (2009) argue that food security in South Africa has always been a prevalent issue. This risk is heightened by the global pandemic. The lockdown restriction exacerbated food insecurity due to loss of income. COVID-19 lockdown restrictions resulted in increased unemployment in various countries worldwide (Blustein, 2020), including in South Africa. From a household perspective, the resultant loss in income undermines purchasing power for food and other consumption goods and services particularly among the lower income households (Hirvonen, de Brauw, & Abate, 2021).

The lockdown due to COVID-19 outbreak disrupted agricultural and food markets through labour shortages imposed by restrictions on people's possibility to travel. Moreover, export restrictions in some countries also disrupted trade flows for staple foods, such as wheat and rice. Combined, these restrictions led to hikes in food prices (Larborde, Martin, Swinnen, & Vos, 2020; Torero, 2020). This raised concern that poverty and food insecurity would worsen, and that the nutritional status of low-income households and vulnerable groups would possibly fall (Larborde et al., 2020).

Considering the implementation of a national level lockdown to restrict the spread of COVID-19, this study looked at how the four pillars of food security has been affected, globally and in South Africa. This study asks the following research question:

- what is the effect of COVID-19 on individual and household food security in South Africa?

The use of the National Income Dynamics Study - Coronavirus Rapid Mobile Survey (NIDS-CRAM) helps in answering these questions. The question used from the survey contain aspects indicating food security which asks about the lack of money and hunger experience.

FAO used the food insecurity experience scale (FIES) measure to define food insecurity as access limitations brought by money or other resources constraints at any level of individuals or households. (FAO, IFAD, UNICEF, WFP & WHO, 2021). Taking into consideration the definition of food insecurity by FAO et al. (2021) and the literature on food security, the following hypotheses are derived:

- Lower educated individuals are more likely to have reduction in economic activity due to the COVID-19 pandemic, all else equal.
- Households that experienced job losses because of the pandemic experience a significantly higher levels of food insecurity compared to their unaffected counterparts.
- Finally, I hypothesize that households that received government grants experience a significantly lower levels of food insecurity compared to those that do not receive grants.

This study is relevant and important as it analyses the pandemic's implications and the consequential restrictive lockdown measures invoked by Governments on the food security of individuals' and households in South Africa and further adds to the findings of the adverse effects of COVID-19 on food security outcomes. This research report thus contributes to the continuing discussion about the social and economic impacts of COVID-19 with focus on food security in developing countries and South Africa. It further adds to the empirical evidence with the use of the National Income Dynamics Study - Coronavirus Rapid Mobile Survey (NIDS-CRAM) panel dataset which provided quantitative estimates of the impact of COVID-19 on food security.

The results illustrate how COVID-19 has worsened individuals and households' food security with higher chances of being food insecure with decreased incomes and lower levels of education. The changes which occurred to employment and income from the shock created by COVID-19 through lockdown restrictions created adverse effects in the accessibility of food. Therefore, hindering all other components of food security. This potentially leads to an overall worsened food security situation in South Africa. A problem which government grants has the potential to alleviates by increasing the grants to enough, increasing government capabilities and with continued provision of grants.

The following section provides a background to measuring food security. This is followed by brief look at COVID-19 and food security from macroeconomic and microeconomic points of view. The research report is then structured as follows: section 4 explains the COVID-19 situation in South Africa and its lockdown policy measures, section 5 provides a review on the literature on food security and COVID-19, section 6 explains the data and descriptive statistics, section 7 displays the empirical methods, results and various discussion points and section 8 concludes the research report.

3. Literature review

3.1. Measurement of food security

Food security is seen as multidimensional with four pillars all interdependent with one another. Discussed below are the definitions, measures, and indicators of food security. The dimensions, interdependency of the four pillars, measures and indicators explored provides a clear and simple understanding of food security and a foundation as to why the specific questions were chosen from the NIDS-CRAM survey.

Papers studying food security use the definitions proposed by the FAO as a conceptual basis for their analysis on food security. The definition used by many is the 1996 FAO definition entailing that food security is only realised when all people live a healthy life with, adequate, safe, and nutritious food always (FAO, 1996). This definition encompasses the four pillars of food security. The FAO (2008) described the four pillars as the main dimensions of food security which needs to be fulfilled simultaneously. The conceptualisation of the four dimensions is explained as the physical availability of food, the economic and physical access to food, food utilisation as the quality of diet and stability of the other dimensions over time (Devereux, Béné, & Hodd, 2020; FAO, 2008). But are commonly referred to as food accessibility, availability, utilisation, and stability. These four dimensions provide the basis of food security and therefore, measurements and indicators need to comprise of each one of these concepts.

The measurements of food security have been widely contested. This is due to the multifaceted dimensions food security holds. Measurements of food security need to consist of and invoke these multidimensional aspects of food security. As explained by the FAO (2008) food availability looks at the aspects in the supply of food and whether it is adequate. Food

accessibility looks at whether people can obtain the food required and how. Food utilisation looks at what people are consuming and whether they have enough calories and nutrients (FAO, 2008). Food stability looks at whether people can have a stable access of the food always required. As Bolarinwa, Ogundari and Aromolaran (2019) state, the interdependence of the four pillars makes it difficult to measure. Therefore, indicators need to reflect all four pillars. But as explained by Hoddinott (1999), and Smith and Subandoro (2007), it is very difficult to create indicators which contain aspects of all four pillars.

Smith and Subandoro (2007) point out the importance of knowing the nature of the food security problem. Is it a problem of quantity, quality, or both? Quantity refers to the food amount consumed and whether this amount is sufficient. This quantity aspect is related to the access pillar as it refers to whether individuals or households have an adequate supply of food for consumption. Quality refers diet variation, food energy acquired from food staples and the quantity of individual foods consumed (whether individuals mainly eat staple foods or other types of foods as well) (Smith & Subandoro, 2007). These two aspects help decipher the suitability of the indicator and measurement. They add to the founding layers of the dimensions of food security. Contributing layers are added by the quality and quantity subdivisions such as consumption amount and diet diversity which are also known as indicators and measurements of food security.

Hoddinott (1999) outlined measurements of household- and individual-level food security as methods ranging from skill- and time-demanding yet accurate to simple but ill-defined. The best methods of measurement being surveys conducted as cheaply as possible with the lowest exposure/risk of misreporting (Smith & Subandoro, 2007; Hoddinott, 1999). The four measurements described by Hoddinott (1999) are individual intake, acquiring the right number of daily calories, diversification in diet, and indices of household coping strategies. These measurements look at the individual and household nutrients and calories, different foods and the frequency of consumption and the adaptations to a shortage or threat to food (Hoddinott, 1999).

The measurements of importance for this study are the individual intake and the indices of household coping strategies. Individual intake makes use of a recall period to measure the amount of food consumed. The household coping strategies measurement looks at the adequacy and vulnerability of the household by asking about the changes in food due to shortages,

shocks, or stressors. Another household-level measure of food security is explained as economic vulnerability by Smith and Subandoro (2007). This indicator measures the percentage of expenditures on food where expenditures is a proxy for income. The increase of income would then decrease economic vulnerability. Resulting in a higher percentage spent on food and ensuring the household to be food secure.

Many studies employ the use of both food expenditure and dietary indicators into their analysis of food security (see Nechifor et al., 2021; Mandal et al., 2021; Kansiime et al., 2021; Bolarinwa et al., 2019). This is done so their analysis covers the basis of all four pillars. Expenditure indicators covers the availability, accessibility, and stability. Whereas dietary indicators cover utilisation. But as argued by Ogundari (2007), there is a trade-off between the concepts of the four pillars. Making it difficult to substantiate the full effect on food security if one of the pillars are missing. Ideally for this study, indicators which contain both the expenditure factor and dietary factor should be used to measure food security. If not, inferences can still be made about the four pillars in terms of the indicators available.

A glance of the research done by the FAO shows that they divided the 1996 definition to represent their measurement of food security which is commonly known as the food insecurity experience scale (FIES). It makes use of eight questions portraying the access to food pillar. The barrier to this access being no money or other resources for individuals and households to obtain food (FAO, IFAD, UNICEF, WFP & WHO, 2021). The FIES uses self-reported, food-related behaviours and experiences which asks respondents to refer to 12 months before the survey, to calculate the severity of food security. The severity of food security is broken down into three levels ranging from low to high severity. The individuals and households are considered food secure or only marginally food insecure if they fall in the first level. The second level indicates moderate food insecurity and the third is an indication of severe food insecurity. For their estimation, they applied the Rasch model which uses a logistic function to estimate the likelihood of individuals and households being food insecure in one of the three levels of severity (FAO et al., 2021).

3.2. Measures, variables and methods

Three studies which use a combination of the expenditure and dietary indicators are by Sisha (2020), Bolarinwa et al. (2019) and Ogundari (2017). The study by Sisha (2020) looks at food

insecurity of households in Ethiopia. The indicators about unavailability of food in the previous 12 months and whether households were worried at the possibility of not enough food in the previous 7 days was used by Sisha (2020) to infer the households food security situation. The study conducted by Bolarinwa et al. (2019) on Rwanda used food expenditure per capita and a Household dietary diversity score (HDDS) which employs the accessibility and utilisation pillars through dietary and nutritional status. Ogundari (2017) study on Nigeria's food security similarly also used per capita food expenditure by using household income as proxy and dietary diversity score (DDS).

The data used by Sisha (2020) was a short panel, therefore, they applied a logit and random-effects model to measure food security through availability of food in the past 12 months and the past 7 days. The study found the chances of food insecurity decreased when the average schooling years of households increased by one year and the risk of being food insecure is lowered with higher wealth status of the household. Household were also seen to have higher chances of becoming food-insecure due to social and natural shocks (Sisha, 2020).

Bolarinwa et al (2019) measured households which were somewhat or totally food insecure by using the socioeconomic, demographic variables and the transitionary states brought about by seasonality by applying a multinomial logit model with correlated random effects. Food insecurity was seen to vary across seasonality and income related indicators such as household savings and profits from business or crops decreased the probability of food insecurity.

It was also found that somewhat food insecure households and food insecure households had an increased likelihood of being food insecure if their income comes from a salary. However, education of household head, household savings and other incomes reduced the probability for both somewhat and food insecure households. To analyse how demographic and socioeconomic variables effect food security through food accessibility and utilisation, Ogundari (2017) used a multinomial logit model which found that income increased diet diversity and decreased the households' chances of being food insecure. Whereas households with higher education had higher chances of being food insecure due to the reduced returns to education evident by Nigeria's unemployment.

Devereux et al. (2020) created a conceptual framework for analysing COVID-19's impact on food security. This framework is broken down into three ways of analysis: the use of the four

pillars, analysing supply using food systems, and analysing demand through wealth distribution known as the entitlement approach by Amartya Sen (Devereux et al., 2020). These frameworks use the main aspects between food security by providing a combined analysis through accessibility, supply, and demand sides of food. This research report used this combined analysis and mainly made use of the four-pillar framework and wealth and resources with insights into the disruptions created in food systems in measuring food security and COVID-19.

3.3. COVID-19 and food security

Food security has been put under strain because of COVID-19. COVID-19 has impacted all aspects of human life. Even more so in developing countries which have high inequality and populations which are largely poor and vulnerable. The FAO et al. (2021) used the food insecurity experience scale (FIES) measure to define food insecurity as access limitations brought by money or other resources constraints at any level of individuals or households. (FAO, IFAD, UNICEF, WFP & WHO, 2021).

Macroeconomically, the impact of COVID-19 on food security between different countries and continents are compared in terms of percentage points (FAO et al, 2021; Labadarios et al., 2011; Woertz, 2020; Workie, Mackolil, Nyika, & Ramadas, 2020). From these macroeconomic studies, when African countries are compared with other countries in other continents, Africa is seen to be the worst affected by the pandemic due to the pre-existing vulnerabilities such as hunger, unemployment, and poverty (FAO, 2021). According to the FAO et al. (2021), Africa is seen as the continent with the highest occurrence of food insecurity. From 2019 to 2020, moderate or severe food security rose Southern Africa rose from 44.3 percent to 49.7 percent in the and in severe food insecurity from 19,2 percent to 22.7 percent (FAO, et al., 2021).

Micro-economically, individual countries studied the impact of COVID-19 on their food security and its various aspects in the four pillars and food systems. The main influence of the pandemic stemmed from restrictions by governments (Elbehri et al., 2022; Bene, 2020). Resulting in its impact on aspects such as income (Arndt et al., 2020), dietary and health implications (FAO et al., 2021; Kansiime et al., 2021; Laborde et al., 2021; Mandal, et al., 2021), food supply chains (Deaton & Deaton, 2020; Woertz, 2020), food prices (Arouna et al.,

2020), food availability and distribution (Deaton & Deaton, 2020; Laborde et al., 2021; Mardones et al., 2020; Nyamwanza & Sinyolo, 2020).

The first of these pillars of food security is availability which is related to food supply. Food supply chains were seen to be impacted by COVID-19. The absence of vaccines makes farming practices difficult (Mardones et al., 2020; Laborde et al., 2021). To reduce contagion through contact, measures such as physical distancing and other protocols needs to be adhered. This constrains the amount of labour employed in the industry. Ultimately reducing the number of workers in these supply chains. Further applying this thinking to other occupations which are more labour-intensive, or labour inclined, as explained by Deaton and Deaton (2021) that food insecurity is tied to food affordability which is dependent on household income. Numerous amounts of people dependent on this labour income would be left with a reduced income or worse, left unemployed (Arndt et al., 2020; Mandal et al., 2021).

Thus, indirectly affecting the other pillars (accessibility, utilisation, and stability) through income. If there is a reduction in the number of workers in the agricultural industry, the amount of produce supplied from various sectors will also decrease as there will not be enough people to yield or harvest the amount pre-COVID-19. This would in-turn drive prices up of certain products because of this limitation on supply and access (Deaton & Deaton, 2021). The same outcomes may occur if consumers were to stockpile as a coping strategy, which increases the demand, to reduce the number of contact chances (Deaton & Deaton, 2020; 2021).

3.4. South African context

The 15th of March 2020 brought a declaration of a national state of disaster for South Africa (Government Gazette, 2020). This was after the Coronavirus was announced by the World Health Organisation (WHO) as a global pandemic. This prompted President Cyril Ramaphosa to address the state of the nation briefly after the national state of disaster was announced. The president imposed a 21-day national level lockdown from the 26th of March to the 16th of April 2020 (Hatefi, Smith, Abou-El-Hossein, & Alizargar, 2020; Parliament of the Republic of South Africa, 2020) invoking restrictive measures and protocols to combat the contagious COVID-19 virus.

These measures and restrictions were taken from the advice and recommendations by the WHO (2021) on COVID-19. The advice and recommendations consist of keeping a physical distance of at least one metre from others and avoid crowds and close contact; if keeping a physical distance is not possible and in non-ventilated areas, a mask must be worn; to prevent the spread by covering ones mouth and nose when coughing or sneezing; hands must be cleaned frequently with the use of soap and water or alcohol-based sanitiser and to self-isolate if symptoms of COVID-19 develop (WHO, 2021). These are also known as social distancing, avoiding close contact, meeting outdoors and sanitising. And with the introduction and distribution of vaccines, getting vaccinated as soon as possible is another recommendation by the WHO (2021).

The South African government took this advice and recommendations and formed five levels of lockdown: with alert level 5 being the highest level of severity with low readiness of the health system and alert level 1 being the lowest with high readiness of the health system (see Government Gazette 53599, 2020). This also understood as highest restriction of movement being alert level 5 to the lowest restriction of movement being alert level 1.

Later in the year of 2020 and early 2021, adjusted alert levels were released to further manage the easing of the lockdown restrictions. This depended on the infections level, transmission rate, capacity of health facilities, how far along public health interventions have been implemented and the livelihood impact of continued restrictions (South African Government, 2022). The amount of economic and social activity depended on the spread of COVID-19. Leaving the South African government with the difficult task of balancing the health of individuals by controlling transmissions and impacting economic livelihoods by restricting movement. As seen with many low-income, emerging countries (Elbehri et al., 2022), it's a task which the South African government have not been able to fully execute due to the lack of resources, negative impacts of the prolonged lockdown strategy and limited fiscal strategies and financial capabilities (Hatefi et al., 2020). Resulting in the easing of the lockdown measures and restrictions.

Lockdown was used as a preventive control mechanism to combat the spread of the virus. Especially since the South African population contains individuals with compromised immunities from various other viruses and circumstances such as tuberculosis (TB) and malnutrition (Parliament of the Republic of South Africa, 2020). Persons with a compromised

immunity have a higher chance of contracting the virus if they encounter it. This prompted the aim of initiating the alert level five lockdown to prevent the health care system from being overburdened with pre-existing medical cases and emergencies and before infrastructure measures were implemented to handle COVID-19 cases.

Included in the measures and restrictions posed by lockdown, only essential services were allowed to continue to operate. These essential services included providing basic needs services such as electricity, water, health care, communications, production and transportation of basic goods and supplies. And business operations necessary to the function of the economy and society such as pharmacies and financial services, amongst others, were only allowed to function (Parliament of the Republic of South Africa, 2020). This left individuals who are not employed in any of these sectors to be confined at home. And if they were employed in essential sectors, specified operations would be either be at normal capacity but most were to operate at minimum capacity in providing essentials. Individuals who had the capability to work for home were able to so. But individuals who were employed and required to work away from home were unable to do so. Thus, the measures restricted the movement of these individuals and thus affected their livelihood.

The issue of food insecurity in South Africa has always been a prevalent one. To lessen the shock of COVID-19, the South African government made use of the pre-existing social protection as "stop-gap measures to address food insecurity", as well as introduced the R350 COVID-19 Social Relief of Distress (SRD) (Wills, Patel, Van der Berg, & Mpeta, 2020). To directly combat the impending severity towards health and nutrition from prolonged lockdown, the government is said to provide support for those most vulnerable through R50 billion in expanded, top-up social grants, social relief of distress for a maximum of six months as well as the distribution of food parcels and vouchers (South African Government, 2022; National Treasury, 2020). The South African Economic Reconstruction and Recovery Plan (2022) explained on the agriculture and agro-processing side, to make up for the decline in fixed capital formation of farming and land inputs, as well as a reduction in incomes of farmers and agribusinesses, the private sector will create 317 000 new jobs. These proposed measures are said to combat food insecurity at the household level by providing support for 230 000 households (South African Government, 2022).

3.5. Pre- and Post- COVID-19

It is safe to say that COVID-19 warrants a shock and threat to food. Exuberating the pre-existing hunger faced worldwide (Workie et al., 2020). To further analyse the shock created, various studies comparing pre-COVID-19 and post-COVID-19 data further shows a combined and integrated impact of COVID-19 on these expenditure and dietary indicators. Amare, Abay, Tiberti, and Chamberlin (2021); Janssens et al. (2021); Nechifor et al. (2021), Kansiime et al. (2021); Mahmud and Riley (2021); Mandal et al. (2021); Woertz (2020) and Gelo and Dikgang (2022) studied the what the impacts were on income, food security, welfare from COVID-19 in Nigeria, Kenya, Uganda, Bangladesh, Arab Gulf States and South Africa, respectively.

The indicators and measurements of food security varied between these studies. Amare et al. (2021) used indicators such as whether a meal was missed/skipped and went not being able to eat for a day because of no food because of no money or resources to attain food. Janssens et al. (2021) categorised food expenditure in their analysis of income after COVID-19. The same indicator was used by Mahmud and Riley (2021) in their study on the economic and wellbeing effects. They also looked at food consumption. The use of both allowed them to deduce hunger levels in rural Uganda. Kansimme et al. (2021) used the 8 questions used in the FIES and the three levels of severity. Nechifor et al. (2021) used food demand, and consumption to measure sufficiency and adequacy. Mandal et al. (2021) also used food expenditure and consumption of fish, which is a staple in the diets of the people in Bangladesh, to analyse how the changes in income led to changes in the number of fish consumed. Woertz (2020) used foods systems and malnutrition to analyse the food availability and accessibility in the Arab Gulf States.

From the findings using fixed effects by Amare et al. (2021), in Nigeria, food insecurity was more prevalent in households who experienced lockdown measures. More vulnerability to food insecurity was also seen in those reliant on non-farm businesses and in poorer households. This is because the highest decline in income and economic activities as the pandemic spread and lockdowns ensued was felt in households specifically reliant on non-farm businesses. Similarly in Kenya, Nechifor et al. (2021) found the reduced wages from employment and other rents led to full or partial closure of businesses which in turn affected household income. Janssens et al. (2021) also used household fixed effects and found a decline in income from work, gifts, and remittances. The reduction in the amount households gifted, in remittances, lent and

withdrawals from savings, with the reduction in schooling and transport costs, the food expenditure of households in Kenya was like pre-COVID-19.

In rural Uganda, Mahmud, and Riley (2021) used household fixed effects to analyse the lockdown impact on income, expenditure, wealth labour supply, and wellbeing. They found decreases in non-farm and labour income resulted in the use of savings, borrowing, and reducing food expenditure to alleviate the loss. This reduction in food expenditure resulted in a rise in reported hunger. Half the households post lockdown reported missing at least a meal in a month as compared to the reported 30 percent of households at baseline (Mahmud & Riley, 2021). A point of interest mentioned by Mahmud and Riley (2021) was the increase in the prices of basic foods due to lockdown may also contribute to decreases in food expenditure and increases in hunger. The increase of food prices was also seen by Mandal, et al. (2021) and Woertz (2020) in fish staples and in global imports. And for individuals who do not have savings and live off labour income are less likely to afford food at these increased prices leading to worsened food security (Kansiime et al., 2021).

The study by Kansiime et al. (2021) focused on income and food security and COVID-19 affects by using probit regression modelling. To analyse the coping mechanisms during the pandemic, they make use of the FIES indicator created by the FAO et al. (2021). They found food insecurity and nutrition worsened. This may have been caused by the income shock created by COVID-19 and the interruptions in food supply chain (Kansiime et al., 2021). Furthermore, they found those dependent on labour income and income-poor were more susceptible to the induced income shock and national social security schemes in both Kenya and Uganda were less likely to lessen this shock due to each country's legal framework.

To combat the short-term economic effects inflicted by COVID-19, the Kenyan government implemented various support measures for partial welfare recovery such cash transfers. This is similarly seen in South Africa with support for households and businesses by implementing cash flow support (National Treasury, 2020). This included income supporting measures. But as Janssens et al. (2021) and Nechifor et al. (2021) mention, these measures may not reach most of the households surveyed as they are mostly economically active in the informal sector and the proposed measures are beneficial to those economically active in the formal sector or are urban households. As seen below, the same occurrences are seen in South Africa. The distribution and effectiveness of such government measures are only beneficial to small group

of the poor and vulnerable due to the lack of administrative capabilities (Wills et al, 2020). Therefore, not being able to fully lessen the COVID-19 shock. Turning towards South Africa, a working paper series and synthesis reports were released with NIDS-CRAM surveys. In these papers and reports, focus was placed on employment, food insecurity and hunger amongst other relevant topics which the data conveys.

From the synthesis reports which gives an overview of all five Waves of NIDS_CRAM (see Spaull et al., 2021c; Spaull et al., 2021b; Spaull et al., 2021a; Spaull et al., 2020b; Spaull et al., 2020a), employment fluctuated between Waves. In the waves 1 and 2 report, a comparison of employment between February 2020 and April 2020 showed a decline the number of people employed with no changes in June 2020 (Spaull et al., 2020b; Spaull et al., 2020a). In June 2020, those who were seen as female, rural, poor, unskilled, and uneducated workers were worse affected (Spaull et al., 2020b). Whereas people with higher education levels were employed more in October 2020 (Spaull et al., 2021a) and those able to work from home had an advantage in work over those who could not during lockdown levels (Spaull et al., 2021b). A full comparison over the one-year period showed slow increases in employment as lockdown restrictions were rolled-back. But despite this, it does not discount that COVID-19's impact on employment still had significant consequences on those who had little or nothing to gain from the aftereffects of COVID-19.

Van der Berg, Patel, and Bridgeman (2021a; 2021b; 2021c; 2020) made use of questions relating to these aspects (some of which are the same questions used in this research report's analysis) and estimate descriptive and multivariate econometric statistics on the responses for these questions from all five Waves of NIDS-CRAM surveyed data. These findings shed light on the scarcity of food poverty and fluctuations in resource flows during lockdown.

Findings in Wills et al. (2020) showed that since the commencement of lockdown, two out of every 5 specified that their respective household main income source was lost. Resulting in a knock-on effect on the expenditure for food. 47 percent reported their household had no money to buy food in April (Van der Berg, Patel, & Bridgman, 2021c; Van der Berg, Patel, & Bridgman, 2021b; Van der Berg, Patel, & Bridgman, 2021a; Bridgman, Van der Berg, & Patel, 2020; Wills et al., 2020). This measure remained in a low 40 percent for wave 2 to wave 4. In wave 5, only 35 percent of the respondents reported diminishing money for March 2021 showing a significant reduction from June 2020 and October 2020. Hunger was still high,

keeping in the range of 30 and 10 percent in all five Waves even though the percentage in diminishing monies to buy food decreased.

The social security provided by the South African government provides numerous South Africans with unconditional income which helps with food security (Winchester, King, & Rishworth, 2021). As mentioned by Van der Berg et al. (2021c) the support for households by the South African government (social insurance, social assistance, social relief) in the form of social grants and food relief by other organisations have only been beneficial to small number of respondents. But as argued by Winchester et al. (2021), of the individuals who receive grants, the sum of which is barely enough to live off. The accessibility of grants is less for individuals who do not live where there is the opportunity to attain them. And help from remittances, as similarly seen in Janssens et al. (2021), between family members does not depend on whether income is coming from government grants or not and is symbolic as explained by Winchester et al. (2021). Therefore, support in any form to improve food security may be important and relevant to our empirical analysis. Specifically, by looking into households which received grants from the government.

Additionally, the informal sector of South Africa plays a critical role in food security. It creates complex food systems affecting the accessibility of food to various local communities (Wegerif, 2020). COVID-19 and the containment measures imposed by the South African government to contain it have disrupted these systems and the further constraints and requirements implemented by the government to accommodate the informal sector has only made operating even more difficult (Skinner & Watson, 2021; Wegerif, 2020). Local communities are highly reliable on informal traders for fresh daily food and the absence of these traders requires individuals to seek food at commercial stores. This places them at more risk of the virus; exposed to higher prices than they would usually pay and thus have less purchasing power (Devereux et al., 2020; Wegerif, 2020). Food security is highly dependent on income. Employment has a huge effect on receiving an income or not. And those with employment needing low education levels to qualify are seen to be worse off due the lockdown measures (Arndt et al., 2020). This is because there was a reduction in working hours because of lockdown restrictions. Meaning a reduction to income earned creating an income shock.

The evidence and impact of COVID-19 and related lockdown restrictions on individuals and households are limited. The impacts of the pandemic argued by Arndt et al. (2020) and

Kansiime et al. (2021) vary in effects. These effects are dependent on the social and economic status, livelihood strategies and the access to markets which individuals and households have. Devereux et al. (2020) explained, wealthier households which do not have to depend on transfers, have better opportunities to accessing social relief and are not adversely affected by the changes made to employment – their job does not require them to leave their home to work. As argued by Arndt et al. (2020) South Africans (poorer households) were limited in their accessibility of livelihood opportunities by the restrictions during extended lockdowns thus experienced combined effects of employment and/or significant or complete income loss. Thus, negatively affecting the food consumed in both the quantity and quality aspects. Hence it is vital to understand the impacts on individual and household level and government mitigation strategies/instruments that can be elevated to ensure shock reduction and income smoothing.

As seen above, many of the studies make use of questions with a time recall, consumption, expenditure, and adequacy indicators and use panel data with estimation techniques such as binary models, fixed and random effects to capture changes in food security from employment, income, and shocks. All the above provide better understanding of food security.

COVID-19's impact on various developing countries varies depending on the socioeconomic characteristics and different livelihoods of individuals and households as said by Kansiime et al. (2021). The impact of COVID-19 on food security in developing countries shows it has worsened food security. This is mainly due to the consequences of lockdown restrictions on employment and income. Further reducing food expenditure and consumption, increasing hunger and worsening food security. Relief and support from governments to cushion the shock is only seen to affect a minority. COVID-19 has exuberated the already high inequalities globally and in South Africa. Resulting in dire consequences for the poor and vulnerable. Especially for those facing the crisis of food insecurity. A forthcoming paper by Gelo and Dikgang (2022) investigating the more recent the effects of job loss on child and household hungers during COVID-19 pandemic in South Africa found that households exposed to a labour market shock during the COVID pandemic experienced a significant increase in food insecurity. Government social grants were found to offset this adverse effect.

The impact of COVID-19 on food security in developing countries and South Africa aids in answering the two posed questions of what the effect of COVID-19 has had on household food

security and what factors determine whether a respondent's food outcomes have worsened during the COVID-19 pandemic. All the above further provides evidence for the hypotheses.

4. Data and methods

4.1. Data and variables

This study uses the National Income Dynamics Study - Coronavirus Rapid Mobile Survey (NIDS-CRAM) dataset. The dataset examines socioeconomic effects of national lockdown in South Africa (see Ingle, Brophy, & Daniels, 2021; CRAM, 2020). The dataset is a collaboration between the Southern Africa Labour and Development Research Unit (SALDRU) at the University of Cape Town, Stellenbosch University, and the University of the Witwatersrand.
The NIDS-CRAM surveys made use of the National Income Dynamics Study (NIDS) Wave 5 conducted in 2017 by the SALDRU (Ingle et al., 2021; CRAM, 2020). NIDS-CRAM is a subsample from NIDS Wave 5 households and is also a panel survey with a shorter questionnaire focused on the impacts of both the COVID-19 pandemic and the South African national lockdown. Considering it is subsample, it is representative of South African households. Computer Assisted Telephone Interviewing (CATI) interviews were used to collect the data (Ingle et al., 2021). The NIDS-CRAM surveys were carried out between May 2020 to May 2021 via telephone calls and SMSs.

The first three waves of NIDS-CRAM were collected in 2020. Wave 1 was conducted from the 7th of May to the 27th of June, wave 2 from the 13th of July to 13th of August and wave 3 from 2nd of November to 13th of December. Wave 4 and wave 5 were collected in 2021, from the 2nd of February to the 10th of March and from the 6th of April to the 11th of May, respectively. Attrition was found after wave 1 and 2 was surveyed (Ingle et al., 2021). The sample sizes from wave 1 and wave 2 were 7 073, while for wave 3 it increased to 8 157.

The initial five-week lockdown which imposed social mobility restrictions was followed by risk-adjusted phased reopening of the economy. The surveys were carried out during these risk-adjusted phased reopening of the economy commonly referred to as lockdown levels. Wave 1 was surveyed during national lockdown level 3 and level 4. Wave 2 was surveyed during national lockdown level 3. Wave 3 was surveyed during national lockdown level 1. Wave 4 was surveyed during national lockdown level 1 and 3. And Wave 5 was surveyed during national lockdown level 1. This is relevant in understanding the amount of economic and social

activity (social mobility and interaction) as allowed during the survey periods and help to understand how the restriction or the lack thereof changed respondents' answers.

Table 1: Variables and expected outcomes

Variable	Description	Expected relationship with dependent variables[1]
Government grant (1=yes)	Respondents indicated whether they personally received any kind of government grant.	WAA: Negative/less likely WE: Negative/less likely RB: Negative/less likely ROMBF: Negative/less likely GH: Negative/less likely EH: Negative/less likely
COVID-19 Social Relief of Distress (SRD) Grant	Respondents indicated they received the COVID-19 Social Relief of Distress (SRD) Grant when asked which government grant/grants they receive.	WAA: Negative/less likely WE: Negative/less likely RB: Negative/less likely ROMBF: Positive/more likely GH: Positive/more likely EH: Positive/more likely
Child Support Grant	Respondents indicated the number of child support grants their household received.	WAA: Negative/less likely WE: Negative/less likely RB: Negative/less likely ROMBF: Negative/less likely GH: Negative/less likely EH: Negative/less likely
Old Age Pension Grant	Respondents were asked to indicate the number people in	WAA: Negative/less likely WE: Negative/less likely RB: Negative/less likely

[1] The dependent variables for the six models are as follows: 1) WAA - Working any activity, captures the responses of individuals who indicated they were not economically active, employed, self-employed and ran a business; 2) WE - wage employment (WE), not economically active and employed respondents; 3) RB – run a business, respondents primarily running their own businesses; 4) ROMBF - run out of money to buy food, respondents who ran out of money and thus had challenges in attaining food; 5) GH - gone hungry, had gone hungry in the last seven days due to the lack of food.; 6) EH, Experienced hunger, went hungry at some point during the week.

	their household which received an old age pension grant.	ROMBF: Negative/less likely GH: Negative/less likely EH: Negative/less likely
Lost Job (1=yes)	Respondents were asked to indicate if they had any kind of job in a specific month.	WAA: Negative/less likely WE: Negative/less likely RB: Negative/less likely ROMBF: Positive/more likely GH: Positive/more likely EH: Positive/more likely
Urban households (1=yes)	Respondents were asked to indicate if they reside in either a traditional, urban or farm setting.	WAA: Positive/more likely WE: Positive/more likely RB: Positive/more likely ROMBF: Negative/less likely GH: Negative/less likely EH: Negative/less likely
Government grants	Individuals who indicated government grants as a source of income.	WAA: Negative/less likely WE: Negative/less likely RB: Negative/less likely ROMBF: Negative/less likely GH: Negative/less likely EH: Negative/less likely
Money from friends or family	Individuals who indicated money from friends or family as a source of income.	WAA: Negative/less likely WE: Negative/less likely RB: Negative/less likely ROMBF: Positive/more likely GH: Positive/more likely EH: Positive/more likely
Household had no income		WAA: Negative/less likely WE: Negative/less likely RB: Negative/less likely ROMBF: Positive/more likely GH: Positive/more likely EH: Positive/more likely

Pension	Individuals who indicated pension as a source of income.	WAA: Negative/less likely WE: Negative/less likely RB: Negative/less likely ROMBF: Negative/less likely GH: Negative/less likely EH: Negative/less likely

The main questions of interest used in the NIDS-CRAM surveys are as follows:

1. In the month of, did your household run out of money to buy food?
2. In the last 7 days has anyone in your household gone hungry because there wasn't enough food?
3. How often did they go hungry?

These three questions measure food security. In question 1, the month in question refers to the specific month asked in the questionnaire (see Spaull et al., NIDS-CRAM Wave 1 Questionnaire, 2020; Spaull et al., NIDS-CRAM Wave 2 Questionnaire, 2020; Spaull et al., NIDS-CRAM Wave 3 Questionnaire, 2021; Spaull et al., NIDS-CRAM Wave 4 Questionnaire, 2021; Spaull et al., NIDS-CRAM Wave 5 Questionnaire, 2021). The availability, accessibility and stability pillars are represented in the above questions used in the measurement of food security for this study. All three questions portray a quantity indicator which looks at the amount of food consumed. Although the results cannot give exact amounts consumed but more of a general answer, for example, consumed less due to lack of money and food.

In question 1, the amount consumed is related to the expenditure amount. Question 1 and 2 both portray a recall period, adequacy and economic vulnerability of the respondents and their respective household. The recall periods require respondents to refer to specific month and 7 days prior to being surveyed. Therefore, the observations refer to during the time (month) or a week before the respective Wave interviews were conducted. Adequacy refers to an adequate supply of food and economic vulnerability is used as a proxy for income. Economic vulnerability can only be assumed for question 2. Whereas question 3 only portrays a definitive recall period.

These indicators provide a setback as they do not truly contain a quality indicator. But even though the utilisation pillar is not portrayed in these indicators, inferences about the food utilisation and nutrition can be made. The lack of nutrients is known to lead to negative impacts on health in the long-term for both adults and children (Mardones et al., 2020). And if the amount of food is constrained due to resource constraints, inferences about the quality indicators and utilisation can be made.

4.2. Empirical model

To estimate the effect of lockdown on employment indicators and food security outcomes (ran out of money, gone hungry and experienced hunger), a probit model with random effects specification was applied. The aim is to estimate the factors that determine labour market participation during the pandemic and to assess if the food security outcomes had worsened following the shock COVID-19 induced. The probit model with random effects specification which is used for estimation is as follows:

$$y_i = \alpha_i + \varphi T + \beta X_i + \varepsilon_i \qquad (1)$$

where y_i is the employment indicator and food security indicators of respondent i. and, is equal to 1 if the respondent indicated they are working any activity, a wage earner, or ran a business and 0 otherwise. y_i as the food security indicator also takes a binary form which is equal to 1 if the respondent indicated they ran out of money to buy food, had gone hungry because of a lack of food and went hungry almost every day and every day and 0 otherwise. T denotes a vector of main variables of interest which include education, lost jobs, and government grants. X_i denotes a vector of other explanatory variables. Parameters φ and β, respectively, are vectors of the parameters of T and X_i to be estimated and ε_i denotes the error term.

5. Results

5.1. Descriptive statistics

Amongst the food security outcome indicators, the NIDS-CRAM survey collected household, socioeconomic and demographic characteristics. These included variables of interest such as education, employment, income, and social relief. Table 2 displays the descriptive characteristics for selected variables. Nearly two thirds of the respondents are female. As this followed the NIDS 2017, respondents who were youth were not surveyed. The minimum age

surveyed was 17. Most of the respondents identified as African/Black. About 50 percent of the respondents reported levels of education lower than matriculation/Grade 12. The average household size was 5 members, and while 13 percent of households received a government grant about 18 percent received the R350 COVID-19 SRD grant. Around 50 and 30 percent of respondents reported receiving the child support grant and the old age pension grant. This is not surprising since, in addition to high unemployment rate, a substantial population of South Africans already relied on government grants hence a shock as COVID-19 was bound to increase grant reliance.

Approximately 26 percent of the respondents indicated losing their jobs during the one-year period. This is in line with the wide-spread job loss that occurred globally and in South Africa at the start of the pandemic and onwards. This may account to jobs which required physical contact but despite the changes in lockdown level restrictions which would allow individuals to work as they normally would have, required they adhered COVID-19 measures and protocols, the number of individuals who lost their jobs is still significantly high.

Close to 60 percent of the respondents reside in urban areas. Respondent's sources of income were obtained from employment, business, government grants, money from friends or family, other, whether household had no income and from a pension for a specified month (see Spaull et al., NIDS-CRAM Wave 1 Questionnaire, 2020; Spaull et al., NIDS-CRAM Wave 2 Questionnaire, 2020; Spaull et al., NIDS-CRAM Wave 3 Questionnaire, 2021; Spaull et al., NIDS-CRAM Wave 4 Questionnaire, 2021; Spaull et al., NIDS-CRAM Wave 5 Questionnaire, 2021). Around 57 and 12 percent of respondents reported receiving income from government grants or money from friends or family were seen as the main income sources and roughly 1 percent of respondents indicated receiving money from friends and family through transfers and dependents. This suggests that many of the respondents needed to acquire financial means outside their own income-activities and resources. Respondents were asked what their take-home pay or profit (after tax and deductions) was for a month specified. The average take home pay or profit is about R2200 (per month). The lowest take home pay reported by respondents was zero, whereas the highest take pay was R100000.

Table 2: Descriptive statistics of selected variables

Post-COVID-19 Wave 1 – 5 (n=38 730)				
	Mean	SD	Min	Max
Gender of respondent (1=male)	0.390	0.488	0	1
Age (years)	40.816	16.130	17	102
Race: African/Black	0.856	0.351	0	1
Coloured	0.087	0.281	0	1
Asian/Indian	0.010	0.101	0	1
White	0.045	0.207	0	1
Education (1=no matric)	0.532	0.499	0	1
Household size (number)	5.470	2.986	1	45
Government grant (1=yes)	0.132	0.338	0	1
COVID-19 Social Relief of Distress (SRD) Grant	0.187	0.390	0	1
Child Support Grant	0.517	0.500	0	1
Old Age Pension Grant	0.298	0.457	0	1
Lost Job (1=yes)	0.260	0.439	0	1
Urban households (1=yes)	0.603	0.489	0	1
Sources of income: Business	0.019	0.137	0	1
Government grants	0.567	0.495	0	1
Money from friends or family	0.118	0.323	0	1
Other	0.009	0.093	0	1
Household had no income	0.001	0.027	0	1
Pension	0.098	0.298	0	1
Transfers and dependents	0.009	0.095	0	1
Take-home pay or profit (after tax and deductions) per month	2172.188	5499.015	0	100 000

The main questions of focus and the key outcome variables have already been explained above. These questions are changed into a binary form, similarly, used by Amare et al. (2021) and Kansiime et al. (2020) to represent the indicators of food security. The first indicator measures whether there was a lack of money for food and takes a value of 1 if the respondent and their

respective household indicated that they ran out of money to buy food in the past month. The second indicator takes a value of 1 if anyone in their respective household did go hungry due to the lack of food. The third indicator measured how often the respondents and their households went hungry and takes the value of 1 if the hunger they experienced was almost every day or every day.

A setback of using such indicators is that, although they provide food expenditure indicators, they lack in dietary indications. Therefore, making it difficult to inquire into the calorific and nutrition in-take of the respondents. Nonetheless, given that food expenditure indicators are linked to availability, accessibility, and stability; it can be concurred that the lack of means to acquire food through income/money, hinders the amount consumed, thus affecting the diets and nutrition requirements of individuals.

A point of caution in this analysis is that weights have not been applied to the results. The NIDS-CRAM survey was conducted on an individual-level basis where household circumstances are included in the questions. As seen above in the above food security questions. Applying weights to this sample would represent the 2017 NIDS Wave 5 (Wittenberg & Branson, 2021; Ingle et al., 2021) and not fully representing South African households and population. Therefore, the analysis provided in this research report refers to the respondent's account.

Table 3 reports a summary of the key outcome variables: food security indicators and labour market participation. From the Table 3, over 22 percent of the respondents experienced food insecurity because they ran out of money to buy food in the month in question. This likely suggests that the impact of COVID-19 reduced respondents' access to food through the lack of resources. It implies that some of the respondents were unable consume an adequate amount of food during the one-month period. About 10 percent of the respondents indicated they had gone hungry for 7 days due to the lack of food while 40 percent of the respondents experienced hunger almost every day or every day. This suggests that a proportion of the respondents experienced economic vulnerability as they were unable to acquire food for 7 days and almost every day or every day, which implies worsened food security for these respondents.

Table 3: Summary of key outcome variables

	Mean	SD	No. observations
Food security indicators			
Ran out of money to buy food (1=yes)	0.220	0.414	38 120
Gone hungry (1=yes)	0.086	0.481	38 210
Experienced hunger (1=almost every day and every day)	0.379	0.485	14 815
Labour market participation			
Regular job	0.365	0.481	21 680
Casual work	0.244	0.430	21 680
Self-employed	0.090	0.286	21 680
Ran a business	0.020	0.139	21 680

The statistics on labour market participation displays the categories which best describes the respondents main form of work. The indicator variables were created into binary indicators for each main form of work category. These indicators of labour market participation provided a look into the impact of COVID-19 on sectoral livelihoods. The main types of work include regular employment, casual work, self-employment, and business activities.

As shown in Table 3, about 37 percent of the respondents are employed at a regular job, about 24 percent have casual work, while only 9 and 2 percent indicate self-employment and running a business, respectively. The higher proportion reporting regular jobs likely suggests that many of the respondents are dependent on salary or wage income. This has implications on food security as argued by Bolarinwa et al. (2019), the likelihood of food insecurity increases when households' income comes from a salary. The changes in employment COVID-19 have created alternative working conditions such as working from home (Spaull et al., 2021b) and reductions in working time due to reduced working capacities. The direct implication of this is the reduction in income generating or earning opportunities which in turn compromises food security for individuals.

These labour market participation percentages likely indicated many of the respondents may have a different main form of work or may not be employed due to the impact of COVID-19.

This may be because of the changes in employment COVID-19 has created such as working from home (Spaull et al., 2021b) or the reductions in work from not being able to due to the work restrictions created by COVID-19. This in turn would create adverse effects in the income of the respondents.

5.2. COVID-19 effect on employment and income-generating activities

The responses on main income loss and change experienced due to COVID-19 are displayed in Figure 1. In wave 1, respondents self-reported loss in their respective household's main income source from the beginning of lockdown. In wave 2 to wave 5, this question was followed-up with the question on whether this main income source increased, decreased, or stayed the same in the past four weeks.

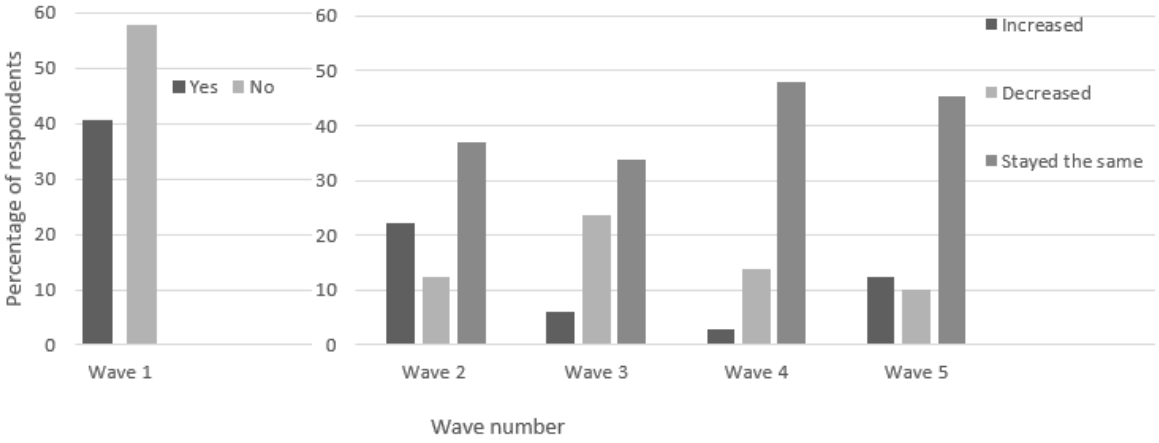

Figure 1: The effects on income-generating activities and employment

Figure 1 indicates that in wave 1, almost 60 percent of the respondents indicated they did not lose their main income source at the onset of lockdown. Despite this, 40 percent of the respondents stated they did lose their main income source. This is not surprising as income and employment aspects is one of the most affected by COVID-19. From wave 2 to wave 5, a large percentage of the respondents specified that their main source of income did not change. A small percentage of respondents specified that their main income source increased. This is not surprising since depending on the lockdown level, respondents would not have been able to increase their income if their income-generating activities and employment had been restricted. What is unexpected is a steady 10 percent of respondents who experience a decrease in their income in the previous four weeks suggesting, on average, at least 10 percent of respondents were restricted from attaining income for most of the one-year period.

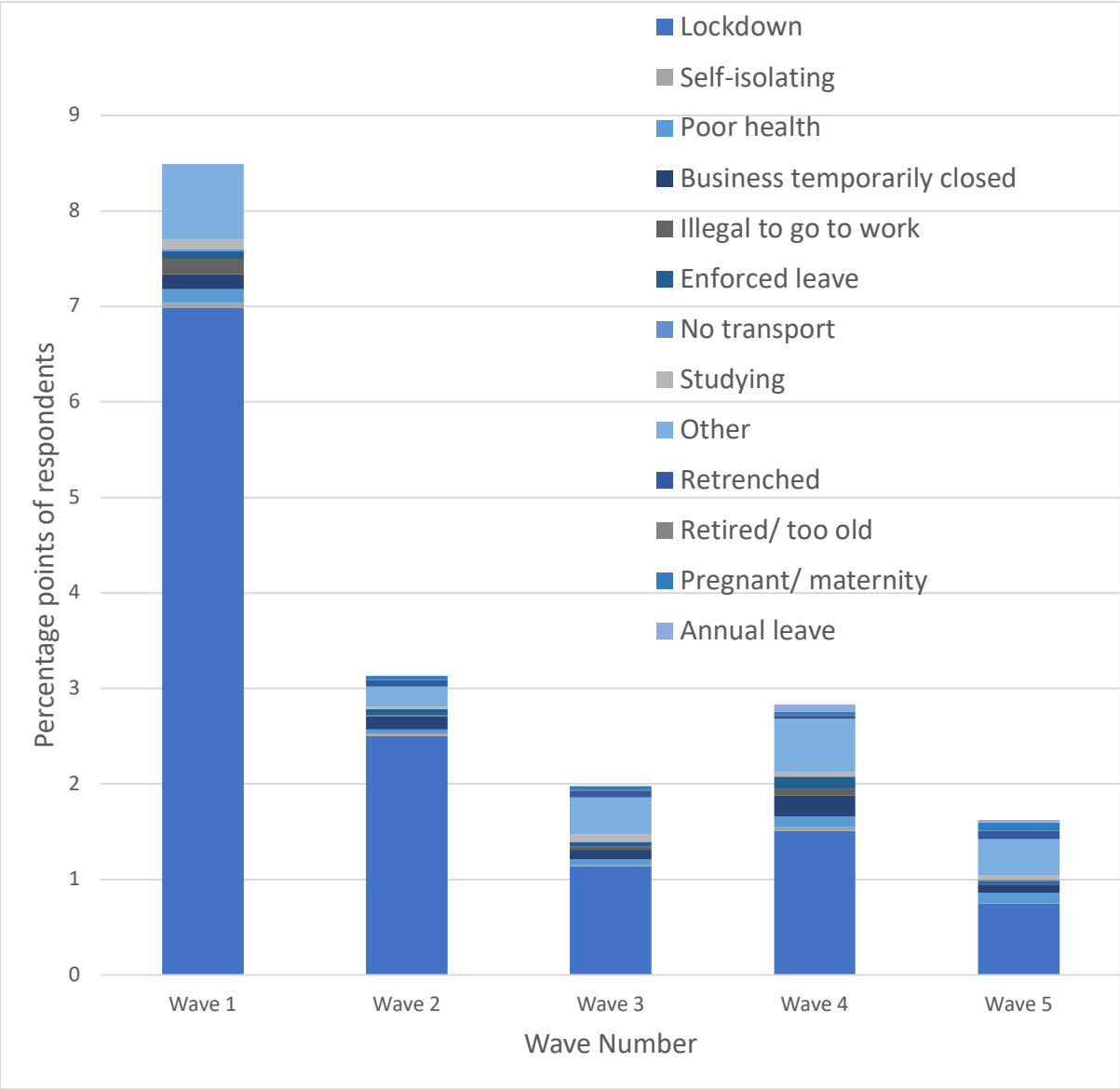

Figure 2: Reasons for not working

Figure 2 displays respondents' main reason for not working. The bars show the main reason from bottom to top with lockdown being first and annual leave last. Despite the low percentage number of responses due to high number of missing values, it is still worthwhile to graph the multiple responses and reasons. Other than being restricted by lockdown measures, the option other was the most reported response. This indicates the respondents had multiple reasons, except the ones specifically asked, for not being able to work due to and during the pandemic. This was followed by poor health and business temporarily closed. This is expected considering the health implications COVID-19 can have on individual who are health compromised and the wide effects the mobility restrictions imposed on businesses if they are not essential. Although there is slight reduction in businesses temporarily closed from wave 1 to wave 3, as

lockdown levels moved from 4 to 1, it increases again in wave 4 showing the effects of the lockdown level 3. This showed the adverse effect of mobility restrictions on employment (Arndt et al., 2020).

5.3. Empirical results

Below are the tables 4 and 5 which estimate binary employment and food security indicators against various selected variables generating employment and food security outcomes. A probit regression is run for each category of Linear Probability Model (LPM) with random effect specification for panel.

5.3.1. Employment

Employment has been affected the most by COVID-19 with adverse effects on income. Table 4 reports marginal effects of the probit estimation on factors determining whether COVID-19 affected the employment of the respondents. The statistically significant variables are related to education, gender, urban households, and the different government grants.

Results show that respondents, on average, with an education level lower than matric/Grade 12 increased the probability of working any activity. Respondents with education levels below matric were 6.5 percent more likely than individuals with a higher education level (including matric and above) to report working any activity. This means that respondents with an education level below matric were more likely to be affected by the changes in employment created by COVID-19. This is in line with the findings in the NIDS-CRAM synthesis report that a highest decline in employment occurred for workers who were unskilled and uneducated (Spaull et al., 2020b). This result suggests the lockdown restrictions affected lower educated respondents by reducing their economic activity more so than higher educated respondents' employment and thus their income. Therefore, the null hypothesis is rejected as due to the pandemic; lower educated individuals were more likely to have a reduction in economic activity. This result is like the study by Arndt et al. (2020) which reported income of lower educated households were more harshly impacted as compared to higher educated households.

Table 4: Marginal effects of the factors determining whether COVID-19 affected labour market participation

	Working any activity	Wage employment	Ran a business
Education (1=no matric)	0.065***	-0.001	-0.000
	(0.008)	(0.001)	(0.001)
Age (years)	0.005***	0.000**	-0.000
	(0.000)	(0.000)	(0.000)
Male dummy	-0.080***	0.003*	-0.001
	(0.008)	(0.002)	(0.001)
Household size	0.003***	-0.000	-0.000
	(0.001)	(0.000)	(0.000)
Urban households dummy	-0.019***	-0.001	-0.001
	(0.007)	(0.001)	(0.001)
COVID-19 Social Relief of Distress	-0.032***	-0.010***	0.000
(SRD) Grant	(0.011)	(0.004)	(0.001)
Child Support Grant (CSG)	-0.016*	-0.008**	0.000
	(0.008)	(0.003)	(0.001)
Old Age Pension Grant (OAP)	0.098***	-0.000	0.000
	(0.008)	(0.001)	(0.001)
Government grant	0.106***	-0.003	0.006
	(0.010)	(0.002)	(0.005)
No. observations	24 405	24 055	14 070

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors (shown in parentheses)

Male respondents, on average, had a decreased probability of working any activity and an increased probability of wage employment. Male respondents were 8 percent less likely than female respondents to answer they are working any activity and were 0.3 percent more likely to report they are wage earners. This suggest male respondents were less likely affected by COVID-19 than female respondents if they are working any activity and more likely affected if they are wage earners, which is not surprising given that in South Africa men are more likely to be in formal employment than women. This affect comes from the restrictive measures from lockdown which led to changes in employment such as working from home. But this

contradicts what was found in the NIDS-CRAM synthesis report where workers who were female experienced a high decline in employment (Spaull et al., 2020b). This can be accounted to the type of job (Casale & Shepherd, 2021) which further reiterates the results showing male respondents were less likely to report working any activity and therefore less likely to be affected by the disruptions than female respondents.

Women who are less educated, poor, identify as Black Africans and work in the informal sector are more likely affected by COVID-19 (Skinner & Watson, 2021; Spaull et al., 2020a). This coincided with the results for males being less affected if they are working any activity but differs from the results for males being affected more so than females if they are wage earners as formal employment is mainly used in this analysis. This suggests that the results estimated in this research report underrepresents the impact of COVID-19 on women in the informal sector.

Respondents who indicated residing in an urban household decreased the probability of working any activity. Respondents who reside in urban areas were about 2 percent less likely to report working any activity than respondents residing in traditional settings and farms. This suggests respondents residing in urban areas had a decreased likelihood to be affected by the COVID-19 impact through earnings from working any activity in the formal sector. Respondents residing in urban areas have better access to livelihood earning opportunities, as well as the advantage of working from home (Spaull et al., 2021b), making it easier for them to continue their work once the lockdown levels were eased hence likely to experience an upswing recovery in incomes in the long-term. Notably though, COVID-19 is more likely to spread in densely populated areas such as urban areas; resulting in stricter protocols and reduced economic activities (Amare et al., 2021) hence urban residents are more vulnerable to COVID-19 disruptions in activities these protocols directly affect.

On average, the respondents who receive the COVID-19 Social Relief of Distress (SRD) Grant and the Child Support Grant (CSG) had a lower probability of working any activity and wage employment. Beneficiaries of the COVID-19 SRD Grant were 3.2 percent and 1 percent less likely to report working any activity and being a wage earner, respectively. This is as expected since the grant was intended to be pro-poor targeted towards the poorest and those who were previously middle-income but shifted to lower income bracket (Spaull et al., 2020b). This also meant respondents were cushioned from severity of COVID-19 effects. The same likelihood

was seen for beneficiaries of the CSG. 1.6 and 0.8 percent of the respondents who indicated receiving the CSG were less likely to report working any activity and having wage employment, respectively. This suggest these respondents are less likely affected by COVID-19. Findings by Spaull et al. (2020a) showed individuals who experienced job losses were in grant-receiving households. This suggests these individuals were already beneficiaries of this grant before COVID-19 and therefore were less affected by the changes in employment.

On the other hand, respondents who indicated they are beneficiaries of a government grant were, respectively, 10 percent more likely to report working any activity. Suggesting they were more affected by the COVID-19 impact on employment. This is expected given this group were more likely to experience harder times as the effects of COVID-19 on employment through lockdown restrictions increased. This suggests the dependency with which respondents have on these grants since they are not able to continue their normal economic activity and would require assistance from the government to fill gap caused by the reduction in their other incomes.

5.3.2. Food security

Table 5 reports the probit results for the factors that determine whether COVID-19 affected food security outcomes and whether food security experience worsened during the COVID-19 period. The statistically significant variables are related to education, gender, urban households, and the different government grants. No significant results were produced for job loss. It was found in the NIDS-CRAM reports on hunger that job loss had an impact on the finances to acquire food. But despite this and capturing job loss during the one-year period, no substantial evidence or significant results were produced to see whether the loss of jobs would incur higher levels of food insecurity during this time.

Table 5: Marginal effects of the determinants of worsened food

	Ran out of money to buy food	Gone hungry	Experienced hunger
Education (1=no matric)	0.072***	0.032***	0.000
	(0.007)	(0.007)	(0.000)
Age (years)	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)
Male dummy	-0.022***	0.001	-0.000
	(0.085)	(0.008)	(0.000)
Household size	0.000	0.001	0.000
	(0.005)	(0.001)	(0.000)
Urban households dummy	0.059***	0.010	0.000
	(0.007)	(0.007)	(0.000)
COVID-19 Social Relief of Distress	0.165***	0.063***	-0.000
(SRD) Grant	(0.005)	(0.008)	(0.000)
Child Support Grant (CSG)	0.066***	0.024***	-0.000
	(0.007)	(0.007)	(0.000)
Old Age Pension Grant (OAP)	-0.009	0.004	-0.000
	(0.007)	(0.009)	(0.000)
Government Grant	0.099***	0.020	-0.000
	(0.008)	(0.014)	(0.000)
Lost job	-0.001	-0.003	-0.000
	(0.007)	(0.008)	(0.000)
No. observations	24 685	24 715	9 210

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors (shown in parentheses)

Table 5 results show on average, respondents with lower education levels had an increased probability of being food insecure. This meant respondents with lower education levels were more likely to run out of money to buy food and go hungry in the last 7 days due to the lack of food by 7.2 and 3.2 percent, respectively. The employment of respondents with low levels of education were more affected by COVID-19 (as shown in table 4) than their counterparts. Since these respondents reported working any activity, the shock of COVID-19 would have hindered

their employment and thus income-generating activities. This would have affected their accessibility to attain food and the food expenditure of respondents (Smith & Subandoro, 2007), leaving respondents at a higher chance of being food insecure due to the shocks created. This is in line with studies by Sisha (2020) and Bolarinwa et al. (2019) on the effect of shocks, the effect of low education levels on food security and the loss of the main income source increased chances of reduced money and hunger (Wills et al., 2020).

On average, male respondents had a decreased probability of not being able to acquire food due to the lack of money. This meant money was not a problem in attaining food for the male respondents. Male respondents had a decreased likelihood of reporting running out of money to buy food as compared to female respondents. Men generally earn more than women therefore it is expected that male respondents would be less likely to report a reduced monies for food. This differs from the results in table 4 which shows male respondents are more likely to report wage employment and therefore affected more so from COVID-19. This suggests they relied on other income sources such as savings as seen in Bolarinwa et al. (2019) and Mahmud and Riley (2020) or have multiple income-generating activities other than formal employment.

Respondents in urban area on average had increased probability of running out of money. Respondents residing in urban households were 5.9 percent more likely than their counterparts residing in traditional and farm settings to run out of money to buy food. This is not surprising as explained by Amare et al. (2021), COVID-19 spreads faster in densely populated areas resulting in stricter protocol measures and reduced economic activity. This would cause disruptions to food systems and supply chains driving food prices up leading to less purchasing power for respondents (Deaton & Deaton, 2021; Devereux et al., 2020; Wegerif, 2020).

As explained by Kansiime et al. (2021) and Mahmud and Riley (2021) this increase in prices would decrease food expenditure leading to increased hunger and food insecurity. The easing of lockdown measures further suggests this likeliness would decrease as the respondents would be able to somewhat resume their economic activity. Which is in line what was found by Van der Berg, Patel, and Bridgeman (2021a; 2021b) with urban areas showing improvement in terms of money for food in wave 3 and 4.

Respondents who are beneficiaries of the COVID-19 SRD Grant and the Child Support Grant (CSG) on average had increased probability of food insecurity. Respondents who are recipients of the COVID-19 SRD Grant and the CSG are more likely to report running out of money to buy food by 16.5 and 6.6 percent, respectively and going hungry in the past 7 days due to no food by 6.3 and 2.4 percent, respectively. Respondents who are beneficiaries of at least one government grant are shown to be more likely to run out of money to buy food than non-beneficiaries by 9.9 percent. This suggests social relief in the form of financial aid does not reduce the likeliness of hunger and the severity of food insecurity.

The opportunities to attaining such grants are more difficult for less wealthier households (Devereux et al., 2020) and for those who do not live where they can attain them (Winchester et al., 2021). The NIDS-CRAM papers on hunger showed the top-up measures to pre-existing grants and the addition of other grants were revoked at the end of 2020 and beginning of 2021 (Van der Berg, Patel, & Bridgman, 2021c; Van der Berg, Patel, & Bridgman, 2021b; Van der Berg, Patel, & Bridgman, 2021a; Bridgman, Van der Berg, & Patel, 2020; Wills et al., 2020). There is high dependency on this top-up and additional grants as it may be the only income source some households have even though the sum is not sufficient to reduce food security on a monthly and weekly basis. These grants are useful to those who have acquired them and have the chances of benefitting recipients more so than they already do. But this potential can only be achieved if the amount is sufficient as suggested by Van der Berg, Patel, & Bridgman (2021b).

5.4. Discussion

From the results in table 3, 4 and 5, income plays a huge role in food security, especially labour income. And employment has a huge effect in whether this income is attained or not. Similarly, to the explanation by Arndt et al. (2020), from the results, individuals with employment needing a low-level education are seen to be worse off due the lockdown measures created by COVID-19. A lower education level meant individuals would have to work a more labour-inclined, labour-intensive job which entails physical presence or contact. Limitations brought by lockdown led to a reduction in working time resulting in a reduction to income earned creating an income shock (Arndt et al., 2020). An income shock as explained by Kansiime et al. (2020) that would be most felt by those dependent on labour income the most.

In table3, 22 percent of the respondents experienced food insecurity as they experienced diminishing monies to obtain food. Showing the impact of COVID-19 had reduced respondents' accessibility to food through the lack of food expenditure. The results from table 4 and table 5 reaffirm this result. The respondents with lower education levels were more likely to be employed and thus, were more likely to be affected by COVID-19. They had a higher likelihood of working in a labour job since low education levels means a low-skilled job which Arndt et al. (2020) described to be impacted more so by COVID-19 protocols and restrictions than jobs requiring a higher education level.

COVID-19 would make them more susceptible to an income shock by preventing these respondents from being able to work their normal income-generating activities. Leaving them with reduced incomes, economically vulnerable and with hindered food expenditure. Further preventing their accessibility to food during the one-month period specified and left more exposed to food insecurity.

These results further suggest respondents were not able to utilise and consume an adequate amount of food during the one-month period. From the literature, food systems were impacted by COVID-19 causing interruptions in trade-flow. Affecting the food availability aspect of food security. But since it is not known whether the availability and utilisation aspects had an impact on the food security outcomes of the respondents except that it was more likely for respondents in urban areas to be affected by limitations in income brought by COVID-19 in acquiring food at higher prices, it can only be speculated that there is worsened food security for these individuals as they have not been able to acquire and utilise food constantly.

In table 4, respondents who are recipients of the Covid-19 SRD grant and the CSG who indicated working any activity and being a wage earner were less likely affected by COVID-19 as they would have received the income source. Respondents who reported themselves as a beneficiary of a government grant were more likely affected by COVID-19 on employment. Lockdown restrictions for these individuals may have been harsher as it may have reduced their other sources of income such as savings and therefore more dependent on the grant for relief. The results in table 5 for the different grants further showed that respondents had more likelihood of no food due to reduced monies. This shows an increase in economic vulnerability, preventing the access to food expenditure which increases the likeliness of food insecurity

monthly. Household recipients of government grants will experience a lower food insecurity if they have the sufficient financial means to reduce it.

Food accessibility means respondents would need to have the physical and economic means to acquire food. The COVID-19 SRD grant and the child support grant would allow individuals the economic means to access food. But since it cannot be seen whether the grant was used to alleviate food insecurity or not, as well as the other three aspects of food security, it is only presumed that the respondents who are employed and are wage earners are less likely to be affected by COVID-19 and therefore would experience less food insecurity. Whereas respondents who a government grant and who are working any activity are more likely affected by COVID-19 and more likely to experience food insecurity. And since respondents who are beneficiaries of government grants shows an increased likeliness to run out of money to buy food, indicates the amount is not sufficient to reduce the likelihood of food insecurity. Therefore, recipients of government grants would experience a significantly higher food insecurity.

6. Conclusion

This research report assessed the impact of COVID-19 on food security in South Africa. This study makes use of the definitions by the FAO and the four pillars of food security to provide a foundation for the analysis of the COVID-19 pandemic impacts on food security. Studies which look at COVID-19 on the global to the individual scale all show the devasting impacts it has had on food systems, food accessibility and food utilisation. The impact of COVID-19 on food security in developing countries shows it has worsened food security. This is mainly due to the consequences of lockdown restrictions on employment and income. Further reducing food expenditure and consumption, increasing hunger and worsening food security.

The acquirement of food is dependent on incomes. The shock created by COVID-19 resulted in lockdown restrictions and measures. This restriction on movement prevented individuals from living their normal lives. The results show how employment was affected and created adverse effects by reducing incomes. This reduction because of a reduction in working time to prevent the spread of COVID-19. In addition, low levels of education attainment make it difficult to work jobs that does not require physical labour, physical contact or working from the safety of home. Further placing individuals at risk of the virus despite trying to attain the

means to live. This inability to attain incomes hinders the accessibility of food. This in turn affects the availability, utilisation, and stability and makes achieving food security a difficult goal to attain.

This research report may only be a partial study on food security as not all four indicators are included in the empirical results. Nevertheless, this study is still relevant and important as it provides a look into the complexities of food security, analyses the pandemic's implications and the consequential shock restrictive lockdown measures invoked by governments on individuals' and households' food security in South Africa. And it further adds to the findings of the adverse effects of COVID-19 on food security outcomes. This research report sheds light on the importance of food security and how the barrier of income should not be the deciding factor in whether an individual experiences hunger or not.

Financial capabilities of a substantial amount in both incomes and social insurance, social assistance, and social relief is extremely important in providing a cushion unprecedented shock such as COVID-19 and in reducing food insecurity. Long-term initiatives such as ensuring all individuals receive education and/or skills to be able to attain the means to live reiterates importance the importance of education and may help to mitigate unprecedented harmful events. The use of grants as a financial alleviator to the shock of COVID-19 needed to have last longer than 6 months to truly be beneficial to individuals directly impacted and to improve food security constantly. And needs to be an amount that is sufficient in order for individuals to properly utilise it. Especially at a time of such a harmful event. But this depends on the capabilities of the South African government.

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