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Full Length Research Paper

Using a multinomial approach to assess vulnerability of rural households to food price shocks in Cape West Coast, South Africa

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This paper draws on the experience of food price shocks (among other factors) that rocked South Africa during the global financial crisis (2007-08). A post-shock assessment of this nature is insightful given the recurring economic shocks that frequently affect South Africa. The paper is based on a survey of 640 rural households sampled in three municipal districts of Matzikama, Cederberg and Bergriver, in Cape West Coast. A multinomial approach is used to estimate the probability scores underlying vulnerability of different types of rural households to a set of identified economic shocks, including food price hikes. Results show farm-workers/labourers and non-land-reform farmers being the most vulnerable livelihood categories as implied by high probability scores relative to other types. Their vulnerability condition is worsened as a majority of the affected households lack credible mechanisms to cope with the recurring shocks. The paper concludes presenting an array of policy suggestions considered vital for dealing with food price shocks especially during period of inflationary crisis. Key amongst these include, the need to implement regular monitoring and evaluation systems for effective support of the most vulnerable households during turbulent periods and improving databases and registers at district and provincial level.

Keywords: Food price hikes, economic shocks, vulnerability, rural livelihoods, multinomial, post-shock assessment.

BACKGROUND

The global financial crisis of 2007/08 hit South Africa hard due to its manifold linkages with global economy (Brinkman et al., 2010). For instance, over 900,000 jobs were lost and the total number of South Africans living in extreme poverty rose from 12.6 (2006) to 15.8 million (Verick 2010). In particular, poor households who spend a significant proportion (about 35%) of their income on food expenditures, became highly vulnerable to economic shocks particularly food prices.

Preceding and during the financial crisis, South Africa experienced shocking rises in food and energy prices. During this period, prices for most basic food commodities rose by 14.5% and even higher for staple products like maize-meal which rose by 25.5% (Stat SA, 2014).

Currently, food prices are threatening to rise to unprecedented level again, reminiscent of 2007/08 price hikes (see Table 1). According to the Pietermaritzburg Agency for Community Social Action (PACSA, 2016), food prices for most commodities have increased by

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14.5% on average for the period March 2015 to March 2016. Prices of vegetable commodities for instance (e.g. cabbage, onions, potatoes) have increased phenomenally (>70%) as shown in Table 1.

An interplay of factors is exerting the observed inflationary pressure on food prices which include: the current severe El Ñino-induced drought has badly affected the country; turbulence in the Rand (ZAR) that has lost 25% of its value against major currencies since December 2015; instability in cereal production resulting with tightening of supply/demand of cereals at both domestic and regional markets. Added together, all these factors are largely to blame for causing the spiralling of food prices in South Africa (Hampton and Weinberg, 2014)

The rising of food prices have far-reaching consequences on poor households in South Africa and developing countries in general (HPLE, 2011): first, as food commodities become increasingly expensive, a significant proportion of the poor will find it difficult to afford a balanced nutritious diet; second, household food security becomes severely compromised as food is not only expensive but rendered inaccessible to a majority of the poor – many who face limited food choice options; because of the latter, many households are often forced to undertake drastic food coping strategies such as: reducing daily meals; cutting down on health/educational expenses; selling and/or disposing of productive assets; etc – all such measures are self-defeating as they exacerbate poverty in the long run; third, household nutritional security is at risk with dire consequences on small children in particular - a third reportedly undernourished and stunted in South Africa (FAO 2013); and finally, the rise in food prices is set to worsen poverty and destitution among the ultra-poor households such as the elderly, orphans, female-headed and chronically sick (e.g. HIV/AIDs).

Future price projections point to continual rise in food prices well above the targeted annual inflation rate as set by the Reserve Bank of South Africa. According to the Bureau for Food and Agricultural Policy (BFAP, 2016), prices for most basic food commodities are projected to rise in 2015/16 by approximately 15 to 20% as shown in Figure 1. However, although prices have shown a slight declining trend in recent months, prices still remain high for most basic food items and predicted to rise further in 2016/17.

MOTIVATION

The likely recurrence of food prices hikes in 2015/16 and future is of grave concern to the government of South Africa (Hampton and Weinberg, 2014). Learning from the past, food price hikes often culminate in social unrest and general instability in a country. For instance the series of food protests that rocked many countries in SADC (Southern African Development Community) region in early 2000 provide classical examples (e.g. Mozambique, Zimbabwe, and Malawi). In a nutshell, high food prices inflict severe impacts on low-income households: they diminish real income and purchasing power of the poor - a majority who depend on government social grants; jeopardise household nutritional security and lead to long-run degradation of livelihoods, mainly due to the use of potentially harmful unsustainable coping mechanisms. This may persist even when prices normalise. Therefore understanding the impact of high food prices on different livelihood types is essentially necessary for planning and preparing for future shocks.

A post-shock assessment of 2007-08 price hikes can provide policy insights necessary for the South African government to put in place more effective social protection and safety net programs. These are essential for cushioning the poor from the possible effects of future price shocks. As Albert *et al* (2007) argue, greater policy emphasis and attention need to be devoted to assisting households that are at risk of becoming poor and those already poor who are likely to stay poor. Rural households face the greatest risk as a majority are not gainfully employed and face limited livelihood options. Policy interventions with potential to reduce and minimize future food poverty are therefore highly socially desirable.

In view of current food prices threatening to rise to unprecedented level (as discussed earlier), this paper seeks to identify type(s) of rural livelihoods predominantly vulnerable to recurring economics shocks and in particular food prices. Identifying the most vulnerable type of livelihood is likely to help the government develop more targeting and effective policy intervention strategies necessary especially during periods of inflationary crisis. The rest of the paper is structured as follows: section 2 discusses the methodology used for estimating probability/vulnerability scores; section 3 looks at the data; section 4 discusses the results, section 5 highlights the policy implications and section 6 concludes.

METHODOLOGY

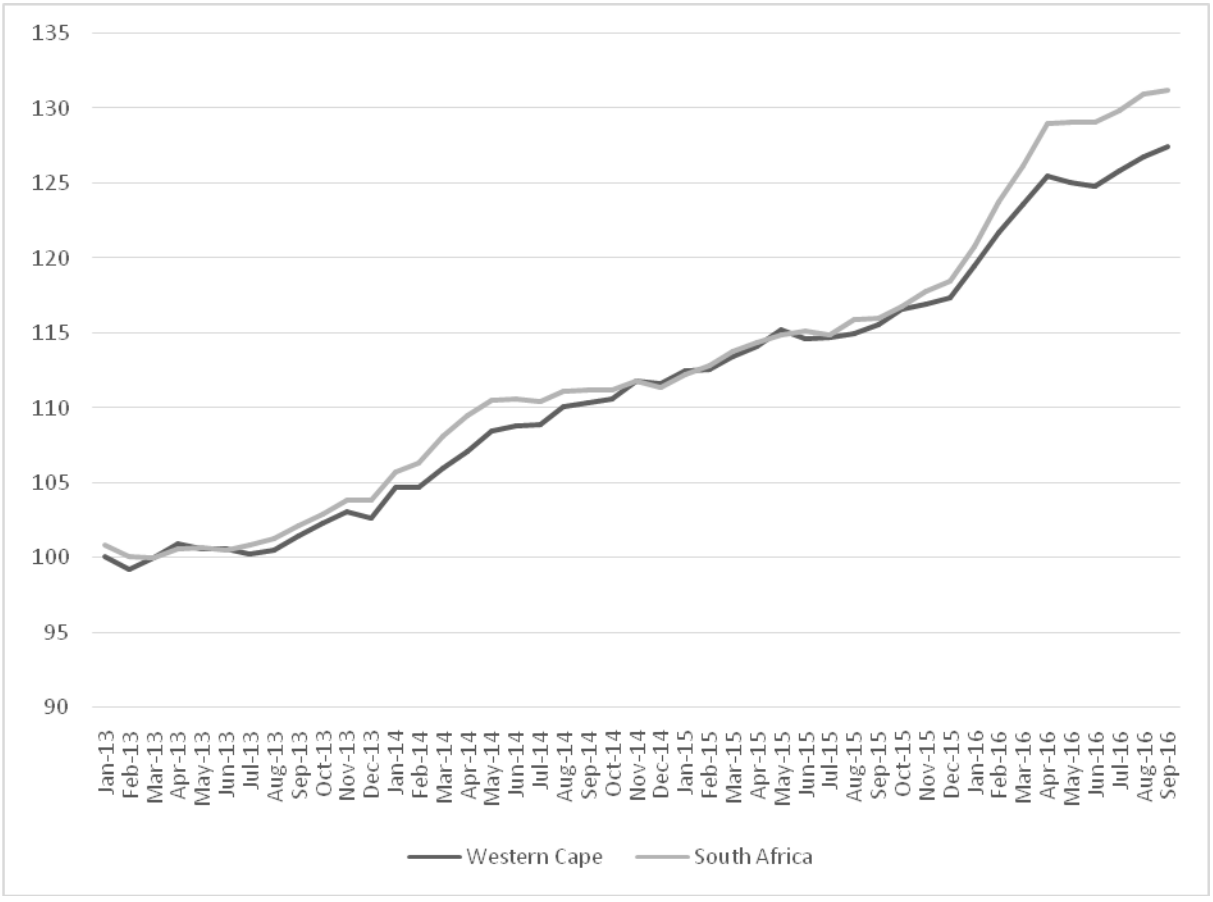
Numerous studies have analysed the concept of vulnerability and its relatedness to risk, poverty and food insecurity (Chaudhuri *et al* 2002, Ligon and Schetcher 2003, FAO 2015). Chaudhuri *et al* (2002) defined the 'vulnerability concept' as the probability of becoming or remaining materially poor in the future. The concept has become closely associated with three related factors:

Table 1. Change in food prices for basic commodities during period 2015-2016.

Food commodity tracked	Quantity tracked	∆ Food Prices
	(in units)	*Nov_2015 to Mar_2016 (%)*
Maize meal	25kg	15.3
Rice	10kg	16.0
Cake flour	10kg	14.0
White sugar	10kg	13.8
Sugar beans	5kg	16.6
Cooking oil	4L	27.3
Maas (milk)	2L	13.4
Cabbage	2heads	83.3
Onions	10kg	85.3
Potatoes	10kg	72.3

Source: PACSA, 2016.

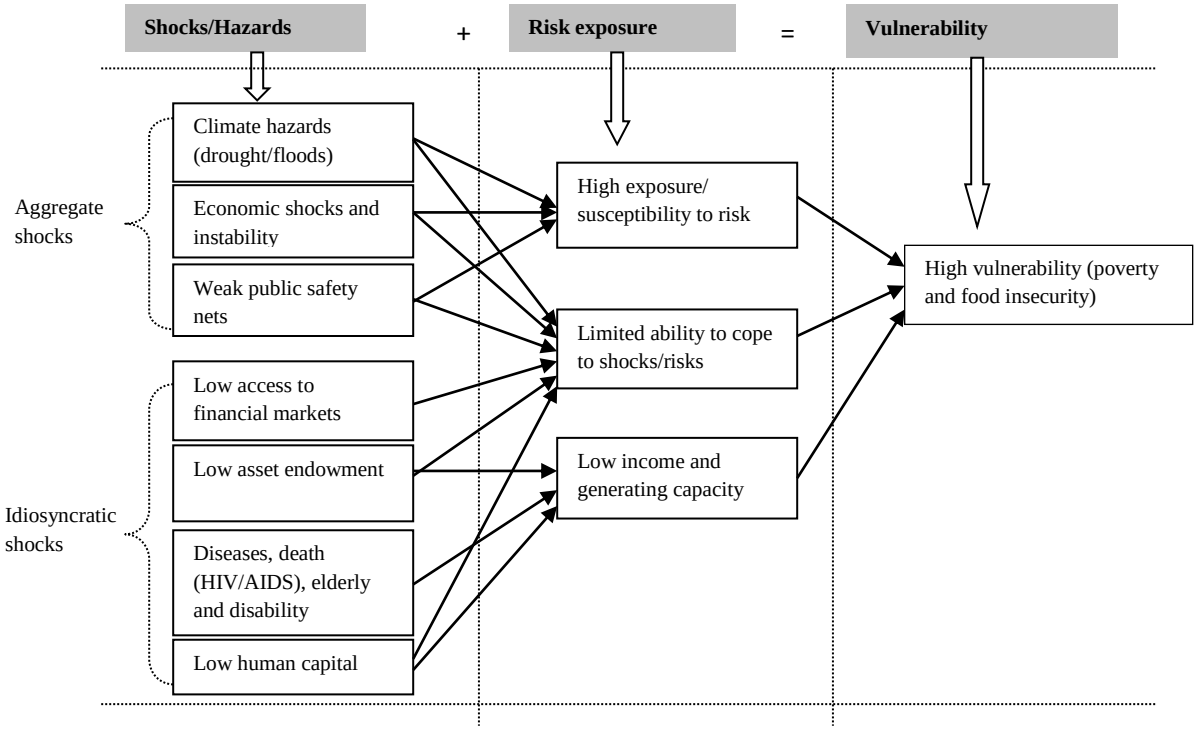
Figure 1. Consumer Price Index for food items (Mar 2013=100)



Source: Adapted from Statistics South Africa.

shock/hazard, risk and exposure. As illustrated in the schematic diagram below (Figure 2), economic shocks are generally the main drivers of poverty in most developing countries. According to Ligon and Schechter

Figure 2. Interrelationships among shocks/hazards, risk exposure and vulnerability



Source: Adapted from Shewmake (2008).

(2003), economic shocks can be generally divided into two broad categories; aggregate and idiosyncratic shocks. Aggregate shocks result in nation-wide impacts with negative ripple effects felt throughout the country. Shocks of this nature are influenced by factors such as climatic hazards (e.g. droughts, floods, tornadoes), chronic disease outbreak, general instability of macroeconomic variables (e.g. inflation, unemployment), weak social protection and public safety net programs. Idiosyncratic shocks, on the other hand, are characterized by household-specific factors such as low asset endowment, poor access to financial markets, low human capital and chronic illness and/or diseases (e.g. HIV/AIDs). A combination of these factors therefore are, among other factors, the major drivers of household poverty, food insecurity and vulnerability.

For a more objective assessment of the vulnerability of rural households to identified economic shocks, a multinomial logit model (MNLM) is used for this purpose. Let's start by presenting the MNLM in general terms, where *y* is the dependent variable with *J* nominal outcomes. The nominal categories are unordered and numbered 1 Through *J*. Let $\Pr(y = m \mid \mathbf{x})$ denotes the probability of observing outcome *m* given **x**. Following Long (1997), the general probability model for *y* can be constructed as follows:

Assume that $\Pr(y = m \mid \mathbf{x})$ is a function of the linear combination $\mathbf{x}\boldsymbol{\beta}_{\mathbf{m}}$. The vector $\boldsymbol{\beta}_{\mathbf{m}} = (\beta_{0m} \ldots\ldots \beta_{km} \ldots\ldots \beta_{Km})$ includes the intercept β_{0m} and coefficient β_{km} measuring the effect of x_{km} on outcome m. The probability is therefore specified as

$$\Pr(y_i = m \mid x) = \frac{\exp(x_i \beta_m)}{\sum_{j=1}^{J} \exp(x_i \beta_m)} \quad (1)$$

While the probability model in equation (1) meets all the probability properties (i.e. nonnegative probability values which sum to 1), it is not identified. This means that more than one set of parameters generates the same probabilities of the observed outcome. To identify the model, some constraints must be imposed on the $\boldsymbol{\beta}'s$. One such constraint commonly used in MNLM is that one of $\boldsymbol{\beta}'s$ is constrained to equal 0, such that $\boldsymbol{\beta}_1 = 0$ or $\boldsymbol{\beta}_j = 0$ - the choice is arbitrary.

Now given this constraint, it follows that $\exp(\mathbf{x}_i\boldsymbol{\beta}_1 = \exp(\mathbf{x}_i\mathbf{0}) = 1$, and hence the probability model in equation (1) can be re-stated as follows:

$$\Pr(y_i = 1 | \mathbf{x}) = \frac{1}{1 + \sum_{j=2}^{J} \exp(\mathbf{x}_i\boldsymbol{\beta}_j)} \quad (2)$$

$$\Pr(y_i = m | \mathbf{x}_i) = \frac{\exp(\mathbf{x}_i\boldsymbol{\beta}_m)}{1 + \sum_{j=2}^{J} \exp(\mathbf{x}_i\boldsymbol{\beta}_j)} \qquad for\, m > 1 \quad (3)$$

Assume that a specific category (*r*) is classified a base case, this means that MNLM is estimating the probabilities as contrasts: $\beta_k, m | r = \beta_{km} - \beta_{kr}$. Hence equation (1) can be manipulated by multiplying by an equivalent component $\exp(-\mathbf{x}\boldsymbol{\beta}_r) / \exp(-\mathbf{x}\boldsymbol{\beta}_r)$ as follows

$$\Pr(y = m | x_i) = \frac{\exp(x_i\beta_m)}{\sum_{j=1}^{J} \exp(x_i\beta_j)} \frac{\exp(-x_i\beta_r)}{\exp(-x_i\beta_r)}$$

$$= \frac{\exp(x_i[\beta_m - \beta_r])}{\sum_{j=1}^{J} \exp(x_i[\beta_j - \beta_r])}$$

$$= \frac{\exp(x_i\beta_{m|r})}{\sum_{j=1}^{J} \exp(x_i\beta_{j|r})} \quad (4)$$

Where $\boldsymbol{\beta}_{m|r}$ is a vector matrix with coefficients $\beta_k, m | r$ for all K. Equation (4) was used to estimate the probability of each livelihood type being impacted by each of the identified shocks. The estimated probability scores underlie the vulnerability of each livelihood category relative to a particular shock.

SURVEY DATA

This study is based on a survey conducted in Cape West Coast (Western Cape Province), where a total of 635 households were drawn and/or sampled from three municipal districts of Bergriver, Cederberg and Matzikama. As shown in Table 2, across all districts, a majority of the sampled households were farm workers (≈ 60%). In Bergriver for instance, close to 80% of the households were predominantly farm workers (FWs). Other livelihood categories like fishermen (FM) and non-land reform (NLR) farmers were the predominant types of livelihood in districts of Cederberg (26%) and Matzikama (20%) respectively.

The sampled households indicated four major shocks (*food price hikes, energy price hikes, electricity blackout and unemployment*) that severely affected them during the turbulent period (2007-08). As indicated in Table 3, most of the sampled households singled out *food price hikes* as the most severe shock that negatively impacted them. Matzikama district recorded the highest proportion (25.6%) of the affected households followed by Cederberg (21.6%). *Energy price hikes* was another shock that affected about 10% of the sampled households in Matzikama. In particular the rise in energy prices for products like kerosene and paraffin - the most common energy sources for domestic use (e.g. cooking) – could have affected a large proportion of poor households. Other significant shocks identified by sampled households were *electricity blackout* (7%) and *unemployment* (5%).

In order to understand the coping mechanisms at their disposal, we probed how the households coped with each identified shock either as individuals or collective community. The results (Table 4) indicate the general lack of credible short- or long-term coping mechanisms at the disposal of the rural poor when hard-hit by unanticipated economic shocks. A mere 10% indicated adopting "*other*" coping mechanisms (though not specified) on how to deal with *food_price shocks* in particular. In view of these results, one can conclude that a majority of rural households appear "defenceless" when faced with crippling economic shocks. Such a situation is likely to perpetuate the state of household food insecurity destituteness and vulnerability amongst the rural poor.

RESULTS AND DISCUSSION

Using the specified MNLM discussed earlier, five types of livelihoods which include land reform (LR) farmers, non-land reform (NLR) farmers, farm workers (FWs), mineworkers (MWs) and fishermen (FM) are coded as unordered categorical dependent variables. The covariates, on the other hand, include household size, income, education, economic shocks and regional variables, with the latter specified as dummy variables. Table 5 shows how these variables were defined as well as their descriptive statistics.

The estimated MNLM regression coefficients are shown in Table 6. Looking at the estimated coefficients explaining shock variables, it's observed that *food_price* negatively impacts all the livelihood types. For some livelihood categories like NLR and FWs for instance, the estimated coefficients accompanying the *food_price* variable indicate statistical significance (at 5% level).

Table 2. Household classification by livelihood types

Farm type	Total sample		Berg River	Cederberg	Matzikama
	N	%	%	%	%
LR	73	11.5	2.9	19.0	15.3
NLR	89	14.0	10.0	10.5	20.2
FWs	356	56.1	78.8	38.6	44.6
MWs	40	6.3	3.3	1.3	12.4
FM	62	9.8	4.2	26.1	5.0
Other	15	2.4	0.8	4.6	2.5
Total	**635**	**100**	**100**	**100**	**100**

Where: LR = land reform farmer; NLR = non-land reform farmer; FWs = farm workers; MWs mine workers; FM = fisherman

Table 3. Major Shocks that affected households in 2007-08

Economic Shock	Whole Sample		Bergriver	Cederberg	Matzikama
	N	(%)	(%)	(%)	(%)
Unemployment	34	5.0	2.1	5.2	8.7
Food price hikes	114	17.9	7.8	21.6	25.6
Energy price hikes	46	7.2	4.6	7.2	10.0
Electricity blackout	41	6.5	3.3	9.8	7.4

Table 4. Household Coping Mechanisms

Coping action	N	Economic shocks			
		Food price hike (%)	Energy price hike (%)	Electricity blackout (%)	Unemployment (%)
Joined church	16	1.7	-	0.3	0.5
Approached govt	36	2.0	-	3.5	0.3
Joined community organization	21	1.3	0.9	0.8	0.3
Joined trade union	7	0.5	0.2	0.2	0.3
Other	101	10.1	2.1	1.6	2.2

Table 5. Variable descriptive statistics and definition.

Variable	Mean	Std dev	Min	Max	Description
Occupation	--	-	-	-	Occupation: LR= Land reform; NLR=Non Land reform; F=Farmworker; M=Mine worker; FM= Fisherman
Totsize	4.51	2.11	1	13	Total size of the household
Educ	0.09	0.70	0	4	Highest level of education attained=matric; 0=otherwise
Income	1320	1306	0	5000	Total income (ZAR) from all the household members per month
Unemp_shock	0.05	0.22	0	1	If household experience unemployment shock=1;0=otherwise
Food_price_shock	0.18	0.38	0	1	If household experienced food price shock=1; 0=otherwise
Energy_price_shock	0.07	0.25	0	1	If household experiences energy price shock = 1; 0=otherwise
Elect_shock	0.06	0.25	0	1	If household experienced electricity blackout shock = 1; 0=otherwise

What is also important to observe is that, all shock variables indicate negative impact on FWs, which could imply severe vulnerability to economic shocks (see more discussion below). Other shock variables do not show consistent impact.

As motivated earlier, the objective of the study is to deter-

Table 6. The estimated logit coefficients of MNLM.

		MNLM coefficients									
		Constant	HHsize	Educ	Income	Economic_shock dummies				Regional dummies	
						Unemployment	Food price	Energy price	Electricity blackout	Matzikama	Bergriver
Comparison											
NLR|LR	B Z-stat	-3.45 (-0.58)	-0.008 (-.10)	-0.089 (-0.37)	0.0001 (0.79)	0.333 (0.55)	-1.192 (-2.53)*	0.494 (0.79)	0.216 (0.38)	0.898 (2.27)*	1.70 (3.16)*
FWs|LR	B Z-stat	1.80 (3.67)*	-.042 (-0.63)	-0.335 (-1.59)**	-0.0002 (-1.75)	-1.159 (-1.88)**	-0.767 (-2.14)*	-0.138 (-0.26)	-0.233 (-0.46)	0.582 (1.85)	2.653 (5.75)*
MWs|LR	B Z-stat	-3.88 (-3.69)*	-0.057 (-0.49)	0.585 (1.88)**	0.0006 (3.76)*	0.415 (0.44)	-0.721 (-1.11)	-0.463 (-0.44)	-1.61 (-1.32)	1.61 (2.00)*	2.17 (2.34)*
FM|LR	B Z-stat	0.156 (0.25)	-0.034 (-0.39)	-0.041 (-0.15)	0.0004 (2.80)*	1.553 (2.37)*	-0.419 (-0.9)	-0.64 (-0.86)	-0.244 (-0.38)	-1.83 (-4.02)*	-0.238 (-0.42)

LR is the referral or base case;
*indicates statistical significance at 5% level;
**indicates statistical significance at 1% level

mine the types of livelihood most severely affected by economic shocks across the three surveyed districts in Cape West Coast. In other words, the aim is to identify who, amongst the identified types of rural livelihoods, consisting of LR farmers, NLR farmers, FWs, FM and MWs, is/are the most vulnerable. The estimated probability measures are shown in Table 7. As observed, the results show FWs being the most vulnerable livelihood type as implied by high probability scores compared to other types. The district of Bergriver shows the highest score (0.70), followed by Matzikama (0.55). Results also show NLR farmers being highly vulnerable with high probability score (0.33) recorded in Matzikama.

Comparing all identified shocks, results indicate *food_price* being the most dominant shock. The districts of Bergriver and Matzikama recorded the highest vulnerability scores of 0.88 and 0.73 respectively. Results also indicate *unemployment* as another severe shock that affected other livelihood types, in particular FM in Cederburg (0.80) and NLR farmers in Matzikama (0.43).

It is important to understand why FWs, in comparison with other rural livelihood types, were worst affected by economic shocks - food prices in particular. Plausible arguments can be offered to explain this observation: first, a majority of FWs are too dependent on wage incomes that often are too low to allow households cope and sustain high food prices; second, FWs lack recourse to any other form of livelihood sustaining activity besides being farm employees. This sharply contrasts other livelihood types who often are able to engage in extra income-generating activities (e.g. seek seasonal employment; sell farm produce; etc); third, FWs consist a subset of the poorest households in Cape West Coast who cannot withstand food price increases such that even slight increases in prices can severely diminish their purchasing power. To worsen matters, under current public safety net programs, FWs are 'not eligible' as they are considered to be gainfully employed. As a result, they have not been accorded much priority in government safety net programs or considerations. Added together, interplay of these factors leave FWs at a distinct disadvantage and comparatively the most vulnerable.

Unlike most countries in Africa, food security in South Africa is predominantly a function of wage incomes and much less a function of own-production meant for self-consumption. In this case, it is not surprising that even livelihood categories like NLR farmers, who are traditionally dependent on own-production, are generally not self-sufficient and most supplement additional food requirements through market purchases. This places food security under different lens in South Africa (compared to other African countries), where food security is largely determined by wage incomes with food prices and affordability playing pivotal role.

Table 7. Estimated vulnerability probabilities underlying different shocks for identified livelihood types across sampled municipal districts.

	Matzikama				**Bergriver**				**Cederburg**			
	Livelihood type*				Livelihood type*				Livelihood type*			
Shocks	NLR	FWs	MWs	FM	NLR	FWs	MWs	FM	NLR	FWs	MWs	FM
Food_price	0.17	0.73	0.05	0.05	0.06	0.88	0.01	0.04	0.08	0.49	0.01	0.41
Unemployment	0.43	0.27	0.08	0.22	0.22	0.49	0.03	0.25	0.1	0.09	0.01	0.80
Energy_price	0.38	0.57	0.03	0.08	0.16	0.82	0.01	0.02	0.26	0.53	0.01	0.19
Electricity_blackout	0.34	0.62	0.01	0.03	0.15	0.60	0.01	0.24	0.20	0.50	0.00	0.29
Average	**0.33**	**0.55**	**0.04**	**0.08**	**0.15**	**0.70**	**0.02**	**0.14**	**0.16**	**0.40**	**0.01**	**0.42**

Livelihood type*: NLR = Non Land Reform; FWs = Farm worker; MWs = Mine worker; FM = Fisherman.

POLICY IMPLICATIONS

Household-level vulnerability to unanticipated shocks constitutes the most severe threats to rural livelihood. Vulnerability is worsened as households are often subjected to a cycle of repeated shocks. Effective safety net programs can provide the much needed social protection to cushion the poor from the severe impact of economic shocks. To address the high vulnerability of rural households to transitory economic shocks, a number of policy suggestions are discussed below:

An appropriate food and nutrition security monitoring and evaluation system for early intervention and support of most vulnerable households must be set up in order to protect the most vulnerable households (e.g. FWs) during turbulent times.

Clear databases and registers are needed at district and provincial level showing different levels of vulnerability; such records will provide important information necessary for building solid social protection system to cater for the most vulnerable (e.g. elderly, unemployment, chronically sick, farm worker, destitute, etc).

Food price stabilisation programs targeting the most vulnerable must be carefully considered and instituted within the short to medium term. Such measures may include creation of buffer stocks, 'smart' price subsidies, tax exemptions and relaxation of import tariffs on basic food items.

Given the disproportionate impact of food price shocks on female-headed households, gender-based intervention strategies targeting food security policies must be given priority. *In-kind transfers* mainly in the form of food gifts and/or parcels could play a crucial role to cushion the affected households during turbulent times.

A voucher system is another potentially effective intervention strategy that can be implemented only during the period of economic turbulence. The voucher is issued only to *qualifying* severely impacted and most vulnerable households. Vouchers come with terms and regulations that guide and restrict their use: they are redeemed only against specific goods/services; have a capped monetary value and supplier restrictions imposed.

CONCLUSION

Using the hindsight of food price hikes of 2007/2008 and in light of the current increasing trend in food prices for most basic commodities in South Africa, this paper argued for the necessity of good post-shock assessments for policy and practice purposes. Thorough knowledge of the implications of economic shocks on different types of livelihoods is vital when designing well-targeted measures specifically intended for the most vulnerable households.

In comparing different livelihood types, the assessment revealed that farm worker households are highly vulnerable to food price shocks in particular compared to other livelihood types. Apart from a strong dependency on on-farm wage labour, the lack of alternative livelihood options in the rural areas may account for this high vulnerability. On the other hand, the status of farm workers as employees excludes them from many pro-poor measures such as public social grants and programs. Specific measures on policy level are necessary to tackle food price hikes, with a special regard to farm worker households and in consideration of the special food security equation of South Africa. This includes proactive (establishing a food and nutrition security) monitoring and evaluation system and active

measures (food price stabilisation measures, in-kind transfers, voucher system) where a gender-based targeting should be given priority.

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