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Abstract

The analysis of household resilience to food insecurity has become a key technical and evidence-based policy instrument for better tailoring development and humanitarian intervention designs. International development agencies must strengthen the capacity of vulnerable households to anticipate, cope with and adapt to shocks and stressors. Despite the humanitarian and development scope of household resilience strengthening, most resilience academic research and policies focused on protracted crises countries. Moreover, too little attention has been paid to in-depth gender inequality analysis in household resilience to food insecurity, and household food security. This paper aims to (i) analyse the key drivers of household resilience to food insecurity and (ii) assess differences in resilience capacity and food security indexes across male and female-headed households, and identify key drivers of these differentials in national, urban and rural areas in the Gambia. Estimations rely on data from the Gambian Integrated Household Surveys on consumption expenditure and poverty-level assessment 2015–2016. The results show that assets and adaptive capacity are the most important pillars in households' resilience building. Female-headed households are 12.40 percent and 20.33 percent less resilient than male-headed households respectively at the national and rural level, while at the urban level, they are 6.85 percent more resilient than male-headed households. Gender differential decomposition indicates that the endowment effect is more important than the structural effect in rural areas and is driven by gender gaps in coping strategies adoption, access to productive resources and household characteristics. Improving crops and income diversification, access to agricultural productive resources, and access to assets for livelihoods of female-headed households is key in building household resilience capacity and reducing the gender gap in resilience capacity and food security.

Keywords: resilience, food insecurity, gender differential decomposition, structural equations model, Oaxaca-Blinder, resilience index measurement and analysis, household, the Gambia.

JEL codes: C01; D63; Q18.

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1 Introduction

Resilience is increasingly seen as a unifying concept and policy instrument used by humanitarian and development institutions and non-governmental organizations to address the chronic vulnerability of populations exposed to recurrent shocks and stressors (Choularton *et al.*, 2015). While some believe shocks have become more frequent, Zseleczky and Yosef (2014) indicate that not all shocks are increasing in frequency, although many are increasing in their severity, scope and impact on household resilience and food security. Climate change and political instability impacts are increasingly recognized as being serious household food security threats in sub-Saharan African countries. Climate-related shocks such as drought, flood, desertification, and erratic rainfall (d'Errico and Di Giuseppe 2018; d'Errico *et al.* 2018), community and ethnic conflicts (Brück *et al.,* 2018; d'Errico *et al.*, 2018), political instability (PCBS and FSS, 2016; Brück *et al.,* 2018; Miaari *et al.,* 2014) and economic shocks (Timmer, 2000; Akter and Basher, 2014) have a long-lasting adverse impact on household food and nutrition security, vulnerability and livelihood. In this context, understanding the state and determinants of household resilience capacity to food insecurity to cope with these shocks is important to provide evidence-based policy recommendations to governments, development agencies and partners to promote or support efficient development and zero hunger interventions targeting households most vulnerable in each developing country, not only in conflict countries as shown the previous studies as a focal point of resilience analysis conducted by many international organizations.

Several resilience studies were carried out in the last decade, the majority of which concentrated in the African Sahel countries: Mali (FAO, 2015a; d'Errico and Pietrelli, 2017), Mauritania (FAO, 2015b), the Niger (FAO, 2011), Nigeria (FAO, 2019a) and Senegal (FAO, 2016). Although the Gambia is part of the Sahel region, facing severe drought and irregular rainfall, there is a lack of studies related to resilience. The purpose of this paper is to evaluate households' resilience to food insecurity in the Gambia and perform gender differential decomposition of household resilience capacity, and food security indicators to provide evidence-based recommendations for policy interventions to strengthen household resilience, improve food and nutrition security and promote social and economic development. The study will provide the root causes of gender inequality in resilience capacity and food security indicators and therefore how to mitigate this through strategically evidence-based intervention.

The Gambia is part of the Sahel region, one of the most vulnerable to climate risks, particularly to drought. The Gambia's climate is characterized by high variability in the amount, annual distribution, and length of precipitation; and by an increase in length and frequency of extreme weather events such as droughts, floods, and dust storms (Jaiteh *et al.*, 2010). The Gambia is heavily dependent on rainfed crops for agricultural production (99 percent of croplands in the Gambia are entirely rainfed), on imports for food security, on tourism receipts and remittances for foreign exchange earnings (Jaiteh *et al.*, 2010; World Bank, 2013). In recent years, the economy has been hit by covariate shocks: the agriculture sector has been affected by erratic rainfalls has been affected by the spill over effects of the regional Ebola crisis and the political crisis during 2015–2016 (World Bank, 2018). The average rainfall in 2014 declined markedly to 638.9 mm, 33 percent below the average in 2013 and 22 percent below the long-term mean (1981 to 2010) of 828.5 mm (World Agrometeorological Information Service, 2014). Also, the 2011–2012 Sahel drought crisis caused massive crop losses, loss of productivity in croplands, with related impacts on household food security and nutrition, and availability of seeds (World Bank, 2013) in the Gambia.

Furthermore, exogenous factors and the recent outbreak of Ebola virus disease in West Africa are endangering stability in the country (UNECA, 2016; FEWS NET, 2017). Climate-based shocks such as rainfall delay and fluctuation have serious adverse effects on household livelihoods notably significant reduction of crop production volumes that mostly affected the rural households that have agriculture activities as a primary source of livelihood in the Gambia.

Moreover, agriculture is the dominant sector in the Gambian economy, employing about 70 percent of the workforce and contributing, on average, 33 percent of GDP (ECOWAS Commission, Republic of the Gambia and African Union, 2020). It produces about 50 percent of the national food supplies and provides 67 percent of household income. Poverty rates are higher in rural areas, where the poor typically work in the agricultural sector, while the poverty rate (based on the national poverty line) in rural areas was 70 percent in 2015 compared to 41 percent in other urban areas and 17 percent the capital city Banjul. Inequality measured by the Gini coefficient was estimated at 35.9 percent in 2015 (World Bank, 2021). Poverty is a major problem in the Gambia and manifests itself by the low human development index (HDI). In 2015, the Gambia is ranked 175 out of 188 countries in HDI. When the measure of the income of below USD 1.25 per day was used, poverty stood at more than 48 percent in 2010, and rural populations are affected more severely by poverty (UNECA, 2016).

There has been an increasing interest in investigating household resilience capacity to cope with climate shocks and hardship to ensure food security and nutrition, protect, and build more sustainable household livelihoods through emergency, resilience, and development interventions in recent years. However, in the Gambia, despite the climate and generic risks recorded such as the recent drought and Ebola disease outbreak that face the population, there is a lack of studies on household resilience capacity to cope with shocks. Indeed, climate and generic shocks harm household resilience capacity and food security in Mauritania (FAO, 2015b), Chad (FAO, 2019b), Karamoja (FAO, 2018). Nonetheless, far too little attention has been paid to household resilience livelihoods and food security in the Gambia, and particularly to quantify household resilience capacity and its impact on food security indicators and address gender inequality in resilience capacity to food insecurity.

This paper aims to: (i) evaluate the household resilience capacity index (RCI) to cope with shocks; (ii) investigate the most determinant pillars of resilience in rural and urban areas; (iii) evaluation gender differential decomposition of RCI and food security indicators; and (iv) provide evidence-based policies recommendations to strengthen household resilience, livelihoods and food security in the Gambia. The FAO resilience index measurement analysis (RIMA) methodology, factor analysis techniques, structural equation model and weighted multivariate regression models are performed in this investigation.

2 Methodology

Household resilience to food insecurity is the capacity that ensures stressors and shocks not to have long-lasting adverse development consequences (FAO, 2016b; d'Errico and Di Giuseppe, 2018; d'Errico *et al.,* 2018). Resilience is the key topic in humanitarian and international institutions to analyse and understand how to help households in coping with shocks and stressors to secure their food, nutrition, and livelihoods (Alinovi *et al.*, 2010; FAO, 2016b; Brück *et al.,* 2018; Bruck and d'Errico, 2019). Households can face two types of shocks: covariate and idiosyncratic[1] (PEP-CBMS Network Coordinating Team and UNDP, 2011). Covariate shocks include flood, drought, earthquakes, cyclones, typhoons, hurricanes, tsunami, dry spells, erratic rain, market shock (price volatility), pest outbreaks, disease outbreaks, irregular migration while idiosyncratic shocks include the death of a family member, pest infestation, illness, loss of jobs, gender-based violence, social exclusion, discrimination, crime, violence and thief (Sagara, 2018).

Women, men, and children are disproportionately affected by disasters, and often have different levels of resilience capacities (Vaughan, 2018). Therefore, disaggregating RCI, and selecting indicators that reveal these differences, is vital to understanding and addressing this inequality. Moreover, to address the drivers of gender RCI inequality and discrepancy of RCI between rural versus urban households, we use the decomposition of Oaxaca-Blinder econometric approach (Oaxaca, 1973; Blinder, 1973; Firpo *et al.,* 2010; Firpo *et al.*, 2011; Aguilar *et al.*, 2014; Oseni *et al.,* 2014; Mukasa and Salami, 2015; Morgado and Salvucci, 2016). The following subsection presents the two quantitative methods that will be used in this paper.

In this paper, we rely for the first part of analysis on FAO resilience index measurement and analysis (RIMA) methodology, combining factor analysis and structural equation modelling (FAO, 2016b; d'Errico *et al.,* 2018) to estimate household RCI.

2.1 Resilience index measurement and analysis methodology

Resilience represents the ability of people, households, communities, and institutions to prepare for, respond to and recover from shocks and stresses (Vaughan 2018). The metric behind it is of growing interest to development researchers, humanitarian agencies, practitioners and policymakers, particularly for those whose work concerns the effects of climate change, conflict, and epidemics on food, nutrition, and livelihood (Alinovi *et al.,* 2009; Mitchell and Harris, 2012; d'Errico and Pietrelli, 2017; Bruck *et al.,* 2018; Knippenberg *et al.,* 2019). However, two approaches have been used to assess people, households, communities, and institutions' capacity to cope with hardship and stressors. The first widely used by humanitarian agencies and non-governmental organizations is a qualitative method. The second, a quantitative method aiming at estimating the level of household resilience capacity, continues to attract the interest of international institutions, such as UN agencies, academics, researchers and non-governmental organizations. The literature showed three principal quantitative methods used to estimate the household resilience capacity (FAO, 2016b; Cisse and Barrett, 2018; Vaughan, 2018; Sagara, 2018).

[1] Idiosyncratic shocks affect individuals or households. On the other hand, covariant shocks affect groups of household, communities, regions or even entire countries (PEP-CBMS Network Coordinating Team and UNDP, 2011).

In the first quantitative approach, the resilience analyses use indices combining indicators into a single measure. To do so, researchers rely on factor analysis and principal component analysis according to the nature of indicators to include in the index (Sagara, 2018).

In order to reflect the definition of resilience, Béné *et al.* (2012, 2015) and Vaughan (2018) highlighted that it is useful to organize capacities into three dimensions: absorptive resilience (capacities defined as ability to minimize exposure and sensitivity to shocks and stresses through the development of coping strategies such as risk reduction, financial services improvement and health insurance); adaptive resilience capacities (that rely on the ability of people, households, communities and institutions to adopt choices and changes in livelihood and other strategies in response to long-term economic, social and environmental change); and transformative resilience capacities (driven by governance, policies and regulations, cultural and gender norms, community networks, and formal and informal social protection strategies that constitute the enabling environment for a systematic change).

The second method sees resilience as the capacity over time of a person, household or other aggregate units to avoid poverty in the face of various stressors and the wake of myriad shocks (Barret and Constas, 2014; Cisse and Barrett, 2018). According to this definition, Cisse and Barrett (2018) recently developed a conditional moment-based approach motivated by the poverty dynamics and traps literature that emphasizes the possibility of nonlinear well-being dynamics and asset-based poverty traps.

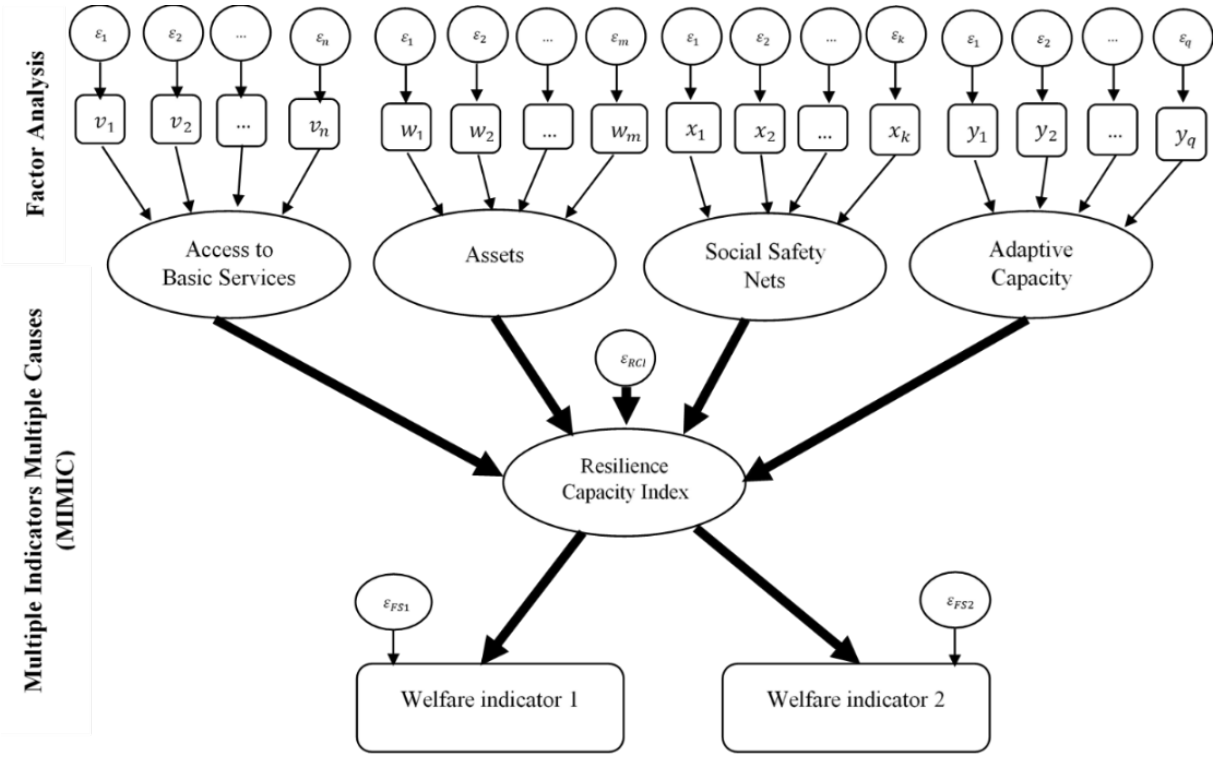
The Food and Agriculture Organization of the United Nations (FAO) resilience analysis approach called resilience index measurement and analysis (RIMA) is the third method that is most widely used by several institutions and academic researchers such as European Union, Alliance for a Green Revolution in Africa (AGRA) and Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel (CILSS), national bureau of statistics and other institutions to Strengthen the resilience of livelihoods, to food insecurity in protracted crisis countries context. For example, FAO used RIMA to resilience analysis in Jordan (FAO, 2013), Karamoja Uganda (FAO, 2018), Mali (FAO, 2015a), Mauritania (FAO, 2015), the Niger (FAO, 2011) and Senegal (FAO, 2011), for better beneficiaries targeting and policies action.[2] In addition, African Union (AU) adopted RIMA to monitor and evaluate the achievement of the Malabo Declaration on *Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods* adopted by the Heads of State and Government of the African Union in Malabo, Equatorial Guinea in June 2014 (African Union, 2015).

Therefore, this paper relies on the third approach to estimate household resilience to food insecurity. According to this methodology, resilience is defined, as *"a capacity that ensures stressors and shocks do not have long-lasting adverse development consequences*" (FAO, 2016b). Indeed, FAO provide a detail explanation of defines resilience as "The ability to prevent disasters and crises as well as to anticipate, absorb, accommodate or recover from them in a timely, efficient and sustainable manner. This includes protecting, restoring and improving livelihood systems in the face of threats that impact agriculture, nutrition, food security, and food safety (FAO, 2020).

[2] Furthermore, the academic papers that relied on the RIMA methodology include Alinovi *et al.* (2010), d'Errico *et al.* (2017), d'Errico and Pietrelli (2017), Bruck *et al.* (2018), d'Errico and Di Giuseppe (2018), d'Errico *et al.* (2018).

The RIMA methodology framework (FAO, 2016b) estimate household capacity index based on four pillars: access to basic services (ABS); assets (AST); social safety nets (SSN); and adaptive capacity (AC). Figure 1 presents the RIMA framework with structural equations model (SEM).

Figure 1. Framework of resilience index measurement and analysis



Source: Adapted form FAO. 2016. *RIMA-II: resilience index measurement and analysis – II.* Rome.

Each pillar index is estimated by factor analysis using a set of key observable indicators as illustrated in the framework (Figure 1).[3]

$$RCI_i = \left[\lambda_1, \lambda_2, \lambda_3, \lambda_4\right] \times \begin{bmatrix} ABS_i \\ AST_i \\ SSN_i \\ AC_i \end{bmatrix} + \varepsilon_i \qquad (1)$$

$$\begin{bmatrix} FSI_i^1 \\ FSI_i^2 \end{bmatrix} = \begin{bmatrix} \gamma_1 \\ \gamma_2 \end{bmatrix} \times RCI_i + \begin{bmatrix} \varepsilon_i^1 \\ \varepsilon_i^2 \end{bmatrix} \qquad (2)$$

Where:

- ABS, AST, SSN and AC represent respectively the four pillars obtained with factor analysis.
- RCI is the resilience capacity index of the *i-th* household.
- ε is the error term.

[3] The welfare indicators could be more than 2 accordingly to the data availability.

Equations (1) and (2) are simultaneously estimated using a structural equation model approach, the Multiple Causes Multiple Indicators (MIMIC) model (Jöreskog and Goldberger, 1974; FAO, 2016b, d'Errico *et al.*, 2018).

2.2 Oaxaca-Blinder decomposition approach

Several studies on resilience to food insecurity (FAO, 2016a; 2018; 2019a; D'Errico *et al.* 2018) and resilience to climate change (FAO, 2019) are run at sub-administration, country, and regional level. Gender inequalities in resilience capacity are sometimes highlighted in these studies comparing male-headed households to female-headed households in terms of average RCI (FAO, 2016b; FAO, 2017; FAO, 2019a; d'Errico and Di Giuseppe, 2018). However, there is no investigation to understand the causes of gender inequality on household resilience capacity and food security indicators. |This paper in trying to fill this gap, relies on Oaxaca-Blinder decomposition (Oaxaca, 1973; Blinder, 1973; Fortin, 2011) methodology to understand the drivers' factors of the gender discrepancy in the resilience capacity to cope with shock and stress such as climate hazards, drought, flood, and generic shocks affecting their food security.

We follow the studies of Firpo *et al.* (2010), Aguilar *et al.* (2014), Oseni *et al.* (2014), Mukasa and Salami (2015), and Morgado *et al.* (2016) in the specification of econometric models.

The first step of the Oaxaca-Blinder decomposition approach involves estimating the RCI of male-headed households, on the one hand, and female-headed households, and then analysing how RCI is linked/react to a series of explanatory variables throughout the following linear model:

$$RCI_{i,g} = \beta_{0,g} + \sum_{k=1}^{K} X_{i,k,g}\beta_{g,k} + \varepsilon_{i,g} \qquad (3)$$

Where:

- RCI represents the resilience capacity index.
- X is the vector of the explanatory variables.
- β represents the vector of the parameters of the model.
- ε is the error term with $\left(E\left(\varepsilon_g \middle| X\right) = 0,\ \mathrm{Var}\left(\varepsilon_{ig} \middle| X\right) = \sigma^2\right)$.
- *g* represents the gender of household heads (g = w for female-headed households and g = m for male-headed households).

In applying the Oaxaca-Blinder (1973) model we can quantify the contribution of the variables explaining the RCI gap between male-headed households and female-headed households (Oseni *et al.,* 2014). In the absence of an advantage for a particular group, the RCI of male-headed households and female-headed households must be the same.

The decomposition of the gender RCI gap between the explanatory factors implies a counterfactual comparison between the coefficients of equation (1) and the coefficients corresponding to the scenario without gender discrimination corresponding to the following model:

$$RCI_i = \beta_0^{'} + \sum_{k=1}^{K} X_{i,k}\beta_k^{'} + \beta_g^{'} g + \vartheta_i \quad (4)$$

Where:

- RCI represents resilience capacity index.
- X is the vector of K independent variables, g the treatment variable, here the gender.
- $\beta_k'{}'$ is the vector of parameters.
- ϑ is the error term independent and identically distributed with zero mean and constant variance σ'^2. β_g' is the parameter associated with the treatment variable (gender of the head of the household).

The RCI differential $\left(\hat{\Delta}_0^{\mu}\right)$ between male-headed households (g = m) and female-headed households (g = w) is given by:

$$\hat{\Delta}_0^{\mu} = \overline{Y}_m - \overline{Y}_w \text{ with } \overline{Y} = E\left(Y\right) \quad (5)$$

By replacing $\overline{Y}_m$ and $\overline{Y}_w$ with the respective expressions resulting from equation (3), we obtain:

$$\hat{\Delta}_0^{\mu} = \left(\hat{\beta}_{m0} - \hat{\beta}_{w0}\right) + \sum_{k=1}^{K} \overline{X}_{mk}\left(\hat{\beta}_{mk} - \hat{\beta}_{wk}\right) + \sum_{k=1}^{K}\left(\overline{X}_{mk} - \overline{X}_{wk}\right)\hat{\beta}_{wk} \quad (6)$$

$\hat{\Delta}_s^{\mu} = \left(\hat{\beta}_{m0} - \hat{\beta}_{w0}\right) + \sum_{k=1}^{K} \overline{X}_{mk}\left(\hat{\beta}_{mk} - \hat{\beta}_{wk}\right)$ represents the unexplained effect, the so-called structural effect, and $\hat{\Delta}_X^{\mu} = \sum_{k=1}^{K}\left(\overline{X}_{mk} - \overline{X}_{wk}\right)\hat{\beta}_{wk}$ is the explained effect of the unconditional gender differential in RCI due to the gender difference in endowments in the observable variables (Oaxaca, 1973; Blinder, 1973; Firpo *et al.,* 2010).

$\hat{\Delta}_X^{\mu}$ is called the endowment effect and can be interpreted as an increase in RCI that female-headed households would obtain on average if they had the same endowments in covariates as male-headed households. Morgado *et al.* (2016) break down the unexplained effect into two structural effects by adding and subtracting equation (4) in the term of structural effect $\hat{\Delta}_s^{\mu}$:

$$\hat{\Delta}_s^{\mu} = \left(\hat{\beta}_{m0} - \hat{\beta}_0^{'}\right) + \sum_{k=1}^{K} \overline{X}_{mk}\left(\hat{\beta}_{mk} - \hat{\beta}_k^{'}\right) + \left(\hat{\beta}_0^{'} - \hat{\beta}_{w0}\right) + \sum_{k=1}^{K} \overline{X}_{wk}\left(\hat{\beta}_k^{'} - \hat{\beta}_{wk}\right) \quad (7)$$

Where $\left(\hat{\beta}_{m0} - \hat{\beta}_0^{'}\right) + \sum_{k=1}^{K} \overline{X}_{mk}\left(\hat{\beta}_{mk} - \hat{\beta}_k^{'}\right)$ is the male-headed households' structural advantage and $\left(\hat{\beta}_0^{'} - \hat{\beta}_{w0}\right) + \sum_{k=1}^{K} \overline{X}_{wk}\left(\hat{\beta}_k^{'} - \hat{\beta}_{wk}\right)$ the structural disadvantage of female-headed households (Morgado *et al.,* 2016).

3 Data

3.1 Description of data

This paper evidence relies on the Gambia Integrated Household Survey on consumption expenditure and poverty-level assessment datasets collected by the World Bank from April 2015 to March 2016 (Gambia Bureau of Statistics, 2015). A two-stage probability proportional to size stratified random sampling without replacement was adopted. At the first stage stratification, enumeration areas were stratified per districts for each local government area. The sample size was calculated[4] to ensure the representatively at national and regional levels. A large final total sample size of 13 281 households is used in this study. The strategy of sampling allows generalizing the results on the overall population because of the random selection process that eliminates the selection bias. Three questionnaires are used in the survey: household questionnaire, household consumption expenditure questionnaire and price questionnaire.

The resilience to food insecurity analysis is at the household level (FAO, 2016b; d'Errico *et al.*, 2017; d'Errico *et al.*, 2019). As has been emphasized before, the four resilience pillars are respectively access to basic services (ABS), asset (AST), social safety nets (SSN) and adaptive capacity (AC) (FAO, 2016b) and the outcome indicators of resilience considered are food security indicators (FAO, 2016b; d'Errico *et al.*, 2017; d'Errico *et al.*, 2019) such as household dietary diversification score (HDDS) and food expenditure.

Table 1. Resilience pillars and food security indicators

Resilience pillars	Key indicators
Access to basic services (ABS)	Access to drinking or improved water
	Access to electricity
	Access to improved toilet
	Closeness to food market
	Closeness to primary school
	Closeness to secondary school
	Closeness to hospital
	Closeness to clinic
	Closeness to public transport
	Closeness to post
	Closeness to police station
	Closeness to road
Assets (AST)	Agricultural wealth index
	Land
	Livestock in tropical livestock units (TLU)
	Wealth index
	House value in United States dollars (USD)
Social safety nets (SSN)	Formal transfers per capita (USD)
	Informal transfers per capita (USD)
	Access to credit
	Social network

[4] For more information on sampling strategy, visit https://microdata.worldbank.org/index.php/catalog/3323/related-materials

Resilience pillars	Key indicators
Adaptive capacity (AC)	Dependency ratio (inv.)
	Coping strategy index
	Household average education years
	Years of education of household head
	Crops diversification index
	Income diversification index
Food security indicators (FSI)	Household dietary diversification score (HDDS)
	Food expenditure (USD)

Source: Author's own elaboration.

Table 1 presents the list of the variables used to calculate each resilience pillar and food security indicators. Access to Basic Services pillar is determined by a set of variables representing water, sanitation and hygiene indicators and access to services to improved water, electricity, improved toilets, education, health, transport and security measured by the physical distance to the service. Asset pillar is determined by wealth index, agricultural wealth index, land access, livestock owned, and house value. Wealth index (WI) is a proxy indicator of wealth, and it is calculated by using data on asset ownership (Kuku-Shittu *et al.*, 2013; Hjelm *et al.*, 2017). WI is derived using factor analysis and considered as one of the key indicators for resilience analysis (FAO, 2016b, 2018; 2019a). Household assets included in the wealth index include durables goods. Agricultural wealth index (AWI) is a composite measure of a household's cumulative agriculture standard. Data on household ownership of agricultural assets such as hoes, machetes, tractors, rake, watering can, pump, etc. are (GBOS, 2015) used to calculate AWI with factor analysis.

Formal and informal transfers, access to credit and social network indicators are used to construct the social safety nets pillar. Finally, indicators including dependency ratio, coping strategy index, household years of education, household head's years of education, household crop diversification, and income diversification index determined adaptive capacity pillars. Income and crop diversification indexes are well known in the literature as climate, economic, food insecurity risks management strategies. Income diversification is an important strategy for rural households to manage drought floods and natural disaster risks (Wan *et al.*, 2016). Income diversification index (IDI) is determined by the number of household income-generating activities. Crops diversification is known as being the agricultural adaptation strategy to climate change notably drought (Okinnagbe and Irohibe, 2014; Meldrum *et al.*, 2018) and has a positive impact on food security (Asfaw *et al.*, 2016; FAO, 2019a). Crops diversification index (CDI) is defined by the numbers of crops cultivated by the household during the previous agricultural season.

Food security indicators are derived from information about the food items consumed during the last seven days preceding the data collection and the household food expenditure during the last month preceding the data collection (GBS, 2015). Following this information, we calculated two food security indicators: HDDS and household food expenditure. HDDS is the number of food groups consumed by a household over a given reference period (Swindale and Bilinsky, 2006). A more diversified household diet is correlated with caloric and protein adequacy, percentage of protein from animal sources, and household income (Swindale and Bilinsky, 2006) and provides a glimpse of a household's ability to access food as well as its socioeconomic status based on the previous 24 hours preceding the data collection (Kennedy *et al.,* 2011; 2013). In Living Standard Measurement Survey (LSMS) used in this paper, the

data on food consumed within the household focus on the last seven days preceding the data collection. HDDS relies on these last seven days' food consumed aggregated in 12 groups of foods. Although the recommended and widely time frame used in HDDS calculation is 24 hours recalls periods (Swindale and Bilinsky, 2006; FAO, 2015a), seven days preceding the data collections a valid time frame for recall to calculate HDDS (FAO, 2015a).

3.2 Descriptive statistics

Table 2 summarizes descriptive statistics of the RCI pillars, its indicators, households' characteristics, shocks, food security indicators, climate risk variables, and other control characteristics. Descriptive statistics are derived on full, urban, and rural samples of households. The desegregated statistics by gender households head (male-headed households vs female-headed households) and gender discrepancy analysis results are also provided.

On average, a household is composed of eight persons, nine in rural areas and six in urban. The households headed by males are larger than those headed by females, this is the same both in urban and rural areas. This is explained by female-headed households' marital status, mainly widows and divorced (Aguilar *et al.*, 2015). Female household heads are younger than male household heads. Women have higher decision-making power when they are the head of the household. The dependency ratio is defined as the number of children (0–14 years old) and older persons (65 years or over) to the working-age population (15–64 years old). Results in Table 2 indicate that the dependency ratio is more important in rural areas, and for male-headed households. This result is consistent with the findings of Anríquez (2007), Hardley *et al.* (2011), and World Bank (2020) that the dependency ratio is significantly associated with high fertility, which is more important in rural areas.

Results in Table 2 show that the female-headed household is wealthier than male-headed households in the urban area, while this status is significantly inverted in the rural area, male-headed households are more wealth. The analysis shows that male-headed households are more equipped in agriculture (Table 2), access to land and possessed livestock.

In terms of food security, on average, households headed by women diversified more their diet compared to male-headed households. However, the food expenditure per household is greater for male-headed households.

Table 2. Descriptive statistics and gender average gap (male-headed household vs female-headed household)

Variable	Full sample	Male-headed household	Female-headed household	Gender gap	Rural	Male-headed household	Female-headed household	Gender gap	Urban	Male-headed household	Female-headed household	Gender gap
Female-headed household	0.139				0.120				0.196			
Migrant household	0.101	0.106	0.070	0.037***	0.073	0.076	0.048	0.028***	0.187	0.205	0.110	0.095***
Age of household head	47.960	48.060	47.380	0.674*	48.700	48.870	47.480	1.390***	45.760	45.400	47.210	-1.803***
Age-squared of household head	2505.900	2515.400	2447.500	67.918*	2581.200	2599.100	2449.900	149.255***	2281.500	2241.900	2443.100	-201.182***
Number of household members	7.966	8.348	5.609	2.739***	8.555	8.958	5.612	3.345***	6.208	6.356	5.603	0.753***
Rural household	0.749	0.766	0.646	0.119***	1.000	1.000	1.000	0.000	0.000	0.000	0.000	0.000
Resilience capacity index (0–100)	36.500	37.120	32.630	4.491***	37.030	37.870	30.830	7.043***	34.920	34.680	35.930	-1.251**
Subjective poverty index (0–100)	50.520	50.330	51.730	-1.410***	48.550	48.350	49.970	-1.611***	56.410	56.760	54.970	1.793**
Household food expenditure (USD)	37.840	38.970	30.840	8.130***	38.870	40.310	28.340	11.965***	34.760	34.600	35.400	-0.806
Household dietary diversification score	9.095	9.079	9.198	-0.119**	8.982	9.001	8.849	0.152***	9.432	9.333	9.835	-0.502***
Closeness to agricultural market	0.222	0.215	0.264	-0.050***	0.225	0.217	0.283	-0.065***	0.212	0.207	0.231	-0.024**
Closeness to public transport	0.285	0.275	0.346	-0.071***	0.280	0.269	0.362	-0.093***	0.300	0.296	0.316	-0.02
Closeness to primary school	0.238	0.230	0.287	-0.057***	0.238	0.229	0.301	-0.072***	0.237	0.231	0.262	-0.031***
Closeness to secondary school	0.116	0.109	0.160	-0.050***	0.100	0.094	0.149	-0.056***	0.165	0.162	0.179	-0.017**
Closeness to hospital	0.023	0.022	0.033	-0.012***	0.011	0.011	0.017	-0.007***	0.058	0.057	0.063	-0.006
Closeness to health clinic	0.146	0.138	0.196	-0.058***	0.138	0.128	0.209	-0.080***	0.168	0.168	0.172	-0.004
Closeness to post office	0.037	0.035	0.051	-0.016***	0.015	0.015	0.016	-0.001	0.104	0.101	0.117	-0.015**
Closeness to police station	0.093	0.086	0.134	-0.048***	0.061	0.056	0.095	-0.039***	0.189	0.184	0.206	-0.021**
Closeness to road	0.456	0.443	0.532	-0.089***	0.444	0.429	0.554	-0.124***	0.489	0.488	0.494	-0.005
Access to electricity	0.355	0.334	0.479	-0.145***	0.240	0.227	0.338	-0.111***	0.696	0.685	0.737	-0.052***
Access to quality water	0.828	0.821	0.873	-0.052***	0.804	0.797	0.851	-0.054***	0.901	0.898	0.911	-0.013
Access to improved toilet	0.433	0.419	0.518	-0.098***	0.354	0.344	0.426	-0.082***	0.671	0.667	0.685	-0.018
Livestock (TLU)	1.579	1.779	0.345	1.435***	2.020	2.228	0.506	1.722***	0.262	0.314	0.050	0.264*
Agricultural wealth index	0.000	-0.003	0.018	-0.021*	-0.076	-0.069	-0.132	0.063***	0.227	0.212	0.291	-0.080***
Land area (hectare)	3.813	4.066	2.253	1.814***	4.570	4.799	2.901	1.898***	1.555	1.674	1.068	0.606
Wealth index	0.000	-0.004	0.023	-0.027**	-0.075	-0.069	-0.121	0.052***	0.224	0.209	0.287	-0.078**
Log of house value (USD)	5.050	5.070	4.924	0.146*	5.638	5.662	5.462	0.200**	3.295	3.137	3.941	-0.805***
Formal transfer (USD) per capita	0.216	0.226	0.153	0.073	0.136	0.140	0.112	0.028	0.454	0.509	0.229	0.280
Informal transfers (USD) per capita	43.190	34.630	96.030	-61.399***	34.930	28.380	82.770	-54.392***	67.860	55.040	120.300	-65.212***
Access to credit or having a saving	0.496	0.493	0.521	-0.028**	0.475	0.472	0.490	-0.018	0.561	0.558	0.576	-0.018
Household transfers issued per capita	6.365	6.833	3.477	3.355***	3.404	3.595	2.002	1.593*	15.200	17.410	6.173	11.234***
Number of cooperatives	0.074	0.075	0.069	0.005	0.092	0.091	0.099	-0.008	0.020	0.021	0.015	0.006

Variable	Full sample	Male-headed household	Female-headed household	Gender gap	Rural	Male-headed household	Female-headed household	Gender gap	Urban	Male-headed household	Female-headed household	Gender gap
Dependency ratio. inv.	0.538	0.534	0.559	-0.025***	0.507	0.505	0.525	-0.020***	0.628	0.629	0.623	0.006
Coping strategy index. inv.	0.968	0.966	0.980	-0.013***	0.961	0.959	0.974	-0.015***	0.991	0.991	0.990	0.001
Crop diversification index	2.285	2.412	1.505	0.906***	2.839	2.949	2.037	0.912***	0.633	0.657	0.534	0.123**
Educated father	0.261	0.254	0.309	-0.055***	0.215	0.213	0.234	-0.021*	0.399	0.388	0.446	-0.058***
Income diversification index	1.204	1.267	0.816	0.451***	1.245	1.310	0.764	0.546***	1.084	1.126	0.910	0.216***
Governance index (0 & 100)	75.230	75.630	72.800	2.828***	78.220	78.470	76.460	2.010***	66.310	66.360	66.120	0.242
Number of men in household decision-making	0.989	0.998	0.931	0.068***	0.990	0.999	0.929	0.070***	0.985	0.997	0.934	0.063***
Number of women in household decision-making	0.037	0.031	0.075	-0.043***	0.039	0.034	0.077	-0.043***	0.031	0.022	0.070	-0.049***
Female member of village development committee	0.075	0.084	0.019	0.065***	0.094	0.104	0.025	0.079***	0.019	0.022	0.009	0.012**
Fire shock	0.012	0.013	0.007	0.006**	0.015	0.015	0.009	0.006*	0.005	0.006	0.003	0.003
Storm shock	0.044	0.046	0.032	0.013***	0.053	0.055	0.043	0.012*	0.017	0.018	0.014	0.004
Drought shock	0.021	0.022	0.015	0.007*	0.026	0.027	0.018	0.008*	0.005	0.004	0.008	-0.004
Wind-storm shock	0.050	0.052	0.035	0.018***	0.061	0.063	0.042	0.022***	0.017	0.016	0.021	-0.005
Flood shock	0.032	0.034	0.025	0.009**	0.037	0.038	0.028	0.010*	0.020	0.020	0.020	0.000
Other shocks	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.002	0.000
Erosion is the Main Environment Concerned (MEC)	0.146	0.148	0.138	0.010	0.143	0.144	0.138	0.006	0.155	0.159	0.137	0.022
Land degradation is the MEC	0.049	0.050	0.040	0.010*	0.058	0.059	0.053	0.006	0.020	0.020	0.017	0.003
Bush fire is the MEC	0.216	0.221	0.183	0.038***	0.256	0.259	0.232	0.027**	0.096	0.097	0.093	0.004
Deforestation is the MEC	0.049	0.051	0.038	0.013**	0.055	0.056	0.044	0.012*	0.033	0.035	0.028	0.007
Disposal solid waste is the MEC	0.042	0.039	0.061	-0.022***	0.016	0.015	0.023	-0.008**	0.118	0.115	0.128	-0.013
Air pollution is the MEC	0.023	0.022	0.029	-0.006*	0.020	0.019	0.030	-0.011***	0.032	0.033	0.026	0.007
Wind is the MEC	0.077	0.079	0.062	0.017**	0.091	0.093	0.076	0.017*	0.035	0.034	0.037	-0.002
Drainage system is the MEC	0.025	0.024	0.035	-0.012***	0.013	0.012	0.019	-0.007*	0.061	0.060	0.064	-0.004
Flood is the MEC	0.081	0.080	0.085	-0.006	0.065	0.065	0.068	-0.003	0.126	0.128	0.118	0.010
Drought is the MEC	0.100	0.101	0.089	0.012	0.116	0.116	0.116	0.000	0.050	0.053	0.040	0.013
Raising temperature is the MEC	0.028	0.026	0.041	-0.015***	0.023	0.023	0.028	-0.005	0.042	0.037	0.064	-0.028***
Other MEC	0.007	0.007	0.008	-0.001	0.008	0.007	0.010	-0.003	0.006	0.006	0.005	0.002
Number of children participated in growth monitoring clinic	0.968	1.052	0.449	0.603***	1.099	1.185	0.471	0.714***	0.574	0.615	0.408	0.207***
Observations	13 281	11 429	1 852	13 281	9 947	8 750	1 197	9 947	3 334	2 679	665	3 334

Note: ***, ** and * respectively significant at 1 percent, 5 percent and 10 percent.

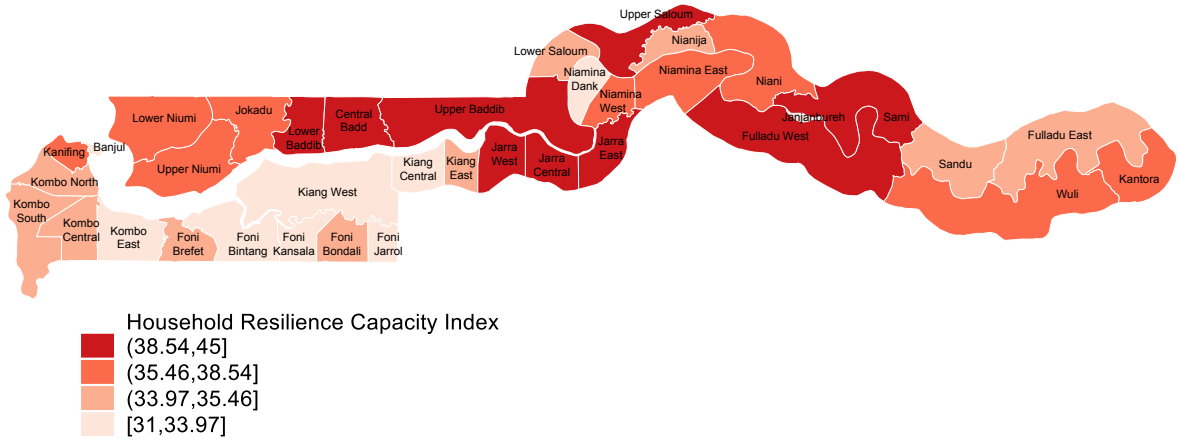
Source: Author's own elaboration.

Figure 2. Pillar's contribution to the resilience-building by local and gender of the household heads

Note: Access to basic services (ABS), asset (AST), social safety nets (SSN) and adaptive capacity (AC).
Source: Author's own elaboration.

Figure 2 shows the contribution of each pillar to the household RCI by geographical area and gender of the household head. Adaptive capacity (AC) and Assets (AST) are the most important pillars for RCI in rural as well as in urban areas. The results show that these two pillars remain the most important for short-term strategies to increase female as well as male-headed household resilience capacity to cope with shocks and climate risks in urban and rural areas. Moreover, access to basic service (ABS) and social safety nets (SSN) are the challenges to overcome. Thereby, the short-term strategies or interventions to increase the resilience capacity of households in the Gambia should focus on investment that contributes to improving households' adaptive capacity and productive and non-productive assets. Despite, ABS, and SSN contribute less to RCI, they remain important to the resilience building and imply more resources and time to improve their contribution. Figure 3 presents the resilience capacity by district. The results show that the districts of Foni Kansala, Foni Jarrol, Kiang West, Niamina Dankunku, King Central, Janjanbureh, Kombo East, Foni Bintang Karanai and Foni Brefet are respectively less[5] resilient while Sami, Central Badibu, Lower Faladu West, Lower Badibu, Jarra East, Upper Baddibu, Jarra Central, and Upper are respectively the most resilient districts.

Figure 3. Resilience capacity index (0–100) mapping by district



Source: United Nations Geospatial. 2018. *Gambia*. United Nations. Cited 24 April 2020. www.un.org/geospatial/file/1928/download?token=Pj86Evtt modified by the author.

[5] Districts with RCI within the interval [31; 33.97] are less resilient while districts with RCI in (38.54; 45] are the most resilient.

4 Empirical results and discussion

This paper first investigates the drivers of resilience and food security indicators through fixed effects linear regression model. Secondly, Oaxaca-Blinder (1987) is estimated to evaluate drivers of the gender differential in household resilience capacity and food security indicators. These empirical analyses are done using full, urban and rural samples datasets.

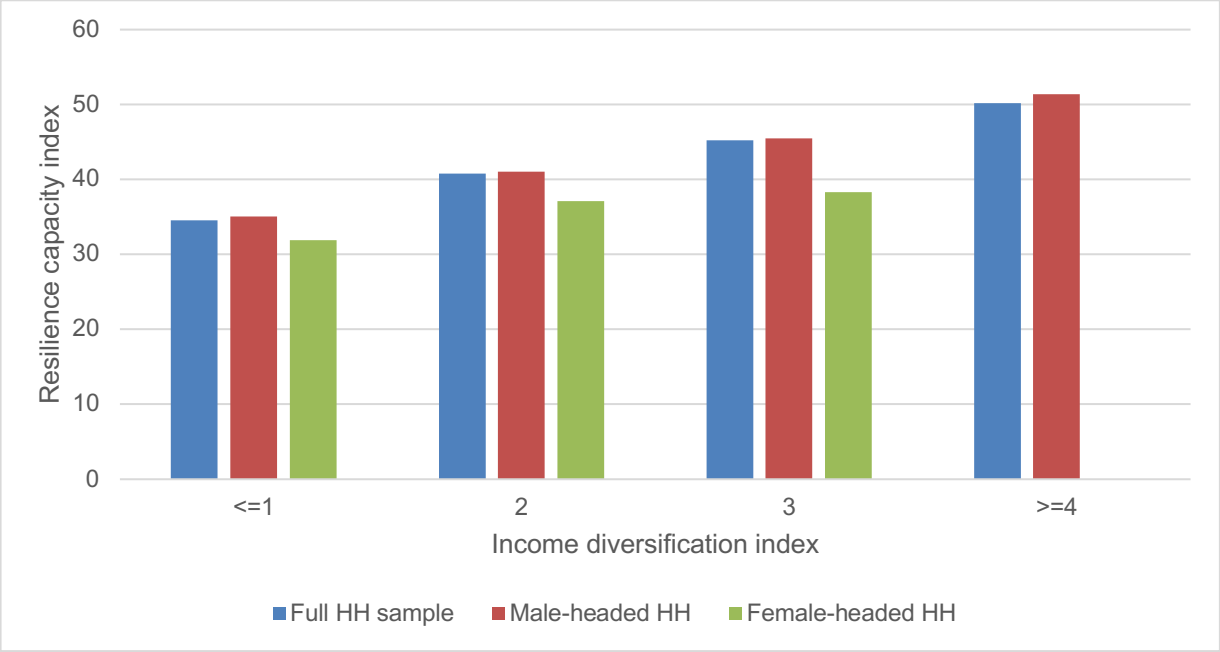
4.1 Drivers of household resilience, dietary diversification index and food expenditure

Table 3 presents the results of fixed effect model estimation. Household demographic and socioeconomic characteristic have an important correlation with household resilience capacity and food security.

Considering the drivers of RCI, results indicate that the sex of the household head has a significant causality with resilience capacity. Households headed by women have lowest RCI compared to those headed by men. Age of household head has a significant positive statistical association with household RCI while age-squared has a negative statistical association with resilience. This result is explained by the fact that, age of household is a proxy indicator of household experience with climate and idiosyncratic shocks (Martey *et al.,* 2012; Gebregziabher *et al.*, 2012; Abate *et al.*, 2014; Atozou *et al.,* 2017). Household head age-squared is considered as physical capacity reduction, and this limits the capacity of households in his planning activities to copes with shocks and risks. The size of household is also significantly and positively associate with household capacity to cope with shock, and this specifically in rural area. The size of household may harm households in terms of food security and malnutrition if dominated by children and elders; meanwhile it is increasing the labour forces in rural areas (agriculture) and can be a source of income for the households if it is dominated by active members. By contrast, this can contribute to increasing the dependency ratio, which is negatively and significantly associated to RCI. The index of governance[6] is also an important driver of household resilience capacity to cope with shocks and stressors. Mainstreaming women in household decision-making contributes significantly and positively in building household resilience capacity, in rural as well as urban areas.

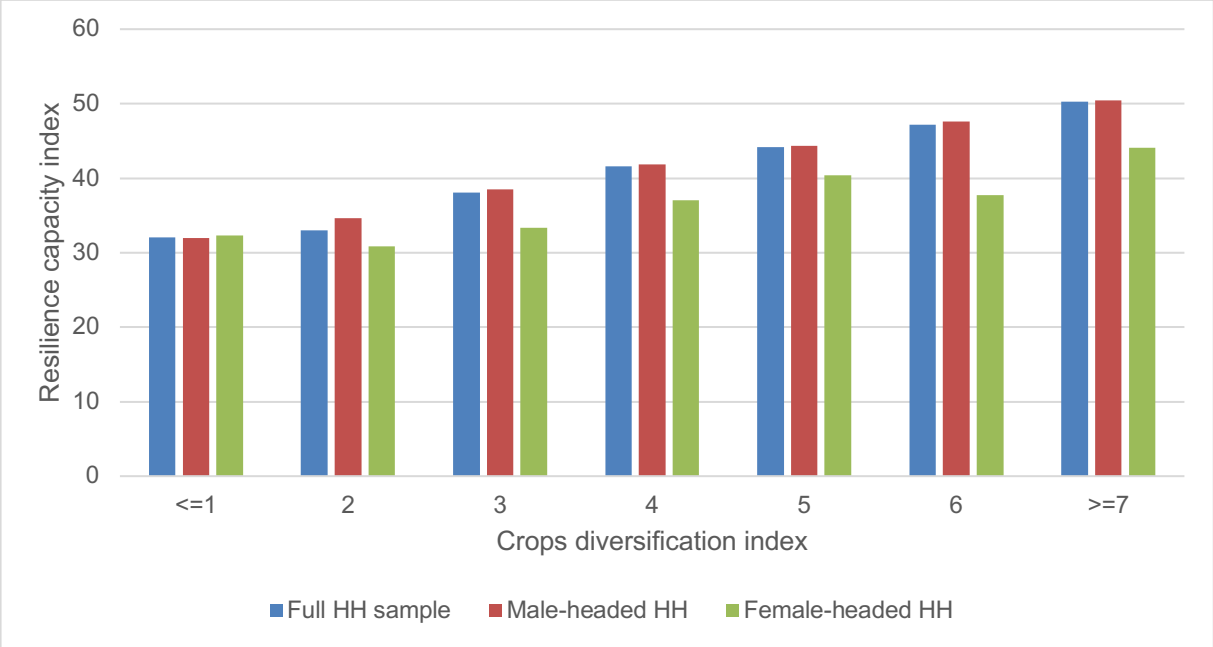
[6] The governance index is calculated using factor analysis on household participation, awareness and implementing inclusive development policies and programme including health, education, law, and decentralization government policies; communities and villages development programmes and projects; and participation of women in the community development committee.

Figure 4. Resilience capacity index and income diversification index



Source: Author's own elaboration.

Figure 5. Resilience capacity index and crops diversification index



Source: Author's own elaboration.

While the assets and adaptive capacity pillars are the keys in resilience building, the results show that access to agriculture and livestock market, access to electricity and improved toilets are significantly important in households' resilience building. The results indicate that livestock (TLU),[7] wealth index, agriculture wealth index, land (ha), and being the owner of the house value are all positively associated to RCI. The results indicate that, in the Gambia, resilience short term intervention should focus on household's assets and adaptive capacity building to strengthen their resilience and food security. Moreover, social safety nets aspects are also important to household resilience capacity building in the Gambia. Specifically, household access to credit and saving, and participation in the social capital production such as association are positively and significantly associated to RCI. Crops and income diversification indexes positively contribute to the capacity of the household to cope with climate and idiosyncratic shocks and risks. Figures 4 and 5 show graphically the positive link between household RCI and income and crop diversification index. Increasing household monthly income is also important for the resilience building in the Gambia. These results are consistence in urban and rural areas. Furthermore, Results indicate that mainstreaming women in household decision-making, access to market, and access to electricity have a significant positive association with RCI in rural area, these associations are not significant in urban areas.

[7] Livestock in tropical livestock unit (TLU) is calculated by weighting the number of each species by its equivalent in TLU. TLU is commonly taken to be an animal having a live weight of 250 kg (GSARS, 2018).

Table 3. Fixed-effect ordinary least squared regression

Variable	Log RCI full sample	Log RCI urban	Log RCI rural	HDDS full sample	HDDS Urban	HDDS rural	Food exp. full sample	Food exp. urban	Food exp. rural
Female-headed household	-0.00485	0.07163***	-0.04406***	0.18746***	0.47685***	0.06746	-1.74471***	1.05094	-3.11614***
	(0.00815)	(0.01692)	(0.00900)	(0.04791)	(0.09464)	(0.05488)	(0.48754)	(0.77401)	(0.61591)
Age of household head	0.00850***	0.01647***	0.00542***	0.02423***	0.07499***	0.00318	0.30847***	0.51546***	0.24049***
	(0.00110)	(0.00274)	(0.00113)	(0.00647)	(0.01533)	(0.00687)	(0.06586)	(0.12538)	(0.07709)
Age-squared of household head	-0.00007***	-0.00015***	-0.00005***	-0.00020***	-0.00070***	-0.00001	-0.00228***	-0.00412***	-0.00172**
	(0.00001)	(0.00003)	(0.00001)	(0.00006)	(0.00015)	(0.00006)	(0.00062)	(0.00123)	(0.00072)
Number of household members	0.01463***	0.02237***	0.01287***	0.00351	0.04633***	-0.00627*	1.25936***	1.55401***	1.18073***
	(0.00062)	(0.00187)	(0.00060)	(0.00370)	(0.01063)	(0.00375)	(0.03760)	(0.08697)	(0.04203)
Rural household	-0.05727***			-0.54395***			-2.00919***		
	(0.00865)			(0.05076)			(0.51653)		
Governance index	0.00090***	0.00070***	0.00105***	0.00357***	0.00075	0.00536***	0.02991***	0.02399*	0.04265***
	(0.00014)	(0.00027)	(0.00016)	(0.00081)	(0.00151)	(0.00097)	(0.00825)	(0.01238)	(0.01084)
Number of men in household decision-making	-0.00165	-0.06459	0.00866	-0.03291	-0.13689	-0.01185	1.69789*	-2.76133	2.37393**
	(0.01707)	(0.05117)	(0.01666)	(0.10016)	(0.28585)	(0.10145)	(1.01914)	(2.33776)	(1.13853)
Number of women in household decision-making	0.03703***	0.02085	0.04096***	0.32145***	0.39303*	0.32092***	2.09940***	-0.41500	2.56625***
	(0.01288)	(0.04020)	(0.01246)	(0.07557)	(0.22471)	(0.07583)	(0.76889)	(1.83775)	(0.85106)
Female member of village development committee	0.01576	0.01209	0.01428	0.01038	0.08972	-0.01362	2.07500***	3.11628	1.80264***
	(0.01045)	(0.04802)	(0.00962)	(0.06129)	(0.26822)	(0.05859)	(0.62363)	(2.19363)	(0.65754)
Closeness to food market	0.03737***	0.02657	0.04572***	0.13818**	-0.07705	0.17247***	1.59255***	1.73030	1.91442***
	(0.01003)	(0.03531)	(0.00954)	(0.05886)	(0.19733)	(0.05805)	(0.59886)	(1.61386)	(0.65154)
Access to electricity	0.01930***	0.00106	0.03379***	0.17756***	0.01205	0.24644***	0.92124**	-0.22674	1.59461***
	(0.00676)	(0.01626)	(0.00707)	(0.03964)	(0.09084)	(0.04305)	(0.40335)	(0.74292)	(0.48320)
Closeness to public transport	-0.01420	-0.01971	-0.00647	-0.17037***	-0.14558	-0.13658**	0.03649	0.17338	0.33789
	(0.00897)	(0.02635)	(0.00886)	(0.05264)	(0.14720)	(0.05396)	(0.53558)	(1.20387)	(0.60556)
Closeness to hospital	0.02767	0.06501	0.00621	0.01938	0.24704	-0.01238	0.12382	0.89513	-1.44964
	(0.03244)	(0.05823)	(0.03961)	(0.19040)	(0.32565)	(0.24114)	(1.93734)	(2.66331)	(2.70633)
Closeness to police station	-0.01082	-0.00667	0.00099	0.10476	0.04700	0.18829	-0.26561	1.43050	-0.54498
	(0.01727)	(0.03609)	(0.01918)	(0.10132)	(0.20165)	(0.11676)	(1.03093)	(1.64913)	(1.31039)
Access to quality water	-0.00397	-0.04315*	0.00532	0.04343	-0.29507**	0.11072***	-0.31666	-1.84779*	0.11741
	(0.00726)	(0.02264)	(0.00698)	(0.04259)	(0.12647)	(0.04252)	(0.43333)	(1.03435)	(0.47725)
Access to improved toilet	0.02747***	0.03557**	0.02557***	0.12695***	0.20695**	0.09972***	2.17426***	1.71256**	2.18985***
	(0.00592)	(0.01532)	(0.00598)	(0.03474)	(0.08563)	(0.03642)	(0.35345)	(0.70034)	(0.40875)
Livestock in TLU	0.00230***	-0.00203	0.00298***	0.01194***	-0.01818	0.01599***	0.20397***	-0.08724	0.23829***
	(0.00056)	(0.00211)	(0.00053)	(0.00329)	(0.01178)	(0.00321)	(0.03346)	(0.09638)	(0.03603)
Agricultural wealth index	0.14456***	0.20994	0.12441***	0.22083	0.51846	0.10898	10.25699***	16.22192*	8.99687***
	(0.03807)	(0.19192)	(0.03473)	(0.22344)	(1.07204)	(0.21154)	(2.27353)	(8.76753)	(2.37407)
Land in hectare	0.00100***	-0.00095	0.00207***	0.00754***	0.00122	0.01270***	0.03293	-0.08535**	0.09969***
	(0.00038)	(0.00078)	(0.00042)	(0.00223)	(0.00436)	(0.00257)	(0.02270)	(0.03569)	(0.02886)
Wealth index	0.07889**	-0.00108	0.09924***	0.38450*	-0.05040	0.68192***	-2.51311	-9.09195	-1.32084
	(0.03912)	(0.19439)	(0.03649)	(0.22957)	(1.08584)	(0.22216)	(2.33595)	(8.88041)	(2.49325)

Variable	Log RCI full sample	Log RCI urban	Log RCI rural	HDDS full sample	HDDS Urban	HDDS rural	Food exp. full sample	Food exp. urban	Food exp. rural
Log house value (USD)	0.00933***	0.00600***	0.00859***	0.03040***	0.01785*	0.03178***	0.37072***	0.26812***	0.36031***
	(0.00089)	(0.00182)	(0.00102)	(0.00524)	(0.01016)	(0.00622)	(0.05332)	(0.08307)	(0.06984)
Formal transfers (USD) per capita	-0.00041	-0.00072	0.00029	-0.00289	-0.00557	0.00510	-0.03326	-0.04318	-0.00871
	(0.00051)	(0.00075)	(0.00083)	(0.00301)	(0.00419)	(0.00504)	(0.03060)	(0.03429)	(0.05657)
Informal transfers (USD) per capita	-0.00004***	-0.00004*	-0.00001	-0.00023***	-0.00027**	0.00004	-0.00155*	-0.00149	-0.00152
	(0.00001)	(0.00002)	(0.00002)	(0.00008)	(0.00012)	(0.00012)	(0.00084)	(0.00100)	(0.00139)
Access to credit or have a saving	0.04975***	0.07004***	0.04359***	0.29191***	0.34991***	0.26346***	2.43734***	2.69322***	2.32025***
	(0.00567)	(0.01403)	(0.00578)	(0.03326)	(0.07841)	(0.03521)	(0.33843)	(0.64123)	(0.39519)
Household transfers Issued per capita	-0.00081***	-0.00036***	-0.00124***	-0.00408***	-0.00256***	-0.00532***	-0.02420***	-0.01631***	-0.02633***
	(0.00006)	(0.00009)	(0.00010)	(0.00035)	(0.00050)	(0.00058)	(0.00357)	(0.00408)	(0.00655)
Number of associations	0.02987***	0.06105	0.02851***	0.23648***	0.43271*	0.22650***	1.30369***	4.03545**	1.15968**
	(0.00777)	(0.04184)	(0.00707)	(0.04561)	(0.23372)	(0.04302)	(0.46410)	(1.91147)	(0.48280)
Dependency ratio inv.	-0.35159***	-0.59366***	-0.20775***	-0.89743***	-2.33996***	-0.12906	-4.00540***	-10.44950***	-0.60181
	(0.01394)	(0.03061)	(0.01498)	(0.08528)	(0.17926)	(0.09489)	(0.86779)	(1.46602)	(1.06495)
Crop diversification index	0.04988***	0.03195***	0.05313***	0.08138***	-0.05762	0.10862***	1.17166***	0.46664	1.27714***
	(0.00207)	(0.00654)	(0.00201)	(0.01217)	(0.03655)	(0.01224)	(0.12387)	(0.29892)	(0.13736)
Educated father	0.04904***	0.08636***	0.02283***	0.28621***	0.47828***	0.15150***	-0.41439	1.67011**	-1.48639***
	(0.00659)	(0.01476)	(0.00700)	(0.03870)	(0.08255)	(0.04265)	(0.39374)	(0.67514)	(0.47871)
Income diversification index	0.07452***	0.07687***	0.07155***	0.26191***	0.31233***	0.24561***	0.87040***	-0.01229	0.95587***
	(0.00437)	(0.01215)	(0.00437)	(0.02563)	(0.06797)	(0.02662)	(0.26074)	(0.55585)	(0.29879)
Household income per month (USD)	0.00035***	0.00042***	0.00029***	0.00220***	0.00241***	0.00191***	0.01743***	0.02059***	0.01717***
	(0.00004)	(0.00009)	(0.00005)	(0.00026)	(0.00048)	(0.00032)	(0.00268)	(0.00393)	(0.00359)
Child growth programme				0.28222***	-0.00097	0.34718***	3.70562***	0.69670	4.07548***
				(0.03919)	(0.09581)	(0.04146)	(0.39881)	(0.78359)	(0.46531)
Constant	2.94307***	2.96270***	3.30959***	7.54403***	7.75182***	9.13735***	6.06356**	10.68303**	21.24264
	(0.03930)	(0.09310)	(0.27107)	(0.23202)	(0.52206)	(1.65006)	(2.36083)	(4.26962)	(18.51846)
LGA Fixed Effect control	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	13280	3334	9946	13281	3334	9947	13281	3334	9947
F-stat	266.13848	83.05712	208.16718	84.32625	32.36309	62.40094	158.25428	54.79677	117.97265
Prob. > F-stat	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
R-squared	0.43304	0.48250	0.43062	0.19896	0.27179	0.18897	0.31793	0.38724	0.30580
Adjusted R-squared	0.43141	0.47669	0.42855	0.19660	0.26339	0.18594	0.31592	0.38017	0.30321

Note: ***, ** and * respectively significant at 1 percent, 5 percent and 10 percent.

Source: Author's own elaboration.

The food security indicators used in this study are Household Dietary Diversity Score (HDDS) and household food expenditure. The results highlight the positive relation of being female headed household and HDDS. Women, relative to men tend to spend their income more than men on food for the family (Quisumbing *et al.,* 1996). Literature shows that women care more about their household feeding than men. Indeed, women spend their earnings in household food consumption compared to male heads of households. Moreover, women incomes although lower are more strongly associated with improvements in children's health and nutrition status than are men's income (Quisumbing *et al.,* 1996, Sraboni *et al.*, 2014). However, the paper's results (Table 3) indicate that female-headed households have significantly less food expenditure compared to male-headed households. Moreover, the results reveal that improving governance in community, integration women in household decision-making are important to improve household food security notably through dietary diversification and food expenditure. These evidences are consistence with the literature. Indeed, Sraboni *et al.* (2014) find that increases in women's empowerment are positively associate with calorie availability and diversity at the household level. Access to basic services is key for household food security improvement especially in rural areas.

Access to market, improved availability and access to food, pushing for household livelihood diversification by developing businesses, may encourage household investment in agricultural production to increase their production and therefore their income. The results show the strong and positive association of household access to market, electricity and improved toilet with HDDS and food expenditure. Zakari *et al.* (2014) finds the same result of household closeness to market on its food security. Access to market is strongly associated with household food security in West Africa especially on its daily rations in the Niger.

Asset is other important aspects of food security in developing countries. Improving household access to productive and unproductive assets is important for strengthening household livelihoods and therefore improve food security and nutrition. Our results indicate that assets notably land, livestock, agricultural wealth index, and house value are significantly and positively associated with household dietary diversification and food expenditure. The assets are a key for sustainable livelihood development and food security improvement (DFID, 2009). Guyo (2011) found the same results, that household assets have a significant association with food security. In addition, asset is key factors for food insecurity reduction in rural areas (Table 3), and that is consistent with literature. Indeed, Kratli *et al.* (2013) demonstrate that livestock assets play a huge role in household food income improvement in Burkina Faso, Chad, Kenya, Mali, the Niger, Somalia, Sudan and the United Republic of Tanzania. For example, in the Niger, the livestock sector is the second source of export revenue after uranium, with pastoralism and agropastoralism systems representing 81 percent of production (Kratli *et al.*, 2013). In Chad, pastoralism livestock make up 40 percent of agricultural production and 18 percent of gross domestic product. On the other hand, Quisumbing *et al.* (1996), and Muraoka *et al.* (2018) find that land access is one of the key drivers of food security. Improving household access to land increase household food consumption, cereal consumption, and home-produced food consumption per adult equivalent (Muroaka *et al.*, 2018).

The social capital such as associations in the community is important for households in hardship period. In fact, vulnerable households rely on the support of the associations and relative to cope with shocks and stressors (RWG, 2014; FAO, 2018; FAO, 2019). The results highlight that participation of households in associations is associated to food security improvement. This result is due to the fact that, household can rely on social capital in case

of hardship. Social capital is associated with positive livelihood outcomes, such as food security, improved incomes and use of natural resources (Sseguya, 2009). Martin *et al.* (2004) indicates that social capital, both at household (relatives i.e. friends and parents) and community levels (associations), is significantly associated with household food security. Gallaher *et al.* (2013) found that social capital has positive impact on household food security by improving household dietary diversity and by reducing the need to resort to emergency and crisis coping mechanisms that are used during food shortages. social capital-related failures are linked to food insecurity in the community, including a breakdown in two-parent families, divergences between religious groups, ambiguous leadership characterised by conflict, and changes in cultural norms (Misselhorn, 2009). Moreover, Sseguya (2009) found that bridging and linking social capital characterized by household membership in groups, access to information from external institutions, and observance of norms in groups were positively associated with food security in southern Uganda. Having a household member who participates in a social or civic organization is also significantly associated with having higher levels of social capital. Social capital, particularly in terms of reciprocity among neighbours, contributes to household food security (Martin *et al.*, 2004). In addition, access to credit and saving contribute improve food security of the household. Households with credit access tend to have greater calorie consumption per capita (Mavimbela *et al.,* 2010; Bidisha *et al.,* 2017). At household level, households that know and trust their neighbours may be more likely to borrow food, borrow a car to get to the supermarket, or reciprocate with child-care responsibilities (Martin *et al.*, 2004). These seemingly trivial favours could conceivably make a large difference in terms of access to food, especially for low-income households. The authors suggested that, at the community level, neighbourhoods with higher social capital might be more likely to have grocery stores that allow customers to use credit and pay for food later.

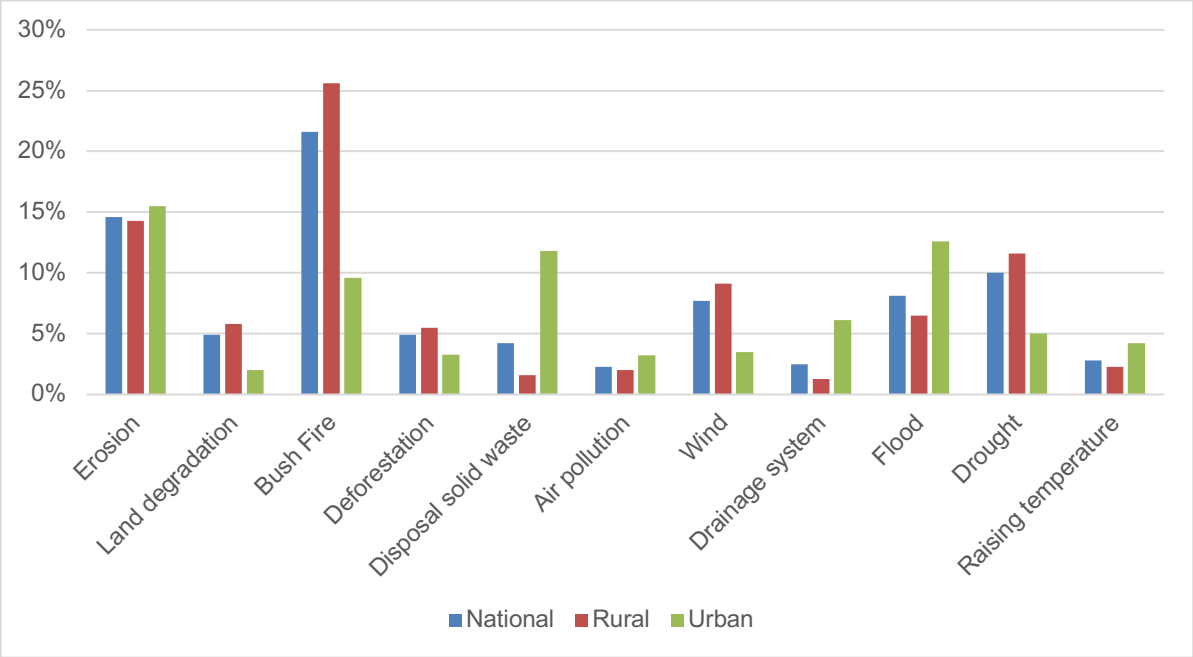
Literature indicates that having a diversified income portfolio is positively associated with food security (Reardon *et al.,* 1991) (Quisumbing *et al.,* 1996; Aidoo *et al.*, 2013). It highlights that income diversification is an important strategy for rural households to manage extreme climatic events (Wan *et al.*, 2016). Aidoo *et al.* (2013), analysed the impact of crop diversification on dietary diversity and agricultural income using data from household surveys of rural households from eight developing and transition economies. Their results show a positive correlation between the number of crops cultivated, household income from crops, and dietary diversity. Asfaw *et al.* (2016) find that crop diversification is positively and significantly associate to food security. As Aidoo *et al.* (2013) and Asfaw *et al.* (2016), our results confirm this statistical association of crop diversification to food security indicators.

Our results suggest that crops diversification and income diversification are significantly and positively associated with household dietary diversity score and food expenditure. Therefore, resilience capacity to food insecurity and livelihoods strengthening programmes or intervention should include crops and income diversification components by providing trainings on business development, and on agricultural innovative techniques adoption particularly pushing for crop diversification also with the help of improved seeds adoption. Indeed, these results are consistent with previous studies. Meldrum *et al.* (2018) indicate that crop diversification is central to risk management practices, and strengthening resilience will require a combination of actions, including maintaining and expanding crop portfolios and restoring soil and ecosystem health, using both traditional and innovative approaches. Akinnagbe and Irohibe (2014) indicate that agricultural adaptation strategies used by farmers include the adoption of drought resistant varieties, crop diversification, changes in cropping

pattern and calendar of planting. Figure 4 presents the main environmental concerns reported by households. Climate changes risks including erosion, drought, flood, land degradation, and wind are the recurrent climate events that face Gambian households in rural as well as in urban areas. Improving stressors and shocks strategies adoptions is key to ensure sustainable food security and building household resilience capacity.

In addition, the findings (Table 3) suggest that the participation of household members in children's growth programme's[8] interventions is a key determinant of the improvement of the diet quality of the household. Indeed, children's growth programme is positively associated with household dietary diversity score, a key aspect of diet quality (Bailey and Hedlund, 2013).

Figure 6. Main environmental concerned reported by households



Source: Author's own elaboration.

4.2 Drivers of resilience capacity index and food security gender differential gaps

We rely on the Oaxaca-Blinder decomposition approach (Blinder, 1973; Oaxaca, 1973) to identify the drivers of the RCI and food security indicators differentials between male-headed households and female-headed households. Oaxaca-Blinder model allows for quantification of the contributions of the explanatory variables to the RCI, HDDS and household food expenditure for male and female-headed households (Oseni *et al.,* 2014). Aguilar *et al.* (2014) indicate that these decomposition methods enable to decompose the gender differential in to: (i) the proportion due to observable differences in the drivers of RCI and in the factors of food security indicators (endowment effect) and (ii) gender differences in their returns (structural effect) (Aguilar *et al.,* 2014; Oseni *et al.*, 2014). Oaxaca-Blinder model allows for the quantification of the contributions of the explanatory factors to the RCI and food security indicator differentials for male-headed and female-headed households (Oaxaca, 1973; Blinder, 1973; Oseni *et al.,* 2014).

[8] See variable Child growth programme in Table 3.

The decomposition results in Table 4 are a function of the mean difference variables (reported in Table 2) by gender of household head and fixed effects least squared regressions estimated parameters reported in Table 3 (respectively for RCI, HDDS and household food expenditure). We run the analysis at the national, rural and urban level as specified in Tables 2, 3, and 4. Therefore, Table 4 spotlights the drivers of gender resilience and food security indicators differentials at the national, urban and rural level.

Table 4. Decomposition of the gender differential in resilience capacity and food security

Variable	Log RCI full sample	Log RCI urban	Log RCI rural	HDDS full sample	HDDS urban	HDDS rural	Food exp. full sample	Food exp. urban	Food exp. rural
DIFFERENTIAL									
Prediction male-headed household	3.54524***	3.43702***	3.57837***	9.07857***	9.33333***	9.00057***	38.97057***	34.59756***	40.30946***
	(0.00379)	(0.01028)	(0.00375)	(0.01854)	(0.04774)	(0.01923)	(0.20866)	(0.41638)	(0.23909)
Prediction female-headed household	3.42124***	3.50548***	3.37510***	9.19762***	9.83511***	8.84879***	30.84062***	35.40320***	28.34396***
	(0.00876)	(0.01640)	(0.00991)	(0.04768)	(0.08292)	(0.05565)	(0.42350)	(0.83680)	(0.45286)
Difference	0.12400***	-0.06846***	0.20327***	-0.11905**	-0.50178***	0.15178***	8.12995***	-0.80564	11.96550***
	(0.00955)	(0.01936)	(0.01060)	(0.05115)	(0.09568)	(0.05887)	(0.47212)	(0.93467)	(0.51209)
EXPLAINED									
Age of household head	0.00578*	-0.02969**	0.00759***	0.01633*	-0.13520**	0.00442	0.20794*	-0.92938**	0.33429**
	(0.00315)	(0.01170)	(0.00292)	(0.00980)	(0.05632)	(0.00992)	(0.11931)	(0.39381)	(0.15302)
Age-squared of household head	-0.00508*	0.02950***	-0.00723***	-0.01359	0.14008**	-0.00167	-0.15504*	0.82884**	-0.25664*
	(0.00279)	(0.01117)	(0.00270)	(0.00843)	(0.05644)	(0.00973)	(0.09387)	(0.36420)	(0.13693)
Rural household	-0.00684***			-0.06488***			-0.23963***		
	(0.00129)			(0.00921)			(0.06249)		
Number of household members	0.04002***	0.01685***	0.04299***	0.00960	0.03490***	-0.02097*	3.44927***	1.17083***	3.94997***
	(0.00246)	(0.00390)	(0.00291)	(0.00886)	(0.01108)	(0.01139)	(0.21480)	(0.26761)	(0.27481)
Governance index	0.00254***	0.00017	0.00210***	0.01010***	0.00018	0.01078***	0.08459***	0.00582	0.08572***
	(0.00066)	(0.00080)	(0.00068)	(0.00317)	(0.00094)	(0.00362)	(0.02770)	(0.02752)	(0.03150)
Number of men in household decision-making	-0.00011	-0.00405	0.00061	-0.00222	-0.00858	-0.00083	0.11467	-0.17303	0.16586
	(0.00118)	(0.00335)	(0.00127)	(0.00664)	(0.01487)	(0.00757)	(0.10077)	(0.26664)	(0.11142)
Number of women in household decision-making	-0.00161**	-0.00101	-0.00176**	-0.01394***	-0.01909*	-0.01374***	-0.09104*	0.02016	-0.10984*
	(0.00064)	(0.00201)	(0.00069)	(0.00397)	(0.01010)	(0.00459)	(0.05145)	(0.14699)	(0.05694)
Female, member of village development committee	0.00102*	0.00015	0.00112	0.00067	0.00112	-0.00107	0.13487***	0.03892	0.14168**
	(0.00058)	(0.00050)	(0.00070)	(0.00334)	(0.00294)	(0.00408)	(0.04938)	(0.03667)	(0.06201)
Closeness to food market	-0.00184***	-0.00063	-0.00296***	-0.00684**	0.00183	-0.01128***	-0.07886**	-0.04116	-0.12521***
	(0.00053)	(0.00082)	(0.00077)	(0.00289)	(0.00432)	(0.00410)	(0.03234)	(0.04494)	(0.04691)
Access to electricity	-0.00280***	-0.00006	-0.00377***	-0.02574***	-0.00063	-0.02742***	-0.13356**	0.01181	-0.17742***
	(0.00102)	(0.00082)	(0.00095)	(0.00626)	(0.00462)	(0.00614)	(0.05916)	(0.03579)	(0.05984)
Closeness to public transport	0.00100	0.00040	0.00060	0.01204***	0.00296	0.01274**	-0.00258	-0.00353	-0.03151
	(0.00062)	(0.00058)	(0.00084)	(0.00395)	(0.00338)	(0.00536)	(0.03701)	(0.02635)	(0.05432)
Closeness to hospital	-0.00033	-0.00037	-0.00004	-0.00023	-0.00141	0.00008	-0.00146	-0.00510	0.00958
	(0.00046)	(0.00052)	(0.00027)	(0.00259)	(0.00243)	(0.00166)	(0.02464)	(0.02078)	(0.01675)
Closeness to police station	0.00052	0.00014	-0.00004	-0.00506	-0.00101	-0.00740	0.01282	-0.03061	0.02142
	(0.00101)	(0.00086)	(0.00089)	(0.00556)	(0.00455)	(0.00531)	(0.05186)	(0.04029)	(0.05322)
Access to quality water	0.00020	0.00058	-0.00029	-0.00224	0.00394	-0.00596**	0.01631	0.02468	-0.00632
	(0.00034)	(0.00060)	(0.00037)	(0.00209)	(0.00401)	(0.00257)	(0.02266)	(0.02708)	(0.02581)
Access to improved water	-0.00271***	-0.00066	-0.00212***	-0.01249***	-0.00382	-0.00822**	-0.21386***	-0.03161	-0.18046***
	(0.00067)	(0.00077)	(0.00063)	(0.00375)	(0.00449)	(0.00339)	(0.04445)	(0.03702)	(0.04775)
Livestock (TLU)	0.00330***	-0.00054	0.00513***	0.01713***	-0.00481**	0.02753***	0.29261***	-0.02306	0.41027***
	(0.00094)	(0.00039)	(0.00097)	(0.00507)	(0.00219)	(0.00499)	(0.07308)	(0.02194)	(0.08300)

Variable	Log RCI full sample	Log RCI urban	Log RCI rural	HDDS full sample	HDDS urban	HDDS rural	Food exp. full sample	Food exp. urban	Food exp. rural
Agricultural wealth index	-0.00305	-0.01673	0.00781***	-0.00462	-0.04131	0.00686	-0.21462	-1.29240	0.56657***
	(0.00220)	(0.01578)	(0.00236)	(0.00501)	(0.06685)	(0.01175)	(0.15638)	(0.99214)	(0.17973)
Land in hectare	0.00181***	-0.00058	0.00392***	0.01368***	0.00074	0.02410***	0.05971	-0.05171	0.18919***
	(0.00061)	(0.00042)	(0.00096)	(0.00361)	(0.00183)	(0.00535)	(0.04095)	(0.03178)	(0.06279)
Wealth index	-0.00214	0.00008	0.00517**	-0.01036	0.00393	0.03562***	0.06774	0.70940	-0.06900
	(0.00145)	(0.01391)	(0.00210)	(0.00750)	(0.06403)	(0.01250)	(0.07624)	(0.87081)	(0.14287)
Log house value (USD)	0.00133	-0.00483***	0.00168**	0.00443	-0.01436*	0.00634**	0.05398	-0.21573**	0.07193**
	(0.00085)	(0.00164)	(0.00083)	(0.00284)	(0.00801)	(0.00322)	(0.03427)	(0.08680)	(0.03624)
Formal transfers in USD per capita	-0.00003	-0.00020	0.00001	-0.00021	-0.00156	0.00014	-0.00244	-0.01210	-0.00024
	(0.00005)	(0.00024)	(0.00003)	(0.00034)	(0.00163)	(0.00036)	(0.00384)	(0.01563)	(0.00148)
Informal transfers in USD per capita	0.00254**	0.00274**	0.00068	0.01424**	0.01786**	-0.00227	0.09521**	0.09738	0.08268
	(0.00100)	(0.00124)	(0.00139)	(0.00602)	(0.00770)	(0.00816)	(0.04443)	(0.06492)	(0.05258)
Access to credit or having saving	-0.00138**	-0.00123	-0.00076	-0.00817**	-0.00613	-0.00473	-0.06824**	-0.04721	-0.04161
	(0.00064)	(0.00153)	(0.00068)	(0.00377)	(0.00768)	(0.00411)	(0.03201)	(0.05913)	(0.03650)
Household transfers issued per capita	-0.00271***	-0.00405***	-0.00197***	-0.01370***	-0.02877***	-0.00847**	-0.08120***	-0.18320***	-0.04195***
	(0.00070)	(0.00146)	(0.00076)	(0.00355)	(0.00865)	(0.00332)	(0.02009)	(0.04547)	(0.01625)
Number of associations	0.00016	0.00037	-0.00022	0.00128	0.00260	-0.00175	0.00708	0.02425	-0.00896
	(0.00028)	(0.00039)	(0.00040)	(0.00222)	(0.00268)	(0.00315)	(0.01245)	(0.02665)	(0.01649)
Dependency ratio, inv.	0.00882***	-0.00351	0.00398***	0.02272***	-0.01385	0.00252	0.10140***	-0.06184	0.01176
	(0.00216)	(0.00639)	(0.00152)	(0.00596)	(0.02519)	(0.00231)	(0.03231)	(0.11274)	(0.02028)
Crop diversification index	0.04517***	0.00392**	0.04838***	0.07376***	-0.00706	0.09910***	1.06204***	0.05722	1.16524***
	(0.00271)	(0.00162)	(0.00317)	(0.01195)	(0.00464)	(0.01395)	(0.13490)	(0.04410)	(0.15464)
Educated father	-0.00271***	-0.00501**	-0.00049	-0.01577***	-0.02773**	-0.00322	0.02284	-0.09682*	0.03156
	(0.00065)	(0.00199)	(0.00033)	(0.00389)	(0.01125)	(0.00216)	(0.02212)	(0.05319)	(0.02180)
Income diversification index	0.03359***	0.01662***	0.03901***	0.11819***	0.06754***	0.13407***	0.39277***	-0.00266	0.52178***
	(0.00225)	(0.00323)	(0.00282)	(0.01213)	(0.01724)	(0.01552)	(0.12742)	(0.12608)	(0.17573)
Household income per month (USD)	0.00243***	0.00727***	0.00309***	0.01541***	0.04137***	0.02019***	0.12188***	0.35412***	0.18101***
	(0.00070)	(0.00209)	(0.00077)	(0.00431)	(0.01178)	(0.00478)	(0.03686)	(0.10639)	(0.05107)
Child growth programme				0.06043***	-0.00007	0.08789***	0.79346***	0.04888	1.03176***
				(0.00887)	(0.00628)	(0.01162)	(0.09611)	(0.05730)	(0.13149)
Total	0.11915***	0.00317	0.15921***	0.06840**	-0.02494	0.21925***	6.38524***	0.24530	8.84936***
	(0.00683)	(0.01509)	(0.00731)	(0.02882)	(0.05810)	(0.03281)	(0.32972)	(0.59941)	(0.40063)
UNEXPLAINED									
Age of household head	0.49525***	0.39064	0.57695***	2.78624***	4.62864***	2.82896***	12.89239	-6.41685	17.87661**
	(0.14024)	(0.28445)	(0.16437)	(0.89404)	(1.66140)	(1.07986)	(8.06321)	(14.57000)	(8.99461)
Age-squared of household head	-0.18989***	-0.15151	-0.22957***	-1.08320**	-1.91201**	-1.18334**	-4.00734	3.32772	-5.44517
	(0.06792)	(0.13473)	(0.08186)	(0.44579)	(0.81026)	(0.55127)	(4.05076)	(7.24197)	(4.44268)
Rural household	0.01038			0.03794			0.11540		
	(0.01500)			(0.09822)			(0.75877)		
Number of household members	-0.06729***	-0.03388	-0.07201***	-0.15803	-0.04977	-0.10786	-2.03940**	-0.89692	-2.63270**
	(0.01519)	(0.02928)	(0.01729)	(0.09661)	(0.17171)	(0.11824)	(1.03625)	(1.96678)	(1.14124)

Variable	Log RCI full sample	Log RCI urban	Log RCI rural	HDDS full sample	HDDS urban	HDDS rural	Food exp. full sample	Food exp. urban	Food exp. rural
Governance index	-0.00557	0.01437	-0.06353*	0.11127	-0.06194	0.12276	-2.33911*	-1.13125	-5.28055***
	(0.02645)	(0.03622)	(0.03768)	(0.17711)	(0.22420)	(0.28076)	(1.32678)	(1.85561)	(1.74324)
Number of men in household decision-making	0.07833	-0.00591	0.09912	0.27261	-0.12898	0.59265	5.48228	2.59510	4.68748
	(0.07776)	(0.07577)	(0.09163)	(0.49777)	(0.41893)	(0.52166)	(4.15518)	(6.34933)	(5.36591)
Number of women in household decision-making	-0.00011	-0.00571	0.00194	-0.01465	-0.05528**	0.01921	0.14696	0.17003	-0.00826
	(0.00611)	(0.00391)	(0.00728)	(0.03939)	(0.02344)	(0.04068)	(0.30176)	(0.27159)	(0.42127)
Female member of village development committee	-0.00066	0.00102	-0.00102	-0.00158	0.01144	-0.00493	-0.05369	0.04781	-0.09613
	(0.00105)	(0.00145)	(0.00134)	(0.00633)	(0.01086)	(0.00778)	(0.08112)	(0.06340)	(0.11462)
Closeness to food market	-0.01896***	0.00000	-0.02145***	-0.06515	-0.07096	-0.05584	-0.80443**	0.62439	-1.00032**
	(0.00607)	(0.01451)	(0.00711)	(0.03975)	(0.08054)	(0.04813)	(0.35891)	(0.90594)	(0.40985)
Access to electricity	-0.00740	-0.03102	0.00444	0.04002	-0.02171	0.07393*	0.30988	0.47833	0.39449
	(0.00789)	(0.02772)	(0.00587)	(0.05079)	(0.17165)	(0.03982)	(0.41545)	(1.25554)	(0.33781)
Closeness to public transport	0.00499	-0.02220	0.01166	-0.02254	-0.14769	0.03098	0.49159	-0.89616	0.74008
	(0.00783)	(0.01845)	(0.00894)	(0.04611)	(0.09581)	(0.05419)	(0.41985)	(1.03702)	(0.45727)
Closeness to hospital	0.00515**	-0.00176	0.00482***	0.02860**	-0.01120	0.02650***	0.10938	-0.35370	0.16467**
	(0.00240)	(0.00737)	(0.00168)	(0.01434)	(0.04033)	(0.00965)	(0.14521)	(0.54303)	(0.08131)
Closeness to police station	-0.01427***	-0.02512*	-0.01088**	-0.00848	-0.08007	0.00200	-0.80000***	-1.16304	-0.65891**
	(0.00512)	(0.01462)	(0.00425)	(0.03163)	(0.08612)	(0.02698)	(0.29549)	(0.79935)	(0.25626)
Access to quality water	-0.02928	-0.02538	-0.03177	-0.12949	-0.17338	-0.16056	-1.21526	-0.93276	-1.39164
	(0.02013)	(0.05231)	(0.02019)	(0.12521)	(0.28853)	(0.13528)	(0.97968)	(2.49988)	(0.99351)
Access to improved toilet	-0.00622	-0.05237**	0.00799	-0.02191	-0.23283	0.04566	0.25299	-2.57209**	0.86983**
	(0.00793)	(0.02414)	(0.00712)	(0.05159)	(0.15406)	(0.04691)	(0.41897)	(1.15622)	(0.38484)
Livestock (TLU)	-0.00067	-0.00007	-0.00041	-0.00334	0.00322	-0.00553	0.02073	-0.05057	0.09145
	(0.00164)	(0.00095)	(0.00244)	(0.01110)	(0.00514)	(0.01598)	(0.10850)	(0.05569)	(0.15992)
Agricultural wealth index	0.00168	-0.01864	-0.02343*	-0.00923	-0.37213	0.01944	0.24925	3.10871	-2.40515***
	(0.00215)	(0.09459)	(0.01406)	(0.01256)	(0.50298)	(0.08359)	(0.21618)	(5.20736)	(0.80040)
Land in hectare	0.00165	0.00281	0.00050	0.01060	0.01835	0.01755	-0.00598	0.07121	-0.09656
	(0.00290)	(0.00203)	(0.00396)	(0.01568)	(0.01150)	(0.01972)	(0.15079)	(0.07770)	(0.23201)
Wealth index	-0.00187	0.02572	0.02473*	0.01427	0.41426	0.00779	-0.35884	-3.78900	2.14289***
	(0.00253)	(0.09439)	(0.01393)	(0.01603)	(0.50279)	(0.08205)	(0.24883)	(5.22818)	(0.78327)
Log house value (USD)	0.01966*	0.01223	-0.00309	0.00571	0.00721	-0.13698	1.08546*	0.97374	0.59891
	(0.01113)	(0.01261)	(0.01676)	(0.07033)	(0.07774)	(0.10760)	(0.65744)	(0.84985)	(0.84130)
Formal transfers (USD) per capita	-0.00020	-0.00013	-0.00000	-0.00118	-0.00117	-0.00071	-0.00094	0.00131	0.01070
	(0.00023)	(0.00032)	(0.00057)	(0.00156)	(0.00223)	(0.00354)	(0.00982)	(0.01383)	(0.02260)
Informal transfers (USD) per capita	0.00014	0.00192	0.00041	-0.01269	-0.01497	-0.00183	0.53264***	0.90319***	0.09003
	(0.00282)	(0.00370)	(0.00546)	(0.01887)	(0.02544)	(0.03392)	(0.16215)	(0.26710)	(0.24232)
Access to credit/having saving	0.00578	-0.00242	0.01032	0.04384	-0.03498	0.08174	0.35334	-0.66915	0.71718
	(0.00819)	(0.01857)	(0.00876)	(0.05378)	(0.11434)	(0.05924)	(0.41864)	(0.89735)	(0.45217)
Household transfers issued per capita	-0.00246**	-0.00126	-0.00326***	-0.01771*	-0.01291	-0.01791***	-0.00246	0.01644	-0.03958
	(0.00111)	(0.00266)	(0.00098)	(0.00920)	(0.02021)	(0.00582)	(0.02825)	(0.07323)	(0.03988)

Variable	Log RCI full sample	Log RCI urban	Log RCI rural	HDDS full sample	HDDS urban	HDDS rural	Food exp. full sample	Food exp. urban	Food exp. rural
Number of associations	0.00046	-0.00002	0.00057	0.00341	-0.00412	0.00508	0.08790	0.05781	0.11567
	(0.00091)	(0.00112)	(0.00125)	(0.00569)	(0.00792)	(0.00808)	(0.07104)	(0.07882)	(0.09822)
Dependency ratio, inv.	-0.12574***	-0.24774***	-0.06004**	-0.51379***	-1.28302***	-0.20697	-2.98411***	-5.97647***	-1.27469
	(0.02314)	(0.05104)	(0.02423)	(0.13756)	(0.29185)	(0.15112)	(1.07733)	(2.23917)	(1.13265)
Crop diversification index	-0.01248	-0.00386	-0.01837	-0.06959	-0.07314	-0.05526	0.89189	0.33494	0.90286
	(0.01019)	(0.00771)	(0.01549)	(0.06859)	(0.04806)	(0.10828)	(0.55029)	(0.45552)	(0.78080)
Educated father	0.00460	0.01690	0.00296	0.03119	0.08944	0.02721	-0.00086	0.32500	0.01273
	(0.00471)	(0.01192)	(0.00446)	(0.03369)	(0.08199)	(0.03215)	(0.28874)	(0.74904)	(0.25091)
Income diversification index	0.01060	0.04226*	0.00355	0.10047	0.23772	0.07166	0.87980	1.33422	0.80418
	(0.00982)	(0.02396)	(0.01044)	(0.06692)	(0.15736)	(0.07211)	(0.58486)	(1.42011)	(0.60826)
Household income per month (USD)	-0.02554***	-0.02835	-0.02116**	-0.13802**	-0.13516	-0.12997**	-0.77374	-0.52734	-0.63638
	(0.00857)	(0.01841)	(0.00924)	(0.05554)	(0.11058)	(0.06141)	(0.54741)	(1.18015)	(0.55361)
Child growth programme				0.03982	-0.01791	0.01685	0.37537	-0.04332	0.33793
				(0.03861)	(0.06277)	(0.04781)	(0.32535)	(0.54242)	(0.38632)
Total	0.00485	-0.07163***	0.04406***	-0.18746***	-0.47685***	-0.06746	1.74471***	-1.05094	3.11614***
	(0.00832)	(0.01562)	(0.00938)	(0.05106)	(0.09459)	(0.05946)	(0.43282)	(0.79028)	(0.50605)
Constant	-0.17851	0.02094	-0.11582	-0.91443	-1.39029	-4.13540***	-7.97995	6.97892	-17.50953**
	(0.11895)	(0.19346)	(0.13746)	(0.76721)	(1.13160)	(0.78835)	(6.42080)	(10.95275)	(7.27728)
Observations	13 280	3 334	9 946	13 281	3 334	9 947	13 281	3 334	9 947

Note: ***, ** and * respectively significant at 1 percent, 5 percent and 10 percent.

Source: Author's own elaboration.

4.2.1 Mean decomposition of resilience capacity index

Table 3 presents the results of fixed effects least squared regressions. Results related to the logarithm of resilience capacity index (log RCI) indicate that at nationals (Pool N), urban (Pool U), and rural (Pool R) administration levels, the conditional mean decomposition is respectively 0.49 percent in favour of male-headed households, 7.16 percent in favour of female-headed households, and 4.41 percent in favour of male-headed households. The results in Table 4 provide that household RCI unconditional gap between female and male-headed households is 12.40 percent and 20.33 percent and statistically significant in favour of male-headed households at respectively national and rural levels; while at the urban level, the unconditional gap is 6.85 percent and statistically significant in favour of female-headed households. Indeed, Figures 7, 8, and 9 present the distribution of RCI by gender of household heads. The distributions show that male-headed households are more resilient compared to female-headed households at the national level and the rural area, while the results seem in favour of female-headed households in the urban area. The decomposition analysis results presented in Table 5 rely on Oaxaca-Blinder decomposition methods to decompose unconditional gender gaps of Table 2 into the portions due to the endowment and structural effects (Aguilar *et al.,* 2015; Oseni *et al.,* 2015).

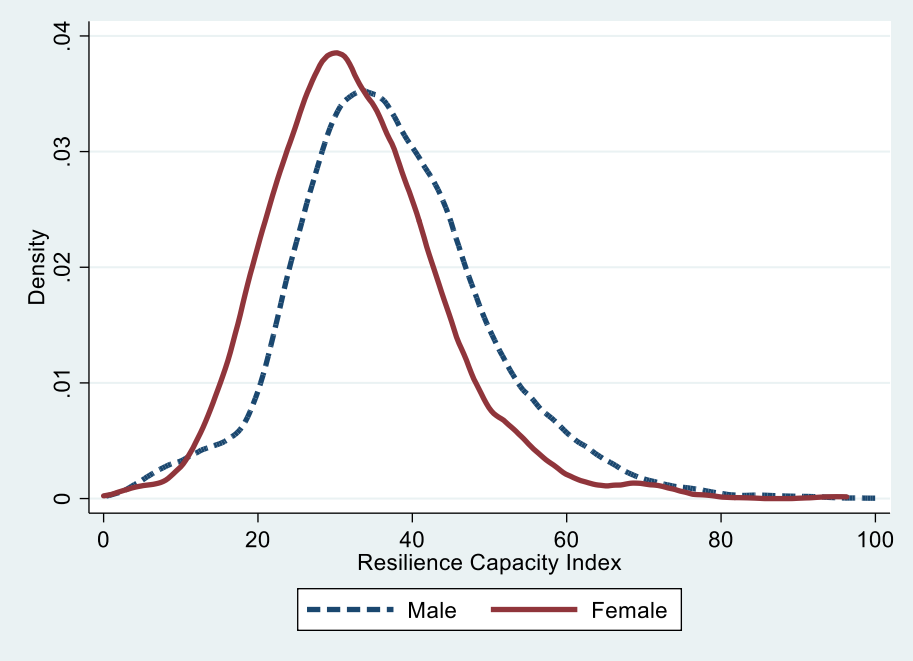
Table 4 presents the outcomes of decomposition analysis. The results in a column (log RCI Full Sample) show that of the 12.40 percent gender resilience capacity differential at the national level, 11.92 percentage points (i.e., 96.10 percent) explained by gender differences in key factors of resilience building. The unexplained or structural account for 0.49 percentage points (i.e., 3.90 percent). Results in the rural area (see columns Log RCI Rural of Table 5) indicate that of 20.33 percent gender RCI gap, 15.92 percent points (i.e., 78.32 percent) are due to gender differences in explanatory variable means level, while 4.41 percent points (i.e. 21.68 percent) are due to structural effects. The structural effect is due to the differences in returns to key resilience factors or unobservable terms (Oaxaca, 1973; Blinder, 1973; Firpo *et al.*, 2009; Firpo *et al.*, 2011; Aguilar, 2014; Oseni *et al.*, 2014; Kilic *et al.*, 2014). In the urban area, results reveal that female-headed households are more resilient than male-headed households. Column Log RCI urban in Table 5 shows that of 6.85 percent gender resilience capacity differential, 104.63 percent is due to the differences in returns of resilience factors or unobservable terms, and -4.63 percent is the endowment effect.

The identification of key factors of gender resilience capacity differential gap from the Oaxaca-Blinder decomposition results reported in Table 5 depends on the descriptive statistics (Table 2), fixed effects ordinary least squared regression (Table). We emphasize that (Aguilar *et al.*, 2014, Oseni *et al.,* 2014), the sign of each covariate in the endowment effect results is an outcome of a combination of (i) the female-headed households minus male-headed households' difference in the average value of the variable shown in Table 2, and (ii) the coefficient of such variable in the pooled fixed effect OLS. Columns 2, 3, and 4 of Table 3, present the results of RCI OLS models respectively for national, urban, and rural administration level. Similarly, columns 5, 6, and 7 of Table 3 presents the results of HDDS models, while columns 8, 9, and 10 show the results of food expenditure models.

The details of RCI decomposition results indicate that the crop diversification index, income sources diversification index, agricultural wealth index, wealth index, livestock, land, access to market, and access to electricity appear as the most important contributors toward the endowment effect. Table 2 indicates that female-headed households, on average, less diversify their crops and income sources than male-headed households. This is consistent

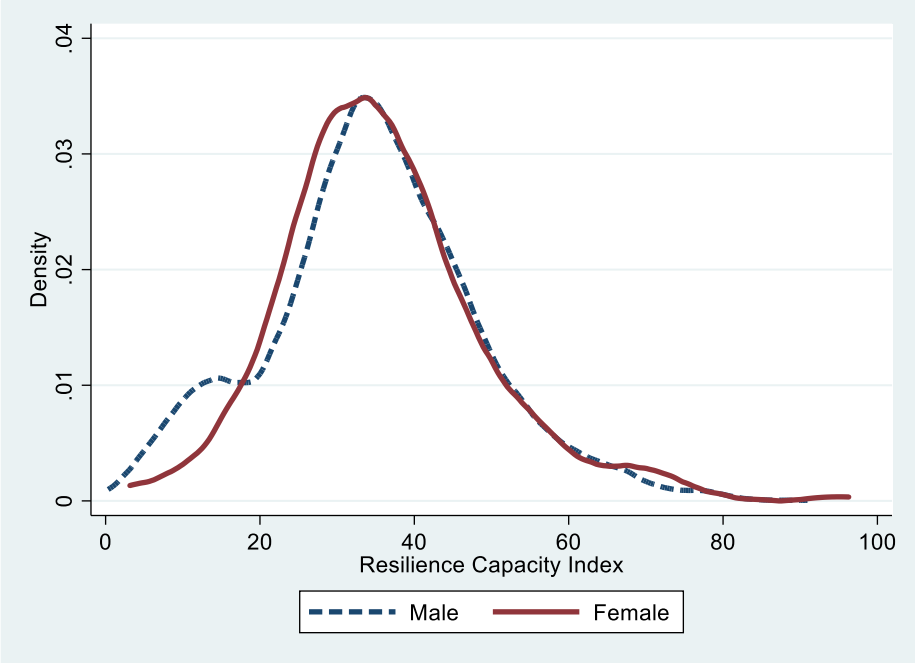
with the literature argues that male-headed household diversifies more their agricultural production (Kimhi and Chiwele, 2000; Fetien *et al.,* 2009; Rehima *et al.*, 2013; Huang *et al.,* 2014; Dube *et al.*, 2016) because of the unequal access to agricultural productive assets, to inputs such as improved seeds and fertilizer, and information (Quisumbing *et al.*, 2009). Dolan (2004) found that female household heads face distinct constraints stemming from differential access to productive resources and cultural norms, which mediate their access to livelihood strategies to diversify their income sources. Crop and income diversifications are keys determinants of household resilience building to adapt to climate change risks such as drought and flood and mitigate their negative effect on household food security and welfare (Huang, 2014; FAO, 2015a; Asfaw, Palma and Lipper, 2016; FAO, 2019a). OB decomposition results indicate that household' land size, wealth index, and livestock are important drivers of the gender resilience gap. Table 2 indicates that female-headed households on average, possess 2.9 hectares low, less wealth index, and 1.7 livestock (TLU) than male-headed households. This is consistent with substantial literature that argues that women's access to land is the main concern for their agricultural development (Quisumbing *et al.* 2009; Aguilar, 2015; FAO, 2019a). Household size, age of household head are also relevant divers of the endowment effect at national, urban and rural administrations. Household size is smaller for female-headed households with respect to male-headed households. This is due to the female-headed households' marital status, mainly widows and divorced (Aguilar, 2015). Access to resources explains most of the gender resilience capacity differentials. Also, access to improved water, access to electricity, closeness to market, governance index and women empowerment in intra-household's decision making and community development are relevant aspects to reduce the resilience gender gap. Findings suggest that Improving female-headed households' access to productive assets will improve their resilience capacity and more importantly reduce gender resilience capacity inequality. Table 5 summarizes the keys drivers of gender differential in resilience capacity, dietary diversification index, and food expenditure.

Figure 7. Distribution of household resilience capacity index at national level



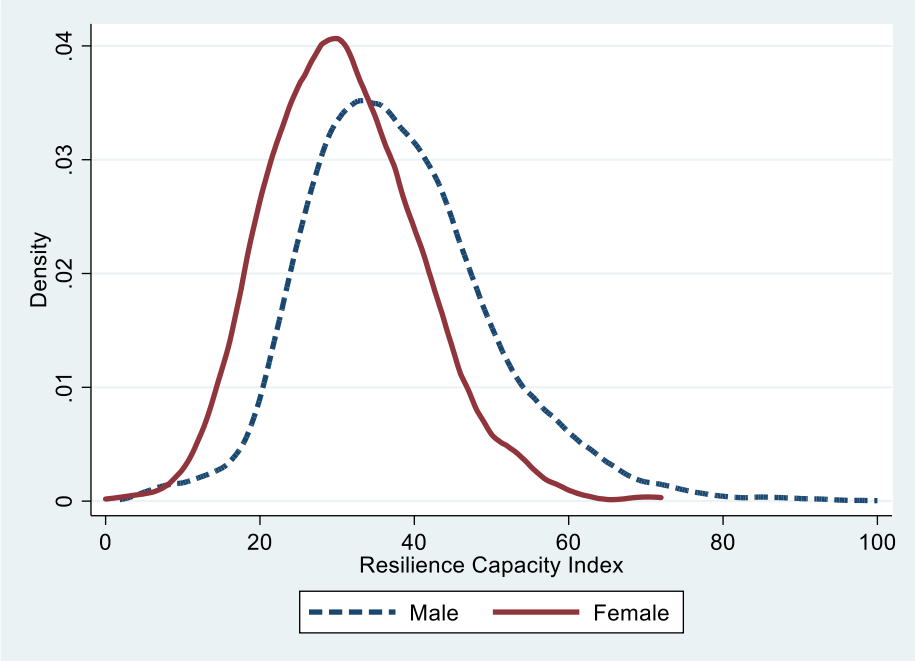
Source: Author's own elaboration.

Figure 8. Distribution of household resilience capacity index in urban areas



Source: Author's own elaboration.

Figure 9. Distribution of household resilience capacity index in rural areas



Source: Author's own elaboration.

Table 5. Statistically significant factors explaining the endowment effect in gender differential decomposition of resilience capacity index (RCI), household dietary diversification score (HDDS) and food expenditure in the Gambia

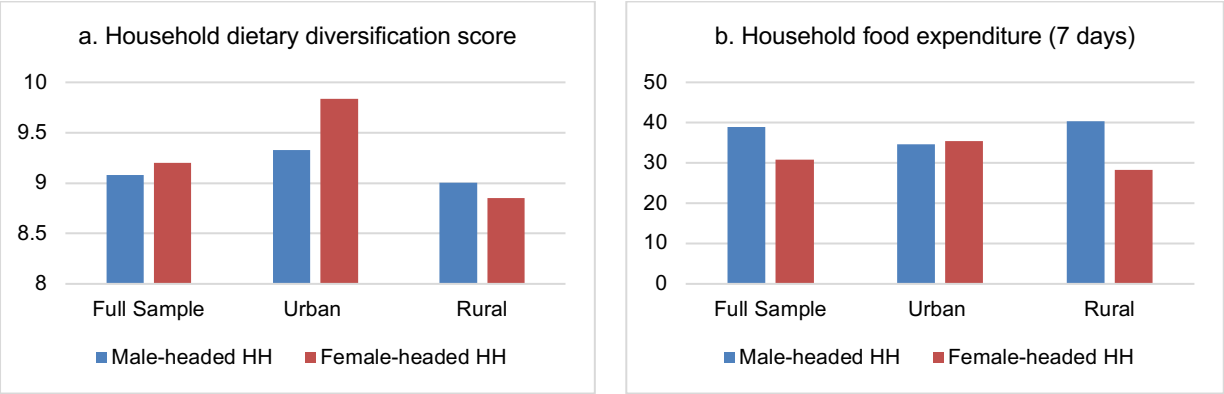
	National	Urban	Rural
Factors explaining the endowment effect in RCI gender differential decomposition	Crops diversification index, Income sources diversification, household income per month; land size, livestock (TLU), access to improved water, access to electricity, closeness to market, governance index, number of women in household decision-making, female member of the village development committee, household size, age of household head, age-squared of household head, rural household, dependency ratio, educated household head, and informal transfers, households transfers issued.	Crops diversification index Income sources diversification, household income per month, household size, age of household head, age-squared of household head, educated household head, and informal transfers, household transfers issued.	Crops diversification index Income sources diversification, household income per month, land size, livestock (TLU), agricultural wealth index, wealth index, access to improved water, access to electricity, closeness to market, governance index, number of women in household decision-making, female member of village development committee, household size, age of household head, age-squared of household head, dependency ratio.
Factors explaining endowment effect in HDDS gender differential decomposition	Crops diversification index Income sources diversification, household income per month, land size, livestock (TLU), access to improved water, access to electricity, access to credit, closeness to market, closeness to public transport governance index, number of women in household decision-making, age of household head, rural household, dependency ratio, educated household head, and informal transfers, households transfers issued, participation in child growth programme.	Income sources diversification, household income per month, livestock (TLU), number of women in household decision-making, household size, rural household, age of household head, age-squared of household head, educated household head, informal transfers, households transfers issued.	Crops diversification index Income sources diversification, household income per month, land size, livestock (TLU), wealth index, access to improved water, access to electricity, closeness to market, closeness to public transport, closeness to quality water, governance index, number of women in household decision-making, household size, house value, households' transfers issued, participation in child growth programme.
Factors explaining endowment effect in food expenditure gender differential decomposition	Crops diversification index Income sources diversification, household income per month, livestock (TLU), access to improved water, access to electricity, access to credit, closeness to market, closeness to public transport governance index, number of women in household decision-making, age of household head, age-squared of household head, rural household, dependency ratio, and informal transfers, households' transfers issued, household size, participation in child growth programme.	Household income per month, age of household head, age-squared of household head, rural household, educated household head, house value, household's transfers issued, household size.	Crops diversification index, Income sources diversification, household income per month, land size, livestock (TLU), agricultural wealth index, access to improved water, access to electricity, closeness to market, closeness to public transport governance index, number of women in household decision-making, age of household head, age-squared of household head, households' transfers issued, household size, house value, participation in child growth programme.

Source: Author's own elaboration.

4.2.2 Mean decomposition of household dietary diversification score and food expenditure

Column 5, 6, and 7 of Table 3 present the results of gender differential decomposition of Household dietary diversification score (HDDS), while columns 8, 9, and 10 highlight the results of household food expenditure gender gap decomposition. As for RCI, the decomposition analysis of food security indicators is made at national, urban and rural administrative levels. Results show that female-headed households diversified more the household diet than male-headed households at national and urban areas (Figure 6). This is in line with the literature saying that women are more forward-looking compared to male-headed households in terms of food security even if with lower income, and women's perception of food security is broader than men's (Cramer *et al.*, 2016). Results in columns 5 and 6 indicate that of the 0.12 and 0.50 point of HDDS respectively at national and urban administration in favour of female-headed households, 157.46 percent and 95.03 percent are explained by the structural effects. However, in rural areas, the HDDS gender gap is in favour of male-headed households (Figure 10). Results in column 7 of Table 3 reveal that, of 0.15 gender HDDS differential, 144.45 percent is explained by the endowment effect, i.e. by the gender differences in the means levels of assets, access to basic services, social safety nets, and adaptive capacity covariates.

Figure 10. Food security indicators by gender



Source: Author's own elaboration.

Figure 10 shows that female-headed households spend less on food per week compared to male-headed households. The food expenditure gender differential is significant at 1 percent level of significance in favour of male-headed households at the national level (USD 8.13), and at rural level (USD 11.97) while the gender gap is in favour of female-headed household but not significant in the urban area. Results suggest that of the USD 8.13 household food expenditure gender differential at the national level, 78.54 percent (i.e. USD 6.39) is explained by the endowment effect. In rural areas, the endowment effect explains 73.96 percent (i.e. USD 8.85) of the gender food expenditure gap, while the structural effect accounts for 26.04 percent. In addition to the aggregate decomposition results, Table 4 shows also detailed results that provide key drivers of gender differential in food security indicators. Table summarizes driver factors explaining the endowment effect. Most of those factors are related to productive resources, assets, access to basic services, governance and women empowerment in household decision-making. Our results indicate that the household food security gap between male-headed and female-headed households is wider in rural than in

urban areas. This is consistent with the findings of Tibesigwa and Visser (2016). The authors, in their study *Assessing gender inequality in food security among small-holder farm households in urban and rural South Africa*, found that male-headed households are more food secure compared to female-headed households and the household food security gap between male- and female-headed households is wider in rural than in urban areas.

Table 4 shows that coping strategies, crops diversification index, income sources diversification, assets (land size, livestock [TLU], agricultural wealth index), access to improved water, access to electricity, closeness to market, governance index, number of women in household decision-making, having female member of village development committee, household size, age of household head, living in rural area, and dependency ratio are all statistically significant drivers of gender differential in resilience capacity and food security indicators.

The results are consistent with substantial literature that argues that the food security differential between male-headed households and female-headed households is explained by their differences in observable and unobservable characteristics (Kassie *et al.*, 2014), and particularly in productive resources and household characteristics (Quisumbing *et al.,* 2001; Quisumbing and Kumar, 2014; Kassie *et al.*; 2014; Oseni *et al.*, 2015). Indeed, Mehra and Rojas (2008) highlight that women face significant barriers in agriculture, especially inequalities in access to and control over crucial resources and inputs such as land, labour, fertilizer and formal finance. Women also face barriers to membership in rural organizations and cooperatives, agricultural inputs and technology such as improved seedlings, training and extension, and marketing services (Mehra and Rojas, 2008). These constraints in accessing agricultural productive resources reduce the availability and accessibility of food in female-headed households and therefore their food security.

Our findings are consistent with literature on gender gaps analysis. Several studies investigated the factors that explain the gender differentials in agricultural productivity and production (Alderman *et al.*, 1995; Quisumbing, 1995; Kinkingninhoum-Medabe *et al.,* 2010; Peterman *et al.*, 2011; Peterman *et al.,* 2014 Kilic *et al.*, 2014; Aguilar *et al.,* 2015; Oseni *et al.*, 2015; Ali *et al.,* 2015). Quisumbing (1995) found that women farmers' lower yields are attributable to lower levels of inputs and human capital than men. Ali *et al.* (2015)'s findings indicate that men have greater access to inputs in Uganda. Oseni *et al.* (2015) analysis factors explaining gender differentials in agricultural production in Nigeria. The findings show that in the North, women produce 28 percent less than men after controlling for observed factors of production and women in the North have access to less productive resources than men. Similar results are carried out by Aguilar *et al.* (2015) employing data from the 2011–2012 Ethiopian Rural Socioeconomic Survey. An overall 23.4 percent gender differential in agricultural productivity is estimated at the mean in favour of male land managers, of which 10.1 percentage points are explained by differences in land manager characteristics, land attributes, and unequal access to resources. Findings of Piterman *et al.* (2014) indicate that, across different types of inputs (technological, natural, and human resources), men generally have higher input measures than women, and that this input gap is responsible for observed agricultural productivity differences between men and women. Peterman *et al.* (2011) investigate gender differences in agricultural productivity in Nigeria and Uganda and found persistent lower productivity on female-owned plots. This shows that our results are consistent with substantial literature and improving female access to agricultural productive resources and assets for livelihood development will contribute to improve food availability and reduce gender differential in food security.

5 Conclusions and policy recommendations

Resilience is increasingly seen as a unifying concept and policy instrument that is used by humanitarian and development institutions and non-governmental organizations to address the chronic vulnerability of populations exposed to recurrent shocks and stressors that threaten their food and nutrition security and livelihood. Policies need to cope with idiosyncratic and climate shocks; environment risks management; and more importantly to guide social and economic development strategies. Consequently, measurement and analysis of household resilience to food insecurity have become a key technical and evidence-based policy instruments for better-tailored development and humanitarian interventions designs for international development agencies, and countries' policymakers.

This paper aims to (i) analyse the keys drivers of household resilience to food insecurity and (ii) to assess differences in resilience capacity and food security indexes across male and female-headed households, and identify keys drivers of these differentials at national, urban, and rural areas in the Gambia. Using data from Integrated Household Survey on consumption expenditure and poverty-level assessment 2015–2016, we estimate and analyse household RCI using FAO resilience index measurement and analysis (RIMA) approach that combines factors analysis and structural equations modelling. Second, we apply Oaxaca-Blinder decomposition method to decompose the unconditional gender gap in (i) portion caused by differences in factors of resilience and food security (endowment effect) and (ii) portion caused by differences in returns of the same factors (structural effect).

The results show that asset and adaptive capacity are the most important pillars in households' resilience building in the Gambia. Moreover, districts of Foni Kansala, Foni Jarrol, Kiang West, Niamina Dankunku, King Central, Janjanbureh, Kombo East, Foni Bintang Karanai and Foni Brefet are respectively less resilient while Sami, Central Badibu, Lower Faladu West, Lower Badibu, Jarra East, Upper Baddibu, Jarra Central, and Upper are respectively the most resilient districts.

Female-headed households are 12.40 percent and 20.33 percent less resilient than male-headed households respectively at the national and rural level, while in urban level, they are 6.85 percent more resilient. Female-headed households significantly diversify their diet more than male-headed households in urban and less in rural. Females expend significantly less than male-headed households. The decomposition of RCI and food security indicators show that the endowment effect is more important than the structural effect in rural areas. The results indicate that improving governance and women mainstreaming in the household as well as in community policy-decision significantly contribute to improving household diet diversification, food consumption and resilience strengthen. Rural households are less resilient and more food insecure than urban households. Household member participation in child growth programmes has a significant positive effect on HDDS.

The analysis reveals that crop diversification, income sources diversification, women empowerment, productive assets including land, livestock, and agricultural wealth, household size, age of household head are the key drivers of resilience and food security gender gaps mostly in rural. In 2018, FAO' Gambia country profile on climate-smart agriculture highlighted the importance of agriculture in the Gambia economy. In fact, agriculture is a major economic activity in the Gambia contributing 25 percent of the gross domestic product and employing about 70 percent of the labour force with 32 percent into active primary agricultural production. Agriculture is the main source of income for about 72 percent of the extremely poor rural households. The sector is characterized by small-scale, subsistence rainfed crop production,

traditional livestock rearing, and horticultural production, small-scale cotton farming and a large artisanal fisheries sub-sector. The National Climate Change Policy (NCCP) emphasizes the evidence of Climate change impacts in the Gambia, including increasing average temperatures and a rainfall regime that is decreasing in amount while increasing in variability (Urquhart, 2016). Based on our results and the vulnerability of the Gambia economy and more specifically agriculture to climate changes risks and the important gender gaps in welfare, resilience, and food security indicators: an appropriate interventions in the Gambia should be gender sensitive and prioritize a multisectoral joint approach combining the following components: (1) promotion of adoption of agricultural climate adaptation best practices including crops diversification et short-term crops production; (2) diversification of income generation activities; (3) livestock development and access to productive assets including agricultural inputs and equipment; (4) improving household access to basic services including agricultural market, improved water, sanitation, hygiene (WASH), education et hospital; (5) family planning and promoting women access to productive assets such as land and livestock, and (6) gender mainstreaming in rural development and governance.

Investment should focus to improve access to productive assets, training programmes to educate smallholders on good agricultural practices, technologies adoption, and importance of crop diversifications as best strategy of climate risks management strategy. Gender-sensitive interventions in the Gambia should target most female-head households and support the provision of productive resources, improvement of women empowerment and promoting female-headed households' access to productive assets, basic services, and social safety nets in order to strengthen smallholders' households resilience capacity and food security, and meanwhile to reduce the gender gap in resilience and food security. Evidence suggests that, in the Gambia, strengthening rural households' awareness of climate change adaption and tailor the best adaptive strategies to cope with climate risks will contribute to improving food security and resilience of vulnerable households' specifically female-headed households.

Globally, this Gambian analysis, highlights that resilience analysis is essential and a powerful policy instrumental tool that help to response to the climate changes risks and overcomes food security challenges in all developing countries whether they are in a prolonged crisis or not. More importantly, resilience analysis is country specific. Therefore, introducing resilience and food security analysis in developing countries will provide evidence-based strategy recommendations that help the household to be prepare and to adopt anticipate actions for the generic shocks, drought, food crisis, financial crisis, and political instability and other events which may have adverse effects on their livelihoods, food and nutrition security. The resilience analysis as policy instrument to prepare households against covariate and idiosyncratic shocks and providing solutions to those suffering from shocks to cope with. These analyses help government, humanitarian and development partners to integrate into their programme and interventions design and implementation the keys pillars and determinants that improve the resilience of households.

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