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The 2012 crisis in Mali and its implications on resilience and food security

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Abstract

Food security can be considered an outcome of resilience. From this perspective, a household can be considered resilient if it manages to recover from a shock and return to the previous level of food security that it held prior to the shock occurring.

As such, exploring the nexus between resilience and conflict means looking at both a theoretical and an analytical framework that can help to establish the channels through which conflict affects resilience and, ultimately, food security. This approach also draws policy-makers' attention to the key aspects to be considered (in the case of conflict) in order to restore and/or maintain resilience and, thus, food security.

This analysis highlights that household resilience deteriorates as a result of: reduced adaptive capacity; a decrease in productive and non-productive assets; and an increase in exposure to shocks.

This paper looks at datasets from Mali in order to econometrically measure the impact of conflict – namely, the 2012 Tuareg rebellion and insurrection of Al Qaeda in the Islamic Maghreb (AQIM) – on resilience to food insecurity for the population in northern Mali. The findings of this paper show that these conflicts have had a strong impact, which must be adequately addressed with supportive interventions.

Keywords: Resilience, Food Security, Conflict, Mali, Structural equation Model

JEL codes: D74, O55, Q18

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1 Background

The nexus between food security and conflict has been and is currently being analysed by many researchers, practitioners and scholars; examples exist of various approaches to studying the effect of conflict on food security based on its connection to economic health (Collier and Hoeffler, 2004), how conflict interferes with socio-political characteristics of individuals and so their food security level (Esteban and Ray, 2009), shocks and stability (Miguel, Satyanath and Sergenti, 2004; Dube and Vargas, 2013), and income composition (Murshed and Tadjoeeddin, 2009), including dependence on aid (Grossman, 1992) and on extractive resources (Collier and Hoeffler, 2005) as key determinants of the relationship between conflict and food security. Further examples exist that attempt to explore the reverse relationship; that is, how food security can affect conflict, which generally looks into the opportunity costs of participating in conflicts (Gurr, 1993; Stewart, 2008; Justino, 2009). Although far from reaching a consensus, the discourse is alive and interesting.

However, the debate does not feature resilience, which is closely related to food security (d'Errico et al. 2016). Although many studies exist that show the link between conflict and various aspects of resilience, no attempt has been made – to the best of the knowledge of the authors of this paper – to approach this relationship in a systematic way. That is, looking at the relationship between conflict and a construct that can be defined as 'household resilience capacity'.

In a scenario of instability, the capacity of households to absorb and adapt to shocks is paramount. Livelihoods, which are already affected by extreme climate conditions and conflict over natural resources, are further jeopardised by the use of force by political actors. Therefore, exploring the link between food security, resilience and conflict can help develop a better understanding of the policy considerations needed for restoring livelihoods and meeting food security needs.

This paper seeks to contribute to the current literature by providing evidence of the negative effect of conflict on household resilience capacity, and by explaining the channels through which these effects deteriorate the capacity to 'bounce back' to a desired level of food security. It achieves its objectives by assessing the negative effects of the conflicts in the Northern regions of Mali against a household resilience measure called RIMA (presented further below in this paper); the analysis further disaggregates the resilience construct in order to assess the channels of transmission between conflict and resilience capacity.

The reminder of the paper presents the identification strategy (chapter 2); the theoretical framework of the nexus between conflict and resilience (chapter 3); the data employed (chapter 4); RIMA (chapter 5); and the estimation strategy (Chapter 6). Chapter 7 discusses the findings and chapter 8 concludes.

1.1 Identification strategy

For a number of reasons, Mali is a valid case study for exploring the relationship between conflict and resilience. Firstly, due to the fact that there is data available; second, because a conflict occurred there that can be identified and contextualized with precision. Finally, given the unique history of the country.

Even though, for a long period of time, Mali has been considered a model nation for stability and democracy in the Sahel region (Holder, 2013),¹ in 2012 the country experienced a series of disruptive events – an insurgency of various armed rebel and Islamist groups, a political coup and major military interventions by foreign powers all within a year, referred to hereafter as ‘the 2012 crisis’.

From January 2012 to January 2013, a chain reaction of events occurred that challenged the stability of the Malian nation, featuring secessionist movements, religious extremism dynamics, questioning of state legitimacy. During early 2012, the security situation in northern Mali had deteriorated due to the simultaneous occurrence of the Tuareg rebellion² and the Al Qaeda in the Islamic Maghreb (AQIM) insurgency.³ As a result of the unstable situation at that time, a political coup led by members of the local military took place in March 2012, which effectively weakened already fragile state structures.

This coup rendered the Government of Mali incapable of responding to the ongoing offensive of armed rebel groups,⁴ which were taking over three northern regions, Kidal, Gao and Timbuktu. This rebel activity triggered the deployment of the African-led International Support Mission in Mali (AFISMA)⁵ and the French-led Opération Serval, both of which were initiated in January 2013.⁶ Although the onset of the 2012 crisis was swift, it is important to stress that there were other long-term factors that contributed to this destabilizing of governance in Mali.

After a coup that took place in 1991, the establishment of Mali’s Third Republic was aimed at tackling corruption within politics and government administration. However, in 2003 corruption in these areas was still a major feature of the Government of Mali, and had spread to every level of state administration. Patronage had become a normalized practice, given that “the posts in public administration can be viewed as assets”, through which individuals could pursue their own interests (World Bank, 2015). Furthermore, the performance of public services was critically poor as a result of a lack of resources. Following on from this, the 2012 military coup established a non-democratic regime, which further distanced governance in Mali from the population and their concerns (Marchal, 2012; Siméant and Traoré, 2012).

¹ However, an analysis of recorded conflict reveals recurring waves of violence in Mali over the past 15 years preceding the more recent 2012 crisis.

² The Tuareg community is a Berber ethnic minority group that for decades had been fighting the Malian state in a claim for more autonomy in the three northern regions of Gao, Kidal and Timbuktu, designated as the ‘Azawad’ territory (Holder, 2013). The Tuareg rebellion was made in 2012 of a coalition of rebel groups in which the MNLA played a central role.

³ The Al Qaeda insurgency in Mali has been implanted in Mali since the end of the 1990’s and the early 2000’s. During this period, the Salafist Group for Preaching and Combat (*Groupe Salafiste pour la Prédication et le Combat* -GSPC) which fought the Algerian government during the civil war were eventually chased away and settled in Mali where they developed ties with Al Qaeda. In 2007, AQIM was born from the roots of the GSPC and the support from the international Islamist nebula. In early 2012, AQIM and its splinter groups actually coalesced with Tuareg rebel groups to challenge the Malian government authority in the three northern regions and to enforce secession over the Azawad territory (Sköns and Nyirabikali, 2016).

⁴ The National Movement for the Liberation of Azawad (MNLA), a Tuareg-led rebel group, initiated the insurrection against the Malian state in January 2012 and was later joined by Mouvement pour l’unicité et le jihad en Afrique de l’Ouest (MUJAO), AQIM, Ansar Dine and former Malian militaries. By November 2012, the MUJAO, AQIM and Ansar Dine controlled, respectively, the regions of Gao, Timbuktu and Kidal (Sköns and Nyirabikali, 2016).

⁵ The AFISMA was a military intervention led by the Economic Community of West African States, which was authorised during December 2012.

⁶ Ansar Dine’s subsequent armed offensive over the region of Mopti triggered the Opération Serval intervention by French forces in January 2013 (Sköns and Nyirabikali, 2016).

Figure 1 The road network and population density in Mali



Source: World Bank, 2015.

The presence of Islamist armed groups in northern Mali is a long-standing phenomenon. Islamist militants have, for centuries, championed a revision of Islam across northern Mali based on the Wahhabi and Salafist ideologies,⁷ sometimes through military means.

AQIM⁸ established its Malian base in the Tigharghar mountains in 2003 (Armstrong, 2013). AQIM and its splinter groups (e.g. the Mouvement pour l'Unité et le Djihad en Afrique de l'Ouest (MUJAO), which later merged with the Al-Mourabitoun militant group) thus became major actors in Mali's 2012 crisis.

The Tuareg people are a Berber ethnic minority group, with communities living across Mali, Niger, Burkina Faso, Algeria, Libya, Morocco and Tunisia. Mali's Tuareg population represents

⁷ Salafism is a Sunni branch of Islam that praises a return to the way of life of the 'pious ancestors' from Mohammed's time and the following two centuries. Salafism is divided in three branches: quietist, activist and jihadist. Wahhabism is a Muslim movement that derives from Salafism. Its followers are Sunni Muslims who defend an orthodox interpretation of Islam, a rejection of the cult of saints and brotherhoods, and a rigorous implementation of sharia.

⁸ AQIM has roots partly in the Algerian jihadist groups, Groupe Islamique Armé (GIA) and Groupe Salafiste pour la Prédication et le Combat (GSPC).

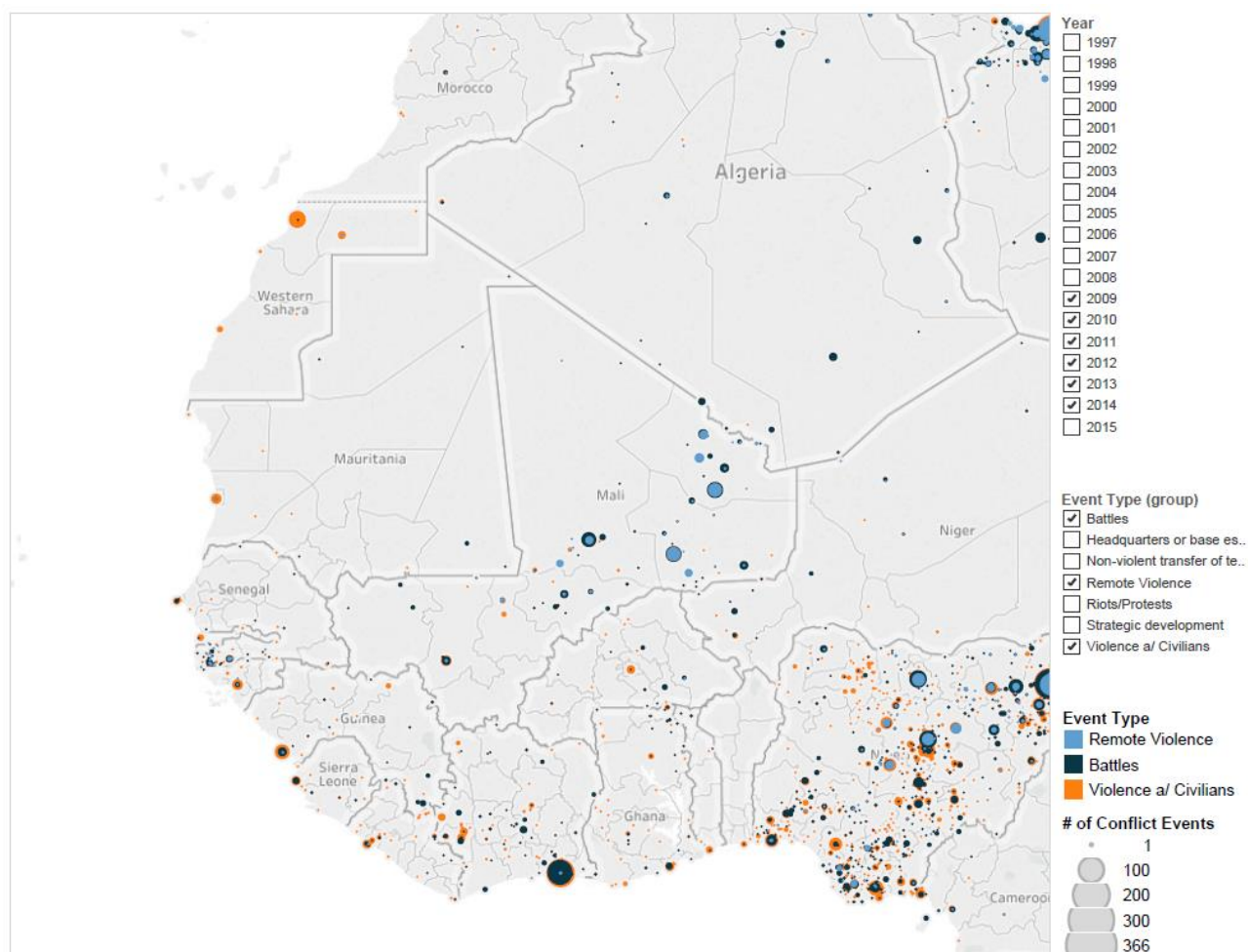
33 percent of the total Tuareg population, and 5 percent of the total population of Mali. Mali's Tuareg communities live mainly in the regions of Timbuktu, Gao and Kidal. Tuareg groups have repeatedly organized rebellions against the Government of Mali to demand an autonomous Tuareg state.

As such, one of the underlying objectives of the 1991 establishment of Mali's Third Republic was to respond to Tuareg appeals through a decentralization process that aimed to transfer administrative power to local authorities and to empower local elites in Tuareg-majority regions (Sköns and Nyirabikali, 2016). In addition, the Tamanrasset agreement, signed in 1991 between the Government of Mali and Tuareg representatives, led to the demilitarization of the north of Mali. Another peace agreement was established in 2006, which led to the withdrawal of state military representatives from the Kidal region, thus limiting military presence to the city of Kidal (OECD/SWAC, 2014).

Despite these agreements, with the return of heavily armed Tuareg militants from Libya – entering Mali from 2011 onwards (Sköns and Nyirabikali, 2016) – the eruption of the 2012 crisis indicates that these relations remained strained.

As a result of the military occupation and administrative rule of AQIM, of its splinter groups and of the Tuareg rebels – referred to hereafter as 'the armed uprising' of 2012 – in the northern regions of Timbuktu, Kidal and Gao, these regions were selected as the conflict-affected areas for study in this analysis. Between 2009 and 2014 political violence in Mali was geographically focused on these three northern regions (ACLED, 2015). Conflict between various armed groups, the Government of Mali and international forces have consistently taken place in the northern areas of Mali (see Figure 2).

Figure 2 Political conflict by event type in West Africa between 2009 and 2014



Source: The Armed Conflict Location and Event Data [ACLED] project.

2 Exploring the nexus between conflict and resilience

2.1 Theoretical framework

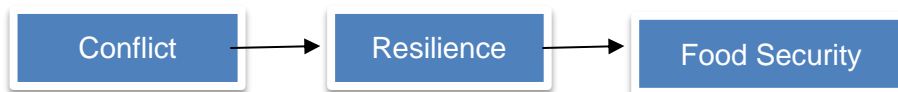
Resilience is a multi-faceted concept that can be broadly defined as “the capacity that ensures adverse stressors and shocks do not have long-lasting adverse development consequences” (Constas, Frankenberger and Hoddinott, 2013). From a theoretical point of view, and based on the above-mentioned definition, addressing resilience calls for a long-term perspective (Pingali, Alinovi and Sutton, 2005). That is, resilience-enhancing interventions should be focused on a medium- to long-term time frame. Furthermore, some components of resilience have an immediate effect on household well-being and food security (for example, on productive assets) while the effect of other components may be more delayed and/or long-term (for instance, on education). Resilience also correlates to agency, that is, the agent’s capacity to absorb and adapt to shocks and consequently transform livelihoods in order to deal with the effects of the shock (d’Errico *et al.*, 2016).

Finally, resilience is an outcome-based concept. In the case of household resilience capacity, the outcome variable that measures how resilient the household is in relation to a shock must be a measure of the agent’s status in terms of a given, standardized output level (e.g. poverty line, minimum food caloric intake, etc.). The dependent variable may differ depending on the scale and unit of analysis. In this case, the analysis focuses on estimating household resilience to food insecurity (i.e. the capacity of a household to return to its previous level of food security after the occurrence of a shock).

Therefore, this relationship can be expressed as:

$$FS_{h,t} = f(RCI_{h,t}, Z_{h,t})$$

where the food security level of the household h at time t depends on the Resilience Capacity Index (RCI) and a set of time-variant and time-invariant socio-economic characteristics of the household. This also sets the scene for the relationship between conflict, resilience and food security. In fact, this analysis claims that conflict affects food security by deteriorating a household’s resilience capacity.



The importance of this relationship is key for policy design, in that the restoration of resilience capacity can have actual effects on food security achievement or maintenance.

Conflict affects resilience and, consequently, food security. The causality link between conflict and resilience can be bidirectional; there is no simple causal explanation for conflict (World Bank, 2011). A wide array of researchers and practitioners are looking at declines in food security and/or resilience as possible concurrent causes of conflict (Justino, 2009; Justino, 2012). People may resort to violence due to: a broad spectrum of threats to their human security (FAO, 2016); loss of assets; and economic and/or political marginalization. All these

factors, individually or together, can trigger conflicts. For instance, unstable, higher food prices can cause social unrest (Bellemare, 2015), as can competition for control of natural resources such as land and water (FAO, 2016).

Typically, economic explanations of the reasons behind people's involvement in violent behaviour are dominated by opportunity cost theories (Maystadt and Ecker, 2014). In other words, individuals might weigh the relative costs and benefits of engaging in criminal activities, either by joining or supporting them (Draca and Machin, 2015). People may engage with militant activity or rebellions because they may stand to gain from that engagement in the form of economic and social opportunities (Grossman, 2004) or because non-participation is riskier than participation (Kalyvas and Kocher, 2007).

A number of trends and factors can lead to social tension, such as unequal distribution of income and other material goods; growing competition for land and water, due to land degradation or high population growth (Bora *et al.*, 2010); higher global food prices (Brinkman and Hendrix, 2011); high infant mortality rates and slow growth in food production (Messer and Cohen, 2007); perception of inequality (Messer, Cohen and Marchione, 2002); competition for food production resources (Simmons, 2013); and worsened climatic conditions (Maystadt and Ecker, 2014). These many factors offer fertile ground for the conditions that precipitate conflict.

It is also true that countries with lower per capita caloric intake are more prone to experiencing civil conflict, and this relationship is stronger in states where primary commodities make up a large proportion of the export profile (Brinkman and Hendrix, 2011). It has been suggested that food insecurity can fuel and drive conflict, especially in the presence of unstable political regimes, a high youth population, stunted economic development, slow or declining economic growth, and high inequality (Breisinger *et al.*, 2014; Ecker, 2014). Finally, those countries with the lowest levels of food security are all either engaged in or have recently emerged from war (von Grebmer *et al.*, 2015).

These arguments are important for Mali, where one of the root causes of participation in the Tuareg rebellion was unemployment and food insecurity. Mali's average rainfall has dropped by 30 percent since 1998 (Stewart, 2013), with droughts becoming longer and more frequent; this translates to chronic food insecurity. Another reason for participation in the rebellion was desertification. Due to this, herders from neighbouring regions and countries (such as Algeria and Niger) have been moving into areas that the Tuareg community uses for grazing.⁹ The emergence of a 'food for jihad'¹⁰ practice was another successful programme in which new recruits were attracted to Islamist armed groups. This is also confirmed by Brinkman and Hendrix (2011), which reports that those most likely to participate in armed conflicts are young men from rural areas with limited education and economic prospects – fighting becomes attractive once work is unavailable.

Socio-economic conditions in the north of Mali, particularly endemic poverty, have created a pervasive sense of marginalization and a lack of livelihood opportunities for young men. This factor has fed into the region's recurrent conflicts (Haysom, 2014). The above-mentioned Tuareg uprising in Mali in the early 1990s was also fuelled by resentment over the embezzlement of international relief funds by ethnically Bambara (i.e. non-Tuareg) government

⁹ Ethnic tensions that have evolved into local or regional conflicts [insert area here – where is this happening?] increasingly seem to be linked to environmental factors and natural resources, especially oil and gas reserves, Nile waters, hardwood timbers, rangelands, and rain-fed agricultural land; research confirms that droughts fuel conflict in Somalia (Breisinger *et al.*, 2014)

¹⁰ The emergence of this trend was reported on in 2015. For further information, see: <http://www.reuters.com/article/us-climatechange-mali-conflict-idUSKBN0NI16M20150427>

officials and military officers (Hendrix and Brinkman, 2013; Benjaminsen, 2008). Misappropriated food aid also become a source of political tension; violent actors diverted food aid in order to satisfy their own basic resource requirements (Hendrix and Brinkman, 2013). Meanwhile, a shortage of natural resources played a major role in engaging the Tuareg community in such a bloody rebellion (Abdalla, 2009). Finally, the Tuareg's community's unfulfilled request to the Government of Mali to create new livelihoods after some members of that community returned from Libya enhanced tension between the government and the Tuareg community.¹¹

While the long-lasting consequences of all these factors on resilience are difficult to estimate, evidence exists of losses in human capital that are often irreversible and may persist across generations (Justino, 2012a). Furthermore, conflict can affect households via economic, social and institutional changes that take place in the communities and location where people live (Justino Brück, T. & Verwimp 2013). Thus, exploring the nexus between resilience and conflict requires utilizing both a theoretical and an analytical framework that can help to establish the channels through which this causal relationship may ultimately affect food security. Furthermore, this draws policy-makers' attention to the particular aspects that need consideration (in the case of conflict) when designing policies targeting the restoration or maintenance of food security.

From a theoretical point of view, Justino (2012a) argues that resilience in situations of conflict depends on three main factors: "(i) the magnitude and duration of the effects of violence; (ii) the type of coping strategies that people are able (or allowed) to access; and (iii) the effectiveness of the strategies adopted to cope with the effects of conflict and violence".

From an analytical point of view, this paper suggests that a sound approach to exploring channels of transmission between conflict and resilience should disaggregate the analysis by pillar of resilience and the components, or variables, of each of these pillars. This allows for the identification of the main determinants of a decline in resilience.

This strategy is explored further below in the section covering the findings of the analysis.

2.2 Destruction and theft of assets

Asset destruction or loss is a common feature of violent conflict; conflict deteriorates both productive and non-productive assets (e.g. houses, land, livestock, utensils, labour) (González and Lopez, 2007; Shemyakina, 2011; Verpoorten, 2009).

Such asset loss directly endangers the capacity of households to maintain survival strategies in the context of violent events, as it reduces a household's productive capacity in the short term. Further, asset loss also decreases a household's ability to effectively recover from a shock in a post-conflict situation (Justino, 2012b). In fact, certain assets can become liabilities in the context of conflict, as their value can attract predatory behaviour, such as looting by conflict actors (Lautze, 2010). In addition, in the case of northern Mali during the 2012 crisis, rebel groups have required mobility to carry out their insurgency operations – controlling the main routes and lines of communication (OECD/SWAC, 2014). Rebel groups can thus hinder pastoralist activity and the nomadic movement of populations and livestock, in some cases also resorting to asset theft for their own consumption or material advantage. Consequently,

¹¹ The Tuareg community is nomadic, moving across Algeria, Burkina Faso, Libya, Niger and Mali. For further information on how their migration practices have compounded the 2012 crisis, see: <http://www.migrationpolicy.org/article/tuareg-migration-critical-component-crisis-sahel>

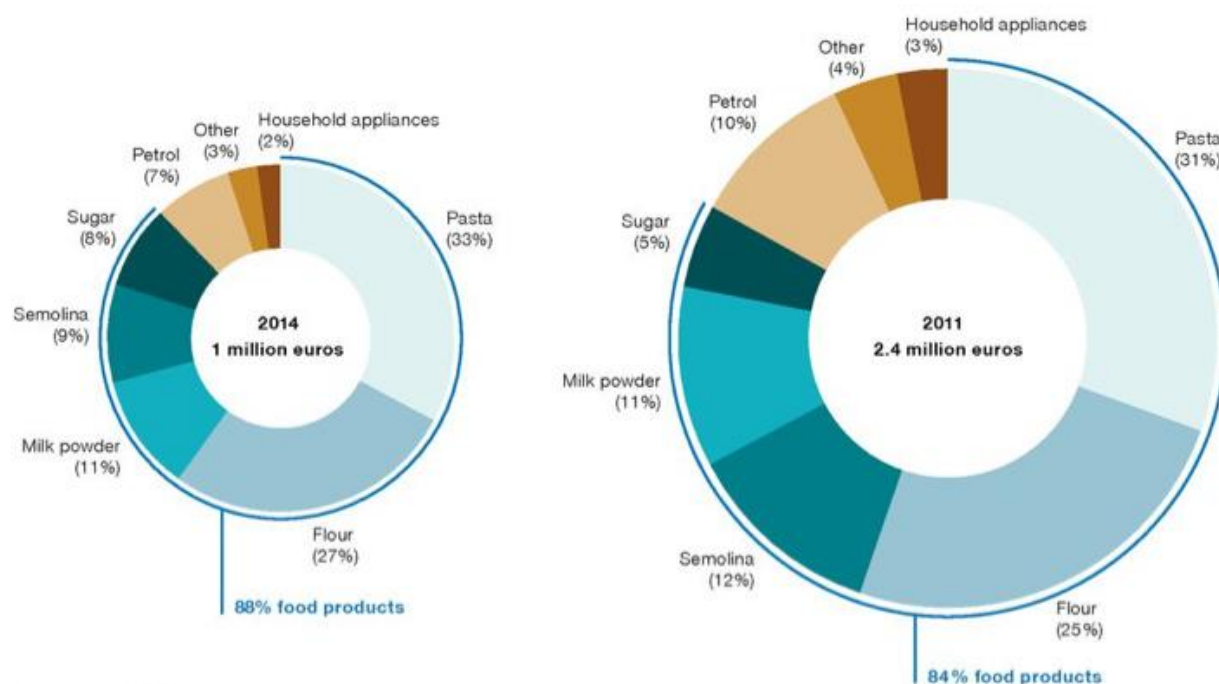
during the 2012 crisis livestock units were repeatedly stolen or the animals died as a result of their migration being inhibited, which thwarted access to pasture and to animal health services. Similarly, agricultural land was left abandoned due to conflict (Foley and Duechting, 2015). It is therefore likely that the resilience of households that depend on agriculture for their livelihood in the Timbuktu, Gao and Kidal regions was severely affected due to the impact of conflict on their productive assets.

Of note for this paper is the fact that the long-term consequences of conflict on resilience (through, for instance, asset destruction, reduced access to education, and significant limitation of basic services provision) could not be included in this analysis without long-running data sets, which are currently unavailable.

2.3 Limited basic services further deteriorated by conflict

As explained above, the provision of basic services in northern Mali was already scarce and inefficient prior to the conflict involved in the 2012 crisis. This was due to the absence of the state, poorly equipped local authorities, and corruption and patronage influencing relations between state officials and citizens. As stressed by Justino, Brück and Verwimp (2013), conflict generally leads to the destruction of civil infrastructure, such as roads, which would otherwise provide local populations with access to basic services, such as water facilities. With the breakout of the armed uprising involving AQIM, its splinter groups and Tuareg rebels in 2012, the provision of services by public authorities in Mali thus deteriorated, most likely as public servants left conflict areas and infrastructure was abandoned, looted or destroyed (Foley and Duechting, 2015; OCHA, 2013). The provision of basic services, such as water facilities, was also reduced due to recurrent droughts and the dehydration of water points (OCHA, 2013), which is likely to have further deteriorated households' resilience capacity. In addition, large quantities of fuel, which can serve to produce electricity, were supplied through unregulated means even before the conflicts of 2012 erupted (OECD/SWAC, 2014). The drastic reduction in unregulated transnational flows of goods between 2011 and 2014 therefore probably impacted household access to electricity, given that there was then a lack of combustible materials available (see Figure 4).

Figure 3 Estimate of weekly value of smuggling from Algeria to Mali



Source: Bensassi, S *et al.*, 2014.

2.4 Localized disruption of social service provision

Regarding household sensitivity to shocks, the situation for households in northern Mali – which was already worse in terms of sensitivity than for households in the south of Mali prior to the 2012 crisis – is also expected to have significantly deteriorated as a consequence of conflict events. During conflict periods, children are often the first victims of a deteriorating nutritional status and of reduced access to health services. This is likely to provoke long-term, negative effects on household productivity and resilience. As a result, this exposes households to greater risk of relying on negative coping strategies or to falling into poverty traps (Justino, 2012). In this sense, according to the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), 96 out of 199 health facilities in the regions of Timbuktu, Gao and Kidal were partially or totally destroyed by the warring parties by October 2013. In addition, only 19 percent of medical personnel were reportedly still working in those three northern regions at the end of 2013.¹² It is worth mentioning that the risk of contracting malaria in Mali is at its highest between May and October each year. As a result, about 500 000 people did not have access to health services at the end of 2013 due to the lack of human resources, medicine and operational facilities, and because of the suspension of aid provision following the coup in early 2012. Moreover, community bodies, such as school parents' associations, had traditionally played a central role in the provision of health assistance in Mali, despite these associations' dependence on external support. These structures were further weakened in northern Mali due to conflict and lack of resources resulting from the 2012 crisis (OCHA, 2013).

¹² It is also noteworthy that most displaced populations from northern Mali moved into Mali's southern regions, where health facilities and schools rapidly became overcrowded. Medical services were thus put under stress by the massive population influx (OCHA, 2013).

2.5 Restricted use of social safety nets

A household's adaptive capacity for dealing with shocks relates to the ways it can respond to a sudden deterioration of its economic status. In this sense, cash transfers and social safety nets can reduce the dependence of household members on their livelihood as a source of income; livelihoods may be affected by the emergence of conflict. The availability of credit and insurance mechanisms, state allowances, cooperation among households and communities, and remittances sent from abroad can all improve the resilience capacity of conflict-affected populations (Justino, 2012). However, in the context of conflict, these forms of financial support can be jeopardized by a number of factors. For instance, distrust among and between communities, the loss of social capital, and the destruction of social networks (Justino *et al.*, 2013). This particularly affects displaced populations, which lose their ties with their original local networks. As reported by OCHA, about 450 000 Malians had fled conflict-affected areas as of December 2013 (i.e. they were internally displaced persons (IDPs) and refugees), and were therefore in need of external and state assistance (OCHA, 2013). Simultaneously, populations affected by the 2012 crisis faced deteriorating economic conditions, which led to halted cash flows, the closure of shops and banks, and thwarted development projects (Foley and Duechting, 2015). Meanwhile, households' capacity to respond to crises can be advanced by improving the education level of household members. However, conflict-affected populations are usually confronted with reduced educational opportunities due to the occupation, looting or destruction of schools and the flight of teachers. This was the case Mali, where, according to OCHA (2013), more than 200 schools were destroyed, occupied or looted by the end of 2013 in conflict-affected areas. Thus, with the improvement of the security situation in Mali, those returning there from 2014 onwards – in particular, to the regions of Timbuktu and Gao – will be met with a lack of school infrastructure and teachers for school-age children.

2.6 Deterioration of food security

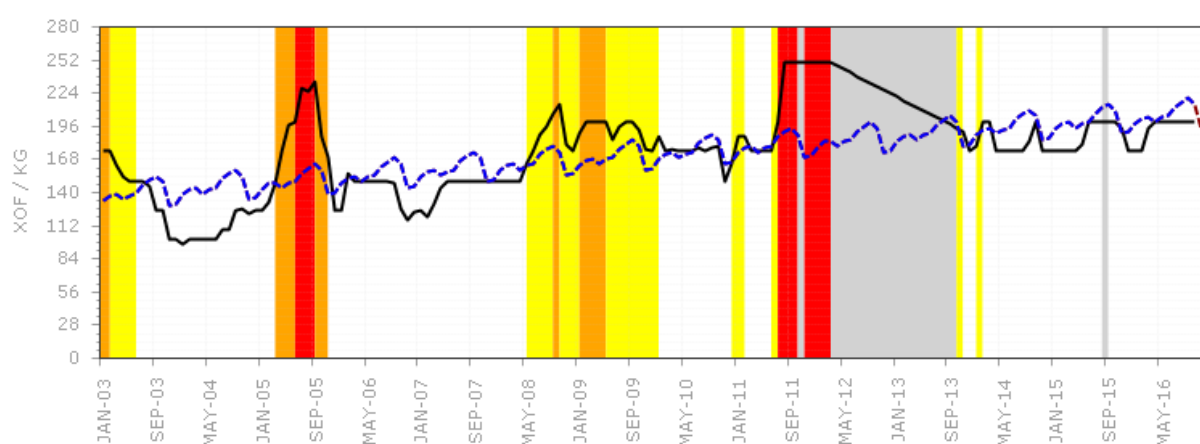
In addition to necessitating the use of significant financial resources – which could otherwise be used for development initiatives – conflicts require human capital and large quantities of food and provisions to feed and supply unproductive social activities. They also destroy the means for already inadequate livelihood systems. At the same time, food insecurity can fuel conflict dynamics, in the sense that limited access to natural resources (e.g. land and water) increases competition between actors, and can provoke inter- and intra-community conflicts over limited food production (FAO, 2016). Prior to the 2012 crisis and its associated conflicts, Mali was already facing nationwide food insecurity. During the occupation of the north of the country by armed groups,¹³ production and trade of food with the south were disrupted and stocks declined. This aggravated the unsustainability of food systems in northern Mali, which could only be addressed to a limited extent through humanitarian aid. Moreover, prior to the 2012 crisis, illegal trafficking had offered a source of food for households in remote areas along the border with Algeria. According to estimates from the Organisation for Economic Co-operation and Development (OECD), in 2011 around €2 000 000 worth of basic foodstuffs was smuggled from Algeria to Mali. These flows of food products then decreased by 50 percent,

¹³ It is worth mentioning that while the Government of Mali recovered control of most of the northern regions in the country, following a nine-month occupation of those areas by AQIM, Ansar Dine, MUJAO and the National Movement for the Liberation of Azawad (MNLA), the security situation there is still critical due to attacks and the use of improvised explosive devices (IEDs).

mainly due to the fight against smuggling and drug trafficking¹⁴ (taking place between 2011 and 2014) in response to the rise of Islamist armed groups in northern Mali (see Figure 4) (OECD/SWAC, 2014; Scheele, 2013). As such, the Comité Permanent Inter-Etats contre la sécheresse dans le Sahel (CILSS) deemed most of the areas in Timbuktu, Gao and Kidal and several areas in the region of Mopti to be in food security crisis in December 2013. The rest of the Sahel areas were considered 'in stress'. This food security crisis was the result of multiple factors, such as the lack of productive agricultural means and pasture for herders, and high prices for basic foodstuffs. These factors were all directly compounded by the conflicts associated with the 2012 crisis onward and its effects on food security (OCHA, 2013).

Food price fluctuations during this period were also affected by conflict, resulting in yet another threat to food security (see Figure 4).

Figure 4 Food price fluctuations, Mali



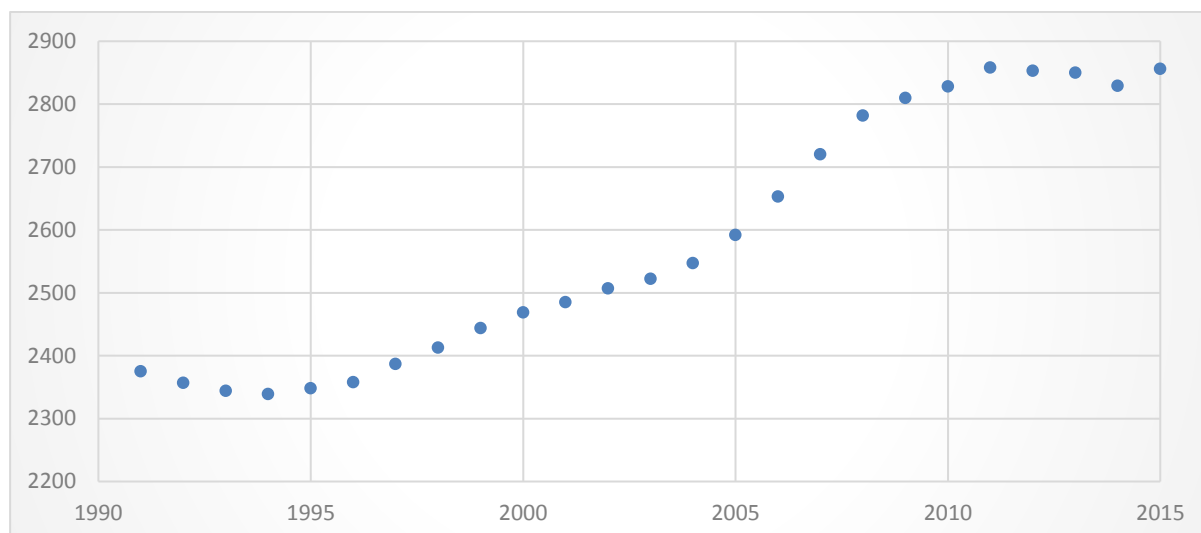
Source: UN World Food Programme, 2016.

For instance, the price of maize dramatically increased during the pre-conflict period in retail markets in the region of Gao. Price monitoring tools were not in operation during the conflict period, but were operational again in late 2013. This price shock may have dramatically threatened food security for Malians.

In general, there are cases where food security has been affected by conflict in several countries and in different contexts. In the case of Mali, an explanatory analysis suggests a close relationship between food security and the Tuareg rebellion and Islamist insurgency during 2012.

¹⁴ In 2013, the governments of the Sahel states –i.e. Algeria, Burkina Faso, Chad, Libya, Mali, Mauritania, Morocco and Niger- coordinated their action through a common response strategy against illicit trafficking, organized crime and terrorism. The strategy implementation rested especially on improving the national and regional capacity in the areas of security and justice to tackle illegal flows of goods and funds (for more information, see following link: <https://www.unodc.org/unodc/en/frontpage/2013/June/sahel-region-countries-agree-to-cooperate-in-response-to-illicit-trafficking-organized-crime-and-terrorism.html>).

Figure 5 Mali Dietary Energy Supply (DES)



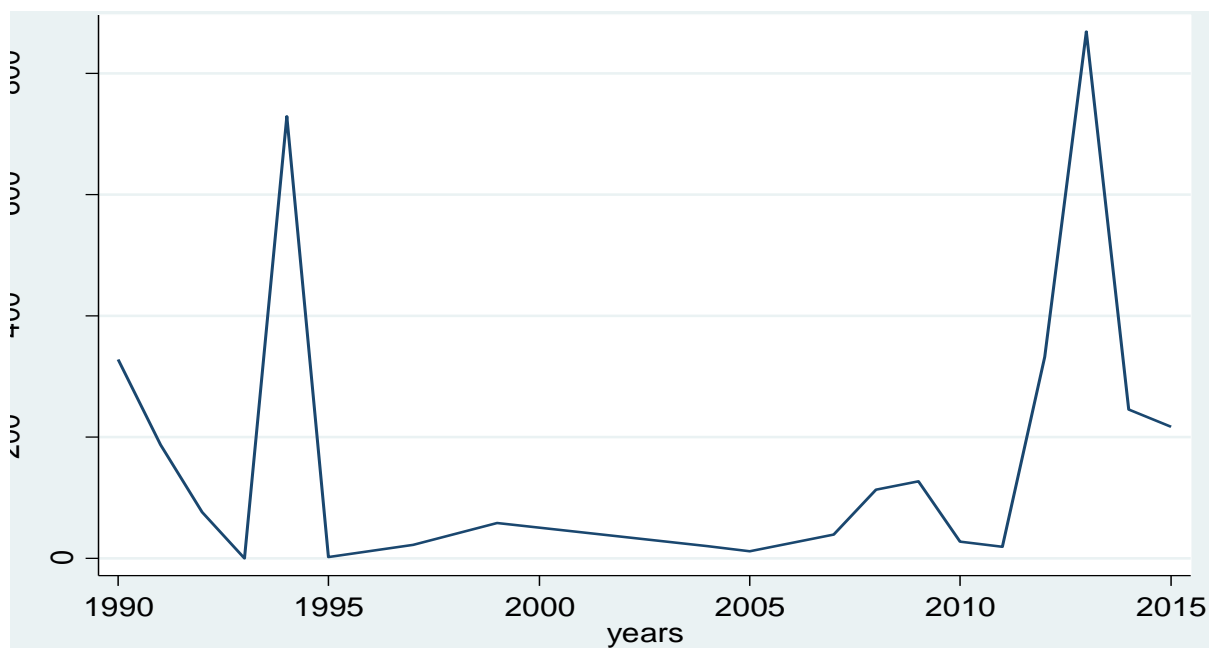
Source: FAO elaboration of WFP data.

The data on the Y axis of **Error! Reference source not found.** are aggregated measures that represent the available dietary energy supply (DES) in terms of kilocalories per day per capita (kcal/day/capita). This is calculated by taking the total supply of food in a country available for domestic consumption and dividing that by the total population. The supply of food available for domestic consumption itself is calculated by adding food imports to national food production and subtracting any food exports, as well as accounting for changes in available stocks. The DES is taken from the United Nations Food and Agriculture Organization (FAO) Food Balance Sheets (FAO Statistical Division, 2016), which is the most comprehensive global dataset available for this type of data.

The graph that appears above in Figure 6, unsurprisingly, shows a similar form to the graph that appears below in Figure 7, which represents conflict intensity over time in Mali, with the Y axis representing the number of deaths. Figure 6 shows that there are two occasions (in 1995 and 2015) that indicate a reduction in DES (in terms of the DES trend over the years), while in Figure 7 in 1995 and 2015 there are increases in the number of deaths. The data depicted in Figure 7 was obtained from a dataset available from the Uppsala Conflict Data Program (UCDP) online database.¹⁵

¹⁵ It is worth noting that there are two time periods that are not covered in this database – one for the period 2000–2003, and another during 2006.

Figure 6 Conflict intensity in Mali from 1990 to 2015



Source: Own elaboration on UPSALA dataset (available at <http://ucdp.uu.se/#country/432>).

At these points in time during 1995 and 2015, food security decreased and violence increased; in the later instance, this occurred at approximately the same time as the occurrence of the Tuareg rebellion and of the Islamist insurgency.¹⁶

¹⁶ The negative effects of conflicts on food security indicators, such as DES, are not immediate. This is for two main reasons: because these indicators are typically collected once a year, and because the figures in the DES datasets from FAO Statistics report the average value for a three-year period.

3 Data

This study employs two different datasets. The first dataset is the Multiple Indicator Cluster Survey (MICS). This includes (for a sub-sample only) the Enquête Légère Intégrée auprès des Ménages (ELIM) which includes a set of questions on livelihood strategies and means of living. The survey has been implemented by the United Nations International Children's Emergency Fund (UNICEF)¹⁷ together with the National Institute for Statistics and the Ministry for Health, Social Development and Promotion of Family in Mali¹⁸ 2009. The second survey comes from the Enquête Agricole de Conjoncture Intégrée aux conditions de vie des ménages 2014 (EAC-I 2014), supported by the Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA).

The MICS and ELIM datasets used for this analysis consist of 8 061 observations at the household level and are representative at the national, regional and urban/rural levels. The EAC-I 2014 covers 3 711 households, but for security reasons it was not possible to collect data on the Kidal region, as it was significantly affected by conflict. As a consequence, that region has been removed from the present impact evaluation analysis. The two sets of data (MICS/ELIM on one side, LSMS on the other) have quite overlapping questionnaires which includes information on livelihoods; health; education; safety nets; shocks; assets; food access and security; and basic services. The ELIM/MICS has a stronger components on children and women health and empowerment. Both, however, lack of proper data for calculating income; therefore it has been removed from the estimation of RIMA. These limitations turned into a RIMA specification that mirrors the data availability and Malian context.

The datasets for both 2009–2010 and 2014 were taken at the household level. The main limitation for this analysis is that the datasets are not panel datasets. Since it was not possible to see the effect of conflict on resilience capacity for the same households for the period of 2009–2010 and 2014, a pseudo-panel strategy was implemented, as explained below.

¹⁷ The MICS survey is freely downloadable in the mics website (available at <http://mics.unicef.org/surveys>). Otherwise a full report is available, issued by the National bureau of Statistics (CSP/SSDSPF 2010) or in the UNICEF-MICS website <http://mics.unicef.org/surveys>

¹⁸ Available in the website of the archive of the National Bureau of statistics: <http://www.afristat.org/nadamali/index.php/catalog/ELIM>

4 Resilience measurement

Resilience is defined according to the definition of the Resilience Measurement Technical Working Group (RMTWG)¹⁹.

Household resilience is estimated through The Resilience Index Measurement and Analysis (RIMA) methodology; this estimates the RCI as a latent variable, which depends on pre-determined dimensions, called pillars of resilience. While further details on this methodology can be found in FAO (2016a), it is important to remind here that there have been quite a number of attempts at measuring household resilience to food insecurity. Some of them employ latent variable models; other approaches this topic with a momentum-based strategy; other simply employ vulnerability or adaptive capacity indicators as proxy for resilience. There is a sort of consensus on the fact that latent variable models are the best approach for measuring household resilience with a unique construct that can then be employed for targeting and impact evaluation (see d'Errico et al 2017). In the case of RIMA, a two-step approach is developed which employs observed variables in order to obtain an estimation for the key pillars of resilience through factor analysis. The second step employs the estimated pillars into a structural equation model in order to obtain a resilience construct called Resilience Capacity Index.

While RIMA-II tends to be consistently designed in every case study, it also very much relies on context specificity.²⁰ In the case of Mali, and due to the limitations abovementioned, the model employs four pillars:²¹ Access to Basic Services (ABS), Assets (AST), Sensitivity (S) and Adaptive Capacity (AC).

The definitions of each pillar and the related variables are reported in Table 1.

Table 1 Resilience pillars and variables

Pillars of resilience	Definition	Variables
ABS	ABS shows the ability of a household to meet needs, such as accessing toilets, water and electricity.	Electricity; improved water facility; improved toilet facility; distance to water.
AST	AST covers the key elements of a livelihood. Productive assets (mainly land and livestock) enable households to produce consumable or tradable goods. Non-productive assets (e.g. house, appliances) are an important determinant of household well-being.	Wealth index; land; tropical livestock units (TLU); house condition index.
S	S measures the degree to which a household has been affected by a shock in the recent past.	Number of children with malaria; number of children with diarrhea; number of infibulated women; number of long-lasting shocks.

¹⁹ The RMTWG has been established under the Food Security Information Network (FSIN).

²⁰ RIMA is adapted in each case study, provided that resilience being a context-specific concept.

²¹ The number of pillars employed in an analysis depends on data availability and context analysis. Further details can be found in d'Errico and Pietrelli (2017).

Pillars of resilience	Definition	Variables
AC	AC is the ability of a household to adapt to a new situation and develop new livelihood sources. Having active and educated members, for example, may decrease the negative effects of a shock on a household.	Number of years of education; dependency ratio; household head (HH) working as employee; HH farmer; HH employer; HH independent worker.

The final RCI is then calculated through a two-step procedure: first, the observed variables are used to build each pillar through Factor Analysis (FA), where every single variable has a specific weight in determining the related pillar; second, a Structural Equation Model (SEM) is used to predict the latent RCI as a relationship between the pillars. Once the RCI is estimated, it is possible to assess which are the most resilient household profiles using various sub-samples of the datasets.²²

In the context of the Mali conflict, the RIMA framework provides analysis of the most important variables that explain resilience and which of those have been affected by conflict to a greater degree. This in turn can be useful for policy design, since this methodology highlights the main drivers that ensure resilience capacity at the household level.²³

²² The selection of the sub-samples depends on data availability and statistical representativeness. It also depends on the final purpose of the analysis and on the data-driven evidence emerging while running the analysis.

²³ The link between food security and resilience is well documented in a long list of publications of the Technical Working Group on Resilience Measurement. As a result of the analytical and research efforts implemented by this TWG, it emerges that every resilience measure needs to be specified against an outcome (food security in this case) and have the final purpose of assessing whether or not a household is able to bounce back to the pre-shock level of food security. RIMA works in the same direction, by measuring this capacity. Further readings on the capacity of RIMA as food security predictor can be found in d'Errico, Pietrelli, Romano (2017).

5 Estimation strategy

5.1 Pseudo-panel approach

Ideally, panel data would have been available for this analysis, but unfortunately this does not exist for the regions and period studied. In order to address this shortcoming, given the availability of repeated cross-sectional data and following the approach found in Deaton (1985), it is possible to conduct a pseudo-panel multivariate regression analysis. There has been a number of studies that develop pseudo-panels (or synthetic panels) out of multiple rounds of cross-sectional data based on age cohorts to investigate income and consumption over time (Deaton and Paxson, 1994) (Banks, Blundell and Brugiavini, 2001; Pencavel, 2006) and poverty over time (Bourguignon, Goh and Kim, 2004; Güell and Hu, 2006). Since cross-section samples are typically refreshed each time surveys (like MICS, ELIM and EAC-I 2014) are carried out, synthetic panels are possibly also less exposed to attrition and measurement error than real panel data (Lanjouw and Dang, 2013). A related yet different approach was recently proposed by Dang *et al.* (2011), featuring both parametric and non-parametric approaches to construct synthetic panels at the household level from two rounds of cross-sections, using conservative assumptions.

As noted by Deaton (1985) and Moffitt (1993), cohorts should be defined based on time-invariant characteristics to prevent (artificial) temporal inter-cohort variation. As such, cohorts have been defined using two dimensions: the age of the HH, and the region where the household is located. Given the trade-off²⁴ between the number of cohorts and the number of observations per cohort, Moffitt (1993) notes that cohort averages should be calculated based on a reasonably "large" number of observations, while Verbeek and Nijman (1992) consider 100 to 200 observations per cohort to be sufficiently large. The final choice of resilience pillars used in a given analysis will therefore be guided by the relevant literature reviews and the amount of relevant data available. In this paper, it was possible to group together 44 unique cohorts (see TableA1 in the Annex).

5.2 Impact evaluation strategy

In this chapter the econometric strategy for identifying those who have suffered the negative effect of conflict on resilience capacity is presented. A general discussion on how to approach impact assessment is presented; it is then followed from the specific estimator adopted for this case study with its relative set of equations.

In a typical randomized control trial, the Average Treatment Effect (ATE) can be identified simply by the mean difference in outcomes between the treatment and the control group, where the treatment group is that which has received government interventions or some form of aid:

$$E_{\tau} = ATE = E[Y_1] - E[Y_0] \quad (1)$$

where Y_1 is the treatment group and Y_0 the control.

²⁴ The higher the number of cohorts created within the same sample, the smaller the number of observations in each cohort, and thus their statistical relevance is lowered.

While (1) estimates the average effect on the entire population, it is also possible to estimate the average effect of treatment (ATT), i.e. the (negative) effect of shock on those subjects who ultimately were reached by the conflict.

$$E_{\tau|D=1} = ATT = E[Y_1|D = 1] - E[Y_0|D = 1] \quad (2)$$

For this analysis, the Difference in Difference (DID) estimator was employed for pillars and observed variables:

$$RCI_{t,i} = \beta_0 + \beta_1 C_{t,j} + \beta_2 T_{t,i} + \beta_3 C_{t,i} * T_{t,i} + \beta_4 X_{t,i} + \varepsilon_i \quad (3)$$

where the RCI of a single household i is given by being or not being in one of the regions affected by the conflict (C) as a dummy equal to one if the household is located in Gao or Timbuktu. T represents the structural break, the time before and after the conflict, $C*T$ the interaction between these two variables and a set of socio-economic characteristics (X), an intercept term (β_0) and the error term (ε). The same DID estimator was applied to each pillar and each variable within the pillars.

The DID approach allows for the mitigation of the effects of unobserved factors that could place downward bias on the accuracy of the results. This is done by looking at the differential effect on resilience capacity in the regions involved in the conflict (i.e. with the highest number of fatalities) before and after the conflicts' occurrence.

In non-experimental analysis, other identification assumptions must be taken into consideration to control for other factors that may determine if a household has participated in an aid programme. In this case, assignment to the treatment group is frequently non-random; therefore, households assigned to the treatment group may differ not only in their treatment status but also in other characteristics that affect both participation in aid programmes and the outcome of interest (Winters, Salazar and Maffioli, 2010)(Caliendo and Kopeinig, 2008). The use of a propensity score allows for solving the counterfactual problem by estimating the conditional probability of receiving the project ($P_i=1$) given a vector of observed characteristics (X) (dimensionality problem).

Another limitation of the DID estimator is that it relies on the fact that both the treatment and control groups' composition has not drastically changed over time. The crucial aspect here is if the groups differ with respect to the variables' (of the resilience pillars) trends over time (Abadie, 2005; Imbens and Wooldridge, 2009). Changes in group composition are common when data come from repeated cross-section or pseudo-panels, rather than pure panel data (Smith et al 2014). Out of the long list of methods adopted in order to control the selection bias, the propensity score matching seems to have a prominent role in the current literature (Smith *et al.*, 2014).

The propensity score (in this case, the probability of participating in a programme, given observed characteristics X_i (Caliendo and Kopeinig, 2008) will be adopted for the RCI only. The RCI is a multidimensional index which, therefore, can be influenced by selection biases present in the different variables that the pillars are comprised of. In fact, each variable can be affected by selection bias and this would ultimately distort the RCI; it is not possible to

completely disaggregate the combined effect of biases caused by the simultaneous action of all the variables employed in the estimation. As a consequence, a more comprehensive approach is to control this bias, albeit with the disadvantage of reduced precision in the estimation.

In terms of the functional form to use, for a binary case like this (i.e. either being or not being involved in conflicts), logit and probit models usually yield similar results (Caliendo and Kopeinig, 2008).

In terms of the variables to be included as covariates in the propensity score model, the matching strategy requires that the outcome variable should be independent of treatment, conditional on the propensity score. Therefore, variable(s) should be chosen that satisfy this condition; that is, including only variables that are unaffected by participation in government aid programmes, or in this case, by conflict. A recommendation is to use variables that are fixed over time, or were measured before the conflict took place (Caliendo and Kopeinig, 2008).

Finally, while there is a number of possible matching algorithms that could be adopted, in this case the nearest neighbour (NN) has been chosen.

The econometric analysis of the impact of conflict on resilience can start with a reduced form equation estimated at the baseline and the follow-up (i.e. for 2009 and 2014).

$$RCI_i = f(b_0 + b_1C_i + b_3X_i + u_i) \quad (4)$$

where household resilience (the RCI) is a function of: an intercept term; the conflicts (C); a vector of control variables and a normally distributed random error term. The RCI is estimated through the RIMA methodology.

Formally, in time 0 (or, the baseline), the causal effect of the treatment is estimated through a model:

$$Y_{i0} = \beta_0 + \beta_1D_i + \beta_2T_0 + \beta_3(T_0D_i) + \beta_4X_i + \varepsilon_{i0} \quad (5)$$

where Y_{it} is the outcome variable; D_{it} is a treatment indicator taking the value of 1 if a household has received the treatment, or 0 if otherwise; and T_t is a time indicator, equal to 0 for the baseline and 1 for the follow-up round. T_tD_i is an interaction between time and treatment variables. ε_{it} denotes an error term and X is the vector of socio-economic characteristic control variables. The mean outcome for the treatment group in the follow-up round is captured by $\widehat{\beta}_0 + \widehat{\beta}_1 + \widehat{\beta}_2 + \widehat{\beta}_3 + \widehat{\beta}_4$.

In this specific case, the outcome of interest, Y , can be considered the change in RCI. This specification indicates the marginal effect of voluntary or involuntary participation in conflict on household resilience. β_2 estimates the impact of the conflict on resilience capacity.

6 Findings

Balance tests were implemented to check the validity of the pseudo-panel approach; the differences between the different cohorts were tested at the baseline. The rationale for employing hypothesis testing is to assess whether there are pre-existing differences between the treatment and control groups. However, as balance in the baseline is a characteristic of observed variables, there is no level below which a hypothetical imbalance can be ignored (Ho *et al.*, 2007).

In this case, the balance tests were applied to the typology of cohorts that were created, which consider the age of the HH and the region in which the household is located.

Table 2 T-test for baseline

Pillars and variables	T-test with cohort
ABS	
Access to electricity	0.0943*** (0.00370)
Distance to water in minutes	0.364*** (0.00347)
Access to toilet	0.453*** (0.00677)
Access to water	-0.0451*** (0.00467)
AST	
Cultivated land per capita	0.142*** (0.00309)
House value	1.785*** (0.0514)
Wealth Index	0.0319*** (0.00121)
TLU per capita	0.0473*** (0.00196)
AC	
Education in years	0.941*** (0.0289)
Dependency ratio	0.0471*** (0.00687)
Wage income	0.0533*** (0.00233)
Farmer income	-0.0918*** (0.00388)
Employer income	0.0119*** (0.000236)

Pillars and variables	T-test with cohort
Other income	0.0219*** (0.00253)
SSN	
Number of children with Malaria	0.176*** (0.00285)
Number of children with diarrhoea	0.134*** (0.00254)
Number of observations	8061

As a consequence of the balance tests, it was determined that the treatment and control groups at the baseline were quite unbalanced. This reinforced the use of the propensity score matching estimator for the RCI instead of the DID approach.

Conflicts in the regions of Gao and Timbuktu have had a negative and statistically significant effect on resilience (-6.8 percent). The propensity score has been created with a set of covariates, which include rural or urban localization; gender of the HH; marital status of the HH; and household size. However, it is important to stress that this negative effect is most likely an underestimation; the removal of the Kidal region from the analysis certainly has the effect of underestimating the impact of conflict on resilience.

Table 3 Impact of conflicts in 2012 on RCI, Mali

RCI (%)	SE	z	p-value	95% interval	
-6.8	.37	-18.5	0.000	-7.6	-6.1

As a further consistency test of the identification strategy, the impact evaluation exercise was replicated for different sub-samples of the population. In particular, based on the political map of Mali, sub-groups of the population were selected that reside in increasingly distant locations from the most conflict-affected zones. The RCIs of the sub-groups and the different conflict impacts were compared with the RCIs and conflict impact for Gao and Kidal.

Four regional zones were drawn up in order to carry this out: Zone 1 is the region of Mopti, neighbouring with the conflict areas. Zone 2 is the combination of two regions, Segou and Sikasso, which are close to Mopti but not directly bordering on Timbuktu and Gao. Zone 3 is the Koulikoro region plus the capital city, Bamako. Finally, Zone 4 is the region of Kayes, which is the most distant from the conflict-affected areas.

Table 4 Difference in conflict impact over RCI

	RCI	SE	z	p-value	95% interval	
Zone 1	-1.9	.47	-4.12	0.000	-2.9	-1.0
Zone 2	-5.4	.43	-12.49	0.000	-6.25	-4.6
Zone 3	-10.6	.59	-17.82	0.000	-11.8	-9.5
Zone 4	-5.2	.55	-9.57	0.000	-6.3	-4.1
Mali	-6.8	.37	-18.5	0.000	-7.6	-6.1

The findings show an expected result – the more distance between the conflict-affected areas and the sub-group, the lesser the impact on resilience. In particular, it is interesting to observe that the difference in RCIs between the conflict-affected areas analysed (Timbuktu and Gao) and Mopti is very low. On the contrary, Bamako suffered much less in terms of the negative impact on its resilience capacity than the conflict-affected regions. These estimations are clearly affected by downward bias, given the above-mentioned removal of the Kidal region from the analysis.

Once the negative impact on the RCI was detected, it was important to understand the channels through which this effect took place. An important distinction must be made between the short- and long-term impacts on resilience.²⁵

The remainder of this analysis attempts to measure the impact of conflict on each variable used within each of the resilience pillars.

Table 5 shows the effect of conflict on each resilience pillar and their variables.

Table 5 Effect of conflicts on resilience pillars and their variables

	ABS	AST	AC	S
effect	-0.283**	-0.295**	-0.116	-0.745***
p-value	0.000	0.010	0.090	0.000
	Wealth index	Land	TLU	House value
effect	-0.126	-0.152	0.076	-0.543***
p-value	0.270	0.090	0.360	0.000
	Electricity	Proximity to drinking water	Toilet	Water
effect	-0.034	-4.651**	-0.287***	0.014
p-value	0.260	0.000	0.000	0.640
	Average education	Dependency ratio	Wage employment	Farm employment

²⁵ This is a very important difference, as it introduces a bias that led to systematic underestimation of the effects on resilience within this analysis, since it does not take in consideration the future positive effects. As an example, consider education, changes to which may well have effects on resilience in the long term rather than in the short term.

	ABS	AST	AC	S
effect	-0.296	-0.002	-0.031	0.082
p-value	0.380	0.990	0.370	0.080
	Employer	Other revenues	Number of children with malaria (inverted)	Number of children with diarrhoea (inverted)
effect	0.021***	-0.102**	0.294***	0.133***
p-value	0.000	0.010	0.000	0.000

*** p<0.01, ** p<0.05, * p<0.1

The data demonstrates that conflict has a strong, statistically significant and negative effect on the pillars of ABS, AST and S. On the contrary, conflicts do not affect AC.

A counter-intuitive effect is found in S, where there is a decrease in diseases reported (malaria and diarrhoea) among children. It also shows an unlikely positive effect on resilience. This could be due to the conflict itself in reducing the number of children, especially those more prone to be sick, due to economic, social and physical reasons. Diarrhoea can lead to malnutrition, both by causing significant dehydration and eliminating nutrients from the body before they are absorbed; malaria can cause the death of the patient. In a 2015 study from the United Nations Children's Fund (UNICEF, 2015), the most common cause of death among children in Mali was malaria (31 percent of all deaths); diarrhoea was reported as the cause of 7 percent of all children deaths. About half of all deaths were of children under five (52 percent) (UNICEF, 2015). Meanwhile, a 2013 outbreak of cholera and other poor hygiene-related diseases was a direct consequence of conflict in northern Malian regions (UNICEF, 2013a).

UNICEF interventions to improve sanitation and the provision of related treatments through Community Health Workers (CHW) have remained significant in the years following those conflicts (UNICEF, 2013b & 2014). This has been necessary, given that, for example, the prevalence of malaria (one of the primary causes of morbidity and mortality for children under five years old and pregnant women) remained as high as 52 percent until 2014. This is also strongly related to the above-mentioned fact that services were disrupted due to conflict during the conflict period studied (OCHA, 2013).

While there is seemingly a positive effect on the pillar S as a result of conflict, this can be partially explained by the lack of pure panel data available for this analysis. Since it was not possible to track the resilience behaviour of the same households over a period of time, it is therefore not possible to take into account deaths caused by the conflict itself or by its indirect effects, which can lead to diseases like diarrhoea. This means that the EAC-I 2014 survey made record only of the healthiest children, who managed to survive after the conflict period, but it could not take into account those who had died as a result of the conflict and its consequences. This could explain the reason behind this counterintuitive effect on S.

Health is also correlated with the significant reduction in safe water provision and safe toilet system utilization, which is reported in Table 5. In particular, infrastructure is typically the first area to be affected as a result of conflict; this is the direct effect of destructive fighting and violence, which result in the breakdown of the economy, agricultural markets, health systems and physical infrastructure (Justino, 2016). This is also reflected in the fact that most foreign

aid arriving to Mali currently focuses on long-term investments in education, health and infrastructure (Miguel, 2007).

There is a negative and significant effect on asset; in particular there is a strong reduction of house value.

There is a negative impact (although not significant) on the AC pillar, which is in line with other findings such as D'Souza and Jolliffe (2013) on the effect of conflict on households' adaptive capacity. However, the effect is negative and significant on revenues coming from other sources and an increase of self-enterprises. This may be interpreted as the result of a reduction/interruption of more traditional income generating activities and the consequent startup of micro enterprises self-managed.

Finally, a negative and statistically significant effect on the value of houses was detected. This variable, which has a limited value per se, can still be important if the house is considered as a proxy for durable assets. Significant migration and displacement took place in Mali between 2012 and 2013 (UNICEF, 2013b); nearly 450 000 Malians left their homes because of conflicts (OCHA, 2013). This may be connected with the lowered house value observed. In fact, people may be moving because of destruction of their property, taking place due to conflict. Otherwise, people may be just moving away from dangerous areas; this implies that these people remain without a dwelling, which ultimately translates to a reduction in the average house value reported.

There are of course other side effects of conflicts that have not been captured by this impact evaluation analysis. For instance, a disruption of schooling for thousands of children was reported by UNICEF (2013a), which has not been explored here. In this analysis, the sole indicator for education included in the estimation was the average number of years of education for the HH; this limits the scope of the analysis and strengthens the need for cross-tabulation and validation with secondary data sources.

7 Conclusions

This paper looked at the effects of conflict on resilience and, as a consequence, on food security in Mali. The empirical analysis adopted a pseudo-panel approach with two sets of cross-sectional data from UNICEF (MICS, conducted from 2009 to 2010) and ELIM, implemented by the National Institute for Statistics and the Ministry for Health, Social Development and Promotion of Family, and from the EAC-I 2014, supported by the LSMS-ISA. The pseudo-panel approach was achieved through the creation of 44 cohorts populated with at least 50 observations each.

The identification strategy selected three regions for the purpose of this analysis: Gao, Timbuktu, and Kidal. However, unfortunately there was no data available for Kidal for the period studied due to security concerns, therefore this analysis covered only Gao and Timbuktu.

The econometric analysis employed DID and propensity score matching estimators to assess the impact of the Tuareg rebellion and the Islamist insurgency in northern Mali.

The findings demonstrate a negative impact on overall resilience, which ultimately translates to a possible threat for food security.

In this case, conflict affected household resilience capacity by reducing access to basic services (in particular, reducing access to safe water and toilets); reducing their assets (durable assets). This poses serious threats to people's capacity to handle subsequent shocks.

The analysis also shows a seemingly counterintuitive reduction of exposure to malaria and diarrhea; this can be however due to the limitation of the pseudo panel approach.

As a general conclusion, the first areas in Mali to be affected by conflict were sanitation and public health. This is strongly linked to the interruption of service provision and destruction of durable assets. Consequently, short-term and immediate responses should aim to restore these systems. People's resilience may be significantly deteriorated by the prolonged nature of conflict in Mali.

Two major interventions have already been put in place to address issues of security and development in the Sahel, with a special emphasis on targeting pastoralists.²⁶ Adopted in May 2013 by a number of central African countries – including Mali – the Ndajamena Declaration took clear actions to support four main objectives in order to “put the pastoral livestock sector at the heart of stabilization and development strategies for the Saharo-Saharan areas in the short-, medium- and long-term”.²⁷

²⁶ Pastoralist and agropastoralist communities have been increasingly under pressure as a result of dynamic population growth and more frequent and intense droughts (Breisinger *et al.*, 2014)

²⁷ Specifically, the declaration has established the following goals: 1) Improving governance, by advocating the inclusion of pastoralist communities in the governance of land and public life, as well as facilitating access to education and healthcare services; 2) Strengthening the resilience of pastoral communities, envisaging high-level discussion on the financing and management of pastoral water infrastructures. Most importantly, the declaration proposes the negotiation of legally binding social agreements to secure mobility and pastoral areas, and to improve access to natural resources (e.g. water and pastures); 3) Enhancing the economic sustainability of the pastoral livestock sector, developing the pastoral economic activities, for example, by improving market infrastructures and establishing transhumance and cattle trading routes, by strengthening the skills of professional livestock bodies, and by improving access to banking services; 4) Enhancing the social sustainability of communities in the Sahelo-Saharan areas, praising the integration of human and animal public health services through innovative policies. They also vow to improve the access of local populations to basic education and vocational training, among other recommendations.

Adopted in November 2013 by the six countries in the Sahel (i.e. Burkina Faso, Chad, Mali, Mauritania, Niger and Senegal), the Nouakchott Declaration recognizes that pastoralism is an effective practice and lifestyle suited to Sahelo-Saharan conditions.

In conclusion, much is still to be done in order to achieve a better understanding of how conflict affects resilience and, as a consequence, food security; yet more so, there is still much more work required in order to explore the reverse relationship. Both macro- and micro-evidence should be brought about that can support this type of analysis.

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Annex

Table A1 Cohorts and cohorts sample size

cohorts	Frequency	Percent	Cumulative
1	142	1.21	1.21
2	304	2.58	3.79
3	310	2.63	6.42
4	333	2.83	9.25
5	280	2.38	11.63
6	184	1.56	13.19
7	129	1.1	14.29
8	284	2.41	16.7
9	361	3.07	19.77
10	341	2.9	22.66
11	260	2.21	24.87
12	166	1.41	26.28
13	158	1.34	27.62
14	372	3.16	30.78
15	395	3.36	34.14
16	342	2.91	37.05
17	235	2	39.04
18	162	1.38	40.42
19	120	1.02	41.44
20	277	2.35	43.79
21	416	3.53	47.32
22	357	3.03	50.36
23	261	2.22	52.57
24	139	1.18	53.75
25	116	0.99	54.74
26	314	2.67	57.41
27	338	2.87	60.28
28	367	3.12	63.4
29	263	2.23	65.63
30	140	1.19	66.82
31	121	1.03	67.85
32	241	2.05	69.89
33	233	1.98	71.87
34	246	2.09	73.96
35	198	1.68	75.65

36	247	2.1	77.74
37	197	1.67	79.42
38	326	2.77	82.19
39	329	2.79	84.98
40	582	4.94	89.93
41	527	4.48	94.4
42	369	3.13	97.54
43	205	1.74	99.28
44	85	0.72	100
Total	11,772	100	

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