



VIOLENCE AND MOBILE MONEY

FINANCIAL DECISIONS USING MOBILE MONEY IN KENYA

SIMEON BROUWER

RADBOUD UNIVERSITY NIJMEGEN

MASTER POLITICAL SCIENCE: CONFLICT, POWER AND POLITICS

SUPERVISOR: HALEY SWEDLUND

STUDENTNR: S4812557

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Abstract

This research analyses how violence affects financial decisions regarding mobile money in Kenya. I use evidence from Jack and Suri's (2011) dataset about mobile money usage and combine it with conflict event data from the Uppsala Conflict Data Program. The results, estimated by a fixed-effects model, show no significant impact of violence on mobile money. Also when introducing three different interaction variables based on household characteristics, the relation did not prove significant. It seems that financial decisions by Kenyan households are not affected by the levels of violence. Mobile money potentially provides security and safety for households to better deal with the uncertainties that go hand in hand with violence. Yet, much is still unknown in research about mobile money and so more evidence is needed with up-to-date data.

Contents

- 1. Introduction 1
- 2. Context 4
 - 2.1 Violence in Kenya..... 4
 - 2.2 Financial development in Kenya..... 7
 - 2.3 Economic impacts of M-Pesa 8
 - 2.4 Social impacts of M-Pesa..... 11
 - 2.5 Violence and mobile money 13
- 3. Methodology 18
 - 3.1 The data..... 18
 - 3.2 Research design 19
 - 3.3 Estimation strategy..... 22
- 4. Results 24
- 5. Discussion 27
- 6. Conclusion..... 29
- References 31
- Tables and figures 34

1. Introduction

The developing world has been troubled with many violent conflicts over the past decades. Armed conflict reports show a longstanding decreasing trend of violence and casualties up until 2014 when the wars in Syria and Ukraine took an uptick. In recent years the violence levels have reached an all-time high since the end of the Cold War and therefore continues to be troublesome for international development and peace (PRIO, 2016)¹. The World Bank report in 2003 by Collier et al. describes the effects of war on social and economic costs. War, they say, is simply ‘development in reverse’. Countries that are caught in the vicious cycles of conflict (the so-called conflict trap by Collier) repeatedly experience the legacy of atrocities, because the economic, political and social spheres are revolving around the constant imminence of violence. The relation between conflict and poverty has been researched extensively and evidence indicates, among other things, that conflict destroys physical capital (Davis & Weinstein, 2002), changes economic preferences (Voors et al., 2012), deters investments (Besley & Mueller, 2012), and strongly limits household consumptions (Serneels & Verpoorten, 2015). Nevertheless, there is still much unknown in the micro-level mechanisms of economic stagnation in conflict-affected areas.

This paper will explore the relation of violence and mobile money and look closely into how it affects household financial decisions. Furthermore, I will look at different household characteristics to examine the contextual differences in risk aversion and expenditures. My research question is formulated as followed: ‘*what is the relationship between violence and financial decisions for households in Kenya and how do different household characteristics interact with this relation?*’ The data that is used for this study is retrieved from a large household survey conducted in Kenya between 2008 and 2014. Tavneet Suri and William Jack (2011) organised this survey and have gathered unique data on the use of mobile money. Mobile money is a tool that allows individuals to make financial transactions on a digital account. It grants users the privilege to save, to invest and to buy or sell services and products. This technology has been used widely in Kenya and is changing livelihoods rapidly. Research about this technology and its effects are still limited, but the evidence has thus far shown interesting developments in financial inclusion for rural and urban areas.

To link violence and mobile money in Kenya, I combine the household panel data with conflict event data by the Uppsala Conflict Data Program (UCDP)². I use data from violent

¹ Although the levels of violence reached an all-time high, strictly speaking the number of related-battle deaths have not exceeded preceding figures.

² See Gleditsch, Wallensteen, Eriksson, Sollenberg, and Strand (2002).

events that happened between 2007 and 2010 in Kenya. This research is particularly unique in analysing the effects of mobile money with structured evidence from survey data. So far, most research about the effects of mobile money or its impact, provided only very limited empirical data. For that reason, this thesis is meant to advance the debate on violence and economic development. Mobile money is quickly upcoming and thus it is necessary to analyse the possible impacts. The link between violence and financial decisions has more often been made in research, though the relation of violence to mobile money has not been extensively covered since mobile banking technology is relatively new. Blumenstock et al. (2014) were the first to empirically assess the link between violence and mobile money. They discovered that in Afghanistan violence is significantly correlated with mobile money usage. In areas where violence was more predominant, mobile money was less used. Instead, the respondents retained their cash in paper to be better able to cope with shocks and uncertainties.

Although I use a different kind of data from a different country, I hypothesize that violence in Kenya also significantly impacts financial decisions concerning mobile money. From the survey of Jack and Suri, I take seven dependent variables that say something about the decision-making of a household. These variables are further explained later in the thesis. I aim to see whether the effects in Afghanistan are similar in Kenya.

Compared to Afghanistan, Kenya experiences different types and intensities of violence. Violence levels in Kenya have been high mainly during election times. Political instability has invoked ethnic tensions and resulted in many forms of structural violence. Problems of land grabbing, cattle rustling and terrorist threats from border countries cause a fearful state of affairs in many places in Kenya. The conflicts that arise are harmful for economic development and especially limit the large population of pastoralists. Mobile money offers a secure and safe system to store money. In violent areas this can help households to deal better with uncertainties. However, as I have already said, the study by Blumenstock et al. shows counterintuitively that people prefer to retain cash instead of mobile money despite poorer security.

The results of my fixed effects estimation do not confirm my hypothesis which means that violence is *not* significantly affecting mobile money and the financial decisions given the data that I use. In my conclusion, I am stressing the importance of different types and intensities of violence that might affect the results. Furthermore, the results of the household interaction variables also do not show significant effects for the response variable. The data and its precision are limited in important ways. Nevertheless, from the data, it seems that violence is not causing a significant impact for financial decisions concerning mobile money in Kenya. I

explain that it is reasonable to think that either violence levels are too low or too structural for it to be influential, or the security of mobile money has given users such confidence and trust in the safety of their mobile money balance.

The thesis is structured as followed. First, I describe the violence levels in Kenya and how ethnicities have played a major role. After that, I present the context and background of mobile money including the economic and social impacts taken from the literature. Chapter 3 presents the methodology of the research followed by the results and discussions. Lastly, I end with a conclusion.

2. Context

2.1 Violence in Kenya

Violent conflicts have continuously prevailed in many Sub-Saharan countries. Some experience large scale conflicts and others are bound by the mechanisms of micro-level violence that has nested itself in politics and in culture. Kenya has been relatively peaceful since 2000 except for one particular period on which I will elaborate later. Most small-scale conflicts arise within cross-border localities where Kenyan pastoralists clash with communities from Somalia, Uganda, South-Sudan or Ethiopia. The main drivers for these conflicts are cattle rustling and issues over borderland. Particularly cattle rustling has become an ingrained problem for traditional pastoralist communities because their livelihood depends fully on the economic value of cattle. Other than that, cattle are just as important for the social status of these pastoralists. The more cattle one owns, the more power one receives. Any threat to grazing lands or cattle is, therefore, a threat to the existence of an entire pastoralist community (Greiner, 2013).

One of the prominent underlying problems for cattle rustling is the dowry payments which must be paid according to traditional custom. Young men are obliged to pay a manifold of cattle to the bride's family before he is allowed to marry. Obviously, at a young age, these men have to either rely on a wealthy family or save all hard earnings for sometimes a decade or more. In the latter case, men regularly resort to violent cattle rustling to complete the dowry sooner. However, in recent years, organized violence has emerged in cattle rustling far beyond the limits of traditional dowry due to the spread of small arms and the politicized claims over administrative boundaries. Kenya's decentralized and troubled politics have produced complex ethnic fractions in the violent disputes over land and political control. Regional leaders that want to safeguard administrative boundaries have been using these violent rustling groups to try and preserve an ethnically homogenous electoral base which causes extreme levels of violence amongst the pastoralist communities. The political fragmentation has increasingly led to ethnic diffusion. The continuous tampering of ethnic cleavages within salient issues contributes to the tensions (Greiner, 2013).

Deep ethnic resentments began to grow ever since Kenya's independence. The Mau Mau uprising, led by the largest ethnic group, the Kikuyu, initiated the process of independence by resisting with military force against the British colonizers. The events eventually created an internal rift for the Kikuyu in which the elite wanted to consolidate post-colonial power by protecting the status apparatus as it was led by the colonizers. If successfully consolidated, the

elite would gain power over the abundant 'White Highlands', a vast area of formerly colonized land (Throup, 1993). Jomo Kenyatta, the first president after independence in Kenya, led a fairly stable multi-ethnic coalition, but he was nevertheless unable to decentralize the power of tribal patrons. Access to land and finances became a matter of virtue depending on the political position of an ethnic leader. Powerful land-buying companies began to alienate people of their customary land because it was supposedly granted to them by the political elite. Ethnicity quickly became a powerful leveraging tool, as it became ingrained within politics. Meanwhile, it also created a class diffusion where the dominating Kikuyu began to thrive at the costs of smaller ethnic associations. Ethnic favouritism evoked feelings of hatred and agony and has in this way led to and shaped the current political situation in Kenya (Bedasso, 2015).

In 1969, Kenya became a de facto one-party state, because Kenyatta convinced his later successor Daniel Arap Moi to merge the two leading parties to complete the process of decolonization. Moi eventually led Kenya as the second president after independence from 1978 to 2002. In 1992, however, Moi had to introduce multiparty elections after external pressure, opening up the system for opposition groups (Tordoff, 1997). This act of democratization was welcomed, but it also brought again the reaffirmation of ethnic identities. Political parties emerged along the lines of ethnic cleavages rather than those of ideological values (Bratton & van de Walle, 1997). Deep ethnic and regional resentments resurfaced in political campaigns and subsequently lead to intense electoral violence. Official figures state that 365 people were killed between October 1991 and December 1992. However, other figures from the Guardian or African Watch report 1.000 and 1.500 deaths respectively. Also, it is estimated that around 300.000 people living in Western Kenya were displaced in the same period (Writenet, 1994).

The most recent and important violent crisis in Kenya took place during and after the 2007-08 elections. Just like in '92, violence in Kenya was largely centred around the elections due to the politicization of ethnic divisions and traditional land ownership. Violence has been especially prevalent in the Rift Valley province, where there are many different ethnic groups and where the competition to secure highlands is fierce. What is interesting, however, is that although land ownership is politicized, many political leaders are at the same time not so keen to engage in these contested issues, because they arguably have a lot of long-established economic control over the areas. Problems of land rights and ownership are therefore hardly tackled by the ruling elites out of fear of losing power. Yet, during times of elections, political leaders have no choice but to participate in these salient and contested issues on land, because in order to maintain economic control they have to keep political control. This is also the reason

why Kenya has so far largely experienced violence throughout election times. Tensions during normal periods were no less realistic, but as I have already said, the political leaders do not actively engage in these issues to protect their economic power and thus try to avoid any escalation. Leaders even go to great lengths to suppress any tensions of land or politics that surface during non-election periods (Kanyinga, 2009).

Before the actual election in 2007-08, campaigns started to become more hostile and turbulent. Contested issues were again discussed along the lines of ethnic cleavages and brought back deep feelings of resentment, causing anxiety to some independent international observers. Frictions between political parties increased, but the campaigning period remained nonviolent. On December 27th, this changed when Mwai Kibaki – the incumbent – was declared winner. Supporters of Raila Odinga, the biggest opponent of Kibaki, perceived the results to be rigged and started to protest on the streets. The protestors demanded ‘truth and justice’ in the elections and very rapidly people began to mobilize in large numbers. In response, national security forces went out and dispersed several protests by force. After this, things quickly escalated into organised and coordinated violence. Enlisted gangs and criminals were mobilized by influential politicians and businessmen and sent out to harm the opposing sides. In the literature, it is unsure whether the rapid development of organized violence suggests some pre-planning before the elections, though it is likely that prominent political leaders enjoy constant support from their patronage, even if that would mean the committing of violence. In response to organized violence, many ethnic groups started to take matters into own hands and planned revenge attacks to expel rivaling groups of their lands and premises. The violence eventually ended when the National Peace Accord was signed in February 2008, two months after the election. Overall it had cost the lives of 1.000 to 1.500 people and caused the displacement of more than half a million Kenyans (Kanyinga, 2009).

The elections in 2013 and 2017 were held relatively peacefully partly due to the international support Kenya received to guarantee free and fair elections. In practice that meant that the electoral process was observed and monitored by international and domestic actors. Also, more importantly, the international rally had moved Kenya to implement a devolved system of government to transfer authority from the national level to the county level. Yet, despite affirmative action from both the international community and Kenya, the elections were obstructed in many instances due to logistical obstacles for sub-national level governments. For that reason, it is still believed by a vast number of the population that these elections were not at all fairly held, but for the sake of maintaining stability, critical tensions were quickly suppressed by the national government (Fiedler, 2018).

2.2 Financial development in Kenya

Since 2000, Kenya's GDP has grown sharply as a result of effective development policies. The financial sector has steadily been reformed to attract new investors and to increase the production activities in the country. Yet despite impressive economic growth numbers from 0.6% in 2000 to 7% in 2007, Kenya failed to attract major FDI's. In the period between 2003 and 2006 the country only received US\$ 39 per capita compared to US\$ 418 and US\$ 310 for Tanzania and Uganda respectively (Abala, 2014). Furthermore, Kenya's number of commercial bank branches equals 5.28 per 100.000 adults. This is approximately the average for Sub-Saharan Africa, but it is nonetheless still not very high compared to countries in other developing areas of the world (IMF, 2017).

Access to banks is important for financial inclusion, but it has been difficult for countries like Kenya to include large rural areas into the financial system. The low population density and small economical revenues that flow from rural areas could not make an economic banking service sustainable. Even in rural areas where banking services are made available, common factors like high distrust among customers and expensive withdrawal fees make it unmanageable to effectively provide financial inclusion (Dupas et al., 2012).

Nevertheless, what is not included in figures on the number and use of commercial banks is the use of alternative financial services such as mobile money. Mobile money is a tool that allows individuals to make financial transactions on a digital account. These digital transactions can be converted into tangible money through mobile money agents. Agents partner with mobile providers and act as 'local banks' through which customers can do their everyday payments or start saving. In Kenya, the service of mobile money, called M-Pesa³, is being used throughout the whole country. It is, however, necessary to stay within the perimeters of network connection to be able to use the service (Jack & Suri, 2011). Over the years, telecom companies in Kenya have built more network towers to extend their coverage. In 2016, it was estimated that all telecom providers combined had coverage of over 90% percent of the population in Kenya (ITU, 2016). Besides that, the figure for mobile penetration in Kenya, i.e the number of active SIM cards calculated as a percentage of the total population, rose above 100% in 2018, which means that there are more active mobile phones in Kenya than people (CAK, 2018). Anyone with an active mobile SIM card and network availability is automatically

³ 'Pesa' means money in Kiswahili – hence M[obile]-Money

included in Kenya's financial system. In the next subsection, I will talk more about the specific impacts of M-Pesa.

2.3 Economic impacts of M-Pesa

Safaricom, Kenya's biggest telecom provider, first launched M-Pesa, in collaboration with Vodafone in 2007. The service allows users to deposit money in their M-Pesa account so it becomes available as digital credit. With their stored balance they can make payments through their mobile phone to other mobile phones. Every time a user wants to cash out or top-up credit they must go to an M-Pesa agent and he or she will provide the necessary service. Even non-registered users can withdraw money from agents whenever they received payments by SMS⁴ (Safaricom, n.d).

The Safaricom annual report of 2018 mentions that M-Pesa had reached 27 million registered users, which is more than 50% of the Kenyan population. Together with other mobile money operators and the fact that non-registered users can also make use of M-Pesa services, it is estimated that around 85% is connected to Kenyans financial system. This percentage is also in line with the network coverage of Safaricom within the country. Moreover, around 155.000 M-Pesa agents are now partnering with Safaricom and are partly stationed in the most remote rural areas to provide many people with mobile banking opportunities. The importance of M-Pesa and its network of agents for financial inclusion is highlighted by the fact that the quantity of ATM's in Kenya is estimated to be around 2000. This is of course quite trivial compared to 155.000 banking agents via M-Pesa (Safaricom, 2018).

Kenyans have embraced the technology of mobile money at a rapid pace and now use it to do business, to send remittances to family or friends, to buy airtime or to save it for the future⁵. Jack and Suri (2011) have studied the economics of M-Pesa and find promising potential for financial development on the microeconomic level. Most importantly, they conclude that M-Pesa increases the easiness of transactions and allows for the safer storage of money. The credit can be transferred at any time and over any distance, whereas before people had to carry or collect tangible cash and then had to travel to distant places to make an exchange. Jack and Suri find great potential in the use of M-Pesa but lack sufficient data to make conclusive claims on the economics of mobile money. Their paper is based on the results of

⁴ Also visually impaired customers or illiterate users can make use of M-Pesa through interactive voice response (IVR). However, the options remain limited, because the system is more vulnerable for fraud.

⁵ Technically, the service for doing business is called 'Lipa na M-Pesa', for buying airtime it is called M-Shwari, and for saving or other credit services it is called M-Kesho. Nonetheless, all services are part of M-Pesa.

two survey rounds and provides mostly preliminary evidence. Among the things they envision is first of all the potential effect for improved inter-personal transactions, which could deepen the person-to-person credit market. Secondly, Jack and Suri argue that saving is an important aspect of M-Pesa, which may help households to make better investment decisions. Thirdly, because of M-Pesa, human capital and physical capital can potentially be positively exploited in places away from home, e.g. when family members take on higher-paying jobs in urban centres. Remittances can namely just be sent through mobile banking. Jack and Suri also argue that for women, M-Pesa could have an empowering effect, because the allocation of household spending can be bargained through mobile phones and therefore make it easier to be in a less visible position where they can keep more of the funds they personally receive. Lastly, M-Pesa features the possibility for households, businesses or individuals to share risks. Risks are for example mitigated by timely transfers of small amounts of money instead of stockpiling cash. For example, when a household head suffer from a health shock, M-Pesa enables them to keep paying for the children's school fees or to request a financial buffer⁶ to be able to pay for medicines and health care (Jack & Suri, 2011).

The research of 2011 by Jack and Suri, only a few years later after M-Pesa was launched, primarily focused on micro-economic impacts. With their household data, they were able to identify improvements for households regarding saving and investments, and risk spreading. Nevertheless, the potential impacts of M-Pesa as described in the study has not been supported empirically. Furthermore, due to a lack of long-term data, they had not yet been able to test for macro-economic effects. The paper in 2016 by Karlan et al. partly tries to fill this missing literature gap and highlight in their paper the need to carefully look at how macro-economic market failures currently plague poor families and how financial digital systems, like M-Pesa, can create strategies to limit these failures. As the authors argue, market failures in developing countries are commonly the result of information asymmetries, high transaction costs, missing property rights, and limited competition.

In the pursuit of finding strategies that limit macro-economic failures, Karlan et al. (2016) show among other things, that while financial services innovations look promising, many innovations do not necessarily deliver positive impacts. Digital micro-credit programs, innovative saving accounts or insurance systems have in studies not yet shown to be highly successful. M-Pesa, on the contrary, has proved to be successful in informal risk-sharing networks, in generating larger cash-flows due to remittances, and in improving consumption

⁶ Every M-Pesa user can access micro credit product (loan) of a minimum of KSHs.100 any time

for non-users. Although more successful, M-Pesa is not without potential risks or pitfalls. Users are for example at risk to become manipulated for the aligned interests of providers and not those of the users themselves. Things like customer protection, data privacy, and universal access are not necessarily in the direct interest of telecom providers. Moreover, a huge pitfall can occur when the value of e-money exceeds the amount of paper cash in the system's circulation, because that would mean extra money is created, thereby causing inflation (Karlan et al., 2016).

Formal institutions and banks have also expressed their worries about the risks of M-Pesa because it has so far only been controlled by Safaricom. Authorities have not yet been able to introduce regulatory checks and balances, and legal regulations to limit the absolute control of telecom providers (Anderson, 2010). Although, some argue that control over private e-money is not necessary since competitors can enter the market freely and limit the monopoly power of Safaricom (Argent et al., 2013; Burns, 2018; Nair & Emozozo, 2018). Indeed, competitors have jumped the bandwagon after Safaricom launched M-Pesa in 2007. Airtel and Equitel have launched their own e-money and together share around 15% of the mobile money market in Kenya. Safaricom has approximately 80% of the market share⁷ (CAK, 2018).

Returning to the impacts of M-Pesa on macro-economic aspects. Although worries exist that M-Pesa in Kenya might disrupt the economy, it has also already shown that a large network of agents combined with an extensive network coverage opens up flows of information (Aker & Mbiti, 2010; Jensen, 2007). Furthermore, the transaction costs in banking have been dramatically lowered when M-Pesa entered the financial system. Opening an account is free and sending or receiving payments now costs only a fraction of what it used to be in formal banking (Gikunju, 2009). Better access to information and lower transaction costs made it attractive for Kenyans to start businesses and become engaged in several entrepreneurial activities (Plyler et al., 2010). This has increased the competition within markets and thus also lowered the chance for market failures.

Nevertheless, since M-Pesa is relatively new, research on the economic impacts is still limited. The technology is promising, but some studies have nuanced the extreme impacts it has had thus far. Jack and Suri (2011) have, for example, reported that 75% of M-Pesa users use it for saving. Yet, the reports of FinAccess⁸ household surveys show a saving rate of 26%

⁷ Remaining market share is attributed to Telkom Kenya (Orange Money) and Mobile Pay.

⁸ The FinAccess is published each year by the Kenyan Financial Sector Deepening (FSD) organisation and is created in collaboration with the Central Bank Kenya (CBK) and Kenya National Bureau of Statistics (KNBS). These reports provide an overview of the access, usage, quality and impact of financial services in Kenya. FinAccess is not to be confused with IMF's Financial Access Survey (FAS).

in the same period (Mbiti & Weil, 2011). Additionally, Jack and Suri argue that the beneficial effects of M-Pesa are more pronounced for female-headed households. However, the report by Hove and Dubus (2019) also shows that many women are still 'left behind' and cannot cope with the technological advancements of M-Pesa. Lastly, despite extensive network coverage in Kenya, the study done by Plyler et al. (2010) reveal that some communities are still excluded and cannot benefit from M-Pesa. As a consequence, the gap between included and excluded communities may grow further and over time create additional problems.

2.4 Social impacts of M-Pesa

Besides financial inclusion, the mobile revolution in Africa is also leading to important social changes. Section 2.3 already shortly mentions the inclusion of rural communities and the opportunities for women to improve their position in the household or as entrepreneurs. In 2012, the World Bank reported that 93% of the Kenyans owned a mobile phone and could thus communicate or make use of mobile money services. At the end of the 1990s this was just 3% of the population (Demombynes & Thegeya, 2012). There is, however, still a small part of the population that is not included, because the cost/benefit ratio of extending the network coverage is too unattractive for providers. At the same time, farmers in desolate areas would still not be able to use M-Pesa efficiently, because it requires an existing and vibrant market, which is not present in most rural areas.

Asongu (2015) has researched the social impacts of mobile phones and of mobile banking, attempting to test whether mobile penetration affects inequality in Africa. With the GINI index as the dependent variable, his findings suggest that mobile penetration has a positive income-redistributive effect for the poor. According to Asongu, mobile banking has led to cost-effective and affordable means to bring aboard those that were formerly excluded by the formal banking systems. In many African countries, the mobile revolution has led to an improved GINI index.

Another study by White (2012) suggests that women are also becoming more equalized as their access to mobile money grants them financial freedom. For this study, White examined Kenyan women in the fishing communities around Lake Victoria. They were observed and regularly interviewed over a period of three months. White observes that men are responsible for the fishing work, whereas the women spend their time selling fish on the markets. The study shows that M-Pesa has helped women to improve sales, to store the bulk of their monetary assets in safety, and to start types of cooperation with other fishery sellers. Furthermore, it

improved the relations between men and women within a household, because the responsibility of generating income was now more equally determined.

A 14-month ethnographic study by Morawczynski and Pickens (2009) also show some evidence that M-Pesa has contributed to female in rural communities. In general, women in rural communities in Kenya are mostly responsible for collecting the remittances sent by urban family members. Before M-Pesa was launched, women had to travel for days to obtain the remittances. Nowadays, if they have access to the service, they can simply withdraw their money at the nearest M-Pesa agent. This saves time, which can be invested in the household or in extra income-generating activities. Especially in separated households where men work long weeks in urban centres, M-Pesa has granted women more financial autonomy (Morawczynski & Pickens, 2009).

Furthermore, there is evidence that M-Pesa has helped households in remote rural areas to cope with and to recover from stresses and shocks. The previous section already shortly mentioned the possibility of risk mitigation whenever household heads suffer from health shocks. In those cases, M-Pesa helps to pay for necessary bills or school fees despite being hospitalized. Even when all M-Pesa credits are used up, the household can request a micro-credit loan to overcome a short period of time. Additionally, M-Pesa has improved how households deal with income shocks. Households in rural areas have varied incomes due to weather conditions that influence the crop yields. Before M-Pesa, turbulent weather conditions often caused irregularities in receiving or sending remittances since it had to be brought physically, either through postal service or by a family member. The regularity and predictability of cash flows through M-Pesa helps to lower the risks of uncertainty. Households show improved investment decisions due to the relaxed trade-off between risks and returns. As a result, households were able to generate a more balanced and less stressful livelihood (Morawczynski & Pickens, 2009).

In addition to the household level, Plyler et al. (2010) have researched how M-Pesa has impacted the community level. One of their main findings is that M-Pesa has resulted in social and human capital accumulation for the communities. Focus group participants appeared to invest more in school attendance for their children and in medical consultations. Some other participants said that M-Pesa has helped for social bonding because it proved to be a convenient tool to help one another in need. However, others would argue that M-Pesa has weakened social bonds because relatives no longer had to travel from urban areas to their rural families or vice versa.

Overall, M-Pesa appears to be most helpful for the rural and poorer segments of Kenyan society. Nevertheless, most studies so far have only based their conclusions on observational qualitative data. Morawczynski & Pickens, Plyler et al., and White, for example, do not provide evidence from experimental data nor from any large cross-sectional datasets. In this way, although M-Pesa appears to deliver social impacts for households and communities, it has yet not been examined extensively. Likewise, it is unsure how livelihoods are socially impacted in the long run. Nonetheless, Kenyans mobile banking is revolutionary for many remote rural communities and seems to positively impact their inclusion within society.

2.5 Violence and mobile money

Central to this thesis is the relationship between violence and the use of mobile money in financial decisions. Like I already mentioned in the introduction, the relation between violence and economic development has been investigated numerous times. By economic development I mean to use an overarching term for all those specific relations that have been examined in combination with violence and conflict. Studying this relation is important because conflict is widely understood to have deterrent effects on economic development. Although, since every country and every conflict is different, it is a matter of continuous research to discover what policies and innovations can limit the impact that conflict has.

Generally, when we speak about economic development, we distinguish between macro-level and micro-level economics. On the macro-level, conflict is weakening governance, endangering public goods provisions, and discouraging foreign direct investments (Collier, 2007; Collier et al., 2003; Goodhand, 2001). On the micro-level, conflict is generally observed to affect household consumption, investments and savings (Besley & Mueller, 2012; Davis & Weinstein, 2002; Serneels & Verpoorten, 2015; Voors et al., 2012). The international community is steadily engaging in addressing the root causes of conflict, e.g by peacebuilding and peacekeeping missions. At the same time, they are also trying to come up with policies or innovations that can limit the impact of conflict. Mobile money is one of these innovations. Experimental studies that have examined the microeconomics of conflict have thus far largely concentrated on conventional money and banking methods. However, now in the era of mobile telephones, possibilities open up as to how ordinary households deal with their assets and liquidity. The technology shows promising features that can help diminish the impact of conflict on households, but empirical research is still scarce.

Blumenstock et al. (2014) were the first to tackle how violence affects mobile money usage. They conducted a threefold research in which they analysed all administrative records

of mobile transactions, executed a randomized control trial, and analysed data from a large financial survey. Concludingly, they find a significant negative relation between violence and M-Pesa usage in Afghanistan. The results are remarkable because logically, one would expect that because violence is present, the only way money can be saved is through storing it digitally, but what happened, on the contrary, was that these households retained paper cash hidden in their houses. In examining this dubious phenomenon, the authors consider the precautionary motive by Keynes (1936). Keynes defines the motive as “the desire for security as to the future cash equivalent of a certain proportion of total resources”. In other words, as Blumenstock et al. (2014) explain, “If current conflict portends a more unstable future, the experience of violence may cause individuals to update their beliefs. Correspondingly, the ability to respond flexibly to changing circumstances may feel more urgent, creating a preference for liquidity.” So even though M-Pesa offers security advantages, this might not be enough to compensate for the ability to respond flexibly to unexpected events.

Furthermore, the preference for liquidity in conflict might also be strengthened because M-Pesa cannot be converted to money outside of the country. For example, individuals that are expelled from the country or flee to find safety are left empty-handed if they fail to convert their existing balance in time. Holding cash is therefore a reasonable desire in violent areas. In the Afghanistan case, the users of mobile money also tended to be wealthier in the data sample which would make it even more plausible that these individuals or households could consider leaving Afghanistan in case of emergency (Blumenstock et al., 2014). Altogether, concrete evidence is only provided for Afghanistan. Violence levels and mobile usage in Kenya though is very different from Afghanistan.

M-Pesa in Kenya is mostly used for sending and receiving remittances, and for buying airtime expenditure. Already in 2008, M-Pesa established itself as the most dominant tool for domestic remittances. Kenya’s remittances largely flow from urban senders to rural receivers. Many families send their grown children or husbands to urban areas to find work so that the entire household is better able to sustain their rural livelihood (Morawczynski & Pickens, 2009). The study by Simiyu (2013) looks at how remittances in the Rift Valley in Kenya changed according to the impact of the 2007 post-election violence and mobile money services. The Rift valley is known for its pastoralist communities, but also for its heavy fighting among ethnic groups. Simiyu finds that remittances sent increased to those households that were victimized by the violence. The extra income helped households to smooth out consumption, and hence act as a coping mechanism to deal with the losses due to political unrest. However, the remittances sent specifically by mobile money remained unchanged. Simiyu does not give

thought as to why mobile money transactions are not increased despite more remittances being sent. However, at the time of data collection, M-Pesa was relatively new and not yet adopted by most Kenyans. Especially rural users were scarce which possibly explains why remittances sent to the overwhelming pastoralist population were not predominantly done by M-Pesa.

Interestingly enough, the overview by Morawczynski and Pickens (2009) state that “M-PESA flows reversed during Kenya’s post-election crisis, with rural users sending money and airtime to urban contacts”. The reason for reverse money flows, they say, is because urban migrants needed money to escape the threat of ethnic violence. Although infrastructure was largely dismantled, the money was used to buy enough airtime to communicate about their situation. As a result, during the post-election period, M-Pesa agents experienced a high demand for their services. Urban customers were making withdrawals rather than deposits. Again, this evidences a precautionary motive in periods of heightened insecurity.

Regardless, the results of Morawczynski and Pickens (2009) show the opposite of what Simiyu concludes. The panel survey data of Simiyu shows that money is flowing from urban to rural areas whereas the ethnographic approach of Morawczynski and Pickens (2009) argue that extra money is flowing from rural to urban areas. Although both types of research look at the impact of post-election violence in 2007, the studied geographic area is different which can explain the disparities. In general, remittances flow from urban places to rural households. However, in periods of extreme violence, these flows increasingly reach the worst victimized households, be it rural or urban.

Considering the above, I can expect to see increased remittances to provinces in Kenya that are experiencing higher levels of violence. The relative demand for cash is likely to increase due to the precautionary motive, but also simply because the inward flow of remittances is higher than the outward flow. The latter, however, does not necessarily result in an increased demand for cash since remittances are received digitally on M-Pesa. Instead of withdrawing their credits, one can just keep the money digitally stored.

Withdrawing cash from M-Pesa requires the service of an agent. Agents are widely spread over Kenya, but less present in rural areas. These agents often operate from small shops or offices with barricaded counters to protect the assets. M-Pesa itself is highly secured, but the shops where agents must store cash remain fragile to external circumstances. Violent robberies are for example commonly reported in the media. Nevertheless, M-Pesa agents show great resilience in violent periods as was seen by Morawczynski and Pickens (2009). During the post-election violence, M-Pesa agents kept providing services while most formal banks had already closed. Now, considering that most violence and tensions in Kenya are present in rural areas,

and considering that rural agents also have relatively more cash (because demand is higher), I hypothesize that the liquidity of mobile money can act as a function of violence levels.

Besides the importance of agents for the liquidity flow of remittances, they are also crucial for the provision of airtime. Like already mentioned, M-Pesa is mostly used either to send or receive remittances or to buy airtime. In exchange for cash, people can buy airtime cards at the M-Pesa agents or top-up their M-Pesa credit with which they can also buy airtime through SMS. In any way, Kenyans must regularly connect with M-Pesa agents. However, in rural areas where agents are scarce, individuals sometimes have to travel long distances to reach an agent. Again, considering that most violence and tensions are present in rural areas, I could expect that increased violence would lower the incentives of individuals to travel and thus spend less on airtime. Although contradictory at first sight to what Morawczynski and Pickens (2009) said about the need for airtime during periods of violence, their study was conducted in Nairobi where agents are found in mass numbers. Buying airtime to communicate about the situation was in those cases less dangerous to do, because of safer travel distances. To some extent, I can thus also expect that airtime expenditure is a function of violence in Kenya.

Existing literature on Kenya has predominantly looked at the effects of electoral violence. However, research in these peak moments, though important, does not necessarily provide representative answers about the usual state of Kenya. Violence during elections has indeed gone to extreme levels and the aftermath is certainly visible over the years, but it must be distinguished from more structural forms of violence that are played out between ethnic groups. Structural violence⁹, as the word already says, is the constant deprivation explained by the negative power of social institutions and systems of social organizations. In Kenya, since the role of ethnicity became salient in politics and in land issues, some marginalized communities have had to live with things such as fewer economic opportunities and less democratic power due to remaining patrimonial influence (Omotola, 2010).

However, as much as violence is destructive, households learn to adapt by creating new coping strategies. (Eriksen & Lind, 2005) have looked at the coping strategies of households in Kenya and how they adapt to the impacts of conflict. They find that households adapt to the threat of violence in ways that reduce long-term vulnerability. Just like with the precautionary motive, individuals may update their beliefs if the current conflict portends a more unstable future and consequently adapt according to their beliefs. Now, given that structural violence is

⁹ The concept of structural violence was first developed by Johan Galtung (1969) to enable more nuanced research on the political, social, cultural and economic forces that shape inequality and suffering of particular groups and communities.

per definition long-term, that on itself makes it less difficult to portend the future. In other words, households that have already experienced structural violence and know they will have to continue experiencing it in the future, have adapted their livelihoods and made themselves less vulnerable, because they know what to expect. In contrast to direct or incidental violence, which occurred during the post-election violence, adaptation is barely possible, because these events could not be foreseen. Considering all the above, the impact of violence on mobile money will undoubtedly differ with the type and intensity of violence. In Afghanistan for example, violence is much more unpredictable, because it is a typical guerrilla war. The intensity of violence varies daily which makes it difficult for households to adapt their livelihood. As already mentioned, it has also impacted mobile money usage as Blumenstock et al. (2014) prove. For Kenya, considering that the country experiences different types and intensities of violence, I expect less if none impact of conflict due to the structural nature of violence. However, since the research is strictly analysing *violent* events that involve deaths or significant injuries, I assume that these are not structural but incidental and direct. So, depending on the frequency and intensity of violent events, I could expect a correlation between violence and mobile money usage in Kenya.

3. Methodology

3.1 The data

In this study, I use two different datasets: (1) A household survey in Kenya carried out between 2008 and 2014 (Jack & Suri, 2011) and (2) a conflict event dataset developed by the Uppsala Conflict Data Program (UCDP, 2017). The first dataset was established to analyse the economic impacts of M-Pesa for Kenyan households. Jack and Suri randomly selected 300 enumeration areas across 118 locations¹⁰. In each of these areas, ten randomly chosen households were surveyed. A total of 3,000 households was selected within a sample frame that included 92% of the population. The residual 8% of the population living in remote Northern and Eastern parts were intentionally left out due to limited network coverage and limited M-Pesa agents at that time. To increase the chance to find households that used M-Pesa, Jack and Suri oversampled locations based on M-Pesa agent coverage, because it was important to have at least one M-Pesa agent in the administrative unit. The total sample is thus not fully randomized.

In 2009, 2010, and 2014, Jack and Suri conducted a follow-up survey to analyse the use of M-Pesa over time. They managed to reach 2,016 of the original 3,000 households in the first consecutive year, followed by 1,595 households and 1,688 households in 2010 and 2014 respectively. However, from 2010 and onwards, the Nairobi area was dropped in the sample, as it was too difficult to track the original households in such a densely populated province over time. The longitudinal characteristics additionally generated some attrition for the dataset, because households might have moved to another province or disappeared for any other reason. As long as the attrition rate is not too high per province, there is no reason to suspect an underlying phenomenon that would otherwise have been imperative for the research. Hypothetically speaking it could be that some households move away from their province because the levels of violence become too risky over the specified time frame whereas other households would not experience much violence. In effect, the data that is collected is mostly representing households that experience less violence, because the households that have fled cannot be recorded anymore. As a result, the data would have produced biased estimates. Although for this research, according to Jack and Suri the magnitude of attrition in their data was not particularly dissimilar compared to regular academic standards in developing countries.

The second data set comes from UCDP and includes all violent events from 2007 to 2010. UCDP. In the dataset, a violent event is defined as: “An incident where armed force was by an

¹⁰ Taken from Jack and Suri (2011): “Kenya is divided into districts, then divisions, then about 2,400 **locations** and further about 6,600 sub-locations. The average population of each location is about 3,000 households”

organised actor against another organized actor, or against civilians, resulting in at least 1 direct death at a specific location and a specific date” (Sundberg & Melander, 2013). The dataset is constructed in such a way that organized violence across time and space can be consistently compared and mapped. Additionally, data from UCDP includes the number of deaths per province which to some extent depicts the intensity of violent events. Besides this dataset from UCDP, similar conflict event datasets exist like those from the Correlates of War project (CoW) and The Armed Conflict Location & Event Data Project (ACLED). These datasets are also used for many academic purposes, but are all different in how they operationalize ‘conflict events’. ACLED reports all political violence and protests and does not exclusively report on ‘violent’ events. Riots, protests, and threats are for example also reported and are integrated into the entire dataset (Raleigh et al., 2010). The CoW project is more similar to UCDP, but the main difference is how they include conflicts in the dataset. For UCDP this standard is at 25 battle-related deaths annually whereas CoW, on the other hand, has a fatality criterion of 1,000 battle-related deaths (Sundberg & Melander, 2013). In Kenya, most violence is not surpassing 1,000 battle-related deaths, but the presence of ethnic tensions and disputes over land and political control are not to be overlooked just because there were fewer casualties. Despite similar reports on violent events, I prefer to use the dataset from UCDP because it captures better the terminological emphasis of conflict in Kenya.

3.2 Research design

The primary focus of this research is to test the relation between violence and several indicators for financial decision-making. The secondary focus is to test whether households with distinctive characteristics show alternative outcomes in the relation between violence and financial decisions. The independent variable for this research is constructed as the number of violent events. I also include the aggregate number of deaths in the events. The use of this extra independent variable is mainly to strengthen and contribute to a wider understanding of existing violence. The dependent variables are derived from the survey of Jack and Suri (2011) and consists of several financial indicators. These are: (1) total remittances sent (2) or received, (3) costs to send and (4) receive remittances, (5) saving instruments used, (6) annual household expenditures, and (7) airtime expenditure.

I treat remittances sent and received as the most important dependent variables for this research. Both can describe the flow of remittances in provinces where conflict is more prevalent and involve most clearly the use of M-Pesa. For this reason, I also present the descriptive statistics on remittances in Table 1 to see what is yearly sent and received. Sender

and received costs of M-Pesa are officially fixed costs according to the mobile money operators (Safaricom, Equitel, Airtel, etc). However, a preliminary look at the survey results already suggests that agents are not always fair in their business. Especially in rural areas where ‘competition’ between agents is limited, agents possess a greater monopoly on their service. To compensate for the higher risks in unstable areas, some agents have demanded bigger payments to send or receive remittances, even though it is against the regulations of mobile money operators. Nevertheless, there is no conclusive evidence that agents act in this way on a big scale. By analysing the costs of sending and receiving remittances, I can potentially find whether areas that experience more violent events indeed have higher costs. The dependent variable of saving instruments is included because it tells something about the spreading of financial risks for households. One of the instruments to spread financial risk by household, is the use of M-Pesa, but that is often not the only instrument they use. Furthermore, I include the dependent variable of annual household expenditure, because it says something about the general financial decision-making. Annual household expenditure consists to a large extent of important yearly payments such as school fees, large assets, and other necessary household investments. Lastly, I have added the yearly airtime expenditure per household as a dependent variable. In section 2.5, I already explain that airtime expenditure can be a good indicator of instability in a region because buying airtime means one must travel to an agent. In areas where traveling is not safe, people are less likely to go to the nearest agent. All these variables are tested independently, but together ultimately say something about the joint financial decision-making of a household.

After the first set of analysis, I test whether heterogeneous effects exists between people having different (1) education levels, (2) trust in M-Pesa agents or (3) household shocks experiences. I only investigate the existence of heterogeneity using the conflict event variable. The interaction terms show how violence differently affects mobile money for each group identifier. The presence of a significant interaction would indicate that the effect of the conflict events variable on mobile money is different at different values of education levels, agent trust, and household shocks. To do this, I am assuming that these terms interact with conflict events.

Both datasets that I use, contain necessary spatial and temporal information to analyse the relationship between violence and mobile money usage. Thus far, Jack and Suri (2011) have mainly used their survey data to distinguish between household users and non-users of M-Pesa. This research will however only focus on M-Pesa users and will also include users of more formal banking methods. For this research, I only selected those users that are actively sending or withdrawing money because it increases the likelihood of being affected by violent events

over time. An active user is defined as having a minimum of one observation (send or withdraw) reported in the survey. The unit of analysis is the surveyed households, not individual M-Pesa users. Moreover, not all household members are individual users of M-Pesa, and not all household members own a mobile phone nor an M-Pesa account. M-Pesa transactions within a household are for that reason regularly organised by the household head.

Furthermore, I have selected only the M-Pesa users who are surveyed in the years of 2008, 2009 and 2010. The results of 2014 are dropped because M-Pesa by then had become more standardized in households. Despite interviewing the same households, increased usage of M-Pesa services due to technological advancements would create a large omitted variable bias. The convenience of using M-Pesa has grown immensely between 2010 and 2014, and also the number of agents has multiplied. If I were to analyse the violence levels with M-Pesa usage I would thus determine a relationship without accounting for the increased usage that should be attributed to technological advancements. The tighter time frame from 2008 to 2010 limits this bias and ensures the year-to-year consistency without gaps in the data. This also makes the temporal impacts of violence more relevant for households. The results of 2014 are nevertheless still useful for some comparisons albeit in a more limited way because there is no data that covers the four-year gap.

The time frame of the UCDP dataset is adjusted to the time frame of survey rounds. The first survey started in August 2008, half a year after Kenya's electoral violence. I include a one-year lag for violence because it is likely that household decisions are affected by not only current events of violence but also by past incidents. The use of a lagged variable for violence is commonly done in these types of research (e.g in Bozzoli et al. (2013), De Ree and Nillesen (2009), and Besley and Mueller (2012)). For this research, it means that electoral violence starting in December 2007 is also included in the analysis. Any remaining event data beyond the survey rounds of 2010 was excluded from my analysis.

The spatial compatibility between both datasets is more weakly aligned. The data retrieved from UCDP is known for its geocoded precision and therefore perfect for spatial analysis. However, data from Jack and Suri (2011) has only limited georeferenced information. As a consequence of ethical and privacy concerns, all variables that contained personally identifying information were dropped from the original dataset, including information on household locations. Nevertheless, provincial information was still retained in the sub-section of sending and receiving remittances. Remittances in the data are more broadly defined than just sending money to relatives. It encompasses everything for household purchases to salary payments and is, therefore, suitable to be analysed within a broader financial paradigm. In total,

Kenya has eight provinces, but as previously explained, the North-Eastern province was intentionally not included for the survey, because of its low population and limited coverage by network providers.

Despite concerns about the precision in the spatial, I integrated UCDP's data with the panel data of Jack and Suri (2011) by constructing a new conflict variable that denotes the number of violent events per province/year for a given household, and the number of deaths caused by these events per province/year. One particular problematic, but unfortunately unavoidable challenge given the type of data available to me, is that provinces are not necessarily representative of spatial proximities. For example, a violent event in the Rift Valley province might be closer to a household in Nairobi province than some households located in the remote parts of the Rift Valley. Accordingly, what is then widely known is that sample data collected from geographically close entities tend to be more alike and are thus not independent, as Tobler (1970) argues in his spatial growth model. In the data, I have corrected for this spatial correlation by accounting for between-variance in the model, which I will explain in more detail in the next section.

3.3 Estimation strategy

Different models exist to estimate the relation between violence and financial household decisions. Depending on what effects one wants to measure, spatial panel models can be analysed through variants of the random-effects or fixed-effects model. Based on my research design, I aim to estimate the within-effects for households rather than the between variations of provinces or households. For such an approximation, I use the fixed-effects method with several dummy variables. In their research, Blumenstock et al. (2014) use a similar approach, exploiting the fixed effects to produce a balanced panel data that controls for time-invariant unobserved heterogeneity. Not controlling for this heterogeneity would result in a biased cross-sectional analysis. For that reason, I include individual fixed effects, time fixed effects, and province fixed effects. To be sure that the fixed-effects model is more appropriate regarding the panel data than the random-effects model, I also run the Hausman test which computes the consistency of estimators that is efficient under the assumption being tested (Allison, 2009). The results are shown in figure 1 and prove to be in line with the fixed-effects model¹¹.

¹¹ The null hypothesis was rejected, because p-value <0.05. According to the Hausman test this proves that there is enough correlation between the unique errors and the regressors and should thus be estimated through a fixed-effects model.

Furthermore, Allison provides a basic fixed-effects model for panel studies in which I incorporate the specific fixed effects. Finally, I run regressions in the form

$$y_{ijt} = \beta_0 + X_{ijt}\beta + C_{jt-1}\gamma + \alpha_i + \beta_t + u_{ijt} ,$$

where y_{ijt} is one of the indicators of financial decision-making for households i ($i = 1, \dots, n$) living in province j at time t ($t = 1, \dots, T$), X_{ijt} is a vector of household and province controls, C_{jt} includes our vector of lagged conflict variables (defined as the number of violent events per year/province and number of deaths per year/province of year), α_i captures a time-invariant unobserved household effect, β_t captures systematic variation across time (time-fixed effect), and u_{ijt} is the usual error term, which is time-variant for each household. To prevent that the occurrence of conflict correlates with the error, I use the lagged independent term of violent conflicts. This approach will yield more consistent estimators, but can still cause a correlation between the lags and the contemporaneous error u_{ijt} . Finally, the parameter of interest is captured in the vector γ , giving an estimate of the effect of violent events on the probability of being affected in financial decision-making. As already described in the research design I restrict the sample to active household M-Pesa users to increase the likelihood of being affected by violent events over time.

4. Results

The result of the estimation strategy is presented in Table 2. Columns 1 to 7 all present the result of a fixed-effect regression with the individual, time and province dummies included. All dependent variables are monetarily characterized, except for the number of saving instruments used. The fixed-effects model has computed the relation between violence and M-Pesa usage, identified by within-individual (household) changes over time, but find no significant relationships between the number of conflict events and seven different dependent variables. However, if we look at our estimated deaths variable, the results show one positive significant relationship between the sender costs and the estimated deaths. This means that the higher the estimated deaths in a given province, the larger the sender costs are. From the example of violence and M-Pesa in Afghanistan, by Blumenstock et al. (2014) we know that mobile money operators either refuse to operate in insecure regions or demand higher premia to compensate for the risks. So, in areas where violence is more prominent, costs to withdraw and send money are also increased. However, in Kenya, the mobile money tariffs are fixed and only differ to some extent between the operators. Safaricom and others do operate within more insecure areas, but it is evidently more costly for them to uphold the flow of liquidity with e-money balances. Every operator has a different cost-benefit strategy behind their network of agents and towers. Some might want to gain market share and expand the competitiveness of mobile money by rolling out the network in more insecure and remote areas despite the costs. Others keep their focus on urban hot-spots, despite heavy competition. Just like in Afghanistan it could thus be that certain operators, that charge higher premia, are more located in these remote and insecure areas, but as Kenyan subscribers altogether have so far not been mapped, that is difficult to tell.

What is more interesting in Table 2, is the mean of remittances sent. It shows a mean amount of 8515 KES, which is approximately 105 US dollars if we take the foreign exchange rates at the time of data collection. Compared to Kenya's per capita income of 2010¹², the amount of remittances sent is roughly 1/10th of their total income within a given year. The real share is less though since observations are measured on the household level and not on the individual level. The recorded remittances have not only been sent to a spouse or family member but were for instance also used to pay debts, school fees, and to sustain businesses. Remittances received were likewise used for the same purposes. Most of these payments were predominantly made through M-Pesa and otherwise through more formal banking methods. With that in mind, considering that the results in Table 2 represent 1/10th of the per capita

¹² Source: <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=KE>

income, it is evident that mobile money was quickly adopted by the Kenyans and used intensively to send and receive money.

Furthermore, if we look at the coefficients of remittances sent and received it shows a negative sign for remittances sent and positive for remittances received. This shows that when conflict events increase, households do in fact send fewer remittances. The coefficient for received, on the other hand, tells us the amount of remittances received is increased whenever conflict events increase. Conflict causes instability and households need to compensate for the loss of stability and security. For that reason, it is logical to assume that family members, spouse or friends send more money to the endangered households to enable them to deal with these uncertainties. The difference between these two could exactly be the money that households withdraw due to a precautionary motive. Looking at the independent variable estimated deaths (#), however, I find contradictory outcomes which causes some confusion on the interpretation of the results. In most of the computations, I find inconsistencies between the variables of conflict events and estimated deaths.

Tables 3, 4 and 5 present the results of the interaction variables in my fixed effects model. These interaction variables are (1) head education level, (2) trust in M-Pesa agent, and (3) number of household shocks. All interactions were separately computed with three out of seven dependent variables: remittances sent, remittances received and airtime expenditure. I left out variables sender cost and received cost because they are determined by the mobile money operators and therefore not connected to particular household transactions. Also the saving instruments and annual expenditure are left out of this analysis, because these two variables relied less on the use of M-Pesa in the data, but say more about general financial decisions within the household.

Table 3 presents the interaction of head education levels including the fixed effects from the original model. The coefficients of education levels show the change relative to the intercept. There are no significant results which evidences that the relationship between violence and mobile money is not differently determined by education levels. It appears by looking at the coefficients that university-level households are sending more remittances in times of conflict and receiving less. The most logical reason would be that these households, given their education level, already enjoy higher incomes than other households which means they have to worry less for the losses of violence. Moreover, they might be sending remittances to other households that are more victimized.

Table 4 presents the interaction of household shocks. This variable is constructed as the number of shocks experienced by a household. Typical household shocks were a large increase

in commodity prices, violent injuries, illness of the household head, and theft/robbery/burglary/assault. The table shows again no significant relations, but the coefficients with remittances sent do indicate that whenever a household experiences more shocks, they are less inclined to send money. Most likely that is because the households need it themselves to compensate for the shocks.

Lastly, Table 5 presents the interaction of trust in M-Pesa agents. Survey respondents were asked whether they trust their M-Pesa agent or not. Agents are crucial for the M-Pesa money circulation and are the only ones who can upgrade your balance or from whom you can withdraw received remittances. The data shows that trust problems are, for example, created when agents overcharge users (even though tariffs are fixed) or when agents refuse to perform transactions. Despite no significant interaction, the remittances coefficients higher results when households trust their M-Pesa agent. The relative change is less evident at the airtime expenditures. With increased violence, I had not expected to see lower expenditures than households that do not trust their agent, because the expectations in section 2.5 indicate that airtime is less likely to be bought when traveling to an agent becomes dangerous. The distrust in agents brings an additional hazard, but looking at the data this does not really change the expenditure of households. The demand for airtime is most likely stronger than the extra risks that violence and distrustful agents give.

5. Discussion

At the times of the surveys, M-Pesa was still relatively new. Jack and Suri had gathered unique data to discover how the mobile money revolution changed the economics of Kenyan households. The focus of their surveys was to find data among M-Pesa users and non-users. My research focussed exclusively on active M-Pesa users, limiting the number of observations. The data also had to cover observations of the same household over three consecutive years to see if there were changes over time. For each dependent variable, the total number of households was slightly different because not all survey sections were answered or questioned. For my remittances section, I was eventually left with 935 households out of 1595 total. However, some of these households, though interviewed three times, did not always consistently report their money transfers. In most cases, I had to drop those observations to preserve the homogeneity of M-Pesa transactions. In brief, since I had to use data from a different study and a different purpose, I was more limited in what I could find between violence and financial household decisions.

The results from our fixed-effects model provided no evidence that violence is significantly affecting how households make financial decisions about M-Pesa or about typical household expenditures. Similar studies, on the other hand, do find a negative relation between violence and financial capital (Besley & Mueller, 2012; Davis & Weinstein, 2002; Serneels & Verpoorten, 2015; Voors et al., 2012). Most of them, granted, have not studied the consequences for mobile money, which is after all assumed to be less vulnerable to insecure environments. Yet at the same time, Blumenstock et al. (2014) find that violence certainly does affect M-Pesa usage in Afghanistan. Although a different country with greater violence levels, I would have at least expected some relation in Kenya too.

I think there is a lot to say about the quality of data that is available for this research. One of the most important things for the data is the spatial information. The closest proximity for this research was given on provincial levels, which for Kenya is quite large. Any estimation done on the district or village level would have brought the results closer to its true value, because then it is more certain that a violent event affects the household. Another remarkable finding of the data is the downward slope of remittances sent and received over the years as seen in the descriptive statistics Table 1. The mean is highest in 2008 but falls sharply in 2009 and 2010. A plausible reason could be that the effort was bigger to collect data in the base year, thereby encoding more transactions into the dataset. Any secondary source would namely argue that the use of M-Pesa has only progressed in every year. Overall, the coefficients and means

show many inconsistencies and contradictions which make it difficult to interpret them for conclusions.

Certainly, if we look at the results of Table 2, it is not unthinkable that present violence levels in Kenya do not affect households in any way. In section 2.5 I have already explained the difference in violence levels and type between Afghanistan and Kenya. Since the violence in Kenya is more structural and less excessive, households can adapt their livelihoods. In effect, the beliefs of one precautionary motive are not updated, hence violence does not significantly affect mobile money usage or how households make other financial decisions. I do see in Table 2 that the amount of remittances received showed to grow positively as violent events increased whereas remittances sent showed a downward spiral. By this logic, not only the preference for cash increases, but also the relative demand for cash.

Another explanation can be found in the security and safety of M-Pesa. Perhaps users have gained so much confidence in the system that mobile banking has become immune to all levels of violence. Although, M-Pesa is unlikely to be completely immune for violence because the physical circulation of money through M-Pesa agents is still indispensable to be able to actively use M-Pesa. In insecure areas with high risks of violent crimes, M-Pesa agent stations could be targeted by organized groups or the agent might himself be active in organized crime. In any case, these hubs of money become vulnerable for raids and therefore restrain the accessibility and effectiveness of mobile banking.

The results of Table 3, 4 and 5 showed no significant relations. I calculated the relative changes between the group identifiers, but the interaction with violence was not strong enough to influence mobile money. The coefficients, however, do imply interesting reactions if the interaction is added. Evidently, the interaction variables in itself affect the dependent variable, but the increased violence can certainly have a different effect for each type of household characteristic. The precautionary motive, for example, requires that households think about the actual risks and future uncertainties. Assuming that household heads with higher education can make a better-calculated choice, it is not unthinkable that increased levels of violence affect those households differently in their financial decisions.

6. Conclusion

M-Pesa, launched in 2007, has offered Kenyans the means to ease financial transactions and to deal with typical household challenges. In a country where formal banking methods are inaccessible or cumbersome for the majority, it is thus not surprising to see that Kenyans quickly embraced and adopted this revolutionary mobile technology. Kenya's tremendous development over the last decade is partly due to the economic success of M-Pesa. However, as Blumenstock et al. proved in Afghanistan, M-Pesa is still vulnerable to conflict despite the security and safety of mobile money. Conflict causes economic stagnation and step by step research is progressing how they relate on the micro- and macro level. The purpose of this study was to find if violence in Kenya potentially impacts how households use M-Pesa and if financial decisions are differently made. The results show no significant outcomes. From the data, it has not become evident that violence affects M-Pesa usage. I do, however, find that the amount of remittances sent and received make up for a large share of Kenyans GDP per capita, though the result is given per household and not per individual.

Furthermore, although the results are not significant, the coefficients do say something about the use of M-Pesa in provinces with higher conflict events. In these circumstances, generally, remittances sent decrease and remittances received increase. This observation possibly indicates that victimized households use the extra remittances to adapt and compensate for the instability and uncertainty that violence brings. However, since the result was not significant enough, it appears that violence in Kenya is not detrimental enough to influence the use of M-Pesa and general financial decision-making. Hence contrary to Afghanistan, I argue that Kenya is not impacted due to different violence levels and intensities. Most violence in Kenya is structural which is not reported in the data of UCDP unless it results in a violent event. Kenyan households learn to adapt to structural violence and find great use in the security and safety that is inherent to M-Pesa. The intensity of violence is mostly high during election periods, but even these events did not result in a significant change regarding mobile money.

Besides the main effect of violence and mobile money, I find that the interaction terms also do not show significant effects. Different education levels, number of household shocks, or trust in M-Pesa agents did not prove to change how violence affects financial decisions. Overall, this research had to deal with many challenges related to the data. The dataset was initially used to measure the economic impacts between users and non-users of M-Pesa, and not to determine a relation between violence and financial decisions. The variance in data was low because the data was only specified by seven provinces over three years. Generally, though,

the results do provide a great indication. So far, it seems that M-Pesa in Kenya is relatively immune to violence. Such a finding can contribute a lot to the further development of mobile technology and financial inclusion. Nevertheless, more research with specific data is needed to find a conclusive answer to the question of whether violence is actually affecting M-Pesa usage.

At the time of the surveys, M-Pesa was still sparsely used in Kenya. However, by 2018 there were more active mobile phones than people and the number of registered M-Pesa users rose above 50%. Also many non-registered Kenyans use M-Pesa or benefit from it. Since much has changed, new data and research is needed to evaluate the impacts of M-Pesa. Other countries have also started to roll-out massive networks for mobile money, but empirical research, so it seems, has not yet followed this development trend. So far, there is only preliminary data available or research is done with more outdated datasets like the one used in this research. Technology moves fast and the adoption rates are high, as Jack and Suri already discovered in 2011. New data could shed refreshing light on what M-Pesa can actually mean for financial inclusion and development, but also on how violence impacts mobile banking. Conflict is development in reverse, as the World Bank clearly stated in 2003. It deters development on a sheer magnitude. Combatting poverty in conflict-affected countries stays troublesome because of instability and insecurity. Solutions like M-Pesa has a great potential in limiting the deterrent effect of conflict, but research on how these two relate is still scarce.

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Tables and figures

Figure 1: Hausman test

	(b)	(B)	(b-B)	$\sqrt{\text{diag}(V_b - V_B)}$
	fe	re	Difference	S.E
Conflict events (#)	324.53	-66.71	391.24	179.37
Estimated deaths (#)	-18.97	8.64	-27.61	21.22

b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg
 Test: Ho: difference in coefficients not systematic
 $\chi^2(2) = (b-B)'[(V_b - V_B)^{-1}](b-B) = 6.4$
 Prob> $\chi^2 = 0.0409$

Notes: P-value is below 0.05 = null hypothesis rejected. There is significant correlation between the unique errors and the regressors. Fixed-effects model is recommended.

Table 1: Descriptive statistics

<i>Variable</i>	Remittances Sent			
	Mean	Standard Dev.	Max	Obs. #
/ Year				
2008	10661.9	27976.5	536000	540
2009	7555.8	13928.5	150000	559
2010	6842.7	23859.4	433000	372

<i>Variable</i>	Remittances received			
	Mean	Standard Dev.	Max.	Obs. #
/ Year				
2008	8473.7	18813.0	195150	493
2009	7388.4	21211.4	305000	545
2010	5704.1	9692.7	67000	353

<i>Variable</i>	Annual household expenditure			
	Mean	Standard Dev.	Max.	Obs. #
/ Year				
2008	55699.7	227951.5	4840000	738
2009	34992.4	79369.7	1034500	793
2010	65868.1	167584.7	2280000	934

<i>Variable</i>	Airtime expenditure			
	Mean	Standard Dev.	Max.	Obs. #
/ Year				
2008	1351.8	1695.4	20000	760
2009	1900.6	2592.8	38000	799
2010	2158.2	3337.1	36600	857

Notes: All figures are given in Kenyan Shillings (KES).

Table 2: Violence and M-Pesa

Dependent Var.	Remittances Sent	Remittances Received	Sender costs	Recipient costs	Saving instruments (#)	Annual expenditure	HH Airtime expenditure
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Conflict events (#) per province	-371.1 (297.6)	148.4 (253.2)	-4.018 (2.477)	-2.160 (2.285)	-0.0144 (0.139)	599.4 (1317.8)	-10.42 (19.23)
Estimated deaths (#) per province	42.83 (33.83)	-8.742 (28.47)	0.647* (0.282)	0.311 (0.260)	0.00145 (0.203)	-163.9 (147.8)	-0.305 (2.183)
Mean Dep. Var.	8515.7	7345.6	104.8	36.1	3.3	52890.9	1819.3
# Households	768	774	768	768	935	935	899
# Observations	1471	1391	1471	1471	2722	2465	2416
R-Squared	0.018	0.012	0.035	0.002	0.294	0.020	0.040
Individual FE	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES	YES

Notes: All dependent variable means, except for the number of savings instruments, are given in Kenyan Shillings (KES). Each observation is an aggregated year. Standard errors are displayed in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Table 3: Household head education interaction

Dependent Var.	Remittances sent					Remittances received					Airtime expenditure				
	<i>Intercept</i>	Primary education	Secondary education	University	Vocational training	<i>Intercept</i>	Primary education	Secondary education	University	Vocational training	<i>Intercept</i>	Primary education	Secondary education	University	Vocational training
	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)	
Conflict events (#) per province	-424.55 (475.6)	1.92 (456.0)	-38.75 (406.2)	234.46 (499.3)	-138.32 (-459.6)	150.83 (329.4)	-90.50 (316.8)	45.56 (281.0)	-177.56 (368.2)	69.94 (341.8)	-21.75 (27.75)	37.36 (25.7)	16.15 (23.1)	-59.67 (31.5)	-17.24 (28.6)
Mean Dep. Var.		6062.8	6749.6	14488.7	15420.1		5295.6	7279.8	11694.2	9163.3		1350.6	1865.5	3451.2	2027.5
# Observations		278	625	123	202		290	577	96	160		530	981	163	286
R-Squared		0.017	0.017	0.017	0.017		0.017	0.017	0.017	0.017		0.05	0.05	0.05	0.05
Individual FE		YES	YES	YES	YES		YES	YES	YES	YES		YES	YES	YES	YES
Time FE		YES	YES	YES	YES		YES	YES	YES	YES		YES	YES	YES	YES
Province FE		YES	YES	YES	YES		YES	YES	YES	YES		YES	YES	YES	YES

Notes: The reference category is educational level 'none'. The dependent variables are the yearly sum of remittances sent per household, yearly sum of remittances received per household, and the yearly sum of airtime expenditure per household. Education levels were measured at the baseline survey in 2008 and only involves the household head. Different levels within primary, secondary and university education have been clustered. Standard errors are displayed in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Table 4: Household shocks interaction

Dependent Var.	Remittances sent					Remittances received					Airtime expenditure				
	<i>Intercept</i>	3-4	5-6	7-8	>8	<i>Intercept</i>	3-4	5-6	7-8	>8	<i>Intercept</i>	3-4	5-6	7-8	>8
HH shocks int. (#)		(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
Conflict events (#) per province	-310.70 (343.9)	-96.63 (393.5)	-99.86 (301.1)	-109.25 (289.1)	-151.51 (495.5)	145.94 (245.7)	-376.68 (302.7)	-227.41 (209.0)	162.21 (208.6)	-453.93 (329.7)	-21.26 (21.3)	-0.90 (25.7)	24.65 (18.4)	15.65 (18.9)	-48.45 (27.8)
Mean Dep. Var.		7687.7	11139.3	7562.7	7993.9		6012.9	9024.3	7209.3	7369.9		2300.4	1576.2	1685.8	1916.8
# Observations		100	265	246	142		86	242	228	128		160	449	390	235
R-Squared		0.016	0.016	0.016	0.016		0.0247	0.0247	0.0247	0.0247		0.0477	0.0477	0.0477	0.0477
Individual FE		YES	YES	YES	YES		YES	YES	YES	YES		YES	YES	YES	YES
Time FE		YES	YES	YES	YES		YES	YES	YES	YES		YES	YES	YES	YES
Province FE		YES	YES	YES	YES		YES	YES	YES	YES		YES	YES	YES	YES

Notes: The reference category is 0-2 household shocks. The dependent variables are the yearly sum of remittances sent per household, yearly sum of remittances received per household, and the yearly sum of airtime expenditure per household. . The number of household shocks is the mean per household of all years combined. Typical household shocks were a large increase in commodity prices, violent injuries, illness of the household head, and theft/robbery/burglary/assault. Standard errors are displayed in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Table 5: M-Pesa agent trust interaction

Dependent Var.	Remittances sent		Remittances received		Airtime expenditure	
	<i>Intercept</i>	Yes (1)	<i>Intercept</i>	Yes (1)	<i>Intercept</i>	Yes (1)
M-Pesa agent trust int.						
Conflict events (#) per province	-674.43 (484.1)	316.87 (361.95)	67.41 (356.9)	24.85 (250.0)	7.61 (35.1)	-22.43 (26.2)
Mean Dep. Var.		9165.5		9050.3		2282.1
# Observations		684		611		982
R-Squared		0.0195		0.0126		0.0394
Individual FE		YES		YES		YES
Time FE		YES		YES		YES
Province FE		YES		YES		YES

Notes: The reference category is 'No'. The dependent variables are the yearly sum of remittances sent per household, yearly sum of remittances received per household, and the yearly sum of airtime expenditure per household. The interaction variable is based on baseline answers of households whether they trust (1) or do not trust (0) their M-Pesa agent. Standard errors are displayed in parentheses. * p<0.05, ** p<0.01, *** p<0.001