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Essays on Remittances in Conflict-affected and Fragile States

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Submitted in fulfilment of the requirements for the
Degree of Doctor of Philosophy

Adam Smith Business School
College of Social Science
University of Glasgow



University
of Glasgow

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Abstract

This thesis investigates the role of remittances in household welfare and the impact of various shocks on remittance flows in fragile conflict-affected Somalia. The thesis constitutes of three interconnected essays.

The first essay analyses how remittances influence key household outcomes, such as asset accumulation, savings behavior, financial inclusion, education and consumption pattern. It utilizes unique survey data from Somalia and propensity score matching techniques are applied to compare households receiving remittances with those that do not, in order to analyze the causal effects of remittances. The results show that remittances (1) have a consistently positive impact on productive assets, such as savings and livestock ownership, as well as on educational attainment for children; (2) enhances financial inclusion and living standards, resulting in higher consumption levels and improvements in both food and non-food consumption; (3) benefits both poor and non-poor households, with the most significant impact observed among non-poor recipients; and (4) increase household wealth across both small and large households, although the effect on livestock ownership is less pronounced in large families. The results underscore the important role of remittances in improving key household outcomes in Somalia. This suggests that stabilizing and supporting remittance flows can significantly enhance asset accumulation, savings, and financial inclusion, and consequently increasing living standards. Effective management of remittance mechanisms is essential for maximizing their beneficial impact on household welfare.

The second essay explores the effects of violent conflict events on the flow and frequency of remittances at the sub-national level. It utilizes detailed administrative data on remittance transactions from money transfer operators in eight developed countries (Australia, Canada, Denmark, Finland, Norway, Sweden, the UK, and the US), focusing specifically on remittances sent to Somalia at the district level. The study focuses on 65 out of 74 pre-war districts, analyzing data from January 2017 to December 2021, with a particular emphasis on 58 districts that consistently received remittances. By employing a fixed effects estimator to account for time and district-specific variations, the research finds that violent conflicts significantly disrupt remittance flows. Specifically,

a one-month lag in overall violence correlates with reductions in both the amount and frequency of remittances. The analysis reveals varying impacts depending on the type of violence, with explosions and attacks on civilians leading to more substantial declines. Additionally, instrumental variable regression, using the African Union Transition Mission in Somalia (ATMIS) as an instrument, confirms that lagged violence conflicts reduce remittance flows and frequency. These findings highlight the urgent need for improved security and stability in conflict-affected areas to support and potentially increase remittance flows, which are important for household welfare in Somalia. Based on these results, it is recommended that policymakers develop strategies to lessen the effects of local conflicts on remittance flows to ensure the continuous availability of these critical external financial flows.

The third essay investigates the impacts of external economic shocks, such as currency depreciation, regulatory de-risking measures, and increases in the Consumer Price Index (CPI) on remittance flows and frequency. Using administrative data from migrant transactions in Australia, Canada, Norway, Sweden, and the US for the period from January 2017 to May 2023, the study employs a staggered adoption design in combination with the Difference-In-Difference (DID) method to analyze the effects of these external shocks on remittance patterns. The results indicate that economic disruptions lead to significant reductions in both the amount and frequency of remittances, and the impacts of such shocks vary (e.g., currency depreciation in Australia, regulatory de-risking measures in Norway and Canada, and increases in the CPI in Sweden each affect remittance flows differently). Extending the analysis with the DID method, the study quantifies the impact of exchange rate depreciation on remittance flows, revealing that a 5–10% depreciation (which proportionally increases the cost of sending remittances) leads to a 4% decrease in remittance amounts. Analyzing shocks by country shows that a 7% rise in remittance costs results in a substantial 12% decrease in remittance flows in Norway, while a 6% increase in costs corresponds to a 7% decline in Sweden. These findings underscore the importance of including such external economic shocks in policy considerations. Effectively addressing and reducing these external shocks is important for sustaining and potentially improving remittance flows, which are important for the economic stability of developing countries.

List of Acronyms

ACLED: Armed Conflict Location and Event Data
AMISOM: African Union Mission to Somalia
AML: Anti Money Laundering
ATE: Average Treatment Effect
ATT: Average Treatment Effect of the Treated
ATMIS: African Union Transition Mission in Somalia
CBS: Central Bank of Somalia
CDI: Combined Drought Index
CFT: Countering the Terrorism
CHIRPS: Climate Hazards Center InfraRed Precipitation with Station data
CPI: Consumer Price Index
CPIF: Consumer Price Index With A Fixed Interest Rate
DID: Difference-In-Difference
EFT: Electronic Funds Transfer
ER: Exchange Rate
FCS: Fragile Conflict-affected Settings
FDI: Foreign Direct Investment
FE: Fixed Effects
FOA: Food and Agricultural Organization
GDP: Growth Domestic Product
HIS: Inverse Hyperbolic Sine
IDP: Internally Displaced Persons
IMF: International Monetary Fund
IV: Instrumental variable
KYC: Know Your Customer LMICs: Low- and Middle-Income Countries
MOPIED: Ministry of Planning Investment and Economic Development

MTB: Money Transfer Business
MTO: Money Transfer Operator
NDVI: Normalized Difference Vegetation Index
ODA: Official Development Assistance
OLS: Ordinary Least Squares
PCA: Principal Component Analysis
PDI: Precipitation Drought Index
PESS: Population Estimation Survey
PSM: Propensity Score Matching
RPW: Remittance Prices World-Wide
SHFS: Somali High-Frequency Survey
SWALIM: Somalia Water and Land Information Management
TDI: Temperature Drought Index
TWFE: Two Way Fixed Effects
UAE: United Arab Emirates
UN: United Nations
UNFPA: United Nations Population Fund
VIIRS: Visible Infrared Imaging Radiometer Suite
WB: World Bank

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Declaration

I declare that, except where explicit reference is made to the contribution of others, that this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

Printed Name: Abdisalam Mohamed

Signature:

Chapter 1

Introduction

1.1 Overview

Remittances, the money sent by expatriate workers to their families in their home countries, play a crucial role in improving the livelihoods of recipient households and enhancing economic growth in developing countries. As a significant source of external income, remittances effectively alleviate poverty and enhance community resilience (Lindley et al., 2024; Mohammed, 2022; Ramachandran and Crush, 2024). In 2023, remittances sent to Low- and Middle-Income Countries (LMICs) were valued at USD 656 billion, outpacing both foreign direct investment and official development aid (World-Bank, 2024; KNOMAD-World Bank, 2024).

Existing research highlights the heightened importance of remittances in conflict-affected and fragile states, where they amounted to USD 70 billion in 2022 (comprising USD 50 billion for conflict-affected countries and USD 20 billion for those facing institutional and social fragility) (Kane et al., 2023). Somalia exemplifies this context, with remittances representing 21% of national GDP, according to the Central Bank of Somalia (CBS, 2023). Due to ongoing conflict, political instability, and limited local opportunities, many Somali families rely on remittances for survival (CBS, 2023).

Despite their crucial role, remittance flows to fragile and conflict-affected environments face significant obstacles, including high transaction costs, limited access to international banking services, and stringent regulations (Carment and Calleja, 2018; Rodima-Taylor, 2022). Research on remittances in these contexts is limited due to a lack of reliable data (Fransen, 2015; Fagen, 2006; Koser and Van Hear, 2002).

Less is known about how remittances relate to essential development outcomes such as asset accumulation, savings, education, and financial inclusion in these settings. There is also limited literature on the link between remittances and violent conflicts or ter-

rorism. Existing studies offer only general insights into how violent conflicts correlate with remittances (Elu and Price, 2012; Mascarenhas and Sandler, 2014; Mughal and Anwar, 2015), and they do not address how subnational level conflicts affect remittance flows. Most existing research on the macroeconomic and socioeconomic impacts of remittances in post-conflict scenarios has been conducted in countries with relatively stable economies, unlike Somalia, which has long endured persistent conflicts. Furthermore, available research has primarily focused on direct transaction costs and their relationship with remittances e.g., (Kpodar and Imam, 2024; Ahmed et al., 2021; Freund and Spatafora, 2008), while other supply-side factors that increase remittance costs (e.g., cost of living, currency depreciation, and regulatory de-risking) have been overlooked.

This doctoral thesis addresses this knowledge gap by investigating the impacts of remittances in Somalia, a context characterised by protracted conflicts and fragility spanning many decades. It specifically examines the multitude of ways through which remittances sustain the lifeline of Somali households and the various factors that disrupt their flow.

Chapter 2 explores how remittances influence asset accumulation, savings behavior, financial inclusion, educational attainment, and consumption patterns, drawing on data from the Somali High-Frequency Survey (SHFS, 2017). Chapter 3 shifts focus to the nexus between violent conflict and remittance flows, analysing how incidents such as violence against civilians and explosions affect these crucial monetary transfers. Chapter 4 broadens the analysis into the global arena, investigating how sender-side economic shocks (including currency depreciation, de-risking measures, and cost-of-living surges) influence the flow and frequency of remittances to Somalia.

By utilising household survey data presented in the first core chapter and detailed transaction-level data from Money Transfer Operators (MTOs) in the second and third core chapters, this thesis provides a robust analysis of the critical role remittances play amidst adversity and instability. Together, these chapters analyse the intricate interactions between internal conflicts, external economic forces, and the enduring resilience of remittances, offering insights that extend far beyond the Somali context.

1.2 Data Challenges

This doctoral thesis draws on two key datasets: a nationally representative household survey from the Somali National Bureau of Statistics (SNBS) and a unique administrative dataset of migrant remittance transactions obtained from formal MTOs based in several developed countries—Australia, Canada, Denmark, Finland, Norway, Sweden,

the United Kingdom, and the United States. The inclusion of both datasets was guided by the aim to rigorously examine the relationship between remittances and household outcomes in a conflict-affected context, as well as to explore how remittance behaviours respond to internal and external shocks.

Collecting and analysing data in a conflict-affected environment such as Somalia presents significant challenges, including limited infrastructure, insecurity, and institutional fragility. These factors complicate general data availability and reliability. The primary challenge in this study stemmed from accessing administrative data held outside Somalia, in Western jurisdictions governed by strict data protection regulations. Specifically, remittance transaction records are classified under the General Data Protection Regulation (GDPR) as “sensitive personal information”; consequently, obtaining access required stringent compliance with legal and ethical safeguards, including anonymisation protocols and privacy protections.

Access to the administrative dataset was further complicated by the need to build trust and establish formal agreements with MTOs, which operate in a highly competitive and sensitive industry that typically does not share disaggregated transaction-level data. The author’s long-standing professional engagement in the remittance sector—holding a remittance license in Norway and partnering with major Somali MTOs—facilitated access by enabling close collaboration, control, and supervision over parts of the dataset. Approval also required coordination with both the Western data controllers and operational management teams based in Somalia, adding to procedural complexity.

The administrative data used in this thesis is of high quality and reliability. It consists of real-time transaction records generated by online remittance platforms and includes verified sender and recipient details. Once processed, these records are immutable and serve compliance and audit functions, ensuring their authenticity. This data spans from January 2017 to May 2023 and covers millions of transactions from several major Somali MTOs, which together handle a significant share of formal remittances to Somalia. The dataset includes migrants from multiple developed countries with large Somali populations, making it broadly representative of formal remittance flows to Somalia.

The scope, granularity, and longitudinal nature of the administrative data constitute one of the most important empirical contributions of the thesis. The dataset includes transactions involving small, medium, and large amounts, sent for diverse purposes such as regular monthly support, education, savings, investment, or emergency assistance during crises. It captures both the frequency and motivation behind remittance behaviours—providing insights into how and when migrants send money. These high-frequency, transaction-level records reflect real-time sender behaviour and exact transfer

amounts, overcoming the limitations of survey data, which is often affected by recall bias or misreporting. Furthermore, the dataset includes unique identifiers for senders and district-level codes for recipients, allowing for behavioural tracking over time and geographic pattern analysis. The ability to track individual remittance behaviour across multiple years adds a dynamic, longitudinal dimension to the analysis, enabling the study of how migrants adjust their support in response to shocks or economic shifts. This enables the thesis to explore how remittance behaviours shift in response to economic shocks, conflict episodes, and macroeconomic trends over both short and long-time horizons.

Accessing such a dataset required not only professional relationships with key stakeholders and gatekeepers but also an in-depth understanding of MTO operations and data handling processes. Due to its uniqueness, granularity, scale, and exclusivity, the dataset provides rare and academically valuable empirical evidence. This thesis is among the first to use such transaction-level remittance data in a conflict-affected context, offering insights that are typically unavailable in migration and remittance research.

While the dataset has limitations—including the absence of recipient geolocation data and omission of informal transfers—it enables robust geographic and temporal analysis. Its reliability, high frequency, and multi-year scope provide a strong empirical foundation for investigating remittance patterns and household outcomes, making it a significant value-added contribution of this doctoral research, as described in the following section.

1.3 Study Contributions

1.3.1 Theoretical and Methodological Contributions

This thesis makes significant contributions to the study of remittances in conflict-affected and fragile contexts, enhancing our understanding of how remittances function in these challenging environments. It offers three key contributions:

First, this thesis delves into the pivotal role and impact of remittances in conflict-affected and fragile settings, with a specific focus on Somalia. Unlike previous studies that often overlooked the complexities of conflict settings, this thesis conducts a comprehensive exploration of how remittances bolster socio-economic resilience in fragile contexts. Through a meticulous analysis of the effects of remittances on crucial household outcomes—such as asset accumulation, savings, financial inclusion, educational attainment, and consumption patterns—this research addresses a critical gap in existing literature. It sheds light on the significant yet largely unexplored influence of remittances, thereby offering a valuable contribution to our understanding of their socio-economic importance

in these challenging environments.

Second, the thesis explores the complex relationship between local violent conflicts and remittance flows and frequency. In contrast to most existing research, which typically focuses on broader country-level data or panels of countries, this study offers a detailed analysis of the impact of localised violent conflicts within Somalia on remittance inflows. By examining how different forms of violence at the district level affect the frequency and volume of remittances, this research provides unique insights into the nuanced interplay between conflict intensity and remittance behaviour. This granular approach offers a more refined understanding of how local conflict dynamics shape remittance patterns, filling a crucial gap in the current literature.

Third, the thesis investigates the impact of external sender-side factors on remittance behaviour, focusing on how external shocks and de-risking policies in sender countries affect the remittance behaviours of migrant senders to conflict-affected Somalia. It analyses the influence of currency depreciation against the USD and de-risking measures (which increase remittance costs) on the flow and frequency of remittances. By highlighting how these sender-side challenges exacerbate the already high costs of sending remittances, the study reveals the added burdens faced by senders and the potential reduction in remittance flows.

Although this research is centred on a conflict-affected setting, it opens avenues for similar investigations in other developing countries, offering insights that have been previously neglected in the academic discourse. In summary, this thesis advances the scholarly understanding of remittances in fragile contexts and provides critical insights into the interplay of conflict, economics, and migration. By addressing these under-researched areas, it contributes significantly to the field and sets the stage for future research in similar settings.

1.3.2 Empirical Contributions to Literature

This thesis contributes to two interrelated strands of literature: (i) the general remittance literature, which examines how remittances impact household wealth accumulation and other socioeconomic outcomes, and (ii) a more recent but growing body of literature on remittances in fragile and conflict-affected settings. These contributions are presented through three empirical chapters that comprise the thesis.

First Empirical Chapter (Chapter 2)

The first empirical chapter contributes to the broad literature on remittances in conflict-affected and post-conflict settings around the developing world in a unique way. Research in stable contexts consistently shows positive remittance effects on household welfare and investment (e.g., [Adams Jr and Cuecuecha \(2013\)](#); [Ahmed et al. \(2018\)](#)). However, much less is known about whether these effects persist in contexts characterised by persistent conflicts and institutional fragility, primarily due to data limitations. In Somalia, existing remittance research is largely qualitative. For instance, [Ahmed \(2000\)](#) and [Lindley \(2007\)](#) analysed the role of remittances in supporting private sector revival and education access but did not examine outcomes like savings, consumption, asset accumulation, or financial inclusion.

In other fragile settings, [Fransen and Mazzucato \(2014\)](#) revealed that remittances in post-conflict Burundi were mainly utilised for non-productive assets, while [Regan and Frank \(2014\)](#) reported that remittances helped compensate for weak state services in Nepal but did not assess broader developmental impacts. Chapter 2 addresses these empirical gaps by analysing household-level data from a conflict-affected fragile context. It demonstrates that remittances support consumption and also promote productive asset accumulation and financial inclusion across diverse settlement types—rural, urban, nomadic, and internally displaced households. These findings extend and challenge existing findings in fragile state literature.

Second Empirical Chapter (Chapter 3)

The second empirical chapter specifically adds to the literature on remittances in conflict-affected and fragile states by analysing how different types of violent conflict affect both the flow and frequency of remittances at the subnational level in the case of Somalia. While previous studies largely explored how remittances influence conflict dynamics (e.g., [Elu and Price, 2012](#); [Regan and Frank, 2014](#)), limited attention has been given to the reverse relationship—how violence affects remittance-sending behaviour. Analysing remittance and conflict dynamics using aggregate-level panel data limits the ability to evaluate localised conflict impacts within countries. This chapter addresses these gaps by utilising a novel panel dataset of individual-level remittance transactions linked to granular conflict data across Somali districts, capturing various types of violence—including explosions, violence against civilians, and battles.

To the best of our knowledge, this study is the first to systematically examine how the nature and intensity of conflict affect remittance flow and frequency in Somalia, using unique administrative data on actual migrant transfers at the district level. While

grounded in the Somali context—where conflict and fragility persist—its originality extends beyond, as few, if any, studies in other conflict-affected countries have employed similarly granular sub-national data capturing real-time remittance behaviour. This addresses a critical gap in the literature, which has largely relied on national or cross-country aggregates that obscure local-level dynamics and sender-specific patterns.

The findings indicate that exposure to violent conflict significantly reduces both remittance flow and frequency. This suggests a shift in the composition of remittances under insecurity and violence. Investment-oriented or large remittances tend to decline, possibly due to increased uncertainty and reduced feasibility of long-term planning. However, smaller, consumption-oriented transfers continue to support households' recovery. These findings provide novel empirical insights into the literature on remittance behaviour in the context of fragility and conflict. Furthermore, they enhance general remittance perspectives by incorporating the role of insecurity and violence. The findings in this study challenge the implicit assumption in remittance theories that remittance flows are primarily shaped by economic factors alone and highlight the critical role of specific contextual political conditions. As such, the second empirical chapter makes a unique and timely contribution to understanding remittance dynamics in countries experiencing prolonged and multidimensional conflict.

Third Empirical Chapter (Chapter 4)

The third empirical chapter engages with both the general remittance literature and the specific literature on fragile states. It analyses how sender-side macroeconomic shocks (particularly the conditions that increase the cost of remitting) affect both the volume and frequency of remittance flows. Within the general remittance literature, existing research has examined how direct transaction costs influence remittance behavior using cross-country panel data (e.g., [Freund and Spatafora, 2008](#); [Beck and Martínez Pería, 2011](#); [Bersch et al., 2021](#)). Specific country studies have also shown that higher costs can disincentivize remitting ([Ferriani and Oddo, 2019](#); [Kakhkharov et al., 2021](#); [Kosse and Vermeulen, 2014](#)). However, this body of work has predominantly focused on direct and observable remittance fees, while largely ignoring broader, indirect sender-side cost factors.

These indirect factors include exchange rate volatility (especially against USD, which is the default remittance currency), inflationary pressures in host countries, and financial de-risking regulations that make it difficult for migrants to use formal remittance channels. The examination of indirect transaction costs is particularly relevant in fragile and conflict-affected contexts, where remittance corridors are already vulnerable due to the absence or weakness of banking infrastructure, disconnection from global financial

networks, and heightened scrutiny under anti-money laundering and counter-terrorism financing regimes. Nevertheless, the existing literature in such contexts remains limited, focusing predominantly on remittance inflows and their humanitarian role, while largely overlooking sender-side frictions.

Chapter 4 fills this knowledge gap, using a unique panel of migrant remittance transaction data and analysing how fluctuations in sender-country macroeconomic conditions affect both the flow and frequency of remittances to Somalia. The findings show that external economic shocks, such as exchange rate depreciation and inflation in host countries, significantly reduce remittance frequency and volume, underscoring how sender-side economic environments can distort remittance behaviour even when recipient needs remain urgent. The findings highlight the overlooked role of indirect cost burdens and reinforce the fragility of remittance pipelines under macroeconomic and regulatory pressure. These insights challenge existing literature that focuses primarily on direct remittance costs, offering new empirical evidence on how indirect shocks shape remittance behaviour—particularly frequency, which is rarely examined due to lack of individual-level data.

1.4 Implications of Research for Remittance Optimisation for Somalia and Other Settings

Remittances are a critical lifeline for recipient Somali households, their communities, and the broader national economy. Beyond direct financial support to families, they generate positive spillover effects by improving the balance of payments, financing small businesses, supporting education and infrastructure, and creating local employment, particularly through investments in transport and real estate. These flows are driven by a combination of altruistic and self-interested motives, such as providing regular support to relatives, contributing to community reconstruction, or saving and investing for future returns.

The findings of this study indicate that remittance behaviour is shaped by multiple overlapping motives, specifically altruism, investment, risk-sharing, and consumption smoothing. Altruistically motivated transfers tend to increase during times of conflict and crisis, as diaspora members respond to the urgent needs of their families. Conversely, remittances driven by investment or savings motives are more sensitive to insecurity, often declining when economic prospects deteriorate or access to recipients becomes uncertain. These dynamics underline the importance of understanding both the context and the purpose behind remittance flows when designing policies to maximise their devel-

opmental impacts.

Somali diaspora communities maintain strong and enduring ties with their homeland, and many return and contribute to society through skills, political engagement, and business ventures, while others anticipate returning once security improves. As stability is restored, remittances intended for investment purposes are likely to grow, and overall flows may increase. The Somali population, therefore, stands to benefit more significantly from these transfers if enabling conditions at both the sending and receiving ends are strengthened.

Optimising remittance mechanisms requires coordinated efforts in both Somalia and host countries. On the recipient side, improving security, advancing peacebuilding, and expanding access to digital financial infrastructure—particularly mobile money and formal banking services—are essential for facilitating efficient, inclusive, and secure transfers. On the sending side, easing regulatory restrictions on money transfer operators, reducing transaction costs, and enhancing access to correspondent banking relationships can help ensure smoother and more consistent remittance flows.

The insights generated by this research are transferable to other fragile and conflict-affected settings. In countries like South Sudan, Yemen, and Afghanistan, where remittances also play a central role in household survival and economic resilience, recognising the diverse motivations behind remittance flows and investing in enabling infrastructure can significantly amplify their developmental impact. While the Somali context has specific historical and institutional features, the broader patterns identified in this study offer lessons for other settings where remittances function as stabilising and developmental tools.

Importantly, the methodological approach employed in this study—the use of administrative remittance data in a conflict-affected and data-scarce environment—demonstrates a transferable model for analysing diaspora finance. This offers practical value for researchers, policymakers, and development practitioners seeking to improve the evidence base and inform policy in similarly challenging contexts.

1.5 Ethical Issues

This research relied on two primary data sources (anonymised household survey data from the SNBS, and administrative remittance data). The household survey data were fully anonymised prior to access, and are publicly available. These datasets contain socio-economic information, including with regard to education, employment, access to services, and exposure to shocks, but exclude personally identifiable details such as names,

addresses, or GPS coordinates traceable to specific households. This level of anonymisation ensured that there was no risk of re-identification, even in a conflict-affected context.

The administrative remittance data initially included personal identifiers such as names, phone numbers, and addresses of remittance senders. To protect privacy, all direct identifiers were removed before analysis, and each transaction was assigned a unique, non-traceable code. These data were obtained from the sender side, and did not involve direct data collection in conflict zones, which reduced the ethical sensitivity, although strict data protection measures were nonetheless applied.

In line with the University of Glasgow's Data Protection Policy and UK GDPR requirements, all research data were securely stored by the researcher in an encrypted and access-controlled environment, with access limited to authorised personnel. Personal and administrative information was stored separately from the research data and handled under strict confidentiality protocols. The anonymisation processes followed University guidance for working with personal and special category data, and care was taken throughout to safeguard data subjects' privacy. All stored data will be deleted within 10 years of the award for this research. The study complied fully with institutional policies, including the Code of Good Practice in Research and associated guidance on research in sensitive settings. These steps ensured the research met the ethical obligations required for working with secondary data from vulnerable populations in conflict-affected contexts.

1.6 Structure of the Thesis

Chapter 2 investigates the role of remittances in crucial household outcomes such as asset accumulation, savings behaviour, financial inclusion, education, and consumption patterns in Somali households. Using unique survey data from conflict-affected Somalia, propensity score-matching methods are applied (nearest neighbour, radius or caliper, and kernel matching). The treatment group includes households receiving remittances, while the control group does not. Matching these groups based on observable characteristics estimates the causal effects of remittances.

The findings demonstrate that remittances exert a consistently positive impact on productive assets—including asset accumulation, savings, livestock ownership, and child educational enrolment—across both urban and rural households. Specifically, households receiving remittances exhibit increases of approximately 0.18, 0.48, and 0.22 standard deviations in savings, aggregate assets, and livestock holdings, respectively, relative to non-recipient households. These results underscore the significant role of remittances in

enhancing household economic capacity and asset accumulation.

Remittances also enhance financial inclusion and living standards, leading to higher consumption levels and improvements in both food and non-food consumption. The analysis indicates that remittances benefit both poor and non-poor households, with the most significant impact actually being among the latter. Remittances increase household wealth in both small and large households, except for livestock ownership in smaller families.

Overall, the findings highlight that remittances significantly improve key household outcomes in Somalia, and underscore how remittances are critical in enhancing important household outcomes in the country. The primary policy suggestions arising from this analysis indicate that by supporting and stabilising remittance flows, asset accumulation, savings, and financial inclusion can be significantly improved, leading to overall better living standards. Optimising remittance mechanisms is vital to maximising the positive impact of effective policies and bringing substantial benefits to household welfare.

Chapter 3 provides valuable insights into the impact of local violent conflicts on remittance flow and frequency. By analysing unique administrative data from Somali migrants in developed countries, the study investigated remittance transactions to Somalia at a district level on a monthly basis. It focused on 65 out of 74 pre-war districts, reporting that 58 consistently receiving remittances from January 2017 to December 2021. Utilizing a fixed effects estimator, to control for time and district-level effects, the study unveils that a one-month lag in violent conflicts significantly disrupts the transfer of monthly remittances to Somalia. The analysis reveals that remittance flows are significantly affected by various forms of violent conflicts, such as explosions and violence against civilians. Specifically, a one-month lag in overall violent conflicts results in a 1.3% decrease in remittances and a 0.9% decrease in their frequency.

Furthermore, explosions lead to a 2% reduction in remittances and a 1.9% decrease in frequency, while violence against civilians causes a 2.4% decrease in remittances and a 2.1% decrease in frequency. These findings point to significant impacts of localized conflicts on the frequency and amount of remittances to Somalia.

Using instrumental variable (IV) regression and African Union Transition Mission in Somalia (ATMIS) deployment as an instrument for violent conflicts, the research affirms that past violent conflicts impede the frequency and volume of remittances. The IV analysis reveals notable effects, including a 10% decrease in monthly remittances caused by conflicts, and reductions of 22% and 14% due to violence against civilians and explosions, respectively. Robustness checks using a two-part model reinforce these findings.

The evidence highlights the critical importance of bolstering security and stability in conflict-affected areas to uphold and potentially bolster remittance flows, which serve as a lifeline for household welfare in Somalia. Policymakers must prioritize developing strategies to mitigate the impact of local conflicts on remittance flows, ensuring the uninterrupted provision of these vital financial resources.

Chapter 4 investigates how external shocks on the sender side, such as local currency exchange rate depreciation, de-risking measures, and Consumer Price Index (CPI) surges, affect the flow and frequency of remittances. The data spans from January 2017 to May 2023, with the units of analysis being individual migrants. The main methodologies employed are a staggered adoption design of the event study framework and the Difference-In-Difference (DID) method, to quantify the cost of remittances resulting from these shocks. The analysis shows that economic shocks lead to a 9% drop in monthly remittance funds and a 4% decline in remittance transfer frequency. Different shocks have varying effects: a 6% drop in the exchange rate in Australia led to a 7% decline in remittance transfers, regulatory de-risking measures in Norway and Canada caused an 8% decrease, and in Sweden, a rise in the CPI led to a significant 29% decrease in remittance flows. Extending the analysis using the DID method, it is found that high exchange rate shocks (5-10%) reduce remittance flows by 4%, with national variations. Analysing shocks separately for each country reveals that a 7% increase in remittance costs results in a 12% reduction in Norway, while a 6% increase in costs leads to a 7% decrease in Sweden. The study highlights the importance of considering these factors in policy formulation for fragile contexts like Somalia and other developing countries. The findings suggest that addressing these external shocks and mitigating their effects could help maintain or improve remittance flows, which are crucial for the economies of developing nations.

Chapter 5 concludes this thesis, noting the main findings and situating them in relation to existing literature.

This study demonstrates that remittances have a significantly positive effect on various household outcomes in the studied context. However, internal violent conflicts and external shocks from the sender's side can disrupt the flow and frequency of remittances. Prolonged internal conflicts negatively affect remittances, while macroeconomic shocks from the sender's side also hinder remittance behaviour. The research introduces new administrative data on sender-side shocks, enhancing understanding of remittances and the influence of de-risking and exchange rate depreciation.

These findings provide insights into conflict-affected regions and offer valuable perspectives on sender-side shocks in other developing country contexts. Reinforcing the

importance of these policy prescriptions, it is crucial to address the factors that disrupt remittance flows to improve household outcomes in conflict zones. Further research should explore additional dimensions of sender-side shocks and their broader implications for remittance systems globally.

Chapter 2

From Conflict to Resilience: The Role of Remittances on Household Wealth in Somalia

2.1 Introduction

Remittances are an important and reliable source of external development finance to developing countries ([Harris and Terry, 2013](#); [Le, 2011](#); [Orrenius et al., 2010](#); [Ratha, 2003](#); [Sghaier et al., 2021](#)). Officially recorded annual remittance flows were valued at USD 551 billion in 2019, nearly five times larger than official development assistance; with three-quarters of remittances flowing to Low- and Middle-Income Countries (LMICs) ([World-Bank, 2019](#)). There is ample literature that examines the impact of remittances on various outcomes in many countries, ranging from the role of remittances to education ([Chaaban and Mansour, 2012](#); [Kifle, 2007](#); [Zhunio et al., 2012](#)), healthcare ([Amuedo-Dorantes and Pozo, 2011](#); [Chezum et al., 2018](#)), poverty, and inequality ([Acosta et al., 2008](#); [Adams Jr and Page, 2005](#); [Olowa et al., 2013](#)) to savings ([Osili, 2007](#)), asset accumulation ([Ahmed et al., 2018](#); [Chiodi et al., 2012](#)), and consumption ([Ahmed and Mughal, 2015](#); [Combes and Ebeke, 2011](#); [Zhu et al., 2014](#)). However, empirical evidence of the relationship between remittances and these various outcomes in conflict-affected countries such as Somalia is scarce or unavailable.

Somalia is one of the poorest nations in Sub-Saharan Africa, having endured civil war and chaos for over 30 years. Since the onset of its devastating civil war in 1991, Somalia's economy has heavily relied on remittances, which constitute 31% of its GDP (Ministry of Planning, Investment and Economic Development [[MoPIED \(2020\)](#)]). Other countries with high remittance shares as a percentage of GDP, according to World Bank data, in-

clude Tonga (38%), Lebanon (13%), Kyrgyzstan (29%), Tajikistan (38%), and Honduras (22%). In terms of total remittance inflows in USD terms, the top recipients are India, China, Mexico, the Philippines, and Egypt ([Ratha et al., 2020](#)). The money sent from expatriate workers to their homelands are typically a lifeline and a buffer against external shocks to the recipient families, while development aid and private investment fluctuate wildly in worn-torn and post-conflict societies. The East African nation of Somalia has been in a civil war and experienced political fragmentation for decades. Successive waves of conflict have obliterated the institutional and physical infrastructure, as well as the economy of the nation. Conventional public institutions and state-driven service delivery disappeared during the conflict, and have only been tentatively re-established in recent years, but with limited impact, as they are dysfunctional and weak. The regulatory environment is fragile, with outdated and seldom-enforced laws ([Girginov, 2019](#); [Isak, 2018](#))

Additionally, Somalia suffers from many profound challenges, including staggering youth unemployment, the internal displacement of vulnerable communities, terrorist insurgencies (most famously by Al-Shabaab), locust infestations, and climate change disasters that seem to occur at an increasingly frequent rate. Despite Somalia lying at the tail end of all global lists in terms of development indicators, the country still survives, and remains largely dependent on the private sector and external resources like remittances and foreign aid.

Remittances make a significant contribution to Somali household income and wealth. Migrant remittances in Somalia are estimated at USD 2 billion, a substantial figure as per ([MoPIED, 2020](#)). It is clear that Somalis have survived during the past 30 years because of remittances and the private sector, due to anecdotal evidence and the default position that some form of socio-economic life has endured despite the total collapse of all conventional societal and political formats. Aid assistance is vulnerable to corruption, and does not directly improve households' livelihoods, unlike remittances, which have fuelled Somalia's dynamic private sector. However, there is a substantial gap in research and data on how diaspora remittances are utilised within Somali households, and to what extent they exert broader economic impacts, despite their acknowledged and evidence importance in themselves.

It is widely believed that migrant remittances are mainly used for short-term consumption and social assistance, which is not sustainable in the long run. Thus, understanding the development impact of remittances in Somalia can provide insights for policymakers and other stakeholders, including donors and their governments in the West, to facilitate the efficient flow of remittances to Somalia if they do indeed have a sig-

nificantly positive contribution to productive activities and outcomes. The quantitative investigation of remittances in Somalia should consider their role in production-based activities, savings, financial inclusion, living standards, and household protection against shocks.

Remittance literature largely overlooks the impact of remittances in the particular contexts of conflict and post-conflict settings, mainly due to limitations related to data accessibility and availability in such dangerous contexts (Fagen, 2006; Koser and Van Hear, 2002). The impact of remittances in post-war Somalia remains unclear, and available literature on remittances is small-scale qualitative research, focusing on a single city or a small number of households, and is primarily conducted in post-conflict Somaliland (Ahmed, 2000; Lindley, 2007, 2008). For instance, Lindley (2007) examined the role of remittances in fragile contexts, taking Hargeisa, the capital city of a self-declared unrecognised Somaliland, as a case study. She demonstrates that remittances can help households cover living expenses, cope with hardships and uncertainties caused by conflict and promote livelihoods. Lindley (2008) points out that remittances have significantly enhanced access to education in Hargeisa. Ahmed (2000) argues that remittances have stimulated the private sector in post-war Somaliland. These studies might not adequately ascertain to what extent remittances affect household wealth outcomes (both productive and unproductive) elsewhere in Somalia's urban and rural areas. Furthermore, both of these pioneering researchers published their works decades ago, and their insights cannot be assumed to remain representative of the reality on the ground in Somalia nowadays.

Existing literature on migrant remittances in post-conflict settings often confines its analysis to urban areas. For example, Fransen and Mazzucato (2014) analysed the effect of remittances on household wealth in urban Burundi. They noted that remittances strongly influence non-productive assets, namely living standards and food security, but exert minimal impact on productive assets such as asset ownership. Other quantitative studies conducted in relatively stable states such as Pakistan reported that migrant remittances increased after the post-9/11 terrorist attacks (Mughal and Anwar, 2015). However, the specific impact of these funds on the welfare of beneficiary households remains ambiguous. Finally, another strand of literature focuses on the interactions between remittances and conflict in a group of developing countries e.g., (Mascarenhas and Sandler, 2014; Regan and Frank, 2014). Notably, Regan and Frank (2014) emphasize that remittances facilitate access to social services and enhance household welfare, services often neglected by governments during crises, thereby potentially reducing civil unrest.

Theories of migration and remittance have not been thoroughly examined in fragile and post-conflict contexts. Households migrating from war-stricken areas do so for

safety, not for economic gain as suggested by the New Economics of Labour Migration (NELM) (Lindley, 2007). There is a lack of quantitative evidence on remittance impacts in these settings, and key questions remain, including whether remittances can support production instead of just consumption, and their effects on services like water and electricity access. Additionally, the varied effects of remittances on urban vs. rural households and those in different conflict zones are unexamined. This paper tests the NELM theory's hypotheses: relative deprivation, investment, and insurance, in fragile and crisis contexts. Relative deprivation suggests that impoverished families adopt migration strategies to diversify earnings and optimize economic opportunities (Stark and Taylor, 1989). The investment hypothesis postulates remittances are used for productive assets, stimulating growth in developing economies (Taylor, 1999), particularly benefiting households facing significant financial constraints (Taylor, 1999; Taylor and Wyatt, 1996). The insurance hypothesis suggests remittances protect families from financial and other unexpected risks (Stark and Taylor, 1989).

Consequently, this thesis examines these hypotheses and investigates the influence of remittances on asset accumulation, savings, financial inclusion, living standards, and their role in protecting households from unforeseen shocks. It seeks to make three major contributions, as adumbrated below.

First, this paper is one of the first quantitative studies on remittances in Somalia, and it contributes to the broad literature of remittances in conflict-affected and post-conflict settings around the developing world in a unique way. Specifically, the study offers some crucial insights into the multidimensional impacts of remittances in fragile post-conflict states. Conflict-affected nations endure a labyrinth set of complexities, and hence it is generally assumed that the findings derived in this setting will be different in terms of magnitude than those obtained in more stable economies (such as the neighbouring countries of Kenya and Ethiopia). While it is clear that remittances play a vital role in enhancing household welfare in Somalia, and could be a substitute for social service provision that the Somali government failed to cover due to long years of civil unrest, there is no public evidence to suggest the vital role that remittances contributed to the Somali economy and families. This research provides robust evidence that remittances consistently and significantly affect household wealth during and after conflict.

Second, this research systematically studies the impact of remittances on essential outcomes, including productive-based activities at both national and sub-national levels. The extent to which remittances fund productive assets and investments is a topic of interest among researchers and policymakers. While micro-level studies indicate remittances boost savings, investments, and education in certain countries (Arif, 1999; Os-

ili, 2007; Zhunio et al., 2012), their impacts in conflict and post-conflict contexts remains inconclusive. This research analyses whether remittances fund productive assets in fragile and critical settings, and challenges the generally held view that remittances in Somalia are primarily directed to meet consumption and social support needs. This is policy-relevant as stakeholders, including government and donor agencies, aim to enhance migrant investments in productive areas. Remittances can stimulate the economy and support objectives in Somalia's National Development Plan-9 for holistic economic growth (MoPIED, 2020). The findings also underscore remittances' role in bolstering productive sectors and ensuring food security in conflict affected contexts.

Third, this paper examines the heterogeneous effects of remittances on households living in various types of settlements (i.e., urban and rural contexts, as well as considering IDPs and nomadic people), as well as small vs. large families, and poor vs. non-poor households. Comparison between different communities is critical, because it sheds light on the effect of remittances in determining the resilience of different communities and their relative levels of inequality within Somalia. It gives us a better picture of who benefits most from remittances and the uneven impact of remittances in some communities, which eventually can make them more vulnerable to natural disasters and famines. This finding is also relevant from a policy perspective, because remittances are channelled to urban and rural areas while other settlements, such as IDPs and nomads, are deprived of the development impact of remittances. Hence, when designing a national policy, priority should also be given to those households deprived of remittances, which would enable them access to decent employment opportunities that improve their living standards and reduce poverty.

This paper utilizes the Somalia High-Frequency Survey (SHFS) data, collected by the World Bank and Somali Statistical Authorities in 2017-2018, to assess remittances' effect on households in conflict-affected Somalia. The nationally representative SHFS dataset includes data from 17 pre-war regions, with households classified as urban ($n = 4011$), rural ($n = 1106$), IDP ($n = 468$), and nomadic ($n = 507$). With extensive details on household welfare, assets, consumption, remittances, access to services, security, and displacement, the data enables a comprehensive quantitative analysis of remittances' impact using matching methods and a quantile regression approach.

Three primary findings emerge from this analysis. First, in contrast to most previous studies, I determine that remittances positively impact a range of productive assets: aggregate asset accumulation, savings, livestock ownership, and child educational enrolment, for both urban and rural households. Propensity score matching (PSM) results reveal that individuals receiving remittances have average savings, aggregate assets,

and livestock holdings that are 0.18, 0.48, and 0.22 standard deviations higher (respectively) than those not receiving remittances. Second, this analysis underscores the capacity of remittance flows to enhance financial inclusion, elevate living standards, and bolster livelihoods and food security by stabilizing food consumption. Lastly, both poor and non-poor households generally benefit from remittances, with non-poor recipients experiencing the most significant gains. In contrast, internally displaced persons (IDPs) do not benefit from remittances.

This paper is structured as follows: Section 2 provides a literature review. Section 3 details the institutional context. SHFS data and descriptive statistics are in Section 4, while Section 5 outlines the empirical strategy. Section 6 shares estimation results, and Section 7 delves into robustness checks and estimation quality. The conclusion is in Section 8.

2.2 Literature Review

2.2.1 Motivations to remit

Understanding the motivations behind remittance flows is crucial for exploring their impacts on household welfare and broader economic development. A substantial body of research has analysed the factors that drive migrants to send money home, revealing a variety of motivations, including altruism, insurance, investment, and loan repayment (Rapoport and Docquier, 2006). This variety in motivations shows the complicated nature of sending money home, and its impact on both migrants and their families.

2.2.2 Early studies on general remittance behaviour

Lucas and Stark's (1985) seminal work laid the foundation for understanding remittance behaviour by introducing a dual framework in which both altruism and self-interest motivate remittance transfers. Migrants motivated by altruistic motives send remittances to help their households meet basic consumption needs, and cope with economic hardships or unexpected crises. In contrast, self-interested motives reflect strategic considerations. For instance, Hoddinott (1994) suggests that the presence of inheritable assets in the household can influence remittance behaviour, with emigrants potentially remitting to secure future claims on family inheritance, thereby reinforcing intergenerational ties and obligations. This dual framework has since been widely adopted and extended in the literature, offering a nuanced lens through which to interpret the complex interplay of emotional, familial, and economic incentives that shape remitting behaviour.

Building on this, Cox et al. (1998) analysed remittances in Peru, and showed that they

often function as informal insurance in contexts with limited access to credit. However, their findings contradict the pure altruism hypothesis, as transfers increase with recipient income—supporting an exchange motive whereby remittances help smooth income shocks within strategic family arrangements. This view is supported by [Gubert \(2002\)](#), who, in her study of Mali, provides empirical evidence that remittances function as informal insurance mechanisms for rural households facing income shocks.

Similarly, [Ilahi and Jafarey \(1999\)](#) analysed remittance behaviours in Pakistan and found that remittances are often used to repay migration-related debts and invest in human capital, suggesting that remittances serve both as a means of debt repayment and as investments in the future welfare of households. [Poirine \(1997\)](#) proposed a model where family remittances are viewed as intertemporal exchanges within an implicit contract; these fund education and other investments, expecting future returns for the migrant. Collectively, these studies highlight the multifaceted roles of remittances in providing insurance, facilitating investments, and shaping intra-family financial arrangements.

In addition to these roles, remittances are also used strategically by migrants to maintain family ties or preserve dignity upon return. [Lucas and Stark \(1985\)](#) propose an intermediary concept known as “enlightened self-interest” or “tempered altruism,” suggesting that remittances benefit migrants themselves in addition to their families, even if consciously considered to be altruistic. This model highlights how remittances function not only as a financial resource for recipients, but also as a means for migrants to protect their own future economic interests. Migrants, for example, may remit funds to cover the costs of educational debts incurred before migration or to finance business ventures in their home countries ([Ilahi and Jafarey, 1999](#); [Poirine, 1997](#))

2.2.3 Studies on remittances to fragile or conflict-affected states

Furthermore, the significance of remittances in fragile or conflict-affected environments cannot be overlooked. Studies by [Fransen and Mazzucato \(2014\)](#), [Lindley \(2007, 2008\)](#), [Majid et al. \(2017\)](#), and [Rodima-Taylor \(2022\)](#) demonstrate that remittances can be especially vital in post-conflict settings, where they may serve as a substitute for formal welfare systems, offering crucial support in times of crisis. [Fransen and Mazzucato \(2014\)](#) found that in urban Burundi, remittances significantly improved non-productive assets such as living conditions and food security, particularly among poorer households, suggesting that remittances act as a form of insurance. Similarly, [Lindley \(2007\)](#) highlighted the role of remittances in Somalia, noting that they are essential for survival and livelihood, especially in the absence of a functioning state. [Majid et al. \(2017\)](#) further emphasized that remittances are a lifeline for many Somali households, constituting a significant

portion of their income and contributing to resilience in the face of ongoing challenges. Building on this evidence, [Rodima-Taylor \(2022\)](#) found that remittances not only provide financial support but also promote social innovation and strengthen community resilience in conflict-affected settings.

These studies emphasize how remittances are adaptable, serving both short-term financial needs and long-term economic recovery investments, especially in areas with weak or absent formal institutions.

2.2.4 Aggregate-Level Studies on Remittances

At the macroeconomic level, several studies have analysed the broader impacts of international remittances on poverty reduction, economic growth, asset accumulation, and conflict mitigation. Using data from 74 low- and middle-income countries, [Adams and Page \(2003\)](#) showed that a 10% rise in international remittances' GDP share reduces poverty by 1.6%, supporting the idea that remittances help reduce poverty. In the same way, [Gupta et al. \(2009\)](#) focused on Sub-Saharan Africa, underscoring how international remittances aid in poverty reduction and financial development. Their results show that remittances help to stabilize the economies of vulnerable nations.

[Anyanwu and Erhijakpor \(2010\)](#) also provided evidence from African countries, showing that international remittances reduce the depth and severity of poverty. Similarly, [Regan and Frank \(2014\)](#) suggested that international remittances can reduce the risk of civil conflict, particularly during periods of economic distress, as they serve as a stabilizing factor in fragile economies.

[Williams \(2020\)](#) focused on the Balkans, and explored the link between diaspora remittances and post-conflict reconstruction. Using aggregate and meso-level data, the study finds that while international remittances continue to flow, weak institutions inhibit diaspora investment in productive sectors.

[Mughal and Anwar \(2015\)](#) analysed monthly time-series data for Pakistan to study the relationship between terrorism and remittance inflows. They found that terrorist attacks lead to increases in international remittances, consistent with altruistic motives.

These aggregate-level studies provide evidence that international remittances are positively associated with poverty reduction, economic stability, and—in some cases—conflict mitigation. However, they fail to show how remittances are used at the household level, and also do not examine how remittance impacts vary across households and contexts.

2.2.5 Individual-Level Studies on Remittances

Individual-level studies, employing household or person-level survey data, offer nuanced insights into the determinants and uses of remittances, as well as their effects on household well-being and asset accumulation. These studies clearly distinguish between international and internal remittances, often analysing how impacts vary based on household wealth, location, and vulnerability.

[Adams Jr \(1996\)](#) employed a three-year panel household dataset from rural Pakistan to examine the effects of internal and external (international) remittances on income distribution and asset accumulation. The study found that international remittances have a positive and significant effect on the accumulation of land assets, while internal remittances positively influence the accumulation of agricultural capital. These findings were affirmed more recently by [Ahmed et al. \(2018\)](#), who analysed data from the 2010–11 Pakistan Household Survey to compare asset accumulation effects of internal versus international remittances. Their findings indicate that international remittances significantly increase household assets, including consumer, productive, housing, and financial assets, whereas domestic remittances do not lead to significant changes.

In the context of rural Mexico, [Chiodi et al. \(2012\)](#) utilized panel data from 1997 to 2006 to study the link between migration, remittances, and asset accumulation. The study concluded that international remittances accelerate the accumulation of productive assets, such as livestock and farm equipment, particularly among credit-constrained households.

Similarly, [Garip \(2014\)](#) used longitudinal survey data from Thailand to analyse the relationship between internal remittances and asset accumulation. The study found that poorer households increased their productive assets (e.g., purchasing tools and livestock with remittances), while wealthier households reduced them, due to the loss of family labour. This suggests an equalizing effect of internal remittances on wealth distribution in rural Thailand (and similar rural economic contexts).

In Bangladesh, [Chowdhury and Radicic \(2019\)](#) employed data from the Bangladesh Household Income and Expenditure Survey to analyse how internal and international remittances affect net assets. The study found that both types of remittances initially lead to asset accumulation, but that the effect diminishes at higher levels of remittance income, indicating a non-linear relationship.

Collectively, these individual-level studies provide robust evidence that international remittances are more likely than internal remittances to support asset accumulation and investment, especially among rural and poor households. They also highlight that household-

level characteristics influence remittance use. Notably, most research on remittance impacts focuses on stable (or *slightly* unstable) areas, with limited individual studies in conflict zones, presumably because of the obvious difficulty of gathering reliable data from countries with ongoing conflicts.

2.2.6 Individual-Level Studies on Remittances in Conflict Settings

Individual-level studies analysing remittances in conflict-affected settings provide critical insights into how households navigate economic instability and insecurity. These studies, grounded in household-level data, reveal that while international remittances are vital for sustaining basic needs, their role in fostering productive asset accumulation is often constrained by the challenging environments of conflict zones.

[Fransen and Mazzucato \(2014\)](#) analysed a household survey in urban Burundi, a nation emerging from conflict, to assess the impact of remittances on household wealth. Their findings indicate that wealthier households are more likely to receive international remittances, challenging the notion of remittances as inherently pro-poor. The study further revealed that remittances predominantly enhance non-productive assets, such as improved living conditions and food security, with limited influence on the accumulation of productive assets. This pattern suggests that, in post-conflict contexts, remittances function more as a form of insurance, rather than as a source of capital for investment (and long-term development).

In the context of Somalia, [Lindley \(2007, 2008\)](#) utilized microdata from surveys and interviews in the urban area of Hargeisa, a major city in northern Somalia and the capital of Somaliland — a self-declared autonomous region that has not received international recognition — to explore the utilization of international remittances. The research highlighted that remittances are primarily allocated towards daily consumption, healthcare, and education, serving as a crucial coping mechanism for households. However, the study notes that the potential for remittances to contribute to productive investments is significantly hindered by ongoing insecurity and the absence of robust financial infrastructure.

[Ahmed \(2000\)](#) analysed the economic effects of international remittances in post-conflict Somaliland through primary data collection. The study underscored that remittances have been instrumental in facilitating private sector recovery by supporting consumption. Nonetheless, the research points out that long-term investments remain limited, primarily due to the lack of formal credit institutions, which restricts the capacity of households to channel remittances into productive ventures.

Majid et al. (2017) employed mixed methods to study Somali households, revealing that international remittances are critical for ensuring food security and providing informal credit. The study also highlighted disparities in access to remittances, with wealthier, urban households more likely to benefit. Moreover, the utilization of remittances for acquiring productive assets is limited, reflecting the broader challenges faced in conflict-affected settings.

These individual-level studies collectively demonstrate that, in conflict-affected environments, international remittances are predominantly utilized to meet immediate consumption needs and provide informal insurance. The potential for remittances to drive productive asset accumulation is often curtailed by factors such as insecurity, underdeveloped financial systems, and unequal access among households. This underscores the necessity for further research to explore strategies that can enhance the developmental impact of remittances in such contexts.

2.2.7 Contribution of the Study

Empirical research on the impact of remittances in fragile and conflict-affected settings remains scarce, largely due to the absence of reliable, large-scale data. This gap is especially evident in Somalia, where remittances play a vital economic role, yet there is limited quantitative evidence on how they affect key household outcomes such as productive asset accumulation, financial inclusion, and overall welfare. Existing studies on Somalia are predominantly qualitative, outdated, and geographically restricted—often being confined to specific urban centres like Hargeisa. Similarly, the few available quantitative studies in other fragile contexts, such as Burundi, are limited in scope, focusing primarily on urban populations and failing to capture broader national dynamics.

This study addresses these gaps by offering a comprehensive, nationally representative analysis of the effects of remittances in Somalia. It contributes to the literature in several ways. First, it distinguishes between internal and international remittances and analyses their respective effects on various dimensions of household wealth, including productive and non-productive assets, consumption, educational spending, and access to financial services. This dual focus offers a more nuanced understanding of how remittances function under conditions of fragility.

Second, the study adopts a disaggregated approach to assess how remittance impacts vary across diverse settlement types—urban, rural, IDPs, and nomadic communities—addressing a major omission in the literature. It also examines heterogeneity across household characteristics, particularly between poor and non-poor, and small and large households. This layered analysis enables a deeper understanding of the distributional

and developmental potential of remittances in conflict-affected environments.

By moving beyond qualitative case studies and urban-centric analyses, this study provides robust, quantitative insights into the role of remittances as both coping mechanisms and potential tools for long-term development. It thereby advances the empirical and theoretical literature on remittances in fragile settings and offers evidence with direct relevance for policy design in Somalia and similar contexts.

2.3 Institutional Context

The economic sector of Somali remittances has undergone various stages over recent decades, from traditional wire transfers to adopting modern digital banking technology. Remittances first became a major phenomenon in the context of Somalia during the 1970s, when emigrant workers to Saudi Arabia and other Gulf countries began sending money home to their families via the convoluted “Franco Valuate” system. As described by Omer (2002), migrants paid Somali merchants (via agents in sending countries, particularly Saudi Arabia), whose trading premises in Somalia purchased high-value consumer goods and diverse commodities, which they then sold on to third parties, whereupon they would reimburse the migrants’ relatives (i.e., intended recipients of remittances) in local currency. However, this method of payment was inefficient, risky, and time-consuming.

While Somalis seeking work abroad during the 1970s were normative temporary economic migrants, of the kind seen from most developing countries, their successors during subsequent decades were additionally spurred by the “push” factor of political oppression and conflict, beginning with the military regime during the 1980s. During this decade, whole families fled to North America and Western Europe, and as they built new lives they sent remittances home to their relatives in Somalia via informal means, facilitated by Somali traders. The civil war from 1991 onwards led to thousands of Somalis being killed or displaced, with the commensurate obliteration of public institutions, infrastructure, and conventional national socio-economic development and activity. This precipitated a further upsurge in emigration.

The civil war was contemporaneous (and interrelated with) prolonged drought, famine, and disease during the period 1991–1994. At this juncture, during the initial displacement and refugee crisis, many sought safety in neighbouring countries, including Kenya, Ethiopia, Djibouti, and Yemen, seeking immediate safety and protection. Over time, a significant number were resettled in Western countries, often through formal refugee resettlement programs facilitated by international agencies, or through family reunification with relatives already living abroad. Others migrated to the Middle East and Southern

Africa, contributing to the formation of a widespread Somali diaspora. These refugees and economic migrants continued to send remittances home via the pre-existing and informal remittance sector, administered by ad hoc traders. However, it was evident given the scale of the Somali diaspora, and the volume of cash being funnelled to the country, that there was an urgent demand for an organized corporate structure to facilitate prompt and safe remittances to Somalia.

During the 1990s UN and US troops failed to restore peace and stability, prompting the US to withdraw its soldiers from Somalia. At the height of conflict and famine, remittances from Somali migrants contributed significantly to helping some families survive and recover from the famine, and sustain livelihoods among the population through timely cash payments. Indeed, the diaspora became a lifeline for those remaining in Somalia, as remittances emerged as a primary source of external development finance. Given the abandonment of the country by the US and international aid agencies, remittances were absolutely essential as a lifeline for millions of people affected by sustained conflict ([Maimbo, 2006](#)).

As the number of migrants grew exponentially, the corporate structure of the Somali remittance industry also improved, and a remittance infrastructure emerged, with various remittance companies being established (e.g., Dahabshil, Al-Barakat, and Amal Express). These quickly expanded their networks and branches in major Somali cities, and operated for senders in more than 40 countries. Competition within the industry intensified, and the remittance industry blossomed alongside the private sector, as Somali merchants established telecommunications businesses that improved the service delivery of remittance companies, enabling them to reach out to and acquire customers. Remittance industries also expanded service delivery to facilitate business transactions involving international regional trade, such as Somali traders who pioneered a vibrant private sector that imported food, construction materials, and consumer goods from the Gulf states. The private sector in Somalia, constituting remittance firms, telecommunications businesses, and import/export companies, began to play a key role in the country's economy, providing hope and innovation following the fall of the state government during the 1990s ([Group, 2017](#)).

In the 2000s, following 9/11, Somali remittance businesses confronted increased scrutiny and intense investigations by the US and its allies, who introduced strict rules and anti-money laundering regulations governing the financial and remittance sector. This resulted in the closure of Al-Barakat, a large and growing remittance firm at the time. The US government designated Al-Barakat a terrorist organization, whereupon it confiscated its assets, and imprisoned many of its corporate employees. The suppression of

this firm caused a major disruption in Somalia's economy, as many families relied heavily on remittances sent by their relatives abroad via its agents. The remaining companies faced labyrinthine complexities in complying with national and international laws, while at the same time trying to practically facilitate vital remittances and transfers to Somalia. Mobile technology was to ameliorate this impasse.

In 2007, Hormuud Telecom introduced the first mobile money transfer (MMT) service in Somalia, enabling users to transfer funds within Somalia and to pay for bills and utilities. The service expanded over time, reaching rural and nomadic settlements, which promoted financial inclusion and access to modern financial services for marginalized and impoverished communities. By 2017, the World Bank predicted that 73% of Somalis over the age of 16 had used MMT services. The advent of MMT technology improved the service delivery of remittance companies, enabling prompt delivery of funds to beneficiary households. In 2013, Taaj Services, the owner of Hormuud Telecom, became the first remittance company to introduce mobile banking in Somalia, which enabled migrants to access a fast, safe, and easy way to transfer funds to family and relatives.

Competition among Somali remittance firms intensified during the subsequent years. Dahabshil, the first formal remittance company in Somalia and one of the largest African money transfer companies (operating in 126 countries worldwide, with a notable presence in Africa) launched MMT service in 2014. Subsequently, the emergence and use of online platforms have increasingly become popular among the Somali diaspora, as the future of remittances tilted towards using these online platforms.

Today, many remittance companies operate as formal payment service providers, complying with global anti-money laundering (AML) regulations, and holding licenses issued by regulatory authorities in sending countries (including in Western jurisdictions) and in Somalia. There are about ten major players in the Somali remittance industry nowadays, including Dahabshil, Taaj Services, Amal Express, Iftin, and Tawakal. The majority of these companies function as private commercial banks, offering deposit and savings accounts and providing consumer lending in the form of small loans, microfinance loans, and investment loans. In this regard, Money Transfer Businesses (MTBs) and Mobile Money Operators (MMOs) facilitate greater financial inclusion, supporting investments in businesses and entrepreneurial ventures, stimulating local economic activity, community projects and infrastructure, and job creation. They also provide a stable source of foreign exchange, which is essential for macroeconomic stability and economic resilience (CBS, 2023).

At the current juncture, the Somali diaspora, numbering well over 1 million, is distributed throughout the world. The largest groups reside in the US, the UK, Canada,

Sweden, Norway, the Netherlands, Finland, Denmark, and Germany. According to Somali authorities, officially recorded annual remittance flows reached USD 2.1 billion in 2021, accounting for 31% of the country's GDP. Therefore, remittances are essential for sustaining many families' livelihoods, serving as a buffer against unexpected risks, and significantly contributing to the growth of Somalia's economy. Despite Somalia's dependency on international remittances, there are various barriers to the flow of such income, including costly transaction fees and Western governments' crackdown on money laundering and terrorism funding. This has resulted in de-risking by banks and the closure of Somali remittance bank accounts. When families lack access to safe and low-cost transfers, the size and frequency of transactions decrease.

According to the 2019 Somalia Labour Force Survey, the annual remittances received by all households in Somalia totalled an estimated USD 865 million, the vast majority of which went to the urban stratum (93.3%), while rural areas only received 6.7%. The survey further stressed that out of the 1.3 million households in Somalia, 28.82% received remittances, and most of the receipts (83.7%) were on a monthly basis. Additionally, the findings highlight that most of the remittances were received from a brother (23.0%), followed by other relatives, including sisters (21.8%), sons (12.6%), and daughters (11.7%). In urban areas, "other relatives" were the most frequent source of remittances at 23.0%, while in rural areas, the most frequent source was brothers, at 26.1% (SNBS, 2019).

The 2022 Somalia Integrated Household Budget Survey (SIHBS) indicated that 20.7% of households had received remittances domestically or internationally in the preceding year. Urban and rural areas reported higher reliance (22.2% and 21.7%, respectively) compared to nomadic households (10.8%). Hawala systems accounted for 55.4% of transfers, while mobile money services handled 41.5%. Urban households favoured Hawala (62%), while nomadic households largely used mobile money (72.3%) (SIHBS, 2022).

Data from the Central Bank of Somalia (CBS) further illustrates a remarkable trend in remittance flows from 2017 to 2023. Initially, remittances dipped slightly from around USD 1.45 billion to about USD 1.3 billion from 2017 to 2018, possibly reflecting economic challenges or shifts in global conditions at the time. However, from 2018 onwards, there was a noticeable recovery and growth, with remittances steadily increasing each year. In 2021, remittance inflows had risen dramatically, surpassing USD 2 billion, showing a significant connection between the Somali diaspora and their home communities. This upward trend continued, reaching the highest recorded level in 2023 at approximately USD 2.18 billion (CBS, 2023). Figure 2.1 displays these volumes during the period 2017–2024.

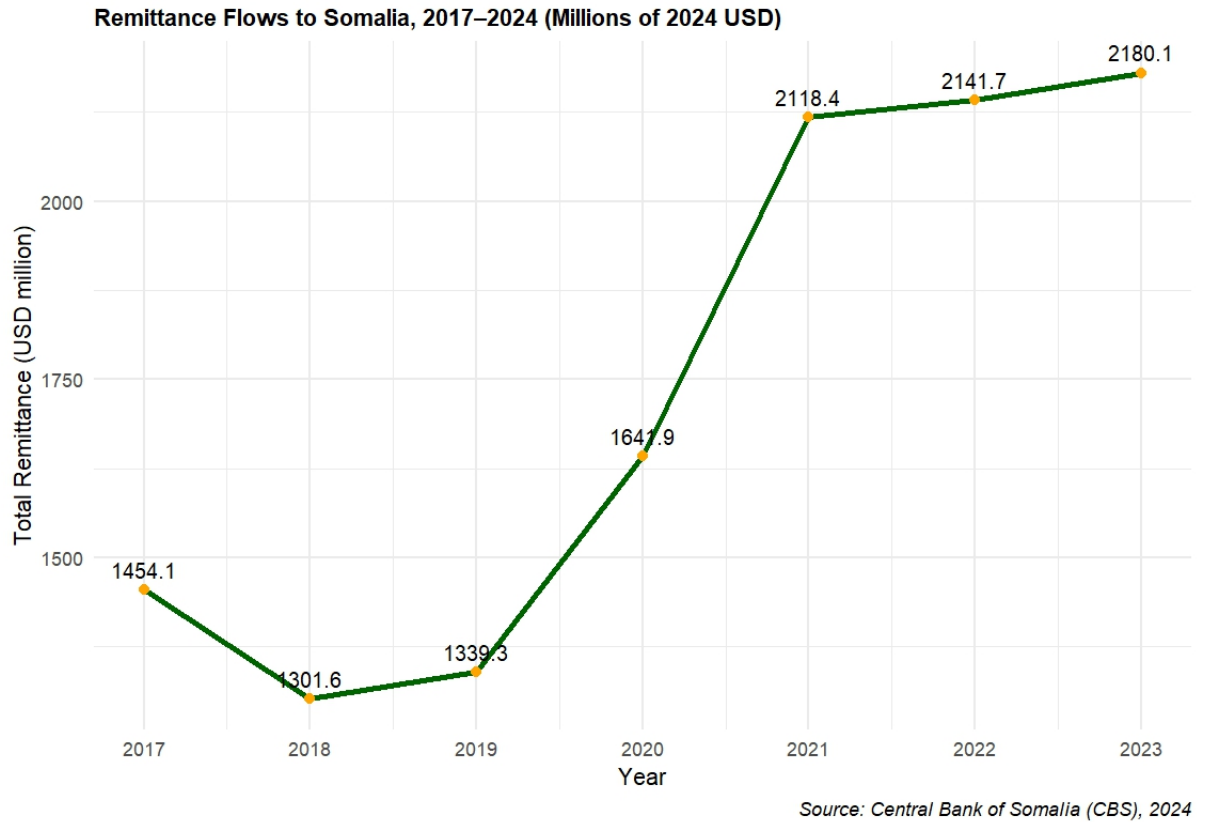


Figure 2.1: *Aggregate Volume of Remittances, 2017–2024 (Millions of 2024 USD)*

2.4 Data

This paper uses Wave 2 of the SHFS dataset, gathered by the Somali Statistical Authorities in collaboration with the World Bank in 2017–18. The SHFS is a nationally representative, cross-sectional dataset, randomly collected from 17 out of the 18 pre-war regions. The 18th region, Jubadda Dhexe, was deemed inaccessible and highly insecure, due to the presence of Al Shabaab militants and the higher likelihood of sporadic attacks during the fieldwork period (and indeed to the present day). A total of 6092 households were surveyed, which included 4011 urban households, 1106 rural households, 468 households in settlements for Internally Displaced People (IDP), and 507 nomadic households.

The SHFS itself employs a multi-stage stratified random sampling design to ensure national representativeness across diverse geographic and socioeconomic groups. The strata were determined by the SHFS according to two dimensions: administrative location (pre-war regions and emerging states) and population type (urban, rural, IDP, and nomadic groups). Households were organized into enumeration areas (EAs), and 12 interviews were conducted in each selected EA. The primary sampling units (PSUs) varied by population type: EAs for urban and rural populations, IDP settlements as de-

financed by UNHCR's Shelter Cluster, and water points for nomadic groups. The selection of PSUs used a probability proportional to size (PPS) approach. The second phase used a micro listing approach to divide EAs into twelve smaller groups, randomly choosing one household per group. For nomadic groups, a water point registration process guaranteed complete household identification. The rigorous sampling design guaranteed a representative survey sample from diverse groups.

Nevertheless, the use of self-reported remittance data engenders potential measurement error, which is a well-documented concern in survey research. Respondents may overreport or underreport remittance transfers due to recall bias, sensitivity around income disclosure, misunderstanding of the reference period, or security issues. These risks are particularly marked in fragile situations like Somalia, where remittance flows are facilitated through informal mechanisms such as hawala systems, complicating accurate reporting ([Brown et al., 2014](#); [Cellhay et al., 2024](#)). To mitigate the risk of measurement error, the empirical strategy utilised a binary indicator variable that captured whether a household received any remittance during the recall period, avoiding reliance on potentially error-prone amounts. The binary specification follows the example of methodological choices made in similar studies, such as [Adams and Cuecuecha \(2013\)](#) in Ghana, and [Ambrosius and Cuecuecha \(2016\)](#) in Mexico. As highlighted by [Justino and Shemyakina \(2012\)](#), incidence-based measures are generally more robust and reliable than volume-based estimations in conflict-affected settings. This methodological approach boosts the internal validity of the analysis, while still permitting meaningful conclusions about remittances and household outcomes.

Even before the devastating civil war in 1991, Somalia's statistical capacity was limited, with a lack of sufficient data on economic and demographic aspects; the last official census was conducted in 1975. The civil war significantly eroded the Somali statistical system. However, several development institutions, like the World Bank, managed to collect limited data on certain sectors in the post-conflict period. Wave 2 of the SHFS, the most comprehensive dataset collected after the civil war, expanded coverage, and provides representative data across a wide range of modules. Leveraging this, the study analyses the impact of remittances on household wealth in post-war Somalia, linking it with key outcomes from the household survey.

2.4.1 Remittances

Remittances, defined as international and internal money transfers (including money and goods) received by households in the 12 months preceding the interview, form a binary treatment variable. It is coded as 1 for beneficiaries and zero otherwise. It is crucial to note

upfront that the remittance amount data is available for certain respondents, while it is not available for others. A significant portion of the interviewed households (19%) reported receiving remittances (both foreign and domestic), while 13% and 9% reported receiving international and internal remittances, respectively (Table 2.1). Most beneficiaries of both foreign and domestic remittances resided in urban areas, 80% and 68% respectively. In all settlement types, IDPs and nomads received the smallest share of remittances.

Table 2.1: Recipients of Remittances by Settlement Status

Settlement/Location Type	Total Remittances		International		Internal	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
National Sample	1131	19%	815	13%	525	9%
Urban	844	75%	648	80%	355	68%
Rural	189	17%	118	14%	110	21%
IDPs	35	3%	23	3%	15	3%
Nomadic	63	6%	26	3%	45	9%

Note: Total remittances refer to household recipients of both international and internal remittances. Source: Author's calculations based on SHFS 2017–18.

2.4.2 Household wealth

This dataset contains comprehensive information on assets, economic conditions, access to services, and consumption. Asset ownership is a dummy variable encompassing 38 categories of productive and unproductive assets. Following [Filmer and Pritchett \(2001\)](#), I created an asset index using the Principal Component Analysis (PCA). The asset list details whether a household owns productive assets such as a minibus, sewing machine, livestock holding, truck, or lorry, along with a variety of unproductive assets like a TV, radio, satellite dish, washing machine, refrigerator, and bed with a mattress, among others. During the index construction, we used frequencies. A frequency between 5% and 95% makes it acceptable to include in the analysis. However, variables with frequencies less than 5% or greater than 95% are not helpful for index creation and should be excluded. The accumulation of productive assets (such as a lorry & minibus) among the interviewed households was minimal, ranging from less than 1 percent to a maximum of 2 percent. Therefore, I excluded those variables from the analysis, except for livestock, where the frequency fell within the specified ranges.

Measuring asset accumulation and living standards in developing countries presents several challenges, particularly when income data is often unreliable or unavailable. As a result, asset ownership data, which reflects a household's long-term wealth ([Filmer and](#)

[Pritchett, 2001](#)), offers a reliable measure of inequality in living standards ([McKenzie, 2005](#)), and generally provides more accurate information than income or expenditure data ([Sahn and Stifel, 2004](#)).

2.4.3 Household consumption

To facilitate analysis, total consumption was measured in terms of daily household expenditure and food consumption (weekly imputed spending). Data for both of these consumption variables were converted into annual figures, which were subsequently log-transformed. This transformation allows for the expression of percentage changes in consumption resulting from remittances, enhancing the interpretability of the findings.

Table [2.2](#) illustrates descriptive statistics of households by remittance status. Column 1 shows the mean outcomes for households receiving remittances, while Column 2 presents the means for those without remittances. Column 3 indicates the difference in means, and Column 4 reports the p-value, with values below 0.05 indicating statistical significance.

Remittance-receiving households and non-receiving households significantly differ in terms of economic, demographic, and wealth characteristics. Remittance recipients are usually non-poor, reside in urban areas, have at least one employed household member (although non-recipients have a higher rate of household head employment), and possess higher literacy rates. Nevertheless, households that receive remittances and those that do not show no significant differences in terms of age, gender, household size, number of children, and the share of the elderly. In a similar vein, households that receive domestic remittances are non-poor, have literate, and employed household heads than non-recipients. Conversely, domestic recipients are primarily located in rural areas and IDP settlements, with a slightly lower number of households compared to non-recipients (see Table [A3](#) in the appendix).

Table 2.2: Profiles of remittance-receiving and non-receiving households

	Without	With	Diff	p-value
Age	37.73	38.06	0.33	0.3958
Gender (Female)	0.505	0.499	-0.01	0.6857
Household Employment	0.769	0.740	-0.03	0.0373
Household Literacy	0.498	0.632	0.13	0.0000
Urban Residence	0.638	0.746	0.11	0.0000
Household Size	5.46	5.38	-0.08	0.2570
Number of Children	2.74	2.68	-0.06	0.3766
Non-Poor Status	0.359	0.507	0.15	0.0000
Small vs Large Household	0.443	0.433	-0.01	0.5488
Share of Elderly	0.033	0.041	0.01	0.1808
Observations	4960	1131		

Note: The table presents the t-test results comparing remittance-receiving and non-receiving households. The P-value indicates the significance level of mean differences between these groups. Remittances refer to both international and internal transfers. A binary variable represents remittances, with 1 representing recipients and 0 representing non-recipients.

2.5 Econometric Models

The analysis examines the relationship between remittances and the previously mentioned outcomes, accounting for a range of economic, social, demographic, and geographic factors. These factors include the age, gender, employment status, and literacy of the household head; household size; number of children; proportion of elderly (65+); and whether the household is classified as small, large, poor, or non-poor. Additionally, the covariates comprise location dummies (urban, rural, nomadic, and IDPs) and the region of residence, representing the specific geographic area in which the household is located.

The main results for asset accumulation, consumption categories, savings, and living standards are estimated using the baseline equation:

$$Y_{ij} = \alpha + \beta R_{emit_{ij}} + X_{ij}\gamma + R_j\theta + \epsilon_{ij} \quad (2.1)$$

In our baseline regression equation, i represents individual households, and j designates the specific region. The variable Y_{ij} serves as the outcome of interest, capturing the standardized asset index for aggregate assets, two asset categories, savings, and fi-

nancial inclusion. X_{ij} comprises household demographic and economic covariates, while R_j introduces region-specific dummies, accounting for geographical location. Lastly, ϵ_{ij} stands for the disturbance term.

2.5.1 The propensity score matching framework

The migration process involves cost, and therefore not all households in developing countries have the means and access to migrate. It might be that individuals who migrate are linked to more affluent families than non-migrants, and therefore households with immigrant members abroad are more likely to receive remittances. Since remittance-receiving families were not selected randomly, they differ from non-recipients in such idiosyncratic characteristics as skills, individual talent, resource endowment, and educational attainment. In practice, households self-select into migration, and migration is not random, thus in observational studies, the estimation of the impact of remittances may be biased by the presence of confounding variables (Becker and Caliendo, 2007; Becker and Ichino, 2002). In such contexts, the problem arises when we want to estimate the participant's outcome with and without receiving remittances, which we cannot observe for the same household simultaneously (Caliendo and Kopeinig, 2008).

Empirical research analysing the effect of remittances on recipient families using cross-sectional data typically adopts one of two approaches to address selection bias: the instrumental variable (IV) method e.g., (Kakhkharov et al., 2021; Karmaker et al., 2023; Mishra et al., 2022) or Propensity Score Matching (PSM) e.g., (Bertoli and Marchetta, 2014; Eghan and Adjasi, 2023; Zennati, 2025)

While instrumental variable (IV) estimation is often considered the gold standard for addressing endogeneity and establishing causal inference, its implementation hinges on the availability of valid instruments—variables that are strongly correlated with remittance receipt but exogenous to the outcome variables. In fragile and data-constrained situations like Somalia, identifying and validating such instruments is particularly challenging. Although existing studies have employed instruments such as migration networks (Hossain and Sunmoni, 2022) or composite macroeconomic indicators like per-capita GNI, unemployment, and interest rates (Azizi, 2019; Catrinescu et al., 2009), these approaches are typically suited to aggregate-level analyses or contexts with robust administrative or longitudinal data infrastructure. In the Somali case, migration networks are highly informal, spatially fragmented, and undocumented, making it difficult to construct a credible, exogenous instrument that satisfies the exclusion restriction.

Regression Discontinuity Design (RDD) was also considered but found unsuitable due to both methodological and data-related constraints. RDD requires the presence of

a continuous assignment or “running” variable with a clearly defined cutoff that deterministically influences treatment—in this case, receipt of remittances. However, SHFS is a cross-sectional dataset that does not include any such assignment mechanism or policy threshold that could plausibly be used to define treatment eligibility. Remittance receipt in the SHFS is self-reported and determined by household circumstances rather than a quantifiable rule or programmatic cutoff. As a result, the survey’s design and data structure do not permit the application of RDD, making it an infeasible strategy for this study.

Given these limitations, PSM provides a feasible and transparent alternative for estimating causal effects in the absence of valid instruments. This methodology avoids functional form assumptions between household characteristics, remittances, and wealth categories. However, it relies on strong identification assumptions, and thus sensitivity tests are required ([Caliendo and Kopeinig, 2008](#)). The PSM approach allows for the construction of a counterfactual comparison group, comprising non-recipient households that closely resemble recipient households in terms of observable characteristics.

This study estimates the Average Treatment Effect on the Treated (ATT), which captures the average effect of remittances on households that actually receive them. This choice reflects both methodological and data-driven considerations. ATT allows for a credible comparison between treated households and their matched non-treated counterparts, based on observable characteristics. In contrast, estimating the Average Treatment Effect (ATE)—the average effect across all households, treated and untreated—would require stronger assumptions about the counterfactual outcomes for non-recipient households had they received remittances. Given the cross-sectional nature of the data and the absence of valid instruments or exogenous variation in treatment assignment, estimating the ATE is not feasible in this context.

Moreover, the focus on ATT does not imply that remittances have no indirect or induced effects on non-recipient households. Rather, such general equilibrium or spillover effects (e.g., changes in local prices, labour markets, or social transfers) fall outside the scope of this study and would require different data and empirical strategies—such as spatial models, panel data, or macro-level simulations—to be credibly identified. Therefore, the focus on ATT is both methodologically sound and consistent with the objective of estimating the direct causal effect of remittances on recipient households in fragile settings like Somalia.

The propensity score represents the likelihood of receiving remittances based on observable characteristics. It enables the estimation of treatment effects while controlling for confounding variables and helps reduce migration selection bias when comparing out-

comes between treated and untreated groups ([Becker and Ichino, 2002](#)). The estimated ATT can be expressed as follows.

The individual treatment effect can be represented as follows. Let Y_{1i} denote the potential outcome for household i if treated (i.e., if it receives remittances), and Y_{0i} the potential outcome if not treated. The individual-level effect of remittances is then given by:

$$\delta_i = Y_{1i} - Y_{0i}$$

To estimate the PSM model, we predict the likelihood of a household receiving remittances based on relevant economic, social, and demographic characteristics. The propensity score, derived by regressing the treatment indicator on covariates using a Probit or Logit model, facilitates the estimation of treatment effects by matching remittance recipients to comparable non-recipients. PSM relies on key identifying assumptions. The Conditional Independence Assumption (CIA) posits that, conditional on observable covariates unaffected by treatment, potential outcomes are independent of treatment status. In other words, treatment assignment is as good as random once observable factors are accounted for ([Caliendo and Kopeinig, 2008](#)).

Effective matching hinges on the validity of this assumption. The propensity score—a conditional probability of receiving the treatment given a set of observable covariates—serves as a balancing score that ensures treated and untreated units are comparable. As emphasized in the literature [Caliendo and Kopeinig \(2008\)](#), it is essential to include only those covariates that influence both the likelihood of treatment (i.e., receiving remittances) and the outcomes of interest (e.g., accumulation of productive and unproductive assets). Omitting relevant covariates can lead to biased estimates ([Heckman et al., 1997](#)). Conversely, including covariates that affect only the probability of receiving remittances—without influencing outcomes—may weaken the balancing property of the propensity score and reduce matching quality [Bertoli and Marchetta \(2014\)](#).

Some debate in the literature concerns the appropriate selection and number of covariates to include. While some scholars advocate for a comprehensive inclusion strategy ([Stuart and Rubin, 2008](#)), others—such as [Rubin and Thomas \(1996\)](#)—emphasize the importance of relevance and caution against unnecessary variables. Over-specification, in particular, has been discouraged by [Bryson et al. \(2002\)](#) and [Schmidt and Augurzky \(2001\)](#) due to its potential to increase estimate variance.

Furthermore, ([Caliendo and Kopeinig, 2008](#)) recommend that covariates be either time-invariant or, preferably, observed prior to treatment. Nevertheless, [Lechner \(2008\)](#) notes that post-treatment variables may still be valid, provided they are not fully influ-

enced by the intervention.

In light of these guidelines, and drawing on the richness of the current cross-sectional data, we selected a theoretically and contextually grounded set of covariates informed by economic reasoning, prior research, and the Somali context (Caliendo and Kopeinig, 2008; Smith and Todd, 2005; Sianesi, 2001). Household composition variables include the number of children, the share of elderly individuals (over 65), household size, region of residence, settlement type (urban, rural, IDP, and nomadic), poverty status (poor vs. non-poor), family size (small vs. large), and employment status of at least one household member. Household head characteristics include age, gender, and literacy.

The comprehensiveness of the dataset—which captures a broad range of economic, demographic, and household-level factors—helps to mitigate concerns about omitted variable bias and strengthens the credibility of key assumptions required for causal inference.

In particular, this supports the conditional independence assumption (also known as unconfoundedness), which implies that treatment assignment is independent of potential outcomes, conditional on observed covariates:

$$Y(0), Y(1) \perp R_i \mid X \quad (2.2)$$

This assumption allows for unbiased estimation of treatment effects using observed characteristics, and is central to the validity of propensity score matching (PSM).

Furthermore, the common support or overlap condition highlights that individuals with the same observable covariates must have a positive probability of being both treated and untreated units (Heckman et al., 1999):

$$0 < P(D = 1 \mid X) < 1 \quad (2.3)$$

When both assumptions hold, the causal effect of remittances can be estimated using the following estimator:

$$\hat{\tau} = \frac{1}{n_T} \sum_{i:T_i=1} y_i - \frac{1}{n_C} \sum_{i:T_i=0} y_i$$

Where n_T and n_C are the number of households in the treated and control groups, respectively. This represents the difference in average outcomes between treated and control households. However, the primary focus is on the Average Treatment Effect on the Treated (ATT):

$$E(Y_1 - Y_0 \mid D = 1) = E(Y_1 \mid D = 1) - E(Y_0 \mid D = 1)$$

To estimate this, we must construct the counterfactual $E(Y_0 \mid D = 1)$ —the average outcome that remittance-receiving households would have experienced had they not received remittances.

Various matching methods exist for identifying this counterfactual by comparing treated and untreated units with similar propensity scores. The most common approaches are Nearest Neighbour (NN) matching, Radius (Caliper) matching, and Kernel matching. This study employs all three methods.

Among these, Kernel matching is used as the main estimation method. It matches each treated unit to a weighted average of comparison units, giving higher weights to units with closer propensity scores (Heckman et al., 1998). Kernel matching draws more information from the sample, reduces variance, and constructs the counterfactual using all comparison units. As noted by Smith and Todd (2005), kernel matching is equivalent to a weighted regression on an intercept using kernel-based weights. These weights depend on the distance in propensity scores and assign greater influence to untreated units with more similar characteristics.

To assess robustness, Nearest Neighbour and Radius matching are also applied in the sensitivity analysis and compared to the main kernel-based results.

2.5.2 Propensity Score Matching and Covariate Balance

Table 2.3 exhibits the results from the PSM method, comparing key covariate balance metrics before and after matching for the treated group (recipients of remittances) and the control group (non-recipients). As revealed in the table, the unmatched sample exhibited observable covariate imbalances, with a mean standardized bias of 11.4% and a maximum individual covariate bias of 47.6%. Following matching, covariate balance improved substantially: the mean bias dropped to 2.3%, and the maximum bias was reduced to 10.3%, both well within acceptable thresholds commonly used in the PSM literature (e.g., below 20%).

In addition to bias reduction, we conducted a joint significance test using the likelihood-ratio chi-squared statistic (LR χ^2), which compares the distribution of covariates between the treated and control groups. Before matching, the LR χ^2 test yielded a highly significant p -value of 0.000, indicating systematic differences in observed characteristics. After matching, the p -value increased to 0.840, suggesting that the covariates were no

longer jointly significant predictors of treatment assignment, thus confirming successful balancing.

The last column of Table 2.3 presents the ratio of the variances (V) of the treated (T) to the control (C) group for each covariate, denoted as $V(T)/V(C)$. This metric assesses the relative dispersion (or spread) of each covariate across the two groups. A value close to 1 indicates similar variance between groups, implying good balance not only in means but also in distributional spread. Ratios substantially above or below 1 (e.g., <0.5 or >2) may signal persistent imbalance. Post-matching, most $V(T)/V(C)$ ratios lie within acceptable bounds, further supporting the adequacy of the match.

Table 2.3: Balancing tests for propensity score matching

Variable		Mean		%bias	%reduct bias	t-test		$V(T)/V(C)$
		Unmatched	Matched			t	$p > t $	
Age	U	38.097	37.699	3.3		0.99	0.324	1.12
	M	38.097	37.926	1.4	57.0	0.32	0.748	1.05
Gender	U	0.49765	0.50713	-1.9		-0.56	0.577	.
	M	0.49765	0.50141	-0.8	60.4	-0.17	0.862	.
hh_emp	U	0.73333	0.77272	-9.1		-2.74	0.006	.
	M	0.73333	0.75869	-5.9	35.6	-1.34	0.179	.
hhliteracy	U	0.63192	0.49819	27.2		7.93	0.000	.
	M	0.63192	0.64977	-3.6	86.7	-0.86	0.391	.
Urban	U	0.7493	0.64205	23.5		6.70	0.000	.
	M	0.7493	0.75587	-1.4	93.9	-0.35	0.725	.
hh_size	U	5.3662	5.4754	-5.4		-1.58	0.115	0.98
	M	5.3662	5.3418	1.2	77.6	0.28	0.781	0.99
Number of children	U	2.6864	2.7619	-3.9		-1.15	0.250	0.99
	M	2.6864	2.7211	-1.8	54.0	-0.41	0.682	0.94
Non-poor	U	0.5061	0.35901	30.0		8.96	0.000	.
	M	0.5061	0.50704	-0.2	99.4	-0.04	0.965	.
Small-vs-large	U	0.4338	0.44733	-2.7		-0.80	0.423	.
	M	0.4338	0.42817	1.1	58.3	0.26	0.793	.
Share of elderly	U	0.04319	0.03086	6.5		2.03	0.042	.
	M	0.04319	0.03286	5.5	16.3	1.25	0.213	.

* if variance ratio outside $[0.89; 1.13]$ for U and $[0.89; 1.13]$ for M

Sample	Ps R2	LR chi2	$p > \chi^2$	MeanBias	MedBias	B	R	%Var
Unmatched	0.035	194.70	0.000	11.4	6.0	47.6*	1.06	0
Matched	0.002	5.70	0.840	2.3	1.4	10.3	1.28	0

* if $B > 25\%$, R outside $[0.5; 2]$

Note: The table displays results from PSM to assess balance between treated and control groups. “Sample” differentiates data pre and post-propensity score matching. “Ps R2” represents covariate balance, with a decrease indicating improved balance post-matching. “LR chi2 & $p > \chi^2$ ” assess balance, with a non-significant p-value post-matching suggesting balanced covariates. “MeanBias” and “MedBias” indicate average and median biases respectively; reductions indicate better balance post-matching. “B” shows the most imbalanced covariate’s bias; a * denotes concern if $B > 25\%$. “R” denotes variance ratios of propensity scores, ideally between $[0.5, 2]$. “%Var” signifies covariate imbalance, with 0 as ideal.

Furthermore, the distribution of propensity scores is assessed graphically. An equal distribution of scores across remittance recipients and non-recipients is expected. The distributions of predicted propensity scores for remittance-receiving and non-receiving households (illustrated in Figure 2.3, concerning asset accumulation in Columns 1, Table 2.6) show significant overlap. This common support region indicates that households in both groups have comparable estimated probabilities of receiving remittances, meaning that suitable matches exist across the covariate space. Both the covariate balancing tests and the graphical display of common support confirm that matching assumptions are met, thus providing a robust foundation for subsequent causal inference.

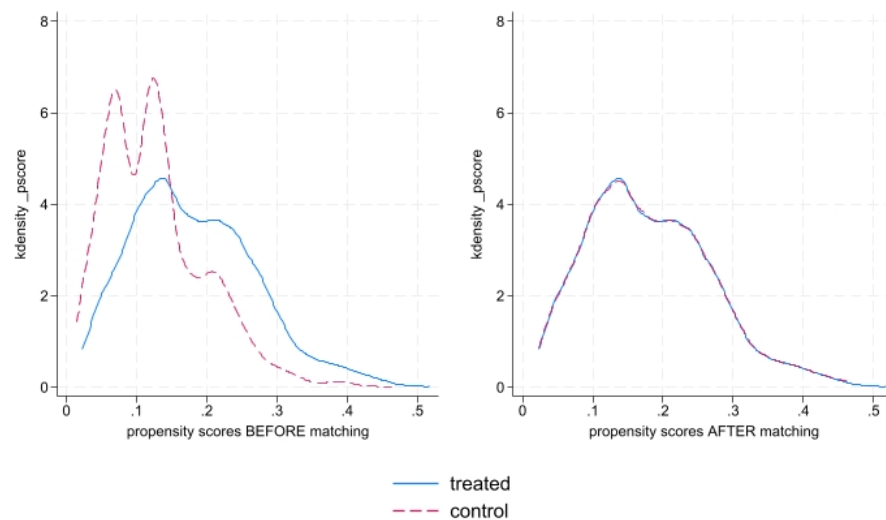


Figure 2.2: Distribution of propensity scores for treatment and control groups before and after matching. Source: Authors’ presentation based on SHFS 2017–18 data.

Note: The figure shows the distribution of propensity scores for remittance recipients (treated) and non-recipients (controls) before and after matching. It combines separate graphs for both groups into a single figure with a common legend to represent both groups, helping to visualize the balance achieved after matching.

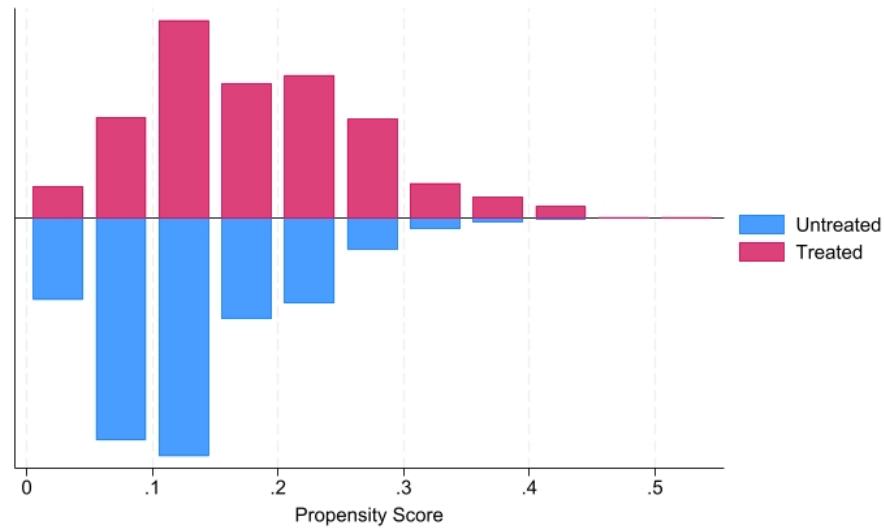


Figure 2.3: *Histogram of propensity scores by treatment status. Source: Authors' presentation based on SHFS 2017–18 data.*

Note: The figure shows the distribution of propensity scores for remittance recipients (treated) and non-recipients (controls). It compares the overlap in propensity scores between the two groups, which is crucial for assessing balance in the matching process.

2.5.3 Quantile Regression for Heterogeneous Effects

The analysis also examines the effect of remittances on household consumption using quantile regressions. In contrast to Ordinary Least Squares (OLS), which provides a broad interpretation of the dataset, quantile regressions—characterized as median estimators—demonstrate robustness against outliers and efficaciously handle heteroskedasticity, thus yielding more precise, policy-relevant findings. Specifically, this analysis seeks to elucidate the effects of remittances across the lower, median, and upper percentiles of total household consumption expenditure, food consumption, and non-food consumption.

The general specification for the quantile regression model is:

$$Q_{\theta}(C_i | R_i, Z_i) = \gamma_{\theta} R_i + Z_i \beta_{\theta} \quad (2.4)$$

In Equation 2.4, $Q_{\theta}(C_i | R_i, Z_i)$ represents the θ th conditional quantile of the consumption expenditure variable for household i . R_i is a binary indicator, taking a value of 1 for remittance recipients and 0 otherwise. The vector Z_i represents a set of household, demographic, and economic variables. Central to our analysis, the coefficients γ_{θ} and β_{θ} denote the estimated impacts of receiving remittances and the influence of other covariates across various quantiles of the consumption distribution, respectively.

For detailed methodological exposition, particularly regarding the linearity assumption and model specification, the discussion below focuses on the quantile regression analysis of food consumption as a representative case. This emphasis arises from food consumption's core position in household welfare studies and the detailed results found, especially regarding the functional form of major covariates.

Assessing Linearity and Model Specification

To ensure the robustness and validity of our quantile regression estimates across the 10th, 25th, 50th, 75th, and 90th percentiles, the functional form of the model and the linearity assumption of the conditional quantile function were rigorously assessed through empirical testing and visual diagnostics.

Regarding household size, a critical determinant of food consumption, the linear term was consistently positive and statistically significant across all estimated quantiles. However, to test rigorously for non-linear effects and potential economies/diseconomies of scale, a squared term for household size (HH size²) was additionally included in the model specifications. The squared term had statistically significant and consistently negative values in all the analyzed quantiles (see Table A7 in the Appendix for the detailed coefficient estimates from the models including the squared term). This suggests a non-linear association: as household size increases, the positive effect of more members on food consumption decreases, implying possible scale economies beyond a threshold. The squared term's inclusion also increased the linear household size term's positive coefficient, better capturing the initial marginal effect. Despite the `qregplot` command in Stata suggesting a largely linear trend for household size (Figures 2.6, 2.7, 2.8, and 2.9), the statistically significant squared term reveals a less obvious, non-linear association. This reinforces the importance of empirical testing complementing visual diagnostics.

For the remittance dummy variable (1 for recipient, 0 otherwise), the concept of linearity applies to its additive effect on the conditional quantile. `qregplot` visualizations displayed generally parallel, but distinct, quantile shifts in food consumption between recipient and non-recipient groups, aligning with linear, dummy variable inclusion. There was no indication from these plots of interaction effects or non-linear impacts that would invalidate its direct inclusion.

Including linear and squared terms for household size, in conjunction with other continuous and dummy variables, the chosen functional form establishes a sound and resilient structure for understanding the diverse effects of remittances and socio-economic determinants throughout the food consumption distribution, allowing for clear understanding of the quantile-specific coefficients.

2.6 Results and Discussion

Table 2.4 presents the odds ratio (OR) estimates from the logistic regression analysis of households receiving total, external, and internal remittances. The literacy of the household head is statistically significant, indicating that households with a literate head had higher odds of receiving remittances. Urban households were also more likely to receive remittances than those in rural, nomadic, or IDP settlements, except in the case of internal remittances. Additionally, the employment of at least one household member reduced the likelihood of receiving total and external remittances, likely because economically active households were more financially independent and thus less in need of external financial support. In contrast, the odds of receiving internal remittances increased for households with employed members, suggesting different dynamics for domestic remittances.

The analysis also shows that non-poor households were more likely to receive remittances, possibly because long-term remittance inflows had been saved and invested in durable assets. Moreover, while households with a larger share of elderly members or extended family sizes exhibited higher odds of receiving remittances, these results were positive but statistically insignificant. Lastly, households residing in unstable regions had higher odds of receiving total and external remittances, highlighting a notable concentration of remittances in crisis-affected areas.

Table 2.4: Logistic regression: The odds of receiving remittances

VARIABLES	Remittances	Intl Remit.	Dom. Remit.
Age (in years)	1.007* (0.004)	1.005 (0.004)	1.012** (0.005)
Gender	0.937 (0.068)	0.892 (0.074)	1.002 (0.099)
Employment of hh head	0.672*** (0.055)	0.539*** (0.051)	1.322** (0.164)
Literacy of hh head	1.696*** (0.128)	1.952*** (0.173)	1.487*** (0.153)
Resides in urban areas	1.533*** (0.122)	2.025*** (0.198)	0.954 (0.099)
Household size	0.996 (0.035)	1.058 (0.041)	0.934 (0.047)
Number of children	1.037 (0.031)	0.998 (0.034)	1.052 (0.045)
Non-poor household	1.878*** (0.133)	2.272*** (0.185)	1.280** (0.123)
Large vs. small households	1.060 (0.118)	1.007 (0.128)	0.903 (0.139)
Share of elders (65+)	1.098 (0.233)	1.369 (0.323)	0.677 (0.216)
Constant	0.093*** (0.017)	0.044*** (0.010)	0.047*** (0.012)
Observations	6,075	6,061	6,054
Pseudo R-squared	0.0345	0.0589	0.0124

Note: Remittances represent both international and internal remittances. Intl Remit. stands for migrant remittances, while Dom. Remit. denotes domestic remittances. In all instances, remittances are binary, coded as 1 for beneficiaries and 0 otherwise. Exponentiated coefficients; Standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

2.6.1 Remittances and consumption expenditure: quantile regressions

The first set of analyses examines the impact of explanatory variables on the conditional mean of total household consumption expenditure using OLS. As shown in the first column of 2.5, total consumption increases when the household has at least one employed member. Additionally, a positive and statistically significant correlation is found between total consumption and the literacy of the household head. The coefficient for household size is negative and statistically significant at the 1 percent level, indicating an inverse relationship between household size and consumption.

Remittances are also included as an exogenous covariate in the OLS analysis, revealing a statistically significant relationship between remittances and consumption at the 1 percent level. Notably, the increase in consumption differs among different levels of consumption.

Table 2.5 shows the coefficients from conditional quantile regressions calculated at the 10th, 25th, 50th, 75th, and 90th percentiles. Remittances have a positive and statistically significant impact on total consumption across all quantiles, but the effect tends to peak at the lower and middle quantiles (around the 25th and 50th percentiles), before tapering off slightly at the higher quantiles. Specifically, the level of consumption at the bottom 10th percentile was 10% higher for recipients. Still, it increased by 12% for both the 25th and 50th percentiles, respectively, before finally slumping to 10% at the 75th and 90th percentile, respectively. This suggests that remittances are relatively more impactful for lower- and middle-income households, helping to increase their consumption, while wealthier households still benefit, albeit to a somewhat lesser extent.

Furthermore, quantile regression estimates for food consumption, as shown in Table A5, demonstrate that remittances significantly improve the consumption of households at the bottom quantile (10th and 25th), indicating the crucial role of remittances in alleviating poverty improving the consumption of the most vulnerable families.

The findings confirm the widely held view that remittances fund household consumption smoothing in developing countries (Beaton et al., 2018; Helmy et al., 2020), especially in countries still affected by fragility and conflict (El-Sakka and McNabb, 1999). Several studies have evidenced a positive and statistically significant association between remittances and consumption with varying magnitudes in post-conflict settings. For instance, the study by Duval and Wolff (2016) found that remittances alleviate poverty by improving the consumption level of the most impoverished households in post-conflict Kosovo.

Table 2.5: OLS and quantile regression estimates of the log of total household expenditure

VARIABLES	OLS	Quantile regressions				
		P10	P25	P50	P75	P90
Recipient of remittances	0.130*** (0.014)	0.095*** (0.029)	0.118*** (0.019)	0.117*** (0.017)	0.103*** (0.015)	0.102*** (0.019)
Age (in years)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	0.001 (0.001)
Gender (male=1)	-0.001 (0.012)	0.009 (0.024)	0.009 (0.015)	0.004 (0.014)	-0.005 (0.012)	-0.025 (0.016)
Employment of hh head	0.079*** (0.014)	0.054* (0.028)	0.080*** (0.018)	0.069*** (0.016)	0.045*** (0.014)	0.048** (0.019)
Literacy of hh head	0.062*** (0.012)	0.060** (0.025)	0.060*** (0.016)	0.054*** (0.014)	0.041*** (0.012)	0.038** (0.017)
Resides in urban areas	-0.094*** (0.013)	-0.075*** (0.025)	-0.072*** (0.016)	-0.056*** (0.014)	-0.066*** (0.013)	-0.055*** (0.017)
Household size	-0.056*** (0.006)	-0.031*** (0.012)	-0.049*** (0.007)	-0.060*** (0.007)	-0.058*** (0.006)	-0.054*** (0.008)
Number of children	0.000 (0.005)	-0.017* (0.010)	-0.003 (0.006)	0.008 (0.006)	0.006 (0.005)	0.007 (0.007)
Non-poor household	0.970*** (0.011)	1.151*** (0.024)	0.899*** (0.015)	0.803*** (0.014)	0.872*** (0.012)	1.045*** (0.016)
Large vs. small households	0.037** (0.018)	0.034 (0.037)	0.033 (0.023)	0.014 (0.021)	0.037** (0.018)	0.041* (0.025)
Share of elders (65+)	-0.038 (0.043)	-0.064 (0.074)	-0.083* (0.047)	0.004 (0.042)	0.024 (0.037)	-0.009 (0.049)
Constant	5.845*** (0.033)	5.163*** (0.060)	5.570*** (0.038)	5.904*** (0.035)	6.198*** (0.030)	6.309*** (0.040)
Observations	6,075	6,075	6,075	6,075	6,075	6,075
R-squared	0.591					
Pseudo R-squared		0.344	0.358	0.385	0.418	0.438

Note: The dependent variable is the log of total consumption expenditure for household i . The exogenous variable of interest is "recipient of remittances", a binary variable that includes both international and internal remittances, with '1' denoting a recipient and '0' indicating a non-recipient. Estimates are derived using OLS and quantile regressions across various percentiles (P10, P25, P50, P75, and P90) of the expenditure distribution. Standard errors in brackets. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Conversely, [Fransen and Mazzucato \(2014\)](#) demonstrate that remittances are concentrated among wealthier families and have significant positive effects on household food security in post-war Burundi. Remittances play a crucial role in improving house-

hold economic welfare and can serve as resilience mechanisms against adverse shocks in post-war Somalia. However, households receiving remittances are less likely to be poor. Many vulnerable Somalis, predominantly IDPs and marginalized communities, are often excluded from the benefits of remittances, as illustrated by the results in Table 2.6. This evidence supports the findings of the SHFS survey, and the subsequent Somalia poverty and vulnerability assessment conducted by the World Bank (Group, 2019).

Furthermore, the positive effect of remittances on consumption smoothing in post-war Somalia is crucial for a food-fragile nation. According to Concern Worldwide (2023) and the (Global Hunger Index [GHI (2023)]), it is one of the world's most vulnerable countries in terms of food insecurity. The civil war, political instability, and natural climatic disasters such as floods and seasonal droughts have further exacerbated the situation for this already food-vulnerable nation. A recent study by Alfano and Cornelissen (2022) reveals the adverse effects of conflict on food prices, even in markets located in remote areas. Somalia faces an inextricable nexus between vulnerability, conflict, and catastrophes. This underscores the need to create an enabling environment for households to recover from crisis contexts by promoting migrant remittances and removing barriers to the efficient flow of funds from primary sending countries.

2.6.2 The effects of remittances on asset categories: total assets, durables, and livestock ownership

Table 2.6 illustrates the estimated results of the kernel matching model for aggregate and category-wise household asset accumulation, savings, and financial inclusion, disaggregated by settlement status. The ATT for total asset accumulation and consumer durables is positive and highly statistically significant at the 1% level, indicating that remittance-receiving households accumulate more assets than non-beneficiaries. The reported estimated results in Table 2.6 demonstrate that recipient of remittances (internal, international, and households receiving any type of remittance) positively and significantly correlated with total asset accumulation and durables, and external remittances have the most substantial effect. The analyses reveal that external remittance-receiving households hold between 0.45 and 0.47 standard deviations more total assets and durables than non-beneficiary households, respectively. These findings highlight the crucial role diaspora remittances played in household asset accumulation after the ruinous civil war that broke out in Somalia in early 1991 obliterated physical infrastructure and the normative economy.

Table 2.6: The effect of remittances on aggregate and category-wise assets, saving and financial inclusion, disaggregated by settlements status

VARIABLES	(1) Remit	(2) iRemit	(3) InRemit	(4) Urban	(5) Rural	(6) IDP	(7) Nomadic
Total assets	0.442*** (0.071)	0.450*** (0.0811)	0.431*** (0.101)	0.426*** (0.0830)	0.661*** (0.152)	0.392 (0.283)	0.0162 (0.124)
Consumer durables	0.443*** (0.069)	0.467*** (0.0808)	0.414*** (0.0948)	0.416*** (0.0835)	0.736*** (0.142)	0.400 (0.291)	0.0150 (0.111)
Livestock ownership	0.136** (0.061)	0.117* (0.0663)	0.127 (0.0920)	0.0624 (0.0393)	0.616*** (0.184)	-0.0915 (0.151)	0.134 (0.185)
Savings	0.075*** (0.014)	0.0735*** (0.0167)	0.150*** (0.0204)	0.0832*** (0.0175)	0.0546** (0.0247)	-0.0200 (0.0571)	0.0791* (0.0437)
Financial inclusion	0.374*** (0.0476)	0.415*** (0.0560)	0.461*** (0.0664)	0.439*** (0.0567)	0.229*** (0.0777)	0.104 (0.277)	0.0960 (0.155)
Observations	5764 ^a 6046 ^b 5764 ^c 6019 ^d 5993 ^e	5764 ^a 6046 ^b 5764 ^c 6019 ^d 5993 ^e	5764 ^a 6046 ^b 5764 ^c 6019 ^d 5993 ^e	3815 ^a 3982 ^b 3815 ^c 3966 ^d 3943 ^e	1034 ^a 1095 ^b 1034 ^c 1088 ^d 1088 ^e	437 ^a 463 ^b 437 ^c 460 ^d 459 ^e	478 ^a 506 ^b 478 ^c 505 ^d 503 ^e

Note: Observations marked with (a) correspond to Total assets, (b) to Consumer durables, (c) to Livestock ownership, (d) to Savings, and (e) to Financial inclusion. The outcomes – namely total assets, consumer durables, livestock ownership, and financial – are indexes constructed using principal component analysis. Savings is a dummy variable coded as 1 for households that save and 0 otherwise. Observations differ across settlements. Remittances are coded as a binary variable, where ‘1’ indicates households receiving remittances and ‘0’ indicates non-recipients. For columns 4–7, the analysis uses recipient of any type of remittance (both foreign and domestic) to estimate differential effects across settlement types. Standard errors in brackets. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

While this study examines the impact of remittances regardless of type, it also analyses internal and international remittances separately to better understand their distinct effects on household outcomes. In the sample, 9% of households receive internal remittances, 13% receive international remittances, and 19% receive any type of remittance. Findings indicate a stronger link between international remittances and productive asset growth (livestock, overall assets, and consumer goods), while domestic remittances show a closer relationship with savings and financial access. This suggests a complementary relationship rather than substitution between the two types. The emphasis on international remittances stems from their significant impact on Somali households and the macroeconomy; they represent roughly 21% of Somalia’s GDP, highlighting their importance for household resilience, consumption, and private investment (CBS, 2023). International remittances also have important policy implications for diaspora engagement, foreign exchange, and financial sector growth. Although particular policy and

macroeconomic relevance is attached to international remittances, this study gives equal analytical attention to both internal and international transfers, focusing on households receiving any type of remittance.

The civil war also engendered displacements and destruction of physical and financial assets due to looting and predation by armed groups. The Somali diaspora was thus essential to their stay-behind households, affording them massively inflated leverage in terms of capital and the ability to purchase assets. In the aftermath of the conflict, migrant remittances were thus crucial for building resilience, sustaining livelihoods, and accumulating lost assets.

An intriguing and critical research question among development economists and policymakers is the nexus between migrant remittances and the accumulation of productive assets in developing countries, particularly in fragile settings. To shed light on this, this study investigates the impact of remittances on livestock asset accumulation. As displayed in Table 2.6, another important finding was that remittances (total, and external) positively and significantly correlated with household's ownership of livestock assets. This finding is broadly consistent with studies on other developing countries ([Adams Jr, 1998](#); [Scott et al., 2024](#)), but not research in conflict-affected zones, thus this represents an important original contribution.

Pastoralists comprise almost a third (29%, $n = 2.3$ million) of the total Somali population ([Schelling, 2013](#)). Those who are solely pastoralists are mainly concentrated in rural and nomadic settlements in the north and central regions, while the southern areas contain mixed farming by agro-pastoralists. The estimated results exhibit that recipients of total and external remittances hold approximately 0.14 to 0.12 SD more livestock assets than their counterparts. The livestock sector dominates Somalia's economy, creating 65% of national employment opportunities, and contributing 40% of GDP and 80% of the country's foreign exchange earnings (Food and Agriculture Organization ([[FAO \(2012\)](#); [Warsame et al. \(2023\)](#)])). Livestock play a crucial role in improving the well-being of poor households, and increase food security, resilience, and asset savings, as well as being a fundamental source of income for pastoralists, agro-pastoralists, the government, and livestock traders.

Conflict, political instability, and the lack of an effective public sector for three decades adversely affected the development of this sector, and agriculture in general was inhibited by droughts and irregular rains in Somalia. In 2011, the region experienced one of the worst droughts in decades, causing the death of tens of thousands of livestock due to water scarcity and diseases. Later, the situation was improved when donors instigated rollout treatment and massive vaccinations of nearly 20 million livestock. As estimated

results reported in Table 2.6 show, if remittances can positively and significantly affect the livestock sector, this is a major issue of direct relevance to policy, specifically given the associated macroeconomic impacts on economic growth and development in Somalia. The National Development Plan 9 (2020–2024) considers the livestock sector as the backbone of the country's economy. Thus, migrant funding should be encouraged to stimulate this essential sector.

Empirical evidence on the impact of remittances on asset accumulation in developing countries abound and has unveiled somewhat mixed results, though similar literature in conflict-ridden and post-war contexts is scant. For instance, the evidence presented by some studies (Ahmed et al., 2018; Adams Jr, 1998; Chiodi et al., 2012) demonstrated the positive link between remittances and asset accumulation in various contexts, whereas Dea and Rathab (2012) found no significant effect of remittances on asset accumulation in Sri Lanka.

The results of this study indicate that remittances positively and significantly affect productive and unproductive assets. These results match those observed in earlier studies conducted in Nigeria (Ajefu, 2018), Pakistan (Ahmed et al., 2018), and Malawi (Kangmennaang et al., 2018), which found that remittances remarkably enhanced household asset levels but contradict the previous research conducted in post-war contexts such as Burundi. Mazzucato et al. (2008) deduced that remittances have insignificant effects on productive assets. For instance, Ajefu (2018) employed probit, bivariate probit, and 2SLS models to investigate the impact of remittances on productive investments. The preferred bivariate probit model predicts that Nigerian households that receive remittances are 13% more likely to invest in productive assets than non-beneficiary households.

In Pakistan, Ahmed et al. (2018) concluded that migrant remittances considerably enhanced the accumulation of household assets, while domestic remittances' contribution was insignificant. By employing various PSM models, kernel model estimates illustrate that foreign remittances remarkably increased productive and financial assets' accumulation by 15% and 65%, respectively. Kangmennaang et al. (2018) indicated that remittances have a significant positive effect on household asset levels in Malawi, and thus inevitably raise household asset holding by 15%. In contrast, Mazwi (2022) found that remittances do not significantly promote asset accumulation in Zimbabwe, although the estimates employed relied heavily on qualitative data.

In conflict-affected settings such as Somalia, the effects of remittances are expected to differ both qualitatively and quantitatively from those observed in stable or post-conflict economies. The common assumption is that in unstable environments, remittances are mostly spent on necessities—food, healthcare, and education—rather than used for in-

vestments or accumulating assets. Persistent insecurity, limited access to formal finance, weak regulatory frameworks, and constrained credit markets all contribute to this expectation. The prevalence of informal transfer methods, including Hawala, underscores institutional shortcomings and strengthens the focus on short-term survival via remittances. Quantitatively, remittance flows in conflict zones may be lower in volume, more volatile, and more frequently disrupted due to logistical challenges, insecurity, and fragile infrastructure. Additionally, the marginal effect of remittances on welfare or asset ownership may be larger due to high baseline vulnerability, yet these effects are often less stable or sustainable over time. The structural and contextual differences justify the expectation of differing remittance outcomes between fragile and stable environments.

However, this study's results contradict prior assumptions; remittances to Somalia also help build productive assets like livestock and savings. This implies remittances can foster development, even in fragile states, given the right circumstances. The findings highlight the need to separately analyze remittance behavior in conflict zones, as opposed to applying conclusions from stable economies.

2.6.3 Remittances, Savings, and Financial Inclusion

Table 2.6 exhibits the ATT for savings and financial inclusion for remittance-receiving households. The saving variable is statistically significant at the 1% level, highlighting that remittances positively and significantly affect household savings in Somalia. While results indicate that remittance-receiving households save more than non-recipients, internal remittances have the strongest effect, revealing that households save 0.15 standard deviations (SD) more than non-beneficiary households.

This finding is broadly consistent with the results reported by [Osili \(2007\)](#), which revealed the positive impact of migrant remittances on household saving and consequently on resources in the origin environment. Moreover, the results illustrate that savings generated from remittances are crucial for families in post-war Somalia, particularly as they provide a buffer in the event of unforeseen financial difficulties or shocks. Likewise, savings have many potential benefits, such as avoiding debt, investing in business or properties, living without financial stress, smoothing future consumption, and providing families with a sense of financial freedom.

In a fragile post-conflict setting such as Somalia, the study assumes that the remittance-receiving household lives in two periods and can confront unexpected shocks in the form of conflicts, attacks, droughts, floods, death, and illness with a probability of p in period one. Consequently, the recipients accumulate savings if there is no shock with a proba-

bility of $1 - p$ in period two¹.

Furthermore, the study assumes that savings serve as an investment if no unforeseen event occurs in the short run. The saving is kept as a liquid or easily cashable investment (e.g., bank accounts/land), and is transformed into investment once a threshold amount of saving is reached. The consequent investment is less liquid (farm machinery, buildings, business, or manufacturing). The exogenous parameter p , which captures the likelihood of unforeseen events in period two, lies between 0 and 1. So, saving can either function as a buffer against unanticipated events or be accumulated and, once a threshold is reached, be invested in productive assets. Thus, in any case, saving plays a crucial role in a conflict-affected country and can function either as consumption smoothing or as saving, which subsequently can generate productive assets in the long run.

Financial inclusion is invariably recognized as a crucial factor for reducing poverty as well as leading the path to achieving the goal of inclusive economic development. The G20 financial inclusion indicators developed by the Global Partnership for Financial Inclusion (GPII, 2016) and endorsed by G20 leaders measure financial inclusion in three dimensions: *access*, *usage*, and *quality of financial service delivery*. Hence, the updated G20 Financial Inclusion Indicators consider owning a bank account (whether individually or jointly) or mobile money account to be key indicators of financial inclusion.

While financial inclusion consists of a broader set of indicators, given the current dataset, this study measures financial inclusion using three variables: *having a private bank account*, *mobile money account*, and *ease of borrowing money*. A financial inclusion index was constructed using the PCA approach, incorporating the three variables mentioned. In Somalia, the money transfer business has taken the role of banks, and such services operate as formal financial institutions by facilitating access to microcredit. Therefore, ease of borrowing money means that the concerned household is capable of accessing microcredit either through formal means, such as banks, or by informal means, such as inter-household loans.

Furthermore, the financial inclusion variable is highly statistically significant at the 1% level, indicating that remittances are positively and significantly correlated with a household's access to financial inclusion. The obtained results show that receiving total, external, and internal remittances increases access to financial inclusion of recipients by 0.23 SD, 0.31 SD, and 0.30 SD (respectively), compared to non-remittance-receiving

¹For a household receiving remittances in conflict zones, consider a two-period framework. In period one, the household may experience shocks with a probability p or not $(1 - p)$. If shocks occur, a portion ϕR of the remittance is consumed, while $(1 - \phi)R$ is saved. Without shocks, θR is used for consumption, saving the residual $(1 - \theta)R$. The expected savings is expressed as: $E[S_1] = p(1 - \phi)R + (1 - p)(1 - \theta)R$. Where R denotes received remittance. For detailed derivations, refer to Appendix A

households.

A key question is whether financial access is a prerequisite for receiving international remittances, and whether remittances in turn promote financial inclusion. In the Somali context, financial access—especially in the form of formal bank accounts—is not strictly required to receive international remittances. Many households access remittances through mobile money platforms or informal mechanisms such as Hawala agents. Therefore, financial access is not a precondition for receipt. However, receiving international remittances may encourage households to open mobile money or bank accounts, particularly to facilitate saving or repeat transactions. This suggests that while minimal financial access may exist, remittances can help deepen financial inclusion by increasing engagement with financial services, particularly in fragile settings where formal institutions are underdeveloped.

The relevance of this finding is accentuated in the existing literature on the impact of remittances on financial inclusion and its subsequent benefits for households accessing financial services. Empirical evidence demonstrates that receipt of remittances positively and significantly improves access to financial inclusion ([Aga and Martinez Peria, 2014](#); [Ajefu and Ogebe, 2019](#); [Anzoategui et al., 2014](#)). However, similar literature in conflict-affected states is unavailable, partly due to data inaccessibility in war-torn economies.

To the best of this study's knowledge, this is the first to explore the effect of remittances on financial inclusion, disaggregated by settlement status in fragile post-conflict nations. Building on this literature and contributing to the remittance literature in conflict settings, the findings underscore the crucial role remittances play in a fragile post-conflict context by enhancing recipient household access to financial inclusion, which has many benefits both at the household and country levels. The notion that remittances can lead to financial inclusion, especially in a conflict-affected setting such as Somalia, has to be understood as an essential element for development, because financial access reduces inequality in society and facilitates the participation of households and businesses within the financial system.

Furthermore, empirical evidence from randomized controlled trials (RCTs) demonstrates that access to microcredit can increase the number of new business start-ups. It can also expand and boost investment in existing businesses, enhance expenditure on business durables, and improve returns from the existing enterprises ([Banerjee et al., 2015](#)).

2.6.4 Disaggregated Effects of Remittances by Settlement Type

To further interpret the heterogeneous impacts of remittances, this study examines differential effects across settlement types—urban, rural, nomadic, and internally displaced persons (IDPs). This disaggregation is an important and underexplored contribution to the literature on remittances in fragile and conflict-affected settings, where aggregate-level analysis often masks important subgroup dynamics.

The findings, as detailed in Table 2.6 (page 48), indicate that remittances are associated with significantly higher levels of savings and financial inclusion in both urban and rural areas. The effects are particularly strong in urban households, with remittance-receiving households showing increases of 0.08 and 0.44 standard deviations (SD) in savings and financial inclusion, respectively, compared to 0.05 and 0.23 SD in rural households. However, this pattern reverses for asset accumulation: rural households record a 0.62 SD increase in total assets, while the effect for urban households is statistically insignificant.

Among nomadic households, remittance effects are generally weaker and statistically insignificant across most outcomes, except for savings, where a positive effect is observed at the 10% significance level. In contrast, the results show that remittances have no significant impact on any of the outcomes examined for IDPs. This suggests that IDPs—who often reside in temporary shelters and face multidimensional vulnerabilities—are less likely to benefit from remittances in the same way as other settlement types.

Table 2.6 (columns 4–7) provides the detailed disaggregated effects of remittances across the four settlement types. These findings are consistent with earlier evidence from post-conflict settings, such as [Fransen and Mazzucato \(2014\)](#), who found that beneficiary households in Burundi accumulated significantly more assets than non-beneficiaries.

A likely explanation for these patterns is that rural households—particularly those engaged in livestock herding—allocate remittances toward productive assets, such as animals and farming equipment. In contrast, urban households may use remittances to enhance financial access and buffer consumption. The insignificant effects among nomads and IDPs reflect distinct structural constraints: nomadic communities often operate outside formal financial systems, while IDPs face severe economic marginalization.

Overall, this analysis contributes new empirical insights by disaggregating remittance impacts across different settlement types in a fragile context. It highlights that remittances do not have a uniform effect across populations and that their development potential depends on local livelihoods, institutional environments, and structural vulnerabilities. As such, this dimension of the study adds to the small but growing body of literature on the spatially heterogeneous effects of remittances in conflict-affected economies.

2.6.5 The heterogenous effect of remittances on various sub-samples

Table 2.7 presents the heterogeneous treatment effects of remittances by household wealth status and household size, highlighting key distributional patterns in their impact. Beneficiary households below the poverty line differ systematically from their non-poor counterparts in terms of asset holdings, consumption composition, savings behaviour, and financial inclusion. Remittances are found to have a positive and statistically significant effect on all analysed outcomes for both poor and non-poor households, with the exception of livestock accumulation, which remains insignificant among poorer households. Moreover, the magnitude of remittance effects is consistently greater among non-poor recipients, particularly with respect to asset accumulation and livestock ownership.

A similar pattern emerges when comparing small and large households. Remittances are positively and significantly associated with household wealth across both groups; however, the effect on livestock ownership is statistically insignificant among larger households. The findings further indicate that large households tend to accumulate more total assets and durable goods and exhibit higher levels of financial inclusion, whereas smaller households report relatively higher savings.

At first glance, these results may appear to diverge from the dominant perspective in the literature, which characterizes remittances in fragile and conflict-affected settings as primarily geared toward short-term consumption smoothing. However, the evidence presented in Table 2.7 suggests that remittances in Somalia also perform a forward-looking role, enabling not only the fulfilment of immediate needs, but also supporting longer-term investment and resilience-building.

Table 2.7: The heterogeneous effect of remittances on sub-samples

VARIABLES	Household Wealth		Household Size	
	Non-poor	Poor	Small	Large
Total assets	0.412*** (0.115)	0.289*** (0.082)	0.357*** (0.092)	0.503*** (0.112)
Consumer durables	0.392*** (0.116)	0.303*** (0.078)	0.359*** (0.092)	0.515*** (0.107)
Livestock ownership	0.165* (0.098)	0.033 (0.081)	0.135* (0.072)	0.137 (0.102)
Savings	0.071*** (0.022)	0.072*** (0.017)	0.084*** (0.020)	0.076*** (0.019)
Financial inclusion	0.233*** (0.073)	0.312*** (0.061)	0.301*** (0.065)	0.331*** (0.070)
Observations	2226 ^a	3538 ^a	3200 ^a	2564 ^a
	2339 ^b	3707 ^b	3369 ^b	2677 ^b
	2330 ^b	3689 ^b	2666 ^b	3353 ^b
	2310 ^d	3683 ^d	3324 ^d	2669 ^d

Note: Observations marked with (a) across all columns refer to total assets and livestock ownership, (b) indicate consumer durables, (c) correspond to savings, and (d) represent financial inclusion. The outcomes represent indices and are estimated using the PCA approach. Remittances are recipient of total remittances (foreign and domestic) and are binary: 1 for recipients and 0 otherwise. Standard errors in brackets. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Several interrelated mechanisms may help explain this apparent divergence from the prevailing narrative. First, in the context of prolonged insecurity and recurrent shocks, households may adopt forward-looking strategies that involve building informal safety nets through asset accumulation. Livestock, for example, serves not only as a productive asset, but also as a store of value and a form of informal insurance. Second, in the absence of functioning credit markets, remittances can help loosen liquidity constraints, enabling households to engage in low-risk, culturally embedded investments. Third, access to financial services—particularly mobile money—enhances households' capacity to manage remittance flows more effectively, allowing them to plan, save, and budget over longer horizons. Finally, larger households may benefit from pooled remittance income and economies of scale, facilitating more strategic allocation across consumption and investment needs.

Taken together, these findings challenge narrow interpretations of remittances as

purely consumptive transfers. Instead, they point to a dual role in fragile contexts like Somalia: remittances serve as both a short-term coping mechanism and a source of forward-looking investment in household resilience, asset accumulation, and informal financial participation.

While the results in Table 2.7 demonstrate that poor households benefit significantly from remittance inflows—particularly in terms of basic consumption, savings, and financial inclusion—the findings also reveal important differences in how remittances are utilised across household wealth groups. Non-poor households appear better positioned to convert remittances into forward-looking investments such as livestock and durable goods, likely reflecting their more stable financial footing, broader investment options, and more established remittance channels. In contrast, remittance impacts on livestock accumulation are insignificant among poorer households, suggesting constraints related to immediate needs or limited investment capacity.

These disparities highlight the need for targeted policy interventions that prioritise poorer households—not at the expense of inclusivity, but in recognition of their greater vulnerability and the potential for remittances to support resilience when paired with appropriate support. Increased access to affordable, secure financial services (like mobile money and savings platforms) can improve poor households’ remittance management and planning. Expanding access to affordable and secure financial services, including mobile money and savings platforms, can help poor households better manage and plan remittance inflows. Complementary efforts such as financial literacy and small-scale investment support—especially in areas like livestock or group-based initiatives—could further enhance their ability to convert remittances into sustainable improvements.

In parallel, the diverse utilisation of remittances by non-poor households presents valuable learning opportunities and should receive sustained support within broader development programs. At the same time, the more diversified use of remittances by non-poor households offers valuable lessons and should continue to be supported as part of broader development efforts. Ultimately, policies aimed at stabilising and optimising remittance flows must ensure accessibility and affordability for all groups, while also addressing structural barriers that prevent the poorest from fully benefiting from these vital transfers.

Furthermore, Table 2.8 below presents the impact of the total, external, and internal remittances on living standards, shock index, the proportion of children enrolled at primary and secondary school, and the household head’s tertiary and secondary educational attainment.

Table 2.8: Remittances and their impact on living standards, resilience to shocks, and educational Attainment

VARIABLES	Total remittances	External remittances	Internal remittances
Living standards	0.196*** (0.045)	0.225*** (0.049)	0.204*** (0.064)
Shock index	0.317*** (0.077)	0.255*** (0.091)	0.270** (0.111)
Primary School Enrollment (Age 6–13)	0.067*** (0.021)	0.080*** (0.024)	0.034 (0.028)
Secondary School Enrollment (Age 14–17)	0.129*** (0.029)	0.146*** (0.031)	0.136*** (0.040)
HH Head Tertiary Educ	0.022 (0.018)	-0.006 (0.020)	0.053** (0.024)
HH Head Secondary Educ	-0.003 (0.010)	-0.000 (0.013)	-0.016 (0.013)
Observations	6022 ^a 5512 ^b 3754 ^c 1775 ^d 4252 ^e	6022 ^a 5512 ^b 3754 ^c 1775 ^d 4252 ^e	6022 ^a 5512 ^b 3754 ^c 1775 ^d 4252 ^e

Note: The table illustrates the impact of remittances on various outcomes. PCA is used to create the outcomes of living standards and the shock index. The primary and secondary enrolment variables represent the proportion of students enrolled at primary and secondary school age. The education level of the household head is dummy coded as 1 if they have secondary or tertiary education, and 0 otherwise. Following the exclusion of missing observations for each outcome, the number of observations (N) varies across the estimated outcomes. Observations marked (a) correspond to living standards, (b) denote the shock index, (c) represents primary enrolment (d) represents secondary enrolment, and (e) encompass both secondary education and tertiary education. The shock index is defined as a wide range of disruptions reported by households. Standard errors in brackets. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

The results demonstrate that remittances are positively and significantly associated with living standards, and that this impact is more amplified for recipients of external remittances. For example, recipients of migrant remittances exhibit living standards that are approximately 0.23 SDs higher than those of non-recipients. Total, external, and internal remittances also appear to buffer households against economic disruptions arising from unanticipated shocks and vulnerabilities.

The results show that total and international remittances positively and significantly

affect both primary and secondary school enrollment for children in post-war Somalia. The results are most robust for recipients of migrant remittances. These findings are broadly consistent with those of previous studies conducted in post-war Somaliland (Ahmed, 2000; Lindley, 2008), and elsewhere in developing countries (Ahmed et al., 2023; Gajurel and Niroula, 2024; Kifle, 2007).

Furthermore, internal remittances positively and significantly correlate with secondary school enrollment, though their impact on primary enrollment remains insignificant. Notably, internal remittances are the only type that positively influence the tertiary educational attainment of household heads, whereas remittances have no effect on the secondary educational attainment of the heads.

2.7 Robustness Checks

While PSM mitigates selection bias due to observable characteristics, it does not rule out bias from unobserved confounders (i.e., factors that may jointly influence both remittance receipt and household outcomes but are not captured in the data). To analyse how vulnerable our results are to such hidden variables, this study conducts two complementary sensitivity analyses: (1) Rosenbaum bounds, to quantify how strong an unobserved confounder would have to be to overturn the estimated treatment effect; and (2) Oster bounds, which compare coefficient stability and changes in the R squared between uncontrolled and controlled regressions to assess potential omitted variable bias. Tables 2.9 and 2.10 report these diagnostics, and allow us to judge whether unobserved heterogeneity is likely to invalidate our findings.

2.7.1 Sensitivity analysis (Rbounds)

In this study, a fundamental assumption underlying our matching estimators is the conditional independence or unconfoundedness, which asserts selection based on observable characteristics. Should there exist unobserved confounding covariates affecting both treatment assignment and potential outcomes, this assumption is violated. To assess this potential violation, we use the bounding procedure proposed by (Rosenbaum and Rosenbaum, 2002). Specifically, we implement Stata's `rbounds`² command for continuous outcomes (DiPrete and Gangl, 2004) and `mhbounds`³ for binary outcomes (Becker and

²This Stata command uses Rosenbaum's (2002) bounding method, adjusted for continuous results, to analyze treatment effects' sensitivity to hidden confounding.

³This Stata command applies Rosenbaum's (2002) sensitivity analysis using the Mantel-Haenszel bounds to assess how robust binary outcome treatment effects are to hidden bias. It is only applicable to binary outcomes.

[Caliendo, 2007](#)). Both commands compute Rosenbaum bounds for average treatment effects on the treated, assessing potential biases between remittance recipients and non-recipient households. Given our objective to analyse the impact of remittances on both continuous and binary outcomes, we apply both commands.

The Rosenbaum sensitivity test evaluates how robust the estimated effects of various outcomes, such as total asset accumulation, are to potential unobserved confounding factors. The parameter Γ measures the impact of hidden biases on treatment assignment. A value of $\Gamma = 1$ suggests no hidden bias, while larger values of Γ indicate stronger unobserved confounding. Table 2.9 shows that at $\Gamma = 1$, the significance levels (`sig+` and `sig-`) are very small, signifying a highly significant estimated effect of total assets with no hidden bias. The point estimates for the upper and lower bounds, both at 0.3878, indicate a moderate, positive effect of total assets. The confidence interval (CI) ranges from 0.2413 to 0.5357, showing that the effect remains positive.

As Γ increases, indicating the potential influence of stronger hidden biases, the significance levels remain small up to $\Gamma = 1.2$, meaning that the effect of total assets remains significant under moderate bias. The point estimates gradually decrease but remain positive, with the confidence interval for $\Gamma = 1.2$ ranging from 0.0472 to 0.7304, suggesting that the effect is still positive but less robust.

However, once Γ surpasses 1.3, the results start to weaken, suggesting that if unobserved factors play a larger role, the estimated effect of total assets could be less reliable. In essence, while the results are robust to moderate biases, caution is advised when stronger unobserved confounding might be present.

In summary, the effect of total assets is robust to small to moderate hidden biases ($\Gamma \leq 1.2$) but becomes less reliable when stronger unobserved confounders are introduced ($\Gamma > 1.2$). Likewise, the examination of consumer durables aligns with the findings for total assets, indicating a substantial positive impact at $\Gamma = 1$. This emphasizes how remittances play a key role in enhancing household quality of life by promoting the accumulation of durable consumer goods. The positive impact remains strong up to $\Gamma = 1.2$, albeit slightly reduced. Nevertheless, at $\Gamma = 1.3$, the significance declines, showing that the impact of consumer durables may be compromised by unobserved confounding. Thus, while consumer durables initially demonstrate a strong contribution to household stability, their effectiveness becomes less certain as hidden biases increase.

This particular value of $\Gamma = 1.30$ implies that, for households appearing to be similar based on observed attributes, their likelihood of receiving remittances might differ by 30 percent. This number, being reasonable, might hint that our findings are robust and

the estimated bias is not extreme.

In conclusion, both total assets and consumer durables exhibit robust positive effects under moderate assumptions of hidden biases. Nevertheless, the results indicate increasing uncertainty as the degree of potential confounding rises, necessitating careful interpretation of the impact of these factors in policy and practice.

Table 2.9: Rosenbaum Bounds for Sensitivity Analysis (N = 1065 Matched Pairs)

Outcomes	Γ	sig+	sig-	t-hat+	t-hat-	CI+	CI-
Total Assets	1.0	1.4e-07	1.4e-07	0.3878	0.3878	0.2413	0.5357
	1.1	0.000075	4.4e-11	0.2866	0.4891	0.1402	0.6379
	1.2	0.005015	5.1e-15	0.1953	0.5818	0.0472	0.7304
	1.3	0.072245	0	0.1108	0.6668	-0.0392	0.8138
	1.4	0.334107	0	0.0329	0.7447	-0.1180	0.8934
	1.5	0.702076	0	-0.0411	0.8156	-0.1917	0.9693
Consumer Durables	1.0	6.1e-08	6.1e-08	0.3857	0.3857	0.2426	0.5274
	1.1	.000047	1.2e-11	0.2858	0.4872	0.1424	0.6279
	1.2	.003975	7.8e-16	0.1936	0.5771	0.0504	0.7180
	1.3	.066119	0	0.1086	0.6608	-0.0349	0.8053
	1.4	.328585	0	0.0313	0.7369	-0.1109	0.8854
	1.5	.706726	0	-0.0409	0.8115	-0.1840	0.9615
Livestock Ownership	1.0	1.3e-09	1.3e-09	0.2679	0.2679	0.2044	0.4087
	1.1	2.2e-06	1.1e-13	0.2044	0.3888	0.1844	0.4087
	1.2	.000389	0	0.2044	0.4087	0.0199	0.5931
	1.3	.012850	0	0.1844	0.4524	0.0000	0.5931
	1.4	.117417	0	0.0000	0.5931	0.0000	0.6131
	1.5	.413421	0	0.0000	0.5931	-0.0437	0.6767
Financial Inclusion	1.0	4.1e-06	4.1e-06	0.3394	0.3394	0.1922	0.4889
	1.1	.000921	3.1e-09	0.2383	0.4415	0.0897	0.5931
	1.2	.029102	8.3e-13	0.1452	0.5355	-0.0052	0.6866
	1.3	.219297	1.1e-16	0.0593	0.6226	-0.0928	0.7738
	1.4	.602901	0	-0.0197	0.7019	-0.1734	0.8543
	1.5	.889735	0	-0.0947	0.7756	-0.2479	0.9265

Note: Γ [* gamma] represents the log odds of differential assignment due to unobserved factors. sig+ and sig- are the upper and lower bound significance levels, respectively. t-hat+ and t-hat- are the upper and lower bound Hodges-Lehmann point estimates. CI+ and CI- are the upper and lower bound confidence intervals at $\alpha = 0.95$.

2.7.2 Oster bounds

In addition to the Rosenbaum (2002) sensitivity analysis reported in the previous section, the study uses the Oster bounds method, as introduced by Oster (2019), to further anal-

use the robustness of the estimated treatment effects against potential omitted variable bias. The Oster method analyses how both observed and unobserved variables influence the treatment effect. Specifically, the assessment includes the stability of treatment estimates when control variables are added or removed, and how these adjustments relate to changes in the R-squared values of the model. A parameter is introduced in this approach to determine the extent to which omitted variable bias affects the treatment effect. If the parameter excludes zero, it suggests that the estimate is likely robust.

The model can be expressed as:

$$Y = \alpha + \text{Remit} \cdot \beta + W_1 + W_2 + \epsilon_{it} \quad (2.5)$$

In this equation, Y denotes the asset accumulation, which serves as the outcome variable of interest. The *Remit* variable is a dummy variable that equals one if the household receives remittances. The term W_1 includes observed control variables, along with their corresponding coefficients. The term W_2 denotes unobserved variables that are correlated with both the asset accumulation outcome and household recipient of remittances. The error term ϵ_{it} is uncorrelated with *Remit*, W_1 , and W_2 .

The Oster bounds method challenges the conventional argument that stability in treatment estimates after controlling for observed variables implies minimal omitted variable bias. This argument assumes that bias from observed controls reflects the bias from unobserved factors. [Oster \(2019\)](#) challenges this by introducing two key parameters: δ (delta) and $R_{\max}$.

The parameter δ quantifies the proportionality of selection on unobservables relative to observables. A value of $\delta = 1$ indicates that unobserved and observed factors are equally important and influence the treatment effect in the same direction. If $\delta < 1$, unobserved factors are considered less influential; conversely, $\delta > 1$ implies that unobservables have a greater influence.

The second parameter, $R_{\max}$, represents the maximum possible R^2 value achievable in a model that includes both observed and unobserved variables along with the treatment. It reflects the maximum explanatory power of the model, which could theoretically reach 1 if the outcome is perfectly explained. However, $R_{\max}$ should always be greater than the R^2 of the controlled model. In this analysis, values of $R_{\max} = 1$ and $R_{\max} = 0.7$ are considered.

Table 2.10: Bound Estimates for Asset Accumulation and Financial Inclusion

Category	Parameter	Coefficient	R-Squared
Asset Accumulation			
Bound Estimate	δ	0.41974	-
Inputs from Regressions	Uncontrolled	0.54141	0.196
	Controlled	0.40578	0.298
Other Inputs	$R_{\max}$	1.000	-
Financial Inclusion			
Bound Estimate	δ	0.13596	-
Inputs from Regressions	Uncontrolled	0.45732	0.147
	Controlled	0.39102	0.164
Other Inputs	$R_{\max}$	1.000	-

Note: Bound Estimates and Regression Inputs for Asset Accumulation and Financial Inclusion.

The results indicate robustness of the estimates. For both asset accumulation and financial inclusion outcomes, the δ values are less than 1, suggesting that the impact of unobserved factors is relatively minor compared to observed factors. The estimated effects are thus robust against omitted variable bias, as supported by the analysis.

The results are reported in 2.10. The findings from the table show that the identified set for the treatment effect does not include zero, indicating that the estimated effect of remittances on asset accumulation and financial inclusion outcomes is robust to omitted variable bias. The δ values of 0.42 and 0.14 suggest that unobserved factors would need to be less influential than observed covariates to drive the effect to zero. Since the sign of the remittance coefficient remains consistent and the identified set excludes zero, this estimate can be considered robust against omitted variable bias (Oster, 2019).

As the results show a value of δ less than 1, this indicates that unobserved variables are less influential, and omitted variable bias is unlikely to affect the validity of our estimates. Hence, both sensitivity approaches confirm the robustness of our results.

2.7.3 Sensitivity analysis: comparing the results of various PSM methods

Table 2.11: The effect of remittances on household wealth using various PSM methods

VARIABLES	Total remittances			External remittances		
	Teffects	NN	Radius	Teffects	NN	Radius
Total assets	0.30*** (0.08)	0.37*** (0.07)	0.44*** (0.08)	0.40*** (0.09)	0.47*** (0.08)	0.63*** (0.09)
Durables	0.39*** (0.08)	0.38*** (0.07)	0.44*** (0.07)	0.56*** (0.09)	0.50*** (0.08)	0.64*** (0.09)
Livestock ownership	0.15** (0.06)	0.17*** (0.05)	-0.004*** (0.06)	0.12* (0.07)	0.09 (0.06)	-0.12 (0.07)
Savings	0.07*** (0.02)	0.09*** (0.02)	0.20*** (0.01)	0.11*** (0.02)	0.09*** (0.02)	0.21*** (0.02)
Financial inclusion	0.42*** (0.05)	0.40*** (0.05)	0.41*** (0.05)	0.38*** (0.06)	0.42*** (0.06)	0.50*** (0.06)
Observations	5,790	5,790	5,790	5,776	5,776	5,776

Note: The table presents the impact of remittances on various outcomes derived from a set of asset lists. These outcomes are represented as indexes and constructed using principal component analysis. We employed three PSM methods: Teffects psmatch, Nearest Neighbor (NN), and Radius Matching. Columns 1–3 demonstrate the effect of total remittances on these outcomes, while columns 4–6 focus on international remittances. The number of observations varies across the outcomes. For total remittances, the observations are 6072 for consumer durables, 6043 for savings, and 6015 for financial inclusion. For international remittances, they are 6058 for durables, 6031 for savings, and 6004 for financial inclusion. Observations in the table represent total assets and livestock ownership. Remittances are binary in the data: 1 for recipient households and 0 otherwise. Standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Table 2.11 presents results from NN, Radius, and Teffects matching estimators for total and external remittances. The main objectives are to conduct sensitivity analysis and compare the statistical significance and sign of coefficients with the kernel matching method employed in equation 2.1. Results obtained from NN and Teffects estimators for both total and external remittances show that remittances are positively and significantly correlated with total and category-wise assets, savings, and financial inclusion. The effects are more pronounced for recipients of migrant remittances. The size and magnitudes are larger for NN matching. Furthermore, the Radius matching method estimates show more substantial statistical significance with remittances and the outcomes than other approaches, except for livestock ownership, where the variable is statistically insignificant. The statistical significance of estimates is commensurate with results obtained

earlier except for the radius method, which indicates an insignificance link between remittances and livestock asset accumulation for both total and external remittances.

2.8 Conclusion

This paper examined the multidimensional role of remittances in post-war Somalia, highlighting the disparities in its reception amidst ongoing political instability and threat of terrorist attacks. The results underscored the limited presence of remittances in the IDP settlements, which are more exposed to conflict and climatic shocks. In urban and rural areas of Somalia, remittance beneficiaries tend to be affluent households with educated members. This trend is consistent with findings from conflict-affected contexts ([Fransen and Mazzucato, 2014](#); [Koser and Van Hear, 2002](#); [Nyberg-Sørensen et al., 2002](#)), and other developing economy settings by [Adams \(2006\)](#); [Bucheli et al. \(2018\)](#); [Mazzucato et al. \(2008\)](#).

Collectively, these studies underscore the prevailing consensus in remittance literature, as highlighted by [Adams Jr \(2011\)](#), concerning remittance recipients being predominantly affluent relative to their local contexts. Challenging the prevailing view that remittances fund predominantly unproductive assets in conflict zones, as claimed by [Fransen and Mazzucato \(2014\)](#), this research reveals a significant positive correlation with productive outcomes. From asset accumulation to livestock ownership and tertiary education, remittances emerged as a crucial component of post-conflict recovery and resilience.

The livestock sector in particular, which has historically supported the Somali economy, exhibits especially profound impacts of remittances, especially for rural households. Another noteworthy finding was the relationship between remittances and food security. By enhancing consumption patterns, remittances play a pivotal role in ensuring food security, a critical aspect in fragile contexts.

Financial resilience also stood out, with savings and financial inclusion emerging as essential indicators of development. The positive trend of remittances towards primary and secondary education underscores the diaspora's recognition of education's long-term potential. One distinctive aspect of this study is its multidimensional approach, segmenting households into various categories such as poor vs. non-poor, large vs. small families, and settlements like urban, rural, nomadic, and IDPs. This segmentation provides comprehensive insights, enabling a deeper understanding of the differential impacts of remittances on these diverse profiles of recipient households.

The findings of this study hold several salient policy implications for post-war Somalia. It is essential to establish mechanisms that facilitate a more equitable distribution of remittances, ensuring that those most vulnerable, particularly IDPs, derive tangible benefits. Given the pronounced impact of remittances on the livestock sector, it emerges as a focal point for economic rejuvenation. Authorities should consider targeted incentives to stimulate remittance-driven investments in this sector.

Additionally, the amplification of financial education and inclusion can harness the potential of remittance-driven savings and investments. A proactive engagement with the diaspora could spur a heightened focus on tertiary education, recognizing it as a long-term investment in the nation's future.

Finally, the diverse impacts of remittances across varied household categories underscore the need for tailored interventions, addressing the unique challenges and potentials inherent in each segment. As Somalia embarks on its path to recovery, the integration of these insights into policy frameworks can amplify the positive effects of remittances, positioning them as both a lifeline and a catalyst for sustainable growth.

In conclusion, this comprehensive exploration into the role of remittances in post-conflict Somalia has contributed substantially to the existing body of literature. However, the constraints of a cross-sectional dataset hint at the need for longitudinal studies to glean more enduring insights. As Somalia navigates its recovery, the potential of remittances to drive innovative financial solutions and shape policy initiatives is undeniable. Future research, leveraging richer datasets, can further elucidate the long-term impacts of remittances, offering a beacon of hope for nations embroiled in conflict.

2.A Appendix

2.A.1 Supplementary Tables

Table A1: Description of Outcome Variables

Variable	Description
Consumer durables	Bed with mattres, bed without mattres, chair, sofa set, desk, table, coffee table, cupboard, kitchen furniture, mortar, iron, clock, farm, air conditioner, refrigerator, washing machine, stove, electric stove, gas stove, kerosene, paraffin, small solar, cell phone, photo camera, radio, CD, TV, CVR, computer, satellite dish, solar panel, generator.
Livestock	Cattle, sheep, goats, camels, chickens, donkeys, horses.
Savings	Dummy variable 1= for savings; 0 otherwise
Financial inclusion	Access to bank accounts, access to mobile money banking, ease of borrowing money.
Living standards	Electricity, water at home, internet.
Shocks	Droughts, floods, fire, water shortage for cattle, water shortage for farming, crop failure, crop disease, livestock disease/death, inflation, reduction in remittances, job loss/business failure, severe illness/accident/death of main earner, death of household member, theft of money, livestock raiding, loss of valuable asset, conflict/violence, land eviction.

Table A2: Descriptive Statistics of SHFS data

Variable	Obs	Mean	Std. Dev.	Min	Max
Remit	6,092	0.186	0.389	0	1
iRemit	6,078	0.134	0.341	0	1
inRemit	6,071	0.086	0.281	0	1
Age	6,091	37.792	11.930	16	90
Gender	6,092	0.504	0.500	0	1
Employment of HH head	6,092	0.764	0.425	0	1
Literacy of HH head	6,076	0.523	0.500	0	1
Urban	6,092	0.658	0.474	0	1
Rural	6,092	0.182	0.386	0	1
IDP	6,092	0.077	0.266	0	1
Nomads	6,092	0.083	0.276	0	1
Household size	6,092	5.442	2.045	1	15
Number of children	6,092	2.729	1.939	0	10
Non-Poor	6,092	0.386	0.487	0	1
Poor	6,092	0.614	0.487	0	1
Small households	6,092	0.441	0.497	0	1
Share of elderly	6,091	0.034	0.182	0	1
Number of adults	6,092	2.630	1.305	0	12
Savings	6,060	0.104	0.305	0	1
Fin Index	6,030	0.000	1.138	-1.664	3.288
Total asset index	5,804	0.000	1.859	-3.025	6.993
Durables index	6,089	0.000	1.844	-2.448	7.111
Livestock Index	5,804	0.000	1.598	-1.040	5.740
Total consumption	6,092	519.178	476.260	6.446	8,412.398
Food consumption	6,092	1,708.787	1,127.648	7.203	10,227.527
Non- food consumption	6,092	689.627	783.319	0	7,869.162

Note: The table presents descriptive statistics for the variables used in this analysis. Remit represents recipients of both international and internal remittances, while iRemit and inRemit denote recipients of international and internal remittances, respectively.

The total asset index reflects a household accumulation of both productive and unproductive assets and is calculated using principal component analysis (PCA). Other indices are also calculated using PCA. Total consumption represents annual imputed consumption in USD.

Table A3: Profiles of international remittance-receiving and non-receiving households

	Without	With	Diff	p-value
Age	37.74	38.08	0.34	0.4448
Share of Elderly	0.032	0.047	0.01	0.0336
Gender (Female)	0.507	0.483	-0.02	0.2046
Household Employment	0.771	0.719	-0.05	0.0011
Household Literacy	0.501	0.667	0.17	0.0000
Urban Residence	0.637	0.795	0.16	0.0000
Household Size	5.46	5.37	-0.09	0.2682
Number of Children	2.75	2.63	-0.12	0.0967
Non-Poor Status	0.361	0.551	0.19	0.0000
Small vs Large Household	0.444	0.427	-0.02	0.3513
Observations	5262	815		

Note: The table presents the t-test results comparing international remittance-receiving and non-receiving households. The P-value indicates the significance level of mean differences between these groups. Remittances refer to both international and internal transfers. A binary variable represents remittances, with 1 representing recipients and 0 representing non-recipients.

Table A4: Profiles of Internal Remittance-Receiving and Non-Receiving Households

	Without	With	Diff	p-value
Age	37.76	38.07	0.31	0.5653
Share of Elderly	0.034	0.029	-0.01	0.4775
Gender (Female)	0.501	0.535	0.03	0.1388
Household Employment	0.759	0.817	0.06	0.0028
Household Literacy	0.514	0.621	0.11	0.0000
Urban Residence	0.656	0.676	0.02	0.3593
Household Size	5.46	5.27	-0.19	0.0415
Number of Children	2.75	2.61	-0.13	0.1369
Non-Poor Status	0.380	0.457	0.08	0.0005
Small vs Large Household	0.446	0.400	-0.05	0.0438
Observations	5545	525		

Note: The table presents the t-test results comparing internal remittance-receiving and non-receiving households. The P-value indicates the significance level of mean differences between these groups. Remittances refer to both international and internal transfers. A binary variable represents remittances, with 1 representing recipients and 0 representing non-recipients.

Table A5: OLS and quantile regression estimates of the log of household food expenditure

VARIABLES	Quantile regressions					
	OLS	P10	P25	P50	P75	P90
Remittances	0.104*** (0.015)	0.142*** (0.034)	0.125*** (0.021)	0.089*** (0.016)	0.066*** (0.019)	0.082*** (0.020)
Age (in years)	0.001 (0.001)	0.001 (0.001)	0.002** (0.001)	0.002** (0.001)	0.001 (0.001)	0.000 (0.001)
Gender (1=male)	0.008 (0.013)	0.049* (0.028)	0.029* (0.017)	0.007 (0.013)	0.008 (0.016)	-0.011 (0.016)
Employment of hh head	0.025 (0.016)	0.072** (0.033)	0.035* (0.020)	-0.006 (0.015)	-0.012 (0.019)	-0.016 (0.019)
Literacy of hh head	0.010 (0.013)	-0.008 (0.029)	-0.004 (0.018)	0.004 (0.013)	-0.008 (0.016)	-0.014 (0.017)
Resides in urban areas	-0.086*** (0.014)	-0.073** (0.030)	-0.099*** (0.018)	-0.068*** (0.014)	-0.055*** (0.017)	-0.062*** (0.017)
Household size	0.124*** (0.007)	0.144*** (0.014)	0.132*** (0.008)	0.119*** (0.006)	0.112*** (0.008)	0.106*** (0.008)
Number of children	-0.000 (0.005)	-0.012 (0.012)	0.001 (0.007)	0.005 (0.005)	0.005 (0.007)	0.008 (0.007)
Non-poor household	0.824*** (0.013)	0.925*** (0.028)	0.774*** (0.017)	0.711*** (0.013)	0.730*** (0.016)	0.864*** (0.017)
Small vs large households	0.011 (0.020)	0.044 (0.043)	-0.008 (0.027)	0.000 (0.020)	-0.004 (0.024)	0.010 (0.025)
Share of elders (65+)	-0.064 (0.047)	-0.132 (0.087)	-0.055 (0.053)	-0.069* (0.040)	-0.007 (0.049)	0.094* (0.050)
Constant	6.232*** (0.036)	5.467*** (0.071)	5.936*** (0.044)	6.319*** (0.033)	6.653*** (0.040)	6.899*** (0.041)
Observations	6,075	6,075	6,075	6,075	6,075	6,075
R-squared	0.451					
Pseudo R-squared		0.256	0.264	0.275	0.282	0.313

Note: The dependent variable is the log of food consumption expenditure for household i . The exogenous variable of interest is "remittances", a binary variable that includes both international and internal remittances, with '1' denoting a recipient and '0' indicating a non-recipient. Estimates are derived using OLS and quantile regressions across various percentiles (P10, P25, P50, P75, and P90) of the expenditure distribution. Standard errors in brackets. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Table A6: OLS and quantile regression estimates of the log of household non-food expenditure

VARIABLES	Quantile regressions					
	OLS	P10	P25	P50	P75	P90
Remittances	0.367*** (0.035)	0.394*** (0.103)	0.301*** (0.055)	0.283*** (0.033)	0.226*** (0.030)	0.179*** (0.034)
Age (in years)	0.002 (0.002)	-0.002 (0.005)	0.003 (0.002)	0.002 (0.001)	0.002 (0.001)	0.003** (0.002)
Gender (1=male)	-0.018 (0.033)	0.059 (0.085)	-0.052 (0.046)	-0.048* (0.027)	-0.026 (0.025)	-0.015 (0.028)
Employment of hh head	0.434*** (0.046)	0.483*** (0.099)	0.346*** (0.053)	0.266*** (0.032)	0.214*** (0.029)	0.186*** (0.033)
Literacy of hh head	0.378*** (0.036)	0.413*** (0.087)	0.377*** (0.047)	0.224*** (0.028)	0.157*** (0.025)	0.184*** (0.029)
Resides in urban areas	-0.259*** (0.037)	-0.427*** (0.089)	-0.125*** (0.048)	0.086*** (0.029)	0.089*** (0.026)	0.046 (0.030)
Household size	0.204*** (0.017)	0.297*** (0.041)	0.170*** (0.022)	0.124*** (0.013)	0.136*** (0.012)	0.105*** (0.014)
Number of children	-0.012 (0.014)	-0.022 (0.035)	0.023 (0.019)	0.035*** (0.011)	0.011 (0.010)	0.023** (0.012)
Non-poor household	1.511*** (0.030)	1.987*** (0.086)	1.455*** (0.046)	1.198*** (0.028)	1.131*** (0.025)	1.109*** (0.029)
Small vs large households	0.019 (0.053)	-0.042 (0.130)	0.060 (0.070)	0.146*** (0.042)	0.104*** (0.037)	0.085** (0.043)
Share of elders (65+)	-0.200* (0.107)	-0.308 (0.262)	-0.314** (0.141)	-0.082 (0.084)	-0.070 (0.076)	-0.056 (0.087)
Constant	3.732*** (0.088)	1.999*** (0.214)	3.396*** (0.115)	4.369*** (0.069)	4.964*** (0.062)	5.475*** (0.071)
Observations	5,954	5,954	5,954	5,954	5,954	5,954
R-squared	0.312					
Pseudo R-squared		0.214	0.204	0.215	0.233	0.255

Note: The dependent variable is the log of non-food consumption expenditure for household i . The exogenous variable of interest is "remittances", a binary variable that includes both international and internal remittances, with '1' denoting a recipient and '0' indicating a non-recipient. Estimates are derived using OLS and quantile regressions across various percentiles (P10, P25, P50, P75, and P90) of the expenditure distribution. Standard errors in brackets. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Table A7: OLS and Quantile Estimates of Food Expenditure with Squared Household Size

VARIABLES	Quantile regressions					
	OLS	P10	P25	P50	P75	P90
Remittances	0.102*** (0.015)	0.145*** (0.035)	0.107*** (0.020)	0.094*** (0.016)	0.068*** (0.020)	0.087*** (0.022)
Age (in years)	0.001 (0.001)	0.001 (0.002)	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	-0.000 (0.001)
Gender (1=male)	0.015 (0.013)	0.066** (0.029)	0.044*** (0.017)	0.013 (0.014)	0.008 (0.016)	-0.007 (0.018)
Employment of hh head	0.012 (0.015)	0.025 (0.033)	0.010 (0.020)	-0.008 (0.016)	-0.021 (0.019)	-0.012 (0.021)
Literacy of hh head	0.006 (0.013)	-0.036 (0.029)	-0.002 (0.017)	0.008 (0.014)	-0.013 (0.017)	-0.010 (0.018)
Resides in urban areas	-0.072*** (0.014)	-0.046 (0.030)	-0.070*** (0.018)	-0.062*** (0.014)	-0.045*** (0.017)	-0.060*** (0.019)
HH size squared	-0.011*** (0.001)	-0.019*** (0.002)	-0.015*** (0.001)	-0.010*** (0.001)	-0.005*** (0.001)	-0.003** (0.001)
Household size	0.276*** (0.019)	0.390*** (0.032)	0.333*** (0.019)	0.258*** (0.015)	0.187*** (0.018)	0.146*** (0.020)
Number of children	-0.006 (0.005)	-0.021* (0.012)	-0.006 (0.007)	0.001 (0.006)	0.004 (0.007)	0.007 (0.007)
Non-poor household	0.838*** (0.012)	0.942*** (0.029)	0.766*** (0.017)	0.713*** (0.014)	0.745*** (0.017)	0.876*** (0.018)
Small vs large households	-0.046** (0.020)	-0.049 (0.045)	-0.079*** (0.027)	-0.055*** (0.021)	-0.031 (0.026)	-0.006 (0.028)
Share of elders (65+)	-0.027 (0.046)	-0.055 (0.088)	0.000 (0.052)	-0.027 (0.041)	0.003 (0.051)	0.105* (0.055)
Constant	5.831*** (0.059)	4.855*** (0.104)	5.425*** (0.061)	5.935*** (0.049)	6.441*** (0.060)	6.774*** (0.065)
Observations	6,075	6,075	6,075	6,075	6,075	6,075
R-squared	0.464					

Note: The dependent variable is the log of food consumption expenditure for household i . The exogenous variable of interest is "remittances", a binary variable that includes both international and internal remittances, with '1' denoting a recipient and '0' indicating a non-recipient. Estimates are derived using OLS and quantile regressions across various percentiles (P10, P25, P50, P75, and P90) of the expenditure distribution. Standard errors in brackets. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

2.A.2 Graphical Exhibits

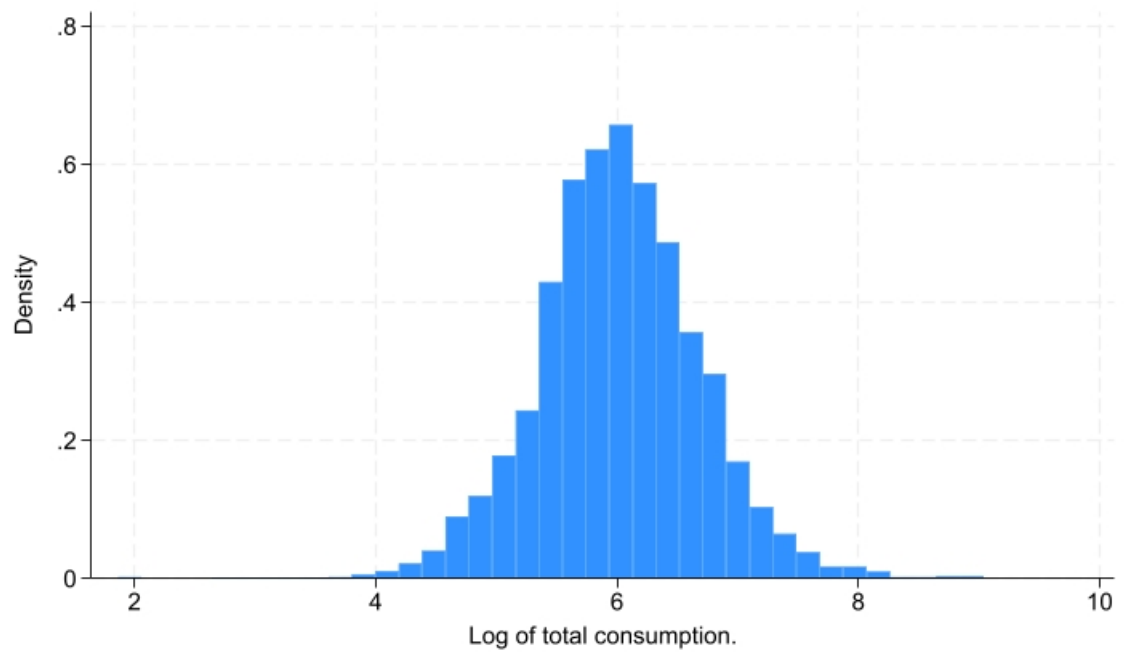


Figure 2.4: Histogram of the natural logarithm of total consumption expenditure

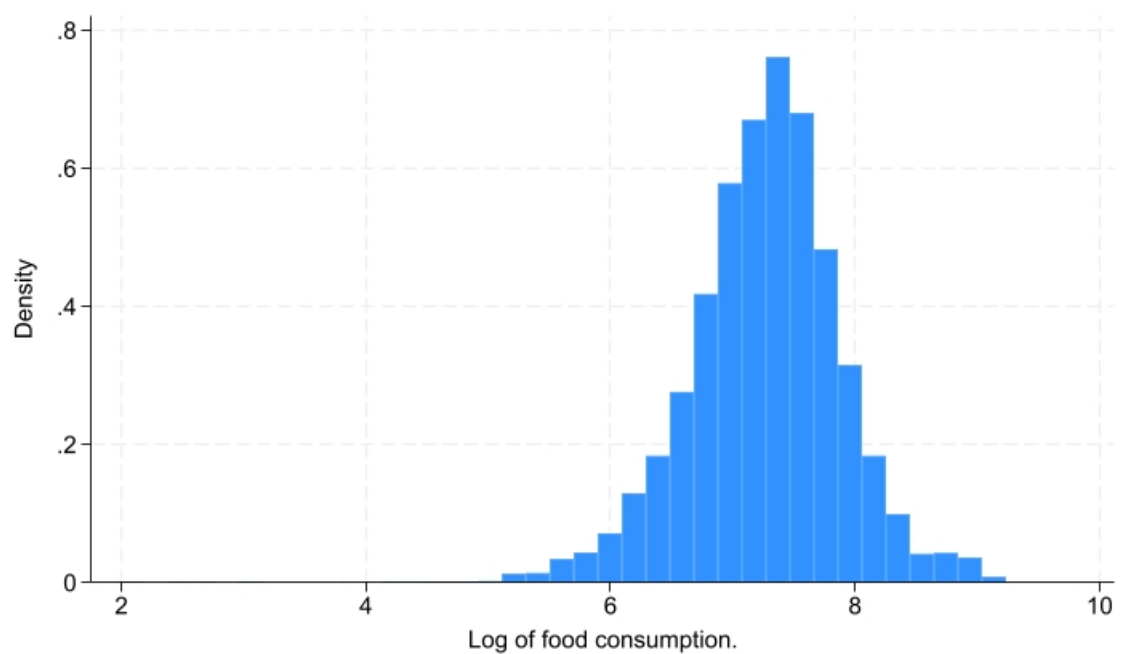


Figure 2.5: Histogram of the natural logarithm of food consumption expenditure

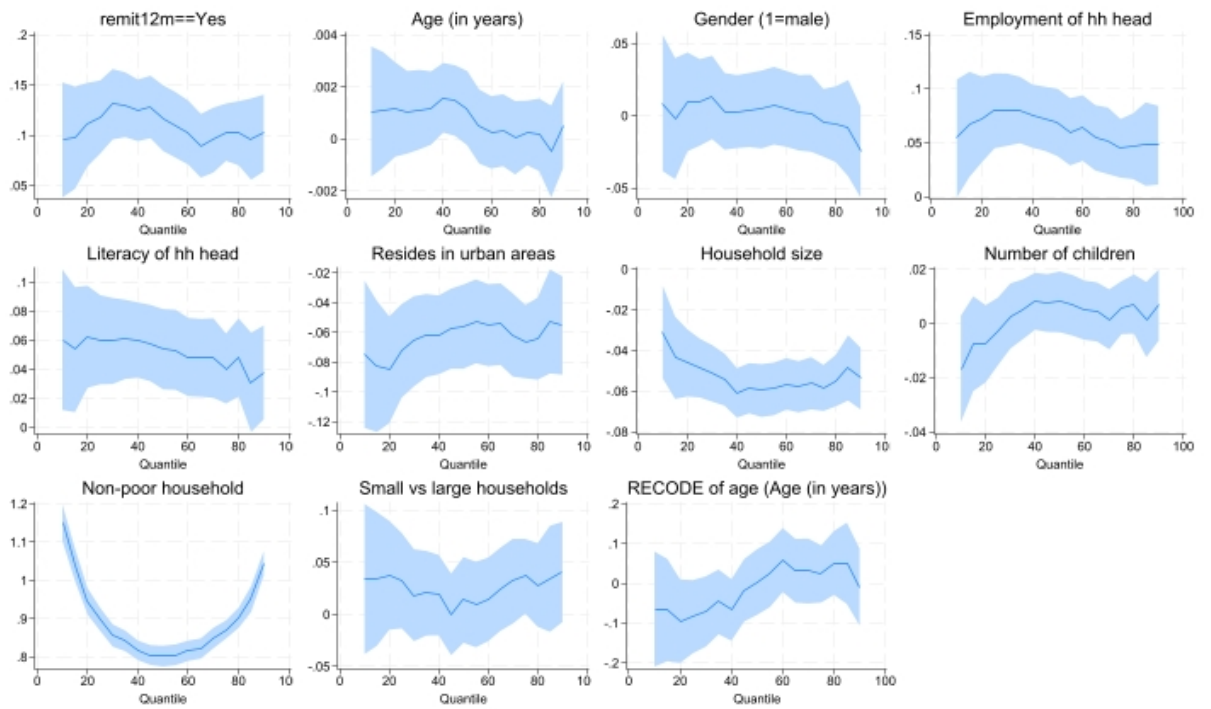


Figure 2.6: Varying Patterns of Total Household Expenditure Coefficients Across Quantiles

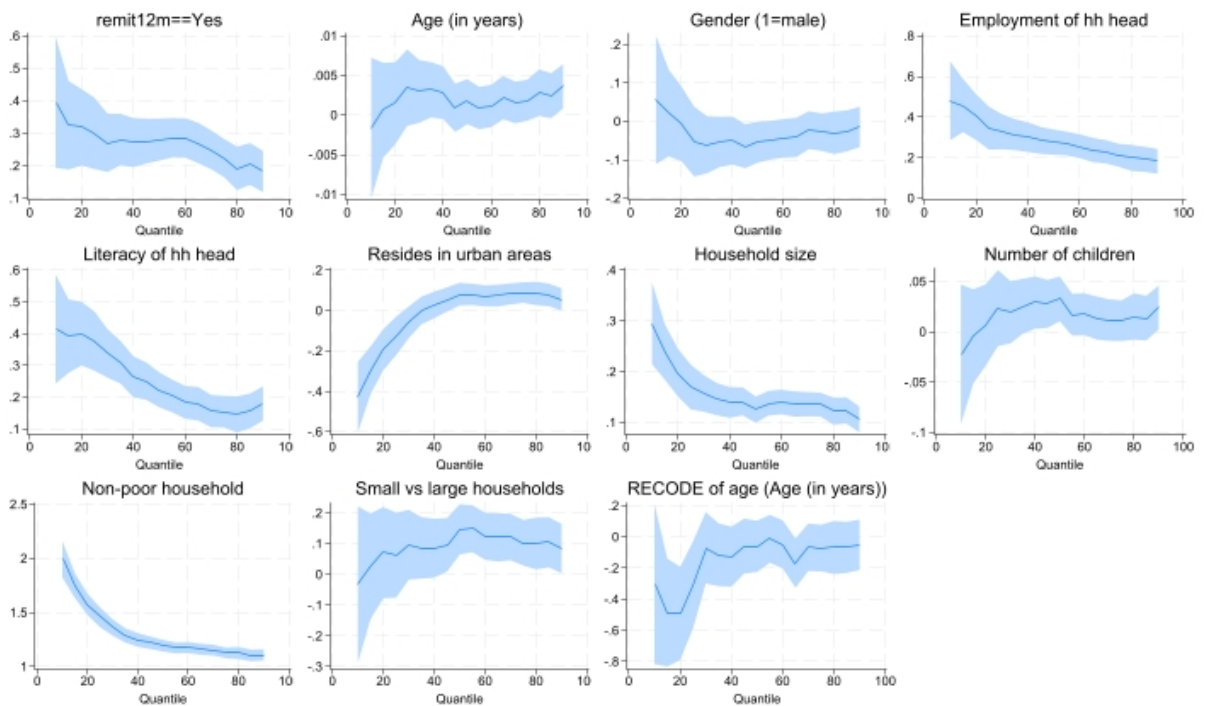


Figure 2.7: Varying Patterns of Total Non-Food Household Expenditure Coefficients Across Quantiles.

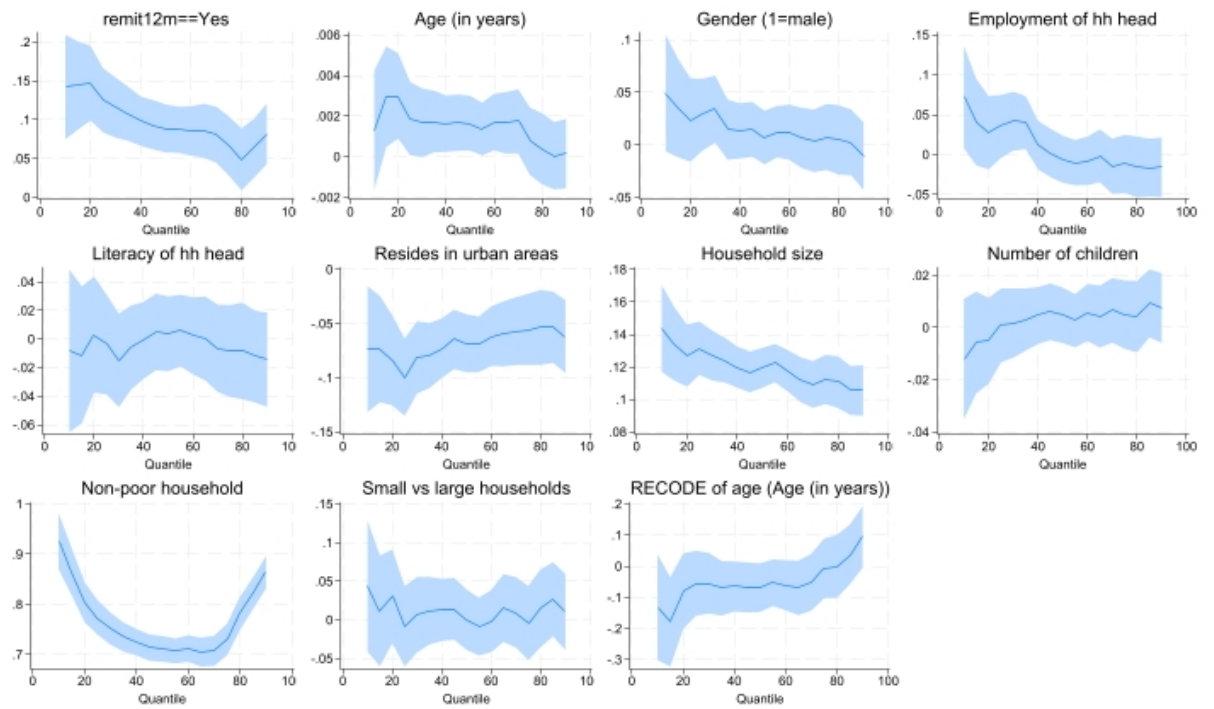


Figure 2.8: Varying Patterns of Household Food Expenditure Coefficients Across Quantiles.

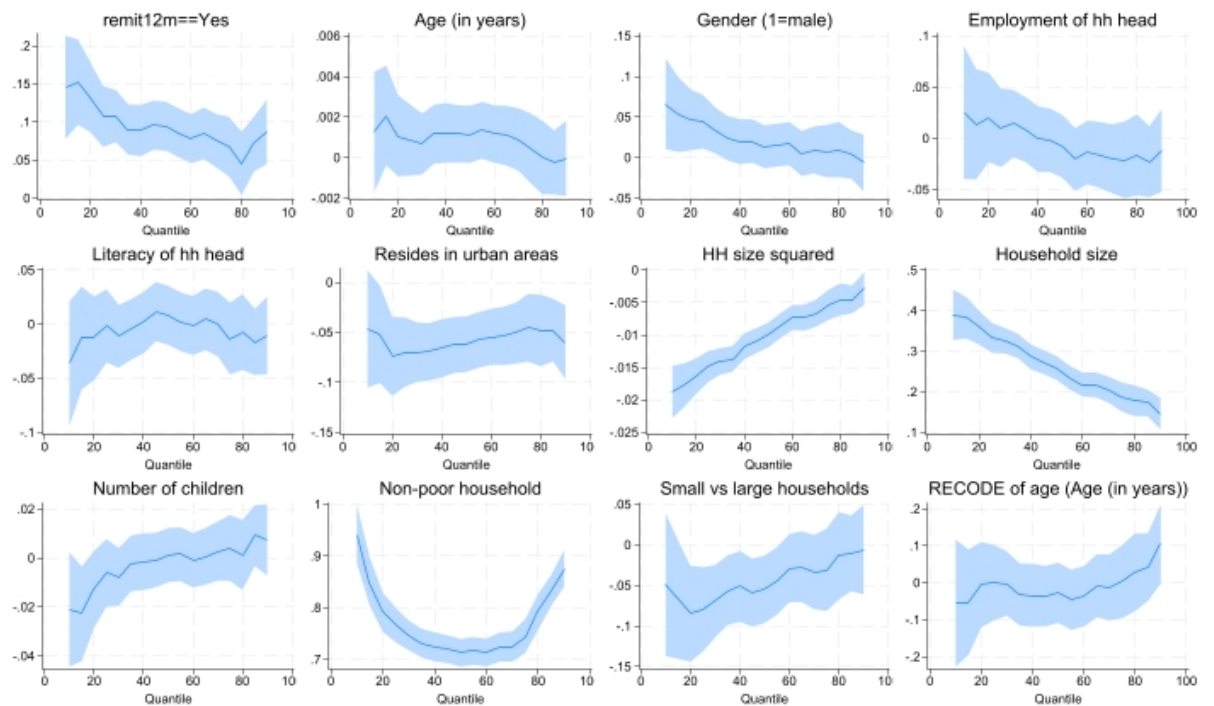


Figure 2.9: Varying Patterns of Household Food Expenditure Coefficients Across Quantiles, Including Household Size Squared.

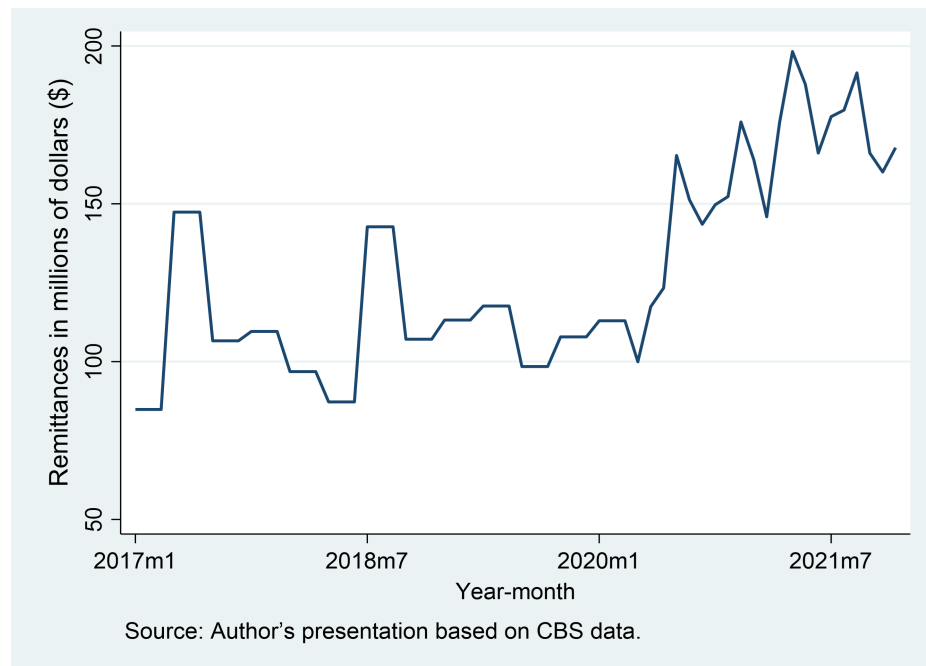


Figure 2.10: *Aggregate volume of remittances, 2017-2021 (millions of 2021 US \$)*

2.A.3 Mathematical Model of Savings in Fragile Conflict-Affected Settings

In a fragile conflict-affected setting, such as Somalia, the role and implications of remittances on household behavior are of particular interest. This appendix explains a two-period mathematical model that captures the decision-making dynamics of a household that receives remittances in such a context.

Model Assumptions and Framework:

1. **Household Life Cycle:** The household lives through two distinct periods. In the first period, the household is vulnerable to unexpected shocks—arising from conflicts, attacks, droughts, floods, death, and illness—with a probability of p . However, with a probability of $1 - p$, the household does not experience such shocks. The second period witnesses the implications of the events from the first period.
2. **Remittance and Consumption Dynamics:** When a shock occurs in the first period, a major portion of the remittance, denoted by ϕR (where $0 \leq \phi \leq 1$ and R is the remittance received), is used towards coping with the shock, leaving a residual amount for savings. In the absence of such shocks, the household may allocate a portion θR (with $0 \leq \theta \leq 1$) of the remittance for consumption and save the remaining amount.

The expected savings after the first period, capturing both scenarios of shocks and no shocks, is given by:

$$E[S_1] = p(1 - \phi)R + (1 - p)(1 - \theta)R$$

This equation integrates the two different pathways of savings. The term $p(1 - \phi)R$ represents the expected savings when a shock occurs, while the term $(1 - p)(1 - \theta)R$ stands for the expected savings when no shock occurs.

3. **Savings and Investment Decisions:** The savings accrued from the first period can be channeled in various ways. If the savings are below a threshold A , they are maintained as liquid assets. However, if they exceed the threshold, they are converted into more productive but less liquid investments, such as machinery or buildings.

Utility Optimization and Decision-Making:

Households derive utility from consumption. Given the diminishing marginal utility of consumption, the utility function is represented as $U(x) = \sqrt{x}$. The objective of the household is to maximize this utility across the two periods. The total utility function spanning both periods is:

$$U_{\text{total}} = U(C_1) + \beta U(C_2 + S_2)$$

Here, β is a discount factor, with C_1 and C_2 denoting consumption in periods 1 and 2, respectively, and S_2 is the savings carried from the first to the second period.

The model underscores that in conflict-affected regions, savings play a dual role. Firstly, as a safety net, they buffer households against unanticipated exogenous shocks. Secondly, in the absence of recurrent shocks, accumulated savings can evolve, facilitating investment in productive assets.

In light of this model, it becomes evident that savings derived from remittances play an instrumental role in shaping household behaviors and decisions in conflict-affected Somalia.

Chapter 3

Surviving through strife: Analysing the impact of violent conflicts on remittance inflows and frequency – Evidence from Somalia

3.1 Introduction

Remittances act as an essential external source of income for developing countries, particularly those grappling with violent conflicts and their aftermath, as they help populations cope with and recover from crises ([Al-Awlaqi et al., 2019](#); [Kpodar et al., 2023](#); [Le De et al., 2015](#); [Savage and Harvey, 2007](#); [Sirkeci et al., 2012](#)). In conflict-ridden regions, conflict and terrorism obstruct economic growth ([Bircan et al., 2017](#); [Collier and Hoeffler, 2004](#); [Fearon and Laitin, 2003](#); [Holtermann, 2012](#); [Sambanis, 2002](#)) and reduce local and FDI and expected returns on investment ([Abadie and Gardeazabal, 2019](#); [Arin et al., 2008](#); [Kollias et al., 2011](#)). Despite these challenges, remittances provide a stable and reliable form of income in conflict-affected contexts, playing an essential role in bolstering education, increasing household incomes, supporting consumption, fostering asset accumulation, and reducing extreme poverty ([Ahmed, 2000](#); [Fagen, 2022](#); [Fransen and Mazzucato, 2014](#); [Lindley, 2009](#)).

Nevertheless, while much is known about the benefits of remittances during crises, the relationship between remittances and various forms of violent conflict—whether civil wars, terrorism, or localised insurgencies—remains inadequately explored. Specifically, there is limited research on how different types of conflict affect the frequency and value of remittances at the subnational level, partly due to a lack of panel data from individual

remitters. This gap in the literature constrains our understanding of how remittance flows respond to and are shaped by the specific nature of violent conflict in affected areas.

Somalia exemplifies the important role of remittances in conflict-affected contexts. Since the collapse of its last functional central government in 1991, Somalia has experienced persistent political instability and varying intensities of violent conflict (Bakonyi and Stuvøy, 2005; Hansen, 2007; Marchal, 2013). Recently, the country has also confronted increasing vulnerabilities due to climate-related disruptions and economic shocks (Maystadt and Ecker, 2014; Oberg et al., 2021; Thalheimer and Webersik, 2020; Thulstrup et al., 2020). These crises have exacerbated issues such as forced displacement, food insecurity, migration, and extreme poverty, making households highly dependent on migrant remittances.

Approximately a quarter of Somali households rely on remittances, which represent 21% of the country's GDP (CBS, 2023). Thus, remittances act as an important economic lifeline, lessen the effect of crises and unexpected shocks. Globally, remittances to low- and middle-income countries outpaced the total of FDI and official development assistance (ODA) (World-Bank, 2024), with conflict-affected nations receiving about USD 50 billion (6.3% of GDP) in remittances (KNOMAD-World Bank, 2022). In Somalia, remittances represent over 20% of GDP, a proportion similar to other high-receiving nations such as Comoros, Haiti, Lebanon, and South Sudan. This suggests the essential role of remittances in sustaining economic stability and development in fragile and conflict-ridden environments.

Given the crucial role of diaspora funds as a reliable external source of income for Somalia, it is imperative to gain a deeper understanding of the behaviour of migrant remitters concerning the amount and frequency of remittances during violent conflicts, especially particularly egregious events such as explosions, violence against civilians, and battles, in their home countries. This understanding can aid in developing policies to decrease transaction costs, establish transparent and fair regulatory frameworks, implement Know Your Customer (KYC) measures, promote investment from the diaspora, and create a stable environment that encourages diaspora communities to invest in Somalia. Such strategies may enhance the timeliness and efficiency of remittance transfers and lessen the adverse effects of violent conflicts on remittances in Somalia.

Some studies have investigated the link between migrant remittances and violent conflicts (Elu and Price, 2012; Mascarenhas and Sandler, 2014; Mughal and Anwar, 2015), but they mainly focused the remittance-conflict nexus, and almost exclusively examined the impact of remittances on conflicts (rather than the converse relationship). For instance, Mughal and Anwar (2015) analysed the short-run dynamics of migrant remit-

tances in the context of terrorism. Using data that was recorded on a monthly basis, and which specifically pertains to terrorist attacks that occurred in Pakistan after the events of 9/11, the study demonstrates that migrant remittances are significantly and positively correlated with the number of casualties engendered by terrorist incidences. Another study on a panel of 142 developing and developed nations by [Mascarenhas and Sandler \(2014\)](#) found that lagged remittances as a proportion of GDP have a significant positive effect on both local and transnational terrorist incidents. [Elu and Price \(2012\)](#) examined the link between remittances and terrorist financing in Sub-Saharan Africa from 1974 to 2006, and estimated that one terrorist event is associated with impacts on remittance inflows ranging from a quarter to a million dollars.

These studies have contributed to our understanding of the role of remittances on the onset of civil war or terrorist activities. Nevertheless, these findings must be interpreted and approached with caution because econometric evidence is often based on aggregate data which evaluates the effect of remittances on a panel of countries rather than focusing on the concentration of the effect of remittances on a subnational level within a single conflict-affected country. These studies also usually restrict their analysis to one subset of violent conflict (i.e., terrorism), and cannot reveal the link between the frequency of remitting and violent conflicts, as the scope of their data is limited.

This paper explores the effects of violent conflicts on the inflow of migrant remittances and the frequency of remitting. It utilises a uniquely rich dataset comprising approximately 3 million actual administrative transactions transferred by the Somali diaspora in eight developed countries to 65 out of 74 pre-war districts in Somalia on a daily, weekly, and monthly basis. Migrants living in developed countries typically use regulated remittance agents and are required to provide personal and recipient household member information as part of compliance procedures. The current research employs these transaction records from over 150,000 unique migrants to examine the behaviour of senders. Most of these migrants regularly transfer money to their families who remain in Somalia, providing external financial support for a range of purposes in a context marked by fragility and violent conflict. The administrative records and transactions of migrant transfers provide ample opportunity to investigate the behaviour of senders in terms of remittance amounts and frequency, especially when violent conflicts erupt, or economic uncertainty or crises occur in their home country.

Furthermore, this study analyses the behaviour of diaspora remittances to Somalia in response to various violent conflicts, such as explosions, violence against civilians, battles, and strategic developments, using violent conflict data as recorded by the Armed Conflict Location & Event Data Project (ACLED). ACLED compiles comprehensive information

on political violence and demonstrations, which includes dates, participants, fatalities, strategies, and precise geographical coordinates. With operations spanning Africa and other continents, ACLED offers detailed incident data for a comprehensive global analysis of conflict trends ¹. In addition, the article expands upon the conflict literature by examining how persistent violent conflicts relate to the remittances flows and frequency, shedding light on the motives and behaviour for which Somali migrants living in developed Western countries send money.

This paper offers a significant contribution to the literature on remittances and conflict through several important avenues. First, it diverges from existing research that concentrates on the effect of remittances on violent conflict in a panel of developing countries (Elu and Price, 2012; Mascarenhas and Sandler, 2014; Mughal and Anwar, 2015). Instead, it seeks to explore the conflict-remittance nexus at a subnational level, using a fragile conflict-affected country as a case study. Such context specific insights may prove crucial in formulating effective policies for conflict prevention and remittance-driven growth.

Second, the study utilises unique transaction-level data of remittances transferred by the Somali diaspora in eight developed Western countries, including Australia, Canada, the US, and several countries in Europe. This enables us to examine the motivations and behaviour of senders when violent conflict erupts in their homeland.

Third, to the best of our knowledge, this is the first empirical study that explores the effect of violent conflicts on the frequency of remitting by migrants, revealing the link between the frequency of channelling funds and violent conflicts.

Fourth, the article sheds light on the detrimental effect of Somalia's persistent violent conflicts on remittances, highlighting how migration and lower levels of entrepreneurship among diaspora members may exacerbate conflicts and ultimately isolate them from entrepreneurial activities, as seen in other post-conflict countries (Williams, 2020). Thus, comprehending the role of persistent conflicts on crucial inflows like remittances, which, if halted, could limit potential investments, is of paramount concern.

Finally, unlike previous studies that have focused solely on terrorist attacks (Elu and Price, 2012; Mughal and Anwar, 2015), this research analyses the impact of several violent conflict and incident types, including explosions, violence against civilians, battles, and strategic developments on monthly remittance inflows and frequency of remitting. This enables us to gain a more comprehensive understanding of the relationship between violent conflicts and remittances, providing valuable insights for policymakers and prac-

¹The data are available at: <https://acleddata.com/data/>.

titioners seeking to mitigate the impact of conflict on fragile, conflict-affected nations.

The baseline results indicate that violent conflict incidences have an adverse impact on both the flow and frequency of remittances. Specifically, a one-month lag in overall conflict events leads to a 1.3% reduction in remittance and a 0.9% reduction in the frequency of remitting. Explosions lead to a 2% drop in remittance flows and a 1.9% decrease in frequency, while violence against civilians causes a 2.4% decline in flows and a 2.1% decrease in frequency. The disruptive nature of violent conflicts and the insecurity they engender lead to displacement, damaged infrastructure, and restricted movement, which are fundamental inhibitors of economic activity and development. Moreover, the results consistently show that violence events have a negative effect on remittance flows and frequency when both continuous and dummy variables for the same conflict categories are used. The findings show that violent conflicts significantly disrupt remittance flow and frequency, regardless of how conflict variables are defined.

We use the African Union Transition Mission in Somalia (ATMIS) security forces as an instrumental variable for the endogenous violent conflict variable. A key concern with this approach is that the deployment of security forces may be influenced by the level of conflict, potentially making the variable endogenous. Nevertheless, it is also possible that the deployment of military forces is determined by other exogenous factors, such as political, logistical, humanitarian, and geographical considerations. Therefore, ATMIS can still be considered a valid instrumental variable for violent conflicts in Somalia.

When using IV in the regression, the results consistently indicate similar negative effects, albeit with varying coefficients that exhibit greater magnitudes. Valid IV provides more reliable estimates of the causal impact of conflicts on remittances, as it addresses potential endogeneity issues that may emerge from omitted variable or reverse causality problems. The findings indicate lagged overall conflict events, explosions and violence against civilian reduce remittances flows by 10%, 18%, and 22%, respectively. A similar pattern emerges in relation to remitting frequency; overall conflicts, explosions, and violence against civilians are associated with decreases in remittance flows of 8%, 14%, and 18%, respectively.

The structure of the remainder of this paper is as follows: Section 2 provides a comprehensive review of the existing literature on conflict economics, with a specific emphasis on the relationship between conflict and remittances. Section 3 covers institutional background and briefly discusses Somali remittance trends and the conflict. Section 4 describes the data sources used in this study, while Section 5 outlines the empirical methodology employed to analyse the data. The results of our empirical analysis are presented in Section 6, and robustness checks are conducted in Section 7 to assess the validity of

our findings. Section 8 concludes the paper.

3.2 Literature Review

The relationship between wealth and conflict has been extensively researched and documented in the literature. As documented by [Sambanis \(2002\)](#), civil war is primarily a phenomenon that disproportionately affects the poor. This view is supported by several empirical studies, including those by [Collier and Hoeffler \(2004\)](#) and [Fearon and Laitin \(2003\)](#), which establish a strong and statistically significant negative association between wealth and conflict. Prolonged conflict traps may exacerbate the dangers of conflict, as evidenced by the fact that a country that has recently emerged from civil war has a 44% likelihood of relapsing into conflict within five years ([Collier et al., 2003](#)). Conflict history is the best predictor of whether or not a nation will undergo another civil war ([Collier and Hoeffler, 2004](#)).

According to [Collier and Hoeffler \(2004\)](#), the danger of renewed conflict is significantly elevated by factors such as low secondary school enrolment, slow economic growth, low per capita income, and an excessive reliance on primary commodity exports and large diaspora populations. The authors argue that monetary incentives, such as the potential earnings from participating in conflict compared to regular labor market wages, play a more significant role in inciting conflict than political and social grievances, such as oppression and societal inequality. Conversely, they assert that factors such as economic disparity, political persecution, absence of democracy, and ethnic and religious division are statistically insignificant at the outbreak of civil war.

[Fearon and Laitin \(2003\)](#) estimate that during the period from 1945 to 1999, around 3.3 million deaths occurred in 25 inter-state wars, while roughly 16.2 million individuals lost their lives in 127 civil wars. To narrow it down further, nearly 300,000 died within one year after Somalia's ruinous 1991 civil war ([UNOSOM-I, 1993](#)). The conflict in Somalia is still ongoing, and as per ACLED's figures, there were 22,592 fatalities resulting from violent conflicts during the study period (2017–21). As [Rohner \(2018\)](#) points out, deteriorating economic and unhygienic conditions resulting from conflicts also engender significant indirect casualties. More specifically, in Somalia roughly 500,000 people have lost their lives due to the "man-made" starvation that followed ([Mukhtar, 1996](#)). Thus, when indirect effects of civil war and conflicts are considered, the total number of casualties more than doubles, particularly as a result of disease transmission ([Ghobarah et al., 2003](#); [Habib, 2024](#); [Herre et al., 2024](#)).

Another line of research has investigated the impact of horizontal inequalities, or so-

cioeconomic disparities between different social classes, which have been found to be positively associated to the onset of violence (Cederman et al., 2011; Kuhn and Weidmann, 2015). Finally, Bircan et al. (2017) explored the potential consequences of conflict on vertical income inequality. Their results indicate that conflict leads to an increase in inequality, particularly during the early stages of post-conflict reconstruction.

Poverty is one of the main economic factors that make some societies susceptible to violent conflict. According to empirical evidence, wealth and economic growth lower the likelihood of civil war, but recessions and poor economic conditions have the reverse effect (Ajayi, 2024; Collier and Hoeffler, 2004; Fearon and Laitin, 2003; Miguel et al., 2004; Jung, 2024; Kešeljević and Spruk, 2024). While some individuals or businesses may prosper from conflict (Guidolin and La Ferrara, 2007; Joseph et al., 2024), conflict as a whole is a net loss for society. In the Somali civil war, some elites and businessmen benefited from the civil strife (Leonard and Samantar, 2011). Moreover, according to Collier (2008), civil wars diminish average economic growth rate by 2.3% per year, with a seven year-long civil war eroding GDP by around 15% and leading to an average costs of 64 billion USD in direct and indirect costs along with spillovers to neighbouring nations (Roth, 2022).

Moreover, conflict significantly reduce access to education and hinders investment in human capital (Justino, 2011; Leon, 2012; Shemyakina, 2011; Utsumi, 2022; Verwimp and Van Bavel, 2014), resulting in long-term adverse economic repercussions. The destruction of human and physical capital, the erosion of institutional capacities, and the impediments to investment in education and healthcare contribute to a cycle of low productivity, stunted development, and a high risk of renewed conflict, potentially entrapping nations in protracted cycles of violence and underdevelopment (Kim and Conceição, 2010). While the adverse effects of war on mortality, health, and economic performance are widely recognized, there remains less consensus regarding its sociological impacts. Several studies suggest that conflict erodes trust, weakens local governance structures, fosters ethnic divisions, and increases the likelihood of criminal behavior in later life (Cassar et al., 2013; Rohner et al., 2013). Conversely, several contributions have shown that conflict is related to increased political participation, greater local collectivism, and greater intra-group trust (Blattman, 2009; Bellows and Miguel, 2009; Gilligan et al., 2014).

Previous literature on the relationship between remittances and conflict has largely used panel data at the aggregate level (Elu and Price, 2012; Mascarenhas and Sandler, 2014; Regan and Frank, 2014), making it difficult to ascertain the specific links between remittances and conflict in a war-torn country. Moreover, although most research have

focused on the impact of remittances on conflict, the link between conflict and remittances has not been adequately investigated. The nexus between frequency of remitting and violent conflicts has also remained largely unexamined due to the lack of access to customer transaction data in previous studies.

Moreover, the existing literature on remittances and conflict is predominantly cross-sectional in nature, with the majority of studies concentrated on individual countries within post-conflict settings (Fransen and Mazzucato, 2014). While surveys have been conducted on the recipient of remittances, reliable data on the volume of remittances received is often lacking. In the case of Somalia, for instance, existing studies on remittances is largely qualitative and confined to relatively stable areas such as Somaliland (Ahmed, 2000; Lindley, 2009; Majid et al., 2018). Currently, no quantitative data are available on the effect of conflict on remittance flows in Somalia.

This research aims to address these gaps by utilising unique panel data and linking dynamic data on conflicts to remittances. Specifically, the study aims to reveal the impact of violent conflict on remittances, which differs from previous studies that have focused on the impact of remittances on conflict. At the policy level, it is crucial to understand how conflict affects remittances in war-torn areas, as remittances play a significant role in stimulating economic development, and conflicts tend to reduce GDP and growth while decreasing remittance flows. This paper will analyse the behaviour of the diaspora in conflict situations and shed light on the effect of violent conflicts on remittance flows and the frequency of remittance transactions. The findings of this study will have important policy implications, as any decrease in remittances due to conflict would hinder their potential for investment and development. As such, mitigating conflicts and promoting peace and conflict resolution are critical for promoting the development role of remittances in Somalia.

The studies presented thus far provides a theoretical framework for understanding the relationship between economic factors and conflict. Building on this foundation, the current study analyses the conflict-remittance nexus in Somalia by focusing on sub-national dynamics and exploring the potential effects of violent conflict on monthly remittance inflows. By linking these two concepts together, this research aims to enhance our understanding of how economic factors, particularly remittances, shape conflict in specific contexts, while also contributing to the broader discourse on the interplay between conflict and economic development.

Furthermore, the literature consistently demonstrates that violence has a markedly damaging effect on wealth, GDP, and broader economic growth. In the Somali context, persistent violent conflicts have significantly disrupted key economic variables and are

expected to reduce remittance flows, which constitute a vital component of the country's GDP. Given the central role of remittances in sustaining the livelihoods of many Somalis, any disruption in these financial inflows could have extensive consequences for the nation's economy and its population. This underscores the urgent need for continued research into the conflict-remittance nexus in Somalia, particularly regarding the potential of remittances to mitigate the adverse effects of war on economic development.

3.3 Institutional background

3.3.1 Somalia remittance trends

Since the collapse of the central government in 1991, Somalia has been plagued by a persistent conflict, chronic food shortages, and repeated climate-related shocks, all of which have displaced hundreds of thousands of Somalis and resulted in severe humanitarian repercussions. Although accurate data are unavailable, it is believed that at least two million Somalis reside outside the country ([Elmi and Ngwenyama, 2020](#)). Many of these immigrants maintain contact with their stay-behind households and channel remittances to help them. Somalia has relied heavily on remittances, as they constitute 21% of the country's GDP ([CBS, 2023](#)).

Remittances play an essential role in the economy of Somalia, providing a crucial source of income for recipient families and communities. The substantial volume of remittances into Somalia has been credited with keeping the country afloat and coping families against unexpected shocks. Recently, remittances also played a crucial role in mitigating disruptions caused by the triple shock of the COVID-19 pandemic, floods, and locust invasion ([IMF, 2023](#)). Despite the significance of remittances to Somalia, nevertheless, remittances flows tend to be concentrated in specific communities, clans, or social groups ([Majid et al., 2018](#)). Conversely, remittances can have positive multiplier effects and boost local economic activity by funding community-wide initiatives such as loans, charities, and infrastructure projects including water sources, education spending, and schools and hospitals in Somalia ([Orozco and Yansura, 2013](#)).

In recent years, advancements in digital technology have significantly transformed the remittance industry, enhancing the ease and convenience with which individuals can transfer funds to relatives abroad. Mobile money and online remittance platforms have become increasingly popular in Somalia and within diaspora as primary vehicle to channel funds.

However, despite these technological strides, the remittance sector in Somalia con-

tinues to face significant barriers. Remittance operators on the sender's side grapple with issues such as de-risking, wherein financial institutions close their accounts because of perceived risks connected with money laundering or terrorism financing, often opting to end banking relationships rather than bear the costs of enhanced due diligence. The country's prolonged violent conflict and political turmoil worsen these issues, obstructing the operation of banks and financial institutions. The absence of international banks in Somalia and the reliance on informal money transfer channels engender difficulties in accessing reliable services, increasing the risk of fraud and money laundering. The Central Bank of Somalia is in the process of reconstruction following decades of conflict and has made remarkable progress in revitalizing the country's financial sector.

Furthermore, The Central Bank of Somalia (CBS) has few correspondent links with foreign banks, offers almost no commercial banking services, and lacks the resources to adequately regulate the industry. Moreover, international financial institutions and MTOs are practically non-existent. As a result, only MTOs, which evolved from the unofficial hawala networks—are the only formal, convenient, and subject to oversight regarding remitting funds to Somalia. Hawala is an informal funds transfer system that plays a crucial role in the economic and financial development of less developed economies worldwide ([Passas, 2016](#); [Redín et al., 2014](#)), especially in fragile conflict-affected nations ([Rodima-Taylor, 2013](#)). The term Hawala is derived from the Arabic word "transfer," ([El-Qorchi, 2002](#)), whereas in Hindi it denotes "trust". The Hawala system has often operated in fragile conflict-affected locations that do not have access to conventional banks and financial institutions to provide financial services to the unbanked communities and facilitate recipients of migrant remittances ([Maimbo, 2006](#)).

A distinguishing characteristic of the Hawala system is that money is transferred without instant currency exchange. Despite the differences, it is remarkably similar to regulated remittance systems used in other countries. In developed nations, Hawala is regulated by their respective governments with access to banking and financial instruments. However, due to de-risking by many of the Western banks, the majority of Somali hawala bank accounts were closed ([World-Bank, 2014](#)). Hawala, on the other hand, is based on a trust network ([Maimbo et al., 2003](#)).

After 9/11, Hawala networks were excessively scrutinized for being a channel for terrorist financing and were unnecessarily criminalized ([De Goede, 2003](#)). Furthermore, Western countries have imposed severe restrictions on banks serving Hawala agents, creating barriers to the Somalia remittance transfers, further jeopardizing the vital flow of diaspora remittances to Somalia ([Durner and Shetret, 2015](#)). The majority of MTOs that process Hawala payments are headquartered in Dubai ([Looney, 2003](#)), with some

having correspondent bank accounts in Kenya, Djibouti, and Uganda. Moreover, in the post-civil war era, UAE became the trade hub for Somalia, making Dubai an important destination both as a financial centre and a major import destination.

The Central Bank of Somalia (CBS) records all aggregate money flows to the country, relying exclusively on information given by money transfer operators (MTOs), but lacks access to personal level data or specific areas where the money is transferred. According to CBS ², remittances to Somalia soared from USD 1 billion to USD 2 billion from 2017 to 2021 (Figure 3.1), with an unexpected surge observed during the Covid-19 outbreak, which might be linked to a drop in informal remittances owing to travel restrictions. Despite its overall strength, the flow of remittances dropped following the epidemic.

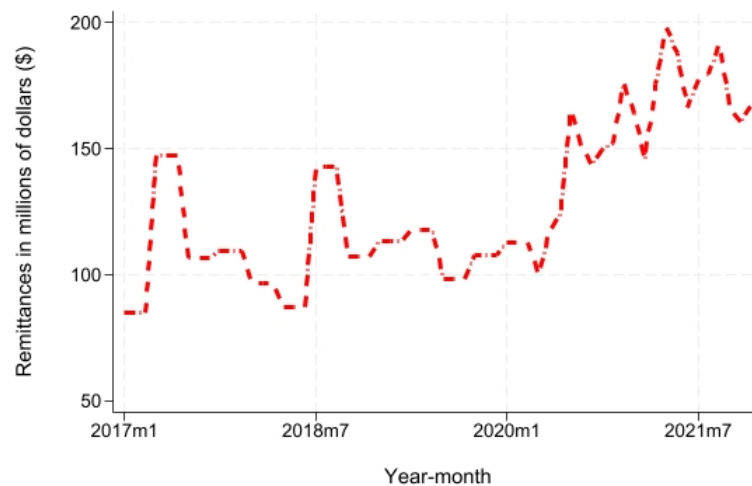


Figure 3.1: *Annual remittance trends in Somalia (2017–2021).* Source: Authors' presentation based on CBS data.

There is disagreement in the literature concerning the correlation between violent conflict and remittance inflows in conflict-affected contexts. On the one hand, conflicts hinder mechanisms that facilitate the transfer of funds, leading to a decrease in remittance inflows. The closure of payment agents, displacement of people, and ruin of infrastructure all contribute to the detrimental effect of conflicts on remittances. Furthermore, in times of violence, people may face obstacles to investing in their home country, resulting in a decrease in remittance amounts intended for investment. Conflicts also heighten the risks of money laundering and terrorism financing, which can lead to de-risking practices by global financial institutions, further restricting formal channels for remittance transfers.

²Quarterly data from 2017 to 2021 was obtained directly from the CBS, corresponding to Figure 3.1

On the other hand, if remittances are positively associated with violent conflicts, it is likely because migrant communities transfer additional funds to help their stay-behind families to cope with the increased hardship. Conflict often obliterates local livelihoods and raises the need for financial support, engendering remittance amounts intended for consumption to increase as households rely more heavily on external income for basic necessities. In such situations, remittances serve as an important lifeline during periods of economic instability. Therefore, both negative and positive correlations are plausible, and the direction of the relationship depends on the specific situation of the country and the nature of the conflict.

Somalia, for example, has been plagued by deadly conflicts for more than 30 years. Conflict and wars are not latent but are living and persistent conflicts in the country. The current study hypothesizes that there is a negative link between violence and remittance inflows in Somalia at the subnational level. One likely explanation for this is that the people in the country have adapted to living with conflict. They understand that when there is conflict, payment agents in conflict zones would shut, preventing the transfer of remittances. This differs from scenarios in other nations, where conflict is more episodic, and diaspora communities respond by sending emergency funds to help families cope with newly emergent crises. In contrast, in some nations, such as relatively stable countries, diaspora groups may send money to afflicted relatives to help them deal with the new conflict or crisis and receiving households may need finances since the violence was unanticipated. In Somalia, nevertheless, individuals have learned to adapt their behaviours to the ongoing conflict, and the closure of payment agents has become a predictable and anticipated effect of the conflict. Thus, this study will test these hypotheses.

3.3.2 The Somali conflict

Somalia experienced a devastating civil war in 1991, resulting in the collapse of the central government. The country's situation was eventually marked by persistent violence, political instability and humanitarian crises. Throughout the years, the nation has faced numerous periods of intensified conflict, such as clan-based violence, and, most recently, insurgency by extremist groups Al-Shabaab. The prolonged instability has caused displacement, migration, destruction of infrastructure, and a fragile economy. As of 2024, Somalia is ranked as a number one in the Fragile State Index (FSI) (Peace TF, 2024). Furthermore, the lack of a fully functioning state reduced the availability of human capital-generating services such as education and health, and hence its productivity (Abdi, 1998; Jeilani, 2016; Kinyoki et al., 2017).

Prolonged civil conflict in Somalia has empowered certain individuals and organiza-

tions to control food supplies and influence both national and local politics. Additionally, cash transfer allocation relies on a small number of traders, telecom operators, and money transfer companies that benefit from aid inflows. Furthermore, cash crop development has led to increased power concentration and marginalization ([Jaspars et al., 2019](#)). Furthermore, [Elder \(2022\)](#) argues that the policies and foreign interventions implemented in Somalia unintentionally strengthen the political influence of dominant logistics companies that also operate as political actors. Consequently, this has the effect of undermining the legitimacy and authority of the Federal Government of Somalia. For instance, [Elder \(2022\)](#) demonstrated that 70% of parliamentarians interviewed had either been given a logistics contract or owned shares in a logistics company during their political careers.

Consequently, influential local businesses and large corporations have influenced post-civil war state formation in Somalia by opposing regulatory measures, providing loans and donations to the government instead of paying their fair share of taxes, and generally hindering the development of effective financial institutions ([Musa and Horst, 2019](#)). Some examples of violent entrepreneurship in Somalia include resource looting, extortion, abduction for ransom (such as piracy), private security services, and tax avoidance or trade taxes ([Hughes and Jones, 2012](#); [Menkhaus, 2012](#); [Ronan and Jenkins, 2017](#)). War can thus appear to some individuals and organizations as a profitable economic activity motivated by avarice, political opportunism, and corporate interests.

In addition to these dynamics, the civil conflict in Somalia has been aggravated by the advent of the militant group Al-Shabaab, which seeks to exercise control over the country's resources and authority. Despite being part of Al-Qaeda, the group's main objective is to acquire power and political influence. By forcefully collecting money and instilling fear through extortion, Al-Shabaab generates substantial revenue from the control and administration of specific areas in the country. The tax revenue collected by the group is reported to be higher than that of the Federal Government of Somalia ([Mubarak, 2020](#)).

The dynamics of Somalia's conflict involve a complex struggle between multiple actors, including politicians, local elites, the militant group Al-Shabaab, and neighboring countries with vested interests in the region. At its core, the conflict revolves around control over scarce resources and political power. Multiple groups, each with their own goals, persistently worsen instability as they seek to gain dominance in Somalia's governance and wealth. The conflict is perpetuated and political instability is deepened by the ongoing competition for resources and authority among these diverse actors. Moreover, international players and neighboring countries, often driven by hidden agendas, have become more intertwined in Somalia's political process, intensifying the conflict

and impeding stability-building efforts.

Despite the complex challenges posed by the Somali conflict, remittances from diaspora communities to their families in Somalia remain a vital and steady external income source. This income not only improves household wealth but is also effectively protected from the misuse of funds or corruption, as frequently witnessed in the public sector. While remittances are important for supporting livelihoods and driving development, there is a significant knowledge gap regarding their relationship with conflict, especially in terms of their correlation with diverse manifestations of violence.

If remittances and conflict are negatively correlated, this would imply that remittances primarily help stabilize consumption, while conflict constrains investment in productive areas. This occurs because conflict undermines the availability of funds that could have been directed toward investment, and it discourages diaspora members who might have otherwise contributed to economic growth. Consequently, only small amounts intended for subsistence continue to flow, preventing remittances from achieving their potential as a tool for development. Therefore, this study aims to analyse the future of remittances in Somalia and their relationship to different types of violence. The hypothesis suggests that continuous violent conflict will result in a decline in remittances, as migrants are discouraged from engaging in entrepreneurial activities, and more citizens choose to migrate to neighboring countries. Insecurity will lead to a decline in remittance inflows and migration, which will ultimately harm Somalia's economic development and growth.

3.4 Data

The paper uses multiple high-frequency and geo-referenced datasets to construct a unique district-level panel for Somalia from 2017 to 2021. The first dataset comprises individual-level remittance transactions from Somali migrants in eight developed countries to sub-national districts in Somalia, recorded daily. This unique dataset provides granular insights into the behaviour and response patterns of the Somali diaspora when transferring funds to their homeland. The second dataset comprises geo-coded conflict data drawn from the Armed Conflict Location and Event Dataset (ACLED), which records daily political violence events for each district. The instrumental variable (IV)—the number of ATMIS security forces deployed to Somali districts—is obtained from official records of ATMIS operations. Finally, climate and weather data sourced from the Somalia Water and Land Information Management (SWALIM) system is used as a control variable in the analysis. These indicators include monthly drought conditions, precipitation levels, and temperature anomalies. The 2014 Population Estimation Survey (PESS) data is included

as a control variable, with estimates revised for the research period using growth rates from World Bank and UN sources. Collectively, these datasets provide the creation of a comprehensive panel that records remittances, violence, security interventions, climatic shocks, and demographic controls at the district-month level.

3.4.1 Remittance data

Data for migrant remittances are sourced from regulated licensed money transfer companies (MTBs) operating in Australia, Canada, Denmark, Finland, Norway, Sweden, the US, and the UK, covering transfers to Somalia from January 2017 to December 2021. These countries represent major host locations for the Somali diaspora, which numbers well over 1 million globally [Elmi and Ngwenyama \(2020\)](#); [Horst \(2008\)](#). The data are extracted directly from the remittance platforms of these licensed MTBs, which comply with Anti-Money Laundering (AML) and Counter-Terrorism Financing (CTF) regulations mandated by their respective jurisdictions to prevent illicit financial flows. MTBs use electronic funds transfer (EFT) or remittance transaction systems for money transfers. In Norway, where the author manages a licensed MTB, the Financial Supervisory Authority (FSA) oversees compliance. MTBs must submit biannual reports, including an annual audit. Senders are required to present valid identification (passport, national ID, etc.) and provide personal information about themselves and the recipients as part of Know Your Customer (KYC) protocols.

Throughout the study period, an estimated 3 million remittances were sent daily, weekly, and monthly to diverse locations across Somalia, reaching 65 of the 74 pre-war districts. The dataset includes detailed sender information (full name, dates, address, contact details), transaction amounts, remittance fees, frequency of transfers, and unique transaction reference numbers. Beneficiary information comprises recipient name, date, amount received, and location. For analysis, remittance transactions were grouped by district and month, enabling measurement of total remittance inflows and frequency at the district level, which is crucial for examining relationships with monthly conflict data.

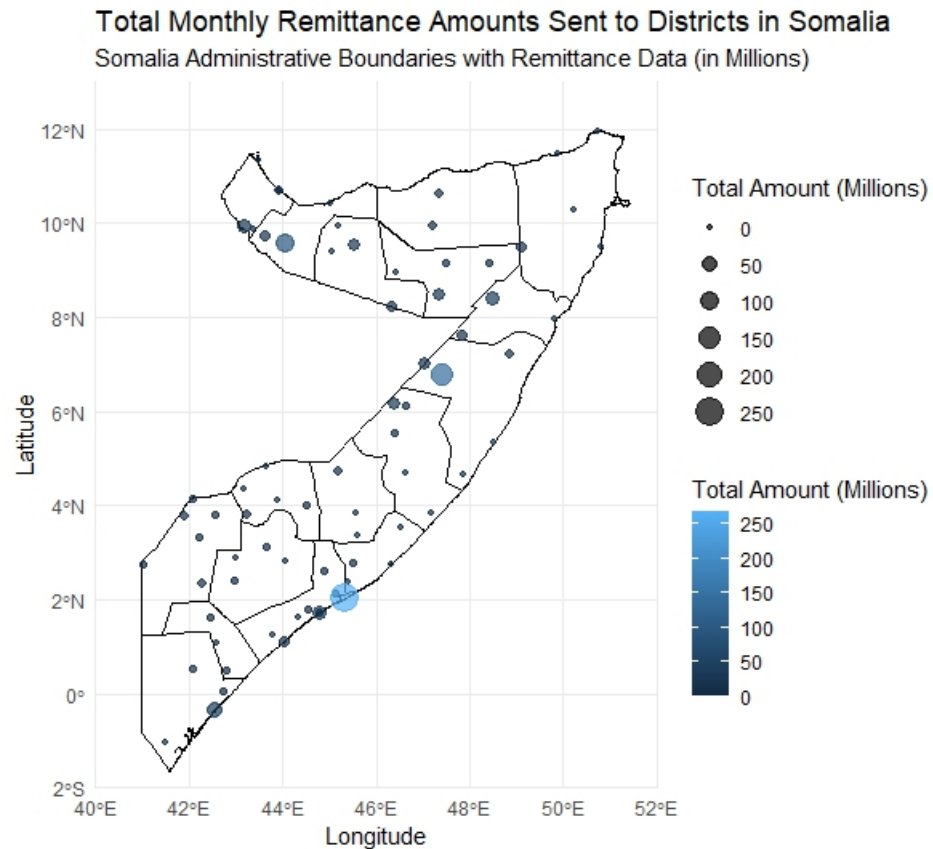


Figure 3.2: *Geographical distribution of remittance recipients in Somalia districts (2017–2021). Source: Authors' presentation based on MTOs data.*

Note: Figure 3.2 shows the distribution of remittances received by districts across Somalia, based on administrative data. The map displays actual remittance transactions sent by diaspora members, capturing both small and large remittances. The size of the dots corresponds to the volume of remittances, with larger dots showing districts that received higher remittance inflows. The visualization showcases the disparity in remittance distribution across districts. .

The Somali remittance market is highly competitive, with numerous companies differentiating themselves through service quality, transfer methods, efficiency, and geographic coverage. However, the data used here primarily reflects remittances sent directly to Somalia and excludes transfers to neighbouring countries with sizeable Somali populations, such as Kenya, Ethiopia, and Uganda. Moreover, the data is limited to a small number of MTBs, with Norwegian data collected through several agents representing different operators and other countries' data sourced mainly from a single major Somali money transfer company. It is important to emphasize that this dataset only captures official, regulated transactions and excludes informal remittance channels, which are believed to constitute a substantial portion of remittance flows (Freund and Spatafora, 2008).

The primary focus of this study is to investigate the relationship between conflict and

remittance behaviour rather than to provide a comprehensive estimate of total remittance volumes to Somalia. The dataset encompasses around three million individual-level transactions involving over 150,000 distinct Somali senders residing across developed countries. Through this rich data, the study gains unique insights into remitter behaviour, including transfer frequency, volume, and responses to violent conflicts affecting families back home. While the data may not cover all MTOs, it still offers valuable insights into the relationship between conflict and remittances among the Somali diaspora.

Table 3.1: Summary Statistics of Total Remittance Amounts Transferred to Somali Districts by Year (N = 4440)

Year	Amount				Frequency			
	Mean	SD	Min	Max	Mean	SD	Min	Max
2017	145997.59	406765.539	0	3539135	587.422	1514.650	0	13728
2018	151565.28	436996.158	0	3657864	569.359	1542.112	0	14173
2019	150079.32	444108.258	0	3692035.2	562.539	1585.881	0	16505
2020	212062.21	703733.800	0	6404995.7	713.534	2256.698	0	23946
2021	292097.41	956196.094	0	8571991.5	765.841	2329.063	0	23459
Total	190360.4	628865.6	0	8571991	639.7392	1882.741	0	23946

Note: Table 2.1 presents the summary statistics of remittance amounts sent to Somalia districts by year (N = 4,440) from 2017–2021. The dataset contains remittance transactions for 74 districts over five years, resulting in 888 observations each year. Out of these, 65 districts were given remittances, and 58 districts received equal amounts every month.

Descriptive Statistics of the Remittance Data

Table 3.1 reports descriptive statistics of migrant remittances transferred to Somalia between 2017 and 2021. During this period, 2.84 million transactions were sent with a total value of USD 845 million and an average of 300 USD per transaction³. Figure 3.3 shows yearly remittance transfers, showing a steady increase until 2020, followed by a significant surge during the COVID-19 pandemic. The remittance data from the CBS, as illustrated in 3.1, supports this trend, showing remittances received from all regulated MTBs. The increase in remittance transfers during the COVID-19 lockdown period could be attributed to a decline in informal channels, resulting in migrants utilising formal remittance channels. The current unique data presented in the study has similar

³The monthly average received by each district is USD 190,360.34. To determine the total remittances received or transferred, this average amount is multiplied by the number of months, districts, and years: $190,360.34 \times 12 \text{ months} \times 74 \text{ districts} \times 5 \text{ years}$. The calculation shows that remittances amount to around USD 845 million. The total sum comes from around 2.84 million migrant transactions, with an average remittance of USD 300 per transaction.

trends to the CBS data, but unlike the aggregate CBS data, it provides location-specific insights by showing the recipient districts, which represent the lowest subnational administrative unit.

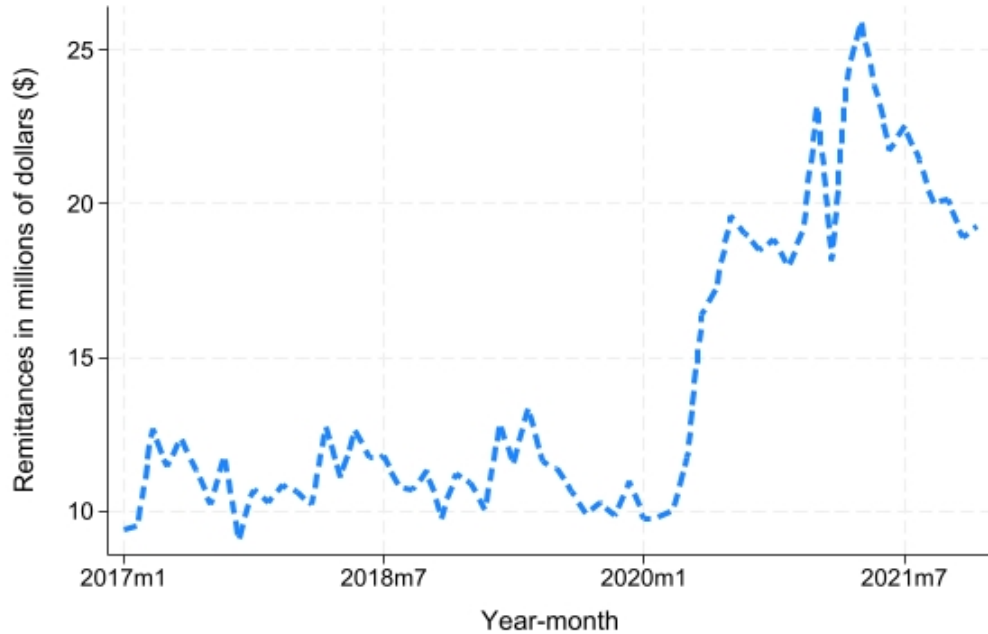


Figure 3.3: *Annual remittances flows to Somalia districts from January 2017-December 2021. Source: Author's presentation based on MTOs data.*

Note: The figure displays the annual remittance flows to sub-national districts in Somalia from 2017-2021. The remittance amount represents the actual transactions made by Somali migrants living in multiple developed countries.

This vital information provides evidence of the behaviour of senders in response to conflicts or crises that might have affected their stay-behind households. Furthermore, this unique data includes information on where money is remitted at a subnational level, the frequency of transferring funds, as well as the amount remitted. Such comprehensive data offers a significant opportunity to investigate how these transfers respond to conflict events or crises that occur back home.

The data further reveals that while 65 districts received money from overseas, a total of 58 districts received monthly remittance inflows regularly, creating a balanced panel of 58 units. Figures 3 and 4 exhibit the distribution of the dependent variables, namely the inverse hyperbolic sine (IHS) transformed remittances and the IHS-transformed frequency of remitting. The graph illustrates that both variables follow a normal distribution.

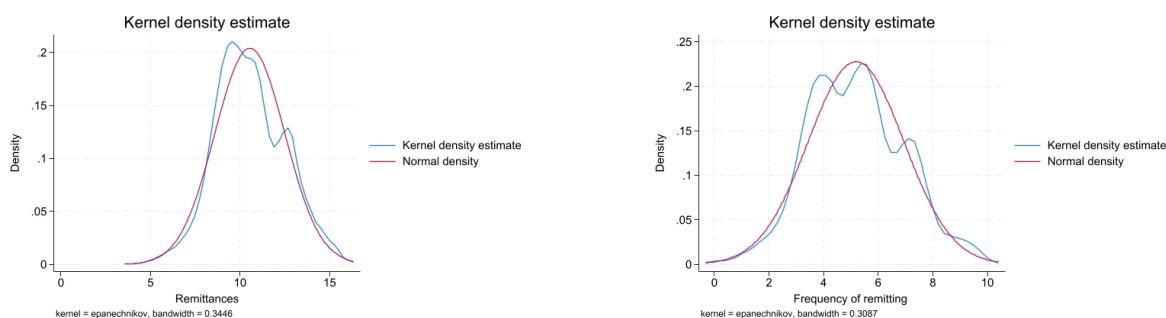


Figure 3.4: Kernel density estimation of remittances and frequency of remitting

Note: Kernel density estimation of remittances and frequency of remitting, both normally distributed

3.4.2 Conflict Data

Somalia remains a fragile, conflict-affected country. According to ACLED data, there were 13,847 recorded events of violence between 2017 and 2021. Most of these conflicts consisted of battles (6,570), which are defined as “violent encounters between politically organized armed militias.” Other significant forms of conflict include explosions or remote violence (3,211), which are “unilateral acts of violence in which the tool of conflict renders the target unable to defend themselves,” and violence against civilians (2,659), which occurs when “an organized armed group intentionally inflicts violence on unarmed civilians.” ACLED data also indicate a marked increase in violent events from the mid-2000s, largely driven by the emergence of Al-Shabaab. The emergence of this group intensified following the intervention of foreign forces in the country. Al-Shabaab claims to fight for Somalia’s liberation from foreign soldiers and seeks to establish Islamic rule in Somalia and the Horn of Africa region (Solomon, 2014).

The conflict data used in this study are sourced from ACLED, a well-established and peer-reviewed dataset widely used in conflict research and policy analysis. ACLED collects real-time geo-coded data on violent events through multiple verified sources, including local informants, media reports, and NGO inputs. It employs rigorous methodologies to reduce duplication, minimize bias, and ensure data reliability. Given its widespread adoption by international organizations such as the United Nations and the World Bank, we are confident in the credibility and accuracy of the conflict data despite the challenging context in Somalia.

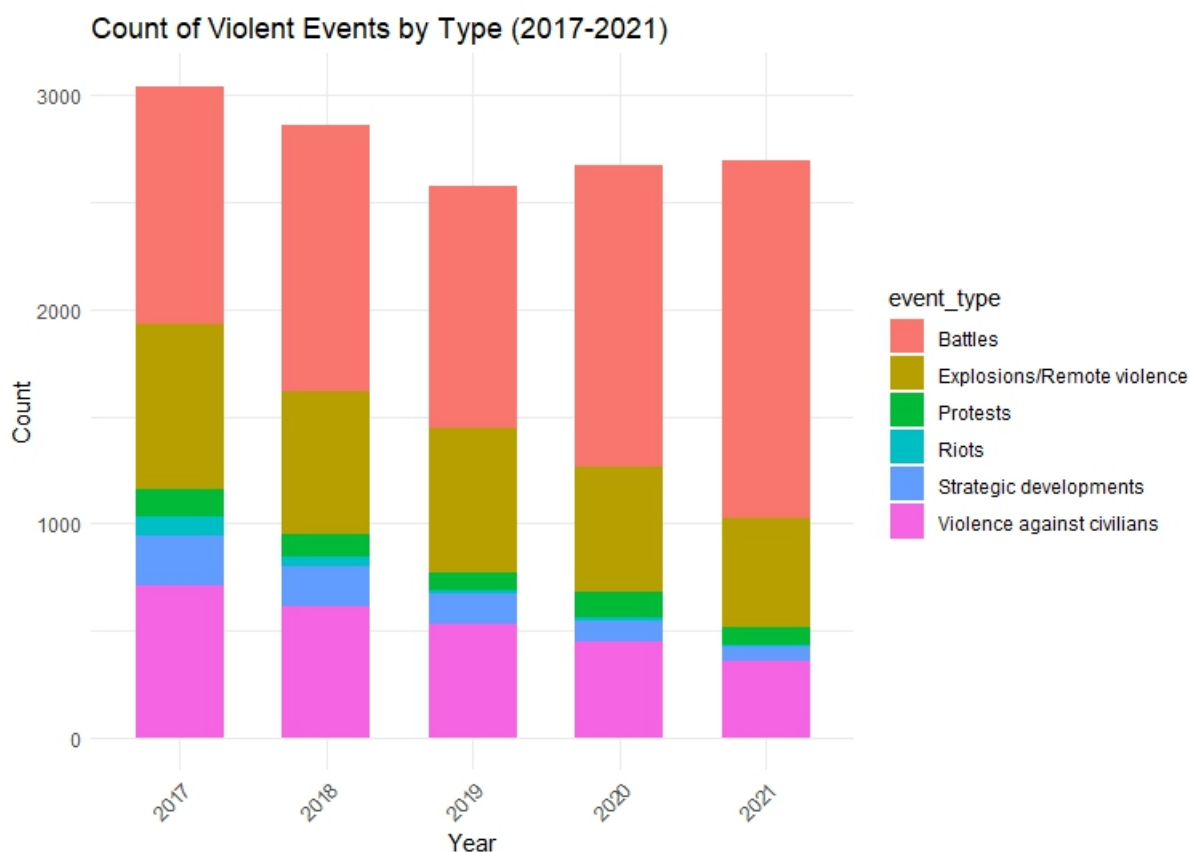


Figure 3.5: *Monthly Count of Conflict Events by Type in Somalia (2017-2021)*. Source: Authors' presentation based on ACLED data.

Note: The bar chart illustrates the frequency of various conflict event types, with battles, explosions, and violence against civilians representing the largest proportions of incidents.

For the empirical analysis, although ACLED data is provided as geo-coded location events (the lowest geographic level available), we operationalised the data by aggregating all events to the 74 pre-war administrative districts to align with the remittance and other datasets. The data is structured at multiple geographic levels: event locations (geo-coded), districts (74 pre-war), and regions (18 pre-war). We used the district-level aggregation for merging with other datasets. Daily conflict events were collapsed to monthly counts per district, distinguishing event types such as battles, explosions, and violence against civilians. These monthly district-level conflict counts were used as explanatory variables, measured both as continuous counts and binary indicators for the presence of conflict. Furthermore, a one-month lag of violent events was included to assess potential delayed impacts on remittance behaviour.

The southern region of Somalia has been disproportionately affected by frequent conflict incidents of varying severity. This particular area accounts for approximately 60% of all conflicts in the country, and nine out of the top ten cities with the highest

levels of violence and casualties are located in this region. Mogadishu, the capital and economic hub, has been greatly affected by conflict incidents. Specifically, there were a staggering 3,163 (23%) violent occurrences during the studied period, encompassing 1,339 battles, 773 explosions, and 840 cases of violence against civilians. In contrast, fewer conflict events and related fatalities have occurred in the northern and north-eastern parts of the country. This could be attributed to factors like functional institutions, political stability, and community involvement in conflict prevention.

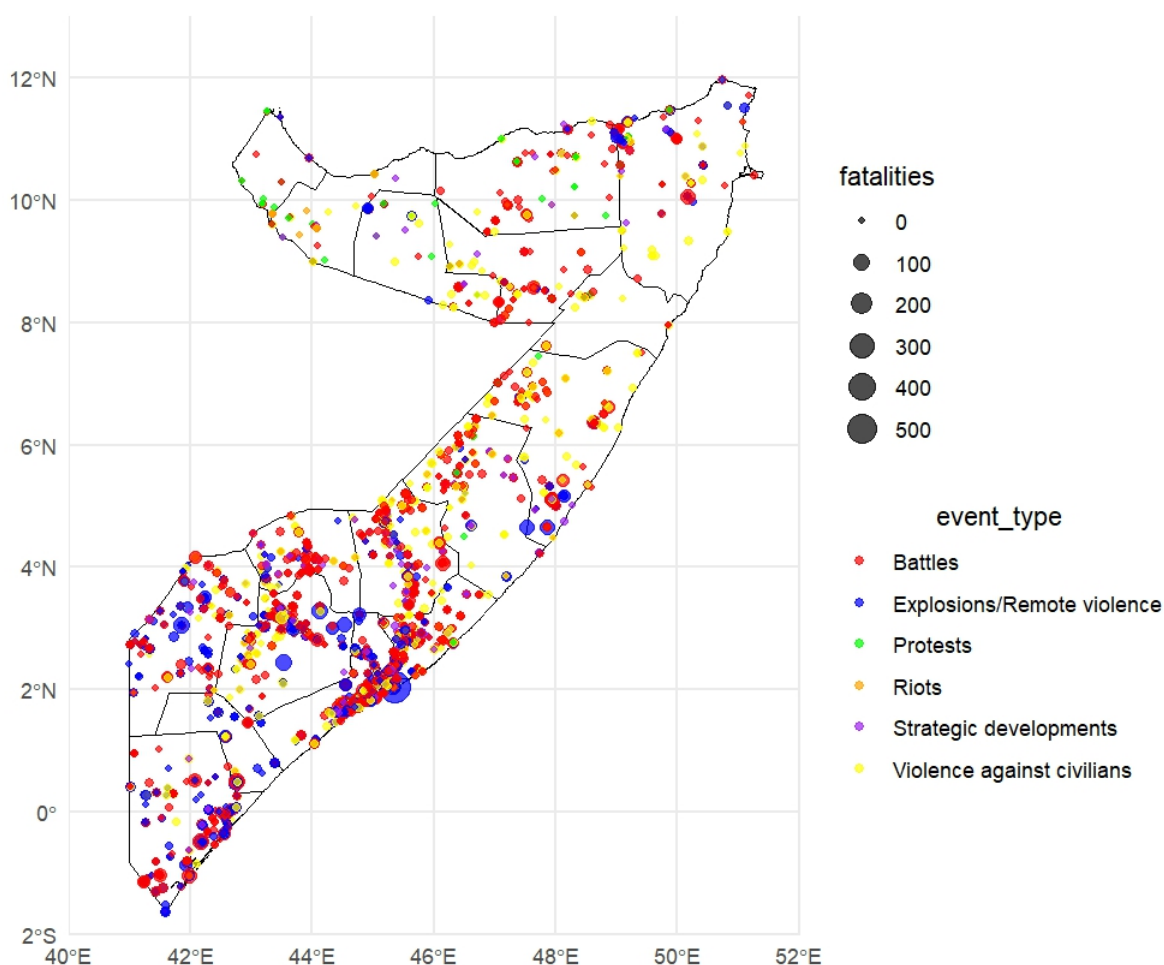


Figure 3.6: *Geographical variation of conflict (2017–2021)*. Source: Authors' presentation based on ACLED data.

Note: The map displays the geo-coded locations of violent conflicts events in Somalia from 2017 to 2021.

Conflict incidents are prevalent throughout the country; however, certain areas experience a lower intensity of conflict compared to the southern regions, where concentrations of incidents are notably higher.

Table 3.2: Overall violent conflicts, sub-conflict types and fatalities in Somalia (2017–2021)

Year	Overall Conflict	Battles	Explosions	VA Civilians	Strategic Developments	Protests	Riots	Fatalities
2017	3034	1113	774	708	237	125	86	6143
2018	2864	1251	662	610	192	109	40	5420
2019	2757	1131	677	530	140	78	19	4513
2020	2670	1403	586	450	91	119	21	3255
2021	2695	1672	512	361	65	77	9	3261
Total	13847	6570	3211	2659	13847	508	174	22592

Note: Overall Conflict aggregates six types of violent conflicts. The last column records fatalities caused by these conflicts. VA Civilians refers to violence against civilians. Strategic Developments include non-violent actions by conflict actors or other agents, such as recruitment, looting, or arrests. Protests are non-violent demonstrations, while Riots involve violent acts against property or people. Source: Authors' calculation based on ACLED data (2017–2021)

3.4.3 Construction of Control Variables

Weather Data

The weather data utilised in this study was obtained from the SWALIM project, an information management system technically supervised by the Food and Agriculture Organization (FAO) of the United Nations in Somalia. SWALIM/FAO conducts systematic monitoring of drought conditions across Somalia, alongside other weather-related variables. The specific weather variables considered in this analysis are derived from the Combined Drought Index (CDI), the Precipitation Drought Index (PDI), and the Temperature Drought Index (TDI). The CDI, a composite measure, integrates three drought-related indices—PDI, TDI, and the Vegetation Drought Index (VDI). Each index fulfils a specific role: the PDI captures anomalies in precipitation and the persistence of dryness, the TDI reflects sustained high temperatures, and the VDI is used as a proxy for soil moisture deficits. These indices are treated as continuous variables within the analysis. Drought severity in this study is analysed by generating a drought severity indicator based on the CDI values. Specifically, CDI values indicate varying degrees of drought, as adumbrated below:

- >1.0: absence of drought
- 0.8–1: mild drought
- 0.6–0.8: moderate drought
- 0.4–0.6: severe drought

- <0.4: extreme drought

Additionally, a variable representing normal (non-drought) conditions is constructed based on CDI values ⁴.

The temperature anomaly variable is formulated using district-level temperature data. Furthermore, a drought indicator is derived from the PDI index, with below average precipitation values serving as a proxy for drought intensity. Precipitation values below 0.4 show significantly below-average rainfall, values between 0.4 and 0.8 represent below-average rainfall, values between 0.8 and 1.0 indicate average rainfall, and values of 1 or higher denote above-average rainfall conditions.

Table 3.3: Control Variables: Weather and Population Data (N=4440)

Variable	Mean	Std. Dev.	Min	Max
Temperature	37.591	3.92	24.882	52.528
PDI	1.503	1.109	0.06	8.45
CDI	1.368	0.868	0.2	6.63
VDI	1.062	0.391	0.43	2.16
TDI	0.964	0.323	0.35	1.88
District population	171852.87	270677.6	14287	2228463
Temperature anomaly	0	3.256	-10.032	16.601
Drought	0.423	0.494	0	1
Absence of drought	0.559	0.497	0	1

Note: The table presents summary statistics of control variables, including monthly weather data and annual population figures for districts in Somalia. Weather variables reflect average monthly conditions, while population data is aggregated annually.

The temperature, precipitation, and vegetation index data used in this study were obtained from the following reliable sources.

- **Temperature:** the Modis Land Surface Temperature dataset ⁵ (as used by the FAO), which offers high-quality global land surface temperature estimates.
- **Precipitation:** the CHIRPS Pentad dataset ⁶, which provides high-resolution rainfall estimates and is widely used in drought and disaster risk reduction initiatives.

⁴A CDI value of > 1.0 indicates normal conditions: absence of drought.

⁵https://developers.google.com/earth-engine/datasets/catalog/MODIS_061_MOD11A1

⁶https://developers.google.com/earth-engine/datasets/catalog/UCSB-CHG_CHIRPS_PENTAD

- **Vegetation:** the VIIRS dataset⁷, which contains high-resolution data on the health and density of vegetation cover.

To address potential confounding from drought and other environmental factors, and thus strengthen internal validity, the study incorporated a wide array of climate-related controls. This includes variables such as rainfall anomalies, temperature deviations, and drought indicators (e.g., the CDI). Climatic shocks such as droughts are known to affect both conflict dynamics e.g., (Maconga, 2023; Burke et al., 2015) and remittance flows e.g., (Mueller et al., 2020), which could bias the estimated effect of conflict on remittance behaviour more effectively by including monthly rainfall anomalies, temperature deviations, and drought severity indices at the district-month level.

The environmental data for this study is reliable and was collected systematically. All weather indicators are sourced from SWALIM/FAO, which applies internationally recognised, satellite-based methodologies for climate monitoring in Somalia. Although remote sensing data can have some measurement errors, using composite indices and aggregating data spatially at the district-month level reduces this by smoothing out short-term inconsistencies. Using multiple, complementary indicators improves robustness and reduces reliance on any single measure.

District Population

Somalia has faced an extended dearth of information regarding regional population numbers and essential characteristics of the Somali people. The last available population data is from a census conducted in 1975 that only provided limited findings. Results from a subsequent population census carried out between 1985 and 1986 were never made public. Nevertheless, the United Nations Population Fund (UNFPA), together with donors and other UN agencies, assumed the lead role in assisting Somali authorities in conducting the Population Estimation Survey.

To control for the district population, population estimates were derived from the 2014 Population Estimation Survey (PESS), which was the first comprehensive household sample survey carried out among the Somali population in decades. Given the absence of any census following the 2014 PESS, district population data for the study period (2017–2021) were obtained by adopting the World Bank Somalia economic update’s approach and presumed an annual population growth rate of 2.9 percent based on UN

⁷https://developers.google.com/earth-engine/datasets/catalog/NOAA_VIIRS_001_VNP09GA

World Population prospects' annual average growth rate estimates between 2010 and 2014 ([World-Bank, 2022](#)).

3.4.4 Data Aggregation and Merging Procedure

To enable district-level analysis, the individual-level remittance transactions were aggregated using a consistent sub-national identifier. A unique district ID was assigned to each of the 74 pre-war administrative districts. Using these identifiers, the data were collapsed to monthly sums of the total remittance amount received and the total number of transactions per district. This yields a monthly district-level panel of remittance flows and frequencies.

ACLED data were similarly aggregated to the monthly district level using the same district ID and temporal identifiers (month and year). This alignment allowed for a direct merging of the two datasets using the common keys of district ID, month, and year. The resulting dataset includes, for each district-month, the total value and frequency of remittance inflows, the number and type of violent events, and temporal identifiers.

In addition, data on the deployment of ATMIS forces were appended to the panel. ATMIS deployment data are available annually and identify the presence or absence of security forces at the district level. This dataset was merged using district ID and year, complementing the monthly panel with an additional measure of district-level security presence.

Finally, climate and weather data (precipitation, temperature anomalies, drought intensity) were added to the dataset, matched by district ID and month-year. These variables serve as control variables to account for the influence of environmental shocks on conflict dynamics and remittance flows, helping to isolate the effects of key explanatory factors in the analysis. Population data were incorporated as a control variable to normalize flows and ensure comparability across districts of different sizes. The result of these steps is a harmonized district-month panel dataset, suitable for fixed-effects regression and other econometric analyses.

3.5 Empirical Methodology

To estimate the effect of violent conflicts on the inflow of monthly remittances and frequency of remitting to 65 out of 74 pre-war districts in Somalia, we use a fixed effects strategy at the district level as follows:

$$\text{Remit}_{it} = \beta_0 + \beta_1 \text{conflicts}_{it-1} + \beta_2 X_{it} + \gamma_i + \delta_t + \epsilon_{it} \quad (3.1)$$

Where Remit_{it} represents the inverse hyperbolic sine (IHS) transformed monthly inflow of remittances and the frequency of remitting to district i at time t ; conflict_{it-1} denotes the lag of the number of various types of violent conflicts experienced by district i at time $t - 1$; X_{it} is a factor of controls; γ_i is the district-specific fixed effect that captures the time-invariant district-specific heterogeneity; δ_t represents the time-fixed effects, which control for time-invariant, time-specific heterogeneity; and ϵ_{it} is the error term for each district-month observation.

In X_{it} , I include precipitation, season-specific drought exposure and district population as controls, given its importance in addressing omitted variable bias.

To determine the appropriate lag structure for the conflict variables in the fixed effects models, this study adopts a one-month lag of violent conflict events based on both theoretical reasoning and empirical relevance. This choice is motivated by the understanding that the impact of violent conflict on remittance flows is rarely contemporaneous. The inclusion of the lag mitigates simultaneity bias; remittances from a given month might not immediately reflect that month's conflicts. There is typically a delay as diaspora members become aware of the conflict, make remittance decisions, and as recipients face logistical disruptions in accessing funds. The impact of these delays is especially acute in vulnerable areas, such as Somalia, with its limited infrastructure and communications. Moreover, conflicts can temporarily displace people, interrupt remittance channels, and create heightened insecurity which may persist and affect future remittance patterns. The monthly structure of the data naturally lends itself to a one-month lag, which captures these behavioral and operational delays. Alternative lag structures (e.g. two-month or longer lags) were considered, but the one-month lag was preferred due to its interpretability, data resolution, and alignment with observed remittance timing patterns in the descriptive analysis. This method is in line with prior studies of conflict's economic consequences; these studies often use lagged variables to capture the delayed and persistent influence of insecurity on economic results (Le et al., 2022; De Groot et al., 2022).

Including the lagged value of total violent conflicts in the regression equation provides several advantages. One primary advantage is that it captures the persistence of conflict and its impact on the monthly inflow of remittances and the frequency of remitting. Violent conflict incidents may have long-lasting effects that extend beyond the end of the conflict, and utilising the delayed conflict variable in the model enables us to capture these persistent effects. For example, several factors, such as economic conditions or

political stability, may impact both the number of conflicts and the monthly inflow and frequency of remittances. By including the lagged conflict variable, we can control for these elements to some extent and obtain more accurate estimates of the effect of conflicts on remittances.

Moreover, building on equation (3.1), the analysis will extend to consider the violent conflict variable under different conditions, employing both its continuous form and a binary specification. This allows us to analyse the effect of violent conflicts on remittance flows under different conditions. This allows us to explore the influence of various violent conflict categories on monthly remittances and frequency under different conditions, with the continuous variable providing insight and understanding into the overall effect of different remittance amounts, while the dummy variable enables us to investigate how districts with more versus less exposure to violent conflict relate with remittances flows and frequency.

Finally, the identification strategy in this model is based on the use of both district-fixed and time-fixed effects, which flexibly control for time-invariant, district-specific and time-specific heterogeneity that might be correlated with both the independent and dependent variables. The district-fixed effects capture the unique characteristics of each district, such as cultural and historical background, that could influence both the number of conflicts and the monthly inflow of remittances and frequency of remitting. The time-fixed effects capture any common time series factors, such as macroeconomic trends, that might affect both the number of conflicts and the monthly inflow of remittances and frequency of migrants sending money home. By including both district-fixed and time-fixed effects in the regression model, the estimation is robust to omitted variable bias and provides more accurate estimates of the causal effect of conflicts on remittances.

Fixed effects are particularly appropriate in this setting given the presence of unobserved, time-invariant district-level heterogeneity that may influence the relationship between violent conflict and remittance flows. These unobserved factors include characteristics such as cultural norms, historical remittance patterns, diaspora size, and local institutional structures, which are stable over time but vary across districts. Focusing on within-district changes over time, the fixed effects estimator isolates how changes in violent conflict affect remittances, while controlling for constant district characteristics.

Nevertheless, a limitation of fixed effects models is their inability to capture unobserved variables that change gradually over time, such as improvements in infrastructure or shifts in local governance. To mitigate this limitation, the study includes key time-varying controls—precipitation, drought conditions, and population—to better account for dynamic factors influencing both conflict and remittance flows.

Moreover, to mitigate potential bias from omitted time-varying variables and endogeneity, the study uses an instrumental variables (IV) approach with two-stage least squares (2SLS) estimation, detailed in the following section.

Endogeneity

While the fixed effects (FE) model helps control for time-invariant unobserved heterogeneity and unit-specific characteristics, there remains a concern that violent conflicts might be endogenously correlated with unobserved factors that influence remittances, potentially leading to biased estimates. To resolve this endogeneity concern, we apply an instrumental variable (IV) methodology. Security forces, especially the African Union Transition Mission in Somalia (ATMIS), are identified as a possible instrumental variable for violent conflicts. The instrument varies over time and across districts⁸. Nevertheless, a potential concern with the instrument is that the placement of armed forces may itself be endogenous, as troops may be deployed specifically in areas with a high propensity for conflict. However, broader political, geographical, and logistical factors also influence the deployment of security forces, which helps justify treating them as a valid instrument.

Fixed effects are particularly appropriate in this setting given the presence of unobserved, time-invariant factors such as diaspora size, clan composition, and historical remittance linkages that differ across districts. However, a limitation is that time-invariant unobservables cannot be directly estimated, and slow-moving confounders may still influence results. To partly address this, this study includes relevant time-varying controls and focuses on within-district variation.

The next sub-section presents the use of an instrumental variables (IV) strategy and two-stage least squares (2SLS) estimation to address potential endogeneity concerns more directly.

Instrument and IV-2SLS estimation:

To account for endogeneity, we utilise a two-stage least squares (2SLS) methodology, using the presence of security forces as an instrumental variable for measuring violent conflict. A valid instrument must fulfill two conditions: relevance and exogeneity. First, the instrument needs to be linked to the lag of different types of violent conflict, which serves as the endogenous independent variable. Second, the instrument needs to satisfy

⁸Security forces were initially sent to Somalia in 2007 to aid the government and fight against Al-Shabaab. ATMIS has expanded from 1600 Ugandan soldiers in Mogadishu to 22,126 military and police personnel from nine nations across districts in south and central Somalia.

the exclusion restriction, which implies that it should only affect the dependent variable through its effect on the endogenous variable and not directly or through other pathways.

The first stage of the IV approach models lag violent conflict as a function of the instrument (security forces) and fixed effects: We can write the first-stage regression model for Conflicts as follows:

$$\text{conflicts}_{it-1} = \eta \mathbf{Z}'_{it} + \phi' \mathbf{X}_{it} + \gamma'_i + \delta'_t + v_{it} \quad (3.2)$$

In equation (3.2), conflicts_{it-1} is the endogenous variable; $\mathbf{Z}'_{it}$ is an instrument for lag of violent conflict types and represents security forces (*SecurityForces_{it}*). The parameters γ'_i and δ'_t represent district and time fixed effects, respectively, and v_{it} is the error term. The coefficient η measures the relationship between security forces and lag of violent conflicts, and if η is significantly different from zero, it indicates that the instrument is relevant.

In the second stage, we use the predicted values of conflict from the first stage to estimate the impact of conflict on remittances, which is the main equation of interest:

$$\text{Remit}_{it} = \beta_0 + \beta_1 \hat{\text{conflicts}}_{it-1} + \beta_2 X_{it} + \gamma_i + \delta_t + \epsilon_{it} \quad (3.3)$$

Here, $\hat{\text{Conflict}}_{it-1}$ represents the fitted values of conflict obtained from the first-stage regression. This second stage corrects for the potential endogeneity of conflict, allowing us to obtain a consistent estimate of β_1 , which captures the effect of conflict on remittances.

The two-stage least squares (2SLS) method is important in addressing the endogeneity issue. However, the validity of the IV approach hinges on the instrument satisfying the exclusion restriction—i.e., security forces must affect the flow of remittances and frequency of transferring funds only through their impact on conflict and not through any direct channels. This requirement is supported by numerous political, geographical, and strategic issues that affect the placement of security forces in Somalia.

First, the deployment of armed troops might also be influenced by broader political and regional stability issues, which are exogenous to the specific conflict dynamics within Somalia's districts. Kenya and Ethiopia⁹ collaborate with local Somali forces to prevent the spread of insurgent activity into their territories. They offer training, equipment, and support to secure border regions (Keating and Abshir, 2018). This geopolitical strategy

⁹Both Ethiopia and Kenya are among the nations that sent their security forces to Somalia as part of the ATMIS mission of the African Union (AU).

often results in the deployment of troops in border areas, irrespective of the local intensity of conflict.

Second, geographical factors significantly impact the placement of peacekeeping forces. Districts might be granted extra troops because of their strategic importance, including their proximity to major supply routes, border areas, or critical infrastructure. These factors play a significant role in determining the presence of security forces, even in areas with lower conflict levels. For instance, troops may be stationed to secure essential road networks or urban centers crucial for maintaining government control. Furthermore, military forces could be deployed to safeguard vital infrastructure, such as ports, airports, and aid distribution centers, thus ensuring the delivery of humanitarian aid to vulnerable populations. This logistical emphasis emphasizes that deployment choices are driven by international obligations and the need to protect essential infrastructure, rather than solely being influenced by local conflict conditions. This indicates that the presence of security forces is influenced by factors unrelated to local conflict intensity, providing evidence for the exogenous nature of the instrument.

Third, military placements are also significantly influenced by humanitarian objectives. Security forces frequently engage in facilitating humanitarian operations, including supporting the repatriation of refugees, the resettlement of internally displaced persons (IDPs), and the delivery of humanitarian aid to affected populations. These humanitarian missions may involve the deployment of troops to regions with minimal conflict, but high levels of pressing humanitarian needs. The end of 2023 saw 3.9 million internally displaced persons in Somalia ([iDMC, 2023](#)), emphasizing the urgent requirement for specific humanitarian aid in these areas.

Finally, the deployment of security forces is also affected by broader military strategies related to capacity-building initiatives. The initiative aims to strengthen the Somali Police Forces by providing specialized training programs to enhance their operational capabilities and readiness, and improve their skills in managing internal security responsibilities. This comes after decades of conflict and weak government structures.

By incorporating these broader determinants of military deployment, we argue that the instrument satisfies both the relevance and exogeneity conditions necessary for a valid IV approach. While the presence of security forces is correlated with conflict, their placement is also influenced by exogenous factors unrelated to remittance flows and frequency. Therefore, the IV method provides a robust method for addressing endogeneity and estimating the causal effect of violent conflict on remittances.

3.6 Results and Discussion

As a first empirical step, I estimate the impact of violent conflicts on both the inflow of monthly remittances and the frequency of remitting, while controlling for weather-related and demographic covariates. To this end, the analysis uses an econometric framework with district and year-month fixed effects, as indicated in equation 3.1.

Violent Conflicts as Lagged Variable

Table 3.4 shows the estimated effects of lagged overall conflicts, explosions, and violence against civilians on the flow and frequency of remittance to districts in Somalia. Columns 1–3 report the results for remittances flows, while Columns 4–6 correspond to remittance frequency. The negative coefficients of the three lagged violent conflict variables are consistently significant, showing that these conflicts have a significant negative effect on both the amount and frequency of remittance transfers.

Specifically, the results indicate that a one-month lag of overall conflict is associated with a 1.3% decline in the flow of remittances and a 0.9% reduction in remittance frequency. In the same vein, a one-month lagged explosions results in a 2% decrease in remittance flows and a 1.9% drop in frequency. Violence against civilians has the strongest effect: a one-month lag is associated with a 2.4% reduction in remittance flows and a 2.1% decline in frequency.

To better understand how remittance flows vary before and after conflict events across districts, the analysis employs a one-month lag of conflict indicators. This modelling choice allows the study to capture short-term behavioural responses in the immediate aftermath of violence while avoiding simultaneity bias that would arise if conflict and remittance variables were measured within the same time window. By separating the event (conflict) from the response (remittance), the lag structure facilitates a clearer interpretation of how remittances react to recent violence.

Moreover, the fixed effects model focuses on within-district variation over time, which controls for all time-invariant district-level characteristics. This setup effectively compares remittance behaviour during relatively peaceful periods with that observed after conflict events, allowing the analysis to identify “before and after” shifts in remittance patterns. In doing so, the study approximates a quasi-experimental design that evaluates how remittance behaviour dynamically adjusts in response to violent shocks.

To address heterogeneity in treatment effects, the conflict indicators are disaggregated into three distinct forms of violence: overall conflict incidence (i.e. the total num-

ber of conflict events), violence against civilians, and explosions. This disaggregation strategy acknowledges that each type of conflict may provoke a different behavioural response. For example, violence against civilians may trigger urgent humanitarian support due to heightened perceptions of vulnerability among family members; overall conflict, by contrast, may suppress remittance flows due to increased logistical or security constraints; and explosions—owing to their indiscriminate and abrupt nature—may prompt sharp remittance spikes in response to displacement, property loss, or other secondary effects. This nuanced approach enhances the explanatory power of the empirical strategy and offers a more granular understanding of how different forms of violence influence remittance behaviour in the Somali context.

Building on these insights, the stronger negative impact of violence against civilians on remittance flows highlights the critical dependence on remittances within Somalia's fragile socio-economic setting. When civilians are directly targeted, insecurity disrupts both the physical access to and the intended use of remittances. This is especially true for remittances earmarked for investment or other productive activities, which require stability, mobility, and functioning local markets. Conflict may displace recipients, limit mobility, or lead to temporary shutdowns of money transfer agents, resulting in time lags and lower flows. Moreover, diaspora may delay or withhold transfers if they are uncertain about recipients' safety or ability to utilise the funds. Thus, the observed decline in flows during episodes of violence against civilians reflects not only reduced transactions but also an interruption of remittance use for longer-term development purposes. These compounded effects reduce both the volume and the effective utilisation of remittances in affected districts.

Table 3.4: The Effects of Lagged Violent Conflicts on Monthly Remittances and Frequency

VARIABLES	Remittances			Frequency		
	(1)	(2)	(3)	(4)	(5)	(6)
Lag of overall conflict	-0.013*** (0.004)			-0.009*** (0.003)		
Log. Population	-0.035 (0.239)	-0.025 (0.243)	-0.031 (0.241)	-0.050 (0.226)	-0.044 (0.228)	-0.049 (0.226)
Temp. anomaly	-0.013** (0.006)	-0.014** (0.006)	-0.013** (0.006)	-0.009** (0.004)	-0.009** (0.004)	-0.009** (0.004)
Drought dummy	-0.019 (0.034)	-0.018 (0.034)	-0.022 (0.034)	-0.020 (0.027)	-0.018 (0.027)	-0.022 (0.027)
Normal	0.062 (0.044)	0.060 (0.044)	0.062 (0.044)	0.053 (0.040)	0.052 (0.040)	0.054 (0.040)
Lag of explosions		-0.020** (0.009)			-0.019*** (0.007)	
Lag of VA civilians			-0.024*** (0.007)			-0.021*** (0.007)
Constant	11.620*** (2.957)	11.311*** (3.022)	11.360*** (3.008)	6.444** (2.788)	6.267** (2.829)	6.300** (2.819)
Observations	3,422	3,422	3,422	3,422	3,422	3,422
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.917	0.917	0.917	0.936	0.936	0.936

Note: The dependent variables are the monthly inflow of IHS transformed remittances and the frequency of remitting. The explanatory variables include a one-month lag of various violent conflict incidences. Overall lagged conflict represents the sum of all violent conflicts, while lagged explosions and lagged violence against civilians represent the number of violent events in these categories for the one-month lag. The control variables include the log of district population, temperature anomaly, drought dummy, and a normal (no drought) condition. The “drought dummy” is based on the precipitation drought index (PDI) and has a value of 1 if the district has experienced drought due to low precipitation levels and 0 otherwise. The other dummy variable reflects normal (no drought) conditions and is derived from the combined drought index (CDI), with a value of 1 if the district has experienced no droughts, and 0 otherwise. The model controls for year-month and district fixed effects. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*)

This study explores the relationship between remittances and violent conflict, revealing a negative correlation between the two. Previous research, however, has shown divergent results. For instance, [Mughal and Anwar \(2015\)](#) found that remittances in

Pakistan increased by an average of \$0.83 million per month for every terrorist attack casualty. [Mascarenhas and Sandler \(2014\)](#) reported that a 1% increase in lagged Remittances/GDP was associated with nearly 3.2 additional domestic terror events, and [Elu and Price \(2012\)](#) indicated that remittance inflows between \$250,000 and \$1 million financed approximately one terrorism event in Sub-Saharan Africa. The negative association found in this study can be attributed to its use of a different context and dataset: it focuses on a conflict-affected country at a sub-national level, linking remittance flows to specific conflict dynamics and employing real migrant transaction data to reveal sender behavior during conflicts.

In contrast, research on remittances and economic shocks demonstrates a different dynamic. For example, [Yang and Choi \(2007\)](#) found that remittances in the Philippines replaced roughly 60% of declines in household income, while [Giannelli and Canessa \(2022\)](#) observed that remittances offset approximately 40% of the income loss and 50% of the food expenditure decline for poorer households in Bangladesh, primarily due to international transfers. Migration and remittances are generally viewed as risk-coping mechanisms in rural areas with volatile incomes and seasonal shocks ([Fafchamps and Lund, 2003](#); [Gubert, 2002](#); [Paxson, 1992](#)). However, the nature and impact of shocks differ from those of violent conflicts.

While a considerable body of literature analyses the impact of economic shocks on remittances, there is comparatively less research on the effects of violent conflict on remittance flows, particularly from the perspective of how conflict itself affects remittance behavior of senders. While most studies focus on remittances as a response to economic shocks, the dynamics change significantly in the context of violent conflict. This study aims to close the gap by analysing how violent conflict affects remittance transfers within a conflict-affected country at a sub-national level. Through analysing how conflict affects the amount and frequency of remittance flows, this study contributes our knowledge of the intricate interplay between violent conflict events and remittances.

Prolonged violent events can exert an adverse effect on remittance inflows and frequency, hindering the allocation of remittances towards productive sectors and investment in a war-torn economy. Nonetheless, remittances intended for consumption smoothing or basic living costs can still be sent, serving as a valuable and reliable source of income during crises in developing countries, as widely documented in existing literature ([Lum et al., 2024](#); [Majid et al., 2018](#); [Regan and Frank, 2014](#); [Rodima-Taylor, 2022](#); [Savage and Harvey, 2007](#)). Despite this, empirical evidence on the link between remittances and conflict remains scarce, particularly in countries such as Somalia that have relied heavily on diaspora remittances for over three decades while enduring prolonged conflict.

As Somalia heavily depends on remittances, any decline in remittances due to violent conflicts could diminish the developmental effect of remittances, reducing their intended use for investment and productive sectors. Such a reduction in remittances for development confirms prior studies positing that civil wars or conflicts can hamper development and GDP growth (Collier and Hoeffler, 2004; Fearon and Laitin, 2003). This shows the negative implicit effect of conflicts on GDP and growth, which is also eventually diminishes remittances intended for investment.

Beyond the direct impact of conflict on remittance dynamics, understanding the influence of environmental factors is also crucial, particularly given Somalia's vulnerability to climate variability. The observed effect of weather anomalies on remittance flows and frequency warrants careful consideration, especially given prior research suggesting varied outcomes. While the drought dummy consistently showed a negative, albeit statistically insignificant, association with remittances, the continuous temperature anomaly variable exhibited a statistically significant and negative effect. This result might initially appear counterintuitive if one solely considers the well-documented "*self-insurance*" motive, where remittances typically increase in response to adverse climate shocks to aid household coping (Yang, 2008a; Bettin et al., 2025).

However, the specific context of Somalia and the nature of different climate variables offer plausible explanations for these results. Temperature anomalies, which are deviations from long-term monthly averages, can interfere with sending and receiving remittances. In Somalia, remittance systems heavily rely on physical agents and money transfer operators (MTOs); thus, extreme heat may impair infrastructure, reduce mobility, and hinder access to local collection points, particularly in rural or insecure districts. Elevated temperatures additionally worsen prior fragilities by amplifying disputes over limited resources, driving displacement, or exacerbating local tensions (Ide et al., 2016). Crucially, as the dataset comprises transaction-level data, including large-value transfers potentially intended for investment or other productive activities, the observed negative effect could reflect a dynamic shift in senders' motivations and behaviour. Faced with severe climatic conditions that hamper investment opportunities and increase operational risks in recipient areas, migrants may reduce these larger, discretionary transfers. Thus, though remittances are often key for coping, their behaviour depends on the nature, intensity, and length of the disruption, plus the socio-economic backdrop and remittance channel reliability.

Conflict as a Continuous Variable

After presenting the impact of the lag of violent conflicts on the flow of migrant remittances and their remitting behaviour, the subsequent analysis entails examining the effects of the same explanatory — the monthly number of violent events confronted by each district.

Columns 1–3 of Table 3.5 show the estimated effect of overall violent conflicts, explosions, and violence against civilians on the inflow of remittances, while columns 4–6 of the same table correspondingly reveal the estimated relationship between remittance frequency and these key explanatory variables. The results unequivocally show a significant, statistically significant negative correlation between the key explanatory variables and both the inflow and frequency of remittances. Specifically, the number of conflicts is associated with a 1.1% decrease in remittances and a 0.9% decline in frequency. Explosions similarly exert a negative influence, reducing remittances by 2.3% and frequency by 1.8%. Additionally, violence against civilians has a significant negative effect, resulting in a 2.8% decrease in remittances and a 2.7% drop in frequency. The negative and highly significant coefficients show that more violent conflict events in Somalia result in significant decreases in monthly remittances and fund transfers to districts.

Table 3.5: The Effects of the Number of Violent Conflicts on the Inflow of Monthly Remittances and Frequency

VARIABLES	Remittances			Frequency		
	(1)	(2)	(3)	(4)	(5)	(6)
Overall conflict	-0.011*** (0.003)			-0.009*** (0.003)		
Log. population	-0.037 (0.239)	-0.030 (0.241)	-0.035 (0.239)	-0.056 (0.223)	-0.051 (0.225)	-0.056 (0.221)
Temp. anomaly	-0.013** (0.006)	-0.013** (0.006)	-0.012** (0.006)	-0.009** (0.004)	-0.009** (0.004)	-0.009* (0.004)
Drought dummy	-0.017 (0.034)	-0.015 (0.033)	-0.019 (0.034)	-0.017 (0.027)	-0.016 (0.027)	-0.020 (0.027)
Normal	0.064 (0.045)	0.061 (0.045)	0.061 (0.045)	0.054 (0.041)	0.052 (0.041)	0.052 (0.041)
Explosions		-0.023*** (0.008)			-0.018*** (0.006)	
VA civilians			-0.028*** (0.007)			-0.027*** (0.006)
Constant	11.569*** (2.958)	11.338*** (3.005)	11.370*** (2.976)	6.551** (2.762)	6.386** (2.797)	6.446** (2.760)
Observations	3,480	3,480	3,480	3,480	3,480	3,480
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.917	0.917	0.917	0.936	0.936	0.936

Note: The dependent variables are the monthly inflow of IHS transformed remittances and the frequency of remitting. The variables—overall conflicts, explosions and violence against civilians are continuous variables representing the number of violent events experienced by the districts. The control variables have been defined in the same manner as described in the footnote of 3.4. The model controls for year-month and district-fixed effects. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*)

Conflict as a Dummy Variable

Table 3.6 illustrates the outcomes of a fixed effects estimator that investigates the link between violent conflicts, remittance flows and frequency of remitting to districts in Somalia. Columns (1-3) exhibit the impact of violent conflict events on the inflow of monthly remittances, while columns (4-6) reveal the effect of violent conflict events on the frequency of remittance transfers to districts. The analysis employs three dummy

variables, namely overall conflicts, explosions, and violence against civilians, which are coded as 1 if a district experiences a specific level of violence and 0 otherwise.

Table 3.6: The Impacts of Dummy Violent Conflicts on the Inflow of Monthly Remittances

VARIABLES	Remittances			Frequency		
	(1)	(2)	(3)	(4)	(5)	(6)
Overall conflict dummy	-0.184** (0.077)			-0.159** (0.061)		
Log. population	-0.032 (0.241)	-0.026 (0.244)	-0.026 (0.244)	-0.053 (0.224)	-0.047 (0.227)	-0.048 (0.226)
Temp. anomaly	-0.013** (0.006)	-0.013** (0.006)	-0.013** (0.006)	-0.009* (0.004)	-0.009** (0.004)	-0.009** (0.004)
Drought Dummy	-0.020 (0.034)	-0.015 (0.034)	-0.016 (0.034)	-0.020 (0.027)	-0.016 (0.027)	-0.017 (0.027)
Normal	0.060 (0.045)	0.058 (0.046)	0.057 (0.046)	0.052 (0.041)	0.049 (0.041)	0.049 (0.042)
Explosions dummy		-0.101** (0.042)			-0.075*** (0.026)	
VA civilians dummy			-0.054 (0.042)			-0.061* (0.036)
Constant	11.443*** (2.994)	11.245*** (3.027)	11.200*** (3.034)	6.491** (2.789)	6.309** (2.813)	6.290** (2.815)
Observations	3,480	3,480	3,480	3,480	3,480	3,480
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.917	0.916	0.916	0.936	0.936	0.936

Note: The dependent variables are the monthly inflow of IHS transformed remittances and the frequency of remitting. The variable overall conflict events is a binary variable indicating whether a district experienced at least eight conflicts events monthly, while explosions and violence against civilians are binary variables representing whether a district confronted three or more explosions or violence against civilians, respectively. The control variables have been defined in the same manner as described in the footnote of 3.4. The model controls for year-month and district fixed effects. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*)

The findings indicate that exposure to violent conflicts has a substantial adverse influence on the inflow of monthly remittances and frequency of remitting. Specifically, the conflict dummy is significant at the 5% level, revealing that districts experiencing at least eight or more violent events per calendar month receive 18.4% and 15.9% less

remittances and frequency, respectively, compared to districts with fewer conflicts. Similarly, exposure to explosions is significantly and inversely correlated to both the flow and frequency of remittances. The coefficient is statistically significant at the 5% level for remittances and highly significant at the 1% level for frequency. It implies that exposure to three or more explosions per calendar month reduces remittances from diaspora by 10% and frequency by 7.5%. While violence against civilians is negatively correlated with the inflow of remittances, the relationship is statistically insignificant. Nonetheless, the link between violence against civilians and frequency is significant at the 10% level and negatively related, reducing frequency by 6%.

In a nutshell, the findings indicate that violent conflicts have a significant adverse effect on both the flow and frequency of remittances in the war-torn economy. These findings underscore the need for policymakers to address the root causes of conflict and mitigate the negative impact of violence on the economic well-being of the conflict-affected districts.

Other Sub-Conflict Types: Strategic Developments and Battles

Furthermore, Table 3.14 shows the effects of strategic advancements and battles on both the inflow of monthly remittances and the frequency with which funds are transferred. Notably, the coefficient of strategic developments is negative, but it is statistically insignificant in relation to the link between remittances, implying that strategic advancements have no effect on remittance volumes. However, in terms of remittance frequency, the coefficient of strategic developments is statistically significant at a 10% level, indicating that such developments reduce the frequency of remitting, resulting in lower remittances from migrants. Battles, on the other hand, have a statistically insignificant impact on both remittances and their frequency. This means that battles can take place in areas outside of cities and thus have no effect on the closure of remittance agencies or the flow of goods and people.

The literature on the nexus between migrant remittances and conflict has yielded mixed results, with some studies showing positive associations and others revealing negative correlations. Nevertheless, this study supports the existing literature's claim of a negative relationship between remittances and violent conflicts or civil wars (Ghorpade, 2017). While previous research has primarily analysed the effects of remittances on the onset of civil wars or terrorism, this study shifts focus to analyse the impact of persistent violent conflicts on remittance flows and frequency. Unlike previous studies that have treated remittances as the primary explanatory variable, this research centers on violent conflicts. It further extends the analysis by considering not only conflict or terrorism but

also other forms of violence, including violence against civilians, battles, and strategic developments.

The objective of this analysis is to examine how episodes of various types of violent conflict influence both the inflow of remittances and the frequency with which migrants remit money. To the best of our knowledge, this is the first study to analyse the effect of violent conflicts on remittances and their frequency at the sub-national level in a country that has endured persistent violence and political turmoil for over three decades.

IV-2SLS Results

Table 3.7 and 3.8 reports our primary 2SLS specification, which explores the causal impact of violent conflicts on remittance inflows and the frequency of remittances to conflict-affected areas in Somalia. The first and second stage results for the lagged overall violent conflicts, explosions, and violence against civilian are reported in columns 1-2, 3-4, and 5-6, respectively. In the first stage, the endogenous variable (lag of conflict) is regressed on the instrument and other explanatory covariates.

The instrument—peacekeeping forces (ATMIS in Somalia)—yields a negative coefficient, indicating that increased security reduces conflict. This aligns with the findings from the fixed effects (FE) model in the main results section, where the lag of conflict is shown to negatively affect remittances. The analysis shows that increased conflict leads to a decrease in remittance inflows. By using security forces as an instrument, the model confirms that enhanced security reduces conflict, resulting in higher remittances. This confirms the assertion that conflict restrains remittances, whereas enhanced security contributes to their reinstatement.

Table 3.7: The Effects of Lagged Violent Conflicts on Monthly Remittances

VARIABLES	(1) first Conflict	(2) second Remit	(3) first Explosions	(4) second Remit	(5) first Violence	(6) second Remit
Log population	-1.007*** (0.237)	-0.121** (0.0563)	-0.175* (0.0984)	-0.0559 (0.0468)	-0.388*** (0.0896)	-0.111** (0.0541)
Temp. anomaly	0.0306 (0.0283)	-0.0103* (0.00573)	0.00932 (0.0118)	-0.0116** (0.00550)	0.0176 (0.0107)	-0.00928 (0.00572)
Drought dummy	0.0596 (0.200)	-0.0196 (0.0398)	0.0923 (0.0832)	-0.00884 (0.0387)	-0.0838 (0.0758)	-0.0440 (0.0400)
Normal	0.368* (0.215)	0.0960** (0.0444)	0.128 (0.0894)	0.0836** (0.0422)	0.187** (0.0814)	0.103** (0.0445)
ATMIS	-0.00616*** (0.000920)		-0.00331*** (0.000383)		-0.00263*** (0.000348)	
Lagged conflict		-0.0954*** (0.0297)				
Lagged explosions				-0.178*** (0.0537)		
Lagged VA civilians						-0.224*** (0.0687)
Constant	37.62*** (3.000)	14.43*** (1.189)	8.567*** (1.248)	12.37*** (0.686)	8.663*** (1.136)	12.78*** (0.776)
Observations	3,480	3,480	3,480	3,480	3,480	3,480
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.860	0.900	0.695	0.906	0.731	0.903

Note: The dependent variable is the monthly inflow of IHS transformed remittances. The explanatory variables include a one-month lag of various violent conflict incidences. Overall lagged conflict represents the sum of all violent conflicts, while lagged explosions and lagged violence against civilians represent the number of violent events in these categories for the one-month lag. The control variables have been defined in the same manner as described in the footnote of 3.4. The model controls for year-month and district fixed effects. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*)

The empirical findings as illustrated in Tables 3.7 and 3.8 show a significant negative correlation between the various violent conflict incidents and monthly remittances and frequency of remitting to districts in conflict-affected Somalia. Delving further into the findings, the analysis shows that a one-month lag of overall violent conflicts reduces monthly remittances by 10% and their frequency by 8%. Explosions cause a reduction in the flow of remittances by 18% and their frequency by 14%, while violence against civilians markedly reduces monthly flows by 22% and frequency by 18%. The study

confirms that persistent conflicts negatively impact both remittance flows and frequency. These remittances are vital for income in war-torn areas. Conflicts disrupt economic activities, damage infrastructure, and hinder money transfer services. This reduction in economic activity and the closure of payment agents further exacerbate the difficulties faced by conflict-affected households.

Table 3.8: The Effects of Lagged Violent Conflicts on Monthly Frequency of Remitting

VARIABLES	(1) first stage Conflict	(2) second Frequency	(3) first stage Explosions	(4) second Frequency	(5) first stage Violence	(6) second Frequency
Log population	-1.007*** (0.237)	-0.119*** (0.0443)	-0.175* (0.0984)	-0.0675* (0.0366)	-0.388*** (0.0896)	-0.111*** (0.0423)
Temp. Anomaly	0.0306 (0.0283)	-0.00665 (0.00451)	0.00932 (0.0118)	-0.00764* (0.00429)	0.0176 (0.0107)	-0.00585 (0.00448)
Drought dummy	0.0596 (0.200)	-0.0197 (0.0313)	0.0923 (0.0832)	-0.0112 (0.0302)	-0.0838 (0.0758)	-0.0389 (0.0313)
Normal	0.368* (0.215)	0.0802** (0.0349)	0.128 (0.0894)	0.0704** (0.0330)	0.187** (0.0814)	0.0855** (0.0348)
ATMIS	-0.00616*** (0.000920)		-0.00331*** (0.000383)		-0.00263*** (0.000348)	
Lagged conflict		-0.0752*** (0.0234)				
Lagged explosions				-0.140*** (0.0419)		
Lagged VA civilians						-0.176*** (0.0538)
Constant	37.62*** (3.000)	8.386*** (0.936)	8.567*** (1.248)	6.758*** (0.536)	8.663*** (1.136)	7.084*** (0.607)
Observations	3,480	3,480	3,480	3,480	3,480	3,480
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.860	0.923	0.695	0.929	0.731	0.926

Note: The dependent variable is the monthly inflow of IHS transformed frequency of remitting. The explanatory variables include a one-month lag of various violent conflict incidences. Overall lagged conflict represents the sum of all violent conflicts, while lagged explosions and lagged violence against civilians represent the number of violent events in these categories for the one-month lag. The control variables have been defined in the same manner as described in the footnote of 3.4. The model controls for year-month and district fixed effects. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*)

Given that remittances are the only reliable external income source for many households in Somalia, a decrease in remittance flows due to violent events reduces a critical

lifeline for recipients. Moreover, conflicts halt remittances that could have been channeled into investments. The negative effects of violent conflict incidents on development and GDP growth have been well researched in previous studies, e.g., (Kešeljević and Spruk, 2024; Müller and Madjid, 2024). In Somalia, remittances make a substantial contribution to GDP, as 20.7% of households receive assistance from migrants living abroad (CBS, 2023). Any decline in these essential flows has a negative impact on growth and the balance of payments, as remittances help in offsetting deficits caused by high levels of imports.

These findings are consistent with Ghorpade (2017), who found that conflict reduces both the likelihood of households receiving remittances and the value of those remittances in Pakistan. Nevertheless, this study differs in several ways.

First, it uses panel data of actual transactions sent by diaspora members to households at the district level, the lowest administrative unit in Somalia. Second, while this study focuses on the conflict-remittance nexus, Ghorpade (2017) analysed the relationship between remittances and conflict. Third, Somalia presents a unique case, being a country still plagued by ongoing conflict and political instability, unlike Pakistan, where institutions are relatively stable, and households are less exposed to conflict.

In summary, this study enhances the existing literature by supplying empirical evidence that showcases the detrimental effect of violent conflict on remittance flows, using Somalia as a significant illustration. The findings imply that policies focused on increasing stability and decreasing conflict could have a positive effect on remittance flows, which are vital for household well-being and overall economic development.

3.7 Robustness Checks

In this study, we employ a two-part model designed to handle the presence of zero observations in the dependent variable. This model is used as a robustness check to complement our primary analyses, which are based on FE and IV models. The two-part model is particularly appropriate for our context as it addresses the issue of zero observations in the dependent variable (remittances and frequency of remitting).

Approximately 15% of districts never received remittances (see Table 3.11), resulting in zero values in the dataset. For the remaining districts that did receive remittances, the amounts are strictly positive. This necessitates a model capable of handling both the occurrence and magnitude of remittances.

The dataset used for the main results section consists of a balanced panel of 58 districts

that consistently received monthly remittances during the study period. Nevertheless, there are some districts with an unbalanced panel that irregularly received funds, and nine districts that never received remittances. To ensure a comprehensive analysis, we include all 74 pre-war districts in Somalia. In this dataset, when a district receives remittances, the outcome is a positive random variable, while when it does not, the outcome is zero-censored, yielding in a value of zero. The two-part model employed is a type of mixture model, where the zeros and non-zeros are generated by different densities (Belotti et al., 2015).

The two-part model consists of two stages. In the first part, we use a probit or logit model to estimate the probability that the dependent variable $Remit_{it}$ (remittances) is greater than zero. The probability that remittances are greater than zero, conditional on the explanatory variables, is given by:

$$\Pr(Remit_{it} > 0) = F(\beta_0 + \beta_1 \text{Conflict}_{it-1} + \beta_2 X_{it} + \gamma_t + \delta_i), \quad (3.4)$$

where F represents the cumulative distribution function (CDF) of either the logit or probit model¹⁰, Conflict_{it-1} denotes the lag of violent conflict, X_{it} represents additional covariates, and γ_t and δ_i are time and district fixed effects, respectively. The predicted probability of observing a non-zero value is:

$$\hat{P}_{it} = F(\hat{\beta}_0 + \hat{\beta}_1 \text{Conflict}_{it-1} + \hat{\beta}_2 X_{it} + \hat{\gamma}_t + \hat{\delta}_i). \quad (3.5)$$

For observations where $Remit_{it} > 0$, the second part of the model estimates the magnitude of remittances using a generalized linear model (GLM) with a log link function. The expected value of remittances, conditional on being greater than zero, is modeled as:

$$\mathbb{E}(Remit_{it} \mid Remit_{it} > 0, X_{it}) = \exp(\gamma_0 + \gamma_1 \text{Conflict}_{it-1} + \gamma_2 X_{it} + \gamma_t + \delta_i), \quad (3.6)$$

where $\exp(\cdot)$ ensures that the predicted values are positive. Conflict_{it-1} and X_{it} are the same covariates used in the first part of the model, and $\gamma_0, \gamma_1, \gamma_2$ are the coefficients to be estimated. γ_t and δ_i capture temporal and district-specific effects, respectively. The predicted value for positive remittances is:

$$\hat{Remit}_{it} = \exp(\hat{\gamma}_0 + \hat{\gamma}_1 \text{Conflict}_{it-1} + \hat{\gamma}_2 X_{it} + \hat{\gamma}_t + \hat{\delta}_i). \quad (3.7)$$

The overall predicted value of remittances, combining both parts of the model, is:

¹⁰In this analysis, we use the Logit model.

$$\hat{\text{Remit}}_{it} = \frac{\exp(\hat{\gamma}_0 + \hat{\gamma}_1 \text{Conflict}_{it-1} + \hat{\gamma}_2 X_{it} + \hat{\gamma}_t + \hat{\delta}_i)}{1 - \hat{P}_{it}}, \quad (3.8)$$

where the numerator $\exp(\hat{\gamma}_0 + \hat{\gamma}_1 \text{Conflict}_{it-1} + \hat{\gamma}_2 X_{it} + \hat{\gamma}_t + \hat{\delta}_i)$ represents the expected magnitude of remittances when they are positive, and the denominator $1 - \hat{P}_{it}$ adjusts for the probability of observing a non-zero outcome. This ensures that the combined prediction accurately reflects both the likelihood and magnitude components of the model.

Given the negative impact of violent conflicts on remittance flows and frequency, as shown in the primary results section of both FE and IV, it is important to conduct additional robustness analysis to fully understand these effects. This includes examining whether the estimated results hold under different model specifications and samples, and whether they are sensitive to including districts that did not receive remittances or received funds in some months. The two-part model addresses these needs effectively.

The main results section of this paper have revealed that conflicts and sub-conflict types, such as explosions and violence against civilians, reduce the inflow of monthly remittances and the frequency of remitting to recipient households living in conflict-affected districts in Somalia. These findings are based on the analysis of a balanced panel of 58 districts that received monthly remittances. The two-part model results, which we will now discuss, offer further insights into the dual effects on both the amount of remittances and the likelihood of remitting. To ensure the robustness and generalizability of these results, additional checks under varied model specifications and samples are necessary.

Table 3.9: The Effect of Lagged Overall conflicts, Explosions and Violence against civilians on the Flow of Remittances

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Overall conflict		Explosions		VA civilians	
	<i>logit</i>	<i>glm</i>	<i>logit</i>	<i>glm</i>	<i>logit</i>	<i>glm</i>
Lagged overall conflict	1.592*** (0.082)	0.994** (0.003)				
Log population	1.167*** (0.084)	1.350*** (0.033)	1.368*** (0.080)	1.363*** (0.032)	1.392*** (0.082)	1.262*** (0.032)
Temp. anomaly	0.012 (0.019)	0.066*** (0.011)	-0.002 (0.020)	0.063*** (0.011)	-0.013 (0.019)	0.065*** (0.011)
Drought dummy	-0.059 (0.176)	0.210** (0.097)	-0.089 (0.172)	0.192** (0.095)	-0.050 (0.171)	0.259*** (0.094)
Normal	-0.323* (0.173)	0.061 (0.098)	-0.340** (0.173)	0.040 (0.096)	-0.383** (0.173)	0.148 (0.095)
Lagged explosions			0.805*** (0.126)	-0.034*** (0.009)		
lagged VA civilians					0.470*** (0.117)	0.046*** (0.013)
Constant	-12.871*** (1.043)	-4.310*** (0.471)	-14.626*** (1.002)	-4.421*** (0.467)	-15.058*** (1.057)	-3.357*** (0.469)
Observations	4,366	4,366	4,366	4,366	4,439	4,439
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean Remit		190360.4		190360.4		190360.4

Note: The dependent variable is the monthly inflow of IHS transformed remittances. The explanatory variables include a one-month lag of various violent conflict incidences. Overall lagged conflict represents the sum of all violent conflicts, while lagged explosions and lagged violence against civilians represent the number of violent events in these categories for the one-month lag. The control variables have been defined in the same manner as described in the footnote of 3.4. The model controls for year-month and district fixed effects. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*)

Tables 3.9 and 3.10 present the estimated results of the two-part model, analysing the impact of lagged violent conflict event types on the flow and frequency of remittances to districts in Somalia. The results are structured in two parts: the first part estimates effects using a logit model, and the second part applies the generalized linear model (GLM). In both tables, the estimated outcomes of the impact of overall conflict, explosions, and violence against civilians on remittances and frequency of remitting are demonstrated in columns 1-2, 3-4 and 5-6, respectively. Column 1-2 show first and second part for

lagged overall conflicts while 3–4 and 5–6 show corresponding estimates for explosions and violence against civilians, respectively.

The GLM results, used as a robustness check for FE and IV methods in the main results section, show that lagged overall conflict has a negative and statistically significant coefficient, showing that overall violence reduces remittance flows by 0.6%. In comparison, the FE model shows a reduction of 1.3%, while the IV model shows a more substantial decrease of 10%. For the frequency of remitting, lagged overall conflict has a negative but statistically insignificant coefficient, while FE and IV models indicate reductions of 0.9% and 8%, respectively.

Similarly, the two-part model estimates for explosions show a 3.4% reduction in monthly remittance flows and a 1.8% decrease in remittance frequency, both of which are statistically significant at the 1% level. These findings are closely aligned with the FE estimates, which show reductions of 2% for remittance flows and 1.9% for frequency, whereas the IV model reveals more substantial reductions of 17% and 14%, respectively, for flows and frequency.

Table 3.10: The Effect of Lagged Overall conflicts, Explosions and Violence against civilians on the frequency of of Remittance.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Overall conflict		Explosions		VA civilians	
	<i>logit</i>	<i>glm</i>	<i>logit</i>	<i>glm</i>	<i>logit</i>	<i>glm</i>
Lagged overall conflict	1.584*** (0.082)	0.99** (0.003)				
Log population	1.161*** (0.084)	1.159*** (0.032)	1.363*** (0.080)	1.176*** (0.031)	1.384*** (0.082)	1.085*** (0.031)
Temp. anomaly	0.008 (0.019)	0.054*** (0.010)	-0.008 (0.020)	0.051*** (0.010)	-0.018 (0.019)	0.051*** (0.010)
Drought dummy	-0.050 (0.176)	0.203** (0.088)	-0.078 (0.172)	0.184** (0.087)	-0.039 (0.171)	0.242*** (0.086)
Normal	-0.290* (0.174)	0.030 (0.090)	-0.299* (0.174)	0.005 (0.088)	-0.344** (0.175)	0.100 (0.087)
Lagged explosions			0.789*** (0.124)	-0.018** (0.009)		
lagged VA civilians					0.477*** (0.120)	0.053*** (0.013)
Constant	-12.802*** (1.046)	-7.389*** (0.463)	-14.578*** (1.004)	-7.548*** (0.455)	-14.969*** (1.064)	-6.532*** (0.456)
Observations	4,366	4,366	4,366	4,366	4,439	4,439
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean Freq		640		640		640

Note: The dependent variable is the monthly inflow of IHS transformed frequency of remitting. The explanatory variables include a one-month lag of various violent conflict incidences. Overall lagged conflict represents the sum of all violent conflicts, while lagged explosions and lagged violence against civilians represent the number of violent events in these categories for the one-month lag. The control variables have been defined in the same manner as described in the footnote of 3.4. The model controls for year-month and district fixed effects. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*)

Surprisingly, while both the FE and IV methods show a negative relationship between violence against civilians and remittances, the two-part model reveals a significant and positive correlation with both remittance flows and frequency.

This discrepancy can be explained by looking at the different methods used in the models. The FE and IV methods capture the overall effects of the various violence conflict events on remittances by controlling for unobserved district and time fixed effects and

addressing endogeneity. They provide a broad view of how violence affects remittance flows generally. On the other hand, the two-part model breaks the analysis into separate stages, concentrating on the decision to remit and the amount sent. This approach can reveal different aspects of the relationship, potentially highlighting different distinctions not seen in the FE and IV models.

The positive coefficient in the two-part model could indicate that, despite the overall disruptive effects of violence on remittances, certain senders may increase remittance transfers on the onset of violence against civilians to help their stay-behind families.

Finally, the consistent results for overall conflict and explosions in all models strengthen the validity of these findings, while the divergency for violence against civilians shows that different models highlight distinct aspects of the remittance response to violent conflicts. While the two-part model offers valuable insights, the FE and IV models are preferred for their ability to provide a broader view of the overall effects. This preference is based on their methodological strengths in controlling for unobserved heterogeneity, addressing endogeneity and ensuring more accurate causal inference.

The first part of the two-part model shows a positive association between the occurrence of violent conflict and both the flow of remittances and the frequency of remitting. This positive coefficient indicates that conflict-affected areas in Somalia are more likely to receive remittances, which may help families cope with crises caused by violence and conflict, possibly because of factors such as displacement or increased financial needs. Nevertheless, the GLM model for lagged overall conflicts and explosions shows negative coefficients, suggesting that while conflicts increase the likelihood of receiving remittances, they reduce the amounts sent, aligning with the results in the main section. This indicates that although districts may still receive remittances during conflicts, the total amount is lower, potentially affecting funds that could have been used for investments. This implies that the negative effects on the magnitude of remittances on the intensive margin are more significant than the positive effects on the likelihood of remittance on the extensive margin.

3.8 Conclusion

This paper has analysed the nexus between violent conflict events and the inflow and frequency of remittances to pre-war districts in Somalia. Using administrative data on migrant remittance transactions spanning from January 2017 to December 2021, the study draws on records obtained from money transfer operators in eight developed countries with sizable Somali populations.

To establish the causal link between violent conflict episodes and monthly remittance flows and frequency of remitting, the paper employs a fixed effects estimator that accounts for time fixed effects and district-specific fixed effects, exploiting of the panel structure of the data. In addition, IV-2SLS regression is used to account for endogeneity while concurrently controlling for time fixed and district fixed effects.

In this analysis, the primary explanatory variables are a continuous variable measuring the number of violent incidents in a specific district, a lagged variable of the same continuous variable, and a dummy variable classifying districts that experience conflicts above a certain threshold as more conflict-affected than districts that encounter lower levels of conflict.

The estimated outcomes of the fixed effects model, using various definitions of violent conflict categories, illustrate that localised violent events impede both the flow and frequency of remittances to districts in Somalia. More specifically, the results show that lagged one-month aggregate conflict reduces remittance flows by 1.3% and frequency by 0.9%. Likewise, lagged explosions lead to a 2% reduction in remittance flows and a 1.9% decline in frequency. Lagged violence against civilians results in a 2.4% decrease in remittance flows and a 2.1% reduction in frequency. These findings suggest that violent conflict events in Somalia have a detrimental effect on remittances, which otherwise serve as a crucial lifeline for recipient households and a critical contributor to the country's GDP.

The estimated impacts of IV-2SLS regression likewise demonstrated a negative link between conflict events, remittances, and frequency, albeit with different coefficients. The one-month lagged variables for overall conflict events, explosions, and violence against civilians exhibit statistically significant negative coefficients of -0.0954, -0.178, and -0.224, suggesting corresponding reductions in remittance flows by 10%, 18%, and 22% (respectively). A similar pattern emerges in relation to remitting frequency, with overall conflicts, explosions, and violence against civilians associated with decreases of 8%, 14%, and 18%, respectively. Robustness checks were performed using Two Part models to confirm the results, which aligned with the fixed effects and IV-2SLS estimator, except for "lagged violence against civilians", which yielded contradictory findings.

While a few studies have analysed the relationship between remittances and conflict (Elu and Price, 2012; Kratou and Yogo, 2023; Mascarenhas and Sandler, 2014; Mughal and Anwar, 2015), most have concentrated on how remittances affect conflict, rather than the converse relationship. Research using country panels has provided broad insights but often neglects the varying degrees of conflict exposure across countries, complicating interpretation. Other studies, such as Mughal and Anwar (2015), used single country

data at the national level, linking annual remittance flows to terrorism, but no research has analysed this relationship at the sub-national level.

Furthermore, much of the literature focuses on terrorism, a single form of violence. In contrast, this study utilises a panel of monthly data transferred by migrants in a country still plagued by conflict, and explores the link between remittances and conflict at sub-national level. This study also explores multiple categories of conflict (i.e., types of violence). While previous findings on the conflict-remittance nexus have been mixed, our results corroborate with studies showing a negative relationship between conflict and remittances [Ghorpade \(2017\)](#), and analysing relationships between conflict and broader economic indicators, such as GDP ([Novta and Pugacheva, 2021](#)).

The results reveal that persistent violent conflicts severely disrupt the flow and frequency of remittances to districts in Somalia. Given these findings, it is essential for Somalia to adopt context specific practical strategies to safeguard these vital remittance flows and ensure continued support for families amidst ongoing violence. In Somalia, where conflict is multi-dimensional and preventing violence and restoring peace is often beyond the government control, immediate focus should be on community-based and localised approaches. Collaborating with MTOs—key private-sector actors in remittance transfer process in crisis contexts—can help maintain remittance distribution.

While mobile banking is used, the ability to receive remittances may be halted by movement restrictions in times of conflict. Implementing immediate security measures after a conflict in an affected area can help reduce challenges by allowing freedom of movement and facilitating easier distribution of remittances. Moreover, conflict halts the flow of large remittances which might be intended for investments purposes, from the diaspora, who would otherwise contribute to long-term development projects. Violence of various forms discourages remittances in the long run, leaving recipients and communities with fewer resources to rebuild and recover.

To more effectively address the disruption of remittance flows during violent episodes, policies should prioritise strengthening the physical and digital infrastructure that supports remittance access in conflict-prone areas. This includes investing in mobile money platforms that can operate under restricted mobility and improving coordination between local authorities and MTOs to establish protected remittance corridors even during crises. Furthermore, contingency protocols should be developed to enable rapid responses to remittance disruptions following sudden outbreaks of violence. Over the longer term, political stabilisation could substantially transform the nature of remittance flows. If Somalia achieves sustained improvements in peace and governance, remittances are likely to shift from short-term humanitarian support to more stable, long-term in-

vestment flows targeted at education, enterprise development, and property acquisition. Such a transition would not only enhance household welfare but also contribute to broader economic growth and reconstruction. This highlights the developmental significance of peacebuilding efforts in remittance-dependent contexts.

In countries like Somalia, where remittances play a pivotal role in economic stability, this double blow—reduced remittances to support livelihoods and reduced investments from diaspora—compounds the hardship faced by families and communities, and negatively affects GDP of the country. There is thus a need for context-specific conflict prevention, stabilisation, and peacebuilding efforts, to reduce the prolonged conflict and collaborate with money transfer operators to keep financial channels open to mitigate these long-term effects and sustain the flow of remittances that so many families depend on.

Future research could focus on the connection between conflict and remittance by utilising migrant transfer panel data linked to geocoded recipients and incorporating geocoded conflict events over longer time frames than this study. This would facilitate a more detailed analysis of how conflicts in specific areas influence remittance behaviour, and enable a better understanding of how conflict intensity and proximity affect migrant behaviour. Furthermore, RCTs examining migrant decision-making in conflict areas can shed light on how conflicts influence remittance priorities.

3.A Appendix

3.A.1 Supplementary Tables

Table 3.11: Descriptive Statistics of Variables (N=4440)

Variable	Mean	Std. Dev.	Min	Max
Remittance dummy	0.845	0.362	0	1
Amount of remittances	190360.36	628865.62	0	8571991.50
Transaction cost	8497.089	26832.942	0	348781.80
Frequency of remitting	639.739	1882.741	0	23946
Fatalities	5.088	16.599	0	670
Conflict	3.119	7.420	0	85
Battles	1.480	3.738	0	44
Explosions	0.723	2.065	0	27
Strategic developments	0.163	0.558	0	7
VA civilians	0.599	1.992	0	33
Dummy of conflict	0.151	0.358	0	1
Dummy of explosions	0.250	0.433	0	1
Dummy of VA	0.249	0.432	0	1
temp	37.591	3.920	24.882	52.528
PDI	1.503	1.109	0.06	8.45
TDI	0.964	0.323	0.35	1.88
VDI	1.062	0.391	0.43	2.16
CDI	1.368	0.868	0.2	6.63
District population	171852.87	270677.60	14287	2228463
Temperature	37.591	3.92	24.882	52.528
Temperature anomaly	6.40e-08	3.311847	-10.63369	9.76405
Absence of drought	0.559	0.497	0	1
Drought	0.423	0.494	0	1

Note: The table presents summary statistics of all variables employed in this analysis. Remittance dummy shows the recipient of any remittances, where 1 denotes the recipient of remittances and 0 otherwise. Dummy variables of conflict, explosions and violence against civilians are specified as described in Table [3.6](#)

Table 3.12: Raw Annual Remittance Flows to Somalia (2017–2024)

Year	Remittances (USD million)
2017	1,454.10
2018	1,301.60
2019	1,339.30
2020	1,641.90
2021	2,118.40
2022	2,141.70
2023	2,180.10
2024	1,448.07

Note: The table presents raw annual international remittance inflows to Somalia in current USD millions. Values represent total yearly flows. *Source:* Central Bank of Somalia (CBS).

Table 3.13: ATMIS Deployment in Somalia by Year (2017–2021)

Year	Sum	Mean	SD
2017	16,178	278.93	522.57
2018	16,190	279.14	522.45
2019	15,044	259.38	505.73
2020	16,789	289.47	542.44
2021	17,733	305.74	572.37
Total	81,934	282.53	530.11

Note: This table presents summary statistics of ATMIS personnel deployed annually across Somali districts with a security presence. Values are aggregated from district-level administrative data. *Source:* ATMIS operational records.

Table 3.14: The Impact of Strategic Development and Battles on Remittance Flows and Frequency

VARIABLES	Remittances		Frequency	
	(1)	(2)	(3)	(4)
lag of SD	-0.026 (0.020)		-0.036* (0.019)	
Log. population	-0.025 (0.244)	-0.024 (0.245)	-0.045 (0.228)	-0.041 (0.230)
Temp. anomaly	-0.014** (0.006)	-0.014** (0.006)	-0.009** (0.004)	-0.009** (0.004)
Drought dummy	-0.019 (0.034)	-0.019 (0.034)	-0.020 (0.027)	-0.020 (0.027)
Normal	0.059 (0.045)	0.057 (0.045)	0.052 (0.040)	0.050 (0.041)
Lag of battles		-0.010 (0.009)		-0.002 (0.007)
Constant	11.222*** (3.035)	11.338*** (3.006)	6.208** (2.827)	6.167** (2.812)
Observations	3,480	3,480	3,480	3,480
Time FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
R-squared	0.917	0.917	0.936	0.936

Note: The dependent variables comprise the monthly inflow of IHS-transformed remittances and the frequency of remitting. The explanatory variables include a one-month lag of strategic developments (SD) and battles. Strategic developments in regression encompass the lag of strategically significant non-violent actions, like recruitment efforts, looting, and arrests conducted by conflict actors or agents in politically unstable contexts. Battle refers to the lag of violent confrontation between two organized armed groups. The control variables have been defined in the same manner as described in the footnote of 3.4. The model controls for year-month and district fixed effects. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*)

3.A.2 Graphical Exhibits

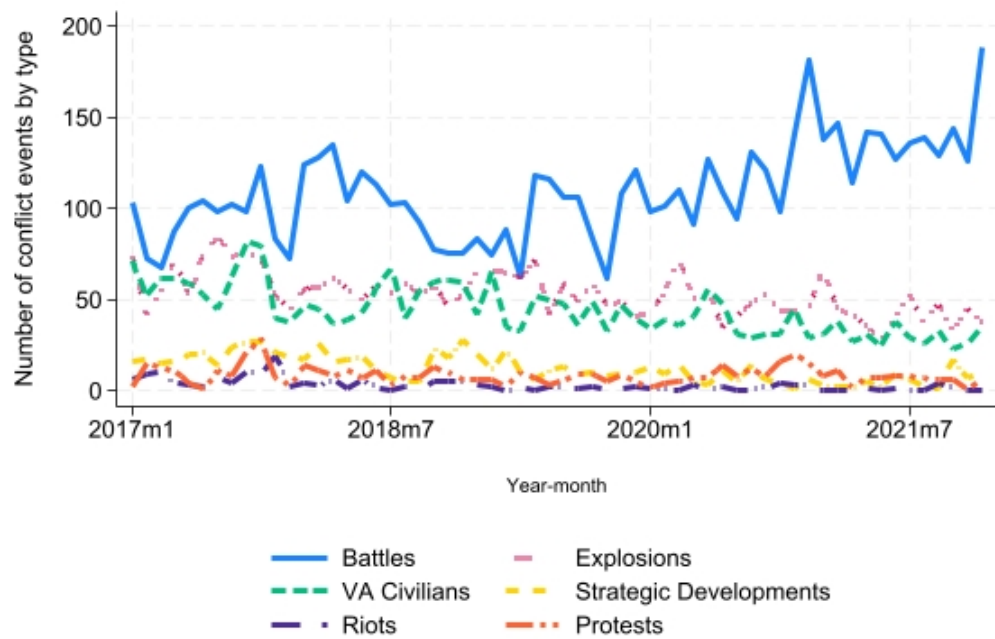


Fig. S1: *Monthly Count of Conflict Events by Type in Somalia (2017-2021)*. Source: Authors' presentation based on ACLED data.

Note: The figure shows the trend of various conflict events. Battles and violence against civilians make up 70% of all conflict events. Explosions play a major role, while protests and riots are not significant.

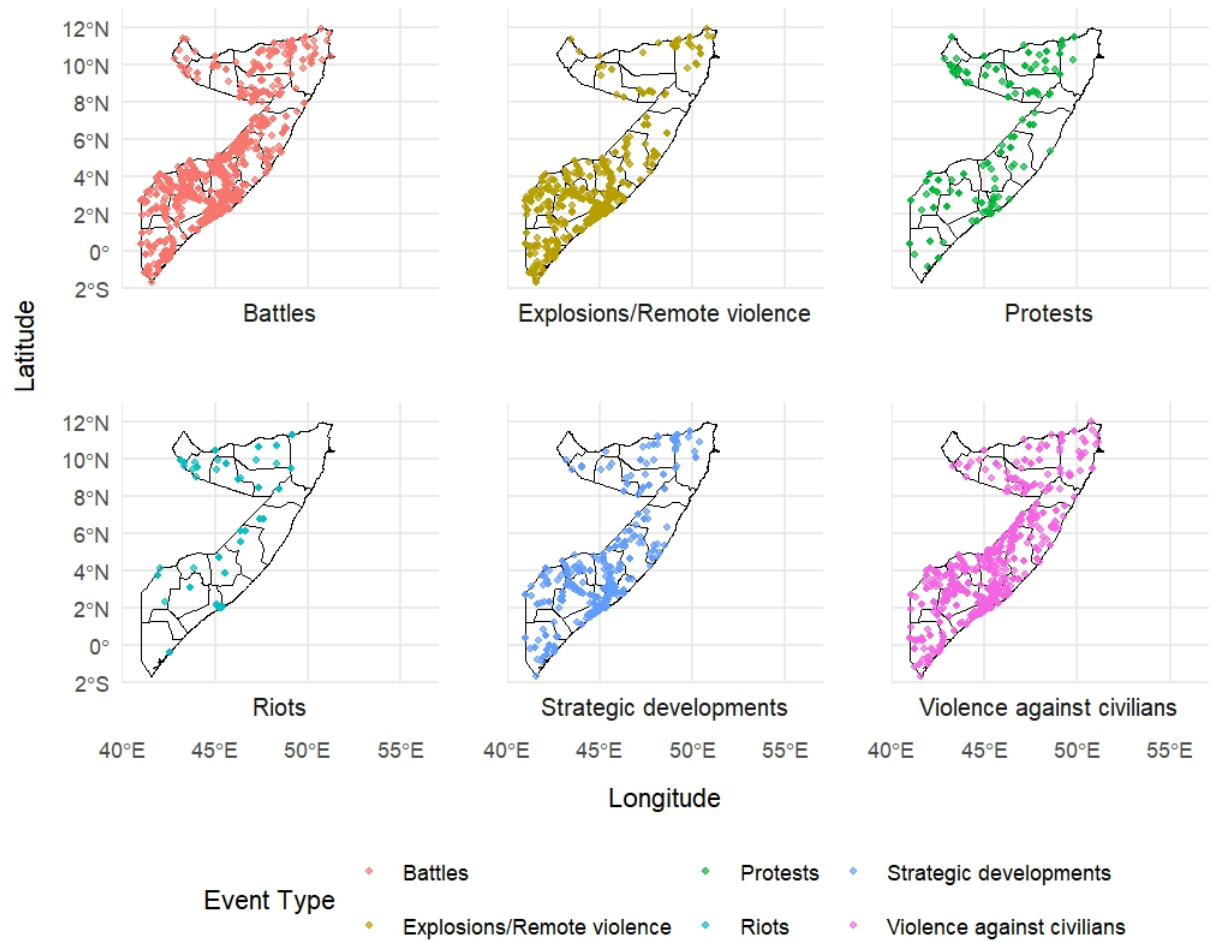


Fig. S2: *Monthly Count of Conflict Events by Type in Somalia (2017–2021)*. Source: Authors' presentation based on ACLED data.

Note: The six geocoded maps show conflict incidents in Somalia, indicating that battles, violence against civilians, and explosions are concentrated in southern Somalia, with a noticeable level of intensity.

However, riots and protests are less intense throughout the country.

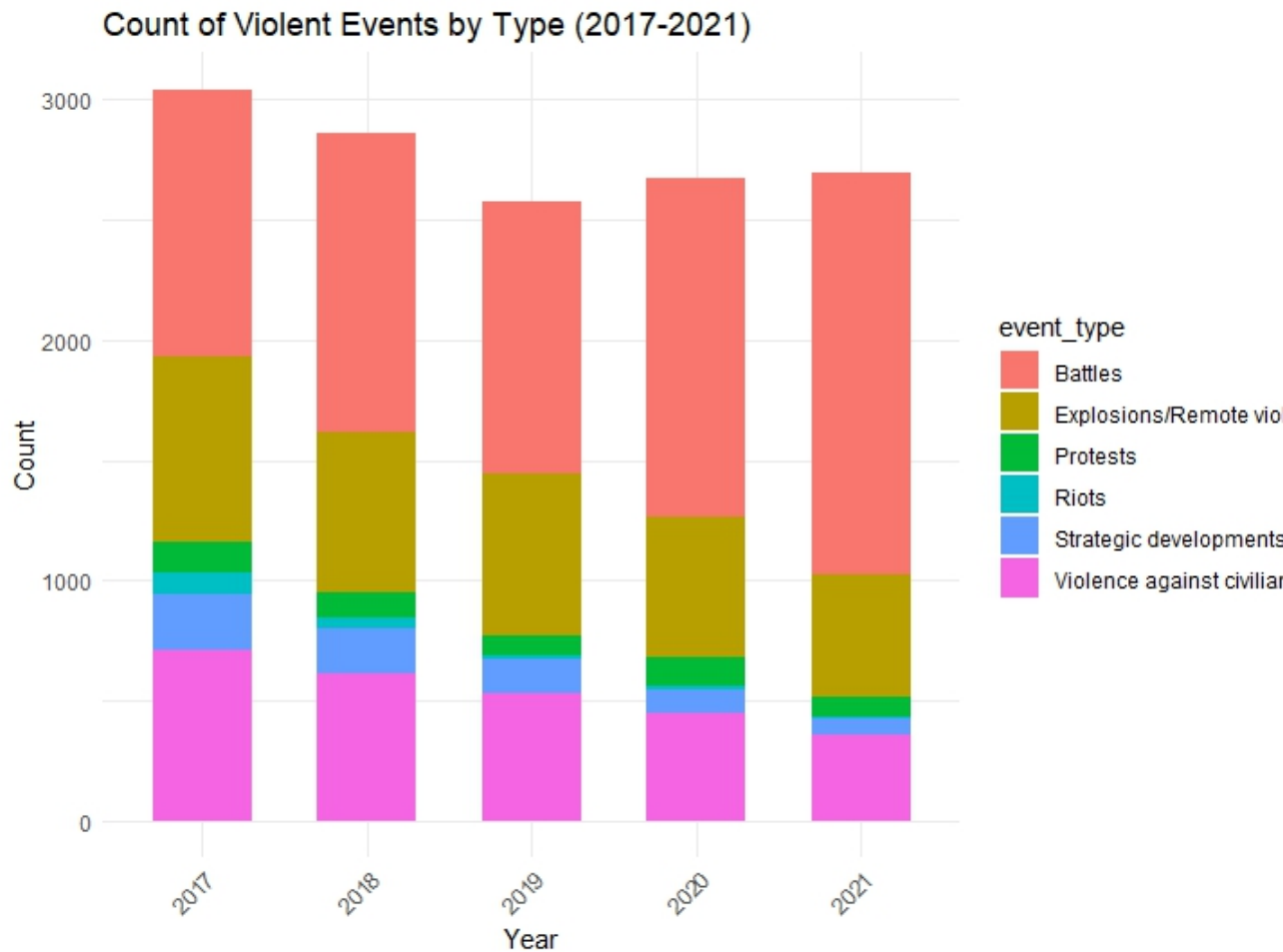


Fig. S3: *Monthly Count of Conflict Events by Type in Somalia (2017-2021)*. Source: Authors' presentation based on ACLED data.

Note: The figure demonstrates that battles and violence against civilians make up 70% of all conflict events. Explosions play a major role, while protests and riots are not significant. The figure shows that battles and violence against civilians dominate conflict events, comprising 70% of the total. Explosions also contribute significantly, while protests and riots remain minimal.

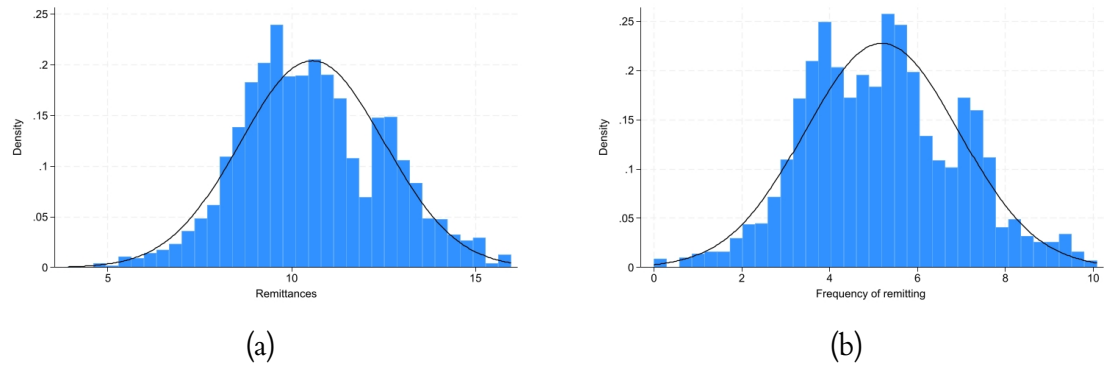


Fig. S4: Histogram of Normally Distributed Remittances Flows and Frequency of Remitting.

Note: The figure shows a histogram distribution of remittances and the frequency of remitting, both exhibiting normal distribution patterns.

Chapter 4

Impacts of sender-side macroeconomic shocks on remittances and sender behaviour

4.1 Introduction

Remittances serve as an important lifeline for developing countries, offering a crucial inflow of external income that significantly enhances the well-being of recipient households. In 2023, remittances to Low- and Middle-Income Countries (LMICs) soared to \$656 billion, exceeding both foreign direct investment and official development aid ([KNOMAD-World Bank, 2024](#)). These inflows have become a cornerstone of economic resilience, especially in countries grappling with crises, fragility, or conflict ([Soukeyna et al., 2023](#)). In regions like Sub-Saharan Africa (SSA), remittances are crucial for alleviating poverty and promoting economic stability. For instance, remittances to SSA grew modestly to \$54 billion in 2023, marking a 1.9% increase from the previous year ([KNOMAD-World Bank, 2024](#)). In a particular case such as Somalia, a country teetering on the brink of various crises, it relies heavily on its diaspora, receiving around \$2.2 billion in remittances in 2023. This figure represents about 21% of the nation's GDP, highlighting the pivotal role these funds play in sustaining the economy and assisting local households ([CBS, 2023](#)).

Despite the developmental benefits of remittances, the ability and motivation for migrants to send remittances back home, and subsequently, remittance flows, can be affected by a variety of factors. The primary factors include migrants' economic conditions ([Joseph et al., 2018](#); [Padhan et al., 2022](#); [Ratha et al., 2016](#)) and transaction costs ([Beck et al., 2022](#); [Bersch et al., 2021](#); [Da Silva Filho, 2021](#); [Freund and Spatafora, 2008](#);

Beck and Martínez Pería, 2011). Migrants' economic conditions, which are influenced by their employment status and wages, can have a significant impact on remittance flow. When migrants have stable employment and good income in the host country, they are more likely to send money back home, as their financial ability allows them to provide regular support to their families. Conversely, any negative economic shock, such as income reduction or unemployment, can severely reduce their capacity to remit and, as a result, remittance streams.

In terms of transaction cost, high transfer rates, which are caused by a combination of transfer fees, currency exchange rate margins, and additional expenses due to various transfer obstacles, have been shown to have a significant impact on the migrants' motivation and remittance flow. This impact is disproportionately felt by the poorest households in SSA. According to *Remittance Prices Worldwide* (RPW), SSA continues to suffer from some of the highest remittance costs globally, averaging 7.39% in Q3 2023 (RPW, 2023). Beyond direct transaction fees, migrants also face indirect costs, such as the depreciation of local currencies against the US dollar, as many Money Transfer Operators (MTOs) use the USD as the default currency for transfers. Although global initiatives and the Sustainable Development Goals (SDGs) target a reduction in remittance costs to 3%, progress has been slow, especially in SSA. The burden of remittance costs—comprising fees, exchange rate margins, and other related expenses—can result in the loss of 5% to 15% of the remitted amounts, depending on the country and the amount transferred (Dilip, 2021; Ratha and Riedberg, 2005). These exorbitant costs drive many migrants toward informal channels, seeking cheaper alternatives, while discouraging low-income individuals from participating in remittance activities altogether (Gibson et al., 2006; Yang, 2011).

Given the critical role of remittance costs in shaping the flow and frequency of money transfers, numerous studies have explored their determinants. These include transaction cost and migrant size (Beck and Martínez Pería, 2011; Freund and Spatafora, 2008), banking competition and market structures (Beck et al., 2022), regulatory measure and transparency (Da Silva Filho, 2021), as well as financial technologies (Bersch et al., 2021). A related strand of literature explores the cost elasticity of remittances (Ahmed and Martínez-Zarzoso, 2016; Ferriani and Oddo, 2019; Freund and Spatafora, 2008; Ahmed et al., 2021; Gibson et al., 2006; Kakhkharov et al., 2017; Kosse and Vermeulen, 2014).

The above literature provides crucial insights about the developmental value of remittance and factors that limit or facilitate its flow. While extant literature emphasises recipient-side determinants and macroeconomic outcomes, it fails to provide crucial insights on how senders respond and adapt to economic shock caused by factors such as

exchange rate depreciation, inflation, and regulatory pressures, including de-risking ¹. The possible reason that causes this gap in the literature is that most existing studies lack transaction-level data and thus fail to explore the short-term behavioural adjustments that migrants make in response to these shocks. To the best of my knowledge, no study has used transaction-level data to explore how macroeconomic shocks and regulatory changes in sending countries affect remittance motivations.

The aim of this paper is to contribute to the remittance literature by shifting the analytical focus to how migrants respond to and adapt to macroeconomic shocks on their side. It does so by utilising remittance transaction data to explore the question: What impact do sender-side macroeconomic shocks have on the volume and frequency of migrant remittances, and how do individual remitters adjust their remittance behaviour, especially in response to increased transaction costs? To address the above question, the study draws from the administrative records of three major Somali MTOs ² with a global presence. The transaction data covers migrant groups in five countries, which include Australia, Canada, Norway, Sweden and the United States, and spanning the period from January 2017 to May 2023. This unique dataset enables us to track the dynamic behaviour of individual migrants in response to various shock events while living in different countries.

By analysing the impact of events like host country currency devaluations against the US dollar, this study sheds light on how these shocks affect the behaviour of senders in terms of the amount and frequency of remittances on weekly, monthly, and quarterly bases. Additionally, the study offers a deeper understanding of how migrants navigate external shocks that inflate the cost of sending money by analysing factors, such as de-risking practices and changes in consumer price indexes (CPI), which might influence senders' behaviour.

Methodologically, the paper employs a staggered adoption design to analyse how shocks influence remittance behaviour, extending the traditional event study framework by considering multiple groups with different exposure dates to shocks. This approach is particularly effective in understanding how various groups of migrants perceive and respond to increased remittance costs over time. By examining variations in remittance flows and frequencies among these groups, the staggered adoption design provides a nuanced understanding of how the timing of economic disruptions shapes remittance behaviour. The research quantifies the impact of heightened remittance costs on the flow

¹De-risking is the act of financial institutions terminating or limiting business relationships with clients or certain types of clients in order to avoid risk rather than managing it. Targeted clients, including Somali MTOs in the West, had their bank accounts closed or restricted.

²The transaction-level data was sourced from three major MTOs: Amal Express, Dahabshil, and Taaj.

of funds using the Difference-in-Difference (DID) method, revealing that shocks leading to substantial cost increases significantly reduce both the monthly flow and frequency of remittances.

The quantification of how individual migrants adjust their remittance behaviour in response to increased transaction costs, especially those driven by external shocks on the sender side, is important for both empirical and policy reasons. It provides empirical micro-level evidence regarding the *heterogeneity* and *temporal dynamics* in relation to responses to economic shocks. Migrants in the selected countries are never homogeneous groups. They may differ in terms of income level, legal status, and motivations for remitting (altruism or investing). The quantification can therefore reveal who is most affected by the shock and how they adjusted. This will provide a better understanding of how different remitters in different contexts respond to external economic shocks and, in turn, how this affects the frequency and pattern of remittance. From a temporal perspective, the study examines the change in remittance frequency across different time intervals—weekly, monthly, and quarterly to provide insights into how changes in time affect how migrants adjust their financial plans in response to economic disruptions. Temporal analysis allows for the identification of short-term, medium-term, and long-term patterns, offering insights into the resilience and adaptability of migrants when confronted with increased costs.

From a policy perspective, the study shows both macroeconomic pressures and regulatory restrictions on the sender side can substantially disrupt migrant remittance behaviour, undermining a vital financial lifeline for recipient households and limiting resources which could otherwise support investment and productive activities. These findings suggest the need for coherent international policies aimed at reducing transaction costs, improving transparency, and minimising the unintended effects of de-risking practices. This is in line with the sustainable development agenda, notably SDG 10.c, which aims to lower migrant remittance transaction costs to under 3 percent and remove corridors over 5 percent. Safeguarding remittance corridors and strong correspondent banking relationships with MTOs and recipient countries is vital. In fragile and conflict-affected contexts, where remittances have significant social and developmental roles, coordinated international action is important to ensure financial integrity efforts do not inadvertently limit remittance flows.

The findings in the study show that diverse shocks in countries like Norway, Sweden, Canada, and Australia lead to a 9% decrease in the monthly flow of remittances and a 4% drop in frequency. Specifically, an exchange rate devaluation of 5–10% correlates with a 4% reduction in flow and a 3% decline in frequency. Furthermore, rising living

costs—particularly food and electricity prices, which have rapidly expanded by 19% and 17%, respectively—result in a dramatic 29% drop in remittance flows and a 19% decrease in frequency. De-risking measures also contribute to an 8% decline in remittance flows.

When comparing different time intervals, the study shows that quarterly results align with monthly outcomes, while weekly data show the most significant reductions, suggesting that migrants react more impulsively to short-term shocks. Moreover, the impact of shocks varies depending on the size of transactions; smaller remittances experience moderate declines, whereas larger transactions, often intended for investment, face substantial decreases, indicating that such shocks significantly hinder the flow of larger sums.

The paper is structured as follows. Section II provides an overview of the institutional context, emphasizing the operations of MTOs. The literature review is discussed in Section III, while Sections IV and V present the data and empirical methodology. Results and discussion are presented in Section VI. Section VII addresses robustness checks, while Section VIII concludes the discussion.

4.2 Institutional Context

The cost of remittances globally is a key factor impacting cross-border fund transfers, especially for recipient households in developing nations that heavily depend on migrant remittances as a vital income source. Sub-Saharan Africa faces an unreasonably high burden of remittance costs. The costs are influenced by multiple factors, such as limited competition, weak financial infrastructure in certain countries, regulatory challenges, and the inability of remittance senders and/or receivers to access the banking sector. Remittance Prices Worldwide [RPW](#) (2023) data reveals that the global average remittance cost modestly decreased from 6.20% in Q2 2023 to 6.18% in Q3 2023. The cost of remittance transactions differs greatly among regions. South Asia has the lowest average cost at 5.44% in Q3 2023, while Sub-Saharan Africa has the highest average cost at 7.39% in Q3 2023 ([RPW](#), 2023). Countries that experience lower remittance costs receive higher remittance flows, whereas higher costs are a burden for migrants and recipients.

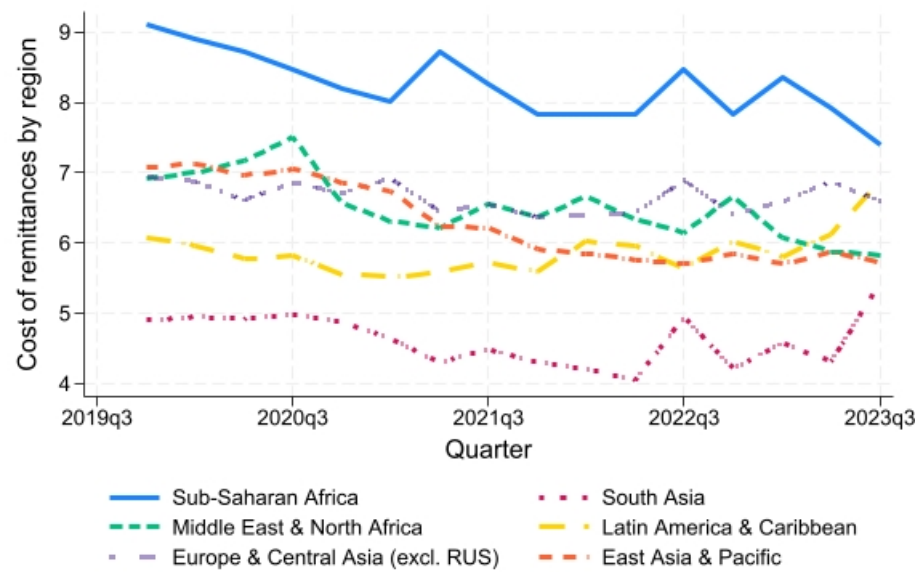


Figure 4.1: *Costs of remittances by global regions, Q4 2019–Q3 2023. Source: Authors' presentation based on RPW data.*

Furthermore, a closer look at recent RWP data shows fluctuations in remittance costs to Somalia (Figure 4.2). According to the data, remittances from the United States have remained the most affordable at an average cost of 5.3 in Q3 2023, whereas Sweden and Australia have higher costs at 9 percent and 8 percent, respectively, in Q2 2023. Moreover, transaction fees in Australia have experienced extreme volatility, surging to 13% in Q4 2020 and plunging to just 5% in Q3 2023. Although the transfer fees for remittances to Somalia were higher in 2019, there has been a noticeable decrease in Q1 2023, particularly for Sweden and Australia (RPW, 2023). The reason for this could be that migrants are utilizing digital remittances as an alternative to traditional MTOs. The reason for the low transaction fees when sending from the US is the absence of exchange rate margins.



Figure 4.2: *Cost of transferring remittances to Somalia from United States, Sweden and Australia, Q3 2019-Q3 2023. Source: Authors' presentation based on RPW data.*

Somalia depends greatly on migrant remittances, with these transfers making up around 21% of its GDP (CBS, 2023). Remittances to Somalia continue to be costly³ due to sender-side de-risking and stringent regulatory oversight. Remittance costs to Somalia are driven by factors such as de-risking, limited banking access, cash transportation, exchange rate fluctuations, sender-side currency depreciations, expensive MTO licenses, and numerous intermediaries in the payment process.

When financial institutions terminate or restrict banking relationships with MTOs in order to avoid risks and due diligence costs instead of dealing with them, they make the process of sending money overseas more difficult (Paul, 2023) and expensive. In the end, this de-risking practice by banks negatively impacts remittance companies, resulting in higher costs for sending remittances and adversely affecting vulnerable underbanked populations in Somalia. This compels MTOs to resort to physical transportation of cash, resulting in increased costs and longer delivery times for customer funds. This also leads to migrants resorting to informal remittance channels.

Furthermore, the cost of remittances is further exacerbated by fluctuations in exchange rates and the depreciation of sender country currencies against the USD, requiring additional funds to offset loss due currency devaluation. For instance, it cost 8.845 kroner to buy one USD in January 2022, and almost a year and a half later, May 2023, it

³Remittance costs are not just driven by transaction fees, but also by exchange rate margins and currency depreciations against USD.

cost 10.7164 (Nordea, 2023)⁴. The krone has depreciated by 21%. This substantial 21% depreciation adds to the cost of remittances proportionally, as migrants will be required to pay more NOK to buy USD and send money to relatives. When this is added to the existing remittance costs, which comprise commission fees and exchange rate margins, migrant senders bear the brunt and either decrease the remittances they would have sent, incur additional costs, or be discouraged from sending money in the long term.

What's more, another major factor driving up the cost of remittances is the incurred costs in maintaining remittance licenses in sender-side countries. These consist of a wide range of legal, audit, and accounting fees, in addition to updating compliance routines and investing in technology such as online platforms to reduce anti-money laundering and countering the financing of terrorism (AML/CFT) risks. These all factors contribute to further trigger remitting costs and hence can lead to decrease potential remittances in the medium and long term.

Hence, taking these foreseeable challenges into account, this study examines how sender-side events affect remittance flow and frequency. The rising cost of remittance transfers to Somalia is further impacted by shocks originating from the sender side, adding to the already expensive nature of these transactions. The study emphasizes the importance of comprehending the factors behind remittance costs and their impact on fund flow, especially in Somalia, where remittances are crucial for sustaining livelihoods, supporting families during crises, and reducing poverty.

4.2.1 Mechanisms of Remittances: Understanding Remittance Operations

Migrant remittances are transferred internationally through a collaboration between MTOs, intermediaries, and final payment agents. These entities ensure the seamless transfer and distribution of funds to intended recipients while adhering to regulatory requirements in various jurisdictions. Licensed MTOs on the remitter side assist with the initial steps of funds transfer. They rely on partnerships with a range of intermediaries and Hawala networks, primarily in Dubai, East Africa, and Somalia, to ensure the effective delivery of remittances to the final beneficiaries. This partnership highlights complex dynamics involved in facilitating remittance transactions, as exhibited in figures 4.3, which outline the key steps of remittance payment, compliance requirements and payment instructions.

⁴Not only Norway, during the same period Swedish krone devaluated by 15% against USD while Canadian and Australian Dollar weakened by 8% and 10%, respectively.

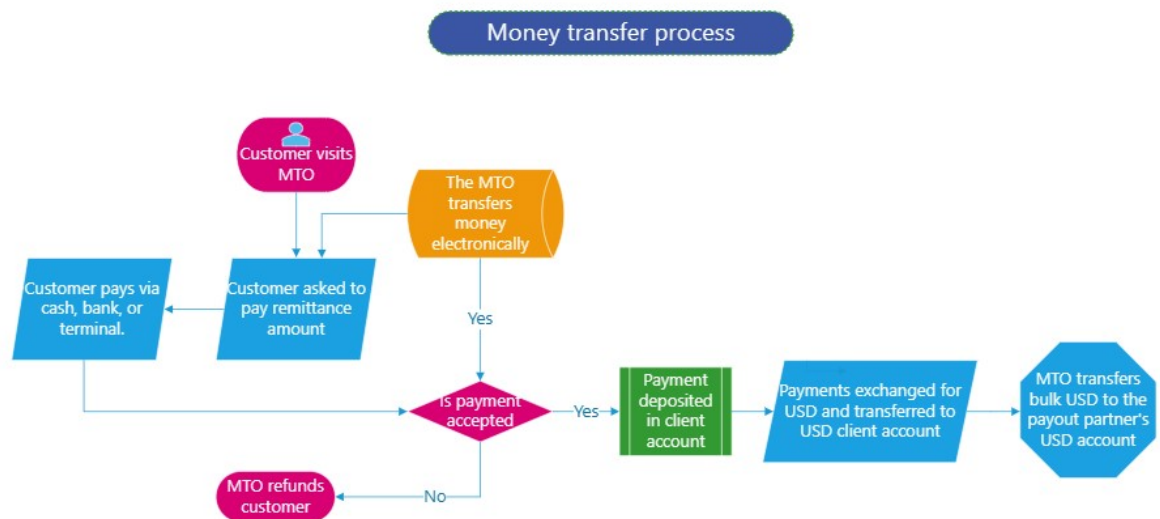


Figure 4.3: *Flowchart illustrating money transfer process*

Note: Exhibits the money transfer process that migrants undergo when sending remittances to their households. The process begins when a migrant approaches for a licensed MTO and ends when the beneficiary household member receives remittances.

The remittance process usually starts when a migrant goes to an MTO, pays the amount, and gives sender and recipient information. The MTO confirms customer's ID and Know-Your-Customer (KYC) information to maintain compliance with regulatory standards. The MTO collects the local currency from the sender and determines the amount to be received by the beneficiary household using the daily exchange rate. The payment is processed and then converted to USD (unless the migrant is from the US), which includes both the principal amount and a transaction fee. The commission or transaction cost obtained by facilitating the funds is split between intermediaries and final payout agents. Payment can be made through bank transfers, cash, or terminal machines. If the AML requirements are not fulfilled, the money is given back to the customer.

The exchange rate is an important element in the remittance process. Somali MTOs (excluding those in the U.S.) convert the sender's currency to USD using the daily exchange rate for transferring remittances. This conversion has a major influence on both the amount a migrant is willing to transfer and the final amount received by the beneficiary. The rates offered by MTOs can differ, impacting their competitiveness, such as between digital platforms and traditional MTOs. The difference between buy and sell rates can substantially impact the overall cost of remittance services, making it an important factor for both senders and recipients to take into account. The complexity of this process is exacerbated by de-risking practices, where financial institutions reduce their exposure to high-risk sectors, including money transfers, due to stringent regulatory re-

quirements. As a result, MTOs may resort to physically transporting cash via couriers to ensure secure fund transfers.

The converted sum of payments received from remitters are transferred to the Hawala headquarter or stored securely as cash. The payout agent distributes funds to ultimate beneficiaries. When MTOs cannot access bank accounts, they ensure to transport collected cash diligently to maintain operations running smoothly.

4.2.2 Peculiarities of Somali Remittance Industry

The Somali remittance sector is characterised by several idiosyncratic features that contribute to its resilience. Central to its operation is the dual-channel system through which it operates, which integrates traditional Hawala networks and licensed MTOs. MTOs, operated by entrepreneurs from the diaspora, are governed by regulations in the countries where they are based, including the US, UK, and other Western nations. In recent years, numerous Hawala operators have acquired licenses in regions like East Africa and Somalia. Despite its still-developing supervisory capabilities, the Central Bank of Somalia has become more involved in regulating and supervising the sector and facilitates the licensing process. In contexts with weak or non-existent banking systems, this regulatory development is vital for stakeholders in the remittance industry to formalize the sector and establish international correspondent banking relationships, improving the direct flow of remittances to Somalia.

Hawala operators, which manage money transfer software and facilitate remittance distribution through its payout agents, are deeply rooted in trust, clan affiliation, and cultural familiarity. This system is especially effective in conflict-affected and fragile states with inadequate banking infrastructure. It depends heavily on personal networks, improving the speed and reliability of transfers. Trust, absence of language barriers, and cultural familiarity between migrants, MTOs, and Hawala operators enable the efficient transfer of remittances to the recipients in Somalia ([Maimbo et al., 2003](#)). Despite its informal origins, Hawala is a cornerstone pillar of economic stability and social cohesion in Somalia.

Western-based MTOs collaborate closely with traditional Hawala systems, maintaining compliance with rigorous AML/CFT regulations. This collaboration shows the industry's ability to meet global regulatory demands and serve the practical needs of the Somali population. Furthermore, the industry's capacity to adapt to de-risking practices by international financial institutions, often resulting in remittance activities shifting to informal and expensive channels, shows its resilience in maintaining financial flows against external pressures.

Beyond facilitating personal remittances, the Somali remittance sector plays a critical role in enabling business transactions crucial to Somalia's import-dependent economy. Furthermore, the gradual shift towards digitalisation, driven by increasing adoption of mobile banking and digital platforms among the diaspora and their families, suggests a future transformation in remittance landscape. Collectively, these characteristics highlight the resilience of the Somali remittance sector, its efficiency in immediately transferring remittances within conflict-affected and fragile areas, and the important role the diaspora plays in rebuilding and contributing to the country's economic growth.

4.3 Related literature

Remittances play a vital role in the global economy. It provides essential external income for recipient households while contributing to the economic growth and development of recipient countries. There is extensive literature that explores the diverse developmental role of remittances. Some of these are economic growth ([Cazachevici et al., 2020](#); [Meyer and Shera, 2017](#)), poverty and inequality reduction ([Arapi-Gjini et al., 2020](#); [Azizi, 2021](#)), asset accumulation ([Ajefu, 2018](#); [Chiodi et al., 2012](#)), healthcare improvement ([Berloff and Giunti, 2019](#)), increased expenditure in education ([Ambler et al., 2015](#); [Askarov and Doucouliagos, 2020](#)), financial inclusion ([Aga and Martinez Peria, 2014](#); [Anzoategui et al., 2014](#); [Gautam, 2019](#)), household savings ([Benhamou and Cassin, 2021](#); [Osili, 2007](#)) and increased investment ([Adams Jr and Cuecuecha, 2013](#); [Gyimah-Brempong and Asiedu, 2015](#)). Recognising the critical role remittances play, policy makers in developed and developing countries are actively advocating avenues to increase and facilitate remittance flows, particularly to support impoverished households.

While the above research establishes the development potential of remittances, it tends to assume that remitting behaviour is stable or altruistic. It often overlooks the extent to which migrants adjust the timing, amount, or channel of remittances in response to changing economic conditions in host countries. There is evolving research on diverse factors that influence migrants' behaviour and, subsequently, remittance flows. Two such key factors are migrants' economic conditions ([Joseph et al., 2018](#); [Padhan et al., 2022](#); [Ratha et al., 2016](#)) and transaction costs ([Beck et al., 2022](#); [Bersch et al., 2021](#); [Da Silva Filho, 2021](#); [Freund and Spatafora, 2008](#); [Beck and Martínez Pería, 2011](#)).

Migrants' economic conditions, which are influenced by their employment status and wages, can have a significant impact on remittance flow. For example, [Ratha et al. \(2016\)](#) found that migrants' remittances to developing countries reached approximately USD 436 billion in 2014, a 4.4 percent increase over the 2013 level. While all develop-

ing regions experienced an increase, remittance flow to Europe and Central Asia (ECA) declined because of the weakening of the Russian economy and the depreciation of the ruble. The finding underscores economic challenges, such as those experienced by Russia and migrant destination countries in general, which affect currency value, unemployment rates, and overall economic growth, can significantly reduce the amount of remittances migrants can send to their home country.

[Joseph et al. \(2018\)](#) used a large-scale, administrative data matching remittances and monthly payroll disbursements to show how migrants' earnings in the United Arab Emirates (UAE) affect their remittances. They examined several conditions that cause income changes in the UAE, including Ramadan, weather shocks, a labour reform, and returns to time. They show that when migrants income changes as a result of any of the external factors above, the amount migrants remit changes proportionally. [Padhan et al. \(2022\)](#) examined the cyclical patterns of remittances, migrants' stock, and income in 31 pairs of countries with India for the period from 2010 to 2016. They found that remittances and migrant stocks move in the opposite direction of the income of the country of origin while in the same direction (pro-cyclical) as the income in the destination country. This means that migrants send more money home, and the number of people migrating increases as the income in the host country goes up.

The impacts of transaction cost, which is the focus of this paper, has also been documented. For example, [Freund and Spatafora \(2008\)](#) analysed cross-country data encompassing 66 countries and found that recorded remittances were positively correlated with migrant stocks and negatively correlated with transaction costs and exchange rate restrictions. Correspondingly, [Beck and Martínez Pería \(2011\)](#) used a large dataset that covers 119 country corridors, showing that the size of migrant communities, among other factors, contributes to decreased remittance transaction costs. The other factors include banking industry competition and reduced barriers to accessing financial services. In a recent study, [Beck et al. \(2022\)](#) utilise a large dataset on remittance costs and show that cost and risk constraints, as well as market structural factors, make it difficult to find cost-effective remittance transfer rates. Through corridor and firm-specific analysis, they found that lower transaction costs are correlated with factors such as higher per capita income, enhanced geographical accessibility to financial institutions, a larger remittance market, proximity between sender and recipient countries, rivalry among remittance service providers, and adherence to a pegged exchange rate regime.

Other factors that could lower transaction costs include financial technologies. [Bersch et al. \(2021\)](#) explored the impact of FinTech in facilitating cheaper and efficient remittances, highlighting its potential to reduce transaction costs associated with money trans-

fers. Finally, [Da Silva Filho \(2021\)](#) examined the remittance ecosystem in depth and found that it is a complex, diverse, and unequal environment. There are numerous factors that drive costs, and no quick and straightforward fixes are available. The multiple, heterogeneous, and complex issues showcased encompass regulatory concerns, including exclusivity clauses that hamper competition among RSPs, strict AML/CFT regulations, restrictive licensing, a lack of transparency in the remittance industry, and an increased likelihood of banks incurring elevated remittance transaction costs.

Besides transaction costs, another strand of literature investigates the cost elasticity of remittances. These comprise various types of research, ranging from cross-country and panel studies focused on specific countries. For the cross-country and panel studies, [Ahmed et al. \(2021\)](#) examine how reducing transaction costs affects remittance flows to developing countries, analysing the potential for larger amounts to be transferred as the cost per transaction decreases. Results indicate that transaction costs have a notable effect on formal remittance volume, with a 1% cost reduction for transferring USD 200, resulting in an approximately 1.6% increase in remittances. The findings underscore the importance of policy interventions to decrease transfer costs by utilising financial intermediaries, thereby improving formal remittances.

Similarly, [Kpodar and Imam \(2024\)](#) analyse the elasticity of remittances to transaction costs utilising a newly constructed quarterly panel database covering 71 countries. They find that cost reductions initially enhance migrant remittances within a quarter before achieving a steady increase at a higher level. Their estimates show that lowering remittance fees to the Sustainable Development Goal target of 3 percent could cause an extra US\$32 billion in remittances. They also identify heterogeneity in cost elasticity across recipient country characteristics. Analysis of micro-data from the USA–Mexico corridor supports the finding that migrants confronting higher transaction costs remit less, particularly among skilled migrants and those with access to a bank account.

At the country level, [Ferriani and Oddo \(2019\)](#) reveal that remittances have a negative correlation with high transaction costs and slow transfer speeds. They utilise remittance outflows data transferred through licensed financial intermediaries from Italy, indicating that migrants prioritise efficiency and cost-effectiveness when channelling funds to their stay-behind households, opting for faster and more cost-efficient approaches. Similarly, [Kakhkharov et al. \(2017\)](#) explore the key factors driving the increasing volume of remittances in the post-Soviet states. Results indicate that lowering transaction costs and currency depreciation in the sender country are primary drivers of remittance growth. Moreover, the authors reveal that lower transaction costs have a negative correlation with remittances, indicating that migrants choose formal channels over informal ones when

transfer costs decrease.

Further research in specific countries—including the Netherlands [Kosse and Vermeulen \(2014\)](#), Pakistan [Ahmed and Martínez-Zarzoso \(2016\)](#), and Tonga [Gibson et al. \(2006\)](#)—highlights the negative effects of transaction costs on remittances. In summary, these studies signal that transaction costs have detrimental effects on formal remittance inflows, primarily due to excessively high remittance fees, prompting migrants to use informal channels for remittances. However, this literature remains primarily focused on formal cost structures and does not extend the analysis to other external shocks that affect migrant remittance decisions.

Building on this background literature, the present study shifts the focus to broader behavioural responses. In particular, it empirically quantifies how migrants respond to changes in their sending environments—such as exchange rate depreciation, de-risking, and inflation—which may affect their remittance capacity, frequency of remitting, and incentive to send money at a given time. External shocks from the sender side can have an adverse effect on remittance flows by making remittances too costly, particularly from the sender's perspective. Shocks such as exchange rate fluctuations, inflationary pressures, and regulatory changes can significantly influence migrants' behaviour and remittance levels.

For instance, exchange rate depreciations of host country currency against the USD (the default currency used Somali MTOs when transferring funds to different areas) make remittance sending costly, as migrants are required to pay more of the local currency for the same amount in USD. Migrants react quickly to such shocks due to the immediate nature of MTO-based transfers. If depreciation intensifies, migrants often wait for appreciation before resuming remittances. In the same vein, inflationary pressures reduce migrants' disposable income and remitting capacity. Regulatory measures such as de-risking—where banks close the accounts of money transfer operators (MTOs)—may lead to reliance on informal mechanisms or physically transporting cash, increasing the logistical and security burdens of sending money. Unlike exchange rate changes, which can potentially reduce or increase effective remittance costs depending on timing, shocks such as inflation and de-risking predominantly constrain the migrants' ability to remit.

In summary, the present study contributes to the literature by shifting the analytical focus to how migrants respond to economic shocks from their side. This is an issue that remains largely under-explored, especially when the recipient side is a context of fragility and conflicts. While previous research has mostly focused on recipient-side determinants and macroeconomic outcomes, this study focuses on how senders adapt their remittance behaviour in response to constraints, such as exchange rate depreciation, inflation, and

regulatory pressures, including de-risking. This consideration views migrants as rational agents who respond and adapt to changing economic realities in their host country. Such conception allows for a more in-depth understanding of the relationship between sender dynamics and remittance flow and frequency. This study not only contributes to the theoretical literature on the diverse determinants of remittances but also provides further empirical insights into remittances in contexts similar to Somalia, where transnational financial lifelines are both critical and vulnerable.

4.4 Data

The dataset used in this study comprises administrative records of migrant remittance transactions from January 2017 to May 2023. It includes 7.2 million transactions sent by 231,394 unique senders. The migrants who live in Australia, Canada, Norway, Sweden and the United States transferred multiple remittance transactions, which were aggregated into monthly totals for analysis. Each record includes the total amount sent by a customer in a month, along with the associated transaction costs and details of the recipients.

These transactions, sourced from prominent Somali MTOs, offer a detailed overview of migrant remittance sending behaviour during the specified period. The majority of migrants originate from Somalia and regularly send remittances to their stay-behind households, while only a minor fraction of migrant remitters are from Ethiopia, Eritrea, and South Sudan. Most Somalis send money to Somalia. Nevertheless, some immigrants send remittances to nearby countries like Kenya, Ethiopia, and Uganda, as well as to the Middle East, like the UAE. Remittances are also channelled to different parts of the globe.

Prior to analysis, the dataset was pre-processed by merging country datasets, transforming remittance variables into inverse hyperbolic sine (IHS)⁵, generating year-month periods, and anonymizing personally identifiable information to ensure compliance with data privacy regulations. Each sender was assigned a unique ID based on their country of residence and full name.

⁵The IHS transformation is often used in applied econometric research to convert right-skewed variables, regardless of their magnitude. The IHS transformation handles the variance and skewness in our remittance data (containing small and large amounts), enabling analysis without sacrificing the clarity of the original values. Unlike the natural logarithm, which requires positive values and leads to the loss of observations with very small amounts, the IHS transformation can handle both small and large values without dropping data, making it especially appropriate for remittance variables that include a wide range of transaction sizes.

Table 4.1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Total Amount Sent	7272017	389.394	1229.719	0.105	300291.34
Amount Sent	7272017	373.185	1196.552	0	291545
Transaction Cost	7272017	16.209	1229.719	0	8746.35
Transaction Cost (%)	7272015	0.053	0.014	0	20
Exchange Rate	7272017	5.54	3.948	1.213	11.123
ER Change	7199326	−0.001	0.028	−0.074	0.1
Total Remit Cost (%)	3242048	0.087	0.031	−0.034	4.075

Monthly Descriptive Statistics

Total Amount Sent	2666288	1061.995	2664.45	0.12	437445.38
Amount Sent	2666288	1017.789	2587.454	0.11	428868
Amount Sent (NO)	294178	795.794	2149.444	0.11	428868
Amount Sent (SE)	249793	550.315	1195.621	0.888	97650
Amount Sent (CA)	389877	681.734	1684.272	2	198376
Amount Sent (AU)	411577	708.138	1645.06	10	190850
Amount Sent (US)	1320863	1351.315	3210.56	1	340000
Transaction Cost	2666288	44.206	80.924	0	8907.1
Transaction Cost (%)	2666288	0.052	0.011	0	4
IHS Remittances	1366737	7.405	1.357	0.12	13.873
Remit Frequency	2666288	2.727	2.647	1	121
Migrant ID	2666483	111851.82	64691.703	1	231394
Event Time	2666483	−4.394	33.742	−71	62
Treated	2666483	0.231	0.421	0	1
Exchange Rate	1345425	4.448	3.787	1.213	11.123
ER Monthly Change	890140	0.001	0.026	−0.074	0.1
Remit Cost (%)	890140	0.087	0.031	−0.034	4.075
Remit Cost (NO) (%)	188755	0.088	0.028	0.006	0.421
Remit Cost (SE) (%)	169711	0.081	0.03	−0.014	0.158
Remit Cost (CA) (%)	254051	0.098	0.017	−0.006	0.15
Remit Cost (AU) (%)	277623	0.088	0.032	−0.01	4.055

Notes: Remit Cost is the percentage of total direct and indirect costs that constitute transaction fees, fixed exchange rate margin, and the net percentage of exchange rate monthly changes—the net depreciation and appreciation of local currency against USD. NO, SE, CA, and AU represent the country codes for Norway, Sweden, Canada, and Australia, respectively. IHS remittances represent the remittance amounts transformed using inverse hyperbolic functions. Migrant ID refers to the unique identification given to each sender. Treated equals 1 when migrants experience shock events and 0 otherwise.

Table 4.1 presents the descriptive statistics for the main variables. The average amount sent is 373 USD with transaction cost of 5%. The total remittance costs, which comprise direct fees, exchange rate margin and net exchange rate monthly change, amount to about 9%. Nevertheless, during periods of high exchange rate depreciation, the transac-

tion costs on average increase by 19%. When we analyse the data on a monthly basis, the number of transactions is 2.66 million, and the average monthly amount sent is \$1017.

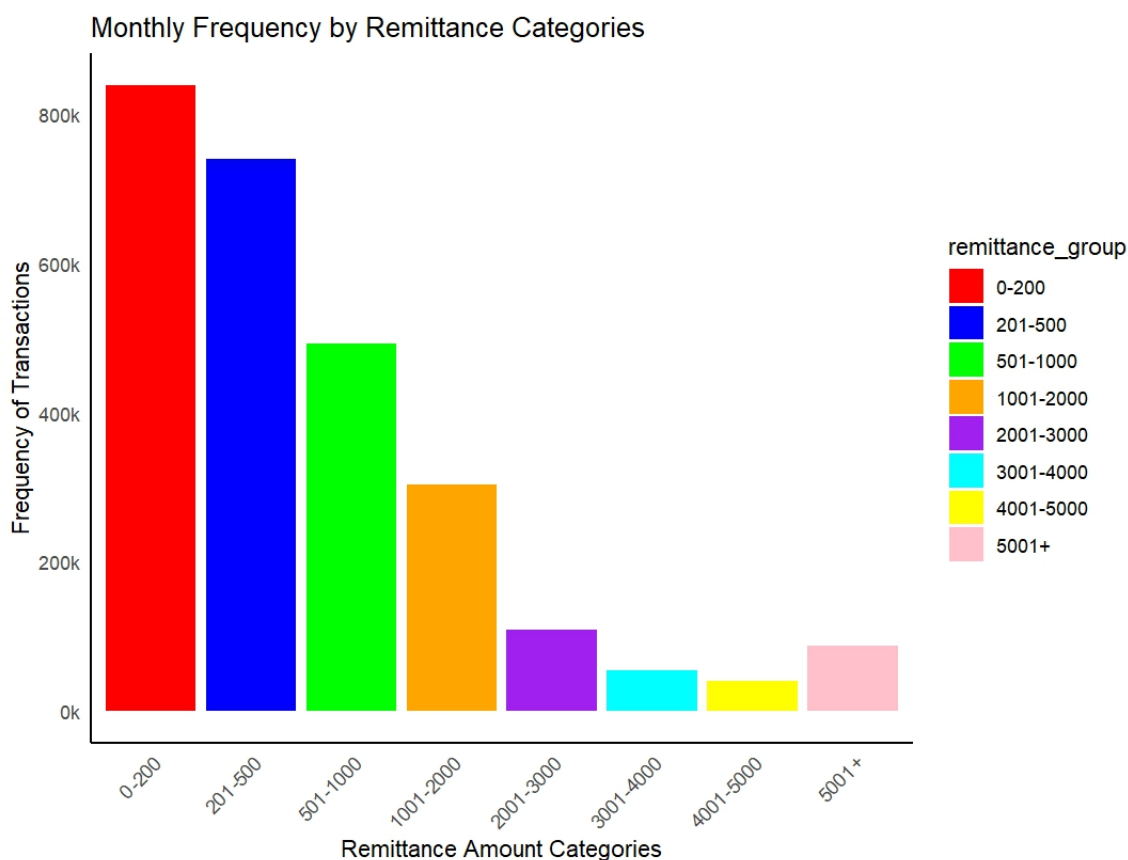


Figure 4.4: *Monthly Frequency Distribution of Remittance Amounts. Source: MTOs databases.*

Note: The figure illustrates the frequency distribution of selected remittance amounts. The most frequent remittance amounts fall within the 0–200 range, whereas remittances exceeding 5000 occur far less frequently, indicating a skew towards smaller remittance amounts.

Furthermore, Figure 4.4 exhibits frequency by selected remittance amount categories. The highest frequency amount group being 0–200 and constitute 78% of total transaction and lowest being 4001–5000. Overall, large amounts are infrequently transferred. Moreover, percentage of direct fees paid by remittance categories is shown in Figure 4.5, revealing that average fees paid are 5% for most of transactions until it decreases to 4% and further 3% for larger transactions beginning from 5001 and above, respectively.

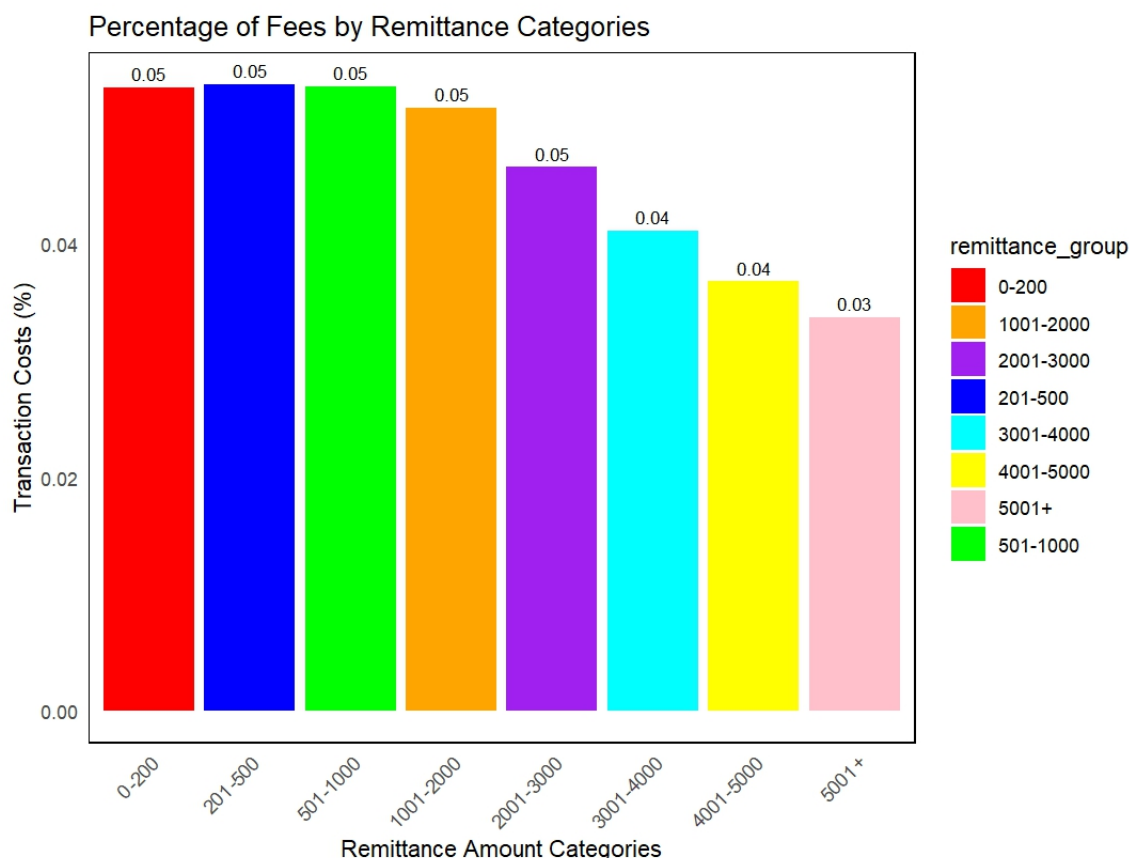


Figure 4.5: *Transaction Fee Structure Across Remittance Categories.* Source: MTOs Databases..

Note: The figure presents the percentage of transaction fees paid across different remittance categories.

Remittance amounts in the 0–3000 range incur the highest transaction costs at 5%. As remittance amounts increase, fees decrease, decreasing to 4% for remittances between 3001–5000 and further to 3% for remittances exceeding 5000. This pattern reflects a declining fee structure for larger amounts.

Migrants may also send larger amounts of money for savings, supporting their families, self-interest, or investments. In this scenario, additional compliance questions are asked, such as proof of income and the purpose of sending money. Remittances are primarily sent with the goal of helping families in times of crisis or to sustain their livelihoods. The data has the potential to uncover insights into unanswered research questions about how migrants behave and respond to external shocks from the sender side, as well as provide an understanding of remittance motives at the individual level. Additionally, it allows us to connect it to external events or shocks that demonstrate migrants' reactions.

Remitting has been explored in literature with various motives, including altruism, self-interest, and investment (Hoddinott, 1994; Lucas and Stark, 1985; Rapoport and Docquier, 2006). With the data, we can also analyse how frequently migrants transfer money, which is dependent on ongoing events. The reasons behind remittances are influenced by several external factors, including remittance costs, access to affordable

banking, de-risking, and host country exchange rate fluctuations. By using transaction level data, we can analyse the behaviour of diverse migrants who are scattered across different countries but still have connections to their home and relatives. This research will pioneer the utilization of transaction level data on migrants from a war-torn country that heavily relies on remittances from the diaspora.

4.4.1 Host Country Currency Movement in Response to USD Fluctuations

Somali remittance companies have served as efficient and reliable channels for transferring funds across borders for decades, particularly in Somalia, where conventional banking systems are dysfunctional. Facilitating remittances in environments where formal banking infrastructure is non-existent, these MTOs have become crucial means for transferring migrant remittances worldwide, typically using the US dollar (USD) as the default currency and holding USD to facilitate transactions. When migrants transfer remittance, they essentially buy USD from the MTO using their local currency at a buy rate set by central banks or financial institutions.

In Somalia, recipient households receive remittances in USD due to its fully dollarized economy. However, recipients in other countries may receive remittances in either USD or the local currency. Migrants use the exchange rate as a benchmark for their remittance transfers, which is determined by various macroeconomic factors and fluctuates daily. Hence, sender-side exchange rate dynamics between the local currency and the USD significantly affect migrant remittance flows and play a crucial role in shaping the value of remittance transfers. Understanding exchange rate dynamics and their impact on remittance amounts is vital for evaluating the effectiveness of migrant remittance transfers as a financial support mechanism.

Remittances are sent daily by the migrants, but the volume of remittances sent is at its peak at the beginning and end of each month as recipient families heavily rely on funds to support their livelihoods. Except for the US, the potential amount of remittance transfers is largely affected by the exchange rate dynamics influenced by numerous factors such as macroeconomic conditions, monetary policies and geopolitical developments. We use transaction-level data from several developed countries, including Norway, Sweden, Canada, Australia and the US. Except for the US, these countries have experienced fluctuations in their exchange rates against the USD. This section presents the dynamics of exchange rates and their implications for remittance costs.

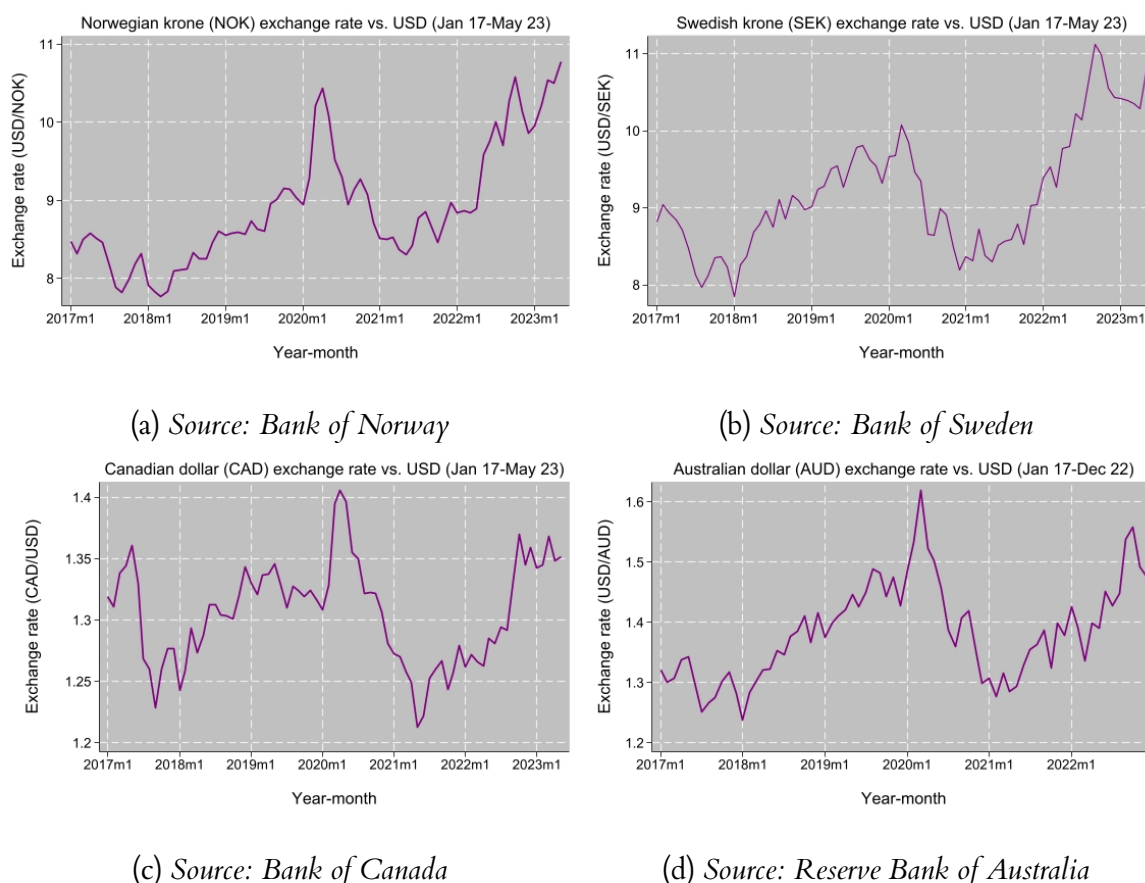


Figure 4.6: Monthly plots illustrating the exchange rate trend between January 2017 and May 2023.

To evaluate how remittances are interlinked with exchange rates (ER), historical monthly average exchange data for Norway ⁶, Sweden ⁷, Canada ⁸ and Australia ⁹ from 2017–2023 are used and sourced from the respective central bank’s official website.

Figure S9 (S8a, S8b, S8c and S8d) exhibit the exchange rate trends from Jan 2017 to May 2023 for Norway, Sweden, Canada and Australia. As the figures illustrate, average monthly exchange rates fluctuate, highlighting variations in the local currency valuations against the USD. Figure S6 (a, b, c, and d) in the Appendix depict monthly percentage changes in exchange rates of the countries relative to USD for the same period. The figures show that there are months in which the exchange rate depreciated by 9%, which implies that the cost of transferring remittances jumps 9% in addition to the standard fees. This volatility in exchange rates reflects the dynamic nature of currency markets

⁶<https://www.norges-bank.no/tema/Statistikk/Valutakurser/?tab=currency&id=USD>

⁷<https://www.riksbank.se/sv/statistik/rantor-och-valutakurser/sok-rantor-och-valutakurser/>

⁸<https://www.bankofcanada.ca/rates/exchange/monthly-exchange-rates/#download>

⁹<https://www.rba.gov.au/statistics/frequency/exchange-rates.html>

and their sensitivity to various economic factors, eventually affecting the cost of money transfers.

Exploring exchange rate dynamics reveals variations in exchange rates between the local currency and USD. These fluctuations have significant implications in determining transfer costs, as they directly affect remittances transferred and received by final beneficiaries. For instance, when a remittance sending country's currency weakens against the USD, it implies that more units of the local currency are required to exchange the equivalent amount of USD for the transfer.

Consequently, in addition to already high transfer fees, migrants confront higher transaction costs as they are compelled to exchange an additional sum of their local currency to meet the USD-denominated remittance amount. The devaluation scenario inflates the overall costs of transferring remittances to stay-behind households, posing financial burdens to migrants and recipients. In contrast, when the local currency strengthens against the USD, senders are not subject to additional transfer costs that they would have had if the local currency had depreciated. In this scenario, migrant senders benefit from reduced transfer costs as fewer units of host nation currency are required to obtain the equivalent USD amount.

Motives of remitting are influenced by a wide array of factors as highlighted by the literature; however, dynamics of sender-side exchange rate fluctuations is one of them, albeit ignored by the existing literature. Depreciation or appreciation of sender-side currencies significantly impacts the amount of remittances transferred by migrants. On the other hand, the existing literature has explored exchange rate fluctuations and how they affect the economy of recipient countries ([Hassan and Holmes, 2013](#); [Hien et al., 2020](#); [Roy and Dixon, 2016](#); [Singer, 2010](#); [Uddin and Murshed, 2017](#)). These studies have shown that remittance causes “Dutch disease” and hence appreciates the real exchange rate of recipient countries. Nevertheless, little is known about the sender-side ER fluctuations, particularly when local currency depreciates against the USD, inflating the cost of remittance transfers and thereby diminishing the purchasing power of migrants, which eventually reduces the amount sent and frequency of remitting.

4.4.2 Consumer Price Index (CPI): Impacts on Sender Purchasing Power

Inflation can erode the purchasing power of migrant remitters, affecting the amount of money they can send back home. In this study, we also analyse a shock in the form of an increase in CPI, specifically an unexpected rise in electricity and food prices. Using

Sweden Statistics data, we create an event in response to a substantial increase in the cost of living. Our objective is to explore the relationship between shocks and the sending behaviour and frequency of remittances among Somali migrants. The typical profile of Somali immigrants, particularly in Scandinavian countries, is characterized by employment in informal sectors, lower employment rates, limited skill sets, and relatively lower incomes compared to other immigrant populations (Bevelander and Luik, 2020; Olsen and Askvik, 2021). The susceptibility of these migrants to cost of living crises can diminish their purchasing power, leaving fewer funds for remittances. When migrants face high living expenses, they tend to reduce the amount of money they send back home, and this reduction has a greater impact when prices of electricity, housing, and food increase compared to service costs. Studies have shown that high inflation rates cause migrants to send less money back home (Al-Abdulrazag and Foudeh, 2022). Sweden experienced a rise in the 12-month inflation rate for the Consumer Price Index with fixed interest rate (CPIIF) from 9.5 percent in November to 10.2 percent in December 2022. Furthermore, the CPI-based inflation rate in December was 12.3 percent, unlike CPIIF which is impacted by interest rate shifts. December saw a 28.8 percent increase in electricity prices from the previous month. Food prices have seen an 18.6 percent increase over the year.

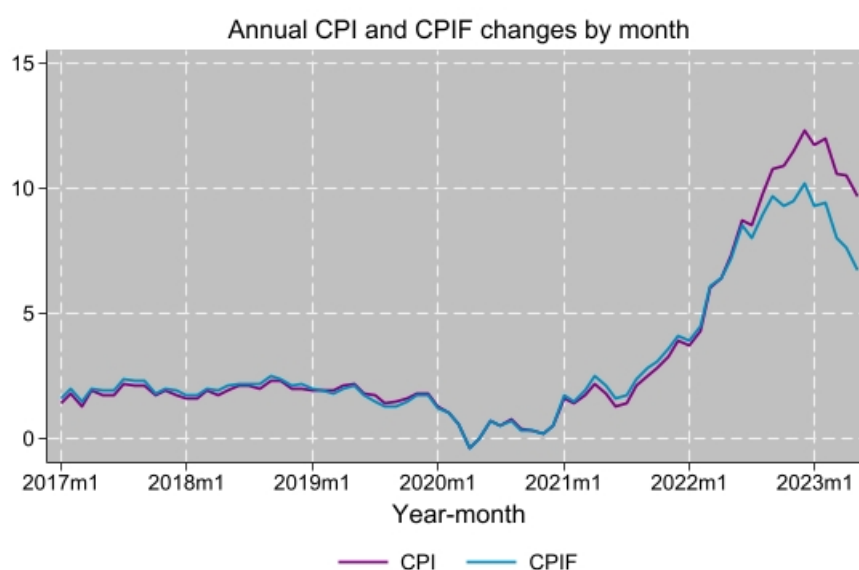


Figure 4.7: *Annual CPI and CPIIF changes by month. Source: Sweden Statistics*

Note: The figure shows monthly changes in Sweden's CPI and CPIIF. Both variables track price trends for goods and services, but the CPIIF excludes the direct effects of changing interest rates on household mortgages. The CPIIF is the preferred inflation measure for Sweden's central bank, the Riksbank, in targeting inflation. Conversely, the CPI is used to measure interest rate unpredictability and is often utilised to identify changes in compensation.

The living standards of Somali immigrants are directly influenced by the increase in electricity and food costs. These immigrants struggle with surviving and a jump in CPI, especially electricity and food price, means that their purchasing power will be severely reduced, which will eventually affect frequency and flow of sending remittances.

4.4.3 De-risking

Remittance service providers, which are non-bank entities, depend greatly on banks for channelling funds across borders through intermediary agents. To facilitate payments, they must access banking accounts and use a correspondent bank to transfer funds from the sender's bank to the receiver's bank, ultimately resulting in payment to the beneficiary recipient. The availability of banking services allows the diaspora to send remittances to recipient households that heavily depend on them, especially in situations of crises, violence, or natural disasters where urgent monetary aid is necessary to sustain their livelihoods.

In recent years, de-risking has become a significant challenge for money transfer operators (MTOs) in the remittance industry. Somali MTOs or Hawala have faced intense scrutiny from authorities and financial institutions. This has led to the restriction and closure of their bank accounts in Europe, the US, Australia, and Canada. As a result, the flow of remittances from migrants to their families back home has been severely impacted. De-risking began in the US in 2012, followed by the UK in 2013, Canada in 2018, and the Scandinavian countries mainly in 2018/2019.

Due to fears of money laundering and terrorism financing, several major banks decided to close accounts held by Somali MTOs. Banks view MTOs as high risk due to the presence of terrorist organizations and weak governance in Somalia, making it difficult for them to manage the risk of sending remittances. As a result, these MTOs were essentially excluded from the banking system, leading to a disruption in the flow of migrant remittances to vulnerable populations in Somalia. The abrupt decline in remittance inflows had severe repercussions for families dependent on these funds for their daily lives, highlighting the extensive influence of de-risking on financial inclusion and poverty alleviation endeavours.

With the de-risking announcement causing a shock to the flow of funds, MTOs must find alternative means to transfer funds, primarily relying on cash transactions. De-risking promotes informal remittances and cash transportation, but it obstructs the flow of funds and raises the time and cost of sending money overseas due to added risks and transportation expenses. Most countries oblige MTOs to submit daily reports and audited annual statements, and failing to do so will result in license revocation. Due to in-

creased scrutiny from banks and authorities, auditors are avoiding establishing customer relationships with MTOs and neglecting to provide audit reports. This has caused the revocation of licenses for many MTOs. The absence of consistent guidance and communication among MTOs, banks, auditors, and authorities has caused numerous MTOs to exit the market.

The focus of this study is also to explore the impact of de-risking on remittance flow and frequency. Based on communication notifications sent to MTOs by banks in Norway and Canada, we examine how de-risking affected the flow of funds and frequency of money sending. We create event dates based on a one-month lag in the de-risking announcement decisions. The noticeable impact occurs a month later when MTOs scramble to transfer funds and notify customers before shutting down their bank accounts.

4.4.4 Control Variables

In the event study, including control variables in the regression equation is not mandatory. However, including control variables is important for accounting for potential confounders and improving the reliability of our analysis. This study examines how macroeconomic shocks impact the purchasing power of individual migrants and influence their decision to send remittances back home. These decisions are shaped by diverse external macroeconomic variables that have interdependencies and directly or indirectly affect money transfers. Hence, variations in macroeconomic indicators, like per capita GDP, significantly impact the choices of migrant remittances. In our regression analysis, we incorporate this covariate to evaluate its impact on the results in comparison to not including any control variables. The results are shown in [A1](#) in the Appendix.

4.4.5 Creation of event dates

To create event dates, we first identify three types of pivotal events for the analysis: exchange rate depreciation, an increase in the Consumer Prices Index (CPI), and de-risking. We aim to analyse the impact of these events on the monthly flow of migrant remittances and the frequency of remittance sending. We have multiple events that occur in different countries at different periods. Therefore, we use a staggered adoption design to study the effect of these events on the outcomes of interest. Next, we establish a time-frame for the event (event window), which shows the period during which the event's effects are expected to be observed. This usually comprises a pre-event period, the event period, and a post-event period. The event window will be 6 months pre/post-event.

We use historical average exchange rate trends, CPI and de-risking data from re-

spective government central bank databases and credible sources . These data are crucial for identifying and selecting event dates to investigate how the occurrence of the events affects our outcomes of interest. Since the exchange rate of local currency vs USD can fluctuate wildly, the study will select event dates which cause unexpected reductions/increases in money sending. Throughout the study, we will also choose several event dates and event windows to see how events and outcomes are interlinked. Table 4.2 illustrates events of interest, their description, event dates and event windows.

Exchange rates fluctuate daily and there are certain days or months in which it fluctuates significantly. When the local currency depreciates significantly against the USD which inflates the cost of remittance transfers, migrants may still continue to send crucial lifeline remittances as planned or reduce slightly. In these cases, the significance depreciation of local currency (occurrence of event) may not cause significant reduction to remittance transfers or frequency, but the effect of the event or shock may manifest at a later time, suggesting that there could be a lag in the event's effect, thereby affecting remittance decisions of migrants sometime after the event has elapsed. We therefore also create lagged event dates to see how lag of shocks affect migrant decisions.

Table 4.2: Event Descriptions and Dates

Country	Event	Description	Event Date	Event Window
Sweden	Spike in CPI	Electricity and food prices rose by 29% and 16%	Dec 2022	June 2022 - May 2023
Norway	De-risking	Bank accounts belonging to MTOs were restricted or closed.	March 2019	Sept 2018 - Sept 2019
Canada	ER depreciation & de-risking	The bank accounts of MTOs were closed and the ER depreciated against the USD.	March 2018	Sept 2017 - Sept 2018
Australia	ER depreciation	AUD has experienced a significant depreciation against USD	Oct 2022	Apr 2021 - Apr 2023

Note: Monthly currency depreciation in the host country against the USD implies that the local currency where the migrant resides has depreciated relative to the default USD used for remittance transfers in the previous month. Other shock events include de-risking, which happens when banks terminate or restrict bank accounts of remittance service providers, and an increase in the cost of living, which diminishes the purchasing power of migrants, potentially reducing their ability to transfer money.

4.5 Empirical methodology

The behaviour of those sending remittances can be influenced by events or macroeconomic shocks. The study investigates how these events influence the flow and frequency of diaspora remittances. Migrants live in different developed countries and go through events at varying times. The analysis takes into account the temporal and spatial heterogeneity introduced by the variation of treatment and events across countries and time periods.

To account for this variation, the study adopts a staggered adoption design within an event study framework. In a staggered adoption setting, different units—here, migrants residing in various countries—are exposed to a given treatment (or shock) at different times, rather than simultaneously. This contrasts with classical difference-in-differences (DID) designs, which assume common treatment timing across units. The staggered adoption design enables the analysis of dynamic treatment effects by leveraging variation in exposure timing.

In this framework, groups face the intervention at different times. Those who have already experienced the event are part of the treatment group, while those who have not yet been exposed serve as the control group during that period. In our study, the control group comprises individual migrants who have not experienced any events or shocks at a given point in time, while the treatment group consists of migrants who faced currency fluctuations, a rise in living expenses, and a process known as "de-risking," which refers to regulatory and compliance practices that lead banks to restrict or terminate banking relationships with perceived high-risk clients, including money transfer operators. Under the staggered adoption design, the treatment and control groups can switch roles due to variation in event timing, implying that migrants transition from untreated to treated at different times. Early adopters become the treatment group, while later adopters serve as the control group during earlier periods, allowing for comparison of pre- and post-event exposure. This dynamic feature of staggered treatment timing is central to the empirical strategy, as it enables the identification of time-varying effects of shocks.

Migrants from the United States serve as pure controls, as they are not exposed to any of the studied shocks over the analysis period. Since the default currency for remittances from the US is USD, they do not face sender-side exchange rate fluctuations, making them an ideal reference group.

In exploring these dynamics, the literature has heavily relied on the two-way fixed effects (TWFE) model, also called DID, to analyse how events affect the outcome variable. The two-way fixed effects model accounts for fixed effects in both groups and time,

enabling the measurement of treatment effects across time. The mathematical representation of the model is as follows:

$$Y_{it} = \alpha + \lambda_i + \delta_t + \gamma D_{it} + \varepsilon_{it}$$

Where Y_{it} represents the amount of remittances transferred and frequency of remitting for migrant i at time t , λ_i and δ_t represent unit and time fixed effects, respectively. D_{it} is a dichotomous variable capturing the occurrence of an event for migrant i at time t , and ε_{it} denotes the error term.

Nevertheless, it is crucial to acknowledge that the two-way fixed effects model is not without limitations. A growing body of literature, including papers by [De Chaisemartin and d'Haultfoeuille \(2020\)](#), [Callaway and Sant'Anna \(2021\)](#), and [Goodman-Bacon \(2021\)](#), highlights challenges in interpreting estimated coefficients, particularly in cases where treatment effect heterogeneity is evident across different groups or time periods. The two-way fixed effects model assumes homogeneity in treatment effects, which may not hold true in many real-world scenarios. In such circumstances, interpreting the estimated coefficients becomes challenging, as the method does not explicitly account for variation in treatment effects. This underscores a critical limitation of the two-way fixed effects model in capturing the nuanced dynamics of treatment effects in complex settings.

These issues are especially relevant when treatment timing is staggered and effects may vary by timing and unit. Under such circumstances, alternative models are necessary to avoid biased estimates.

In response to these challenges, this study adopts the panel event study framework, developed by [Freyaldenhoven et al., \(2019\)](#), to analyse how different events or shocks affect the flow of migrant remittances and the frequency of fund transfers. This framework can visually represent the impact of an event by comparing variations in estimators around the baseline time. The framework assumes that events are endogenously independent of future temporal changes to ensure consistent outcome estimation. This model is an expansion of the standard two-way fixed effects model, including all subsequent periods and estimating the average treatment effect ([Goodman-Bacon, 2021](#)). This design is distinct from typical DID models, which assume a common timing for events among all individuals, and from interrupted time series models, which do not account for the effects of additional confounding factors that may occur around the event.

The event study framework is particularly well-suited for staggered adoption designs, as it includes relative time indicators (leads and lags) that capture treatment dynamics over time for each unit based on the specific timing of their exposure.

In addition to handling variation in treatment timing, the event study framework offers several advantages over TWFE methods. It allows for the analysis of pre-treatment trends ¹⁰, helping analyse the plausibility of the parallel trends assumption, and enables the examination of post-treatment dynamics, such as the timing, intensity, and duration of effects—whether temporary, persistent, or fluctuating (Clarke and Tapia-Schythe, 2021).

The framework requires a definition of treatment and control groups. In our context, the treatment group includes immigrants from Australia, Canada, Norway, and Sweden, while migrants from the United States serve as pure controls. These countries were selected primarily due to data availability and the concentration of the Somali diaspora.

We have a panel comprising migrants (i) and time periods (t). Each individual migrant (i) is treated as a unit of analysis and assigned a unique identity (ID). Our objective is to estimate the effect of an event (a treatment) occurring at different time periods in countries where migrants reside. The dependent variable is the daily remittance transaction values sent by migrants, observed at different time periods ($t = t, \dots, t$), aggregated at monthly, weekly, or quarterly intervals depending on the level of analysis.

A variable, $Event(m)$, records the time t when an event occurs in country c and is experienced by migrant i . To estimate its impact, we examine outcomes across a symmetric time window before and after the event—referred to as the effect window. This variable takes the value 0 at the time of the event, negative values in pre-event periods, and positive values in post-event periods. The outcome of interest is denoted as $Remit_{ict}$. The panel event study specification estimates the dynamics of treatment effects across this window of time for all periods ($t = t, \dots, \bar{t}$).

$$Remit_{ict} = \alpha + \sum_{j=1}^J \beta_j (Lead\ j)_{ict} + \sum_{k=1}^K \gamma_k (Lag\ k)_{ict} + \mu_i + \eta_t + X'_{ict} \Gamma + \varepsilon_{ict} \quad (4.1)$$

In this equation, $Remit_{ict}$ represents the inverse hyperbolic sine (IHS) transformed remittances sent by migrant i residing in country c at time t . The IHS transformation is applied to handle the right-skewness and presence of very small as well as large remittance amounts, allowing for meaningful interpretation similar to a logarithmic transformation without losing observations with small remittances. The terms $(Lead\ j)_{ict}$ and $(Lag\ k)_{ict}$ denote the lead and lag variables ¹¹ for events affecting the behavior of migrant i to

¹⁰Event study estimation does not demonstrate that units exposed to events and those not exposed would have inevitably followed similar trends in the post-reform period (Kahn-Lang and Lang 2019)

¹¹In equation (1), "Lead" refers to periods before the event (typically called lags), and "Lag" refers to

remit at time t , respectively. The parameters μ_i and η_t represent migrant and time fixed effects, X'_{ict} denotes the vector of time-varying controls, β_j and γ_k represent treatment indicators capturing the effects of treatment at different time leads and lags following an event occurring j periods away from t , and ε_{ict} represents the error term.

The results are estimated using high-dimensional fixed effects (hdfe), which account for multiple fixed effects. This approach is highly valuable for managing multiple fixed effects. In equation 4.1, lags and leads to the event of interest are defined as follows:

$$(\text{Lead } J)_{ict} = 1[t \leq \text{Event} - J] \quad (2)$$

$$(\text{Lead } j)_{ict} = 1[t = \text{Event} - j] \text{ for } j \in \{1, \dots, J - 1\} \quad (3)$$

$$(\text{Lag } k)_{ict} = 1[t = \text{Event} + k] \text{ for } k \in \{1, \dots, K - 1\} \quad (4)$$

$$(\text{Lag } K)_{ict} = 1[t \geq \text{Event} + K] \quad (5)$$

Lags and leads represent binary variables signaling when a migrant sent remittances to households a certain number of periods before or after a specific event. Final lags and leads beyond I and J periods are accumulated, as shown in equations 2 and 5. To capture the baseline difference between areas with and without the event, a single lag or lead variable is excluded. In the first specification, the baseline excluded case occurs at the initial lag when i equals 1.

The event study framework is a valuable tool for exploring the effects of events on outcomes, surpassing the capabilities of two-way fixed effects models. Nonetheless, the estimation of an event study is not without its limitations. The findings by [Sun and Abraham \(2021\)](#) suggest that panel event studies continue to encounter heterogeneity issues, specifically in relation to the weighting of treatment effects when there is variation among treatment groups in specific lag and lead terms. An important consideration in event study designs is the potential for inferential issues arising from the selective survival of models that satisfy pre-trend test criteria ([Roth, 2022](#)).

4.5.1 Parallel trends assumption

The parallel trends assumption is crucial for the validity of DID and event study methodologies. This assumption suggests that, in the absence of treatment, the outcome variable (migrant remittance behavior) would have followed the same trend over time for both treated and control units, with any pre-existing differences between the groups remain-

periods after the event (typically called leads). This notation is consistent with the labels in our regression table, ensuring clarity and alignment with the results.

ing constant.

To primarily check this assumption, we visually inspect the time trends of the treatment and control groups, relative to the occurrence of multiple external remitter-side shock events. As exhibited in Figure 4.8, which plots the average amount remitted for both groups over time, the trends appear to be parallel prior to the occurrence of the shocks.

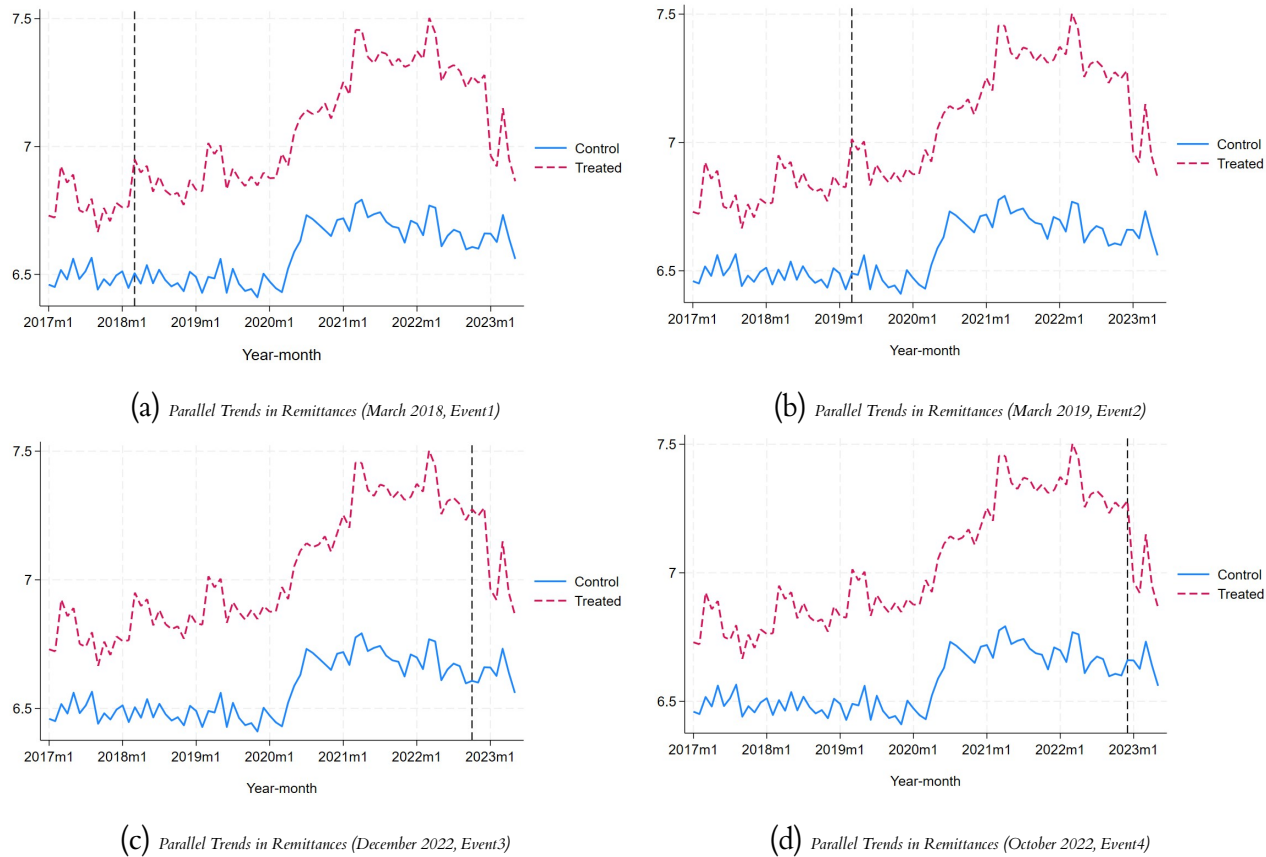


Figure 4.8: *Parallel Trends in Remittances by Event: Control vs. Treatment Groups*

Note: The figure shows the parallel trends in remittances between the control and treatment groups across four different shock events. Each graph shows the trends in remittances prior to the shock, as indicated by a vertical line corresponding to the specific shock event date. Graph (4.8a) shows the trends surrounding Shock 1 on March 1, 2018; Graph (4.8b) focuses on Shock 2 occurring on March 1, 2019; Graph (4.8c) illustrates the trends for Shock 3 on December 1, 2022; and Graph (4.8d) captures the trends for Shock 4 on October 1, 2022. The visual representation of these parallel trends is important for assessing the potential impact of each shock on remittance flows over time, particularly the extent to which the treatment group diverges from the control group after the intervention.

Nevertheless, visual inspection alone might not be adequate. Recent research highlights the flaws of traditional pre-trend tests, which are often underpowered and prone to bias (Rambachan and Roth, 2023). In response to these concerns, they propose a more

robust testing method that takes into account possible violations of the parallel-trends assumption. This entails estimating the maximum deviation from parallel trends (Mbar) and constructing corresponding confidence intervals for post-treatment outcomes under this deviation. If the confidence intervals exclude zero, even with maximum deviation, we can confirm the robustness of the treatment effect to deviations from the parallel trends assumption, supporting the impact of multiple sender-side shocks on migrant remittance behavior.

In the robustness checks section, we use [Rambachan and Roth \(2023\)](#) sensitivity tests under relative magnitude and smoothness restrictions. These tests will enable us to examine the resilience of our treatment effect estimates to deviations from the parallel-trends assumption resulted by different shocks that escalate the cost of remittance transfers. The aim is to determine which of our results survive these robustness checks, providing a clearer picture of the robustness and validity of our findings.

4.5.2 Serial correlation

One potential issue with panel event studies is the possibility of serial correlation in the outcome variable over time. We are observing the behavior of remitters over time, focusing on both the transfer of remittances and the frequency of remittance transactions.

However, this modeling framework is susceptible to the potential presence of serial correlation within individual remittance patterns, where consecutive remittance observations from the same individual may be correlated over time ([Bertrand et al., 2004](#); [Clarke and Tapia-Schyte, 2021](#)). While [Bertrand et al. \(2004\)](#) emphasized the importance of addressing serial correlation in DID models, this concern also arises in panel event studies, especially when the outcome variable shows significant serial correlation while the independent variable exhibits minimal variation over time ([Clarke and Tapia-Schyte, 2021](#)).

The presence of serial correlation in the outcome variable can significantly impact the validity of estimated coefficients of event effects, thereby undermining the underlying foundational assumptions of such studies. In our study context, serial correlation in the outcome variable refers to a situation where the current volume of remittances transferred is correlated with its past values. This can arise due to several factors such as unobserved heterogeneity, omitted variables, or autocorrelation. One crucial assumption in panel event studies is the independence of errors across time and individuals, ensuring each observation contributes unique information. Nevertheless, the potential presence of serial correlation violates this assumption, as errors become correlated within individuals over

time. Additionally, serial correlation can also violate the assumption of homoscedasticity, as the variance of the errors may vary systematically with time. This further undermines the validity of statistical inferences, potentially leading to biased and inefficient parameter estimates.

To address this issue (bias caused by serial correlation), researchers often employ cluster-robust variance-covariance estimators (CRVEs) to compute standard errors and confidence intervals for regression parameters. However, it is essential to recognize that standard CRVEs are only asymptotically valid. This means that the performance of CRVEs improves as the number of remittance senders (or clusters) approaches infinity.

The reliance on a large number of clusters for robustness is extensively discussed in the literature by [Cameron and Miller \(2015\)](#). The remittance dataset under scrutiny in this study comprises over 170,000 distinct clusters. This number of clusters meets the threshold for the number of clusters ($S \geq 42$) as suggested by [Angrist and Pischke \(2009\)](#). This large number of clusters indicates that the dataset is well-suited for standard clustering methods. With such extensive cluster representation, the study's analytical framework is well-equipped to capture the nuances of remittance behavior across diverse individual-month observations.

The events we are studying are unexpected and beyond the control of both individual migrants and MTOs. When these events occur, such as when the exchange rate of the host country significantly decreases against the USD, this new information is quickly factored into the decision-making process for remittances. As a result, it influences the behavior of migrants regarding the amount and frequency of remittance transfers. The sudden decrease in remittance flows and frequency within a short period around the event's occurrence reflects the direct impact of the unexpected event and likely little else. Therefore, the various events analyzed in this study can be seen as pseudonatural experiments. Hence, the methodology can effectively handle the research questions. The methodology is a good fit for the data and produces consistent estimates, enhancing the reliability and credibility of our analysis.

4.6 Results and Discussion

This section presents the outcomes of the estimated model. We analyse how events affect remittance flow and frequency among migrants in Australia, Canada, Norway, Sweden, with migrants from the US serving as “pure controls”. The section uncovers the impacts of the shocks by leveraging the data's heterogeneity across different factors, such as small vs. large amounts and remittances to Somalia vs. other locations. We delve into the

heterogeneity of shocks, such as ER depreciation, CPI increases, and de-risking, and also analyse the effect of shocks on the timing of remittances (weekly vs quarterly).

Tables 4.3 and 4.4 show the estimated coefficients of how different external sender side shock events affect the flow and frequency of monthly remittances. These two tables are analysed together to capture the dynamics of both the magnitude (flow) and timing (frequency) of migrant remittances following the diverse events. The shocks considered include exchange rate depreciation, de-risking practices by banks, an increase in the cost of living, and all distinct staggered events across countries. These events, considered unexpected shocks, can suddenly disrupt remittance flows and frequency. This has the potential to negatively affect migrant remittance behaviour, and neither MTOs nor migrant remitters have control over them. Column 1 of each table reports the estimated coefficients for exchange rate depreciation, while Columns 2, 3, and 4 present the coefficients for de-risking, an increase in CPI, and combined effect of all staggered shock events across countries, respectively. Table 4.3 focuses on the flow of remittances, while Table 4.4 shows corresponding results for the frequency of remitting.

Table 4.3: The impact of shocks on the flow of monthly remittances

VARIABLES	(1) ER depreciation	(2) De-risking	(3) Surge in CPI	(4) All shocks
lead6	0.0674*** (0.00805)	0.0271** (0.0133)	0.137*** (0.0178)	0.0178** (0.00861)
lead5	0.0191** (0.00972)	0.0578*** (0.0164)	0.0645*** (0.0220)	0.0522*** (0.0106)
lead4	0.000232 (0.00983)	0.0646*** (0.0163)	0.0514** (0.0216)	0.0167 (0.0104)
lead3	0.0159* (0.00958)	0.0357** (0.0160)	0.0497** (0.0217)	0.0165* (0.0100)
lead2	0.0184* (0.00940)	0.0386** (0.0162)	0.0146 (0.0211)	0.0286*** (0.0102)
lag0	-0.0592*** (0.00935)	-0.0846*** (0.0159)	-0.292*** (0.0259)	-0.0968*** (0.0105)
lag1	-0.0115 (0.00980)	-0.0272* (0.0163)	-0.0983*** (0.0322)	-0.0103 (0.0107)
lag2	0.0123 (0.00977)	0.00381 (0.0161)	-0.0825** (0.0369)	0.0243** (0.0109)
lag3	0.0910*** (0.0102)	0.0319* (0.0166)	-0.0609* (0.0345)	0.135*** (0.0117)
lag4	0.101*** (0.0111)	0.0190 (0.0173)	-0.0103 (0.0372)	0.122*** (0.0119)
lag5	0.0764*** (0.0108)	0.0151 (0.0168)	-0.222*** (0.0483)	0.0634*** (0.0117)
lag6	-0.0358*** (0.00874)	-0.0747*** (0.0133)		-0.0319*** (0.00948)
Constant	6.813*** (0.00374)	6.845*** (0.00325)	6.819*** (0.00161)	6.831*** (0.00407)
Observations	2,606,975	2,606,975	2,606,975	2,606,975
R-squared	0.362	0.353	0.370	0.385
Migrant FE	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES

Note: Remittances represent the amount of international migrant transfers, including transaction fees, and are transformed using the inverse hyperbolic sine (IHS) function. The shocks considered include exchange rate (ER) depreciations against the USD, increases in CPI, and de-risking events. Column 1 shows the effect of ER devaluations on remittance flows, while Columns 2, 3, and 4 show the effect of de-risking, CPI surges, and a combination of distinct shocks, respectively. The dates of ER depreciations are as follows: Sweden (January 2022), Norway (September 2022), Canada (March 2018), and Australia (October 2022). The treatment group consists of migrants living in Norway, Sweden, Canada, and Australia who experienced shocks, with migrants from the U.S. serving as pure controls. For shocks affecting only one or two countries (such as de-risking), all other countries that did not confront the shock serve as controls. Robust standard errors are reported in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

The analysis begins with an examination of the event period (lag0), which highlights the immediate effects of shock events on both the flow and frequency of remittances. Across all heterogeneous events, the empirical results reveal statistically significant negative coefficients during the event period, showing a decline in remittance behavior. In Column 1 of both tables, it is noteworthy that at the onset of the shock event, the coefficient for exchange rate depreciation stands at -0.0592 for monthly remittances, and -0.0201 for remitting frequency. These estimates are both statistically significant at the 1% level. The implications are clear: when the exchange rate depreciates, the cost of transferring remittances rises. This leads to a 6% reduction in the monthly remittance flow and a 2% decrease in frequency. This suggests that, while exchange rate devaluation decreases the amount of remittances sent, it has a relatively modest impact on the frequency of transferring remittances.

Similarly, de-risking, detailed in Column 2 of both tables, lead to a 8% decrease in monthly remittance flow (Table 4.3) and a 3% decrease in remitting frequency (Table 4.4). This indicates that de-risking significantly affect both the amount and frequency of remitting, though the reduction in flow is more pronounced compared to the reduction in frequency. The results align with previous studies emphasizing the adverse impact of de-risking on remittance activities. De-risking initiatives not only obstruct formal remittance channels, making it difficult for migrants to send money through official channels, but also promote informal channels, which are often less secure and more expensive (Vasquez, 2017). This exacerbates financial exclusion for vulnerable populations and their respective countries.

Moreover, in our context, de-risking interrupts the money migrants send home, leading them to use less efficient and more costly methods. This interruption reduces the amount of money being sent and increases the fees for transferring money. Migrants who usually rely on trusted money transfer organizations because of their family and cultural ties may remit less money temporarily and await their preferred organizations to resume operations. However, these interruptions make it harder for people to access financial services and delay the timely provision of financial help, making economic hardships worse, especially for vulnerable unbanked communities that rely on these crucial financial flows.

These findings highlight the importance of promptly implementing effective policy measures to counteract the harmful effects of de-risking on remittance flows. Continuous remittances are crucial for maintaining livelihoods and reducing poverty in many developing economies. By addressing de-risking challenges, policymakers can safeguard the financial stability of migrant communities and support sustainable development.

Remarkably, a surge in CPI, as shown in Column 3, have a substantial impact. Table 4.3 reveals a 29% decrease in monthly remittance flow, while Table 4.4 shows a 19% reduction in frequency. This underscores that an increase in CPI not only greatly diminish the amount of remittances but also notably reduce its frequency, highlighting the pronounced effect of on migrant remittance dynamics and behaviour.

The unexpected surge in the cost of living, specifically the significant increases in electricity and food prices, substantially weakened the purchasing power of migrants. When migrants' disposable income is insufficient to cover basic expenses, they prioritize their own needs, resulting in a decrease in remittances and frequency. This often causes a decrease in altruistic remittances, as migrants cannot satisfy the needs of their stay-behind households and relatives compared when there are no shocks.

Finally, the combined effect of all staggered shocks, as detailed in Column 4, leads to a 10% reduction in monthly remittance flow (Table 4.3) and a 4% decrease in remitting frequency (Table 4.4). These results indicate that all shock events collectively contribute to a significant reduction in remittance magnitude and a notable decrease in frequency of remitting.

The findings also suggest that the magnitude of decline in monthly remittance flow is consistently greater than decline in frequency, implying that shocks impact more on the magnitude of remittances than frequency of remitting. This further means that the frequency of money transfers is not dropping as sharply, which may show a persistent need to support recipient households or maintain family connections, but the external sender-side shocks and their economic pressure on remitters is reducing the size of each remittance transaction because of reduced income or increased costs in the remittance-sending country, limiting how much migrant senders can afford to send despite continuing to remit.

In summary, the analysis of both tables demonstrates that each event type significantly affects monthly remittance flow and frequency, with a surge in CPI showing the most substantial reductions in both areas. This is particularly evident in the case of Sweden, where inflation shocks exerted the strongest effect, as reflected in both the large negative coefficients (notably at lag 0, the event date) and the sharp declines observed in the event study graphs. In contrast, the negative effects of de-risking measures in Norway and Canada, while still significant, were relatively smaller. The stronger response to inflation is likely attributable to its immediate and direct impact on migrants' disposable income and cost of living, thereby constraining their ability to remit funds. Exchange rate devaluation also negatively affects remittance flow and frequency but to a lesser degree compared to CPI hikes. The combined shock events (as shown in the last column

of the tables) yield an intermediate effect, balancing the influences across the different types of shocks.

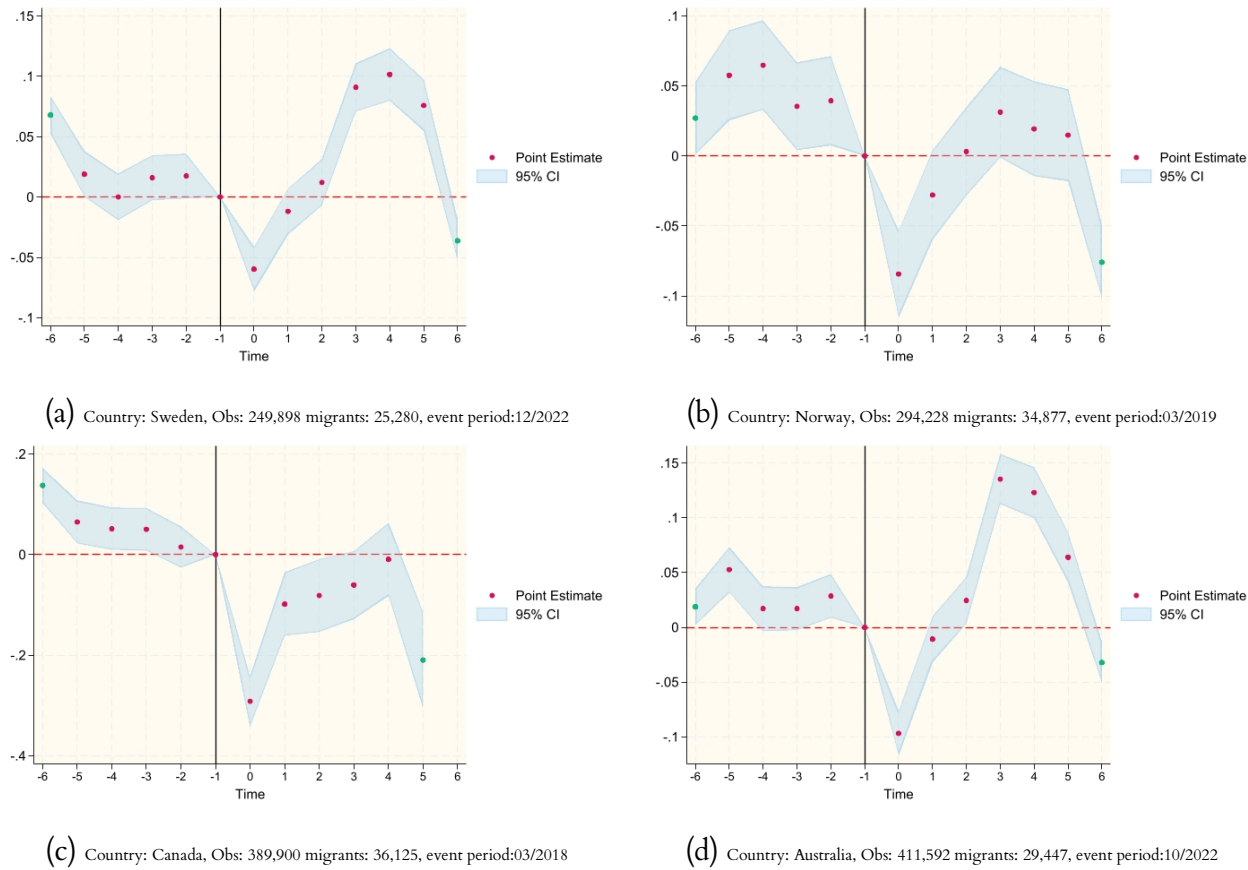


Figure 4.9: Event Study Plots showcasing monthly remittances by shock type.

Note: The figures show the effect of the diverse shock events on the monthly flow of remittances. In Figure 4.9a, a plot in the event study displays the depreciation of ER. De-risking is illustrated in Figure 4.9b. Figure 4.9c presents a surge in the CPI. Figure 4.9d displays all distinct combined shock events. The point estimates are shown alongside their corresponding 95% confidence intervals as described in equation (2). The base period (omitted), denoted by a solid vertical line, is one month before the event in each country where a migrant lives..

Table 4.4: The impact of shocks on frequency of remitting

VARIABLES	(1) ER depreciation	(2) De-risking	(3) Surge in CPI	(4) All shocks
lead6	0.0369*** (0.00445)	-0.00377 (0.00710)	0.0571*** (0.00992)	-0.000375 (0.00475)
lead5	0.0134** (0.00527)	0.0116 (0.00864)	0.0134 (0.0118)	0.0174*** (0.00557)
lead4	0.0174*** (0.00518)	0.0202** (0.00851)	0.00847 (0.0114)	0.0116** (0.00546)
lead3	0.0176*** (0.00506)	0.0157* (0.00830)	-0.00808 (0.0115)	0.00221 (0.00533)
lead2	0.0120** (0.00494)	0.0132 (0.00833)	-0.0108 (0.0113)	0.0164*** (0.00530)
lag0	-0.0201*** (0.00489)	-0.0309*** (0.00821)	-0.193*** (0.0141)	-0.0419*** (0.00551)
lag1	0.000496 (0.00510)	-0.00768 (0.00838)	-0.0609*** (0.0181)	0.00111 (0.00564)
lag2	0.0248*** (0.00527)	-0.0118 (0.00880)	-0.0714*** (0.0206)	0.0145** (0.00596)
lag3	0.0407*** (0.00553)	0.00499 (0.00896)	-0.0398* (0.0210)	0.0589*** (0.00625)
lag4	0.0736*** (0.00585)	0.0109 (0.00884)	-0.0474** (0.0211)	0.0656*** (0.00620)
lag5	0.0429*** (0.00595)	0.00351 (0.00886)	-0.120*** (0.0253)	0.0309*** (0.00636)
lag6	0.00419 (0.00496)	0.00652 (0.00723)		0.0283*** (0.00534)
Constant	1.491*** (0.00204)	1.503*** (0.00174)	1.500*** (0.000896)	1.498*** (0.00221)
Observations	2,606,975	2,606,975	2,606,975	2,606,975
R-squared	0.462	0.462	0.462	0.462
Migrant FE	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES

Note: Frequency denotes the number of times a migrant sends money and is transformed using the inverse hyperbolic sine (IHS) function. The shocks considered include exchange rate (ER) depreciations against the USD, increases in CPI, and de-risking events. Column 1 shows the effect of ER devaluations on remittance flows, while Columns 2, 3, and 4 show the effect of de-risking, CPI surges, and a combination of distinct shocks, respectively. The dates of ER depreciations are: Sweden (January 2022), Norway (September 2022), Canada (March 2018), and Australia (October 2022). The treatment group comprises migrants living in Norway, Sweden, Canada, and Australia who experienced shocks, with migrants from the U.S. serving as pure controls. For shocks affecting only one or two countries (such as de-risking), all other countries that did not confront the shock serve as controls. Robust standard errors are reported in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Moreover, the analysis reveals a remarkable similarity in response patterns across the different shock events—each of which exhibits a large negative shock during the event period (Lag 0), followed by a gradual recovery in the subsequent periods. This consistent response across events validates the methodological decision to combine these shocks in the analysis, as shown in column 4 of both tables. The similarity in magnitude and direction of the effects shows that, despite the distinct nature of each event, they trigger comparable dynamics in monthly remittance flow and frequency, with a sharp initial decline and a subsequent resumption towards normalcy. This convergence in patterns further strengthens the robustness of the combined staggered shock variable, as it effectively captures the aggregate effect of these shock events in a unified framework, lending greater coherence and reliability to the overall findings.

Examining the estimates prior to the shocks, the pre-event trends, reflected in the coefficients for ER depreciation, De-risking, a surge in CPI, and all shock events, demonstrate relative stability, with some variation across shock events. However, as the tabular results and graphical depictions show, the post-event responses are significantly more volatile than the pre-trends, which is reassuring, as it shows that the observed reductions are primarily attributable to the shocks rather than any pre-existing trends. This suggests that the observed deviations in pre-trends are relatively a minor concern. Pre-trend deviations, as discussed in [Rambachan and Roth \(2023\)](#), are accounted for through sensitivity analysis, which will be addressed in the robustness section.

The post-event period reveals substantial volatility, particularly in the shock period (Lag 0), where significant reductions in monthly remittance flow and frequency are observed across all different shock events. This volatility contrasts sharply with the relative stability of pre-trends, reinforcing the notion that the observed declines are attributable to the shock events themselves rather than underlying trends. The first post-event period continues to reflect reductions, though of a diminished magnitude. By the third post-event period, positive coefficients begin to emerge, signalling a gradual recovery and normalization of remittance flows and frequencies.

This observed increase in remittance flow and frequency following the initial declines suggests a dynamic response in remittance behaviour over time, potentially indicating a catch-up effect or resumption of remitting activities after an initial shock induced decline. The behaviour observed could be due to postponed money transfers or a renewed focus on investment following the unexpected event. This could indicate that remittance transfers were initially postponed or that migrants who were sending money for investment purposes resumed sending after the shock, among other possible interpretations. Figures 4.9 provide graphical depictions of point estimates derived from the event study

regression analysis, allowing us for a clearer visual representation of the pre-trend and post-trend of the monthly flow of remittances and frequency in response to the shock events. In summary, this observation shows how remittance behaviour is dynamic, with a decrease at first and then a subsequent recovery or increase over time.

The adverse impact of high transaction costs on remittance transfers is widely recognized. Such costs not only deter migrants from sending money back home but also encourage the use of informal channels (Freund and Spatafora, 2008). While existing literature has extensively documented the effects of excessively high transaction costs on funds remitted to recipient countries (Ahmed et al., 2021; Gibson et al., 2006; Kakhkharov et al., 2017; Kosse and Vermeulen, 2014; Kpodar and Imam, 2024), little attention has been given to other hidden expenses that inflate the cost of money transfers and burden senders. Unexpected currency devaluation and other shocks also contribute to a decrease in the amount of money remitted, as they diminish the purchasing power of senders.

Previous research has primarily relied on aggregate panel data to investigate remittance patterns across countries or within individual countries e.g., (Ahmed et al., 2021). However, no study has examined the use of individual migrant transactions and how they respond to shocks that make money sending more expensive. The unique nature of this dataset also enables us to explore the frequency of remittances sent by migrants, providing insights into the number of times migrants remit money to their households back home.

This paper aims to understand how shocks affect sender behaviour when complications arise in money sending. Will migrants decrease remittance transfers and frequency in response to such events? In the following section, using the DID method, we quantify the effect of the extent to which a percent increase in remittance costs leads to a percent decline in flow and frequency.

4.6.1 Quantifying Shocks Using DID Method

In this section, we employ the Difference-in-Difference method to investigate the differential effects of the various shocks, which concomitantly escalate the cost of transferring remittances—on the flow and frequency of monthly remittances to several developed nations. The aim is to quantify rigorously the extent to which a $X\%$ rise in shocks, such as the exchange rate devaluation, leads to a $Y\%$ decline in both the flow and frequency of monthly remittances. This analysis converts the effects into percentage changes in remittances across these countries, using a simplified back-of-the-envelope calculation. There are various ways to achieve this, including:

First, we construct a monthly exchange rate shock variable ¹². When this exchange rate depreciation is substantial, defined as a percentage increase of 4% or greater, the expenditure associated with transferring remittances escalates proportionally. The total cost borne by individual migrants comprises the standard transaction cost augmented by the incremental cost attributable to the pronounced exchange rate shock. We, therefore, create a dummy variable (high depreciation) to denote 1 for months, in which depreciation is 4% or greater and 0 otherwise. The creation of the dummy variable does not involve shock dates; rather, we concentrate on periods of high cost for all countries, regardless of the migrant's exchange rate shock date.

The second approach is to define shock periods for each country separately. We construct a binary shock variable for each country where 1 represents the date a shock happened and 0 otherwise.

The third procedure involves creating a continuous variable that represents aggregation of the costs associated with ER fluctuation and standard transaction fees.

To quantify how much the cost of remittances increased after each event, we estimate the Two-Way Fixed Effects (TWFE) or DID model, which is expressed:

$$Y_{it} = \alpha_i + \gamma_t + X_{it}\beta + D_{it}\tau + \epsilon_{it} \quad (4.2)$$

In this specification, Y_{it} represents the amount of remittances transferred by individual i in country c at time t . α_i are individual fixed effects and γ_t are time fixed effects. X_{it} represents covariates, and ϵ_{it} is the error term. The treatment indicator D_{it} equals 1 if individual i is exposed to ER depreciation at time t , and 0 otherwise, with τ capturing the treatment effect on the ER devaluation.

¹²The monthly exchange rate shock is computed as:

$$\text{Monthly_Shock}_t = \left(\frac{\text{Exchange rate}_t - \text{Exchange rate}_{t-1}}{\text{Exchange rate}_{t-1}} \right) \times 100$$

This formula reflects the relative change in exchange rate from the previous month to the current month, expressed as a percentage.

Table 4.5: Quantifying the Effect of ER depreciation (shocks) on Remittance Flows

VARIABLES	(1) High depreciation	(2) Remit Norway	(3) Remit Sweden	(4) Remit Canada	(5) Remit Australia	(6) Total cost
High depreciation	-0.109*** (0.002)					
ER depreciation Norway		-0.048*** (0.010)				
ER depreciation Sweden			-0.128*** (0.015)			
ER depreciation Canada				-0.055*** (0.015)		
ER depreciation Australia					-0.068*** (0.014)	
Total Cost						-0.050*** (0.004)
Constant	6.700*** (0.006)	6.646*** (0.006)	6.646*** (0.006)	6.646*** (0.006)	6.646*** (0.006)	6.843*** (0.020)
Observations	2,666,025	2,666,025	2,666,025	2,666,025	2,666,025	890,191
Number of ID	231,331	231,331	231,331	231,331	231,331	75,613
Migrant FE	YES	YES	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES	YES	YES

Note: The dependent variable (remittances) is the inverse hyperbolic sine (IHS) transformed variable. Column 1 shows the estimated results of DID of the impact of ER depreciation on the flow of remittances using a dummy variable where 1 denotes exposure to high depreciation (4–10%), which escalates the cost of remittances by (4–10%). Columns 2–5 show the results of each country separately. The variable is created using the event date when ER depreciation is high. The dummy variable equals 1 when ER depreciation is high and 0 otherwise. In column 6, we use a continuous variable representing both the standard fees and the cost increase due to ER depreciation. We control for both time and unit-fixed effects. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Columns 1–6 of Tables 4.5 and 4.6 present the impact of exchange rate devaluation on monthly remittance flow and frequency. In Column 1 of both tables, a significant exchange rate depreciation of 4 percent or greater, which raises the cost of sending remittances by a similar percentage, leads to a 10% decline in the monthly flow of remittances and a 13% reduction in its frequency. This indicates that elevated remittance costs across countries lead to a considerable contraction in the flow and frequency of remittances. In Column 2 of both tables, a 6 percent devaluation in exchange rate in Norway, corresponding to a 6% increase in the cost of sending remittances, induces a 5% reduction in the flow of monthly remittances and a 6% decline in frequency.

In contrast, Column 3 of Table 4.5 demonstrates that a 4% increase in the cost of sending remittances in Sweden results in a 13% decrease in flow, while Table 4.6 shows

a 3% decline in frequency. Column 4 of both tables reveals that a 3% increase in the cost of transferring remittances in Canada is associated with a 6% decline in flow and a 2% reduction in frequency transferring remittances.

Similarly, Column 5 of Table 4.5 illustrates that a 6% rise in the cost of transferring remittances in Australia is associated with a 6% reduction in monthly flow of remittances, alongside a 3 percent decrease in frequency, as reflected in Table 4.6. And finally, the total cost of transferring remittances encompasses standard transaction fees imposed by MTOs, as well as fluctuations in monthly exchange rates.

Depreciation of the local currency against the USD increases the cost, while appreciation reduces it. Thus, total costs reflect both fixed transaction fees and variable costs driven by exchange rate movements. This continuous variable is employed to analyze the impact of total costs on the flow and frequency of remittances. Column 6 of both tables reveals that total costs reduce flow by 5% and frequency by less than 1 percent.

Table 4.6: Quantifying the Effect of ER depreciation on the Frequency of Sending Remittances

VARIABLES	(1) High depreciation	(2) Freq Norway	(3) Freq Sweden	(4) Freq Canada	(5) Freq Australia	(6) Total cost
High depreciation	-0.125*** (0.001)					
ER depreciation Norway		-0.058*** (0.006)				
ER depreciation Sweden			-0.030*** (0.008)			
ER depreciation Canada				-0.022*** (0.008)		
ER depreciation Australia					-0.028*** (0.008)	
Total Cost						-0.006*** (0.000)
Constant	1.527*** (0.004)	1.465*** (0.004)	1.465*** (0.004)	1.465*** (0.004)	1.465*** (0.004)	1.521*** (0.007)
Observations	2,666,025	2,666,025	2,666,025	2,666,025	2,666,025	890,191
Number of id	231,331	231,331	231,331	231,331	231,331	75,613
Migrant FE	YES	YES	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES	YES	YES

Note: The dependent variable (frequency of remitting) is the inverse hyperbolic sine (IHS) transformed variable. Column 1 shows the estimated results of DID of the impact of ER depreciation on the flow of remittances using a dummy variable where 1 denotes exposure to high depreciation (4–10%), which escalates the cost of remittances by (4–10%). Columns 2–5 show the results of each country separately. The variable is created using the event date when ER depreciation is high. The dummy variable equals 1 when ER depreciation is high and 0 otherwise. In column 6, we use a continuous variable representing both the standard fees and the cost increase due to ER depreciation. We control for both time and unit-fixed effects. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

In summary, the results have demonstrated that an increase in the total cost of transferring remittances, driven by transaction fees and exchange rate fluctuations, leads to a decline in both the flow and frequency of remittance dynamics. These costs represent a considerable burden for developing countries, impeding flow of a crucial lifeline for recipient households. Lowering these transactional costs would increase the flow of remittances to these countries (Kpodar and Imam, 2024).

De-risking primarily targets MTOs in corridors associated to high-risk countries due to concerns about money laundering, terrorism financing, and other financial crimes. The regulatory action requires MTOs to either cease or drastically scale back operations, resulting in a decrease in formal remittance flows and a greater dependence on informal channels. Although remittance transfer costs are not directly affected by higher living

costs, they do diminish the purchasing power of remitters. Migrants, especially those facing economic hardship in developed countries, are disproportionately affected by rising costs of essentials such as food and electricity. Economic strain results in reduced disposable income, which in turn limits the remittance amount to their home countries.

Although quantifying the full impact of de-risking and higher living costs is challenging, their consequences are evident: MTOs face additional costs related to the physical transportation of funds, and migrants have less available income to send home. Table 4.7 displays the DID estimates, which measure the decrease in remittance flow and frequency caused by these disruptions, giving us a sense of their impact.

Table 4.7: The impact of de-risking and CPI hikes on the monthly remittance amounts and the frequency of remitting

VARIABLES	(1) Remittances	(2) Frequency	(3) Remittances	(4) Frequency
De-risking	-0.059*** (0.011)	-0.031*** (0.006)		
CPI_Shock_Sweden			-0.394*** (0.023)	-0.231*** (0.012)
Constant	6.646*** (0.006)	1.465*** (0.004)	6.646*** (0.006)	1.465*** (0.004)
Observations	2,666,025	2,666,025	2,666,025	2,666,025
Number of ID	231,331	231,331	231,331	231,331
Migrant FE	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES

Note: The dependent variables, remittances and frequency of remitting, are transformed using inverse hyperbolic sine (IHS). Column 1 illustrates the effect of de-risking on remittance flows, while column 2 shows its impact on remittance frequency. Columns 3 and 4 demonstrate the impact of CPI increase. We control for both time and unit-fixed effects. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Column 1 indicates that de-risking policy results in a 11% reduction in the flow of remittances, accompanied by a 6% decrease in its frequency, as reported in Column 3. In contrast, Columns 2 and 4 reveal that a rise in living costs leads to a more pronounced decline, with a 39% reduction in flow and a 23% decrease in frequency. These findings highlight that disruptions stemming from de-risking policies and hike in cost of living exert significantly adverse effects on both the amount and frequency of monthly

remittances, with rise in cost of living demonstrating a particularly severe impact.

The results suggest that sender-side shocks have a collective and individual impact on remittance behaviour across countries, although the extent of disruption varies. Additionally, the results underscore how external disruptions raise remittance fees, which may lead to the use of informal channels or hinder the intended use of funds for family support or investment. This is especially relevant in countries like Somalia, which heavily depend on diaspora remittances, as disruptions from sender-side shocks could hinder development efforts.

Previous research has mainly focused on the adverse impact of direct transaction costs on remittance transfers ([Ahmed and Martínez-Zarzoso, 2016](#); [Beck and Martínez Pería, 2011](#); [Gibson et al., 2006](#); [Kpodar and Imam, 2024](#)). Nonetheless, our research indicates that external shocks play a role in driving up remittance costs, hindering the regularity of monthly remittance inflows. Encouraging informal channels when remittance costs are remarkably high ([Freund and Spatafora, 2008](#)) may lead to funds being redirected from family support or investments. Particularly, interruptions in remittance transfers to countries like Somalia, which depend heavily on diaspora remittances, can hinder altruistic contributions and impede the country's development.

Furthermore, Sub-Saharan Africa, which bears the greatest burden, faces the risk of losing a substantial amount of money that would have supported households dependent on diaspora remittances, owing to increased transaction costs.

Frequency, defined as the number of times a migrant transfers money, is influenced by various factors such as the needs of stay-behind families, the connection between the sender and recipients, and the level of altruistic motives of the sender. Although there is no literature on the frequency of sending remittance motives due to the lack of individual-level data, the observed trends indicate a complex connection between migrant behaviour and the occurrence of unexpected shocks that interrupt remittance behaviour. These findings highlight the importance of studying both the amount and frequency of remittances to understand how external shocks affect migrant remittance behaviour.

In summary, shocks that raise remittance costs or limit sending channels negatively impact remitting frequency and flow. Migrants may choose to keep their money and send it later when the transfer conditions become more favourable, or their willingness to send more money may be affected by the financial challenges posed by diminishing purchasing power, or the lack of available channels may force them to resort to informal methods.

4.6.2 Exploiting Heterogeneity in the Data

By analysing the varying remittance amounts sent by migrants, we explore how these amounts respond to shocks. Small amounts are typically assumed to be used for subsistence, altruism, or assisting families with living expenses or unforeseen crises, particularly in countries like Somalia that face frequent climatic disruptions and conflicts negatively impacting potential recipients. We also assume that large amounts are transferred for investment purposes and for self-interest. This section aims to analyse the impact of shocks on remittance sent and frequency of sending, specifically focusing on different amounts sent by migrants (small vs. large).

Small (Subsistence) Amounts

The estimated coefficients of the impact of different events or shocks on monthly small remittances from migrants in Australia, Canada, Norway, and Sweden are shown in Table 4.8, with US migrants as the control group. The shocks being discussed are similar to the shocks that were addressed in the preceding section. The estimated coefficients indicate the influence of pre-event, event period, and post-event on the flow of small monthly remittances.

Columns 1–6 in Table 4.8 illustrate varying small amounts of remittances (≤ 50 , ≤ 100 , ≤ 200 , ≤ 300 , ≤ 400 , and ≤ 500 , respectively), with lag0 indicating when the event occurs. The lag0 coefficients in all columns (which represent the event date) are negative and statistically significant at the 1% level. This implies that shocks impede the flow of remittances. As the amount sent rises from ≤ 200 to ≤ 500 , the decline in remittance flow becomes more pronounced. For example, in column 3, shocks result in a 5% decline in remittances, whereas in column 6, the decrease is 8%, indicating a greater impact as the amount increases. While columns 1–6 primarily reflect small amounts intended for subsistence or livelihood support, the noticeable effect of shocks becomes increasingly apparent as the amount sent escalates.

Table 4.8: The impact of shocks on small remittance amounts

VARIABLES	(1) Remit ≤ 50	(2) Remit ≤ 100	(3) Remit ≤ 200	(4) Remit ≤ 300	(5) Remit ≤ 400	(6) Remit ≤ 500
lead6	-0.0204** (0.00995)	-0.0172** (0.00731)	-0.0160** (0.00686)	-0.0143** (0.00688)	-0.0171** (0.00697)	-0.0226*** (0.00714)
lead5	-0.0146 (0.0125)	0.00821 (0.00911)	0.0248*** (0.00849)	0.0335*** (0.00841)	0.0316*** (0.00848)	0.0272*** (0.00871)
lead4	-0.00263 (0.0122)	-0.00143 (0.00898)	0.0103 (0.00832)	0.0175** (0.00828)	0.0206** (0.00836)	0.0128 (0.00861)
lead3	-0.00942 (0.0123)	-0.00513 (0.00875)	2.11e-05 (0.00811)	0.000951 (0.00805)	0.00563 (0.00813)	0.000909 (0.00834)
lead2	-0.0120 (0.0120)	0.00109 (0.00879)	0.0147* (0.00823)	0.0202** (0.00818)	0.0211** (0.00820)	0.0184** (0.00841)
lag0	-0.0614*** (0.0126)	-0.0549*** (0.00903)	-0.0503*** (0.00839)	-0.0568*** (0.00833)	-0.0690*** (0.00842)	-0.0796*** (0.00864)
lag1	-0.00408 (0.0126)	0.00238 (0.00913)	0.00525 (0.00849)	0.00692 (0.00846)	0.00454 (0.00855)	-0.00104 (0.00879)
lag2	-0.0249* (0.0133)	-0.00895 (0.00957)	0.00737 (0.00891)	0.0204** (0.00885)	0.0287*** (0.00891)	0.0283*** (0.00913)
lag3	-0.00357 (0.0135)	0.0201** (0.00984)	0.0408*** (0.00918)	0.0563*** (0.00919)	0.0632*** (0.00932)	0.0631*** (0.00957)
lag4	0.00510 (0.0136)	0.0223** (0.00987)	0.0495*** (0.00930)	0.0552*** (0.00931)	0.0614*** (0.00936)	0.0617*** (0.00963)
lag5	-0.0328** (0.0136)	-0.0250** (0.0101)	0.00269 (0.00938)	0.0176* (0.00934)	0.0175* (0.00944)	0.0199** (0.00968)
lag6	-0.0142 (0.0107)	-0.00779 (0.00790)	0.00747 (0.00754)	0.0136* (0.00759)	0.0141* (0.00768)	0.00920 (0.00789)
Constant	4.995*** (0.00465)	5.663*** (0.00352)	6.085*** (0.00335)	6.270*** (0.00335)	6.361*** (0.00339)	6.460*** (0.00346)
Observations	634,745	1,493,397	2,014,990	2,207,003	2,288,308	2,369,523
R-squared	0.362	0.353	0.370	0.385	0.395	0.402
Migrant FE	YES	YES	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES	YES	YES

Note: Remittances represent the amount of international migrant transfers, including transaction costs, and are transformed using the inverse hyperbolic sine (IHS) function. The shocks considered include exchange rate (ER) depreciations against the USD, a surge in CPI, and de-risking events. Column 1-6 exhibits varying small remittance amounts, ranging from less than or equal to \$50 up to less than or equal to \$500. The dates of the shock events are: Norway (September 2022), Sweden (December 2022), Canada (March 2018), and Australia (October 2022). The treatment group comprises of migrants living in Norway, Sweden, Canada, and Australia who experienced shocks, with migrants from the U.S. serving as pure controls. For shocks affecting only one or two countries (such as de-risking), all other countries that did not confront the shock serve as controls. Robust standard errors are reported in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Despite the diverse intentions behind sending small amounts, like altruism and coping with shocks, remittances are consistently impeded by shocks, highlighting how they disrupt migrant financial practices.

The negative impact of the shocks that impede migrant remittance transfers found in the current study corroborates the findings in previous research on the link between high transfer costs and remittances. While research has explored the negative effect of high transaction costs on remittance transfers, e.g., ([Freund and Spatafora, 2008](#); [Gibson et al., 2006](#)), little consideration has been given to the influence of other indirect costs on the flow of remittances. Additional indirect expenses increase the overall cost of remittances, burdening migrant senders and potentially decreasing the amount and frequency of transfers. By employing a distinctive transaction level of migrant transfers, this study adds to the existing remittance literature by uncovering the adverse impact of high costs on remittance transfers. Remittance costs to Sub-Saharan Africa are exceptionally high, resulting in decreased funds flowing into the region. Furthermore, the presence of other indirect costs may hinder future remittances, posing a challenge to achieving the SDG goal of reducing remittance to 3%.

When shocks occur, the frequency of sending small amounts also decreases ([Table A2](#)). The estimated coefficient for the event period (lag0) indicates a statistically significant negative relationship at the 1% level. This suggests that the frequency of remittance transfers decreases immediately after migrants experience shocks in their respective countries. This demonstrates that the frequency of sending money reduces by 4–5% across all scenarios explored.

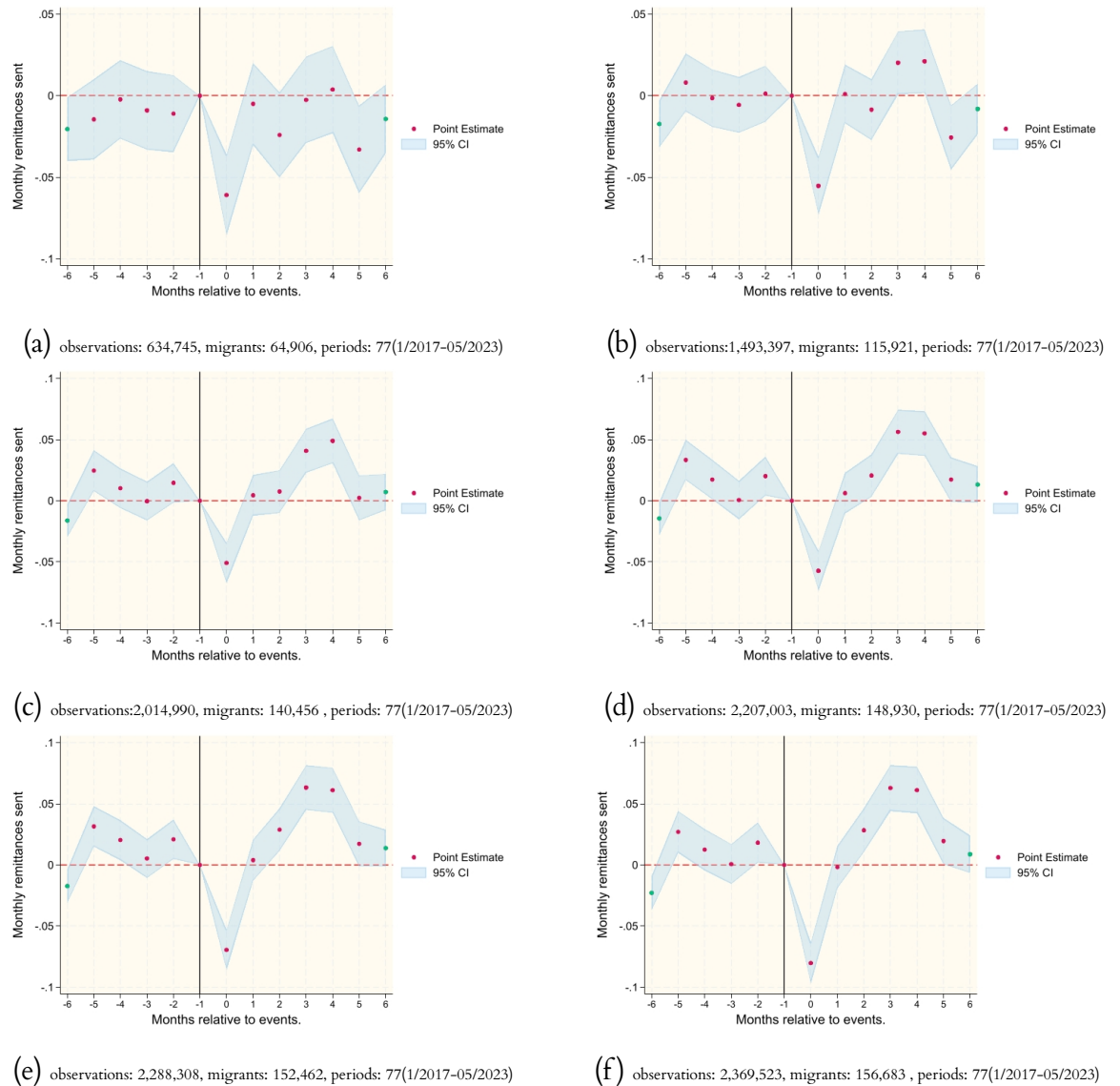


Figure 4.10: Event Study Plots showcasing shocks on small remittance amounts.

Note: The figures show the effect of shock events on the monthly flow of small remittances from migrants in Sweden, Norway, Canada, and Australia, with the US serving as a control. The point estimates are shown alongside their corresponding 95% confidence intervals as described in equation (2). The base period (omitted), denoted by a solid vertical line, is one month before the event in each country where a migrant lives.

Large (Investment) Amounts

Larger remittances are mostly used for investment purposes. Somalis in the diaspora transfer larger amounts¹³ for various purposes, such as saving money, investing in small

¹³Compliance requirements for AML/CFT differ by jurisdiction, and there is no universally defined threshold for large transactions. Enhanced due diligence, KYC procedures, and AML/CFT checks are usually required for significant transfers, often with supporting documentation like proof of funds and transaction purpose.

businesses, real estate, and more. These larger transactions can be a crucial instrument for the development of the country and can have positive spillover effects. Migrants save their income with the intention of investing it back in their country of origin and eventually returning there. Remittance, especially larger transaction funds, is a significant approach Somali diaspora supports the country's development. Other ways the Somali diaspora contributes to the Somali economy and livelihoods involve providing humanitarian aid, sharing knowledge and experiences gained abroad, and actively engaging in politics, recovery, and reconstruction endeavours.

In this section, we investigate how shocks that indirectly raise the cost of remittance transfers affect remittance transactions of different sizes (≥ 10000 , ≥ 12500 , ≥ 15000 , ≥ 17500 , and ≥ 20000). We hypothesize that shocks significantly hinder the flow of larger funds, as they escalate transaction costs and impose additional burdens on the remittance process.

In the event period, the estimated coefficients of larger transactions in columns 1-5 display a negative association with the occurrence of the event, suggesting a negative correlation between the flow of larger monthly transactions and shocks. Larger transactions in columns 2, 3, and 5 are statistically significant, while columns 1 and 4 show statistically insignificant coefficients, despite their negative sign. Shocks have a significant negative impact on the transfers of larger funds, resulting in reductions of 73%, 67%, and 38% for remittance sums of ≥ 12500 , ≥ 15000 and ≥ 20000 respectively.

The hindrance caused by shocks is much greater for larger transactions compared to small amounts, indicating that migrant senders significantly decrease the transfer of larger sums and may opt to withhold until conditions stabilize. Shocks lead to a notable decrease in frequency of larger transactions, albeit not as much as larger amount transfers (Table 5.2 A in Appendix).

Table 4.9: The impact of shocks on large remittance amounts

VARIABLES	(1) Remit ≥ 10000	(2) Remit ≥ 12500	(3) Remit ≥ 15000	(4) Remit ≥ 17500	(5) Remit ≥ 20000
lead6	-0.070 (0.121)	-0.372** (0.161)	-0.266 (0.185)	0.092 (0.129)	0.057 (0.137)
lead5	0.146 (0.167)	-0.197 (0.316)	-0.456 (0.300)	-0.108 (0.275)	-0.086 (0.254)
lead4	0.028 (0.159)	0.188 (0.289)	0.264 (0.424)	0.652** (0.326)	0.697** (0.301)
lead3	-0.106 (0.135)	-0.354 (0.216)	-0.159 (0.250)	0.210 (0.189)	0.111 (0.205)
lead2	0.037 (0.168)	-0.367** (0.187)	-0.180 (0.218)	0.302 (0.186)	0.214 (0.188)
lag0	-0.103 (0.159)	-0.728** (0.288)	-0.672** (0.313)	-0.178 (0.155)	-0.382** (0.180)
lag1	0.009 (0.149)	-0.541*** (0.188)	-0.446* (0.231)	-0.088 (0.229)	-0.163 (0.243)
lag2	0.101 (0.191)	-0.257 (0.250)	-0.116 (0.303)	0.136 (0.278)	-0.152 (0.350)
lag3	0.016 (0.149)	-0.263 (0.221)	-0.266 (0.254)	0.046 (0.233)	0.083 (0.256)
lag4	0.016 (0.205)	0.035 (0.255)	0.190 (0.306)	0.650*** (0.204)	0.698*** (0.219)
lag5	0.249 (0.180)	-0.300 (0.205)	-0.258 (0.244)	-0.179 (0.283)	-0.392 (0.273)
lag6	-0.214* (0.127)	-0.438** (0.182)	-0.301 (0.212)	0.024 (0.153)	0.011 (0.168)
Constant	10.470*** (0.029)	10.884*** (0.029)	10.930*** (0.031)	11.047*** (0.019)	11.098*** (0.019)
Observations	8,144	3,494	2,975	1,975	1,723
R-squared	0.362	0.353	0.370	0.385	0.395
Migrant FE	YES	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES	YES

Note: Remittances represent the amount of international migrant transfers, including transaction costs, and are transformed using the inverse hyperbolic sine (IHS) function. The shocks considered include exchange rate (ER) depreciations against the USD, a surge in CPI, and de-risking events. Columns 1–6 exhibit varying large remittance amounts, ranging from greater than or equal to \$10,000 up to greater than or equal to \$20,000. The dates of the shock events are: Norway (September 2022), Sweden (December 2022), Canada (March 2018), and Australia (October 2022). Robust standard errors are reported in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Larger transactions are sensitive to the occurrence of shocks. One possible explanation is that shocks especially host country currency depreciations make sending larger sums exceedingly costly and hence discourage senders sending money and paying higher transaction costs. Another reason is that migrants holding larger amounts may opt to delay sending remittances until more favourable conditions arise, such as reduced transaction costs or more stable exchange rates. In reaction to external shocks, they might decide to retain their funds or seek out informal methods of money transfer that provide better flexibility or lower costs. This behaviour indicates migrants' adaptive responses to changing economic conditions, where they seek to optimize the value of their remittances while minimizing transaction costs and risks associated with currency fluctuations.

Negative coefficients are observed in post-event data until lag4, where they become positive and statistically significant for sums of 17500 and 20000. Migrants choose to keep larger sums of money for investment or future use, delaying sending it until conditions improve.

In a nutshell, the results indicate that shocks have a negative impact on transferring both small and large transactions, with a greater negative effect observed for larger transactions. This result supports our initial hypothesis that small amounts are often used for altruistic reasons, such as dealing with crises and helping recipient households, while larger amounts are more commonly used for investments and savings.

In spite of challenges and shocks, migrants maintain their remittance transactions at small amounts, making adjustments to their behaviour and slightly reducing both the frequency and amount. Nevertheless, transfer amounts and frequency revert to normal levels and even rise further in the short run 2–3 months after the shock. On the other hand, migrants prefer to decrease both the amount and frequency of larger sums substantially, eventually returning to normal in the medium term.

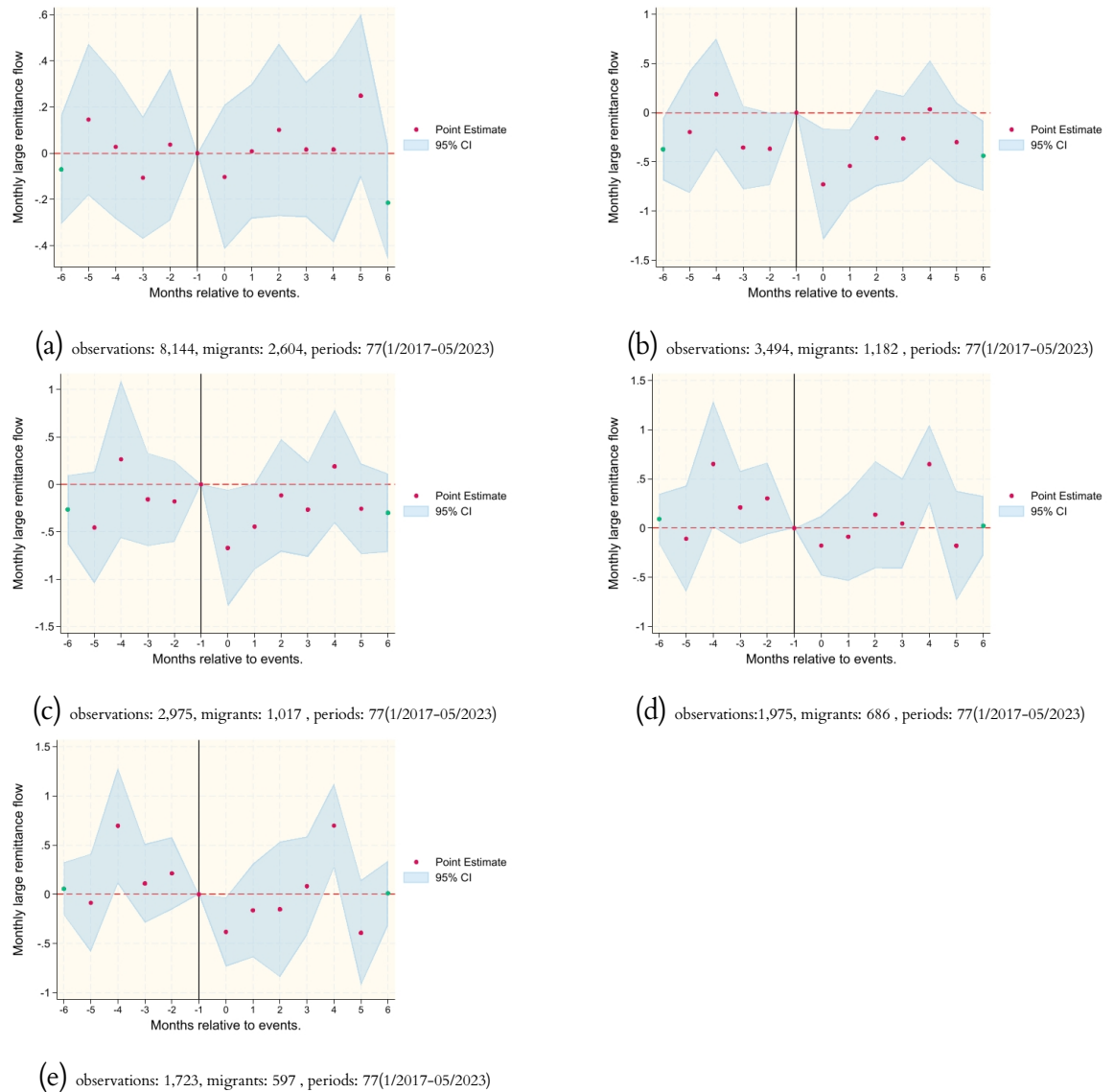


Figure 4.11: Event Study Plots showcasing shocks on large remittance amounts.

Note: The figures show the effect of shock events on the monthly flow of large remittance amounts from migrants in Sweden, Norway, Canada, and Australia, with the US serving as a control. The point estimates are shown alongside their corresponding 95% confidence intervals as described in equation (2). The base period (omitted), denoted by a solid vertical line, is one month before the event in each country where a migrant lives.

4.6.3 Timing of Events and Remittance Flows: Weekly vs. Quarterly

We analyse how remittances respond to weekly and quarterly shocks, using monthly shocks as a reference point to compare the effects across different time intervals. Migrants often react impulsively to weekly shocks, causing immediate but temporary declines in both remittance flow and frequency. For instance, weekly shocks cause a 12% reduction

in remittance flow and a 9% decline in frequency, as reported in [4.10](#). The volatility is more noticeable with weekly shocks than with monthly shocks, but the latter allow for a longer adjustment period.

The analysis also show that weekly shocks are significantly and negatively associated with both small and large remittance transactions. The reduction in remittance amounts is more pronounced for weekly shocks compared to monthly shocks. Specifically, weekly shocks decrease small transactions by 12% and 13% for amounts of 300 and 500 USD, respectively, whereas monthly shocks result in declines of 6% and 8% for the same amounts.

Similarly, large transactions decrease by 77% and 71% for sums of 12,500 and 15,000 USD following weekly shocks, compared to 71% and 66% for monthly shocks. These findings suggest that weekly shocks have a more substantial negative impact on remittances, likely due to more impulsive reactions to immediate changes, while the longer timeframe associated with monthly shocks allows for greater adjustment in sending patterns.

Table 4.10: The impact of shock events on the flow of weekly remittances and frequency

VARIABLES	(1) Remittances	(2) Frequency
lead6	0.048*** (0.011)	-0.013*** (0.004)
lead5	0.028* (0.014)	-0.000 (0.006)
lead4	-0.057*** (0.016)	-0.067*** (0.007)
lead3	0.042** (0.017)	-0.018*** (0.007)
lead2	0.057*** (0.018)	-0.005 (0.007)
lag0	-0.116*** (0.016)	-0.085*** (0.006)
lag1	-0.016 (0.017)	-0.028*** (0.007)
lag2	0.049*** (0.018)	-0.001 (0.007)
lag3	0.054*** (0.016)	0.012* (0.006)
lag4	-0.039** (0.015)	-0.053*** (0.006)
lag5	0.023 (0.017)	-0.038*** (0.007)
lag6	0.003 (0.011)	-0.012*** (0.004)
Constant	6.314*** (0.005)	1.150*** (0.002)
Observations	4,554,709	4,554,709
R-squared	0.329	0.236
Migrant FE	YES	YES
Year-month FE	YES	YES

Note: Remittances represent amount of international migrant transfers including transaction fees, and frequency denote the number of times a migrant sends money. The overall shocks considered are exchange rate depreciations, an increase in CPI and de-risking. Canada and Norway experienced de-risking, Australia, Canada experienced exchange rate devaluation against the USD and Sweden experienced a hike in the CPI, especially electricity and food prices. The treatment group are migrants who experienced shocks living in Norway, Sweden, Canada and Australia where migrants from the US are pure controls. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Quarterly shocks, as demonstrated in Table A4, lead to a 10% reduction in remittance amounts and a 4% decrease in the frequency of remittances. Although quarterly shocks also affect remittances, they do so less severely than weekly shock events. This is because the longer time frame associated with quarterly shocks allows migrants more time to adjust their remittance sending patterns, resulting in a more gradual decline in both the flow and frequency of remittances.

Overall, the findings highlight the importance of timing in shaping remittance behavior. Weekly shock events have the most remarkable immediate effect, while monthly and quarterly shocks lead to less sudden changes. Comprehending these dynamics is important for analysing how external shocks influence remittance flows over different time periods. Additionally, pre-trends seem to hold better in monthly data than in weekly or quarterly data, which justifies the previous approach of using monthly data.

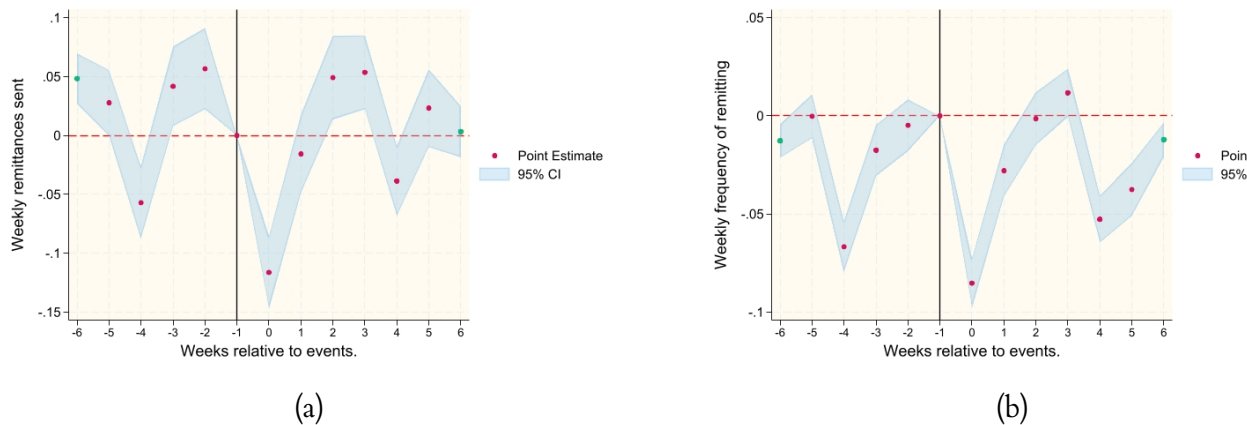


Figure 4.12: Visual representation of remittance flow and frequency across all countries and shocks.

Note: The figure illustrates the impact of events on weekly remittances (figure a) and frequency (figure b) by migrants in Norway, Sweden, Canada, and Australia, with US migrants serving as controls. The events for each country are as follows: Norway (March 2019), Sweden (December 2022), Canada (March 2018), and Australia (October 2022). The point estimates are shown alongside their corresponding 95% confidence intervals as described in equation (2). The base period (omitted), denoted by a solid vertical line, is one month before the event in each country where a migrant lives

Table 4.11: Shocks on weekly flow of small and large funds

VARIABLES	(1) ≤ 300	(2) ≤ 500	(3) ≥ 12500	(4) ≥ 15000
lead6	-0.017* (0.009)	-0.009 (0.009)	0.126 (0.193)	0.324** (0.159)
lead5	0.001 (0.012)	0.011 (0.012)	0.213 (0.423)	0.419 (0.394)
lead4	-0.099*** (0.013)	-0.100*** (0.013)		
lead3	-0.017 (0.013)	-0.010 (0.014)	-0.121 (0.261)	0.116 (0.249)
lead2	0.008 (0.014)	0.021 (0.014)		
lag0	-0.115*** (0.013)	-0.126*** (0.013)	-0.771** (0.345)	-0.712** (0.303)
lag1	-0.028** (0.014)	-0.020 (0.014)	-0.109 (0.229)	0.255 (0.189)
lag2	0.006 (0.014)	0.022 (0.015)	0.127 (0.269)	0.309 (0.254)
lag3	0.023* (0.012)	0.028** (0.013)	-0.109 (0.413)	-0.141 (0.398)
lag4	-0.053*** (0.012)	-0.061*** (0.013)	0.269 (0.285)	0.435 (0.278)
lag5	-0.028** (0.013)	-0.012 (0.014)	0.121 (0.234)	
lag6	-0.021** (0.009)	-0.011 (0.009)	0.239 (0.221)	0.468** (0.190)
o.lead4			0.000 (0.000)	0.000 (0.000)
o.lead2			0.000 (0.000)	0.000 (0.000)
o.lag5				0.000 (0.000)
Constant	5.856*** (0.004)	6.012*** (0.004)	10.732*** (0.035)	10.768*** (0.026)
Observations	3,693,986	4,056,517	4,030	3,394
R-squared	0.220	0.241	0.580	0.593
Migrant FE	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES

Note: Column 1 and 2 represent small weekly remittance sums, whereas columns 3 and 4 depict large weekly remittance sums. All weeks correspond to the months previously analysed. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

4.6.4 Discussion of Sections 4.6–4.6.3

Daily and dynamic fluctuations in exchange rates (ERs) affect local currencies' value and volatility, and resultant devaluations can occur. The costs related to currency depreciation raise the prices of remittances and inflate transaction costs, sometimes even more than standard direct costs. The decisions of migrants in such macroeconomic currency devaluation are affected in various ways.

First, the transfer of remittances is commonly determined by demand from the recipient side. If households back home require money immediately, due to shocks or to cover essential needs, the individual migrant is likely to prioritize transferring remittances, regardless of higher costs engendered by the ER devaluation. In such situations, the urgent need of the recipient family for money outweighs the incidentally increased costs of transferring funds. This scenario is commonly observed in situations where households rely on remittances to meet essential needs or cope with unexpected shocks, and this is particularly true in areas affected by fragility and conflict, such as Somalia.

The increase in remittance costs can have both short- and long-term implications. In the short term, migrants might bear the high transfer fees, leading to a high financial burden on them. However, in the long term, persistent currency devaluation coupled with elevated transfer costs could strain the financial stability of the migrant, possibly leading to a decrease in the overall amount sent and frequency over time if the cost burden becomes unsustainable.

Second, in cases where remittances are not urgently required by the recipient household, and the migrant has the freedom to choose when to make the transfers, they may opt to delay sending money for a few days or a week, to observe exchange rate variations and determine if the exchange rate returns to a more affordable or attractive level. If the ER improves, the migrant transfers the same amount of anticipated remittances at a lower cost, compared to if the rate would have been higher. If not, the migrant can still transfer money, but send an amount less than the optimal remittances *pro tem* (i.e., less the migrant would have typically transferred, possibly with the intention of sending more in future, when exchange rates are more favourable, as described below). The resultant “wait and see” approach, which delays money sending, can explain why the flow of remittances and frequency diminish at the onset of the event.

Third, if migrants intend to transfer more substantial sums, the remittance transaction fees will increase. Furthermore, a higher rate of currency depreciation indicates a significant decrease in the value of the host country's currency. This compels migrants to postpone such money transfers until the exchange rate improves. In these situations,

migrants can decide to send lesser quantities. This reduction strategy corresponds directly with our findings, suggesting that migrants are adjusting their financial support to manage higher transfer costs while still providing essential aid, albeit at a reduced level.

The response of migrants to exchange rate fluctuations highlights the unique characteristics of migrants and MTOs in the remittance industry, where socio-economic factors intersect with macroeconomic dynamics. Exchange rate fluctuations are influenced by several macroeconomic factors, including inflation rates, interest rates, trade balances, and government fiscal policies, which are beyond the control of migrants and MTOs. To fully comprehend the impact of host country exchange rate devaluation against USD on migrant remittance behaviours in recipient economies, it is crucial to understand these interconnected factors. The observed reduction in remittance flows due to the diverse shocks (e.g., sender-side currency depreciation, de-risking, and jump in CPI) aligns with previously published literature on the impact of high transaction costs on remittance flows.

Previous studies indicate that high transfer fees impede remittance flow [Ahmed and Martínez-Zarzoso \(2016\)](#); [Beck and Martínez Pería \(2011\)](#); [Gibson et al. \(2006\)](#); [Kpodar and Imam \(2024,?\)](#), while de-risking discourages formal channels and promotes informal ones, though de-risking research lacks quantitative methods and is primarily found in reports or blog posts [Haley \(2017\)](#); [Vasquez \(2017\)](#). While the current study focuses on the effects of sender-side exchange depreciation on remittances, previous research indicates that the depreciation of the home country's real exchange rate encourages the flow of funds from the host to the home country ([Higgins et al., 2004](#)). Conversely, if a migrant's currency strengthens compared to the home country currency, this will result in an increase in the amount of remittances received by households from overseas [Yang \(2008b\)](#).

In spite of this, our study adds to the body of literature by investigating how sender-side shocks that increase remittance costs affect the flow of remittances, bringing attention to an often-overlooked aspect of other expenses.

The availability of panel administrative data on actual migrant transactions can provide insights into how individuals respond to external shocks that disrupt remittance flows and frequency. Our study builds on the existing literature and reveals that when there is substantial currency depreciation and other shocks, there is a clear decrease in remittances, highlighting how migrants adapt financially and respond to these external shocks. The broader implications of these findings emphasize the necessity of policy actions to decrease the excessive costs associated with remittances, in line with the SDG objective of reducing transaction costs to less than 3% by 2030. An essential aspect is

addressing factors like de-risking that encourage informal channels and indirectly lead to increased remittance costs.

4.6.5 Heterogeneous impact of shocks on recipient location

In this section, we aim to explore the unique responses of migrants from diverse cultures to shocks affecting the cost of sending money. Expanding on previous research, particularly the study conducted by [Aycinena et al. \(2010\)](#) that analyses the influence of remittance costs on remittance flows to El Salvador, we investigate the impact of shocks that increase the cost of money transfers on the flow and frequency of remittances to various destinations. From April 2007 to March 2008, the authors conducted a field experiment involving 253 migrants from El Salvador in Washington D.C. area to explore how these migrants respond to reductions in remittance fees. In contrast to this previous research, which analysed a small sample of 253 customers, our study utilizes a large administrative dataset of over 7 million transactions from more than 170,000 customers residing in various developed nations known for their remittance sending, representing diverse cultures and countries. The event study method drops singleton observations to avoid inflating statistical significance and ensure accurate inference ([Correia, 2015](#)). Therefore, event study permits the analysis of migrants who sent money at different intervals throughout the study period. These migrants reside in various countries and send money to different countries, showcasing the cultural diversity in our dataset.

This study aims to understand how migrants from different cultures adjust their remittance-sending behaviours due to changes in exchange rates, transaction fees, and other factors like de-risking that indirectly affect the cost of remittance transfers. Our study period, from Jan 2017 to May 2023, allows us to thoroughly examine migrant behaviours in various time and geographic settings.

Furthermore, the study aims to investigate how migrants adapt to financial disturbances in terms of remittance behaviours, considering factors such as the remittance amount and transaction frequency. By analysing remittances sent to Somalia and comparing them with those sent elsewhere, as well as conducting intra-country comparisons, we hope to gain insights into how migrants from different cultural backgrounds respond to shocks and adjust their sending behaviours. This analysis sheds light on the resilience of migrant remittances in the face of economic disruptions, offering valuable insights.

Table 4.12: Monthly flow and frequency (Somalia vs. other countries)

VARIABLES	(1) Remit (Som)	(2) Freq (Som)	(3) Remi (other nations)	(4) Frequency (other nations)
lead6	0.030** (0.012)	-0.010 (0.006)	0.042*** (0.011)	0.032*** (0.006)
lead5	0.041*** (0.015)	0.004 (0.008)	0.054*** (0.014)	0.033*** (0.007)
lead4	0.028* (0.015)	0.016** (0.007)	0.021 (0.014)	0.022*** (0.007)
lead3	0.016 (0.015)	0.009 (0.007)	0.033** (0.013)	0.016** (0.007)
lead2	0.022 (0.015)	0.008 (0.007)	0.032** (0.013)	0.024*** (0.006)
lag0	-0.122*** (0.015)	-0.054*** (0.008)	-0.064*** (0.013)	-0.024*** (0.007)
lag1	-0.029* (0.016)	-0.005 (0.008)	-0.019 (0.014)	-0.006 (0.007)
lag2	-0.031** (0.016)	-0.025*** (0.008)	0.038*** (0.014)	0.018** (0.007)
lag3	0.012 (0.016)	0.002 (0.009)	0.061*** (0.015)	0.018** (0.008)
lag4	0.016 (0.017)	-0.004 (0.009)	0.040** (0.016)	0.034*** (0.008)
lag5	0.015 (0.017)	0.015* (0.009)	0.010 (0.016)	0.009 (0.008)
lag6	-0.052*** (0.013)	0.019*** (0.007)	-0.067*** (0.013)	0.003 (0.006)
Constant	6.711*** (0.006)	1.485*** (0.003)	6.638*** (0.005)	1.303*** (0.003)
Observations	1,502,192	1,502,192	1,516,408	1,516,408
R-squared	0.429	0.453	0.459	0.407
Migrant FE	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES

Note: Column 1 and 2 display monthly remittances and frequency exclusively to Somalia, while column 3 and 4 indicate monthly remittances and frequency to all nations except Somalia. Shocks occurred in different countries at different times (Sweden: December 2022, Norway: March 2019, Canada: March 2018, and Australia: October 2022). The treatment group consists of migrants who experienced shock events in their country of residence, while the control groups include migrants living in other countries. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Table 4.13: Monthly flow and frequency (Somalia vs. other countries)

VARIABLES	(1) Remit (Som)	(2) Freq (Som)	(3) Remi (other nations)	(4) Frequency (other nations)
lead6	-0.032 (0.023)	0.023** (0.012)	-0.014 (0.030)	-0.012 (0.016)
lead5	0.025 (0.028)	0.031** (0.014)	0.065* (0.037)	0.017 (0.019)
lead4	-0.008 (0.027)	0.009 (0.014)	0.051 (0.037)	0.014 (0.019)
lead3	-0.003 (0.025)	0.013 (0.013)	0.036 (0.035)	0.010 (0.018)
lead2	-0.031 (0.026)	-0.005 (0.013)	0.049 (0.035)	0.034* (0.018)
lag0	-0.099*** (0.027)	-0.041*** (0.014)	0.020 (0.034)	-0.011 (0.017)
lag1	-0.006 (0.027)	-0.011 (0.014)	0.018 (0.035)	-0.010 (0.018)
lag2	0.082*** (0.029)	0.039*** (0.015)	0.066* (0.036)	0.011 (0.018)
lag3	0.078** (0.033)	0.034** (0.017)	0.065 (0.041)	-0.011 (0.020)
lag4	0.029 (0.034)	0.032* (0.017)	0.003 (0.041)	0.008 (0.021)
lag5	0.009 (0.032)	0.003 (0.017)	-0.036 (0.041)	-0.030 (0.021)
lag6	-0.073*** (0.027)	-0.019 (0.014)	-0.013 (0.032)	-0.014 (0.017)
Constant	6.392*** (0.014)	1.225*** (0.007)	6.438*** (0.022)	1.330*** (0.012)
Observations	224,100	224,100	233,671	233,671
R-squared	0.482	0.390	0.374	0.395
Migrant FE	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES

Note: Column 1 and 2 display monthly remittances and frequency exclusively to Somalia, while column 3 and 4 indicate monthly remittances and frequency to all nations except Somalia. Shocks occurred in different countries at different times (Sweden: December 2022, Norway: March 2019, Canada: March 2018, and Australia: October 2022). The treatment group consists of migrants who experienced shock events in their country of residence, while the control groups include migrants living in other countries. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

In Table 6.9, columns 1 and 2 illustrate the responses of migrants transferring money to Somalia to different shocks in terms of remittance and frequency. Meanwhile, columns 3 and 4 present similar findings excluding funds to Somalia.

Similar results for funds sent to Sudan are shown in columns 1 and 2 of Table 5.15, while columns 2 and 4 show results for South Sudan. These two tables are analysed together as they investigate remittance behaviour across culturally diverse migrant groups and locations, offering a comparative analysis of how migrants respond to shocks in money sent across various locations.

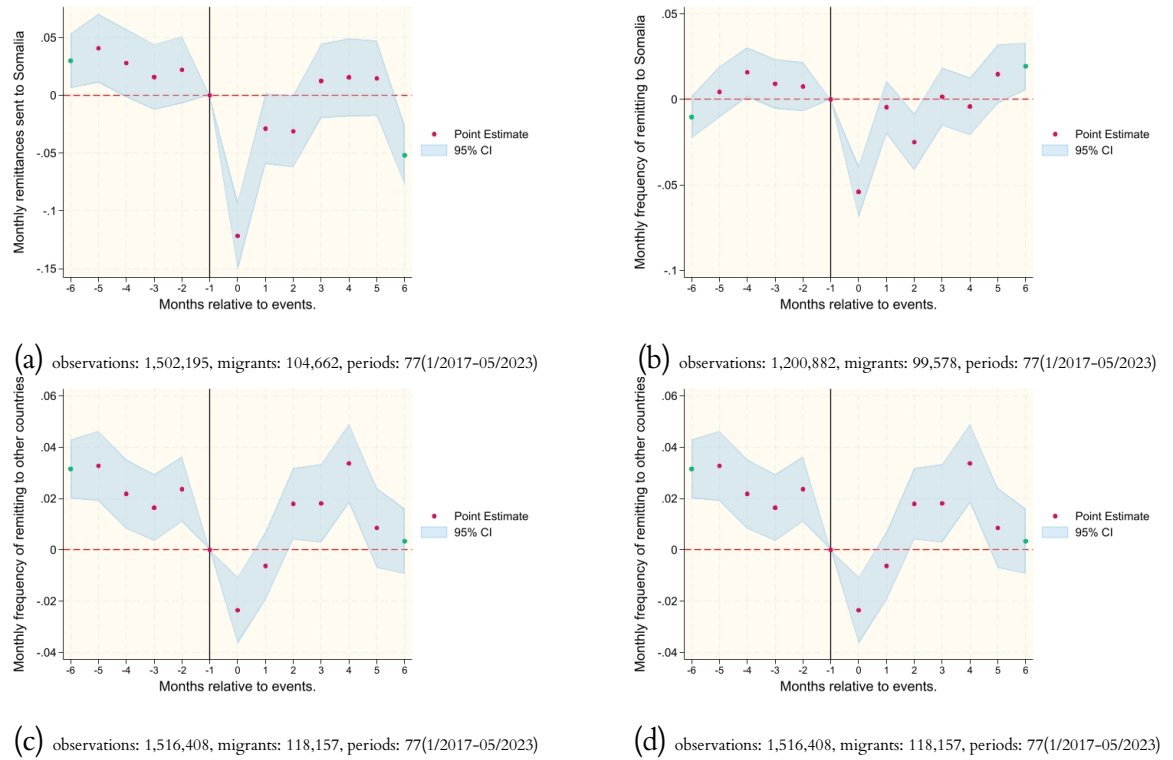


Figure 4.13: Event Study Plots showcasing monthly flow of remittances and frequency (Somalia vs. other countries.)

Note: The estimated impact of shocks on monthly remittance flow and frequency to Somalia is visualized in (a and b) of Figure 15, while (c and d) exhibit the flow of funds and frequency to other countries.. The point estimates are shown alongside their corresponding 95% confidence intervals as described in equation (2). The base period (omitted), denoted by a solid vertical line, is one month before the event in each country where a migrant lives.

The regression findings indicate that the coefficient of the event period is negative and statistically significant at the 1 percent level for migrants in multiple countries transferring remittances, except for South Sudan. This suggests that the remittance sent by these immigrants reduces because of shocks that worsen the cost of remittances. For example, funds sent to Somalia decline by 12%, with frequency decreasing by 5%. In contrast, funds to all other countries excluding Somalia reduce by 6%, accompanied by a decline in frequency by 2%. In a similar vein, funds sent by migrants from Sudan to their country decreased by 10% due to shocks, with a 4% decline in frequency. Nevertheless, the

result is not statistically significant for South Sudan, despite having a positive coefficient. While shocks affect the flow of funds for all countries except migrants from South Sudan, the decline in funds sent to Somalia and Sudan is particularly significant, while other countries experience a milder decrease.

The reason behind the significant drop in remittances to Somalia, compared to other countries, can be attributed to various factors. Somalia might have a larger number of migrants sending remittances compared to other countries in the analysis. This larger migrant population suggests that any adverse shock affecting the sending behaviours of migrants would have a more significant impact on the overall remittance flows to Somalia. Furthermore, migrants who send money to Somalia may be more likely to send larger amounts compared to migrants sending money to other nations. One reason for this could be the presence of larger families or a greater need for financial assistance in Somalia. Due to this, migrants who send larger sums of money may be more prone to lowering their remittances when faced with shocks that raise the cost of money transfer, leading to a more noticeable decline in remittance flows to Somalia. Furthermore, remittance transaction flows to South Sudan remain stable, with no significant decline observed. The coefficient estimate even suggests a positive but statistically insignificant result, indicating minimal disruption in remittance behaviours despite shocks.

Overall, these findings imply that the impact of shocks on remittance sending behavior is complex, with culture, behaviour of migrants and recipient country-specific factors playing a significant role in explaining these variations.

4.6.6 Alternative Event Dates

We analyse alternative shock event dates beyond those discussed in the main results section. Given that the staggered adoption design can accommodate multiple shocks experienced by various entities, we now use shock amounts of 200 and 500 for both remittance flow and frequency. The alternative event dates considered are the Covid-19 period for Norway and Australia, both of which confronted high exchange rate depreciations of 9% and 7%, respectively. The shock dates for Canada and Australia remain unchanged, with the US acting as the counterfactual group.

Table A6 in the appendix reports the estimated coefficients, showing that shocks reduce remittance flow and the frequency of small transactions (amounting to 300) by 9% and 7%, respectively. For transactions of 500, shocks lead to a 14% decrease in flow and a 7% reduction in frequency. Surprisingly, the pre-trend seems to hold better with the alternative event dates and the Covid-19 period. Moreover, the findings passed the robustness check of Rambachan and Roth (2023), demonstrating the reliability of the

results. This further sensitivity robustness check confirms that the estimated effects are consistent even when accounting for potential biases and alternative specifications, thus reinforcing the robustness and validity of the original analysis (see Figure XX in the appendix).

4.7 Robustness Checks

The results section shows that the event study framework provides reliable estimates of how diverse shock events affect remittances and the frequency of remitting among migrants in various countries where the treatment is staggered, with individual migrants exposed to events at different times. Given the potential limitations of event study designs highlighted in the literature e.g., (Sun and Abraham (2021); Roth (2022)), we will incorporate sensitivity tests recommended by Rambachan and Roth (2023) and utilize alternative models proposed by De Chaisemartin and d'Haultfoeulle (2020) to account for dynamic treatment effects.

4.7.1 Roth sensitivity analysis

We test the reliability of our estimated results with sensitivity analysis, following the method suggested by Rambachan and Roth (2023). This approach analyses the effect of potential violations of the parallel trends assumption on our post-event point estimates and confidence intervals. To conduct the test, one needs to determine the maximum deviation from parallel trends ($\bar{M}$) and confidence intervals for post-event point estimates considering this deviation. The focus is on assessing confidence intervals for our estimated parameter of interest with different $\bar{M}$ values, considering that post-treatment parallel trends have $\bar{M}$ times larger maximum deviation than pre-treatment trends.

Figure 16 displays the results of the parallel trend sensitivity analysis, considering relative magnitudes deviation and smoothing constraints. These analyses correspond to the results shown in Table 6.1 and Figure 8. Under relative magnitude deviation, we examine how the results of the estimated coefficients hold up when the post-event parallel trends deviate by no more than a constant $\bar{M}$ relative to the maximum pre-event parallel trends violation. For instance, we find that with a pre-trend deviation up to 2 times, the impact of various shocks on the flow and frequency of sending remittances by migrants living in different countries at the onset of the event remains robust. This indicates that our results are not sensitive to moderate deviations from the parallel trends assumption, ensuring the validity of our estimated effects.

Moreover, under smoothness constraints, we impose restrictions on how much the

slope of the pre-trend can vary across consecutive periods. To test the reliability of our findings, we examine if the post-event deviations deviate significantly from a linear extrapolation of the pre-trend. The analysis demonstrates the robustness of diverse shock events' impact on remittance sending transfers by migrants residing in multiple countries, even with smoothness constraints. This indicates that our conclusions are not influenced by irregularities in the changes of trends, further confirming the importance of our treatment effects.

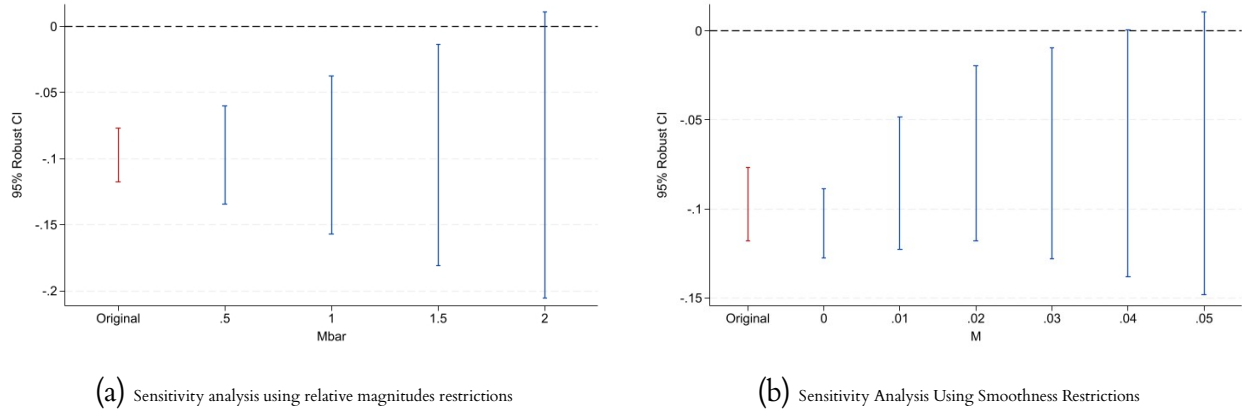


Figure 4.14: The sensitivity analysis of pre-trend.

4.7.2 Alternative methods

In the previous results section, we analyzed individual migrants as our unit of analysis. However, we now use the country where migrants live as the unit of analysis and examine how exposure to shock events affects the flow of weekly remittances and frequency at the country level. The weekly remittances capture the total amount of money migrants send within a country.

As a robustness check, we utilize the [De Chaisemartin and d'Haultfoeuille \(2020\)](#) estimator as an alternative approach, complementing the panel event study framework. This estimator extends the event-study approach to accommodate continuous treatment and heterogeneous treatment effects across time and treated units. The event study and TWFE methods may be biased if negative weights arise, as recent literature suggests [De Chaisemartin and d'Haultfoeuille \(2020\)](#). This happens when events vary over time and across units, as in our context where shock events occurred at different times in different countries where individual migrants are located.

The equation (2) is derived from [De Chaisemartin and d'Haultfoeuille \(2020\)](#) model:

$$R_{ict} = \alpha + \sum_{t=-q}^{F_b-1} \kappa_t Z_{ct} + \sum_{t=F}^S \gamma_t Z_{ct} + \lambda_t + \mu_c + X_{ict} + \epsilon_{ict} \quad (4.3)$$

Where R_{ict} is amount of remittances transferred by migrant i in country c at period t and $t = F_b$ is the period when a shock-event occurs. α represents the intercept, κ_t is counterfactual estimator for each pre-event period from $t = -q$ to $t = F_b - 1$. The κ_t coefficients test for the parallel trend assumption of a difference-in-differences design. γ_t is the coefficient of the shock-event effects for each $t \geq F_b$. Exposure to event Z_{ct} is equal to 1 for countries that experienced shock-events and 0 otherwise. λ_t and μ_c are time and county fixed effects, respectively. X_{ict} is a vector of optional control variables. The disturbance term, ϵ_{ict} , is clustered at the county level.

In this study, the treatment involves exposure to shock events. Countries that experience these shocks are considered to be treated, while countries without shocks serve as the control group. [De Chaisemartin and d'Haultfoeuille \(2020\)](#) points out that observations in the same (c, t) cell have the same treatment. Under the parallel trends assumption, the authors show that the expectation of the treatment coefficient as:

$$\beta_{fe} = \sum_{(g,t): D_{g,t}=1} W_{g,t} \Delta_{g,t}$$

In our model, the coefficients κ_t and γ_t can be expressed in terms of the overall weighted sum of treatment effects, similar to β_{fe} . Specifically, for the periods t within $[-q, F_b - 1]$, we have:

$$\kappa_t = \sum_{(c,t): Z_{c,t}=1} W_{c,t} \Delta_{c,t} \quad \text{for } t \in [-q, F_b - 1]$$

and for the periods t within $[F, S]$, we have:

$$\gamma_t = \sum_{(c,t): Z_{c,t}=1} W_{c,t} \Delta_{c,t} \quad \text{for } t \in [F, S]$$

Here, $\Delta_{c,t}$ is the average treatment effect (ATE) in group c and period t , and the weights $W_{c,t}$ sum to one but may be negative. The reason for negative weights is that β_{fe} is derived from a weighted average of various difference-in-differences (DID) analyses, which compare the changes in the outcome between consecutive time periods for different groups. The presence of negative weights in the DID approach can be attributed to situations where the “control group” is subjected to treatment in both periods, resulting in the cancellation of the treatment effect in the second period.

To tackle this issue, we employ the DiD estimator developed by [De Chaisemartin and d'Haultfoeuille \(2020\)](#), which is robust to different treatment effects over time and across various groups. In this method, we compare the outcome changes of groups that

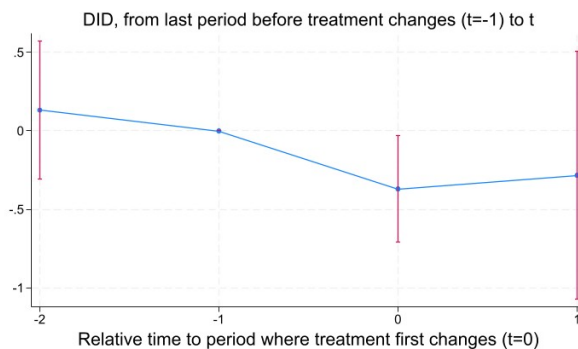
transition from untreated to treated at different times (“switchers”) with those of groups that remain untreated. The standard errors are estimated by employing bootstrapping techniques.

The table shows that the effect of diverse shock events on the weekly ¹⁴ flow of remittances is negative and statistically significant. This indicates that even when we aggregate data at the country level, shocks significantly reduce the flow of remittances. The graph also displays that when events occur, the flow of remittances decreases substantially.

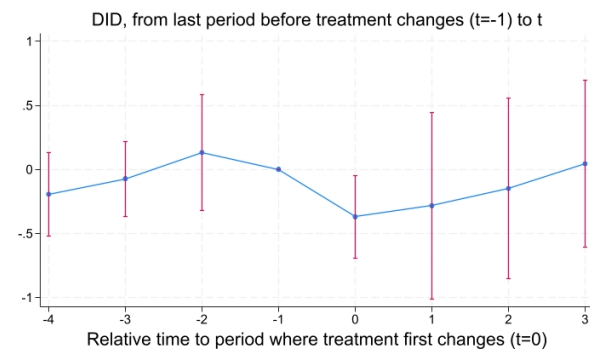
Table 4.14: Effect of Diverse Event Exposure on Weekly Flow of Remittances by Country

	Estimate (1)	Estimate (3)
Exposure	-0.331 (0.248) [0.032]	-0.175 (0.282) [0.024]
Observations	79	181
Switchers	23	51

Note: Estimate 1 in column 1 denotes when 1 dynamic and placebo estimators are used, while Estimate 3 in column 2 represent when 3 dynamic and placebo estimators are used. Standard errors in parentheses; P-values in brackets



(a) When 1 robust dynamic and placebo estimators are used



(b) When 3 robust dynamic and placebo estimators are used

Figure 4.15: The sensitivity analysis of pre-trend.

¹⁴Did_multiplengt command of (De Chaisemartin and d’Haultfoeuille, 2020) is the slowest of the available DiD estimators. Given that we have large observations when the unit of analysis is individual migrants, for using this DID estimator, I use country where migrants live as a unit of analysis. Since we have 5 countries and almost 7 years, the observations will be small if we continue analysing the data at the monthly level. Hence, the choice for weekly is to increase the number of observations and analyse how different shocks affect remittance amount and frequency by country.

4.8 Conclusion

This paper uses a novel daily remittance transactions dataset for over 200,000 unique migrants residing in five countries over a 6-year period, from Jan 2017 to May 2023, to investigate how individual migrants respond to sender-side external shocks that escalate the cost of sending remittances and more specifically how the diverse shocks affect the flow and frequency of remitting. While the current literature has explored the link between remittances and transaction costs (Ahmed and Martínez-Zarzoso, 2016; Freund and Spatafora, 2008; Kakhkharov et al., 2017; Kosse and Vermeulen, 2014; Kpodar and Imam, 2024), other factors like host country exchange rate devaluation, de-risking, and increased cost of living have been overlooked. By using novel data and an event study framework, this study found that external shock events affecting remittance costs or migrant purchasing power negatively impact the flow and frequency of remittances.

Results from the DID method show that a 4% or greater exchange rate depreciation leads to a 10% decrease in monthly remittance flow and a 13% reduction in their frequency. The findings indicate that increased remittance costs have a substantial impact on reducing the volume and regularity of remittances between nations. Furthermore, if the exchange rate in Norway devalues by 6%, remittance costs will rise by 6%, resulting in a 5% decrease in monthly flow and a 6% decline in frequency.

Moreover the results from the event study approach suggest that shocks reduce monthly remittance flow and frequency across all countries by 9% and 4%. Migrants react impulsively to weekly shocks events, adjusting their remittance behaviour abruptly in shorter time intervals compared to monthly and quarterly events. The comparison between small remittances for altruistic purposes and large transactions for investment motivations reveals that migrants significantly reduce the flow and frequency of the latter. For example, there is a 72% decrease in the flow of large sums ≥ 12500 and a 23% decrease in frequency, while small sums ≤ 200 only decrease by 5% and 4%. This indicates that shocks impede the flow of essential funds that migrants might have used for investing in conflict-affected countries, such as Somalia, which heavily depends on remittances from the diaspora. Shocks prompt migrants to seek cheaper alternatives, leading to increased use of informal channels for sending money home. The use of real remittance transaction data from panel studies can provide valuable insights that cannot be obtained from aggregate country and cross-country datasets used in existing literature.

Furthermore, the study suggests that policy makers should focus on indirect implicit costs caused by regulatory issues, inflationary pressures, and other macroeconomic shocks that hinder remittance flows to developing countries, in addition to contributing

to the literature in various areas. The study emphasizes the significance of FinTech and remittance platform technologies in reducing remittance costs, which have seen a decline in recent years. However, it requires awareness and knowledge sharing, adaptability from the sender side. The study highlights the need for more research on the relationship between remittances and sender side shocks, which has been largely overlooked. This includes conducting experiments or using reliable quasi-experimental methods to better understand the remittance behaviour of migrants and the factors that influence remittance flows.

4.A Appendix

4.A.1 Supplementary Tables

Table A1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Amount Sent	7272017	373.185	1196.552	0	291545
Total Amount Sent	7272017	389.394	1229.719	0.105	300291.34
Total Commission	7272017	16.209	1229.719	0	8746.35
Weekly Descriptive Statistics					
Amount Sent	4609349	588.762	1682.876	0	340000
Total Commission	4609349	44.204	80.922	0	8907.1
Total Amount Sent	4609349	614.334	1730.26	0.105	346800
IHS Remittances	4609349	6.33	1.094	0.105	13.45
Frequency	4609349	1.578	1.139	1	63
Migrant ID	4609349	110780.05	64409.24	1	231394
Event Time	4609349	-21.427	147.094	-308	271
Treated	4609349	0.214	0.41	0	1
Monthly Descriptive Statistics					
Amount Sent	2666483	1017.749	2587.369	0.11	428868
Total Commission	2666483	44.204	80.922	0	8907.1
Total Amount Sent	2666483	1061.953	2664.362	0.12	437445.38
IHS Remittances	2666483	6.828	1.196	0.12	13.682
Frequency	2666483	2.727	2.647	1	121
Migrant ID	2666483	111851.82	64691.703	1	231394
Event Time	2666483	-4.394	33.742	-71	62
Treated	2666483	0.231	0.421	0	1
Quarterly Descriptive Statistics					
Amount Sent	1366737	1985.612	4518.712	0.11	518001
Total Commission	1366737	86.242	152.658	0	11630.02
Total Amount Sent	1366737	2071.854	4663.977	0.12	529631.02
IHS Remittances	1366737	7.405	1.357	0.12	13.873
Frequency	1366737	5.321	6.376	1	316
Migrant ID	1366737	112876.63	65133.899	1	231394
Event Time	1366737	-4.04	10.628	-23	21
Treated	1366737	0.511	0.5	0	1
Control Variables					
GDP Per Capita	30	62267.388	14556.817	43562.438	108729.19
CPI	30	2.891	2.126	0.497	8.369
Exchange Rate	35	4.389	3.951	1	10.565

Notes: IHS remittances represent the remittance amounts transformed using inverse hyperbolic functions. Migrant ID refers to the unique identification given to each sender. Treated equals 1 when migrants experience shock events and 0 otherwise.

Table A2: The impact of shocks on frequency of small remittance amounts

VARIABLES	(1) Remit ≤ 50	(2) Remit ≤ 100	(3) Remit ≤ 200	(4) Remit ≤ 300	(5) Remit ≤ 400	(6) Remit ≤ 500
lead6	-0.014* (0.008)	-0.012** (0.006)	-0.011** (0.005)	-0.009* (0.005)	-0.009* (0.005)	-0.008 (0.005)
lead5	-0.012 (0.010)	-0.002 (0.007)	0.006 (0.006)	0.012** (0.006)	0.013** (0.006)	0.012** (0.006)
lead4	0.006 (0.010)	-0.000 (0.007)	0.003 (0.006)	0.007 (0.006)	0.009 (0.006)	0.010* (0.006)
lead3	-0.005 (0.010)	-0.008 (0.007)	-0.007 (0.006)	-0.008 (0.006)	-0.004 (0.006)	-0.005 (0.005)
lead2	-0.008 (0.009)	-0.003 (0.007)	0.005 (0.006)	0.009* (0.006)	0.010* (0.006)	0.013** (0.005)
lag0	-0.043*** (0.010)	-0.043*** (0.007)	-0.040*** (0.006)	-0.043*** (0.006)	-0.044*** (0.006)	-0.044*** (0.006)
lag1	0.002 (0.010)	-0.001 (0.007)	0.000 (0.006)	-0.001 (0.006)	0.002 (0.006)	-0.001 (0.006)
lag2	-0.024** (0.011)	-0.016** (0.007)	-0.004 (0.007)	0.004 (0.006)	0.008 (0.006)	0.009 (0.006)
lag3	-0.002 (0.011)	0.016** (0.008)	0.027*** (0.007)	0.033*** (0.007)	0.038*** (0.006)	0.041*** (0.006)
lag4	0.007 (0.011)	0.019** (0.008)	0.038*** (0.007)	0.042*** (0.007)	0.047*** (0.006)	0.050*** (0.006)
lag5	-0.016 (0.011)	-0.013 (0.008)	0.005 (0.007)	0.011* (0.007)	0.013** (0.007)	0.017** (0.007)
lag6	-0.004 (0.009)	0.001 (0.006)	0.012** (0.006)	0.016*** (0.006)	0.018*** (0.005)	0.020*** (0.005)
Constant	1.233*** (0.004)	1.359*** (0.003)	1.439*** (0.002)	1.468*** (0.002)	1.479*** (0.002)	1.490*** (0.002)
Observations	634,745	1,493,397	2,014,990	2,207,003	2,288,308	2,369,523
R-squared	0.362	0.353	0.370	0.385	0.395	0.402
Migrant FE	YES	YES	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES	YES	YES

Note: The estimated coefficients by country are represented in columns 1 to 4. Shocks occurred in different countries at different times (Sweden: December 2022, Norway: March 2019, Canada: March 2018, and Australia: October 2022). The treatment group consists of migrants who experienced shock events in their country of residence, while the control groups include migrants living in other countries.. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Table A3: The impact of diverse shocks on frequency of remitting

VARIABLES	(1) De-risking	(2) ER-depreciation	(3) Spike in CPI
lead6	-0.012* (0.007)	-0.012** (0.006)	0.057*** (0.010)
lead5	0.004 (0.008)	0.030*** (0.007)	0.013 (0.012)
lead4	0.015* (0.008)	0.015** (0.007)	0.008 (0.011)
lead3	0.008 (0.008)	0.009 (0.007)	-0.008 (0.012)
lead2	0.012 (0.008)	0.028*** (0.007)	-0.011 (0.011)
lag0	-0.024*** (0.008)	-0.022*** (0.007)	-0.192*** (0.014)
lag1	0.001 (0.008)	0.001 (0.007)	-0.063*** (0.018)
lag2	-0.005 (0.008)	0.025*** (0.007)	-0.071*** (0.021)
lag3	0.024*** (0.008)	0.070*** (0.007)	-0.040* (0.021)
lag4	0.014* (0.008)	0.081*** (0.007)	-0.047** (0.021)
lag5	0.016** (0.008)	0.028*** (0.008)	-0.119*** (0.025)
lag6	0.013* (0.007)	0.002 (0.006)	
Constant	1.502*** (0.002)	1.505*** (0.002)	1.500*** (0.001)
Observations	2,607,406	2,607,406	2,607,406
R-squared	0.461	0.462	0.462
Migrant FE	YES	YES	YES
Year-month FE	YES	YES	YES

Note: Column 1 illustrates the de-risking encountered by Norway and Canada in March 2018 and 2019, respectively. Canada and Australia saw their local currencies depreciate against the USD in March 2018 and October 2022, respectively, as shown in column 2. Sweden, on the other hand, experienced an increase in the cost of living in December 2022, as indicated in column 3. The treatment group consists of migrants who experienced shock events in their country of residence, while the control groups include migrants living in other countries. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Table A4: The impact of shock events on the flow of quarterly remittances and frequency

VARIABLES	(1) Remittances	(2) Frequency
lead6	0.100*** (0.009)	-0.032*** (0.007)
lead5	0.115*** (0.010)	-0.012 (0.007)
lead4	0.071*** (0.009)	0.009 (0.006)
lead3	0.012 (0.008)	-0.013** (0.006)
lead2	-0.026*** (0.008)	-0.015*** (0.006)
lag0	-0.098*** (0.008)	-0.041*** (0.006)
lag1	0.010 (0.009)	0.041*** (0.007)
lag2	0.032*** (0.010)	0.033*** (0.007)
lag3	0.055*** (0.014)	0.078*** (0.008)
lag4	-0.002 (0.014)	0.018** (0.009)
lag5	0.015 (0.014)	0.105*** (0.009)
lag6	-0.160*** (0.012)	0.058*** (0.008)
Constant	7.427*** (0.004)	1.971*** (0.003)
Observations	1,299,702	1,299,702
R-squared	0.526	0.575
Migrant FE	YES	YES
Year-month FE	YES	YES

Note: Remittances represent amount of international migrant transfers including transaction fees, and frequency denote the number of times a migrant sends money. The overall shocks considered are exchange rate depreciations, an increase in CPI and de-risking. Canada and Norway experienced de-risking, Australia, Canada experienced exchange rate devaluation against the USD and Sweden experienced a hike in the CPI, especially electricity and food prices. The treatment group are migrants who experienced shocks living in Norway, Sweden, Canada and Australia where migrants from the US are pure controls. Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Table A5: The impact of shock events on the flow of monthly remittances and frequency

VARIABLES	(1) Remittances	(2) Frequency
GDP per capita	0.0355 (0.0344)	-0.193*** (0.0207)
Exchange Rate	-0.729*** (0.0371)	-0.269*** (0.0219)
CPI	0.340*** (0.0110)	0.0734*** (0.00681)
lead6	0.0633*** (0.00874)	0.0152*** (0.00483)
lead5	0.0705*** (0.0106)	0.0245*** (0.00560)
lead4	0.0344*** (0.0105)	0.0185*** (0.00549)
lead3	0.0341*** (0.0101)	0.00944* (0.00535)
lead2	0.0291*** (0.0102)	0.0167*** (0.00532)
lag0	-0.0975*** (0.0105)	-0.0412*** (0.00553)
lag1	-6.44e-05 (0.0110)	0.00970* (0.00581)
lag2	0.0342*** (0.0112)	0.0233*** (0.00612)
lag3	0.0490*** (0.0138)	0.0314*** (0.00740)
lag4	0.0161 (0.0142)	0.0216*** (0.00732)
lag5	0.0135 (0.0138)	0.0238*** (0.00737)
lag6	-0.0441*** (0.00988)	0.0271*** (0.00561)
Constant	6.829*** (0.432)	4.006*** (0.260)
Observations	2,510,896	2,510,896
R-squared	0.447	0.466
Migrant FE	YES	YES
Year-month FE	YES	YES

Note: Remittances represent amount of international migrant transfers including transaction fees, and frequency denote the number of times a migrant sends money. The estimation procedure resembles Table 6.1, but we include control variables in this regression. The control variables consist of GDP per capita, annual exchange rates, and annual CPI. These control variables are transformed using inverse hyperbolic sine (asinh). Robust standard errors in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Table A6: Impact of Shocks on Remittance Flow and Frequency for Various Transaction Amounts

VARIABLES	(1) Remittances	(2) Remittances	(3) Frequency	(4) Frequency
lead6	0.020*** (0.007)	0.022*** (0.007)	0.003 (0.005)	0.006 (0.005)
lead5	0.024*** (0.009)	0.038*** (0.009)	0.013** (0.006)	0.019*** (0.006)
lead4	0.025*** (0.009)	0.041*** (0.009)	0.014** (0.006)	0.022*** (0.006)
lead3	0.020** (0.008)	0.025*** (0.009)	0.009 (0.006)	0.010* (0.006)
lead2	0.012 (0.008)	0.010 (0.009)	0.007 (0.006)	0.007 (0.006)
lag0	-0.090*** (0.009)	-0.136*** (0.009)	-0.065*** (0.006)	-0.076*** (0.006)
lag1	-0.093*** (0.009)	-0.066*** (0.009)	-0.055*** (0.006)	-0.044*** (0.006)
lag2	-0.036*** (0.009)	-0.014 (0.009)	-0.042*** (0.006)	-0.033*** (0.006)
lag3	0.075*** (0.009)	0.072*** (0.009)	0.055*** (0.006)	0.058*** (0.006)
lag4	0.094*** (0.009)	0.097*** (0.009)	0.066*** (0.006)	0.067*** (0.006)
lag5	0.109*** (0.009)	0.115*** (0.009)	0.070*** (0.006)	0.077*** (0.006)
lag6	0.048*** (0.007)	0.046*** (0.008)	0.019*** (0.005)	0.020*** (0.005)
Constant	6.252*** (0.003)	6.439*** (0.004)	1.463*** (0.002)	1.485*** (0.002)
Observations	2,606,975	2,606,975	2,606,975	2,606,975
R-squared	0.362	0.353	0.370	0.385
Migrant FE	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES

Note: Robust standard errors are reported in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

4.A.2 Graphical Exhibits

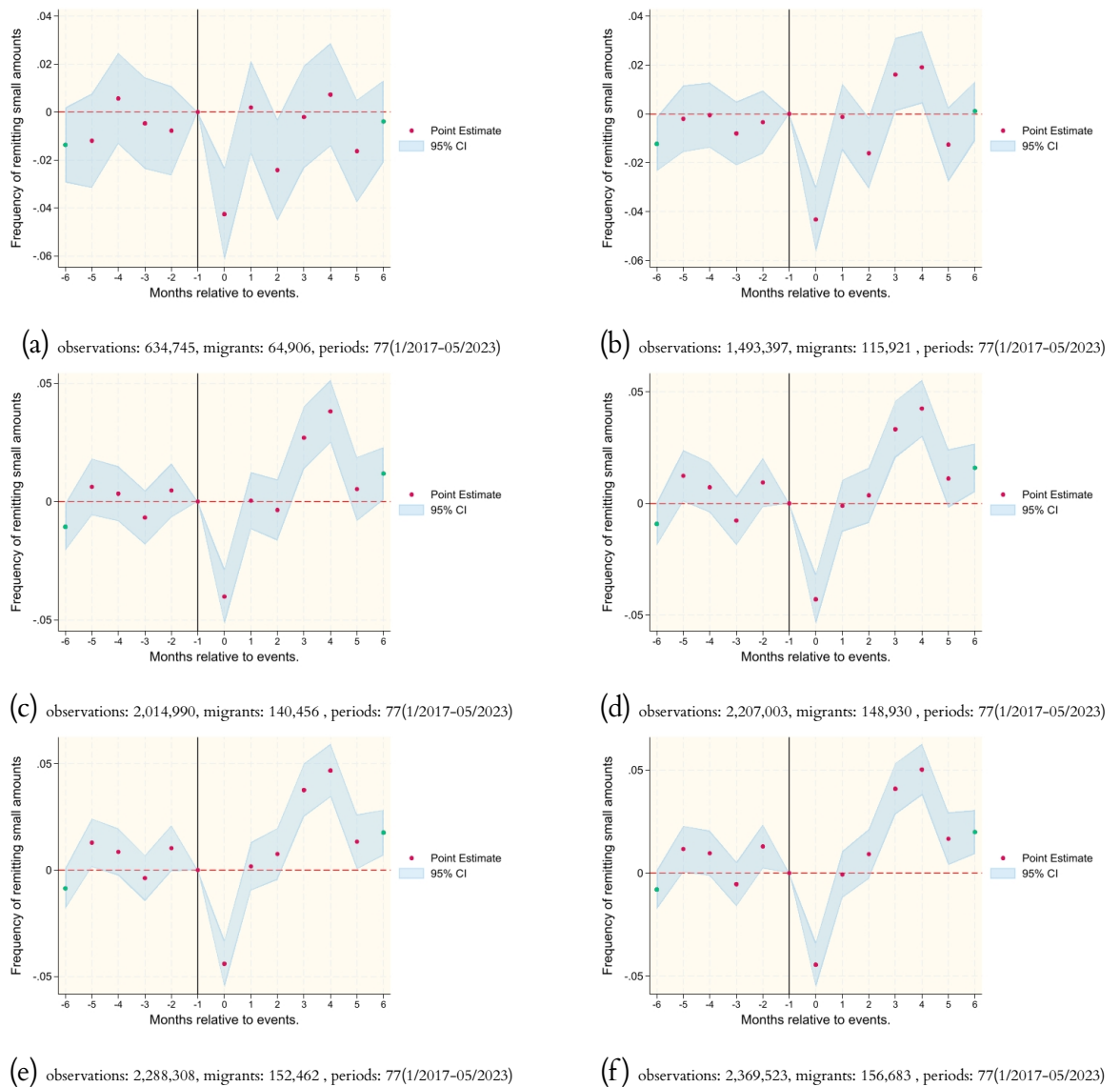


Fig. S1: Event Study Plots showcasing shocks on frequency of small remittance amounts.

Note: The figures show the effect of shock events on the monthly frequency from migrants in Sweden, Norway, Canada, and Australia, with the US serving as a control. The point estimates are shown alongside their corresponding 95% confidence intervals as described in equation (2). The base period (omitted), denoted by a solid vertical line, is one month before the event in each country where a migrant lives.

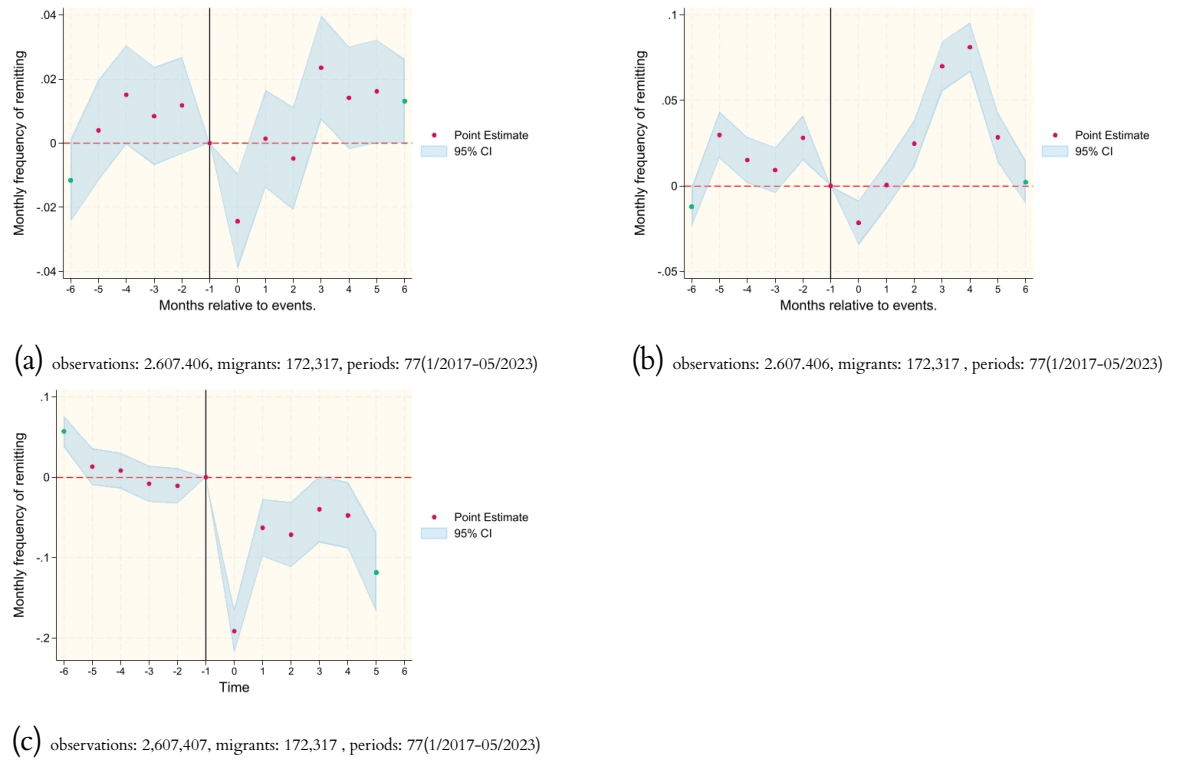


Fig. S2: Event Study Plots showcasing diverse shocks on frequency.

Note: The figures show the effect of shock events on the monthly frequency from migrants in Sweden, Norway, Canada, and Australia, with the US serving as a control. The point estimates are shown alongside their corresponding 95% confidence intervals as described in equation (2). The base period (omitted), denoted by a solid vertical line, is one month before the event in each country where a migrant lives.

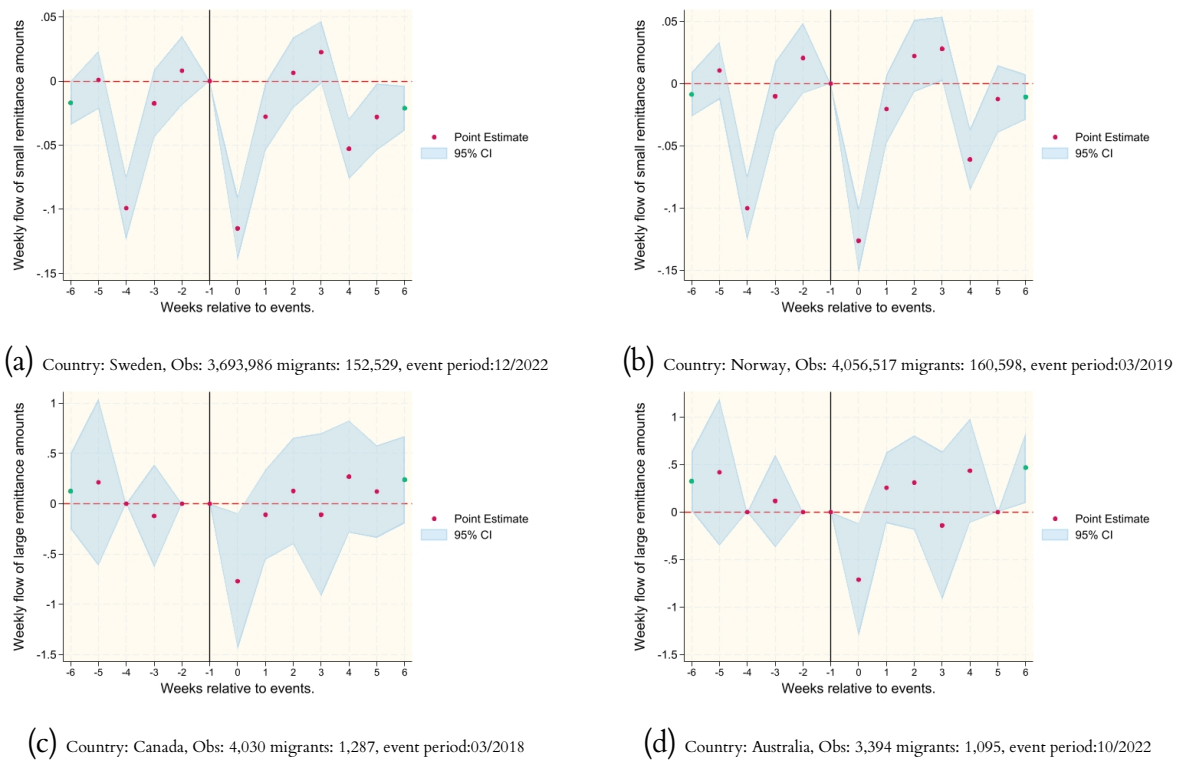


Fig. S3: Event Study Plots showcasing weekly small and large remittances

Note: The figures exhibit the effect of shocks on weekly small and large remittance amounts from migrants in Sweden, Norway, Canada, and Australia, with the US serving as a control. The point estimates are shown alongside their corresponding 95% confidence intervals as described in equation (2). The base period (omitted), denoted by a solid vertical line, is one month before the event in each country where a migrant lives.

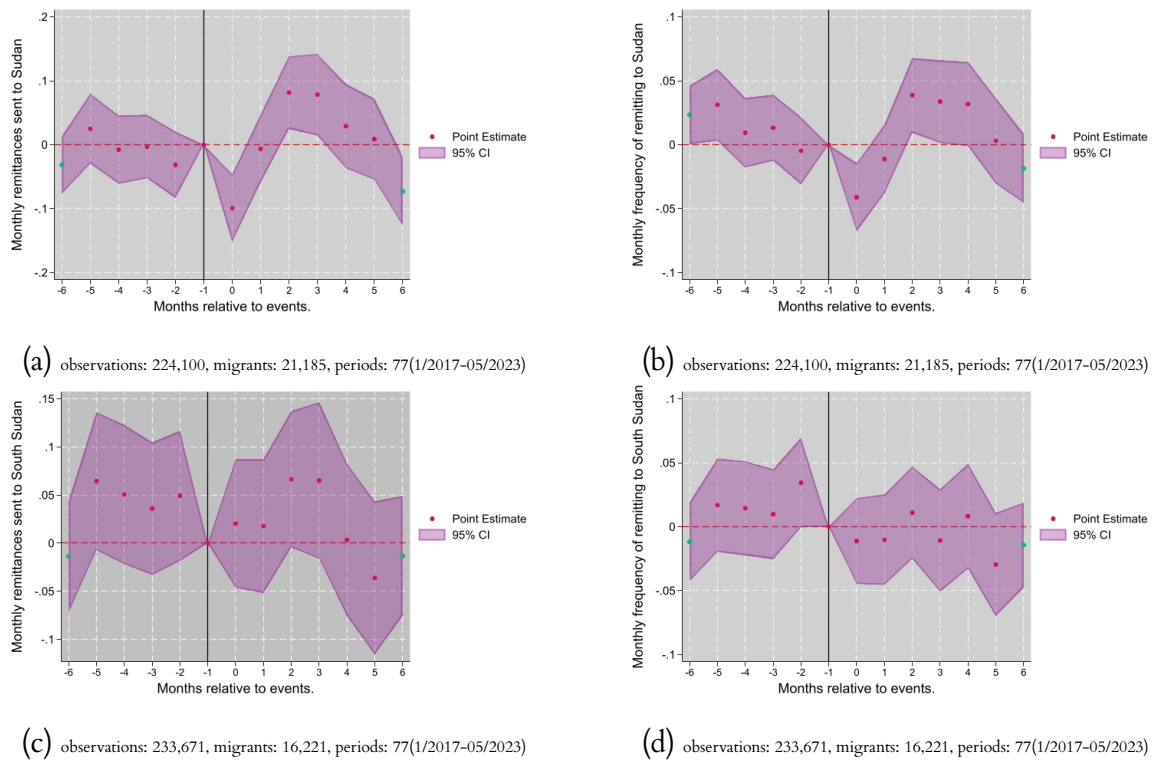


Fig. S4: Event Study Plots showcasing monthly flow of remittances and frequency (Somalia vs. other countries.)

Note: The estimated impact of shocks on monthly remittance flow and frequency to Sudan is visualized in (a and b) of Figure 15, while (c and d) exhibit the flow of funds and frequency to South Sudan. The point estimates are shown alongside their corresponding 95% confidence intervals as described in equation (2). The base period (omitted), denoted by a solid vertical line, is one month before the event in each country where a migrant lives.

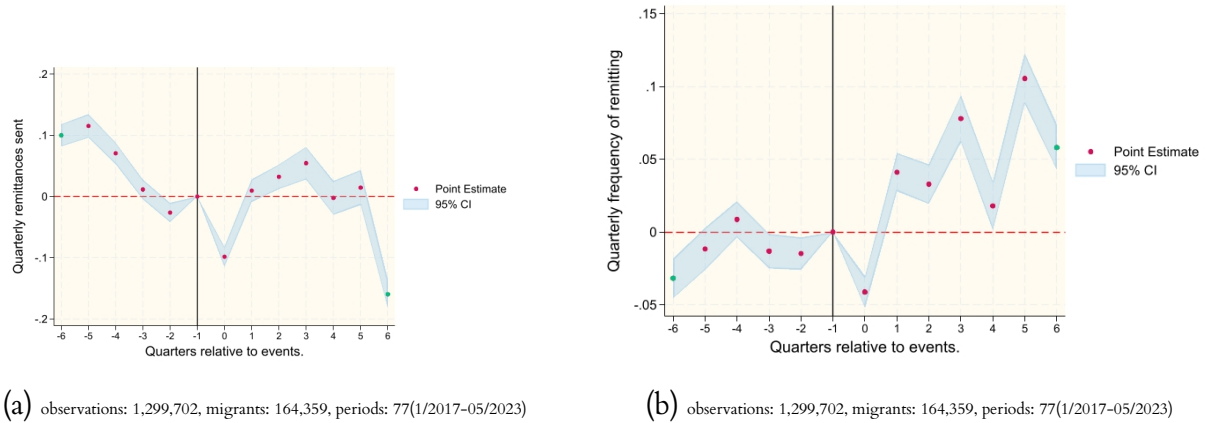


Fig. S5: Visual representation of quarterly remittance flow and frequency across all countries and shocks.

Note: The figure illustrates the impact of events on monthly remittances (figure a) and frequency (figure b) by migrants in Norway, Sweden, Canada, and Australia, with US migrants serving as controls. The events for each country are as follows: Norway (Q2 2019), Sweden (Q4 2022), Canada (Q1 2018), and Australia (Q4 2022). The point estimates are shown alongside their corresponding 95% confidence intervals as described in equation (2). The base period (omitted), denoted by a solid vertical line, is one month before the event in each country where a migrant lives

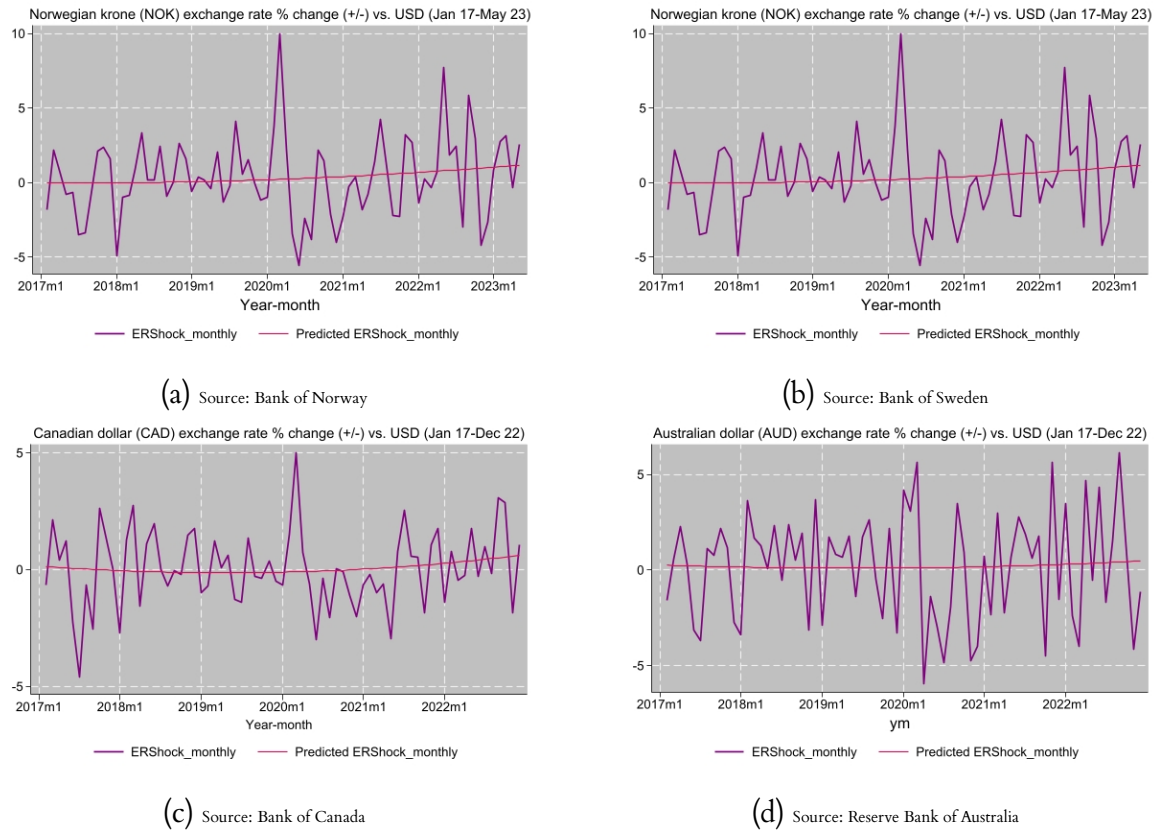


Fig. S6: Monthly plots illustrating the exchange rate % change (+/-) against USD between January 2017 and May 2023.

Note: Figure S6 (a, b, c, and d) displays the monthly fluctuations in host country currencies relative to the US dollar. The display indicates changes in local currencies compared to USD, with negative values indicating appreciation and positive values indicating depreciation. The event dates for the event study analysis are chosen based on significant depreciation of host country currencies against USD, excluding the Covid-19 period.

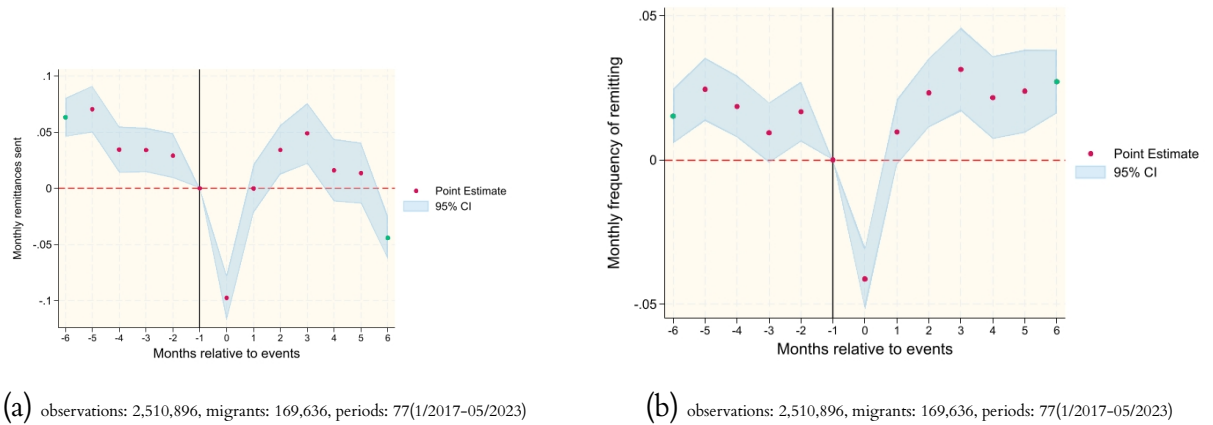


Fig. S7: Visual representation of remittance flow and frequency across all countries and shocks.

Note: The figure illustrates the impact of events on monthly remittances (figure a) and frequency (figure b) by migrants in Norway, Sweden, Canada, and Australia, with US migrants serving as controls. The events for each country are as follows: Norway (March 2019), Sweden (December 2022), Canada (March 2018), and Australia (October 2022). The point estimates are shown alongside their corresponding 95% confidence intervals as described in equation (2). The base period (omitted), denoted by a solid vertical line, is one month before the event in each country where a migrant lives

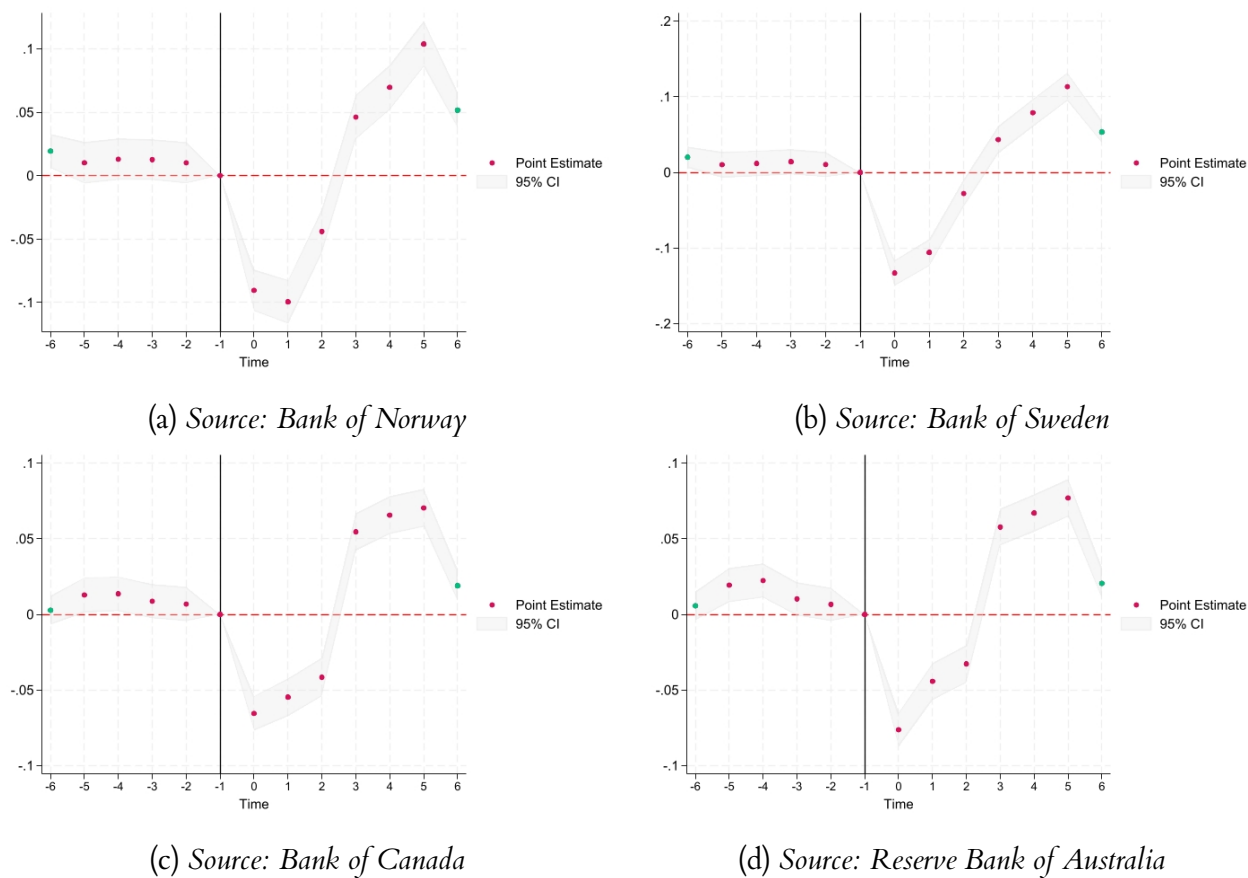


Fig. S8: Monthly plots illustrating the exchange rate trend between January 2017 and May 2023.

Roth sensitivity analysis: Smoothness restrictions

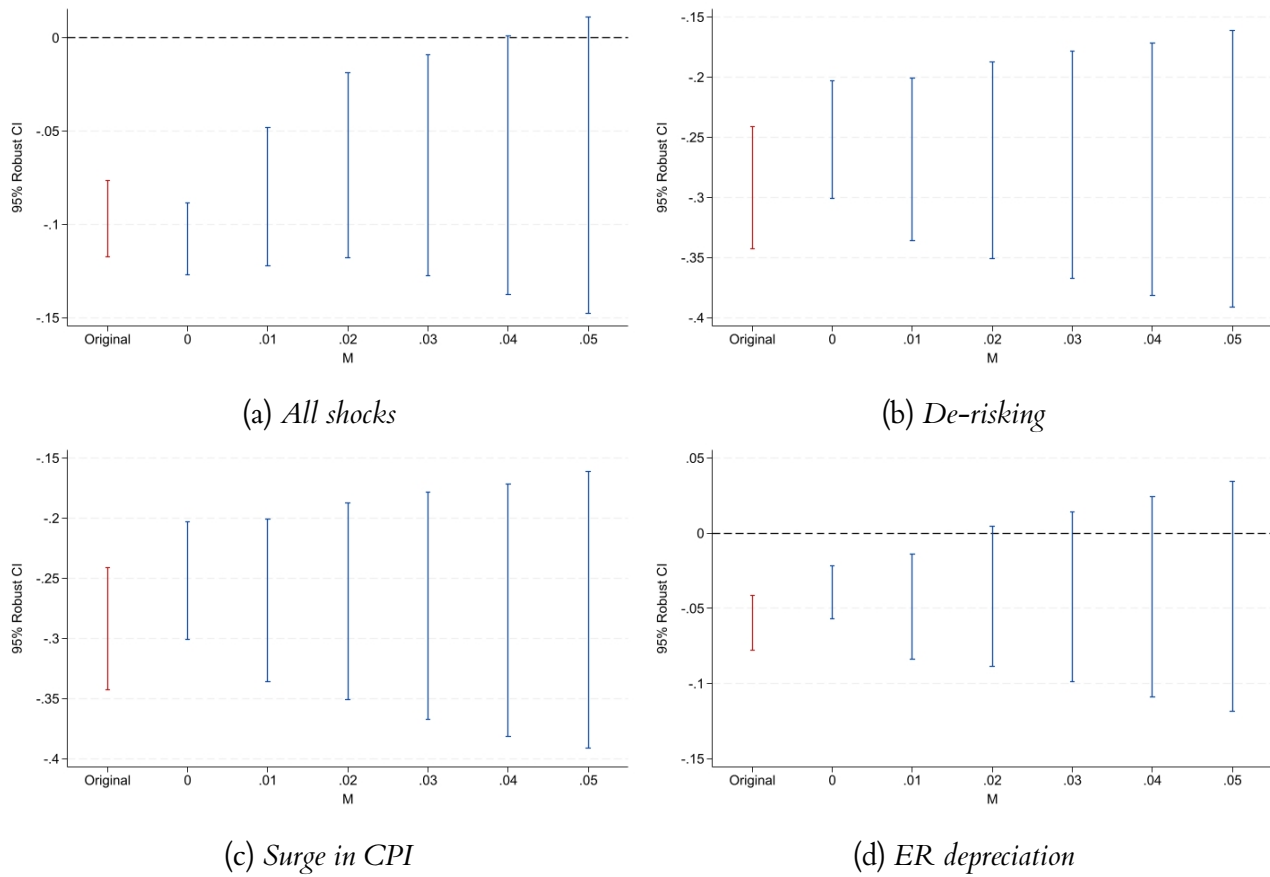


Fig. S9: The figure reveals the sensitivity analysis of pre-trend effects under smoothness restrictions across four shock scenarios: all staggered distinct shocks (a), de-risking (b), a surge in CPI (c), and ER depreciation (d). The outcome variable is the IHS-transformed flow of monthly remittances. Sub-figure (a) shows that the confidence intervals for all shock types remain below zero up to a smoothness parameter M of 0.03, showing robust results. Figures (c) and (d) provide confirmation that the tested smoothness parameter values consistently show confidence intervals below zero, passing the robustness test. This analysis shows the consistent stability of pre-trend effects under different shock events and smoothness conditions.

Chapter 5

Conclusion

5.0.1 Academic contributions: key takeaways on remittances in fragile states

The significance of remittances is unparalleled in fragile and conflict-affected states (FCS), where households use these funds to cope with various financial shocks ([Atta-Aidoo et al., 2024](#)). In 2022, remittance flows to these countries were estimated at around USD 70 billion, or 8.8 percent of GDP, surpassing the volume of official aid received ([KNOMAD-World Bank, 2022](#); [Kane et al., 2023](#)). In Somalia, remittances are important for both national development and the welfare of recipient households, representing for 21% of national GDP ([CBS, 2023](#)). Despite the widely held view that remittances are counter-cyclical and smooth consumption in difficult periods ([Eldemerdash and Landis, 2023](#); [Kim et al., 2024](#); [Makina, 2024](#)), their impact on productive investments, the connection to violent conflicts, and the role of external sender-side factors that escalate remittance costs remain underexplored. To provide a comprehensive analysis of these phenomena, this thesis employs a diverse range of research methods and various datasets. Methodologically, it applies key empirical strategies in applied microeconomics for causal inference, including DID, PSM and event study frameworks. It consequently addresses three separate yet interrelated topics on remittances in FCSs using the case of Somalia, as presented in the three papers (one per chapter) described below.

5.0.2 How remittances affect both productive and unproductive outcomes (Chapter 2)

The findings of the first paper reveal that households receiving remittances consistently consume more than those that do not. The impact is important for the most impoverished households, improving their food consumption, and emphasizing the crucial role of remittances in reducing poverty. Remittances have a significant impact on productive

assets, such as livestock, savings, and education. They also promote durable assets and financial inclusion, ultimately elevating living standards. Furthermore, the vulnerability of IDPs in fragile contexts is underscored by the limited benefits they receive from remittances.

The paper underscores the need for a more equitable distribution of remittances, with a particular emphasis on vulnerable groups, such as IDPs. A study of post-conflict Burundi by [Fransen and Mazzucato \(2014\)](#) found positive impacts of remittances on asset accumulation, while this chapter found that remittances are important for enhancing productive assets during ongoing conflict. To maximize the effect of remittances, policymakers should adopt innovative interventions that facilitate productive investments. This entails the creation of financial instruments and incentives, such as specialized microfinance programs for households that receive remittances, to stimulate business development and asset growth. Essential steps include boosting financial literacy, creating secure financial channels, and fostering partnerships between financial institutions and remittance service providers. These strategies aim to optimize the positive outcomes of remittances on asset accumulation, savings, livestock, and long-term investments, ultimately fostering sustainable economic growth in conflict-affected regions.

5.0.3 The effect of violent conflict on remittance flows at the district level (Chapter 3)

The second paper transitions to an analysis of how localized violent conflicts affect remittance flows, revealing that various forms of violence significantly reduce both the amount and frequency of remittances. Explosions and violence against civilians, for instance, lead to notable declines in remittance transfers. These findings highlight the detrimental impact of conflict and terrorism on the financial support families depend on, underscoring the critical importance of stability for sustaining consistent remittance flows. The findings in the second paper hold several policy implications for remittance actors, shedding light on the critical intersection of remittances and conflict.

The chapter emphasizes the need to comprehend the negative impact of violent conflicts on remittance flows and highlights the significance of strategic policy interventions. While remittances are generally counter-cyclical, increasing during crises due to altruistic motivations ([Lindley et al., 2024](#); [Resende-Santos, 2024](#)), persistent violence can significantly diminish these flows and reduce the investment sentiment of remitters. This persistent conflict confirms the mostly negative correlation between violent conflicts and other forms of foreign exchange flows, as documented in recent studies ([Alfar et al., 2024](#); [AlShammari et al., 2023](#); [Wang et al., 2024](#)). In this vein, the nexus between

remittances and persistent conflict in a country still categorized as being conflict-affected shows that remittances, as a financial inflow of a unique nature, diminish when conflicts are persistent.

A multi-pronged strategy should be enacted by policymakers to tackle the identified issues. In times of crises, safe and efficient remittance transfers require advancements in security measures and a robust mobile banking infrastructure. By establishing and preserving designated safe zones in conflict-affected regions, remittance flows can be stabilized through the provision of secure environments for financial transactions and investments.

Furthermore, a comprehensive policy approach should encompass increased diplomatic efforts and peacebuilding initiatives to foster stability, while also recognizing the crucial role that remittances play in supporting local development. Diversifying investments across different sectors reduces over-reliance on remittances, and also creates a more resilient economy that can better absorb shocks. Tailored financial education programs and investment incentives, including diaspora bonds or investment funds, can be used to actively engage the diaspora and enhance their remittance contributions.

Supporting community-based development projects that directly benefit from remittances can strengthen their positive influence. Enhancing economic stability and growth in conflict-affected areas can be achieved by promoting investment in stable regions and making use of the skills of diaspora returnees.

Further research into the effects of various conflict types on remittances is also crucial for developing effective and targeted policy solutions. This innovative and comprehensive strategy has the potential to not just maintain but also boost remittance flows, supporting economic resilience and development.

5.0.4 External shocks' impacts on remittance flows (Chapter 4)

The third paper shifts focus to how external sender-side shocks influence remittance behaviour among migrants. External shocks exert numerous impacts on remittance flows, including the depreciation of host country currencies against the USD, de-risking policies by banks, and increases in the cost of living. These shocks negatively affect both the flow and frequency of remittances, due to increasing the cost of sending money, reducing disposable income and the ability to send funds home. The study emphasizes the need to address these external shocks to sustain remittance flows, which are essential for the economies of developing nations.

The discoveries unveiled in the third paper highlight the significant decrease in re-

mittance amounts and frequency in response to external remitter-side shocks. Migrants usually send less money in the wake of such shocks, especially for larger transactions. Tackling these challenges requires a comprehensive policy approach. Governments in developed economies should focus on creating supportive frameworks that enable migrants to maintain their remittance flows, such as ensuring access to low-cost money transfers and establishing regulatory environments that facilitate cross-border remittance transactions. By fostering conditions that enable migrants to send money more efficiently, policymakers can help sustain the vital financial support that remittances provide to families and communities in developing nations.

Improving access to correspondent bank accounts and mobile money services is vital for enhancing remittance flow efficiency. Aligning with SDG 10.c requires global collaboration and reducing remittance costs to 3% by 2030. Achieving this goal necessitates global cooperation and attention to both direct and indirect costs, often neglected in research. Addressing the withdrawal of correspondent banking relationships (CBRs) and the closure of MTO bank accounts requires collaborative efforts between authorities, banks, and financial institutions. Some key recommendations including monitoring access to correspondent banking and MTO services, complying with AML and CFT regulations, and implementing a risk-based approach for financial supervisory authorities.

Improved communication and information sharing between regulators, banks, and MTOs, along with the use of technical tools to lower information costs and precise risk-based guidance, will lead to enhanced transparency and efficiency. Promoting formal remittance channels and complying with legal requirements and industry standards will enhance the delivery of remittances to families in need, fostering inclusive and sustainable economic recovery in fragile and conflict-affected states.

5.0.5 Scope, limitations, and recommendations for future research

Somalia, a country plagued by long-lasting conflicts and political instability, still bears the scars of a conflict-affected country. Some parts of Somalia are gradually becoming post-conflict areas, although their institutions remain fragile. Amidst this fragility, one critical coping mechanism for Somali households is the substantial support from the diaspora through remittances. This study has highlighted how important remittances are for both sustaining households and improving financial inclusion, consumption, living standards, and asset accumulation. Although remittances are crucial for Somalia's economy, the connection between remittances and productive assets is still uncertain, not just in Somalia but also in other conflict-affected areas.

By addressing existing limitations, paper one of this study uncovers the impact of remittances on productive assets and critical household factors such as financial inclusion and asset accumulation. Yet, as indicated in the subsequent papers two and three, several factors pose challenges to the smooth flow of remittances. These factors consist of violent conflicts within districts and external factors that increase remittance costs. These challenges have the potential to disrupt the continuous flow of diaspora remittances. Tackling these challenges is crucial for optimizing remittances and their impact on assets.

Despite the valuable insights provided by this study, the presence of several limitations emphasizes the requirement for more comprehensive research. Although the novel household survey data is comprehensive, it lacks the ability to effectively capture temporal dynamics due to its cross-sectional nature. Moreover, the transaction-level data, despite being comprehensive, could be enhanced by incorporating geo-coded locations and correlating them with specific location-based conflict incidents. Moreover, a broader dataset encompassing all money transfer operators in Somalia and extending the panel data over a longer period, ideally 15 years, would provide a more robust analysis. These enhancements would provide a greater insight into the functioning of remittances in challenging contexts .

To further understand the dynamics between remittances and household outcomes in conflict-affected settings, future research can utilise RCT methodologies, to enable a rigorous investigation into how remittances correlate with various outcomes in these challenging contexts, addressing significant gaps in the existing literature. By collaborating with MTOs in the studied countries, senders participating in the RCT will facilitate engagement with their recipients in Somalia. This approach will analyse how interventions, like savings account access and discounted fees, can improve the well-being of conflict-affected families and communities. Additionally, it will analyse how lower fees can promote increased money flow, ensuring that more resources reach those in need.

Additional research should examine sender-side factors and their connection to recipient-side outcomes, in order to comprehend the wider effects of remittances. Analyses should encompass both remittance flow and its implications for household welfare. Future studies can gain a better understanding of remittances' impact on resilience and development in Somalia and other conflict-affected areas by considering these aspects.

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