Geopolitical shocks, capital outflows, financial inclusion and digital financial inclusion

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2025

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This study examines the effect of capital outflows, induced by geopolitical shocks, on financial inclusion and digital financial inclusion in emerging markets and developing economies. Several measures of financial inclusion and digital financial inclusion were analysed for 17 emerging markets and developing economies from 1999 to 2023. The data were estimated using the median quantile regression and generalized linear model regression methods. The findings reveal that capital outflows, induced by geopolitical shocks, have a negative effect on financial inclusion and digital financial inclusion. Greater capital outflows, induced by geopolitical shock, decrease the level of financial inclusion through a contraction in the number of commercial bank branches in emerging markets and developing economies. Also, greater capital outflows, induced by geopolitical shock, decrease the level of digital financial inclusion through a decrease in the number of people using the internet to access commercial bank branch services and automated teller machine services. Political stability, GDP growth, population growth, unemployment, tax revenue and regulatory quality are significant determinants of financial inclusion and digital financial inclusion. The social implication is that geopolitical shocks and capital outflows adversely affect society by limiting access to essential financial services. The managerial implication is that financial managers will constantly need to anticipate geopolitical risk, its effect on financial services and develop safeguards to cushion its effect on financial service providers and customers.

Pre-print version

June 2025

1. Introduction

Geopolitical shocks are a source of concern to many policymakers and business executives around the world. Geopolitical shocks are the adverse effect countries in a region experience due to the unexpected trade, military or political actions of one or more countries in another region (Jawadi et al, 2024; Wang et al, 2024). They adversely affect countries that are unrelated by triggering unprecedented and unforeseen shift in trade and investment. Geopolitical shocks also affect growth, inflation, financial markets, and supply chains (Singh et al, 2024; Jawadi et al, 2024, Wang et al, 2024). The war in Russia and Ukraine is an example of a geopolitical shock. The Russia-Ukraine war which occurred in Europe disrupted the supply of fertilisers from Russia to other countries and also disrupted the supply of grains from Ukraine to other countries while increasing energy prices in Europe and in some parts of Asia (Sohag et al, 2023; Zhang et al, 2023). The supply chain disruption led to food and energy inflation in many African and Asian countries (Sun and Su, 2024; Singh et al, 2024). Other geopolitical shocks that have affected European and Asian countries include the 2003-2011 Iraq war, the 2018-2020 US-China Tariff Trade War and the on-going 2022 Israel-Hamas conflict (Khurshid et al, 2024; Yilmazkuday, 2025).

The recurrence of geopolitical shocks has led policymakers, such as central banks and other national authorities, to review their policy frameworks and introduce safeguards to mitigate the adverse effect of geopolitical shocks on the financial system. Some central banks have begun to conduct a review of their monetary policy and macroprudential strategies to build resilience mechanisms and ensure monetary stability, price stability and financial stability in a changing geopolitical environment (Franconi, 2024). However, one area in which policymakers have not built resilience mechanisms against geopolitical shocks is financial inclusion. By definition, financial inclusion is the process of ensuring affordable access to, and use of, essential financial services by all members of the population (Sebai et al, 2025), while digital financial inclusion is the use of digital technologies to expand access to affordable and essential financial services to all members of the population (Wei et al, 2025). Policymakers consider a high level of financial inclusion to be a worthwhile development policy goal because a high level of financial inclusion can assist in achieving the monetary and fiscal policy objectives of the monetary and fiscal authorities. Financial inclusion can also accelerate entrepreneurial development, improve livelihoods and stimulate economic growth

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(Demirgüç-Kunt and Singer, 2017). Despite these benefits, recent discussions in the policy and academic literatures have not considered how the level of financial inclusion might be impacted by geopolitical shocks.

The existing literature document evidence that geopolitical shocks create uncertainty and lead to capital flow reversals which can have a damaging effect on emerging markets and developing countries (Ftiti et al, 2024). Several studies have examined the financial implications or financial effects of geopolitical shocks and capital flows in various contexts. These studies show that geopolitical shocks give rise to uncertainty and create a difficult economic environment for financial institutions to navigate (Jawadi et al, 2024), geopolitical shocks increase financial system fragility (Liu and Shen, 2024; Zhu et al, 2025), it increases the risk of bank solvency (Behn et al, 2025), it stimulates firms to increase their cash holdings (Behera and Mahakud, 2025), it triggers capital flows to emerging market economies from advanced economies (Ftiti et al, 2024) and geopolitical shocks are a friction to corporate investment efficiency (Nguyen et al, 2025).

These studies highlight the financial implications of geopolitical risks, one of which is capital outflows. But the literature has not examined the implication or effect of geopolitical shocks and capital outflows on financial inclusion. The literature has not provided any insight into how geopolitical shocks might trigger capital outflows and affect the level of financial inclusion in emerging markets and developing economies. Therefore, the gap we identify in the literature is that there is little or no knowledge about the effect of capital outflow, that is induced by geopolitical risks, on the level of financial inclusion. The silence in the literature about this important topic raises many unanswered questions such as: do geopolitical shocks induce capital flows which in turn affect the ability of financial service providers to offer affordable financial services to firms and individuals? Do capital outflows decrease access to financial services? Are financial service providers the channel through which capital outflows, induced by geopolitical shocks, affect access to financial services for members of the population. These questions have not yet been answered in the literature. The present study seeks to provide answers to some of these questions. Providing answers to these questions will help policymakers to understand the effect of geopolitical shocks and capital outflows on the level of financial inclusion. It will also assist policymakers in understanding the channel through which geopolitical shocks and capital flows affect financial inclusion. Such

understanding can assist policymakers and practitioners in developing safeguards to reduce the effects of geopolitical shocks and capital outflows on the level of financial inclusion.

This study examines the effect of capital outflows, induced by geopolitical shocks, on financial inclusion. This study presents a first attempt to examine the effect of capital outflows on financial inclusion during geopolitical shocks. We predict that adverse geopolitical shocks can lead to foreign capital outflows which, in turn, can lead to a shortfall in funding for financial service providers. The funding shortfall can decrease the ability of financial service providers to extend financial services to people in unbanked and underserved locations. Our prediction implies a negative relationship between capital outflows, induced by geopolitical shocks and the level of financial inclusion. Conversely, foreign capital inflows may provide abundant financial resources to domestic financial service providers who will use a part of the capital inflow to extend their branch networks and other financial services to new locations to reach underserved people and increase financial inclusion. They can also use a part of the foreign capital inflow to deploy fintech and digital technologies to serve unbanked and underserved adults to increase the level of digital financial inclusion. Our research design considers foreign capital outflows, triggered by geopolitical shocks, to be a determinant of financial inclusion while controlling for other factors affecting financial inclusion in emerging market and developing countries. We find that greater capital outflows, induced by geopolitical shock, decrease the level of financial inclusion through a contraction in the number of commercial bank branches in emerging markets and developing economies. We also find that greater capital outflows, induced by geopolitical shock, decrease the level of digital financial inclusion through a decrease in the number of people using the internet to access commercial bank branch services and automated teller machine services.

The findings of this study contribute to the existing literature that examine the financial consequences of geopolitical shocks, but which have not examined the effect of geopolitical shocks on financial inclusion outcomes. The present study contributes to the literature by showing that low levels of financial inclusion is a potential consequence of adverse geopolitical shocks. Secondly, the study contributes to the literature that examine the determinants of financial inclusion. This literature identified several external factors affecting financial inclusion. But the literature has not considered geopolitical shocks to be a

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determinant of financial inclusion. The present study adds to the literature by identifying geopolitical shocks to be an external determinant of financial inclusion.

In the remaining sections of the article, the theoretical framework and literature review are presented in section 2. The hypothesis development is presented in section 3. The research design is reported in section 4 while the discussion section and conclusion of the study are presented in sections 5 and 6 respectively.

2. Theoretical Framework and Literature Review

This section presents the theoretical framework using the "*investment under certainty*" theory. The section also presents a review of the relevant literature.

2.1. Theoretical Framework

In the theoretical literature, Bernanke (1983), Pindyck (1991) and Caballero and Pindyck (1992) propose the "*investment under uncertainty*" theory which posit that external factors create uncertainties. Such uncertainties affect the investment decisions of firms (Bernanke, 1983). When faced with uncertainty, firms will delay crucial investment decisions and also delay hiring decisions during uncertain times (Pindyck, 1991). The delayed investment and hiring decisions by firms will lead to reduced output which will have an adverse effect on the macroeconomy. In the context of financial institutions, elevated uncertainty caused by external factors such as geopolitical events can increase financing costs for financial institutions (Dang and Huynh, 2025; Waisman et al, 2015), or discourage them from expanding the provision of financial services during times of heightened uncertainty. This can adversely affect the level of financial inclusion.

2.2. Literature review

2.2.1. Geopolitical shocks literature

This section reviews the literature that examine the effects of geopolitical risks. Bondarenko et al (2024) investigate geopolitical risk perceptions in Russia by examining how the geopolitical risk shocks identified from local news sources affect the Russian economy. They find that geopolitical risk shocks increase inflation expectation in Russia and the sanctions

imposed on Russia significantly worsened the inflationary impact of geopolitical risk shocks. Asadollah et al (2024) were interested in the effect of global geopolitical risks and supply chain shocks on global inflation. They examine monthly data from 1999 to 2022 and find that global supply chains disruption is the main determinant of global inflation in the long run while positive geopolitical shocks increase headline inflation only up to one year, but the effect does not persist in the long run. Yu and Wang (2023) examine the effect of geopolitical risks on foreign direct investment flows in 41 countries from 2003 to 2020. They find that geopolitical risks decrease foreign direct investment inflows and hinder the development of the domestic economy. However, they observe that the effect of geopolitical risk on foreign direct investment is insignificant in developed countries. Kapopoulos et al (2024) also investigate the relationship between foreign direct investment inflows and geopolitical risk in 43 economies from 1985 to 2022. They distinguish between global and idiosyncratic geopolitical risks. They find that both global and idiosyncratic geopolitical risks decrease foreign direct investment inflows. Aksoy-Hazır and Tan (2023) focus their study on Turkey because Turkey is an important destination for foreign direct investment. They examine the effect of geopolitical risk on the cash holdings of 210 Turkish firms over the 2005 to 2019 period. They find a positive relationship between geopolitical risk and cash holdings, implying that Turkish firms who are faced with uncertainty prefer to hoard cash as a precautionary measure. Carney et al (2024) focus on how geopolitical events affect investors' cost of equity. They examine 19 countries from 1987 to 2018 and find that higher geopolitical risk increases the cost of equity capital in emerging markets. The result implies that high geopolitical risks compel equity investors to move capital from emerging markets to more safer and mature markets. This will increase the cost of equity capital for firms in emerging economies. Wang et al (2024) also find a negative relationship between geopolitical risk and firm-level corporate investment, and the negative effect is more pronounced for firms with more irreversible investment or higher market power while the effect is less significant for firms that can quickly substitute labour for capital. Li and Cheng (2024) examine whether geopolitical risk increase the risk-taking of firms. They analyse the data of Chinese A-share listed companies and find that geopolitical risk increases corporate risk-taking but horizontal diversification smoothens out the adverse effect of geopolitical risk on the risk-taking of Chinese firms.

2.2.2. Capital outflows literature

This section reviews the literature on the determinants and consequences of capital outflows. Leykun Fisseha (2022) examine capital flight in African countries. They pay attention to the effect of capital flight and financial liberalization on domestic investment in 30 African countries from 2000 and 2019. They find that capital flight constrains domestic investment financing in African countries while financial liberalization did not have a significant impact on domestic investment in African countries. Zhang and Colak (2022) investigate the effect of economic policy uncertainty on cross-border capital flow decisions for listed firms in China. They find that economic policy uncertainty originating from China does not dissuade foreign direct investment inflow into China, but it prevents foreign direct investment outflow from leaving China. They also find that government policies and uncertainty are determinants of foreign direct investment. Heydarian et al (2022) focus on how financial sanctions affect capital outflow. They investigate the effect of financial sanctions on capital outflow in Iran during the 2005 to 2019 period. They find that the financial sanctions imposed on Iran led to capital outflows from Iran. Le and Kim (2021) investigate the impact of institutional quality on foreign direct investment flows in Asian countries from 2009 to 2017, focusing on South Korea, China, Japan, Singapore, and Hong Kong. Their results show that the size of home and the partner countries, geographical distance, trade interaction between two countries, economic freedom, labour supply, tariff rate, and capacity of the government are determinants of foreign direct investment from Asian countries. Liu et al (2023) find that capital outflows reduce income inequality by increasing the share of household income which alleviates inequality. Zhou (2024) examines the role of capital controls in preserving macroeconomic stability in China. The author shows that capital controls can preserve macroeconomic stability through the combined use of capital controls and foreign exchange interventions in China. The study also shows that the preferred exchange rate policy to preserve macroeconomic stability in China is a managed floating exchange rate system. Antwi et al (2024) investigate the impact of capital flight on economic growth in Africa. They examine 54 African countries from 2000 to 2021. They find that capital flight hurts economic growth. They also find that external debt repayment and outward foreign direct investment have a significant negative effect on economic growth in Africa, while foreign portfolio investment outflow has a positive but insignificant effect on economic growth.

2.2.3. Financial inclusion literature

This section reviews the literature on the determinants of financial inclusion, focusing on the literature that examine the factors outside the control of financial service providers that affect financial inclusion. For instance, Abdulai and Issahaku (2024) consider financial development to be a determinant of financial inclusion. They examine the effect of financial development on financial inclusion and the moderating role of legal institutions in the relationship. They utilise the quantile regression method to analyse data from 41 sub-Saharan Africa from 2000 to 2020 and find that financial development has a significant positive effect on financial inclusion. Their findings imply that improving the level of financial development is a way to accelerate financial inclusion in sub-Saharan Africa. Foguesatto et al (2024) consider market risk to be a determinant of financial inclusion. They examine the association between market risk and financial inclusion in 49 countries from 2004 to 2021. They find a positive correlation between various financial inclusion indicators and market risk. They find that market risk is strongly correlated with financial inclusion in countries with active mobile money accounts and mobile money agents. Taylor et al (2024) consider accounting standards to be a determinant of financial inclusion. They investigate the role of accounting standards in increasing financial inclusion. They show that the adoption of International Financial Reporting Standards (IFRS) increases access and use of financial services by reducing perceived corruption and enhancing trust and transparency in the financial system so that people can willingly access and use financial services. Zeqiraj et al (2022) consider institutional quality to be a determinant of financial inclusion. They examine how institutional quality (in terms of control of corruption, government effectiveness, political stability, regulatory quality, rule of law, and voice and accountability) affect financial inclusion in 73 developing countries. They find that institutional quality enhances access to formal financial services in developing countries. Heyert and Weill (2025) consider trust in banks to be a determinant of financial inclusion. They examine banks from 28 countries and find that trust in banks has a positive impact on financial inclusion and it positively affects financial inclusion for all individuals, regardless of their socio-demographic characteristics. Eshun and Kočenda (2025) examine sub-Saharan Africa (SSA) and the Organization for Economic Cooperation and Development (OECD) countries from 2000 to 2021. They find that trade openness, political

stability, the level of income and remittances are significant determinants of financial inclusion.

2.2.4. Effect of geopolitical shocks on the financial sector

Other studies examine how geopolitical shocks affect the financial system, but these studies did not examine how geopolitical shocks affect financial inclusion or access to financial services. The general consensus in the literature about the effect of geopolitical shocks on the financial system is that geopolitical events or shocks can diminish investor confidence, delay investment, heighten capital outflows, amplify financial market volatility and increases financial system instability (Nguyen et al, 2025; Zhu et al, 2025; Liu and Shen, 2024). In a study of 28 European countries, Liu and Shen (2024) examine the effect of foreign geopolitical risks on financial instability from1985 to 2024. They find that foreign geopolitical risks increase financial instability in Europe through rising energy inflation and capital flight from European countries to the U.S. They also observe that low-income countries with a market-based financial system are more exposed to foreign geopolitical risks than high-income countries. In a related study from China, Zhu et al (2025) examine the impact of global geopolitical risk on financial stability. They find that geopolitical risks increase financial instability, and it increases financial stress total connectedness. Wang et al (2025) investigate whether bank regulatory policies mitigate the impact of geopolitical risk on financial stability. They analyse 688 listed banks from 33 countries and find that stricter restrictions on banking activities, more robust deposit insurance systems, and regulatory agencies with stronger enforcement capabilities are able to mitigate systemic risk induced by geopolitical risk, thereby preserving financial stability. Adel and Naili (2024) investigate the impact of geopolitical risks on the profitability and solvency of banks operating in 13 emerging economies from the Middle East and Africa from 2003 to 2019. They find that banks that anticipate geopolitical risks are more able to adapt to geopolitical risks and experience improved bank performance. Behn et al (2025) also examine the effect of geopolitical risk on bank solvency and find that geopolitical risks decrease bank capital-to-asset ratio and increase the risk of bank solvency. In the Indian context, Behera and Mahakud (2025) examine the effect of geopolitical risk on corporate cash holdings among 2,090 Indian firms. They find that geopolitical risk has a positive impact on the cash holdings of Indian firms. Their finding implies that firms are more likely to hold more cash in times of heightened geopolitical risk. Nguyen et al (2025) examine the effect of

geopolitical shock on corporate investment efficiency among 15,696 US firms from 1985 to 2023. They argue that geopolitical shocks are a friction that impede optimal investment decisions. They further argue that geopolitical risks are linked to a deteriorating macroeconomic environment, fewer investment opportunities, and higher financing costs. In their empirical analysis, they find a negative relationship between geopolitical risk and corporate investment efficiency which confirms that geopolitical risk acts as a friction impeding optimal investment decisions. They also find that geopolitical risks reduce corporate overinvestment, and it increases underinvestment. Ftiti et al (2024) show that geopolitical risks trigger capital outflows from Europe and attract capital inflows to BRICS countries.

2.2.5. Gap in the literature

The above studies in the literature have examined (i) the effect of geopolitical risks, (ii) the determinants and effect of capital outflows, and (iii) the external determinants of financial inclusion. However, the literature has not examined the combined effect of geopolitical shocks and capital outflows on the level of financial inclusion. The literature has not provided any insight into how geopolitical shocks might trigger capital outflows and affect the level of financial inclusion. Therefore, the gap we identify in the literature is that there is little or no knowledge about the effect of geopolitical risk-induced capital outflows on the level of financial inclusion. The silence in the literature about this important topic raises many unanswered questions. The present study addresses this gap in the literature by examining the effect of capital outflows, induced by geopolitical shocks, on financial inclusion.

3. Hypothesis development

Building on the literature review, existing studies such as Ftiti et al (2024) and Nguyen et al (2025) show that heightened geopolitical risks are associated with a deteriorating macroeconomic environment, delayed investment, fewer investment opportunities, and higher financing costs. We argue that geopolitical shocks can lead foreign investors to panic and recall their capital invested in emerging markets and developing economies. The resulting capital outflows will lead to delayed investment in emerging markets and developing economies. The capital outflows, induced by geopolitical shocks, can influence financial

service providers to adopt a wait-and-see approach and delay or slow down their investment in bank branch expansion and automated teller machine supply. The delayed investment and adoption of a wait-and-see stance towards investment would translate to banks opening fewer bank branches and providing fewer automated teller machines which will be insufficient to meet the needs of underserved customers and unbanked adults, thereby decreasing the level of financial inclusion. Furthermore, the capital outflows induced by geopolitical risks can lead to increase in financing costs and a preference to hold cash (Behera and Mahakud, 2025). The increase in financing costs can also translate to increase in the cost of digital financial services which may become unaffordable for people, thereby discouraging them from using digital financial services, and this will be detrimental to digital financial inclusion. Therefore, the formulated hypothesis is that foreign capital outflows, induced by geopolitical shocks, will decrease both the level of financial inclusion and the level of digital financial inclusion.

H1: Foreign capital outflows, induced by geopolitical shocks, decrease the level of financial inclusion.

H2: Foreign capital outflows, induced by geopolitical shocks, decrease the level of digital financial inclusion.

4. Research Design

4.1. Data and sample

The data used in this study is annual in its trend. The data were collected from the World Bank's World Development Indicators (WDI) which archives economic data from multiple databases (see Table 1). We focus on countries that are listed in the International Monetary Fund (IMF)'s classification of emerging markets and developing economies (EMDEs). We focus on the EMDEs because EMDEs are mostly affected by capital flow reversal during adverse geopolitical events. Data were collected for seventeen (17) emerging markets and developing economies that have available and sufficient data for seven consecutive years. The EMDE countries are Argentina, Brazil, China, Egypt, India, Indonesia, Iran, Mexico, Nigeria, Pakistan, Poland, Russia, Saudi Arabia, South Africa, South Korea, Thailand and Turkey (see Table 2).

The period examined is from 1999 to 2023. The sample period is long enough to capture multiple geographical shocks of the last two decades. Finally, the data is panel in nature and the panel data is unbalanced because some countries have missing data observations for some years.

Table 1. Description of variables			
Variable	Indicator Name	Description	Source
AMT	Number of Automated teller machines (per 100,000 adults)	Extent of automated teller machine penetration. Automated teller machines are computerized telecommunications devices that provide clients of a financial institution with access to financial transactions in a public place.	International Monetary Fund, Financial Access Survey.
CBB	Commercial bank branches (per 100,000 adults)	Commercial bank branches are retail locations of resident commercial banks	International Monetary Fund, Financial Access Survey.
DEP	Depositors with commercial banks (per 1,000 adults)	Depositors with commercial banks are the reported number of deposit account holders at commercial banks.	International Monetary Fund, Financial Access Survey.
TNT	Individuals using the Internet (% of population)	Internet users are individuals who have used the Internet (from any location) in the last 3 months. It includes using the Internet via a computer, mobile phone, personal digital assistant, games machine, digital TV etc.	International Telecommunication Union (ITU) World Database
FDO	Foreign direct investment (net) outflows to GDP ratio	This is the net outflows of investment from a country to other countries as a share of GDP.	International Monetary Fund, Balance of Payments database
GDG	GDP growth rate	Annual percentage growth rate of GDP at market prices based on constant local currency.	World Bank national accounts data, and OECD National Accounts data files.
INF	Inflation, consumer prices (annual %)	Inflation as measured by the consumer price index	International Monetary Fund, International Financial Statistics
PST	Political stability and absence of violence/terrorism index	Political stability and absence of violence/terrorism index measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism.	WGI & WDI
PG	Annual population growth rate	Percentage change in total population size	WDI, United Nations Population Division.
RQ	Regulatory Quality	Regulatory quality index captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	WGI & WDI
TR	Tax revenue to GDP ratio	Tax revenue refers to compulsory transfers to the central government for public purposes.	International Monetary Fund.

EP	Total unemployment rate	Total unemployment rate refers to the share of the labor force that is without work but available for and seeking employment.	International Labour Organization.
GEO	Geopolitical shock	A geographical shock dummy variable that take the value of one in the year in which a geopolitical shock occurred and zero otherwise. The shocks captured in the GEO dummy variable are the Iraq war (2003-2011), the Donbas War (2014-2022), the US-China trade war (2018-2020), the Russia-Ukraine War (2022-2023). The years with zero entries are 1999, 2000, 2001, 2002, 2012 and 2013 which did not have a major geopolitical event.	Author index construct
DFI	A proxy for the number of people using the internet to access commercial bank branch services	A measure of digital financial inclusion. It is measured as the principal component analysis of the percentage of people using the internet and the number of commercial bank branches per 100,000 adults.	Author index construct
DFID	A proxy for the number of depositors using the internet to access their bank accounts	Another measure of digital financial inclusion. It is measured as the principal component analysis of the percentage of people using the internet (TNT) and the number of bank accounts per 1,000 adults (DEP)	Author index construct
ADFI	A proxy for the number of people using the internet to access automated teller machines.	Another measure of digital financial inclusion. It is measured as the principal component analysis of the percentage of people using the internet (TNT) and the number of automated teller machines per 100,000 adults (AMT).	Author index construct

Source: World Development Indicators and author's own work

4.2. Model

The model specification used in this study is presented below in equations 1 and 2. The model estimates financial inclusion as a function of foreign capital outflows and other macroeconomic and institutional factors. The model used in this study is a variation of the model used in existing studies such as Warsame et al (2022), Lee et al (2022) and Ozili (2024). The variables in the model are AMT = number of automated teller machines per 100,000 adults. CBB = number of commercial bank branches per 100,000 adults. DEP = number of bank accounts or depositors per 1,000 adults. TNT = percentage of the population using the internet. FDO = foreign capital net outflows to GDP ratio. GDG = gross domestic product growth rate. INF = inflation rate. PST = political stability index. PG = population growth rate. RQ = regulatory quality index. GEO = geopolitical risk dummy variable. EP = total unemployment rate. TR = tax revenue to GDP ratio. DFI = digital financial inclusion index, derived from the principal component analysis (PCA) of CBB and TNT. DFID = digital financial inclusion index, derived from the PCA of DEP and TNT. ADFI = digital financial inclusion index, derived from PCA of AMT and TNT. i, t represents country and year. ε_{it} is the error term.

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$(CBB, AMT, DEP)_{i,t}$
$$= \beta1 FDO_{i,t} + \beta2(GEO * FDO)_{i,t} + \beta3 GEO_t + \beta4 INF_{i,t} + \beta5 RQ_{i,t}$$
$$+ \beta6 TR_{i,t} + \beta7 PG_{i,t} + \beta8 EP_{i,t} + \beta9 PST_{i,t}$$
$$+ e_{i,t} \dots\dots\dots\dots equation\ 1$$

$(DFI, ADFI, DFID)_{i,t}$
$$= \beta1 FDO_{i,t} + \beta2(GEO * FDO)_{i,t} + \beta3 GEO_t + \beta4 INF_{i,t} + \beta5 RQ_{i,t}$$
$$+ \beta6 TR_{i,t} + \beta7 PG_{i,t} + \beta8 EP_{i,t} + \beta9 PST_{i,t}$$
$$+ e_{i,t} \dots\dots\dots\dots equation\ 2$$

4.3. Justifying the regression methodology used in the study

Two estimation techniques were used to estimate the model to ensure that the results are robust to alternative estimations. The first econometric method is the panel median quantile regression method. This econometric technique addresses problems in the dataset particularly outliers in the dataset and the potential for non-linearity with the predictor variables (Koenker, 2005). The quantile was set at 0.5 or the 50th percentile which is the median quantile in the quantile regression estimations, meaning that 50 percent of the data points are less than the value of the median. The second econometric method is the generalised linear model regression method which addresses non-normal data and uses a link-up function to establish a relationship between the linear predictor and the expected value of the response variable, thereby enabling the modelling of non-linear relationships in the dataset (Dobson and Barnett, 2018).

4.4. Variables justification

The dependent variables used in this study are several measures of financial inclusion which are the number of commercial bank branches per 100,000 adults, the number of automated teller machines per 100,000 adults and the number of bank accounts (or depositors) per 1,000 adults. These variables are widely used in the literature to measure the level of financial inclusion (Mehrotra and Yetman, 2015). Another set of dependent variables used in this study are several unique indexes used to measure the level of digital financial inclusion. The indexes are modified from the indexes adopted in Ozili (2025a) and Jin et al (2024). They include the DFI index, DFID index and ADFI index. The DFI index is a measure of digital financial inclusion and captures the number of people using the internet to access commercial bank branch services. The DFI index is constructed as the principal component analysis of the percentage of people using the internet and the number of commercial bank branches per 100,000 adults.

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The DFID index is another measure of digital financial inclusion. It captures the number of depositors using the internet to access their bank accounts. The DFID index is constructed as the principal component analysis of the percentage of people using the internet (TNT) and the number of bank accounts (or bank depositors) per 1,000 adults (DEP). The ADFI index is another measure of digital financial inclusion. It captures the number of people using the internet to access automated teller machines. The ADFI index is constructed as the principal component analysis of the percentage of people using the internet (TNT) and the number of automated teller machines per 100,000 adults (AMT).

The GEO dummy variable captures the geopolitical shocks which have occurred over the sample period. The GEO dummy variable takes the value of one in the year in which a geopolitical shock occurred and zero otherwise. The shocks captured in the GEO dummy variable are the Iraq war (2003-2011), the Donbas War (2014-2022), the US-China trade war (2018-2020), the Russia-Ukraine War (2022-2023). The years with zero entries in the GEO dummy variable are 1999, 2000, 2001, 2002, 2012 and 2013 because there were no major geopolitical events in these years. The FDO variable captures the annual foreign direct investment outflows from a country.

The main explanatory variable is the FDO*GEO variable which measures the foreign capital outflows that are induced by geopolitical events. It captures the outflow of capital from emerging markets and developing economies due to geopolitical shocks. We expect that adverse geopolitical shocks will trigger foreign capital outflows from domestic financial institutions in emerging markets and developing economies. This, in turn, will adversely affect the ability of financial service providers to access funding to extend affordable financial services to underserved and unbanked people. Therefore, we expect a negative relationship between FDO*GEO and the financial inclusion variables.

The INF variable captures the rate of inflation. A high level of inflation will incentivise financial institutions to reprice loans and other banking services (Ozili, 2025b). This will increase the cost of financial services and make them expensive for low-end users of financial services. It can be a barrier to financial inclusion and potentially discourage unbanked adults from joining the financial system. We expect a negative relationship between the inflation rate and the level of financial inclusion.

The GDG variable controls for the effect of economic fluctuations on the level of financial inclusion. The existing literature shows that GDP growth has a complementary effect on financial inclusion. This is expected because periods of positive economic growth often lead to greater employment, output and income, and a greater ability of people to access and afford basic formal financial services (Van et al, 2021). Therefore, a positive relationship between GDG and the financial inclusion variables is expected.

The RQ variable controls for the effect of regulatory quality on the level of financial inclusion. The existing literature shows that high-quality regulatory policies can improve the functioning of the financial system, ensure that people are treated fairly in the financial system and promote equitable access to financial services (Zeqiraj et al, 2022). Therefore, a positive relationship between RQ and the financial inclusion variables is expected.

The TR variable is the tax revenue to GDP ratio. It controls for the effect of taxation on the level of financial inclusion. High taxes in the economy could give the authorities significant revenue which they can use to support the provision of physical and digital financial access points for members of the population, thereby increasing the level of financial inclusion (Oz-Yalaman, 2019). Therefore, a positive relationship between TR and the financial inclusion variables is expected.

The PG variable is the population growth rate. It controls for the rate of growth of the total population. A high population growth rate is detrimental for financial inclusion if the population grows too fast and the demand for financial services outweigh the supply of financial services. The demand pressure could create scarcity and lead to high cost of formal financial services which may be detrimental for financial inclusion. Therefore, a negative relationship between PG and the financial inclusion variables is expected.

The EP variable is the total unemployment rate. A high unemployment rate is detrimental to financial inclusion because people who are unemployed may have no income to rely on. Lack of income is a commonly cited reason why people do not own a bank account (Williams et al, 2023). If people do not have jobs and do not earn any income, they will have little or no incentive to open a bank account or to be financially included. Therefore, a negative relationship between EP and the financial inclusion variables is expected.

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The PST variable is the political stability and absence of terrorism index. The absence of war and terrorist attacks leads to a stable political environment which improves the oversight functions of regulatory institutions, improves the monitoring of financial institutions and improves the quality of financial services offered to customers (Ozili, 2024). This indicates that a stable political environment can have positive benefits for financial inclusion. Therefore, a positive relationship between PST and the financial inclusion variables is expected.

4.5. Descriptive statistics and correlation analysis

The median descriptive statistics for the sample period, reported in Table 2, reveal that net capital outflow to GDP (FDO) is higher in South Korea and Thailand and is much lower in Pakistan over the sample period. The number of bank depositors (DEP) is higher in Indonesia and Turkiye and is much lower in China. The number of commercial bank branches per 100,000 adults (CBB) is higher in Poland and Russia and is much lower in Nigeria. The number of automated teller machines per 100,000 adults (AMT) is higher South Korea and Russia and is much lower in Pakistan. The inflation rate (INF) is higher in Iran and Nigeria and is much lower in Thailand. Political stability (PST) is higher in Poland and South Korea and is much lower in Nigeria. Population growth (PG) is highest in Saudi Arabia and Pakistan and is much lower in Russia. Regulatory quality (RQ) is higher in South Korea and is much lower in Iran. Tax revenue (TR) is higher in South Africa and Turkiye and is much lower in Iran. Unemployment rate (EP) is highest in Iran and Brazil and is much lower in Thailand. The Pearson correlation result in table 3 shows that capital outflow (FDO) is negatively correlated with the number of commercial bank branches (CBB) and the number of bank depositors (DEP). On the other hand, capital outflow (FDO) is positively correlated with the number of automated teller machines.

4.6. Stationary test

We also perform an Augmented Dickey Fully (ADF) unit root test of stationarity (see appendix 1). The ADF unit root test reveals that the CBB, FDO, GDG and EP variables are stationary. This is because the p-value of these variables is less than 0.05 which leads to the rejection of the null hypothesis that the variables are non-stationary. In contrast, the AMT, DEP, TNT, INF, PST, PG, RQ, TR, GEO, DFI, DFID and ADFI variables are non-stationary because the p-value of these

variables is greater than 0.05 which leads to the acceptance of the null hypothesis that the variables are non-stationary.

Countries	AMT	CBB	DEP	FDO	GDG	INF	PST	PG	RQ	TR	EP	DFI	ADFI	DFID
	Median	Median	Median	Median	Median	Median	Median	Median	Median	Median	Median	Median	Median	Median
Argentina	38.9	13.12	921.6	0.32	2.40	-	-0.01	1.02	-0.69	12.35	8.6	0.86	1.85	2.12
Brazil	110.5	18.82	616.2	0.63	2.90	6.20	-0.29	0.81	-0.02	14.03	10.1	1.38	2.49	0.63
China	50.7	8.77	18.1	0.86	8.33	1.92	-0.50	0.57	-0.31	9.39	4.5	0.25	0.53	-0.52
Egypt	10.6	4.40	360.5	0.08	4.34	9.46	-0.97	2.02	-0.55	13.92	9.8	-0.98	-0.95	-0.09
India	12.8	12.24	-	0.41	7.41	5.13	-1.01	1.41	-0.31	10.17	7.6	-0.80	-	-
Indonesia	38.8	14.84	1871.5	0.61	5.03	5.35	-0.61	1.26	-0.22	11.11	5.1	-0.003	-	3.25
Iran	41.2	28.89	-	0.02	3.33	16.61	-1.04	1.27	-1.45	5.93	11.5	1.33	-	-
Mexico	48.7	13.97	-	0.63	2.11	4.54	-0.68	1.35	0.19	11.29	3.6	0.53	-	-
Nigeria	13.3	4.73	651.8	0.19	5.30	12.53	-1.92	2.71	-0.89	-	3.7	-1.12	-1.13	-0.17
Pakistan	5.7	8.88	277.1	0.02	4.21	7.69	-2.25	2.23	-0.68	10.33	0.7	-1.11	-1.41	-1.20
Poland	57.2	29.71	1075.1	0.89	4.38	2.58	0.55	-0.05	0.84	16.70	9.5	-	-	-
Russia	142.1	30.16	-	2.25	4.30	9.01	-0.92	-0.14	-0.38	13.14	6.0	-	-	-
Saudi Arabia	61.2	7.72	752.8	0.70	3.31	2.23	-0.46	4.20	0.06	3.25	5.6	-	-	-
South Africa	57.1	9.50	-	0.51	2.48	5.33	-0.16	1.18	0.39	23.58	24.6	-	-	-
South Korea	265.3	17.05	-	1.88	3.16	2.49	0.41	0.50	0.98	13.78	3.3	-	-	-
Thailand	98.5	10.75	1146.2	1.57	3.44	1.62	-0.87	0.62	0.13	15.38	1.1	-	-	-
Turkiye	70.5	17.01	1343.4	0.31	5.53	10.44	-1.03	1.27	0.24	17.94	10.4	-	-	-
Aggregate statistics:														
Mean	36.32	12.41	472.41	0.41	4.11	8.81	-0.93	1.37	-0.47	11.22	7.08	-0.44	-0.14	0.393
Median	21.1	12.2	390.5	0.28	4.44	6.41	-0.77	1.29	-0.39	11.12	7.07	-0.07	-0.41	-0.24
Std. Dev.	33.99	6.79	400.1	0.48	3.79	7.79	0.73	0.71	0.51	2.63	3.82	1.09	1.29	1.14
Observations	172	186	94	249	255	230	233	255	233	147	255	181	171	92

Table 2. Median descriptive statistic for the variables

Source: Author's own work

Table 3. Pearson correlation for the variables

Variables	AMT	CBB	DEP	FDO	GDG	INF	PST	PG	RQ	TR	EP	DFI	ADFI	DFID
AMT	1.00													

CBB	0.87***	1.00												
	(0.00)	-----												
DEP	0.42**	0.76***	1.00											
	(0.02)	(0.00)	-----											
FDO	0.31*	-0.004	-0.43**	1.00										
	(0.10)	(0.98)	(0.02)	-----										
GDG	-0.21	-0.50**	-0.68***	0.55***	1.00									
	(0.27)	(0.01)	(0.00)	(0.00)	-----									
INF	-0.32*	0.02	0.52***	-0.60***	-0.51***	1.00								
	(0.09)	(0.89)	(0.00)	(0.00)	(0.00)	-----								
PST	0.89***	0.69***	0.12	0.42**	0.08	-0.52***	1.00							
	(0.00)	(0.00)	(0.52)	(0.02)	(0.67)	(0.00)	-----							
PG	-0.75***	-0.45	0.12	-0.58	-0.21	0.74	-0.85	1.00						
	(0.00)	(0.02)	(0.52)	(0.00)	(0.28)	(0.00)	(0.00)	-----						
RQ	0.77***	0.76***	0.45**	0.18	-0.12	-0.17	0.78***	-0.49***	1.00					
	(0.00)	(0.00)	(0.01)	(0.35)	(0.53)	(0.36)	(0.00)	(0.00)	-----					
TR	0.187	0.59***	0.91***	-0.50***	-0.59***	0.68***	-0.05	0.39**	0.38**	1.00				
	(0.34)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.79)	(0.04)	(0.04)	-----				
EP	-0.23	0.14	0.70***	-0.60***	-0.62***	0.68***	-0.54***	0.59***	-0.20	0.71***	1.00			
	(0.23)	(0.46)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.31)	(0.00)	-----			
DFI	0.90***	0.92***	0.62***	0.11	-0.42**	-0.18	0.72***	-0.67***	0.64***	0.34*	0.07	1.00		
	(0.00)	(0.00)	(0.00)	(0.56)	(0.02)	(0.34)	(0.00)	(0.00)	(0.00)	(0.08)	(0.69)	-----		
ADFI	0.952***	0.81***	0.37*	0.32*	-0.22	-0.40**	0.83***	-0.83***	0.63***	0.06	-0.17	0.94***	1.00	
	(0.00)	(0.00)	(0.05)	(0.09)	(0.25)	(0.03)	(0.00)	(0.00)	(0.00)	(0.73)	(0.37)	(0.00)	-----	
DFID	0.69***	0.83***	0.81***	-0.13	-0.57***	0.08	0.41**	-0.38**	0.46**	0.53***	0.44**	0.91***	0.77***	1.00
	(0.00)	(0.00)	(0.00)	(0.49)	(0.00)	(0.68)	(0.03)	(0.04)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	-----

***,**,* denote statistical significance at the 1%, 5% and 10% levels. P-values are reported in parenthesis.

Source: Author's own work

5. Discussion

In this discussion of results section, we estimate and explain the results using two estimations to ensure that the results are robust to alternative estimations. We begin by examining the unilateral effect of capital outflows on the level of financial inclusion and digital financial inclusion. Thereafter, we examine the joint effect, or interaction effect, of geopolitical shocks and capital outflows on the level of financial inclusion and digital financial inclusion.

5.1. Effect of capital outflows on financial inclusion and digital financial inclusion

The median quantile regression result reported in table 4 shows that the FDO variable has an insignificant effect on the financial inclusion and digital financial inclusion indicators in columns 1 to 6 of Table 4. In contrast, the generalized linear model regression result reported in table 5 shows that the FDO variable has a significant positive effect on the AMT and ADFI indicators in columns 3 and 6 of Table 5. The two results are conflicting and inconsistent in the median quantile regression estimation and the generalized linear model regression estimation. Also, the two estimations do not confirm the first and second hypotheses.

Regarding the control variables, the PG coefficient is negative and significant in relation to the AMT, DFID and ADFI variables in columns 3, 5 and 6 in tables 4 and 5. This indicates that a high population growth is significantly associated with fewer automated teller machine penetration and low levels of digital financial inclusion. This result is consistent with our expectation. The PST coefficient is positive and significant in relation to the AMT variable in column 3 in tables 4 and 5. This indicates that political stability is conducive for financial inclusion through greater automated teller machine penetration. This result is consistent with our expectation. The EP coefficient is positive and significant in relation to the AMT variable in column 3 in tables 4 and 5. The result is consistent with our expectation. This indicates that a higher unemployment rate is associated with greater financial inclusion through greater automated teller machine penetration. The TR coefficient is positive and significant in relation to the CCB, AMT, DFI and ADFI variables in columns 1, 3, 4 and 6 in tables 4 and 5. This result is consistent with our expectation. This indicates that higher tax revenue is significantly associated with higher physical financial inclusion and higher digital financial inclusion. This result is consistent with our expectation, and it implies that tax revenues are used to support the provision of physical and digital financial access points to increase financial inclusion in

emerging markets and developing economies. The INF variable is insignificant in tables 4 and 5, implying that inflation does not significantly affect physical or digital financial inclusion in emerging market and developed countries. The GDG coefficient is negative and significant in relation to the DEP, AMT, DFI, DFID and ADFI variables in tables 4 and 5. This indicates that the level of financial inclusion and digital financial inclusion are higher during periods of low economic growth. This result is contrary to our expectation of a positive effect of economic growth on financial inclusion.

Table 4. Effect of capital outflows on financial inclusion and digital financial inclusion: median Quantile regression estimation

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	CBB	DEP	AMT	DFI	DFID	ADFI
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
FDO	0.300 (0.78)	-23.522 (0.74)	9.068 (0.34)	-0.139 (0.29)	0.125 (0.58)	0.369 (0.29)
INF	0.267 (0.49)	11.787 (0.49)	0.790 (0.60)	0.021 (0.75)	0.043 (0.47)	-0.032 (0.51)
GDG	-0.126 (0.59)	-16.708* (0.10)	-2.380** (0.03)	-0.092** (0.01)	-0.119** (0.01)	-0.148*** (0.00)
RQ	2.404 (0.76)	499.593 (0.14)	4.693 (0.85)	-0.282 (0.82)	0.023 (0.98)	0.053 (0.94)
TR	0.929*** (0.00)	18.271 (0.33)	7.764*** (0.00)	0.186*** (0.00)	0.018 (0.79)	0.230*** (0.00)
PG	2.361 (0.66)	-152.58 (0.26)	-28.479** (0.04)	-1.230*** (0.00)	-0.997** (0.02)	-1.6563*** (0.00)
EP	0.444* (0.07)	44.252** (0.04)	2.579* (0.10)	0.001 (0.97)	0.148* (0.05)	0.081 (0.16)
PST	5.086 (0.41)	-49.869 (0.88)	37.305** (0.02)	0.464 (0.60)	0.319 (0.69)	0.651 (0.31)
Pseudo R^2	18.32	64.12	43.79	41.86	60.28	53.11
Adjusted R^2	6.44	55.46	38.87	36.89	50.69	49.00
Observations	91	37	88	90	37	88

***,**,* represent statistical significance at the 1%, 5% and 10% levels. P-values reported in parenthesis

Source: Author's own work

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Table 5. Effect of capital outflows on financial inclusion and digital financial inclusion: generalised linear model (GLM) regression estimation

	(1)	(2)	(3)	(4)	(5)	(6)
	CBB	DEP	AMT	DFI	DFID	ADFI
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
FDO	1.784	-98.450	14.556***	0.076	-0.021	0.263*
	(0.22)	(0.38)	(0.00)	(0.62)	(0.95)	(0.08)
INF	0.398	89.363	-0.761	0.018	0.003	-0.046
	(0.15)	(0.69)	(0.40)	(0.55)	(0.96)	(0.11)
GDG	-0.234	-35.685**	-2.501***	-0.093***	-0.153***	-0.121***
	(0.35)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)
RQ	-6.006*	1115.95***	-8.707	-0.568	2.021**	0.011
	(0.07)	(0.00)	(0.45)	(0.12)	(0.02)	(0.97)
TR	0.893***	76.007***	7.396***	0.118***	0.142**	0.196***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.00)
PG	-0.345	-402.11**	-33.591***	-0.927	-1.575***	-1.533***
	(0.87)	(0.03)	(0.00)	(0.19)	(0.00)	(0.00)
EP	0.235	-23.174	3.196**	0.052	-0.009	0.129***
	(0.53)	(0.39)	(0.01)	(0.19)	(0.89)	(0.00)
PST	4.336*	-758.63***	29.366***	0.651**	-1.778**	0.731**
	(0.10)	(0.00)	(0.00)	(0.02)	(0.02)	(0.01)
Pearson statistic	49.56	66.19	512.96	55.01	45.56	51.91
Dispersion	49.56	66.19	512.96	55.01	45.56	51.91
Observations	91	37	88	90	37	88

***,**,* represent statistical significance at the 1%, 5% and 10% levels. P-values in parenthesis

Source: Author's own work

5.2. *Interaction effect on financial inclusion in terms of number of commercial bank branches*

We estimate the results using two estimations to ensure that the results are robust to alternative estimations. The result is reported in table 6. The GEO*FDO variable has a significant negative effect on the CBB dependent variable in both the median quantile regression and GLM estimations in columns 1 and 2 of Table 6. The result indicates that greater capital outflows, induced by geopolitical shock, decrease the level of financial inclusion through a contraction in the number of commercial bank branches in emerging markets and developing economies. This result is consistent with the first hypothesis which predicts a negative effect of capital outflows, induced by geopolitical shock on financial inclusion. This result implies that capital outflows, induced by geopolitical shock, is not

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beneficial for financial inclusion in emerging markets and developing economies. Regarding the control variables, the PST variable is positively significant in relation to the CBB variable in both the quantile regression and GLM estimations in columns 1 and 2 of Table 6. **This result is consistent with our expectation**. It indicates that greater political stability is associated with high financial inclusion via bank branch expansion. The INF and GEO variables are positively significant in relation to the CBB variable in both the median quantile regression and GLM estimations in columns 1 and 2 of Table 6. This indicates that a high inflation rate and the occurrence of geopolitical shock are associated with greater financial inclusion via bank branch expansion. In contrast, the RQ, TR, PG and GDG variables are statistically insignificant in the two estimations in Table 6.

5.3. Interaction effect on digital financial inclusion in terms of using the internet to assess bank branch services

We also assess the effect of capital outflows, induced by geopolitical shock, on the number of people using the internet to access commercial bank branch services. We measure this by constructing an index ("DFI") from the principal component analysis (PCA) of the percentage of people using the internet and the number of commercial bank branches per 100,000 adults. The derived index "DFI" is used as the dependent variable in columns 3 and 4 of Table 6. The GEO*FDO variable has a significant negative effect on the DFI dependent variable in both the median quantile regression and GLM estimations in columns 3 and 4 of Table 6. This result is consistent with the second hypothesis which predicts a negative effect of capital outflows, induced by geopolitical shock on digital financial inclusion. This result indicates that greater capital outflows, induced by geopolitical shock, decrease the level of digital financial inclusion through a decrease in the number of people using the internet to access commercial bank branch services. This implies that capital outflows, induced by geopolitical shock, is not beneficial for digital financial inclusion. Regarding the control variables, the PG variable is negatively significant in relation to the DFI variable in both the median quantile regression and GLM estimations in columns 3 and 4 of Table 6. This result is consistent with our expectation. It indicates that higher population growth is associated with fewer people using the internet to access bank branch services in emerging markets and developing economies. The GDG variable is negatively significant in relation to the DFI variable in both the median quantile regression and GLM estimations in columns 3 and 4 of Table 6. This indicates that

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higher GDP growth is associated with fewer people using the internet to access bank branch services in emerging markets and developing economies. This result is contrary to our expectation, and it is inconsistent with the argument of Van et al (2021) which suggest a positive relationship between GDP growth and digital financial inclusion.

Table 6. Effect of capital outflows, induced by geopolitical shocks, on financial inclusion and digital financial inclusion via commercial bank branches

Variable	Dependent variable: CBB = Financial inclusion via commercial bank branches		Dependent variable: DFI = Digital financial inclusion	
	(1)	(2)	(3)	(4)
	Median Quantile regression	Generalised linear model regression	Median Quantile regression	Generalised linear model regression
	CBB	CBB	DFI	DFI
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
FDO	10.330*** (0.00)	15.302*** (0.00)	1.056** (0.02)	1.329*** (0.00)
GEO*FDO	-12.699*** (0.00)	-17.062*** (0.00)	-1.302** (0.02)	-1.591*** (0.00)
GEO	13.047*** (0.00)	13.615*** (0.00)	1.006** (0.04)	1.276*** (0.00)
INF	0.594** (0.03)	0.436* (0.06)	0.029 (0.41)	0.026 (0.33)
GDG	-0.148 (0.34)	-0.322 (0.12)	-0.122** (0.01)	-0.097*** (0.00)
RQ	-0.670 (0.88)	-3.451 (0.23)	-0.222 (0.71)	-0.271 (0.41)
TR	0.036 (0.89)	0.092 (0.73)	0.104** (0.01)	0.039 (0.18)
PG	1.593 (0.63)	-2.369 (0.19)	-1.311** (0.03)	-1.136*** (0.00)
EP	0.464* (0.07)	0.426 (0.17)	0.032 (0.39)	0.073** (0.04)
PST	7.748* (0.05)	3.973* (0.08)	0.439 (0.52)	0.595** (0.02)
Pseudo R^2	20.12		47.36	
Adjusted R^2	11.24		41.44	
Pearson statistic		33.95		0.42
Dispersion		33.95		0.42
Observations	91	91	90	90

***,**,* represent statistical significance at the 1%, 5% and 10% levels. P-values in parenthesis

Source: Author's own work

5.4. Interaction effect on financial inclusion in terms of the number of bank depositors

We also estimate the results using two estimations to ensure that the results are robust to alternative estimations. The result is reported in table 7. The GEO*FDO variable has an insignificant effect on the DEP dependent variable in both the median quantile regression and GLM estimations in columns 1 and 2 of Table 7. The insignificant result does not support our hypotheses. The result indicates that capital outflows, induced by geopolitical shock, do not have a significant effect on the number of bank accounts or bank depositors in emerging markets and developing economies. Regarding the control variables, the control variables are not consistently significant in both the median quantile regression and GLM estimations in columns 1 and 2 of Table 7. Therefore, no meaningful conclusion can be drawn for the control variables.

5.5. Interaction effect on digital financial inclusion in terms of depositors using the internet to access their bank accounts

In this section, we examine the effect of capital outflows, induced by geopolitical shock, on the number of depositors using the internet to access their bank accounts or bank deposits. We measure this by constructing an index ("DFID") from the principal component analysis of the percentage of people using the internet and the number of bank accounts per 1,000 adults. The GEO*FDO variable has an insignificant effect on the DFID dependent variable in both the median quantile regression and GLM estimations in columns 3 and 4 of Table 7. The insignificant result does not support our hypotheses. The result indicates that capital outflows, induced by geopolitical shock, do not have a significant effect on the number of people using the internet to access their bank accounts.

Regarding the control variables, the PG variable is negatively significant in relation to the DFID variable in both the median quantile regression and GLM estimations in columns 3 and 4 of Table 7. This indicates that higher population growth is associated with fewer people using the internet to access their bank accounts in emerging markets and developing economies. This result is consistent with our expectation. The GDG variable is negatively significant in relation to the DFID variable in both the median quantile regression and GLM estimations in columns 3 and 4 of Table 7. This result is inconsistent with our expectation, and it is inconsistent with the argument of Van et al (2021) which suggest a positive relationship

between GDP growth and digital financial inclusion. It indicates that higher GDP growth is associated with fewer people using the internet to access their bank accounts in emerging markets and developing economies.

Variable	Dependent variable: Dep = number of bank accounts or depositors		Dependent variable: DFID = Digital financial inclusion (i.e. depositors using the internet to access their deposits)	
	(1)	(2)	(3)	(4)
	Median Quantile regression	Generalised linear model regression	Median Quantile regression	Generalised linear model regression
	DEP	DEP	DFID	DFID
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
FDO	-152.345 (0.51)	-391.503 (0.29)	0.357 (0.54)	-0.482 (0.63)
GEO*FDO	151.439 (0.55)	274.272 (0.45)	0.040 (0.94)	0.436 (0.65)
GEO	-114.500 (0.51)	-14.233 (0.94)	-0.301 (0.41)	-0.038 (0.94)
INF	13.914 (0.47)	5.425 (0.82)	0.086* (0.07)	-0.003 (0.96)
GDG	-15.309 (0.17)	-36.444** (0.02)	-0.121*** (0.002)	-0.154*** (0.00)
RQ	452.965 (0.24)	1083.26*** (0.00)	0.128 (0.89)	1.964** (0.03)
TR	29.168 (0.36)	85.917*** (0.00)	0.004 (0.96)	0.158* (0.05)
PG	-221.088 (0.29)	-394.01** (0.04)	-1.106** (0.01)	-1.569*** (0.00)
EP	42.545 (0.11)	-31.775 (0.27)	0.151** (0.04)	-0.023 (0.77)
PST	-48.353 (0.89)	-766.24** (0.01)	0.260 (0.76)	-1.794** (0.02)
Pseudo R^2	65.65		47.36	
Adjusted R^2	54.19		41.44	
Pearson statistic		68.047		0.48
Dispersion		68.047		0.48
Observations	37	37	37	37

Table 7. Effect of capital outflows, induced by geopolitical shocks, on financial inclusion and digital financial inclusion via number of bank accounts (or number of bank depositors)

***,**,* represent statistical significance at the 1%, 5% and 10% levels. P-values in parenthesis

Source: Author's own work

5.6. Interaction effect on financial inclusion in terms of the number of automated teller machines

We also estimate the results using two estimations to ensure the results are robust to alternative estimations. The result is reported in table 8. The GEO*FDO variable reports a negative relationship with the AMT variable with mixed significance in both the median quantile regression and GLM estimations in columns 1 and 2 of Table 8. This implies that the result is not robustly significant. Regarding the control variables, the PST variable is positively significant in relation to the AMT variable in both the median quantile regression and GLM estimations in columns 1 and 2 of Table 8. This indicates that greater political stability is associated with a high level of financial inclusion via greater automated teller machine penetration. The GDG variable is negatively significant in relation to the AMT variable in both the median quantile regression and GLM estimations in columns 1 and 2 of Table 8. This result is inconsistent with our expectation. It indicates that higher GDP growth is associated with fewer people using the internet to access automated teller machines in emerging markets and developing economies. The PG variable is negatively significant in relation to the AMT variable in both the median quantile regression and GLM estimations in columns 1 and 2 of Table 8. This result is consistent with our expectation. It indicates that higher population growth is associated with fewer people using the internet to access automated teller machines in emerging markets and developing economies. The TR coefficient is positive and significant in relation to the AMT variable in columns 1 and 2 in table 8. This indicates that higher tax revenue is significantly associated with greater ATM penetration. This result is consistent with our expectation, and it implies that tax revenues are used to support the provision of automated teller machines in emerging markets and developing economies. The EP coefficient is positive and significant in relation to the AMT variable in columns 1 and 2 in table 8. This result indicates that high unemployment is significantly associated with greater ATM penetration.

5.7. Interaction effect on digital financial inclusion in terms of people using the internet to access automated teller machines

We also assess the effect of capital outflows, induced by geopolitical shock, on the number of people using the internet to access automated teller machines. We measure this by constructing an index ("ADFI") from the principal component analysis of the percentage of people using the internet and the number of automated teller machines per 100,000 adults. The derived "ADFI" index is used as the dependent variable in columns 3 and 4. The GEO*FDO variable has a significant negative effect on the ADFI dependent variable in both the median quantile regression and GLM estimations in columns 3 and 4 of Table 8. This result is consistent with the second hypothesis which predicts a negative effect of capital outflows, induced by geopolitical shock on digital financial inclusion. The result indicates that greater capital outflows, induced by geopolitical shock, decrease the level of digital financial inclusion through a decrease in the number of people using the internet to access automated teller machines. This implies that capital outflows, induced by geopolitical shock, is not beneficial for digital financial inclusion.

Regarding the control variables, the PG variable is negatively significant in relation to the ADFI variable in both the median quantile regression and GLM estimations in columns 3 and 4 of Table 8. This indicates that higher population growth is associated with fewer people using the internet to access automated teller machines in emerging markets and developing economies. This result is consistent with our expectation. The GDG variable is negatively significant in relation to the ADFI variable in both the median quantile regression and GLM estimations in columns 3 and 4 of Table 8. This result is inconsistent with our expectation and indicates that higher GDP growth is associated with fewer people using the internet to access automated teller machines in emerging markets and developing economies.

Table 8. Effect of capital outflows, induced by geopolitical shocks, on financial inclusion and digital financial inclusion via automated teller machines

Variable	Dependent variable: AMT = Financial inclusion via automated teller machines		Dependent variable: ADFI = ATM-based digital financial inclusion (people accessing ATMs using the internet)	
	(1)	(2)	(3)	(4)
	Median Quantile regression	Generalised linear model regression	Median Quantile regression	Generalised linear model regression
	AMT	AMT	ADFI	ADFI
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
FDO	26.399* (0.05)	43.658*** (0.00)	1.092** (0.04)	1.011*** (0.00)
GEO*FDO	-24.577 (0.12)	-36.811*** (0.00)	-1.168** (0.03)	-0.945** (0.01)
GEO	15.608 (0.21)	27.718*** (0.00)	0.840 (0.12)	0.714** (0.01)
INF	0.292 (0.85)	-0.699 (0.42)	-0.019 (0.63)	-0.044 (0.11)
GDG	-2.708** (0.01)	-2.651*** (0.00)	-0.157*** (0.001)	-0.125*** (0.00)
RQ	7.716 (0.71)	-3.154 (0.78)	0.455 (0.43)	0.155 (0.67)
TR	6.673*** (0.00)	5.609*** (0.00)	0.189*** (0.00)	0.149 (0.00)
PG	-32.467** (0.03)	-36.705*** (0.00)	-1.950*** (0.00)	-1.612*** (0.00)
EP	3.204* (0.06)	3.684*** (0.00)	0.096 (0.12)	0.142*** (0.00)
PST	29.525* (0.10)	28.581*** (0.00)	0.409 (0.41)	0.711** (0.01)
Pseudo R^2	46.09		55.08	
Adjusted R^2	39.87		49.90	
Pearson statistic		454.66		0.48.5
Dispersion		454.66		0.48.5
Observations	88	88	88	88

***,**,* represent statistical significance at the 1%, 5% and 10% levels. P-values in parenthesis

Source: Author's own work

4.3. Further analysis

Finally, we conducted another analysis to determine the impact of geopolitical shocks and capital outflows on a unique composite digital financial inclusion index. We construct the FIND index as a composite digital financial inclusion index. The FIND index is a proxy for the number of people using the internet to access commercial bank branch services, deposit accounts and ATM services at the same time. It is measured as the principal component analysis of (i) the percentage of people using the internet, (ii) the number of commercial bank branches per 100,000 adults, (iii) the number of bank accounts (or depositors) per 1,000 adults, and (iv) the number of automated teller machines per 100,000 adults. The result, which is reported in table 9, shows that the FDO coefficient is statistically insignificant in relation to the FIND index. Also, the FDO*GEO coefficient is equally statistically insignificant in relation to the FIND index. This implies that capital outflows induced by geopolitical shocks do not have a significant effect on the constructed composite digital financial inclusion index. However, the control variables, such as the GDG, TR, PST and PG variables, have a robust significant effect on the composite digital financial inclusion index.

Table 9. Additional analysis: effect of capital outflows and geopolitical shocks on composite digital financial inclusion index

	(1)	(2)	(3)	(4)
Variable	FIND	FIND	FIND	FIND
	Median QR	GLM	Median QR	GLM
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
FDO	0.298 (0.43)	0.214 (0.28)	-0.455 (0.66)	-0.425 (0.52)
GEO*FDO			0.467 (0.65)	0.579 (0.33)
GEO			0.194 (0.74)	-0.163 (0.62)
INF	-0.009 (0.89)	0.007 (0.88)	-0.038 (0.63)	0.008 (0.87)
GDG	-0.127*** (0.03)	-0.109*** (0.00)	-0.114** (0.03)	-0.102*** (0.00)
RQ	-0.867 (0.41)	-0.227 (0.69)	-0.192 (0.89)	-0.285 (0.65)
TR	0.161** (0.04)	0.182*** (0.00)	0.208** (0.01)	0.218*** (0.00)
PG	-0.784 (0.26)	-1.156*** (0.00)	-1.039* (0.08)	-1.327*** (0.00)
EP	0.150* (0.05)	0.126** (0.01)	0.101 (0.21)	0.102* (0.06)
PST	2.309* (0.06)	1.709*** (0.00)	1.517 (0.21)	1.513** (0.01)
Pseudo R^2	82.92		84.24	
Adjusted R^2	76.62		75.89	
Pearson Statistic		0.13		0.14
Observations	27	27	27	27

***,**,* represent statistical significance at the 1%, 5% and 10% levels. P-values reported in parenthesis

Source: Author's own work

6. Conclusion

Geopolitical shocks are generally disruptive. They create uncertainty and trigger capital outflows which affect emerging market and developing economies. In this study, we focused on the effect of capital outflows that are induced by geopolitical shocks and assess their impact on access to financial services in emerging market and developing economies. Our main argument was that adverse geopolitical shocks can lead to foreign capital outflows which, in turn, can lead to a shortfall in funding for financial service providers. The funding shortfall can decrease the ability of financial service providers to extend financial services to unbanked adults and people in underserved locations, thereby decreasing the level of financial inclusion. We test this hypothesis using data from emerging markets and developing economies.

The data were estimated using the median quantile regression and the generalized linear model regression estimations. The result revealed that greater capital outflows, induced by geopolitical shock, decrease the level of financial inclusion in emerging markets and developing economies. The channel through which this happens is through a contraction in the number of commercial bank branches. It was also found that greater capital outflows, induced by geopolitical shock, decrease the level of digital financial inclusion. The channel through which this happens is through a decrease in the number of people using the internet to access commercial bank branch services and ATM services.

The results have policy implications for the progress being made to accelerate financial inclusion in emerging markets and developing economies. The results call for EMDE policymakers to closely monitor geopolitical events, determine the risk posed by geopolitical events and evaluate their potential impact on financial inclusion in emerging markets and developing countries. Such evaluation should lead policymakers to conduct a review of their national financial inclusion strategies in order to incorporate safeguards and resilience mechanisms to preserve the level of financial inclusion in a changing geopolitical environment.

The social implication of the findings is that geopolitical shocks and capital outflows can adversely affect society by limiting access to essential financial services for members of society. The managerial implication of the findings is that financial managers need to

constantly anticipate geopolitical risk, its effect on the provision of financial services and develop safeguards to cushion their effects on financial service providers and their customers. Financial institutions need to respond effectively to capital outflows that arise from geopolitical events, but they should not be allowed to respond by halting or delaying the expansion of essential financial services to those who need it the most. This will not only decrease the level of financial inclusion, but it will hinder financial development in emerging market and developing countries.

Future studies can examine the effect of geopolitical shocks on the microfinance institutions that are helping to accelerate financial inclusion in rural areas. Such analysis can provide insight into whether geopolitical shocks have a more significant effect on microfinance institutions compared to large financial institutions or large banks. Future studies can also examine the impact of geopolitical shocks on economic inclusion. Another area for future research is to investigate the impact of geopolitical shocks on the financial resilience of individuals and small businesses.

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Appendix

Appendix 1. Augmented Dickey Fuller (ADF) Unit Root Test for Stationarity				
Variable	ADF Fisher Chi-Square Test Statistic	P-value	Observation	Decision Remark
AMT	19.90	0.796	120	p-value > 0.05. The time series is not stationary.
CBB	49.37	0.014	142	p-value < 0.05. The time series is stationary.
DEP	3.89	0.985	62	p-value > 0.05. The time series is not stationary.
TNT	12.61	0.999	204	p-value > 0.05. The time series is not stationary.
FDO	49.25	0.044	211	p-value < 0.05. The time series is stationary.
GDG	76.51	0.000	221	p-value < 0.05. The time series is stationary.
INF	40.35	0.098	195	p-value > 0.05. The time series is not stationary.
PST	33.25	0.504	174	p-value > 0.05. The time series is not stationary.
PG	32.44	0.544	221	p-value > 0.05. The time series is not stationary.
RQ	34.97	0.422	174	p-value > 0.05. The time series is not stationary.
TR	19.97	0.459	97	p-value > 0.05. The time series is not stationary.
EP	52.82	0.021	221	p-value < 0.05. The time series is stationary.
GEO	19.33	0.625	143	p-value > 0.05. The time series is not stationary.
DFI	16.18	0.963	134	p-value > 0.05. The time series is not stationary.
DFID	1.76	0.999	60	p-value > 0.05. The time series is not stationary.
ADFI	13.59	0.978	120	p-value > 0.05. The time series is not stationary.

Source: Author's own work