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Income-level analysis of money demand stability in Sub-Saharan Africa using cross-sectional ARDL

ABSTRACT

Relevance: The stability of money demand is essential for effective monetary policy, especially in Sub-Saharan African (SSA) countries that face various economic challenges. These challenges include volatile exchange rates, fluctuating foreign interest rates, and high inflation, all of which can disrupt money demand stability. Understanding how these dynamics interact with different income levels—upper middle, lower middle, and low—is crucial for developing effective regional monetary policies and achieving economic stability.

Research Objective: This study aims to evaluate the stability of money demand across different income levels—upper middle, lower middle, and low—in SSA. By applying the cash-in-advance theory, the study seeks to provide insights and actionable policy recommendations on the influence of key economic variables.

Data and Method. This study employs the cross-sectional augmented autoregressive distributed lag (CS-ARDL) model to analyze both the short- and long-run influences of real exchange rates, foreign interest rates, real GDP, and inflation on money demand. By doing so, it aims to provide a nuanced understanding of money demand stability, capturing variations often overlooked in existing research. The analysis uses data from the World Bank Indicators and the International Monetary Fund (IMF), allowing for a detailed examination of money demand stability across various income levels in the region.

Results. The findings reveal a positive and significant relationship between the real exchange rate, foreign interest rates, real gross domestic product, and real monetary aggregates. However, inflation has a contractionary effect on the real monetary aggregate, destabilizing money demand. Money demand stability is observed in upper-middle and low-income countries, while lower-middle-income countries exhibit variability, indicating differing levels of economic resilience across income categories.

Conclusion. The study recommends adopting unified monetary policies and a single currency to enhance stability and stimulate economic growth in the region. Additionally, implementing inflation-targeting policies can further strengthen economic stability and promote sustainable development in SSA.

KEYWORDS

money demand, sub-Saharan Africa, real monetary aggregate, foreign interest rate, inflation rate

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Анализ стабильности спроса на деньги и уровня доходов в странах Африки к югу от Сахары с использованием перекрестного ARDL

АННОТАЦИЯ

Актуальность. Стабильность спроса на деньги имеет важное значение для эффективной денежно-кредитной политики, особенно в странах Африки к югу от Сахары (SSA), которые сталкиваются с различными экономическими проблемами. К этим проблемам относятся нестабильные обменные курсы, колеблющиеся иностранные процентные ставки и высокая инфляция, все из которых могут нарушить стабильность спроса на деньги. Понимание того, как эта динамика взаимодействует с различными уровнями дохода — выше среднего, ниже среднего и низкий — имеет решающее значение для разработки эффективной региональной денежно-кредитной политики и достижения экономической стабильности.

Цель исследования. Исследование направлено на оценку стабильности спроса на деньги при различных уровнях дохода — выше среднего, ниже среднего и низкий — в странах Африки к югу от Сахары. Применяя теорию аванса, исследование стремится предоставить идеи и действенные рекомендации по политике относительно влияния ключевых экономических переменных.

Данные и методы. Это исследование использует модель поперечного сечения с расширенным авторегрессионным распределенным лагом (CS-ARDL) для анализа как краткосрочного, так и долгосрочного влияния реальных обменных курсов, иностранных процентных ставок, реального ВВП и инфляции на спрос на деньги. Таким образом, оно направлено на обеспечение детального понимания стабильности спроса на деньги, охватывая изменения, которые часто упускаются из виду в существующих исследованиях. Анализ использует данные из показателей Всемирного банка и Международного валютного фонда (МВФ), что позволяет провести детальное изучение стабильности спроса на деньги при различных уровнях дохода в регионе.

Результаты. Результаты показывают положительную и значимую связь между реальным обменным курсом, иностранными процентными ставками, реальным валовым внутренним продуктом и реальными денежными агрегатами. Однако инфляция оказывает сдерживающее воздействие на реальный денежный агрегат, дестабилизируя спрос на деньги. Стабильность спроса на деньги наблюдается в странах с высоким средним и низким уровнем дохода, в то время как страны с низким средним уровнем дохода демонстрируют изменчивость, что указывает на разные уровни экономической устойчивости в разных категориях дохода.

Заключение. В исследовании рекомендуется принять единую денежно-кредитную политику и единую валюту для повышения стабильности и стимулирования экономического роста в регионе. Кроме того, реализация политики таргетирования инфляции может еще больше укрепить экономическую стабильность и способствовать устойчивому развитию в странах Африки к югу от Сахары.

КЛЮЧЕВЫЕ СЛОВА

спрос на деньги, страны Африки к югу от Сахары, реальный денежный агрегат, иностранная процентная ставка, уровень инфляции

ДЛЯ ЦИТИРОВАНИЯ

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利用横截面ARDL分析撒哈拉以南非洲的货币需求与收入稳定性

摘要

现实性：货币需求的稳定性对于有效的货币政策非常重要，尤其是在面临各种经济挑战的撒哈拉以南非洲地区。这些挑战包括不稳定的汇率、波动的国外利率和高通胀，所有这些都会破坏货币需求的稳定性。要制定有效的地区货币政策并实现经济稳定，了解这些动态如何与不同的收入水平（中上层、中下层和低层）相互作用至关重要。

研究目标：本研究旨在评估撒哈拉以南非洲不同收入水平（中上、中下和低收入）的货币需求稳定性。通过应用超前理论，本研究试图就关键经济变量的影响提出见解和可行的政策建议。

数据与方法：本研究采用横截面增强自回归分布滞后（CS-ARDL）模型，分析实际汇率、国外利率、实际国内生产总值和通货膨胀对货币需求的短期和长期影响。因此，它旨在详细了解货币需求的稳定性，涵盖现有研究中经常忽略的变化。分析使用了世界银行和国际货币基金组织（IMF）的指标数据，从而可以详细研究该地区不同收入水平的货币需求稳定性。

研究结果：研究结果表明，实际汇率、国外利率、实际国内生产总值和实际货币总量之间存在显著的正相关关系。然而，通货膨胀会破坏货币需求的稳定性，从而对实际货币总量产生调节作用。中高收入和低收入国家的货币需求保持稳定，而中低收入国家则表现出变化，这表明不同收入类别的经济恢复能力不同。

结论：研究报告建议采用单一货币政策和单一货币，以加强该地区的稳定并促进经济增长。此外，实施通货膨胀目标政策可进一步加强撒哈拉以南非洲的经济稳定，促进可持续发展。

关键词

货币需求、撒哈拉以南非洲、实际货币总量、外国利率、通货膨胀率

供引用

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Introduction

In the 21st century, as economic globalization advances and monetary policy frameworks evolve, understanding the dynamics of money demand in Sub-Saharan Africa (SSA) has gained critical importance for both scholars and policymakers. The region faces a variety of economic and developmental challenges, exacerbated by uncertain economic conditions that stifle both domestic and foreign investment. Volatility in money demand and exchange rates further complicates the development of effective monetary policies, managing balance of payments, and alleviating external debt pressures. Additionally, high inflation rates diminish purchasing power, drive up living costs, and can potentially lead to social unrest (Adil et al., 2018; Samuel et al., 2019a).

Given these economic and developmental challenges, the stability of SSA's economy hinges on a well-targeted and effective monetary policy

framework, where monetary aggregates like M1 and M2 serve as key tools for controlling inflation. Understanding the stability of the money demand function is especially crucial in SSA, where inflation and exchange rate volatility are deeply intertwined with monetary stability (Albulescu & Pepin, 2018). Research by Adil, Hatekar, and Sahoo (2020), as well as Samuel et al. (2019a), underscores the role of money demand as a powerful economic policy instrument, particularly in today's global economy, where economic structures are rapidly shifting. The 2007–2008 global recession exposed significant vulnerabilities in financial systems, regulatory frameworks, and broader economic imbalances, prompting a renewed emphasis on money and liquidity within monetary policy (Narayan, 2010; Udo et al., 2019b).

In response to financial and economic imbalances worsened by the Ebola outbreak and the recent COVID-19 pandemic, central banks across

SSA implemented measures to boost liquidity and maintain financial stability. For instance, the South African Reserve Bank lowered its repo rate by 300 basis points, the Central Bank of Nigeria reduced its benchmark interest rate, and the Central Bank of Kenya cut its Cash Reserve Ratio (CRR). Likewise, the Bank of Ghana reduced the primary reserve requirement to enhance banking sector liquidity, alongside other regulatory interventions like loan moratoriums and forbearance policies (Udoh et al., 2023b; Ndubuaku, et al. 2021).

This study aims to assess the stability and influence of money demand in SSA, with a particular focus on income-level distinctions. It addresses key gaps in the literature and methodology, as most empirical studies on money demand, such as Miller et al. (2019) in the US, have focused on developed economies, leaving SSA underexplored. Factors like inconsistent data, a large informal sector, rapid structural changes, underdeveloped financial systems, political and economic instability, and the prevalence of foreign currencies in domestic transactions complicate the analysis of money demand in SSA. Moreover, prior research often aggregates SSA countries, overlooking the varied impacts of money demand stability across different income levels, leading to heterogeneous results.

This study focused on SSA countries, given their regional economic and structural changes, to contribute to the literature. The theoretical framework of this study is the cash-in-advance theory, which provides a robust framework for understanding money demand by explicitly accounting for the role of money in facilitating economic transactions and identifying key predictors such as income levels, interest rates, and inflation. This theoretical basis supports the analysis of money demand stability, which is critical for formulating effective monetary policies. Specifically, the study assesses:

1. The long-run influence of income, exchange rate, foreign interest rate, and inflation rate on money demand in SSA.
2. The variability of money-demand stability across diverse income levels in SSA and its implications for potential monetary integration in the region.
3. The policy implications of future patterns in money demand stability for liquidity management and economic stability in SSA economies in SSA economies.

To achieve these objectives, we employ the Cross-Sectional Augmented Autoregressive Distributed Lag (CS-ARDL) model, which accounts for cross-sectional dependence and heterogeneity due to the diversity in SSA countries' economic structures, income levels, and monetary policies. By disaggregating the analysis based on income levels: lower-middle income (LM), upper-middle income (UMI), and low income (LI), the study offers granular insights into how economic variables affect money demand differently across these categories. The dataset spans from 1999 to 2023, capturing long-term trends and cyclical patterns that previous studies with shorter datasets may have missed. Moreover, by utilizing the cash-in-advance theory, which acknowledges open market operations and socioeconomic interdependencies of these economies, this study ensures robust model stability through the Hansen (1992) test.

Beyond the SSA, the insight from this study will inform actionable policy decisions in other emerging economies, which share common challenges such as managing inflation, financial inclusion, and external vulnerabilities. The link between the two regions is evidenced by their transitional economic structures, external economic dependencies, and the role of monetary policy in maintaining stability in the face of these challenges. By exploring how income-level distinctions influence money demand in SSA, policymakers can draw parallels to their economy, particularly in managing inflation, exchange rates, and monetary policy. This cross-regional application could enhance economic resilience, support sustainable development, and foster greater financial stability in emerging countries.

This study enhances our understanding of money demand dynamics in SSA and offers practical insights for promoting economic stability in the region. By addressing gaps in the literature and providing empirical evidence through econometric analysis, it aims to support policymakers working to strengthen economic resilience and encourage sustainable development in SSA.

Theoretical framework

This study is grounded in theories related to the money demand function, capital mobility, currency substitution, and the quantity theory of money, offering insights into income levels in SSA countries. Tables 1 and 2 summarize the empirical and theoretical reviews, respectively.

Table 1

Summary of Empirical Reviews

Author(s)	Country	Methodology	Key Findings
Wang (2011)	US	Money demand functions with regime shifts	Semi-elasticity of interest rate increased sharply, indicating variable sensitivity during significant economic changes.
Zuo et al. (2011)	China	Smooth time-varying model	The stability of money demand is influenced by the role of asset prices in a rapidly growing economy.
Folarin and Asongu (2019)	Various	ARDL model	Interest rates are not always effective for money demand stability; other factors are also important.
Adil et al. (2020)	India	Asymmetric influence analysis	There are complex interactions between exchange rates and money demand in an open economy.
Chaisrisawatsuk et al. (2004)	Asian countries	Portfolio balance model	Effective monetary policies can mitigate currency substitution effects.
Mera et al. (2020); Samuel et al (2023); Samuel et al (2019)	Central and Eastern European Countries	Traditional money demand function and economic sentiments	Money demand is influenced by economic sentiments, especially with euro and dollar substitution.
Karaman et al. (2020)	European Union	Analysis of political and fiscal factors	Monetary stability is attributed to political factors and fiscal capacity.
Nepal and Paija (2020)	SAARC countries	Rational policy instrument analysis	The money supply has a significant influence on controlling monetary policies, highlighting the importance of regional policy coordination.

Source: compiled by the authors (2024)

Table 2

Summary of Theoretical Reviews

Concept	Description	Key References
Money Demand Function	The money demand function captures the influence of various macroeconomic predictors, anchored in real income and price levels. Its stability indicates effective monetary policy and helps mitigate fiscal disruptions.	Hueng (1998); Khan & Ahmed (2016); Samuel et al. (2019d)
Capital Mobility and Currency Substitution	Money demand stability is influenced by capital mobility and currency substitution, which are key instruments of monetary policy, particularly through the mechanisms of exchange rates and interest rates.	Nepal & Paija (2020); Chowdhury (1995)
Influence of Capital Mobility	Capital mobility impacts monetary policy by integrating exchange rates and interest rates, supporting an open economy.	Chowdhury (1995)
Economic Agents' Motives	Understanding motives for holding money is crucial for monetary authorities. Direct and indirect motives affect money demand.	Samuel et al (2019a); Samuel et al (2023c); Ndubuaku, et al. (2021).
Quantity Theory of Money	The quantity theory of money posits that money demand exogenously influences money supply, affecting both inflation rates and economic growth.	
Stability of Velocity of Money	The stability of the velocity of money is equivalent to assessing the stability of money demand.	Samuel et al. (2019a)
This table succinctly captures the main points related to the money demand function, capital mobility, currency substitution, and their implications for monetary policy.		

Source: compiled by the authors (2024)

Despite a wealth of literature on money demand across various economies, there remains a notable gap concerning the SSA region. Previous studies have largely concentrated on individual countries or regions, including the United States, Chi-

na, Tunisia, Turkey, Italy, India, other Asian nations, Central and Eastern European countries, and the SAARC region. While these studies offer valuable insights into the economic conditions and policy impacts of those nations, they often overlook SSA.

Given the unique economic conditions and policy environments in SSA, it is crucial to specifically assess the money demand function within this region. The limited empirical research on SSA countries means that policymakers lack tailored insights into how various macroeconomic variables influence money demand. This gap is particularly significant considering the economic diversity and varying income levels across SSA.

Understanding these dynamics is essential for several reasons. SSA countries exhibit considerable heterogeneity in income levels, economic structures, and political stability, necessitating a nuanced analysis that differentiates how economic variables affect money demand across different income brackets. Without region-specific studies, it is challenging for SSA policymakers to design and implement effective monetary policies that can stabilize prices, control inflation, and promote economic growth.

Additionally, SSA countries often experience high economic and political volatility, which impacts the money demand function. This makes it imperative to employ models that can detect and account for structural breaks and other dynamic changes in the economic environment. The unique economic conditions and policy challenges faced by SSA, such as high levels of informality, exchange rate and inflation volatility, and political instability, further underscore the need for dedicated research in this area.

Materials and Methods

Using quarterly data spanning 24 years, we sourced information from the World Bank In-

dicators and the International Monetary Fund (IMF) for the period from 1999Q1 to 2023Q4. We applied the linear interpolation technique to convert the annual datasets into quarterly observations. This technique assumes that changes between annual data points occur at a constant rate throughout the year, and it is widely used in literature to convert low-frequency data into higher-frequency observations for complex statistical estimations. Notably, this method preserves the magnitude and trend of the converted data in comparison to the original dataset. The linear interpolation equation is expressed as follows:

$$y = y_1 + (x - x_1) \frac{(y_2 - y_1)}{(x_2 - x_1)}, \tag{1}$$

where: x_1 and y_1 = first coordinates; x_2 and y_2 = second coordinates; x = the interpolation performance point; y = interpolated value.

The 24-year timeframe captures the long-term trends and cyclical patterns, providing a comprehensive analysis of money demand in SSA. The extended timeframe reveals the influences of various economic and political events on money demand. The study variables include monetary aggregate (M2), income (RGDP), foreign interest rate (FINR), exchange rate (REC), and inflation rate (INF).

The study focuses on SSA countries, categorized based on income levels as defined by the World Bank in Table 3.

Table 4 presents detailed descriptions and key measurements of the variables used in the study.

Table 3

Sample Countries

Panel A:	Sample SSA Countries (SSA)
	Angola; Benin; Botswana; Burkina Faso; Burundi; Cabo Verde; Cameroon; Central African Republic; Chad; Comoros; Congo, Dem. Rep.; Congo, Rep.; Côte d'Ivoire; Equatorial Guinea; Eritrea; Eswatini; Ethiopia; Gabon; Gambia; Ghana; Guinea; Guinea-Bissau; Kenya; Lesotho; Liberia; Madagascar; Malawi; Mali; Mauritania; Mauritius; Mozambique; Namibia; Niger; Nigeria; Rwanda; São Tomé and Príncipe; Senegal; Sierra Leone; Somalia; South Africa; South Sudan; Sudan; Tanzania; Togo; Uganda; Zambia and Zimbabwe
	Lower Middle-Income Countries (SSA-LM): GNI per capita between \$1,036 and \$4,045 Angola; Benin; Cabo Verde; Cameroon; Comoros; Congo, Rep.; Côte d'Ivoire; Eswatini; Ghana; Kenya; Lesotho; Mauritania; Nigeria; São Tomé and Príncipe; Senegal; Tanzania; Zambia and Zimbabwe
	Upper Middle-Income Countries (SSA-UM): GNI per capita between \$4,046 and \$12,535 Botswana, Equatorial Guinea, Gabon, Mauritius, Namibia and South Africa,
	Low-income countries (SSA-LI): GNI per capita of \$1,035 or less Burkina Faso; Burundi; Central African Republic; Chad; Congo, Dem. Rep.; Eritrea; Ethiopia; Guinea; Guinea-Bissau; Liberia; Malawi; Madagascar; Mali; Mozambique; Niger; Rwanda; Sierra Leone; Somalia; South Sudan; Sudan; Togo; Uganda and Gambia

Source: compiled by the authors

Table 4

Variables Description and Key Measurements

Variables	Description	Unit/Expression	Methodology
M2	Real monetary aggregate	Constant 2015 US dollars (\$)	Linear interpolation for quarterly data transformation and natural log transformation.
RGDP	Real gross domestic product (proxied a country's real income)	Constant 2015 US dollars (\$)	
REC	Real exchange rate (proxied real value of a country's currency, capture fluctuation, and variation)	US dollars	
INR	Inflation rate	Percentage	
FINR	Foreign interest rate		
Source of Data: World Development Indicators (WDI, 2023): https://databank.worldbank.org/source/world-development-indicators ; International Monetary Fund (IMF, 2023): https://www.imf.org/en/Data			
M2 was adopted due to the unavailability of data for M3 or M4 in most SSA countries. This study adopted the methodologies of Azimi et al. (2020) and Hameed et al. (2022). To circumvent autocorrelation hitches, the variables were naturally log-transformed to ensure robust estimations.			

Source: compiled by the authors

The specification is based on the cash-in-advance framework. Following Hueng (1998), long-run linear specification is expressed as:

$$\ln M2_t = \alpha_i + \psi_1 \ln FINR_t + \lambda_2 \ln RGDP_t + \delta_3 \ln REC_t + \varphi_4 \ln INR_t + \mu_t. \quad (2)$$

Equation (1) is re-express in panel form as:

$$\ln M2_{it} = \alpha_i + \psi_1 \ln FINR_{it} + \lambda_2 \ln RGDP_{it} + \delta_3 \ln REC_{it} + \varphi_4 \ln INR_{it} + \mu_{it}. \quad (3)$$

To ensure dataset stability and avoid potential misspecifications, the Augmented Dickey and Fuller (1979) and Phillips and Perron (1988) unit roots were applied to determine if the series exhibits a stochastic trend. The Zivot and Andrews (1992) test was also used to account for structural breaks. The cross-sectional dependence (CD), reflecting regional economic integration among SSA countries, was tested using the Lagrange Multiplier (LM) test by Breusch and Pagan (1980).

Cointegration Test

The long-run link between M2 and its predictors was assessed via a cointegrating approach. The model considers structural breaks and the influence of lead-lag relationships, employing the Westerlund cointegration test. The cointegration equation is expressed as follows:

$$\Delta \ln y_t = \lambda y \ln y_{t-1} + \lambda x \ln x_{t-1} + \omega k_t + \sum_{i=1}^p \vartheta_{iy} \Delta \ln y_{t-i} + \sum_{i=1}^p \vartheta_{ix} \Delta \ln x_{t-i} + \varepsilon_t, \quad (4)$$

where: λ = long-run; ϑ = short-run, and ω = trend coefficient.

The (H_0) of no cointegration in Equation (5) is rejected if $\lambda_y = \lambda_x = 0$. The model was adopted for its capabilities to incorporate structural breaks and account for lead-lag length links, particularly in datasets with low-frequency observations. The Westerlund model is expressed as:

$$\Delta \ln y_{it} = C_i + a_i (\ln y_{it-1} - b_i (\ln x_{it-1})) + a_{j-1}^{pj} a_{ij} \Delta \ln y_{it-1} + a_{j-1}^{pj} \varphi_{ij} \Delta \ln y_{it-1} + \varepsilon_{it}. \quad (5)$$

Reject (H_0) of no co-integration if p-value > 0.05.

Cross-Sectional (CS) -ARDL Test

To achieve our objectives, we employ the Cross-Sectional Augmented Autoregressive Distributed Lag (CS-ARDL) model of Pesaran (2006), modified by Chudik et al. (2015) to account for cross-sectional dependence and heterogeneity due to the diversity in SSA countries' economic structures, income levels, and monetary policies. In this study area, the regression and other linear models are predominantly employed to focus on short-term links while neglecting longitudinal links due to data availability, analytical challenges, focus on immediate outcomes, and others. Adopting a varied paradigm to investigate money demand stability is vital for a resourceful policy formulation in SSA (Grassa & Gazdar, 2014; Samuel et al., 2023). The CS-ARDL model allows for a synchronized estimation of the short-run dynamics and long-run equilibrium link and also offers a comprehensive understanding of money de-

mand behaviour across diverse income brackets. By considering heterogeneity among countries, the CS-ARDL model provides more nuanced and reliable insights, avoiding the spurious results often associated with traditional panel data methods. The CS-ARDL model expression is as follows:

$$\Delta \text{In}y_{it} = \varphi_i \text{In}y_{it-1} + \lambda_i \text{In}x_{it-1} + \sum_{p=0}^{PT} \vartheta_{xip} \text{In}\ddot{x}_{t-p} + \sum_{p=0}^{PT} \vartheta_{yip} \text{In}\dot{y}_{t-p} + \varepsilon_{it}, \quad (6)$$

where φ_i = dependent variable coefficient, PT = lags limit in the CS ($PT \sqrt[3]{T}$), λ_i = explanatory variables coefficients, and ε_{it} = error term.

By disaggregating the analysis based on income levels: lower-middle income (LM), upper-middle income (UMI), and low income (LI), the study offers granular insights into how economic variables affect money demand differently across these categories. The dataset spans from 1999 to 2023, capturing long-term trends and cyclical patterns that previous studies with shorter datasets may have missed.

The CS-ARDL model results presented in Table 3 panel A account for the cross-sectional means, lags, and heterogeneous coefficients. The Hansen test ensures the robustness of the findings by detecting structural breaks, accounting for the economic and political volatility in SSA. This test helps in validating the stability of the model parameters, making the results reliable for policy recommendations.

Null hypothesis:

$H_0 : \beta_i = \beta$ for all i (cross-section are independent)

$H_1 : \beta_i \neq \beta_j$ for $i \neq j$ (each cross-section's dependence).

Results

The results in Tables 5 and 6, which confirm CD and cointegration among SSA countries, offer significant insights into the magnitude of predictors' influences on M2 across different income levels in the region. Table 5, B unit root test results show that the series is stationarity at diverse orders of integration, indicating that economic links within SSA are stable over time but sensitive to structural breaks caused by both local and international events.

The ZA test results identified structural break dates in 2000, 2006, 2008, 2010, 2013, 2016, and 2022. These breaks correspond to significant local

and international events, including the post-Cold War era and economic reforms (1999-2008), debt relief initiatives (1996-2006) and the multilateral debt relief initiative (MDRI), Kenya's post-election violence (2007-2008), and South Sudan's civil war (2013-present). The Eurozone debt crisis (2010-2012) indirectly impacted trade, while health crises such as the Ebola outbreak (2014-2016) and the COVID-19 pandemic (2020-present) significantly disrupted economic activities, increased uncertainties, and influenced money demand in SSA. Other emerging economies being susceptible to international economic shifts, can benefit from insights gained from SSA to navigate the complexities of regional economic integration. This approach will ensure that its monetary policies align with both national and regional economic objectives, allowing for targeted policies that address the specific needs of various income groups and enhance the overall effectiveness of monetary policy.

CS-ARDL and ARDL

The symmetric CS-ARDL model reveals a significant nexus between M2 and its predictors (real GDP, real exchange rate, foreign interest rate, and inflation) in SSA for both long- and short-run elasticities reported in Table 7. RGDP, REC, and FINT positively influence M2, while inflation has a contractionary effect. Money demand stability is observed in UMI and LI, whereas LMI countries exhibit instability, highlighting the need for targeted monetary policies.

Long-Run Elasticities

The findings provide valuable insights that can be applied in emerging economies and region, especially in understanding the complex interplay between economic variables and money demand. The panel results in Table 7 revealed that a 1% change in RGDP increases M2 by 62% in SSA. This result is consistent with the Keynesian theory, which posits that economic expansion increases income, leading to higher demand for money for transactional and precautionary purposes. This finding implies that sectoral growth, particularly in manufacturing, services, and agriculture, could similarly heighten money demand. For policymakers in other emerging economies, the understanding of this link would aid to ensure that the money supply grows in tandem with RGDP to support economic activities without triggering inflationary pressures.

Table 5

Cross-Sectional Dependence (CD) and Unit Root Results

Panel A: CD					
Variables	M2	RGDP	REC	INR	FINT
Breusch-Pagan LM test	259.111***	310.010***	130.201***	270.731***	290.013***
Pesaran CD	47.10***	11.10***	21.08***	16.00***	13.10***
LIM					
Breusch-Pagan LM test	245.091***	304.219***	103.821***	167.432***	183.763***
Pesaran CD	45.80***	21.30***	11.98***	34.10***	28.31***
UIM					
Breusch-Pagan LM test	204.820***	272.236***	219.012***	341.402***	368.103***
Pesaran CD	28.90***	23.62***	16.70***	28.69***	22.14***
LI					
Breusch-Pagan LM test	346.901***	230.810***	142.341***	100.241***	298.010***
Pesaran CD	20.52***	10.96***	21.33***	3.27***	23.10***
Panel B: Unit Root Test					
Variables	M2	RGDP	REC	INR	FINT
ADF I (1)	-1.90	-6.90***	-2.19	8.17***	-3.81
ADF I (0)	-4.02***	-2.11	-5.81***	2.13	-8.18***
PP I (1)	-2.91	2.00	-8.91***	6.00***	-2.99
PP I (0)	-8.81***	7.12***	-3.71	3.12	-6.11***
Zivot and Andrew I (1)	-2.56	-1.40	-2.01	-8.56***	-3.90
Zivot and Andrew I (0)	-11.80***	-6.81***	-10.23***	-1.99	-6.01***
LMI					
ADF I (1)	-2.10	-5.16***	-5.19***	8.70***	-2.11
ADF I (0)	-5.62***	-3.00	-5.81***	6.23***	-9.18***
PP I (1)	-2.00	4.10***	-8.91***	6.00***	-3.09
PP I (0)	-6.19***	9.19***	-2.01	2.55	-9.19***
Zivot and Andrew I (1)	-3.01	-5.40***	-5.18***	-9.86***	-3.00
Zivot and Andrew I (0)	-9.08***	-9.81***	-8.03***	-14.61***	-9.11***
UMI					
ADF I (1)	-4.01	-9.13***	-8.02***	9.31***	-8.29***
ADF I (0)	-8.41***	-9.46	-2.13	2.00	-8.250***
PP I (1)	-8.20***	7.14***	-15.21***	9.40***	-2.06
PP I (0)	-12.91***	3.01	-2.03	2.51	-7.38***
Zivot and Andrew I (1)	-2.30	-6.40***	-9.12***	-15.05***	-3.14
Zivot and Andrew I (0)	-7.82***	-3.81	-2.13	-2.51***	-9.15***
LI					
ADF I (1)	-3.23	-9.13***	6.89***		-6.19***
ADF I (0)	-6.39***	-9.46	3.03		-8.25***
PP I (1)	-5.10***	7.14***	8.24***		-2.29
PP I (0)	-9.95***	3.01	3.05		-8.98***
Zivot and Andrew I (1)	-1.01	-6.40***	-10.25***		-2.14
Zivot and Andrew I (0)	-10.68***	-3.81	-4.15***		-8.37***

Source: the authors' (2024) estimations are based on research statistical data. (***)significance at 5%).

Table 6

Cointegration Results

Westerlund Test				
Statistics	Panel (SSA)	LMI	UMI	LI
Variance ratio	16.983***	10.893***	18.321***	10.893***
F-statistics	17.893***	9.345***	18.921***	10.129***
T-statistics	-12.459***	-6.012***	-13.821***	-7.378***

Source: the authors' (2024) estimations are based on research statistical data (***at 5% significance level).

Table 7

CS-ARDL

Long-Run Elasticities: (Dependent Variable M2)				
	Panel	LMI	UMI	LI
RGDP	0.620 (9.556) ***	0.535 (7.454) ***	0.0525 (9.697) ***	0.417 (7.876) ***
REC	0.238 (7.711) ***	0.269 (11.939) ***	0.509 (9.697) ***	0.706 (7.961) ***
INR	-0.095 (-0.307) ***	-0.161 (-5.757) ***	-0.451 (-4.109) ***	-0.530 (-1.799) ***
FINT	0.585 (8.757) ***	0.833 (6.466) ***	0.101 (4.912) ***	0.198 (7.249) ***
Short-Run Elasticities				
RGDP	0.8033 (21.532) ***	0.149 (9.307) ***	0.9481 (5.391) ***	0.8602 (11.061) ***
REC	0.243 (7.043) ***	0.486 (8.717) ***	0.214 (4.4741) ***	0.176 (8.644) ***
INR	-0.351 (-5.528) ***	-0.108 (-7.464) ***	-0.161 (-5.757) ***	-0.764 (-9.292) ***
FINT	0.530 (5.890) ***	0.2804 (3.9698) ***	0.246 (5.633) ***	0.113 (6.778) ***

Source: the authors' (2024) estimations are based on research statistical data (***at 5% significance)

A 1% change in REC and FINR increases M2 by 23% and 58%, respectively. These findings reveal SSA's sensitivity to international financial markets and exchange rate fluctuations. The positive REC influence on M2 aligns with the portfolio balance approach, where individuals adjust their portfolios based on relative returns, affecting overall money demand. The positive FINR influence of 58% on M2 highlights the significant influence of global financial conditions on SSA's money supply. For other emerging economies, which are also vulnerable to global financial conditions due to its open economy, these results are relevant as it underscore the importance of stabilizing the exchange rate and managing foreign capital flows to maintain a stable money supply amid external shocks.

The negative effect of INF on M2, where a 1% change in INF diminishes M2 by 0.09% reflects the

erosion of public confidence in domestic currencies. This aligns with the quantity theory of money, where high inflation diminishes the real value of money, leading to a decline in money demand as individuals and businesses seek alternative assets. Maintaining low and stable inflation is crucial for preserving money demand and ensuring economic stability. Maintaining low and stable inflation is crucial for preserving money demand and price stability to foster confidence in the national currency. By controlling inflation, SSA countries like other emerging economies can prevent a decline and stabilized money demand, which is essential for economic stability and growth.

Long-Run Elasticities: Income Level Variations in Money Demand

The findings reveal diverse responses across diverse income levels in SSA due regional eco-

economic heterogeneity. In LMI: RGDP, REC, and FINR influence M2 significantly by 53%, 23%, and 83%, respectively due to robust demand for money driven by transactions and investments, influenced by increase in export revenues, remittances, and significant capital inflows or outflows driven by interest rate differentials. The negative INF effect decreased M2 by 0.161%, reflecting the erosion of purchasing power. Conversely, in UMI: the minimal influence of RGDP on M2 indicates a shift towards non-monetary transaction channels like credit and electronic payments in most SSA countries. The significant REC and FINR impact on M2 at 50% and 10% indicate greater market integration and reliance on imports/exports and financial markets development to absorb external shocks efficiently. The negative INF on M2 by 0.45% reveals a shift from holding money towards other assets due to as high inflation.

In LI: RGDP, REC, and FINR increase M2 by 41%, 70%, and 19%. These results emphasize the influences of exchange rate changes in these economies and the sensitivity of SSA economies to global financial conditions. INF decreases M2 by 53%, indicating a drastic decline in economic agents' motive of holding money due to loss of confidence in the domestic currency.

The short-run income level results, in collaboration with long-run results, reveal that the surge in M2 is attributed to government expenditure, foreign direct investment, and economic activity in key sectors like agriculture, mining, and services. In LMI and LI countries, the increase is more pronounced due to increased investment opportunities and consumer spending. In LMI countries of Benin, Tanzania, Senegal, Comoros, and Cabo Verde, low inflation rates (1.9%-2.7%)

sustained confidence in domestic currency. Capital controls and foreign exchange reserves moderate FINR's positive impact on M2. In UMI, the weak financial infrastructure limits M2 growth.

Theoretically, the cash-in-advance theory, the positive influence of RGDP on M2 in both long and short runs, supports this theory. The quantity theory of money posits that M2 is directly proportional to the price level. The negative influence of INF on M2 aligns with this theory, as a 1% change in inflation reduces the real value of money and demand correspondingly. Policymakers must tailor monetary and fiscal policies to manage M2, considering these dynamics and ensuring responsiveness to both domestic and international economic conditions in SSA countries. The study results in panel and income level align with the findings of (Ncube, 2020 Mensah, 2013). The negative impact of INF on M2 underscores the importance of price stability in maintaining monetary stability. Studies by Ndubuaku, et al. (2021); Shafq and Malik (2018) and Adhikari (2019) support these findings.

Emerging economies, with its diverse economic landscape, would benefit from the understanding of how money demand dynamics differ across income levels. Tailoring monetary policies to address the specific needs of different regions or sectors within the country would enhance the effectiveness of these policies.

Diagnostic Test Results

The diagnostic tests results in Table 8 indicate that the CS-ARDL model is the best fit, the post-estimation results computed based on SSA income levels revealed that the results are free from heteroskedasticity and serial correlation issues.

Table 8

Diagnostic Tests

Test	Panel	LMI	UMI	LI
Residual Normality	0.766 (0.653) ***	0.832 (0.88) ***	0.876 (0.987) ***	0.438 (0.231) ***
R ²	0.92	0.85	0.79	0.87
Breusch-Pagan Godfrey	0.34 (0.305) ***	0.66 (0.457) ***	0.63 (0.553) ***	0.46 (0.225) ***
Breusch Godfrey	0.33 (0.84) ***	0.93 (0.29) ***	0.82 (0.365) ***	0.34 (0.221) ***
Jarque Bera	1.92 (0.654) ***	0.87 (0.567) ***	3.38 (0.327)	0.74 (0.227) ***

Source: the authors' (2024) estimations are based on research statistical data (***at 5% significance)

Table 9

Stability of Model Parameters Results

SSA	Test Statistics			Remark
	MeanF	SupF	L _c	
LMI	14.981***	26.120	6.101	Reject (H_0)
UMI	1.813	5.110	1.012	Accept (H_0)
LI	1.341	1.341	0.810	Accept (H_0)

(*** indicates rejection of (H_0) stability at 0.05% significant. Critical values for SupF, MeanF, and Lc come from Hansen (1992), pages 327–329.

Source: the authors' (2024) estimations are based on research statistical data

Stability of Model Parameters

The validation of the model parameters is essential for understanding the dynamics of money demand in SSA. Hansen's (1992) MeanF, SupF, and LC tests were employed to assess money demand stability, highlighting the varying degrees of parameter stability across diverse income levels in SSA.

The findings in Table 9 provide valuable insights into the economic and policy factors influencing money demand stability, aligning with the study's objectives. The instability observed in LMI SSA countries underscores the challenges these economies face. Poor monetary policy, reliance on imported goods, supply chain disruptions, and volatile inflation rates contribute significantly to the instability in money demand. This finding aligns with the quantity theory of money, which posits that volatile inflation rates erode the real value of money, and with the cash-in-advance theory, highlighting how poor monetary policy affects cash holdings.

The vulnerability of SSA economies to external influence, like exchange rate volatility driven by trade imbalances and capital flight, further exacerbates money demand instability. This is particularly evident in countries with a high dependence on imports, where fluctuations in exchange rates increase the cash holding cost. The larger informal sector in countries like Tanzania and Zimbabwe, where a large proportion of transactions occur outside formal financial systems, adds to the unpredictability of money demand (Samuel et al., 2023; African Development Bank, 2016). The high dependency ratios from the growing young SSA population also contribute to this instability by impacting household savings and money demand stability (World Bank, 2018; Samuel et al., 2019d).

The stability in UMI countries like South Africa and Botswana can be attributed to prudent fiscal

and monetary policies. The pegging of exchange rates to the Euro in many West and Central African countries using the CFA franc helps stabilize money demand by reducing exchange rate volatility (World Bank, 2018; South African Reserve Bank, 2019; African Development Bank, 2020). Economic diversification in UMI countries reduces vulnerability to commodity price shocks, supporting stable money demand. These findings are consistent with the cash-in-advance theory, where a stable economic environment ensures a steady demand for money to facilitate transactions.

In LI countries such as Uganda and Mali, traditional banking systems enhance money demand stability through the provision of reliable financial services (World Bank, 2017). Factors such as financial education initiatives, political stability, robust institutional frameworks, adherence to the rule of law, effective governance, international aid, debt relief programs, and beneficial trade agreements stabilized money demand.

In LI SSA countries such as Uganda and Mali, traditional banking systems enhance money demand stability through the provision of reliable financial services (World Bank, 2017). Factors such as financial education initiatives, political stability, robust institutional frameworks, adherence to the rule of law, effective governance, international aid, debt relief programs, and beneficial trade agreements further enhance money demand stability (SADC Economic Report, 2019; UNCTAD, 2018; Mauritius Economic Review, 2018; Botswana Institute for Development Policy Analysis, 2019).

The findings emphasize the importance of strong economic policies and diversification strategies in stabilizing money demand, especially in UMI countries. In contrast, instability in LMI countries points to challenges such as weak monetary policies, reliance on imports, and volatile inflation. The

differences in money demand across income levels highlight the need for coordinated monetary policies in SSA. Implementing unified monetary policies and inflation-targeting frameworks can help manage external shocks and stabilize money demand. Given the negative impact of inflation on M2, inflation control measures are essential to restoring confidence in domestic currencies. Addressing external vulnerabilities, such as exchange rate volatility, can be achieved by pegging exchange rates to more stable currencies or adopting flexible regimes that adapt to market conditions.

We have also found evidence for the critical role of economic policies, diversification, and external vulnerability management in achieving money demand stability. For emerging economies, these insights offer valuable guidance on strengthening monetary and fiscal policies.

Conclusion

The study confirms the significant influence of macroeconomic variables on money demand in SSA, with notable variations across income levels. The findings underscore the importance of inflation targeting and regional monetary integration for enhancing economic stability in SSA countries, decomposed into UMI, LMI, and LI income levels. Using quarterly datasets from IMF and WDI from 1999–2023, this study captures both short-long-run effects through the CS-ARDL model and cash-in-advance framework, providing an all-inclusive analysis often ignored by previous studies.

RGDP's positive effect on M2 highlights the robust linkage between economic growth and money demand in SSA. Similarly, REC's positive effect on M2 indicates that exchange rate fluctuations influence the desirability for holding domestic money. The FINR and M2 positive nexus reveals SSA's sensitivity to global financial conditions. The negative effect of INF on M2 is particularly severe in LI countries, where a 1% increase in inflation decreases M2 by 53 %.

Income level results reveal a minimal impact of RGDP on M2 due to the prevalence of non-monetary transaction channels, while REC

and FINR in UMI significantly affect M2. In LMI, RGDP, REC, and FINR all impact M2, while INF's negative impact on M2 contributes to monetary instability. RGDP, REC, and FINR impact M2 in LI, while INF's negative effect indicates a loss of confidence in domestic currency. Money demand stability in UMI and LI indicates effective management of monetary resources. Instability in LMI countries is due to high inflation, exchange rate volatility, a large informal economy, and low financial inclusion. We have also found the significant influence of global financial conditions on money demand. Open economies in SSA are sensitive to international financial conditions.

The study's findings have important policy implications for SSA countries, particularly regarding the benefits of monetary integration and the strategic use of monetary aggregates for policy adjustments. By adopting common monetary policies or a single currency, SSA countries could reduce volatility caused by individual currency fluctuations and inflation, while also facilitating trade and economic growth by lowering transaction costs for cross-border trade. A unified monetary policy framework could strengthen SSA countries' bargaining power in international financial markets, improving trade and investment terms, and enhancing macroeconomic oversight and fiscal discipline. The negative impact of inflation on monetary aggregates underscores the need for effective inflation targeting to ensure price stability and maintain a stable money demand function. The study recommends an inflation-targeting regime to address future inflation and systemic asymmetries.

In summary, coordinated monetary policies and effective inflation targeting can boost economic stability and growth in SSA countries. Future research should focus on sector-specific monetary policy analysis to better understand the unique needs of different sectors. This study enhances the understanding of money demand stability in the SSA region and the role of income level stability, providing valuable insights for policymakers, academics, and stakeholders interested in money demand dynamics in SSA.

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