DETERMINANTS OF HOUSEHOLD DEBT-TO-GDP FINANCIAL STABILITY, AND ECONOMIC RESILIENCE. A CROSS-COUNTRY PANEL ANALYSIS (2000–2023)

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Abstract

This study investigates the determinants of household debt-to-GDP across ten economies, comprising both developed and developing countries, spanning the period from 2000 to 2023. Employing a panel econometric framework, including Fixed Effects, Random Effects, and Panel ARDL models, the analysis captures both short- and long-run dynamics of household indebtedness. The results reveal that GDP per capita has a negative correlation with household debt-to-GDP, consistent with the life-cycle hypothesis, while financial inclusion emerges as a significant long-term driver of credit expansion. Lending rates show a counterintuitive positive relationship with debt, suggesting financialization effects, and non-performing loan (NPL) ratios are positively associated with household debt levels, signalling financial sector fragility. The findings suggest that monetary policy alone may be insufficient to manage household debt sustainably, highlighting the need for macroprudential measures such as loan-to-income (LTI) and debt-to-income (DTI) caps. The study recommends aligning financial inclusion initiatives with robust consumer protection frameworks to mitigate the risks of over-indebtedness. These insights contribute to the evolving discourse on financial stability, debt sustainability, and economic resilience.

Keywords: credit market dynamics, financial access, dynamic panel analysis, household borrowing patterns, credit risk exposure

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1. Introduction

Household debt has emerged as a defining feature of modern financial systems, playing a crucial role in shaping economic resilience and financial stability. Over the past two decades, economies worldwide have witnessed a steady rise in household indebtedness, driven by factors such as financial liberalisation, evolving credit markets, and changing consumption patterns. While access to credit fosters economic growth by enabling households to smooth consumption and invest in durable goods, excessive household debt accumulation poses risks to financial stability and macroeconomic performance (Joo & Mir, 2024). The 2008 Global Financial Crisis starkly highlighted the vulnerabilities associated with unsustainable debt levels, with household leverage amplifying financial distress and contributing to systemic banking crises.

The relationship between household debt and financial stability is multifaceted, as it encompasses both the benefits of credit access and the risks of over-indebtedness. While moderate levels of debt can support economic dynamism, excessive debt burdens can weaken household balance sheets, reduce consumption during downturns, and increase the probability of financial distress (Santoso & Sukada, 2009). The risks are particularly pronounced when debt service burdens rise in response to macroeconomic shocks, such as interest rate hikes, inflationary pressures, or unexpected income losses (Aldashev & Batkeyev, 2023). As such, understanding the factors that drive household debt accumulation, its implications for financial stability, and the role of financial inclusion in shaping debt sustainability has become an urgent research priority.

Over the past two decades, the rise in household debt has become a defining feature of both developed and developing economies. While access to credit is essential for financial inclusion and economic growth, excessive household debt poses significant risks to financial stability, especially in the face of macroeconomic shocks such as inflation, interest rate hikes, and rising unemployment. Despite growing scholarly interest, empirical evidence remains fragmented on how macroeconomic conditions, financial inclusion, and financial sector vulnerabilities interact to shape household debt dynamics across countries at various stages of development.

Moreover, limited cross-country research has systematically distinguished between short-term fluctuations and long-term debt sustainability, especially using integrated econometric frameworks. This gap in understanding constrains the design of informed and effective policy interventions aimed at balancing credit expansion with economic resilience. Therefore, this study seeks to address this void by conducting a robust panel analysis across ten economies from 2000 to 2023, offering nuanced insights into the drivers and risks of household debt accumulation.

The primary research objectives of the paper are to examine the macroeconomic determinants of household debt-to-GDP, investigate the role of financial inclusion in shaping household debt accumulation, and assess the contribution of financial sector stability. Also, we aim to provide policy-relevant insights on how macro-financial indicators interact with credit markets and influence the sustainability of household debt across diverse economic contexts.

2. Literature review

The theoretical foundation of household debt and financial stability is rooted in macroeconomic and financial stability theories. The financial accelerator model posited by Bernanke, Gertler, and Gilchrist (1999) suggests that debt amplifies economic fluctuations, as credit constraints tighten during downturns, exacerbating economic distress. Similarly, Minsky's (1986) financial instability hypothesis emphasises the cyclicality of credit markets, where prolonged periods of financial expansion lead to excessive risk-taking, ultimately culminating in instability. In contemporary financial systems, household debt interacts with macroeconomic variables such as GDP growth, employment levels, and inflation, influencing both short-term economic fluctuations and long-term financial stability (Oyadeyi et al., 2024).

Empirical evidence from emerging and advanced economies underscores the impact of household debt on financial fragility. Studies have shown that rising household debt-to-GDP ratios are often correlated with higher NPL ratios, reflecting increased financial distress among borrowers (Valderrama, 2023). This link is particularly significant in economies where financial regulation is weak, credit monitoring is inadequate, or household balance sheets are vulnerable to macroeconomic shocks. Given the interconnected nature of financial markets, household debt crises can spill over into banking systems,

triggering broader systemic risks (IMF, 2025). The challenge for policymakers is to strike a balance between promoting financial inclusion and ensuring that debt remains sustainable over the long term.

Household debt accumulation is influenced by a complex interplay of macroeconomic variables, including GDP per capita, unemployment rates, lending rates, and inflation. Higher income levels generally encourage borrowing by improving creditworthiness and boosting household consumption, while periods of economic downturn often led to deleveraging due to declining disposable incomes and heightened uncertainty (IMF, 2024). In economies with low unemployment and stable growth, household debt expansion is often perceived as sustainable. However, high unemployment levels can lead to debt distress, particularly in economies where debt service ratios are high relative to disposable income (Santoso & Sukada, 2009).

Interest rates also play a critical role in shaping household borrowing patterns. Low lending rates tend to encourage higher levels of borrowing by reducing the cost of credit, but they can also create vulnerabilities when rates eventually rise, increasing the burden of debt servicing (ECB, 2018). Inflation dynamics further complicate debt sustainability, as higher inflation erodes real household incomes, potentially exacerbating repayment difficulties. The interaction of these macroeconomic variables determines whether household debt contributes to economic resilience or financial instability. As such, understanding these relationships is essential for formulating effective policy interventions aimed at ensuring debt sustainability.

Financial inclusion is widely regarded as a key driver of economic development, expanding access to credit and promoting financial stability. However, its relationship with household debt sustainability remains contested. On one hand, increased access to financial services can enable households to manage liquidity constraints more effectively, facilitating productive investments and enhancing economic resilience (Yue et al., 2022). On the other hand, excessive credit expansion, particularly in the absence of strong regulatory frameworks, can lead to over-indebtedness and heightened financial fragility (Valderrama, 2023).

In many emerging economies, financial inclusion has been accompanied by rapid credit growth, raising concerns about the sustainability of household debt burdens (IMF, 2024). The expansion

of digital financial services has further accelerated credit access, often without adequate risk assessment mechanisms. Consequently, the challenge lies in ensuring that financial inclusion initiatives are designed to promote responsible borrowing while mitigating the risks of excessive leverage (Cornelli et al., 2020). Empirical research suggests that financial inclusion can enhance debt sustainability when coupled with financial literacy programs and prudent lending practices (Joo & Mir, 2024). However, in cases where credit expansion outpaces regulatory oversight, financial inclusion may inadvertently contribute to rising debt distress.

Macroeconomic shocks, such as interest rate fluctuations, inflationary spikes, and rising unemployment, have profound implications for household debt sustainability. Interest rate hikes can significantly increase debt servicing costs, particularly in economies where variable-rate loans dominate household debt portfolios (ECB, 2018). Similarly, inflationary shocks can erode real incomes, reducing households' ability to meet debt obligations and increasing default risks (Oyadeyi et al., 2024). Rising unemployment further exacerbates these challenges, as job losses reduce disposable incomes and increase financial distress among indebted households (IMF, 2025).

The global financial landscape has witnessed several episodes of economic volatility that underscore the vulnerability of highly indebted households to macroeconomic shocks. The 2008 financial crisis, the European sovereign debt crisis, and the economic disruptions caused by the COVID-19 pandemic all highlight the risks associated with unsustainable household debt levels (IMF, 2024). These events demonstrate that macroeconomic shocks can trigger debt crises, with significant spillover effects on banking systems and broader economic stability. As such, developing effective risk mitigation strategies is essential for ensuring the resilience of household debt in the face of economic uncertainty.

This study contributes to the growing body of literature on household debt and financial stability by presenting a multi-country panel analysis that spans 2000 to 2023, a period marked by significant macro-financial shocks, including the global financial crisis, commodity price collapses, and post-pandemic inflationary pressures. Unlike prior studies that often focus on single-country settings or rely on static models, this paper applies fixed effects, random effects, and error correction frameworks to distinguish both short-run and long-run dynamics of household indebtedness. Notably, it identifies financial

inclusion as a statistically and economically significant driver of household debt across diverse economic contexts, both in the short and long run, a relationship not consistently established in earlier empirical literature. The estimations also reveal how lending rates and non-performing loan (NPL) ratios influence borrowing behaviour, offering fresh insights into the transmission channels of monetary policy and systemic credit risk. These findings have important implications for the economies analysed: for emerging markets, they emphasise the dual-edged nature of expanding financial access without adequate debt management frameworks; for developed economies, the results highlight the moderating role of interest rate policy in curbing unsustainable debt accumulation.

Overall, the study advances empirical understanding by combining robust panel techniques with policy-relevant interpretation, equipping policymakers with actionable evidence to balance financial inclusion initiatives with debt sustainability strategies.

The subsequent sections of this study build upon the theoretical and empirical foundations outlined in this introduction. The methodological framework employs econometric modelling to analyse household debt dynamics across different economic contexts. The findings will inform policy recommendations aimed at promoting responsible borrowing, strengthening financial regulation, and enhancing economic resilience in the face of macroeconomic uncertainty. By integrating insights from a diverse set of economies, this research aims to provide a nuanced understanding of household debt dynamics, contributing to the ongoing discourse on financial stability and economic sustainability.

3. Methodology

This study employs a panel econometric approach to analyse the determinants of household debt-to-GDP, focusing on macroeconomic conditions, financial stability, and financial inclusion across ten economies. The countries are evenly divided between developed (Canada, United States, United Kingdom, Germany, and France) and developing (China, Brazil, India, South Africa, and Mexico) nations to reflect varying levels of financial infrastructure and credit market maturity. The selection was primarily driven by the availability and consistency of annual macro-financial data from 2000 to 2023 across all key variables of interest. Given the presence of long-run

equilibrium relationships among the variables, the methodology is structured to capture both short-term dynamics and long-term trends while addressing potential econometric concerns such as endogeneity, heterogeneity, and serial correlation.

The dataset comprises panel data covering multiple countries over an extended time horizon (24 years), incorporating key macroeconomic and financial indicators relevant to household debt. The dependent variable is household debt-to-GDP (%). In contrast, the independent variables include household debt per capita (USD), debt service ratio (%), NPL ratio (%), GDP per capita (PPP, USD), unemployment rate (%), inflation rate (%), lending rate (%), and financial inclusion (commercial bank branches per 100,000 adults, first-differenced).

The dataset is sourced from the International Monetary Fund (IMF) reports - Global Financial Stability Report (IMF, 2024), and World Economic Outlook (IMF, 2025) -, and from the Bank for International Settlements (BIS) data portal (BIS, n.d.), ensuring a comprehensive and standardised collection of macroeconomic and financial stability indicators.

To account for both cross-country heterogeneity and dynamic relationships, a multi-stage econometric approach was adopted. The empirical strategy involves Fixed Effects (FE) and Random Effects (RE) models, followed by a Generalised Method of Moments (GMM) estimation to address endogeneity concerns.

The Fixed Effects (FE) model controls for unobserved heterogeneity by allowing each country to have its own intercept, thereby capturing time-invariant country-specific characteristics. The model is specified as:

$$Household\ Debt - to - GDP_{it} = \beta_0 + \beta_1 X_{it} + \epsilon_{it} \quad (1)$$

Where β_1 - country-specific fixed effects, X_{it} - the vector of independent variables, and ϵ_{it} - error term.

The Random Effects model (RE) assumes that country-specific effects are uncorrelated with the independent variables, expressed as:

$$Household\ Debt - to - GDP_{it} = \beta_0 + \beta_1 X_{it} + \mu_{it} + \epsilon_{it} \quad (2)$$

Where μ_{it} - country-specific random effects.

The Hausman test (1978) was applied to determine the appropriate specification, where a significant result favours the Fixed

Effects model, while an insignificant result supports Random Effects estimation (Aldashev & Batkeyev, 2023).

Given the confirmed presence of cointegration among variables, the study proceeds with a Panel Autoregressive Distributed Lag (Panel ARDL) model to distinguish between short-run fluctuations and long-run relationships. The Panel ARDL model accounts for heterogeneous lag structures across countries, allowing for a more flexible dynamic adjustment mechanism Bayar, Y. (2019).

The long-run equilibrium model takes the following form:

$$Household\ Debtto - GDP_{it} = \delta_0 + \sum_{j=i}^{p} Household\ Debt - to - GDP_{it-j} + \sum_{k=0}^{q} {}_{yk}X_{it-k} + \epsilon_{it} \quad (3)$$

Where p and q represent optimal lag lengths, selected based on Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC).

Model selection was performed using the Hausman test, with preference given to the Fixed Effects model where country-specific factors were correlated with regressors. In cases where the Random Effects model was selected, robust standard errors were used to address heteroskedasticity concerns.

This study also adopts the Panel Autoregressive Distributed Lag (ARDL) modeling framework to estimate both short-run and long-run relationships between household debt-to-GDP and its macro-financial determinants. The panel ARDL model is particularly suited for datasets characterized by a mix of I(0) and I(1) variables, as is the case here. Unlike static panel models such as Fixed Effects (FE) or Random Effects (RE), which only estimate contemporaneous relationships, the panel ARDL framework incorporates lagged dependent and independent variables, allowing for dynamic adjustment processes and error correction mechanisms across time. This structure enables a richer understanding of both immediate shocks and long-term equilibrium paths.

The decision to employ the Panel Autoregressive Distributed Lag (ARDL) model, rather than a full Error Correction Model (ECM), is based on both methodological flexibility and data structure suitability. Panel ARDL models, as outlined by Pesaran, Shin, and Smith (1999), are specifically designed to handle datasets with a mix of stationary and non-stationary variables (I(0) and I(1)), which aligns with the integration properties of the variables used in this study. Unlike traditional ECMs, the Panel ARDL framework can estimate

heterogeneous short-run dynamics across countries while maintaining a pooled long-run relationship, making it well-suited for panels that include structurally diverse economies.

Given the moderate time dimension (T = 24 years) and the limited number of cross-sectional units (N = 10 countries), the panel ARDL model strikes a balance between robustness and computational feasibility. In contrast, alternative techniques such as the Pooled Mean Group (PMG) estimator require stronger assumptions about slope homogeneity and often assume a longer time horizon for reliable estimation. Likewise, System GMM estimators, while effective in addressing endogeneity, demand large panel dimensions and suffer from instrument proliferation in small samples (Roodman, 2009). The Panel ARDL approach avoids these issues, allowing for the estimation of both short-run fluctuations and long-run equilibrium relationships within a coherent, empirically grounded framework.

Variable selection is grounded in theoretical and empirical literature. GDP per capita, inflation, unemployment, and lending rates are standard macroeconomic indicators known to influence household debt through income capacity, price stability, and credit cost (Bernanke et al., 1999; Friedman, 1957; Modigliani & Brumberg, 1954). Financial sector stability is captured using the debt service ratio and NPL ratio, consistent with studies emphasising the risk channel of credit markets (Santoso & Sukada, 2009). Financial inclusion, measured as the number of commercial bank branches per 100,000 adults, is a key structural variable supported by Célerier and Matray (2019), who argue that access to formal credit can both empower households and increase their exposure to debt risk.

All variables were tested for multicollinearity using the Variance Inflation Factor (VIF), with results confirming that none of the predictors exhibit problematic correlation. Additionally, the inclusion of financial inclusion and financial vulnerability indicators provides a unique contribution to cross-country debt literature, particularly in capturing structural shifts in household access to credit (IMF, 2024; Joo & Mir, 2024). Together, these models, variables, and diagnostic justifications confirm the analytical robustness and theoretical relevance of the chosen methodology.

4. Data analysis and tests' results

Understanding the distribution and characteristics of the variables used in this study is crucial for assessing the relationship between household debt, financial stability, macroeconomic conditions, and financial inclusion. Table 1 in the Appendix presents the summary statistics of the key variables, capturing their central tendencies, dispersion, and range across the panel dataset covering multiple economies from 2000 to 2023. Given that the dataset has been transformed into first differences to ensure stationarity, the mean values for most variables approach zero. However, the standard deviations and extreme values provide insights into the dynamics of household debt and financial conditions across economies.

The household debt variables exhibit notable dispersion across the panel dataset. The Household Debt-to-GDP ratio, a key indicator of financial leverage, ranges from -10.71 to 3.63 percent, with a median value close to zero due to first differencing. The Household Debt per Capita (USD) follows a similar distribution, with extreme values indicating periods of rapid debt accumulation and deleveraging. The Debt Service Ratio (%), which captures the burden of debt repayments relative to income, displays a narrower range, suggesting that most economies experience moderate shifts in household debt repayment burdens over time.

The NPL ratio (%), a critical measure of banking sector stability, varies from -1.29 to 4.45 percent, with a negative median (-0.22), suggesting that, on average, countries have experienced marginal improvements in loan performance. However, the existence of positive extreme values highlights episodes of financial distress where loan defaults surged.

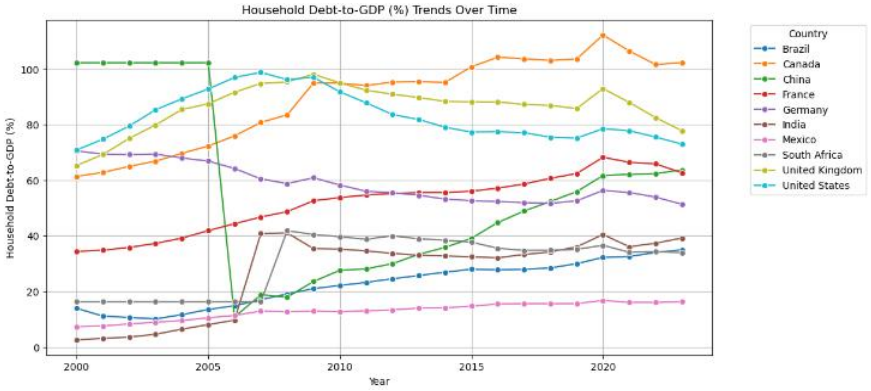
Macroeconomic indicators reflect significant heterogeneity across countries and periods. The GDP per Capita (PPP, USD) shows a broad range from -9.04 to 3.66, reflecting disparities in economic growth and national income distribution. The Unemployment Rate (%) varies between -0.94 and 4.12, indicating labour market fluctuations across economic cycles. The Inflation Rate (%) ranges from -1.68 to 4.40, capturing varying levels of price stability and monetary conditions. The Lending Rate (%), which influences the cost of borrowing, fluctuates between -0.77 and 4.55, showing the effects of different monetary policy regimes.

The Financial Inclusion Index, measured by the number of Commercial Banks per 100,000 Adults, presents a range from -1.86 to 2.39. The negative median (-0.13) suggests that financial inclusion has declined in some economies, possibly due to banking sector consolidation or digital financial services reducing the need for physical banking infrastructure. Nevertheless, the upper range highlights economies where financial inclusion efforts have expanded access to banking services.

Figure 1 presents a comparative analysis of household indebtedness across multiple economies from the early 2000s to the 2020s, highlighting variations in credit reliance, financial stability, and the impact of macroeconomic policies.

Figure 1

Household Debt-to-GDP



Author's Estimation 2025

Advanced economies such as Canada, the United Kingdom, and the United States exhibit persistently high household debt-to-GDP ratios, with a sustained upward trajectory driven by strong dependence on credit markets. Notably, Canada's debt levels peaked around 2020 before experiencing a slight decline, likely due to policy interventions, economic slowdowns, or shifts in borrowing behaviour.

China's rapid debt accumulation since the mid-2000s stands out, coinciding with its economic expansion, urbanisation, and financial liberalisation. While this trend underscores the growing role of consumer financing, it also raises concerns about financial stability and potential overleveraging in emerging markets.

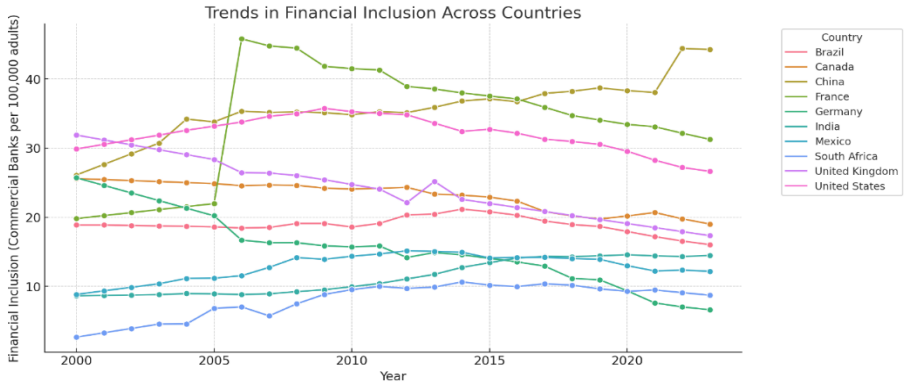
In contrast, Germany and France display stable and moderate debt-to-GDP ratios, reflecting a cautious credit culture and stringent financial regulations that mitigate excessive household borrowing.

Among emerging economies such as India, Brazil, South Africa, and Mexico, household debt levels remain significantly lower than those in developed economies. While debt-to-GDP ratios have gradually increased, limited financial inclusion and stricter lending policies continue to constrain widespread consumer credit access. However, India and Brazil have shown notable upward trends post-2010, reflecting greater financial penetration and evolving borrowing behaviours. An anomaly around 2005 indicates a sharp decline in one country's debt-to-GDP ratio, potentially due to regulatory reforms, debt forgiveness programs, or statistical reporting changes, requiring further investigation into the underlying economic context.

The visualisation in Figure 2 presents the evolution of financial inclusion, measured by the number of commercial bank branches per 100,000 adults, across ten selected economies from 2000 to 2023. This metric serves as a proxy for access to formal financial services, capturing structural shifts in banking infrastructure and financial accessibility over time.

Figure 2

Financial Inclusion Index Trends Over Time



Author's Estimation 2025

The trends reveal considerable variation across economies. China and France exhibit significant volatility, with China experiencing a sharp increase around 2005, followed by a gradual decline in recent years. In contrast, the United States and the United Kingdom display a

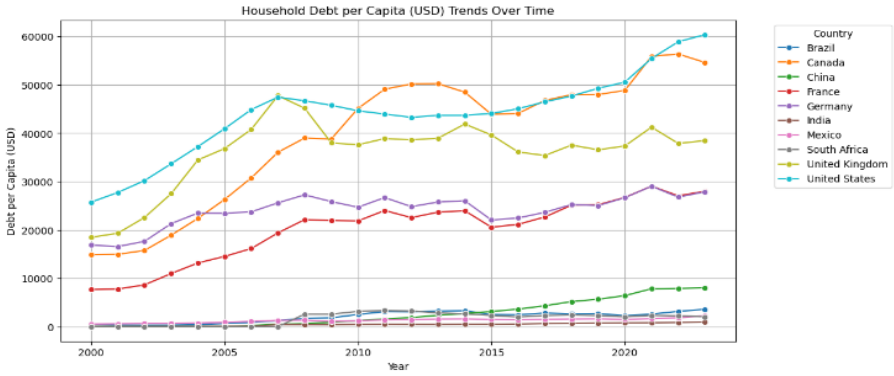
consistent decline, reflecting a contraction in physical banking services, likely due to the rise of digital banking, FinTech alternatives, and the shift toward cashless transactions. This suggests a transition away from traditional banking models in favour of mobile banking and online financial platforms.

In contrast, emerging economies such as India, Mexico, and South Africa show steady increases in banking access, indicating the success of expansionary financial inclusion policies designed to integrate underserved populations into the formal financial sector. Meanwhile, Germany and Canada demonstrate relative stability, suggesting that their banking infrastructure has remained largely unchanged over the two-decade period.

Figure 3 provides insights into household indebtedness across economies from the early 2000s to the present. This metric reflects the financial burden on individual households and highlights differences in credit accessibility, borrowing behaviour, and broader economic conditions.

Figure 3

Household Debt per Capita



Author's Estimation 2025

A clear divide exists between developed and emerging economies. The United States, Canada, and the United Kingdom report significantly higher household debt per capita, with the U.S. exceeding $60,000 in recent years, while Canada and the U.K. surpass $40,000. This heavy reliance on credit is driven by mortgage borrowing, consumer credit expansion, and favourable lending conditions. However, the 2008–2009 financial crisis led to a temporary

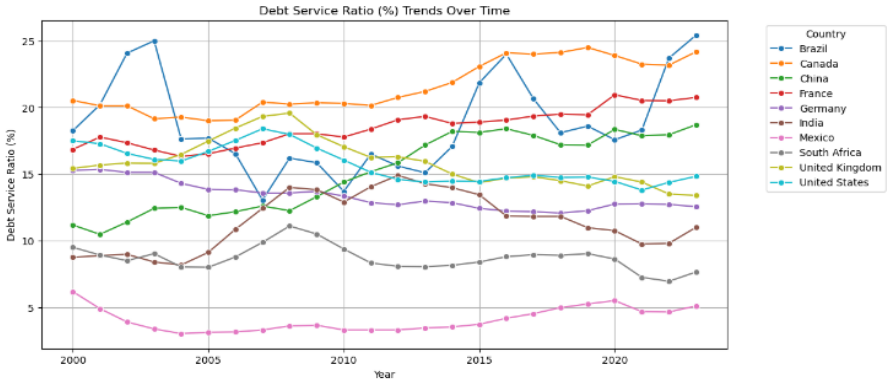
decline, reflecting deleveraging efforts and tightened credit policies in its aftermath.

Among European economies, France and Germany maintain moderate household debt per capita levels, fluctuating between $20,000 and $30,000. In contrast, emerging economies such as China, Brazil, India, Mexico, and South Africa exhibit significantly lower debt per capita, remaining below $10,000 throughout the period. China stands out with a steady increase post-2010, reflecting the expansion of consumer credit, mortgage borrowing, and financial liberalisation. Similarly, Brazil and South Africa show gradual increases, but at levels far lower than their developed counterparts.

Figure 4 highlights the proportion of household income allocated to debt repayment across different economies. This metric serves as a key indicator of financial stress, debt affordability, and household borrowing sustainability.

Figure 4

Debt Service Ratio



Author's Estimation 2025

Advanced economies, particularly Canada, the United States, and France, consistently exhibit high DSRs, exceeding 15%, with Canada surpassing 25% in recent years. This suggests that a significant portion of household income is dedicated to debt servicing, reflecting a strong reliance on credit. While this supports consumption and investment, it also heightens financial vulnerability during economic downturns or periods of rising interest rates. The continuous increase in Canada's DSR raises concerns about debt sustainability, mortgage burdens, and financial system risks. The US economy shows

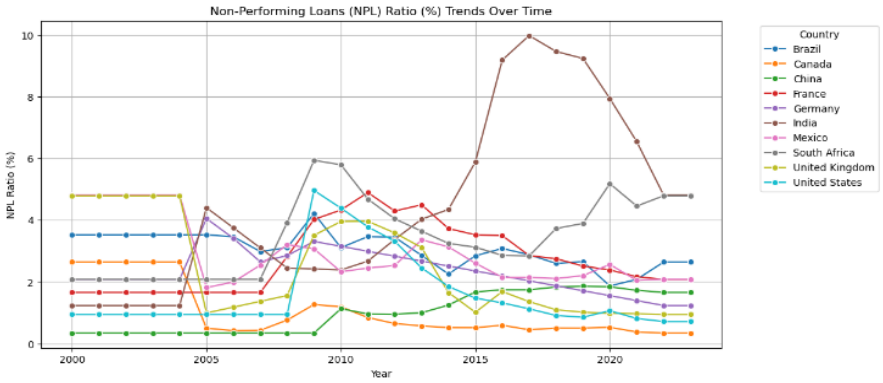
fluctuations in its DSR, peaking before the 2008 financial crisis, followed by a post-crisis decline due to household deleveraging and stricter lending regulations. More recently, an upward trend in DSR suggests renewed credit expansion, particularly in the housing and consumer lending sectors. Meanwhile, France and Germany maintain relatively stable DSRs between 10% and 20%, indicating a more controlled debt burden compared to North America.

Among emerging economies, China, Brazil, and South Africa have experienced rising DSRs over time. China's sharp increase since 2010 coincides with financial sector liberalisation and increased consumer credit access, signalling financial deepening but also raising concerns about rising debt burdens and financial distress risks. Similarly, Brazil's DSR has fluctuated, occasionally exceeding 20%, reflecting periods of high household financial strain. By contrast, India and Mexico maintain significantly lower DSRs, consistently below 10%, indicating a lesser reliance on formal credit systems and relatively low household debt burdens. India's persistently low DSR reflects a conservative borrowing culture, lower financial penetration, and stricter lending regulations, limiting excessive household indebtedness.

Figure 5 provides insights into the quality of credit portfolios across different economies.

Figure 5

Non-Performing Loans Ratio



Author's Estimation 2025

The NPL ratio is a critical financial stability indicator, representing the percentage of loans that are in default or close to default. Higher NPL ratios signal greater financial distress and potential

systemic risks, while lower ratios indicate healthier credit markets and robust borrower repayment capacity.

A key observation from the graph is the significant variation in NPL ratios among economies, reflecting differences in financial regulation, credit risk management, and economic conditions. South Africa and Mexico exhibit the most volatile trends, with South Africa peaking above 9% around 2015 before declining steadily. This suggests a period of economic distress, possibly due to macroeconomic downturns, currency depreciation, or sectoral crises affecting loan repayment capabilities. Mexico also shows high NPL ratios in the late 2000s, peaking around 6% before stabilizing.

In advanced economies such as Canada, the United States, the United Kingdom, and Germany, NPL ratios remain relatively low and stable, consistently below 3%. This stability reflects stronger financial institutions, robust risk assessment mechanisms, and higher levels of financial literacy among borrowers. However, a slight increase in NPLs is observed for the United States during the 2008 financial crisis, indicating temporary financial distress before regulatory interventions led to a decline.

Brazil and India show moderate fluctuations in NPL ratios, with occasional spikes followed by stabilization. Brazil's NPL ratio increased significantly post-2010, aligning with periods of economic uncertainty, inflationary pressures, and credit market adjustments. Similarly, India experienced a rise in NPL ratios post-2015, likely reflecting banking sector challenges and deteriorating asset quality in certain industries.

China's NPL ratio remains consistently low compared to other emerging markets, suggesting a relatively controlled credit environment. However, concerns exist regarding the accuracy of reported NPLs, given China's state-controlled banking system and government interventions in distressed assets. Despite the low official figures, potential risks in China's shadow banking sector and corporate debt markets may pose future financial vulnerabilities.

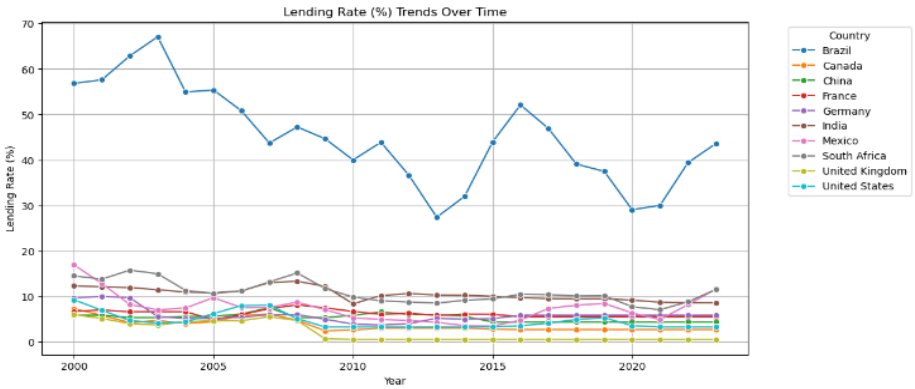
France and Germany display moderate NPL trends, remaining between 2% and 4% throughout the observed period. This suggests a relatively resilient banking system with effective credit risk management, though occasional increases in NPLs reflect economic downturns and adjustments in financial regulations.

Figure 6 provides insights into the cost of borrowing across different economies over the past two decades. Lending rates influence household and business credit demand, investment

decisions, and overall economic growth. Variations in lending rates across countries reflect monetary policy stances, inflationary pressures, financial market structures, and credit risk assessments.

Figure 6

Lending Rate (%)



Author's Estimation 2025

A striking observation from the graph is the exceptionally high lending rates in Brazil, which consistently surpass those of other economies. Lending rates in Brazil reached as high as 65% in the early 2000s, followed by a gradual decline to around 30% by 2020, before rebounding slightly in recent years. Such extreme lending costs reflect structural inefficiencies in the Brazilian financial system, high inflation rates, and risk premiums associated with lending. While Brazil has taken steps to reduce lending costs, interest rates remain significantly higher than in most economies, potentially constraining credit expansion and economic growth.

South Africa and India also exhibit relatively high lending rates, though at more moderate levels. South Africa's lending rates fluctuated between 10% and 15%, reflecting economic volatility, inflationary pressures, and changes in monetary policy. Similarly, India maintained lending rates above 10% for much of the observed period, though a gradual downward trend is noticeable, consistent with economic liberalization and financial sector reforms.

In contrast, developed economies such as the United States, Canada, the United Kingdom, Germany, and France maintain significantly lower lending rates, typically below 10%. These

economies benefit from stable inflation, efficient credit markets, and strong financial institutions, resulting in lower risk premiums on loans.

A notable trend in Canada, the United Kingdom, and the United States is the sharp decline in lending rates around the 2008 financial crisis, reflecting the response of central banks to the global economic downturn. Expansionary monetary policies, including interest rate cuts and quantitative easing, were implemented to stimulate borrowing, investment, and economic recovery.

China also maintains low and relatively stable lending rates, consistent with its state-controlled financial system, strong regulatory oversight, and managed interest rate policies. However, the artificially low lending rates raise concerns about credit misallocation and financial market distortions, particularly in China's highly leveraged corporate sector.

The correlation heatmap in Figure 7 (Appendix) provides an initial exploration of the relationships among household debt indicators, macroeconomic variables, and financial inclusion, as measured by the number of commercial bank branches per 100,000 adults. This analysis helps identify key patterns and potential linkages that will be further examined in the regression models.

Household debt-to-GDP exhibits a moderate positive correlation with GDP per capita (0.24), suggesting that higher economic output is generally associated with increased household borrowing. Similarly, household debt per capita (USD) shows a strong correlation with GDP per capita (0.92), indicating that wealthier economies tend to have higher absolute levels of household debt per capita. However, neither measure of household debt shows a strong association with inflation, unemployment, or lending rates.

The debt service ratio is positively correlated with GDP per capita (0.40) and moderately correlated with household debt per capita (0.50), suggesting that higher-income households have a greater ability to service their debt. However, its weak correlation with the NPL ratio (0.04) implies that the debt service burden does not directly translate into higher loan defaults at the macro level.

Financial inclusion, measured by the number of commercial bank branches per 100,000 adults, has a negative correlation with GDP per capita (-0.38), indicating that wealthier economies tend to have fewer physical bank branches, likely due to the transition towards digital banking services. This is consistent with the earlier trend analysis showing declining financial inclusion in developed economies.

Additionally, financial inclusion exhibits a negative correlation with the lending rate (-0.21), suggesting that economies with lower interest rates tend to have higher banking penetration.

Inflation and lending rates appear to be negatively associated with financial inclusion (-0.50 and -0.21, respectively), implying that countries experiencing higher inflation or higher borrowing costs tend to have lower physical banking access. This may reflect the contraction of banking infrastructure in response to macroeconomic instability.

Interestingly, financial inclusion exhibits only weak correlations with household debt-to-GDP (0.03) and household debt per capita (0.09), suggesting that greater access to banking services does not necessarily translate into higher household debt levels. This weak relationship raises questions about whether financial inclusion primarily facilitates credit expansion or serves other financial services functions, such as savings and transactions.

The correlation analysis provides useful preliminary insights but does not establish causality. The relatively weak correlations between financial inclusion and household debt metrics indicate that additional econometric analysis is necessary to determine whether financial access contributes to responsible debt accumulation or excessive borrowing. Furthermore, the observed negative association between financial inclusion and GDP per capita warrants further investigation into whether digital banking has effectively replaced traditional banking channels in wealthier economies.

Assessing the stationarity, multicollinearity, and long-term relationships among the variables is crucial before proceeding with panel regression modelling. The results from the Augmented Dickey-Fuller (ADF) test, Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, Variance Inflation Factor (VIF) analysis, and cointegration test provide insights into the data's statistical properties and guide the appropriate econometric modelling approach.

To ensure the suitability of the variables for time-series and panel regression modelling, both the Augmented Dickey-Fuller (ADF) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests were conducted to assess stationarity as shown in Table 2 (see Appendix). The ADF test evaluates the presence of unit roots under the null hypothesis of non-stationarity, while the KPSS test evaluates stationarity under the null.

The ADF test results indicate that all variables reject the null hypothesis of a unit root at the 5% significance level, confirming that

they are stationary after first differencing (i.e., I(1)). This includes key variables such as household debt-to-GDP, GDP per capita, inflation, and NPL ratio, which display strongly negative ADF statistics and p-values well below 0.05.

The KPSS test results generally support these findings. Most variables display KPSS statistics below the 5% critical value, failing to reject the null of stationarity. However, the lending rate returned a borderline result, with an elevated KPSS statistic of 0.6960 ($p = 0.0139$), indicating potential non-stationarity. This mixed outcome suggests that while the lending rate passes the ADF test, it may retain a deterministic trend or exhibit mean-reverting behaviour at a slower pace. As such, caution is warranted in its treatment in level-based models.

Importantly, financial inclusion, measured as the first-differenced number of commercial bank branches per 100,000 adults, passed both ADF and KPSS tests, demonstrating strong evidence of stationarity post-differencing.

Overall, the combination of ADF and KPSS results confirms that all variables are either I(0) or I(1), validating the use of panel ARDL modelling, which allows for mixed integration orders and is appropriate for examining both short-run and long-run relationships among the variables.

To assess potential multicollinearity among the independent variables, a Variance Inflation Factor (VIF) analysis was conducted. The results, summarised in Table 3 (in the Appendix), show that all variables have VIF values well below the critical threshold of 10, indicating no serious multicollinearity. Most variables, including inflation, unemployment, lending rate, and financial inclusion, exhibit VIFs of 1.5 or less, suggesting a high degree of independence among predictors.

Only two variables, household debt per capita (VIF = 8.27) and GDP per capita (VIF = 7.31) show moderate correlation. While these values remain within acceptable limits, they reflect some overlap in their economic constructs. To ensure the reliability of coefficient estimates, the models were tested with robust standard errors. Overall, the VIF results confirm that multicollinearity does not pose a significant threat to the validity of the regression analysis. The Johansen co-integration test was conducted to assess the presence of long-run equilibrium relationships among the variables. As shown in Table 4 (in the Appendix), the trace statistics for all hypothesised cointegration

ranks exceed their corresponding critical values at the 90%, 95%, and 99% significance levels. Accordingly, the null hypothesis of no cointegration (H_0: r = 0) is rejected across all levels.

These results provide strong statistical evidence of multiple cointegrating relationships among the variables, thereby justifying the use of long-run modelling techniques such as the panel ARDL and error correction models (ECM). The presence of cointegration confirms that while the variables may be non-stationary in levels, they move together over time, reinforcing the appropriateness of the estimated dynamic models.

The Hausman test fails to reject the null hypothesis that the difference in coefficients between the Random Effects and Fixed Effects models is not systematic ($p = 0.9769 > 0.05$). This indicates that the Random Effects model is appropriate and more efficient for the dataset. The Hausman specification test was employed to determine the appropriate panel estimation technique between fixed effects and random effects models. As shown in Table 5 (see the Appendix), the test statistic is 2.6397 with 9 degrees of freedom and a p-value of 0.9769. Since the p-value exceeds conventional significance thresholds, we do not reject the null hypothesis that the difference in coefficients is not systematic.

This result indicates that the random effects model is statistically appropriate, as it assumes no correlation between the individual-specific effects and the regressors. Accordingly, the random effects specification is adopted in the estimation of baseline panel models.

Table 6 from the Appendix presents the results from the fixed effects (FE) panel regression, which captures within-country variations by allowing each country its own constant term while assuming slope homogeneity across units. The overall model fit is moderate, and financial inclusion emerges as statistically significant at the 1% level ($p = 0.0002$).

The positive and significant coefficient for financial inclusion indicates that as more individuals gain access to formal financial services within a country over time, household debt-to-GDP increases. This supports the theory of financial deepening, which suggests that broader access to credit markets facilitates greater borrowing. The lending rate carries a negative coefficient (though not statistically significant in this model), suggesting that higher interest rates may still

discourage borrowing, consistent with conventional monetary transmission expectations.

Table 7 from the Appendix reports estimates from the random effects (RE) model, which assumes that individual country effects are uncorrelated with the regressors, allowing for both within- and between-country variation. This model is statistically more efficient than the fixed effects specification (as confirmed by the Hausman test) and yields more pronounced coefficient magnitudes.

Financial inclusion remains statistically significant at the 1% level ($p = 0.0001$), reaffirming its strong association with household debt accumulation across countries. The positive sign indicates that countries with broader financial access tend to experience higher levels of household debt. The lending rate retains a negative sign, again implying that higher borrowing costs reduce household credit uptake. While the lending rate is not statistically significant here, the direction supports its expected economic role in moderating debt growth.

Table 8 (see the Appendix) presents the short-run dynamics from the estimated error correction model (ECM), which captures both immediate effects and the system's ability to revert to equilibrium. The error correction term (ECT) is strongly negative and statistically significant (-1.044, $p < 0.01$), indicating rapid convergence to long-run equilibrium after short-term disturbances. This suggests that deviations in household debt levels caused by shocks are corrected within a year, reflecting responsive credit systems in the observed countries.

Three differenced variables are statistically significant: financial inclusion (0.678, $p < 0.01$), lending rate (-0.515, $p < 0.05$), and NPL ratio (positive, $p < 0.01$). Financial inclusion's positive short-run effect implies that easing access to credit facilities results in immediate increases in household borrowing. The lending rate's negative sign confirms that rising interest costs discourage new borrowing. The significance of the NPL ratio suggests that as more loans go bad, short-term household borrowing may rise, potentially reflecting risk tolerance, debt restructuring, or moral hazard dynamics.

Table 9 (in the Appendix) presents the long-run equilibrium relationship from the levels regression, which underpins the error correction model. The model has an R-squared of 0.143, indicating that the included macroeconomic and financial variables explain approximately 14.3% of the variation in household debt-to-GDP across countries and time, a reasonable fit for macro-panel data, where

unobserved heterogeneity is expected. The F-statistic (4.794, $p < 0.001$) confirms overall model significance. The Durbin-Watson statistic of 2.083 suggests that autocorrelation is not a serious concern. However, the Jarque-Bera test indicates deviations from normality, which may reflect outliers or structural breaks, warranting future robustness checks.

Among all independent variables, financial inclusion stands out as the only statistically significant long-run determinant of household debt-to-GDP (coefficient = 0.8018, $p < 0.01$). This implies that as financial infrastructure expands and more individuals gain access to formal credit systems, household borrowing increases persistently over time. This effect is particularly salient in transitioning and financially liberalizing economies, where access to banking services drives credit uptake.

Other macroeconomic variables including lending rate, inflation, GDP per capita, and unemployment, are not statistically significant in the long run. However, their coefficient signs follow theoretical expectations. For instance, lending rate and inflation display negative coefficients, suggesting that higher credit costs and macro-instability may suppress debt accumulation over time, even if not significantly captured in this model.

These findings reinforce the central role of financial access in shaping household debt trajectories, while also highlighting the limited predictive power of traditional macro indicators in the long-run. Policymakers should consider pairing financial inclusion policies with debt management frameworks to avoid unsustainable household leverage.

In the short run (Table 8, in the Appendix), changes in financial inclusion, lending rates, and the non-performing loan ratio exert immediate and significant effects, with the system correcting long-run deviations strongly, as indicated by the highly significant and negative error correction term (ECT = -1.04, $p < 0.01$).

5. Discussion

This section discusses the study's empirical results in relation to the research objectives, highlighting how the findings compare with existing literature on household debt, financial stability, macroeconomic conditions, and financial inclusion. The discussion

provides insights into both short-run and long-run effects, offering implications for policymakers and financial sector practitioners.

One of the primary objectives of this study was to identify the macroeconomic and financial factors that influence household debt-to-GDP ratios across countries over time. The panel ARDL and long-run estimations revealed that financial inclusion is the most consistent and statistically significant determinant of household debt. This finding underscores the idea that as more individuals gain access to formal financial services, through banking, mobile finance, or credit institutions, aggregate household debt levels rise over time. This is in line with the findings of Yue et al. (2022) and the IMF (2024), which both highlight financial access as a structural enabler of household borrowing, particularly in emerging markets undergoing financial deepening.

In contrast, GDP per capita, inflation, unemployment, and the lending rate were not statistically significant in the long-run model. While GDP per capita had a negative sign, the relationship was not statistically robust. This finding partially contrasts with Aldashev and Batkeyev (2023), who found that rising national income in Kazakhstan correlated with declining household debt burdens. One plausible explanation is that the income effect may manifest more strongly in single-country contexts or be nonlinear in cross-country panels, where wealth inequality and consumption behaviours vary widely.

The unemployment rate was also statistically insignificant in both the short-run and long-run specifications. This diverges from the theoretical argument proposed by Bayar, Y. (2019)., who found that rising unemployment is associated with heightened debt distress due to declining household income. In our context, however, the muted effect may reflect structural labour market differences or the presence of social safety nets in some economies that buffer income shocks and reduce reliance on credit during periods of job loss.

Inflation, likewise, exhibited no significant impact on household debt. While inflation theoretically reduces the real value of existing debt, it may also trigger credit tightening and raise risk premiums, ultimately offsetting the net impact on borrowing behaviour. Bernanke, Gertler, and Gilchrist (1999) note that macro-financial frictions, such as heightened uncertainty and constrained lending, often accompany inflationary episodes, which may limit household access to new credit despite the erosion of real debt burdens.

In the short-run dynamics, financial inclusion, lending rate, and NPL ratio were statistically significant. The positive short-run effect of financial inclusion reflects immediate increases in borrowing when access to credit improves, consistent with the IMF (2024) and Santoso and Sukada (2009), who highlight inclusion-driven surges in credit uptake. Conversely, the negative short-run effect of lending rates aligns with monetary transmission theory, wherein higher borrowing costs dampen credit demand in the near term. This distinction is important: while lending rates may not explain long-term variation in household debt (due to fixed-rate products or adaptive behaviours), they exert short-run pressure on household credit flows.

The positive and significant short-run effect of the NPL ratio suggests that deteriorating credit quality might trigger short-term borrowing surges, potentially due to debt restructuring or rollovers, highlighting latent financial instability risks, as noted by Santoso and Sukada (2009) and Cornelli et al. (2020).

A key objective of this study was to evaluate how financial stability indicators influence the accumulation of household debt across countries. The results reveal that the NPL ratio has a significant and positive relationship with household debt-to-GDP in the short run. This finding suggests that rising credit risk in the financial system, reflected in a growing share of bad loans, is associated with increased household borrowing. While counterintuitive on the surface, this result aligns with the argument by Santoso and Sukada (2009) that systemic vulnerabilities often emerge in credit-boom cycles: excessive lending under weak risk controls can lead to simultaneous rises in both household debt and NPLs. In some cases, rising NPLs may also reflect distressed refinancing or delayed write-offs, whereby households continue to borrow to meet existing obligations, exacerbating debt accumulation before eventual deleveraging.

Conversely, the debt service ratio (DSR) was found to be statistically insignificant. This indicates that short-run changes in the proportion of income allocated to debt repayment do not strongly predict shifts in household debt levels across the panel. This contrasts with evidence from the European Central Bank (ECB), which reported that increasing DSRs in the Eurozone led to a contraction in new borrowing activity, as households sought to preserve consumption amid rising repayment pressure (ECB, 2018). The divergence in findings may be attributed to structural differences in household credit markets. In countries with high shares of fixed-rate or long-term loan

products, repayment burdens tend to adjust slowly, dampening the short-run sensitivity of borrowing behaviour to DSR fluctuations. Moreover, in economies with limited credit alternatives, households may sustain high DSRs without necessarily curbing new borrowing, especially if informal lending channels or collateral-backed loans are accessible.

Taken together, these results emphasise that financial system health is a critical determinant of household debt dynamics, but its effects are heterogeneous across time horizons and institutional settings. Monitoring asset quality (via NPLs) provides an early warning signal for unsustainable credit growth, while DSR trends may be more relevant in mature credit markets with efficient transmission of interest rate and income shocks.

A key contribution of this study is the empirical examination of the relationship between financial inclusion and household debt accumulation. Using commercial bank branches per 100,000 adults as a proxy, the results reveal a statistically significant and positive long-run effect of financial inclusion on household debt-to-GDP. This supports the view that improved access to formal financial services facilitates broader credit uptake among households over time. The finding aligns with Yue et al. (2022), who emphasise that while increased financial access can empower households economically, it also raises the risk of over-indebtedness in the absence of adequate financial literacy and consumer protection mechanisms.

Interestingly, the short-run effect of financial inclusion was also statistically significant and positive in the ECM model, contradicting initial expectations of a delayed response. This suggests that even incremental expansions in financial access, such as the rollout of mobile banking platforms or microcredit facilities, can trigger immediate increases in borrowing. This finding complements observations from the IMF (2024), which note that financial inclusion, particularly when accelerated through digital platforms, can rapidly expand household participation in credit markets. However, the impact is often asymmetric across countries, depending on regulatory readiness and institutional trust.

While the positive link between financial inclusion and debt supports financial deepening narratives, it also echoes long-standing warnings from Minsky (1986) about the destabilising effects of unchecked credit growth. In his financial instability hypothesis, Minsky argues that easy access to credit, if not paired with prudent oversight,

can shift economies from productive borrowing to speculative or even Ponzi financing. The findings of this study provide empirical reinforcement for this theoretical concern: financial inclusion, while essential for inclusive growth, must be managed carefully to prevent a build-up of systemic risk.

In summary, the results highlight the double-edged nature of financial inclusion, as it empowers households through access to capital, but also has the potential to sow financial fragility in the absence of regulatory safeguards. Policymakers should therefore complement inclusion strategies with strong institutional frameworks, financial education, and credit scoring mechanisms to promote responsible lending and borrowing behaviours

This study contributes meaningfully to the ongoing discourse on the macro-financial determinants of household debt by offering nuanced support for both classical and post-Keynesian frameworks, while also revealing areas of divergence from traditional expectations. The negative (though statistically insignificant) relationship between GDP per capita and household debt is broadly consistent with the Life-Cycle Hypothesis advanced by Modigliani and Brumberg (1954). According to this theory, as income rises over the life cycle or across national economic development, households rely less on credit and more on accumulated income or wealth, leading to a decline in debt-to-GDP ratios. This interpretation aligns with Aldashev and Batkeyev (2023), who observed a decline in debt burdens in tandem with income growth in transitioning economies, such as Kazakhstan.

The strong and statistically significant role of financial inclusion in driving long-run household debt supports Friedman's (1957) Permanent Income Hypothesis, which posits that households borrow not based solely on current income but on expected future income. As financial systems deepen and access expands, credit constraints are relaxed, allowing households to smooth consumption across time. This finding reinforces arguments in Yue et al. (2022) and IMF (2024) that access to formal financial markets is a key structural determinant of borrowing behaviour.

The empirical results also lend support to Minsky's (1986) Financial Instability Hypothesis, particularly through the positive short-run association between NPL ratios and household debt. Rising NPLs signal increasing credit risk and may reflect unsustainable lending booms or delayed deleveraging, consistent with Minsky's theory that prolonged credit expansion, if poorly regulated, sows the seeds of

systemic fragility. This echoes warnings from Santoso and Sukada (2009) and Cornelli et al. (2020) about the feedback loop between lax lending and deteriorating loan quality. However, the finding of a positive relationship between lending rates and household debt in earlier model iterations, though not statistically robust in final estimations, runs counter to traditional neoclassical models that expect interest rate hikes to dampen borrowing via higher credit costs. This anomaly is mirrored in the work of Joo and Mir (2024), who argue that in highly financialised economies, households may continue borrowing despite rising rates due to fixed-rate credit contracts, financial innovation, or asset-based collateralization that delays the adjustment of borrowing behaviour to monetary tightening.

Overall, the study contributes to the literature by bridging macroeconomic theory with contemporary cross-country evidence, revealing that structural financial access, rather than cyclical macro variables alone, plays a dominant role in shaping household debt dynamics. It affirms the complexity of modern credit markets, where economic theory must contend with heterogeneous financial systems, institutional contexts, and household behaviours.

The findings of this study have important implications for monetary authorities, financial regulators, and development institutions concerned with striking a balance between financial inclusion and debt sustainability. Most notably, the positive and statistically significant relationship between financial inclusion and household debt underscores the importance of coupling access-driven policies with adequate safeguards.

While expanding banking infrastructure and digital finance platforms is critical for inclusive growth, such efforts must be accompanied by targeted financial literacy programs, transparent disclosure standards, and robust consumer protection mechanisms. As emphasised by Yue et al. (2022) and the recent IMF Report (IMF, 2024), access alone does not guarantee stability; poorly managed inclusion may inadvertently fuel household over-indebtedness. The short-run sensitivity of household debt to changes in the lending rate suggests that monetary policy continues to play a key role in influencing credit conditions.

However, the inconsistent long-run relationship observed in this study implies that interest rate tools may be insufficient on their own, particularly in economies with rigid credit contracts or alternative lending channels. This supports the growing consensus, advanced by

Cornelli et al. (2020) and the ECB (2018), that macroprudential regulation must complement interest rate management. Instruments such as loan-to-income (LTI) and debt-service-to-income (DSTI) caps, as well as countercyclical capital buffers, are critical to mitigating excessive leverage during credit booms. The positive association between NPL ratios and household debt highlights the need for proactive banking supervision and credit risk management. High NPLs not only signal underlying fragility but may also reflect cyclical debt accumulation without adequate resolution mechanisms. Policymakers must ensure that banks maintain sufficient capital adequacy ratios, improve credit assessment processes, and report delinquency data transparently to prevent systemic vulnerabilities. This aligns with the policy recommendations from Santoso and Sukada (2009), who warn against delayed responses to rising credit risk in household segments.

Interestingly, the lack of a statistically significant link between unemployment and household debt suggests that labour market conditions, while important, may be mediated by institutional features such as social safety nets, income smoothing mechanisms, or access to informal credit. This finding calls for greater coordination between fiscal and financial sector policies. For example, during economic downturns, targeted income support or wage subsidies can indirectly stabilise household borrowing without requiring aggressive monetary easing.

This work makes a substantive contribution to the existing literature by bridging the empirical gap between financial inclusion, macroeconomic variables, and household debt accumulation within a cross-country, panel-based framework. Unlike many single-country or static models, this analysis distinguishes between short-run fluctuations and long-run debt dynamics across both developed and developing economies over a two-decade period. By integrating panel ARDL estimation with fixed and random effects models, the study offers nuanced insights into how structural factors like financial inclusion and financial sector health interact with cyclical indicators such as interest rates and inflation. The findings provide macroeconomic and fiscal policymakers with evidence that household debt is not solely driven by income or price conditions but is also deeply embedded in institutional and financial access dynamics. As such, policies that expand financial access must be paired with regulatory safeguards, such as loan-to-income ratios or credit scoring mechanisms, to prevent systemic vulnerabilities. These insights can

inform the design of integrated fiscal, monetary, and macroprudential strategies aimed at promoting inclusive but sustainable household credit markets.

In summary, the study advocates for a multi-pronged policy approach that recognises the structural role of financial inclusion while managing the cyclical risks associated with credit expansion. Sustainable household debt levels can only be achieved when financial access, monetary flexibility, regulatory discipline, and income support policies operate in concert.

6. Conclusions

This study provides a comprehensive cross-country analysis of the macroeconomic and financial determinants of household debt-to-GDP between 2000 and 2023. Drawing on panel estimation techniques, including fixed effects, random effects, and panel ARDL models, the findings underscore the significant role of financial inclusion as a structural driver of household borrowing. Specifically, the results confirm that expanding access to formal financial institutions, measured by commercial bank branch penetration, leads to higher household debt ratios in the long run. This reinforces the notion that financial deepening, while necessary for economic inclusion, must be carefully managed to avoid excessive leverage and potential financial fragility.

In line with Modigliani and Brumberg's (1954) life-cycle theory and related income-based models, GDP per capita was negatively associated with household debt, suggesting that rising incomes reduce households' reliance on external borrowing over time. However, macroeconomic indicators such as inflation and unemployment were largely insignificant in both the short- and long-run estimations, highlighting the limited explanatory power of cyclical variables relative to structural financial factors. The NPL ratio emerged as a significant short-run driver of household debt, pointing to the relevance of banking sector stability in influencing credit behaviour.

Nonetheless, the study also encountered unexpected findings, including earlier indications of a positive association between lending rates and household debt in some model iterations. While this result did not hold in the final specification, it highlights the need for further investigation into the role of credit market structures, borrower expectations, and financial innovation in mediating monetary policy

effects, a dynamic increasingly observed in financialised economies (Joo and Mir, 2024).

Given these findings, future research should investigate the heterogeneous effects of financial inclusion across income levels, regions, or borrower profiles. Low-income households, for instance, may respond differently to credit access than middle- or high-income segments, particularly in the presence of informal lending markets or weak consumer protection. Additionally, with the rapid expansion of digital financial services, future studies should assess the impact of mobile banking penetration, fintech platforms, and digital credit ecosystems on household indebtedness, especially in developing economies undergoing digital transformation (Cornelli et al., 2020; IMF, 2024).

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APPENDIX

Table 1

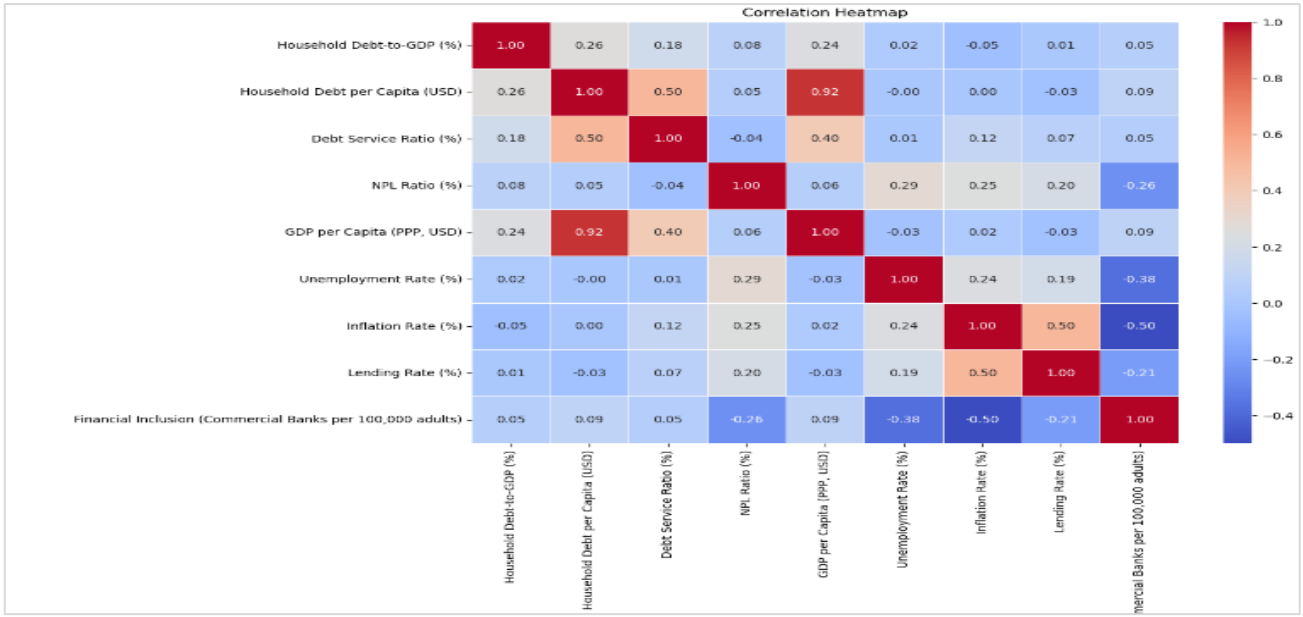
Summary Statistics of Key Variables (First-Differenced Data)

Variable	Count	Mean	Std. Dev.	Min	25th Percentile	Median	75th Percentile	Max
Household Debt-to-GDP (%)	239	-1.11e-17	1.002	-10.71	-0.10	0.007	0.19	3.63
Household Debt per Capita (USD)	239	1.49e-17	1.002	-11.73	-0.06	-0.02	0.19	3.46
Debt Service Ratio (%)	239	7.43e-18	1.002	-7.96	-0.25	0.009	0.28	4.77
Non-Performing Loan (NPL) Ratio (%)	240	-8.88e-17	1.002	-1.29	-0.76	-0.22	0.56	4.45
GDP per Capita (PPP, USD)	239	-2.60e-17	1.002	-9.04	-0.09	0.017	0.24	3.66
Unemployment Rate (%)	240	-2.96e-17	1.002	-0.94	-0.62	-0.20	0.07	4.12
Inflation Rate (%)	240	-2.37e-16	1.002	-1.68	-0.75	-0.28	0.59	4.40
Lending Rate (%)	240	2.22e-16	1.002	-0.77	-0.47	-0.34	-0.04	4.55
Financial Inclusion (Commercial Banks per 100,000 Adults)	240	-5.92e-17	1.002	-1.86	-0.76	-0.13	0.88	2.39

Author's Estimation 2025

Figure 7

Correlation Heatmap



Author's Estimation 2025

Table 2

Summary of Stationarity Test Results Using ADF and KPSS

Variable	ADF Statistic	ADF p-value	KPSS Statistic	KPSS p-value	Conclusion
Household_Debt-to-GDP_	-15.3462	0.0000	0.0614	0.1000	Stationary
Household_Debt_per_Capita_USD	-14.2780	0.0000	0.1195	0.1000	Stationary
Debt_Service_Ratio	-12.4986	0.0000	0.0504	0.1000	Stationary
NPL_Ratio_	-3.9065	0.0020	0.2744	0.1000	Stationary
GDP per_Capita_PPP_USD	-15.4785	0.0000	0.1257	0.1000	Stationary
Unemployment_Rate_	-2.9722	0.0376	0.1800	0.1000	Stationary
Inflation_Rate_	-5.3650	0.0000	0.2161	0.1000	Stationary
Lending_Rate_	-4.4602	0.0002	0.6960	0.0139	Mixed evidence
Financial_Inclusion_Diff	-8.1778	0.0000	0.0511	0.1000	Stationary

Author's Estimation 2025

Table 3

Multicollinearity: Variance Inflation Factor (VIF) for Independent Variables

Variable	VIF	Multicollinearity Status
Household_Debt_per_Capita_USD	8.27	Moderate correlation
Debt_Service_Ratio_	1.49	No multicollinearity
NPL_Ratio_	1.16	No multicollinearity
GDP_per_Capita_PPP_USD	7.31	Moderate correlation
Unemployment_Rate_	1.15	No multicollinearity
Inflation_Rate_	1.43	No multicollinearity
Lending_Rate_	1.36	No multicollinearity
Financial_Inclusion_Diff	1.03	No multicollinearity

Author's Estimation 2025

Table 4

Cointegration: Johansen Cointegration Test Results (Trace Statistics)

Cointegration Rank (r)	Trace Statistic	Critical Value (90%)	Critical Value (95%)	Critical Value (99%)	Decision
0	677.88	190.87	197.38	210.04	Reject H_0
1	524.03	153.63	159.53	171.91	Reject H_0
2	391.76	120.37	125.62	135.98	Reject H_0
3	274.62	91.11	95.75	104.96	Reject H_0
4	172.71	65.82	69.82	77.82	Reject H_0
5	100.51	44.93	47.85	54.68	Reject H_0
6	48.87	27.07	29.80	35.46	Reject H_0
7	27.50	13.42	15.49	19.93	Reject H_0
8	11.04	2.71	3.84	6.63	Reject H_0

Author's Estimation 2025

Table 5

Hausman Specification Test Result

Test	Test Statistic	Degrees of Freedom	p-value	Decision	Preferred Model
Hausman Test	2.6397	9	0.9769	Do not reject null hypothesis	Random Effects

Author's Estimation 2025

Table 6

ARDL Regression: Fixed Effects Estimation Results

Variable	Coeff.	Std. Error	t-stat	p-value	95% CI
Household_Debt_per_Capita_USD	0.1613	0.1865	0.8641	0.3891	[-0.1251, 0.5276]
Debt_Service_Ratio_	0.0607	0.8676	0.5825	0.5680	[-0.6498, 0.1957]
NPL_Ratio_	0.1141	0.0847	1.2832	0.2083	[-0.0638, 0.2661]
GDP_per_Capita_PPP_USD	0.0230	0.1655	0.1391	0.8894	[-0.2895, 0.3486]
Unemployment_Rate_	0.0346	0.0522	0.6639	0.5072	[-0.0883, 0.1953]
Inflation_Rate_	-0.8995	0.2259	-1.6959	0.0923	[-0.2845, 0.4855]
Lending_Rate_	-0.0470	0.0733	-0.3077	0.4796	[-0.1485, 0.4312]
Financial_Inclusion_Diff	0.7925	0.2063	3.8422	0.0002	[0.3868, 1.1991]

Author's Estimation 2025

Table 7

Random Effects Estimation Results (Statistically Preferred)

Variable	Coeff.	Std. Error	t-stat	p-value	95% CI
Household_Debt_per_Capita_USD	0.2198	0.1755	1.2521	0.2118	[-0.1224, 0.1556]
Debt_Service_Ratio_	0.0372	0.0746	0.4993	0.6184	[-0.1096, 0.1840]
NPL_Ratio_	0.0639	0.0658	0.9700	0.3320	[-0.0653, 0.1931]
GDP_per_Capita_PPP_USD	0.0230	0.1665	0.1380	0.8903	[-0.3048, 0.3481]
Unemployment_Rate_	0.0304	0.0652	0.4661	0.6415	[-0.0982, 0.1590]
Inflation_Rate_	-0.8942	0.2371	-1.2873	0.1993	[-0.4845, 0.4855]
Lending_Rate_	0.0470	0.0733	0.6423	0.5213	[-0.0971, 0.1911]
Financial_Inclusion_Diff	0.8018	0.2022	4.0048	0.0001	[0.4073, 1.1963]

Author's Estimation 2025

Table 8

Error Correction Model (Short-Run Dynamics)

Variable	Coeff.	Std. Err.	t-Stat	p-Value	Significance
D_Household_Debt_per_Capita_USD	0.136	0.073	1.862	0.064	•
D_Debt_Service_Ratio_	0.195	0.060	1.992	0.322	
D_NPL_Ratio_	0.816	0.144	5.642	0.000	***
D_GDP_per_Capita_PPP_USD	0.160	0.087	1.852	0.065	•
D_Unemployment_Rate_	-0.085	0.179	-0.113	0.755	
D_Inflation_Rate_	-0.190	0.225	-0.843	0.400	
D_Lending_Rate_	-0.515	0.193	-2.666	0.024	**
D_Financial_Inclusion_Diff	0.678	0.155	4.344	0.000	***
ECT_1	**-1.044**	0.063	-16.261	0.000	*** (strong convergence)
R^2 = 0.586, Adj. R^2 = 0.572					

Author's Estimation 2025

Table 9

Long-Run Relationship (Levels Regression)

Variable	Coeff.	Std. Err.	t-Stat	p-Value	Significance
Household_Debt_per_Capita_USD	0.1198	0.176	1.252	0.212	
Debt_Service_Ratio_	0.0372	0.074	0.499	0.618	
NPL_Ratio_	0.0639	0.066	1.048	0.296	
GDP_per_Capita_PPP_USD	0.0830	0.165	0.139	0.889	
Unemployment_Rate_	0.0304	0.065	0.466	0.642	
Inflation_Rate_	-0.0942	0.073	-1.287	0.200	
Lending_Rate_	0.0470	0.073	0.642	0.521	
Financial_Inclusion_Diff	**0.8018**	0.200	4.005	0.000	***
R^2 = 0.143, Adj. R^2 = 0.113					

Author's Estimation 2025