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Saving Behavior and Financial Access in the Digital Era: Cross-Country Panel Evidence from High-Income Economies

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Abstract

This study aims to address the empirical gap between the expansion of financial access and the persistence of unequal financial behavior in highly digitalized, high-income countries. Specifically, this study analyzes the effects of saving behavior and financial access on both traditional and digital financial behavior, while also examining the moderating role of internet penetration in these relationships. The study employs a quantitative approach using a cross-country panel data design. The data are obtained from the Global Findex surveys conducted in 2014, 2017, and 2021, covering 42 high-income countries with a total of 126 country-year observations. The analysis applies panel data regression to examine the relationships among variables and to test the proposed moderating effects. The results show that saving behavior has a positive and statistically significant effect on both traditional and digital financial behavior, confirming the importance of financial discipline. In contrast, financial access does not exhibit a consistent direct effect. Its influence becomes more relevant in the digital context through interaction with internet penetration, although the moderating effect remains relatively limited. The findings imply that policies should not only focus on expanding financial access but also emphasize strengthening financial capability and digital literacy. In addition, the development of digital financial systems should promote more effective and responsible financial usage. In terms of originality, this study contributes to the literature by simultaneously examining traditional and digital financial behavior within a cross-country empirical framework, while explicitly modeling the moderating role of digital infrastructure, which remains underexplored in previous studies.

Keywords: Digital financial behavior; saving behavior; financial access; internet penetration; financial capability.

Abstrak

Penelitian ini bertujuan untuk mengatasi kesenjangan empiris antara perluasan akses keuangan dan masih adanya ketimpangan perilaku keuangan di negara berpendapatan tinggi yang telah terdigitalisasi. Secara khusus, studi ini menganalisis pengaruh perilaku menabung dan akses keuangan terhadap perilaku keuangan tradisional dan digital, serta menguji peran moderasi penetrasi internet dalam hubungan tersebut. Penelitian ini menggunakan pendekatan kuantitatif dengan desain data panel lintas negara. Data diperoleh dari survei Global Findex pada tahun 2014, 2017, dan 2021 yang mencakup 42 negara berpendapatan tinggi dengan total 126 observasi *country-year*. Analisis dilakukan menggunakan regresi data panel untuk menguji hubungan antarvariabel serta efek moderasi yang diusulkan. Hasil penelitian menunjukkan bahwa perilaku menabung memiliki pengaruh positif dan signifikan terhadap perilaku keuangan tradisional maupun digital, yang menegaskan peran penting disiplin finansial. Sebaliknya, akses keuangan tidak menunjukkan pengaruh langsung yang konsisten. Pengaruh akses keuangan menjadi lebih relevan dalam konteks digital melalui interaksi dengan penetrasi internet, meskipun efek moderasinya relatif terbatas. Implikasi penelitian ini menunjukkan bahwa kebijakan perlu tidak hanya berfokus pada perluasan akses keuangan, tetapi juga pada penguatan kapabilitas keuangan dan literasi digital. Selain itu, pengembangan sistem keuangan digital perlu diarahkan untuk mendorong penggunaan yang lebih efektif dan bertanggung jawab. Secara orisinal, penelitian ini memberikan kontribusi dengan mengkaji secara simultan perilaku keuangan tradisional dan digital dalam kerangka empiris lintas negara, serta secara eksplisit memodelkan peran moderasi infrastruktur digital, yang masih jarang dilakukan dalam studi sebelumnya.

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Kata Kunci: Perilaku keuangan digital, perilaku menabung, akses keuangan, penetrasi internet, kapabilitas keuangan.

INTRODUCTION

Over the past decade, the rapid digitalization of financial systems has fundamentally transformed how individuals access and use financial services. Data from the World Bank's Global Findex database show that the share of adults worldwide who own a financial account increased from 62 percent in 2014 to 76 percent in 2021 (Demirgüç-Kunt et al., 2022). At the same time, global internet penetration rose significantly, reaching approximately 67 percent of the world's population in 2023 (International Telecommunication Union, 2023). These developments reflect a substantial expansion in financial inclusion driven by digital financial services, mobile technologies, and fintech innovations.

The expansion of digital infrastructure has made financial services more accessible, efficient, and integrated into everyday economic activities. Mobile banking platforms, electronic payment systems, and fintech applications increasingly enable individuals to participate in formal financial systems while reducing transaction costs and improving service delivery (Khan et al., 2025; Kumar et al., 2026; Pesa et al., 2026). However, despite this progress, a critical issue persists. Greater access to financial services does not automatically translate into improved financial behavior. Empirical evidence suggests that individuals with access to financial services do not necessarily engage in responsible financial practices such as consistent saving, long-term financial planning, or prudent debt management (Prabhakaran, 2025). In some cases, digital financial expansion may even increase exposure to impulsive spending and excessive reliance on short-term credit. This paradox highlights a crucial gap between financial inclusion and financial behavior.

Existing literature on financial behavior can be broadly categorized into three main strands. First, studies on financial access emphasize the role of institutional availability in promoting financial inclusion and participation. These studies generally assume that expanding access to financial services leads to improved financial outcomes. However, prior research remains limited in explaining why increased access does not consistently result in responsible financial behavior, particularly in high-income economies where access is already widespread (Okrah & Nepp, 2022; Rathod, 2025).

Second, behavioral finance studies highlight the importance of individual-level factors, particularly saving behavior, financial discipline, and self-control, in shaping financial decision making. Saving behavior reflects forward-looking preferences and the ability to manage financial resources effectively over time (Sadik & Rahman, 2024; Sarwar et al., 2024; Szalai, 2025). Although this strand provides important insights into financial decision making, it often overlooks the structural and technological contexts in which financial behavior occurs.

Third, research on digital finance focuses on the role of digital infrastructure, including internet penetration, in facilitating financial participation. Digital technologies improve access to financial information, enable real-time transactions, and expand the reach of financial services (He & Li, 2019; Hong et al., 2014). Nevertheless, existing studies remain limited in examining how digital infrastructure interacts with both financial access and behavioral factors to shape financial behavior outcomes. In particular, the moderating role of internet penetration in linking financial capability and financial behavior remains underexplored.

Taken together, these strands reveal several important research gaps. First, prior studies rarely integrate financial access, behavioral factors, and digital infrastructure within a unified analytical

framework. Second, most empirical research relies on cross-sectional or single-country data, which limits the ability to capture dynamic changes across countries and over time. Third, the distinction between traditional financial behavior and digital financial behavior has not been systematically examined, despite their potentially different determinants in digitally advanced economies.

To address these gaps, this study employs cross-country panel data from 42 high-income countries across three waves of the Global Findex survey (2014, 2017, and 2021). The study aims to analyze how financial access and saving behavior influence both traditional financial behavior and digital financial behavior, while also examining the moderating role of internet penetration. By integrating these elements within a single empirical framework, this study seeks to provide a more comprehensive understanding of financial behavior in the context of digital transformation.

Financial access is theoretically expected to reduce barriers to participation in formal financial institutions by lowering transaction costs and increasing the availability of financial services (Ozili, 2022; Rafinda, 2025). However, empirical evidence suggests that this relationship is not always consistent, as access alone does not necessarily lead to responsible financial behavior (Okrah & Nepp, 2022; Rathod, 2025).

Saving behavior, on the other hand, reflects financial discipline, self-control, and long-term orientation, which are essential for effective financial decision making (Abdul-Rahim et al., 2022; Núñez-Letamendia et al., 2024; Shefrin, 2020). Individuals with strong saving habits are more likely to engage in structured financial practices and participate in formal financial systems.

In the digital context, financial access provides the institutional foundation for participation in digital financial services, while saving behavior supports the effective and responsible use of these services (Aubhi et al., 2025; Cao, 2026; Poudel, 2025; Shahid et al., 2025). However, the role of digital infrastructure introduces additional complexity. Internet penetration can facilitate financial participation but may also generate behavioral risks, such as impulsive spending and excessive reliance on digital credit (He & Li, 2019; Hong et al., 2014).

Based on the preceding arguments, this study proposes that financial access and saving behavior play important roles in shaping both traditional and digital financial behavior. First, financial access is expected to positively influence Traditional Financial Behavior (FBP), as better access to financial services may encourage individuals to engage in more structured and responsible financial practices (H1). Similarly, saving behavior is assumed to have a positive effect on Traditional Financial Behavior (FBP), since individuals with stronger saving habits tend to demonstrate better financial discipline and planning in conventional financial activities (H2). Furthermore, financial access is also expected to positively influence Digital Financial Behavior (DFB), as broader access to financial services may facilitate the use of digital financial platforms and transactions (H3). Saving behavior is likewise proposed to positively influence Digital Financial Behavior (DFB), as individuals who are accustomed to managing their savings may be more willing and able to adopt digital financial tools (H4). In addition, this study considers internet penetration as a moderating factor in the digital financial context. Higher internet penetration is expected to strengthen the relationship between financial access and Digital Financial Behavior (DFB) (H5), as well as the relationship between saving behavior and Digital Financial Behavior (DFB) (H6). Therefore, this study positions internet penetration as a contextual factor that may enhance the transformation of financial access and saving behavior into digital financial practices.

LITERATURE REVIEW

Financial Behavior in the Digital Era

Financial behavior refers to how individuals manage their financial resources through activities such as saving, spending, borrowing, and investing. Traditionally, researchers have explained financial behavior through psychological and socio-economic factors, including risk attitudes, self-control, income stability, and financial literacy. In recent years, the rapid digital transformation of financial services has introduced new contextual influences that shape how individuals engage with financial systems. The increasing availability of mobile banking, fintech platforms, and electronic payment systems has improved access to financial information, reduced transaction costs, and expanded participation in formal financial markets (Abdul-Rahim et al., 2022; Cao, 2026; Poudel, 2025; Shahid et al., 2025).

In the digital era, financial behavior increasingly reflects the interaction between individual capabilities and technological environments. Digital platforms enable users to access financial information in real time, automate transactions, and monitor financial activities more efficiently. At the same time, digital financial systems may introduce new behavioral risks, such as impulsive spending triggered by instant transactions, algorithm-driven financial choices, and misinterpretation of automated financial signals. Therefore, scholars emphasize that digital financial participation must be supported by adequate financial literacy, regulatory frameworks, and consumer protection mechanisms to ensure responsible financial decision making (Aubhi et al., 2025; Cao, 2026).

Financial behavior can be categorized into several key dimensions. First, it can be divided into traditional financial behavior and digital financial behavior**.** Traditional financial behavior refers to financial activities conducted through conventional financial institutions, such as saving through banks or engaging in formal financial transactions. In contrast, digital financial behavior involves financial activities conducted through digital platforms, including mobile banking, online transactions, and fintech services.

Second, financial behavior can be categorized based on time orientation into short-term consumption behavior and long-term saving behavior**.** Short-term behavior emphasizes immediate consumption and financial convenience, while long-term behavior reflects financial discipline and future-oriented planning. Third, financial behavior may also be distinguished between productive financial behavior**,** such as saving and investing, and consumptive financial behavior, such as excessive spending or short-term borrowing. These categorizations highlight the multidimensional nature of financial behavior and its dependence on both individual characteristics and technological environments.

Within this framework, saving behavior (SB) represents a central behavioral dimension, reflecting financial discipline, long-term orientation, and the ability to delay consumption in order to achieve financial stability (Abdul-Rahim et al., 2022; Poudel, 2025; Shahid et al., 2025).

Financial Access and Institutional Context

Financial access refers to the ability of individuals to obtain and use formal financial services, including bank accounts, credit facilities, payment systems, and investment instruments. Research on financial inclusion consistently emphasizes that access to financial institutions is a fundamental requirement for economic participation and financial stability. However, the effectiveness of financial access depends not only on availability but also on the institutional environment in which financial services operate (Greben & Mihus, 2025; Rafinda, 2025; Rathod, 2025).

Several studies highlight that institutional factors play a critical role in determining how financial access translates into actual financial behavior. These factors include regulatory quality, consumer

protection mechanisms, financial infrastructure, and public trust in financial institutions. Cross-country evidence suggests that strong regulatory frameworks, reliable digital payment systems, and effective data protection policies promote more stable and responsible financial participation (Joy, 2026; Okrah & Nepp, 2022; Suchocka et al., 2021).

Financial access can be categorized into several dimensions. First, it can be distinguished between formal financial access and informal financial access**.** Formal access refers to participation in regulated financial institutions such as banks and licensed financial providers, whereas informal access involves unregulated or community-based financial practices.

Second, financial access can be categorized into physical access and digital access**.** Physical access refers to the availability of financial institutions such as bank branches and ATMs, while digital access refers to access to financial services through digital platforms, including mobile banking and fintech applications. Third, financial access can also be differentiated between access and usage**,** where access refers to the availability of services, while usage reflects the actual engagement with those services.

These categorizations indicate that financial access should not be viewed as a single indicator, but rather as part of a broader institutional and technological ecosystem. In countries with strong institutional governance, expanding financial access tends to encourage saving behavior and deeper engagement with formal financial systems. In contrast, in environments with weak regulatory frameworks, increased access may not lead to improved financial discipline and may even increase exposure to financial risks.

Internet Penetration as a Moderating Factor

Internet penetration represents the extent to which digital infrastructure is available within a society and plays a crucial role in shaping financial participation. The contextual behavior framework suggests that technological environments influence how individual capabilities and attitudes are translated into observable financial actions (He & Li, 2019; Hong et al., 2014). Access to the internet improves information transparency, enables real-time financial transactions, and expands the reach of digital financial platforms.

However, the impact of digital infrastructure is not uniform across individuals or countries. Differences in digital literacy, regulatory quality, platform governance, and technological maturity may produce diverse financial behavior outcomes. In well-regulated digital environments, internet access can strengthen responsible financial practices by facilitating financial monitoring, automated saving mechanisms, and access to formal financial services.

Internet penetration can be categorized into several contextual dimensions. First, it can be classified into high and low digital environments**,** reflecting the extent to which digital infrastructure is developed within a country. High penetration environments are characterized by widespread internet access and advanced digital ecosystems, while low penetration environments face limitations in digital infrastructure.

Second, internet penetration can be categorized based on institutional quality**,** distinguishing between well-regulated and weakly regulated digital environments. In well-regulated systems, digital infrastructure supports secure and efficient financial participation, whereas in weakly regulated systems, it may increase financial vulnerability.

Third, internet penetration can also be viewed in terms of technological maturity**,** ranging from emerging digital systems to fully integrated digital financial ecosystems. These differences influence how financial access and saving behavior translate into financial outcomes.

In this study, internet penetration is conceptualized as a moderating factor that shapes the relationship between financial access, saving behavior, and financial behavior. In highly digitalized

environments, financial participation may be influenced not only by access and behavioral capacity but also by the characteristics of the digital ecosystem itself.

Conceptual framework

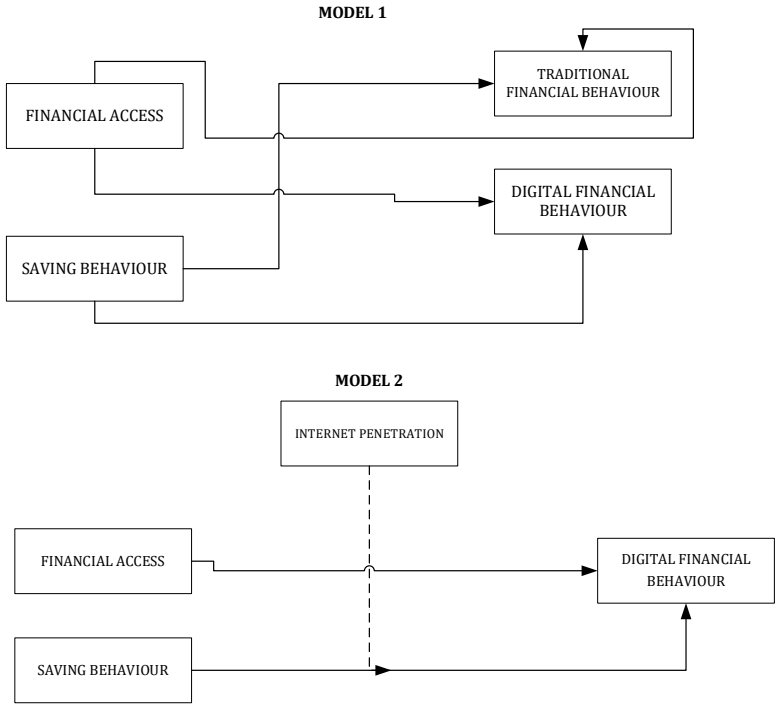

Figure 1. Conceptual Framework

Figure 1 presents the conceptual framework of this study. The framework includes two analytical specifications that capture both the direct relationships and the moderating effects among the key variables.

The first specification represents the baseline model, which examines the direct influence of Financial Access (FA) and Saving Behavior (SB) on financial behavior. In this model, FA and SB serve as the independent variables, while Traditional Financial Behavior (FBP) and Digital Financial Behavior (DFB) are treated as the dependent variables. The purpose of this specification is to identify how structural access to financial services and individuals' behavioral capacity shape financial participation in both traditional and digital settings.

The second specification introduces the digital dimension by incorporating Internet Penetration as a moderating variable. In this model, the analysis focuses specifically on Digital Financial Behavior (DFB) as the outcome variable. Internet penetration interacts with both Financial Access and Saving Behavior to assess whether digital infrastructure strengthens or weakens the relationship between structural access, behavioral discipline, and participation in digital financial activities.

Taken together, these two specifications illustrate a shift from a basic behavioral framework toward a digitally contextualized model. In this broader framework, financial behavior is shaped not only by individual characteristics and institutional access but also by the wider digital environment in which financial decisions take place.

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RESEARCH METHODS

This study examines financial behavior using a cross-country panel dataset, where the unit of analysis is country-level financial behavior observed over time. The dataset consists of 42 high-income countries observed across three survey waves (2014, 2017, and 2021), resulting in a balanced panel of 126 country-year observations. Although the Global Findex survey collects data at the individual level, the variables used in this study are aggregated at the country level by calculating the proportion or average values of relevant indicators. This approach enables the analysis to capture variations in financial behavior across countries and over time. The focus on high-income countries is justified by data availability, relatively consistent digital infrastructure, and the policy relevance of advanced financial systems in these economies.

This study adopts a quantitative research design using panel data analysis. This method is selected because it allows for the examination of both cross-sectional differences and temporal dynamics in financial behavior. Panel data models are particularly suitable for controlling unobserved heterogeneity across countries and improving estimation reliability compared to purely cross-sectional approaches (Hsiao, 2014; Wooldridge, 2010). The use of a panel framework also enables the study to investigate how structural access, behavioral factors, and digital infrastructure interact over time.

The data used in this study are derived from the Global Findex database published by the World Bank, which provides internationally comparable indicators related to financial access and financial behavior. Additional macroeconomic variables, including GDP per capita, inflation, and demographic indicators such as age, are obtained from complementary datasets. All variables are constructed at the country level. Traditional Financial Behavior (FBP) represents financial activities conducted through conventional financial institutions, while Digital Financial Behavior (DFB) captures financial activities performed through digital platforms. Financial Access (FA) measures access to formal financial institutions, and Saving Behavior (SB) reflects financial discipline in allocating income to savings. Internet Penetration is measured as the proportion of internet users relative to the total population. To ensure comparability, key variables are standardized, and GDP per capita is transformed into logarithmic form.

Data collection in this study relies on secondary data compilation and aggregation. Relevant variables are extracted from the Global Findex survey and combined with macroeconomic indicators. The aggregation process involves calculating country-level proportions and averages for each survey wave. This approach allows the study to construct a consistent panel dataset across countries and time periods.

The data are analyzed using panel regression techniques. The main estimation method is the Fixed Effects model, which controls for unobserved country-specific characteristics that remain constant over time (Baltagi, 2021; Wooldridge, 2010). A Hausman test is conducted to confirm the appropriateness of this model. The baseline specification examines the direct effects of Financial Access and Saving Behavior on financial behavior:

$$FBP_{it} = \alpha_i + \beta_1 FA_{it} + \beta_2 SB_{it} + \gamma X_{it} + \varepsilon_{it}$$

$$DFB_{it} = \alpha_i + \beta_1 FA_{it} + \beta_2 SB_{it} + \gamma X_{it} + \varepsilon_{it}$$

To examine the moderating role of digital infrastructure, the following model is estimated:

$$DFB\_it = \alpha\_i + \beta\_1\ FA\_it + \beta\_2\ SB\_it + \beta\_3\ Internet\_it$$

$$+ \beta_4 (FA_{it} \times Internet_{it}) + \beta_5 (SB_{it} \times Internet_{it}) + \gamma X_{it} + \varepsilon_{it}$$

To address potential econometric issues such as heteroskedasticity, serial correlation, and cross-sectional dependence, Driscoll–Kraay standard errors are applied (Driscoll & Kraay, 1998). Additional diagnostic tests include the Wooldridge test for autocorrelation and the Pesaran CD test for cross-sectional dependence. Multicollinearity is assessed using the Variance Inflation Factor (VIF), and explanatory variables are mean-centered to reduce mechanical correlation in interaction terms (Kutner et al., 2004). Subsample analysis based on GDP per capita is conducted to examine cross-country heterogeneity, and robustness checks are performed using weighted panel regression and M-estimator techniques. Data processing is conducted using Microsoft Excel, while econometric analysis is performed using RStudio.

RESULTS AND DISCUSSION

Data Structure and Panel Sample

This study uses panel data derived from the Global Findex surveys conducted in 2014, 2017, and 2021. The dataset includes 42 high-income countries observed across the three survey waves, producing a balanced panel of 126 country-year observations.

Although the number of observations is relatively modest for cross-country panel analysis, the empirical specification remains manageable because the model includes a limited number of explanatory variables. In Model 2, eight explanatory variables are included alongside country and time fixed effects. With 126 panel observations, the ratio between observations and estimated parameters remains within acceptable ranges for panel estimation.

To improve statistical reliability, the estimation uses robust standard errors with Driscoll–Kraay corrections. This approach addresses potential econometric issues such as heteroskedasticity, serial correlation, and cross-sectional dependence. Additional diagnostic tests and robustness procedures are discussed in the following sections.

Descriptive Statistics

Table 1 reports the descriptive statistics for the main variables used in the empirical analysis. Traditional Financial Behavior (FBP) has an average value of 0.43 with a standard deviation of 0.18. Digital Financial Behavior (DFB) shows a slightly higher mean of 0.56 and a standard deviation of 0.14. This pattern suggests that digital financial activities are relatively widespread across the sampled countries.

Financial Access (FA_c) and Saving Behavior (SB_c) are standardized variables with mean values close to zero due to the centering procedure applied in the moderation analysis. Saving Behavior displays greater variation across countries than Financial Access. This pattern indicates that cross-country differences in financial discipline are more pronounced than differences in access to formal financial services.

Internet penetration also shows considerable variation across the sample, reflecting differences in digital infrastructure among high-income economies.

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Table 1. Descriptive Statistics

Variable	Mean	SD	Min	Max
FA_c	0	0.13	-0.47	0.09
SB_c	0	0.19	-0.35	0.35
FBP	0.43	0.18	0.1	0.83
DFB	0.56	0.14	0.25	0.88
Internet	0	10.86	-38.68	16.39
Age	50.96	8.59	22.14	70.26
LnGDP	10.32	0.56	9.07	11.44
Inflation	1.86	1.65	-1.35	8.88

Correlation Analysis

Table 2 presents the Pearson correlation matrix for the key variables. A relatively strong correlation appears between Financial Access and Saving Behavior, with a coefficient of 0.75. This relationship suggests that countries with broader access to financial services often display stronger saving habits.

A very strong correlation is observed between Traditional Financial Behavior and Digital Financial Behavior, with a value of 0.93. This result indicates that digital financial engagement often develops from existing traditional financial practices. However, the two variables represent different aspects of financial participation.

Traditional Financial Behavior reflects activities conducted through conventional financial institutions, such as formal deposits and regulated financial transactions. Digital Financial Behavior, by contrast, captures financial interactions carried out through digital channels, including mobile banking and online financial services. The strong correlation therefore reflects complementarity between traditional and digital financial practices rather than conceptual overlap.

Table 2. Correlation Matrix

Variable	FA_c	SB_c	FBP	DFB	Internet
FA_c	1	0.75	0.56	0.43	0.63
SB_c	0.75	1	0.74	0.61	0.65
FBP	0.56	0.74	1	0.93	0.47
DFB	0.43	0.61	0.93	1	0.37
Internet	0.63	0.65	0.47	0.37	1

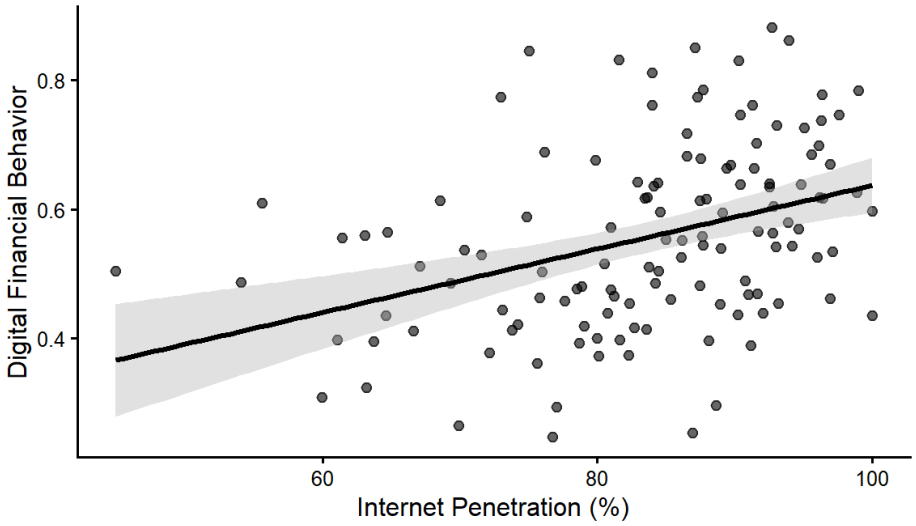

Figure 2. Internet Penetration and Digital Financial Behavior

The figure illustrates the relationship between internet penetration and digital financial behavior across country–year observations. Each point represents a country-year observation from the sample of high-income economies. The fitted regression line indicates a positive association between digital connectivity and participation in digital financial activities.

Multicollinearity Diagnostics

Potential multicollinearity among the explanatory variables was assessed using the Variance Inflation Factor (VIF). The results show that all predictors remain within acceptable thresholds. Financial Access and Saving Behavior display VIF values slightly above five, while the remaining variables remain well below this level. These results indicate that although some explanatory variables are correlated, the degree of multicollinearity is not severe enough to distort the regression estimates.

Table 3. Variance Inflation Factor

Variable	VIF
FA_c	5.1
SB_c	5.1
Internet	3
FA × Internet	4.6
SB × Internet	3
Age	1.3
LnGDP	3.2
Inflation	1.3

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Panel Regression Results

Determinants of Traditional Financial Behavior

Model 1 estimates the determinants of Traditional Financial Behavior using a fixed effects panel specification. The Hausman test strongly supports the use of the fixed effects estimator. The test statistic equals 71.50, with a p-value below 0.001. The results show that Saving Behavior has a positive and statistically significant relationship with Traditional Financial Behavior. In contrast, Financial Access does not show a statistically significant coefficient.

Table 4. Determinants of Traditional Financial Behavior

Predictor	Coefficient	SE	p-value
FA_c	-0.112	0.12	0.353
SB_c	0.378	0.117	0.002
Internet	-0.0002	0.0008	0.794
Age	0.003	0.002	0.249
LnGDP	-0.015	0.064	0.817
Inflation	-0.006	0.002	0.018
Model statistics			
R^2 = 0.23			
Observations = 126			
Country Fixed Effects = Yes			

The model explains about 23 percent of the variation in Traditional Financial Behavior. Although this explanatory power is moderate, financial behavior is influenced by many social, institutional, and psychological factors that are difficult to fully capture in cross-country empirical models.

Determinants of Digital Financial Behavior

Model 2 examines Digital Financial Behavior using a two-way fixed effects specification with Driscoll–Kraay standard errors. Saving Behavior shows a positive and statistically significant coefficient, indicating a strong association with digital financial participation. Financial Access does not display a statistically significant direct effect. Internet penetration shows a negative coefficient that becomes statistically significant after applying robust corrections. The interaction between Financial Access and Internet penetration is positive and marginally significant at the 10 percent level. Meanwhile, the interaction between Saving Behavior and Internet penetration shows a statistically significant negative coefficient. Table 5 reports the regression results for the determinants of digital financial behavior.

Table 5. Determinants of Digital Financial Behavior

Predictor	Coefficient	SE	p-value
FA_c	0.185	0.128	0.152
SB_c	0.361	0.039	<0.001
Internet	-0.0014	0.0006	0.03
FA × Internet	0.0078	0.004	0.074
SB × Internet	-0.0038	0.0007	<0.001
Age	-0.0005	0.003	0.855
LnGDP	-0.073	0.019	0.0003
Inflation	-0.0078	0.003	0.003

Observations = 126
Country Fixed Effects = Yes
Time Fixed Effects = Yes

To facilitate the interpretation of the moderating effect, Figure 3 presents an interaction plot illustrating how internet penetration moderates the relationship between financial access and digital financial behavior.

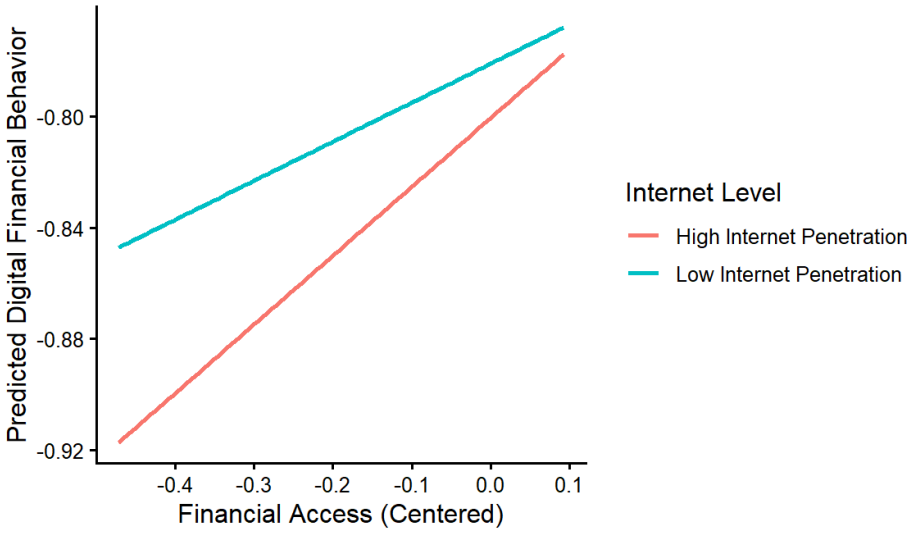

Figure 3. Moderating Role of Internet Penetration

The figure illustrates the moderating role of internet penetration in the relationship between financial access and digital financial behavior. The slope of the relationship becomes steeper at higher levels of internet penetration, suggesting that digital connectivity may strengthen the influence of financial access on digital financial participation.

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Hypothesis Testing

The results of the hypothesis tests are summarized in Table 6, which compares the theoretical expectations with the empirical outcomes derived from the panel regression models.

Saving Behavior shows a strong and statistically significant relationship with both Traditional Financial Behavior and Digital Financial Behavior. These positive and significant coefficients support Hypothesis H2 and Hypothesis H4, indicating that financial discipline plays a central role in shaping financial practices.

By contrast, Financial Access does not show a statistically significant relationship with either Traditional Financial Behavior or Digital Financial Behavior. Therefore, Hypothesis H1 and Hypothesis H3 are not supported. These findings suggest that access to financial services alone does not necessarily lead to improved financial behavior.

Regarding the moderating effects, the interaction between Financial Access and Internet penetration is positive and marginally significant at the 10 percent level, providing partial support for Hypothesis H5. This result suggests that digital infrastructure may strengthen the role of financial access in promoting digital financial participation.

The interaction between Saving Behavior and Internet penetration shows a statistically significant negative coefficient. This finding supports Hypothesis H6, but indicates a negative moderating effect, implying that higher levels of internet penetration may weaken the positive relationship between saving behavior and digital financial behavior.

Table 6. Hypothesis Testing Summary

Hypothesis	Relationship	Expected Sign	Result
H1	Financial Access → Traditional Financial Behavior	+	Not supported
H2	Saving Behavior → Traditional Financial Behavior	+	Supported
H3	Financial Access → Digital Financial Behavior	+	Not supported
H4	Saving Behavior → Digital Financial Behavior	+	Supported
H5	Internet × Financial Access → Digital Financial Behavior	+	Marginally supported
H6	Internet × Saving Behavior → Digital Financial Behavior	+	Supported (negative moderation)

Cross-Country Heterogeneity

To further explore whether the determinants of digital financial behavior vary across countries with different economic conditions, an additional subsample analysis was conducted. The sample of countries was divided into two groups based on the median value of GDP per capita. This approach allows

the identification of potential differences in the relationships between financial access, saving behavior, and digital financial participation across countries with different levels of economic development.

Table 7 reports the results of the subsample analysis. The findings reveal noticeable differences between the two groups of countries. In the group of countries with relatively lower GDP per capita within the high-income category, saving behavior remains a strong and statistically significant predictor of digital financial behavior. In addition, the interaction between financial access and internet penetration becomes statistically significant in this subsample. This pattern suggests that improvements in digital infrastructure can strengthen the role of financial access in facilitating digital financial participation.

In contrast, among countries with higher GDP per capita, financial access shows a stronger direct association with digital financial behavior. Internet penetration also becomes more influential in shaping digital financial participation in these economies. However, the moderating role of internet penetration appears weaker in this group compared to the lower GDP group.

Overall, the subsample analysis highlights the presence of cross-country heterogeneity in the determinants of digital financial behavior. While saving behavior remains an important factor across both groups, the relative importance of financial access and digital infrastructure differs depending on the level of economic development.

Table 7. Subsample Analysis by GDP per Capita

Predictor	Lower GDP Countries	Higher GDP Countries
FA_c	0.263	0.761***
SB_c	0.261***	0.310***
Internet	0.00003	-0.005***
FA × Internet	0.015***	-0.004
SB × Internet	-0.014*	0.009*
Age	-0.0003	0.01
LnGDP	-0.161	0.025
Inflation	-0.0036	-0.0017

Observations = 126
Country Fixed Effects = Yes
Time Fixed Effects = Yes
Notes: *** p < 0.01, ** p < 0.05, * p < 0.1.

Robustness Analysis

To confirm the stability of the empirical findings, several robustness checks were performed using alternative estimation techniques. These include weighted panel regression to account for differences in country population size, robust regression using M-estimators to reduce the influence of potential outliers, and a comparison between fixed effects and random effects estimators.

The results across these alternative specifications remain consistent with the baseline estimation. In particular, the coefficient of Saving Behavior remains positive and statistically significant across all estimation approaches. This consistency indicates that the main findings are not driven by specific estimation techniques or by extreme observations in the dataset.

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Table 8. Robustness Tests

Model	SB Coefficient	Significance
Fixed Effects	0.361	***
Random Effects	0.347	**
Robust Regression (M-estimator)	0.293	**
Weighted Panel Regression	0.361	**

Note: *** p < 0.01, ** p < 0.05.

Overall, the robustness analysis confirms that saving behavior remains a stable predictor of financial behavior across different model specifications.

Temporal Dynamics Across Survey Waves

The panel structure of the dataset also allows the examination of temporal patterns across the three survey waves included in the analysis: 2014, 2017, and 2021. Table 9 reports the mean values of key variables across these waves.

Table 9. Mean Comparison Across Survey Waves

Wave	SB Mean	FBP Mean	DFB Mean
2014	0	0.42	0.54
2017	0.01	0.44	0.56
2021	0.02	0.45	0.58

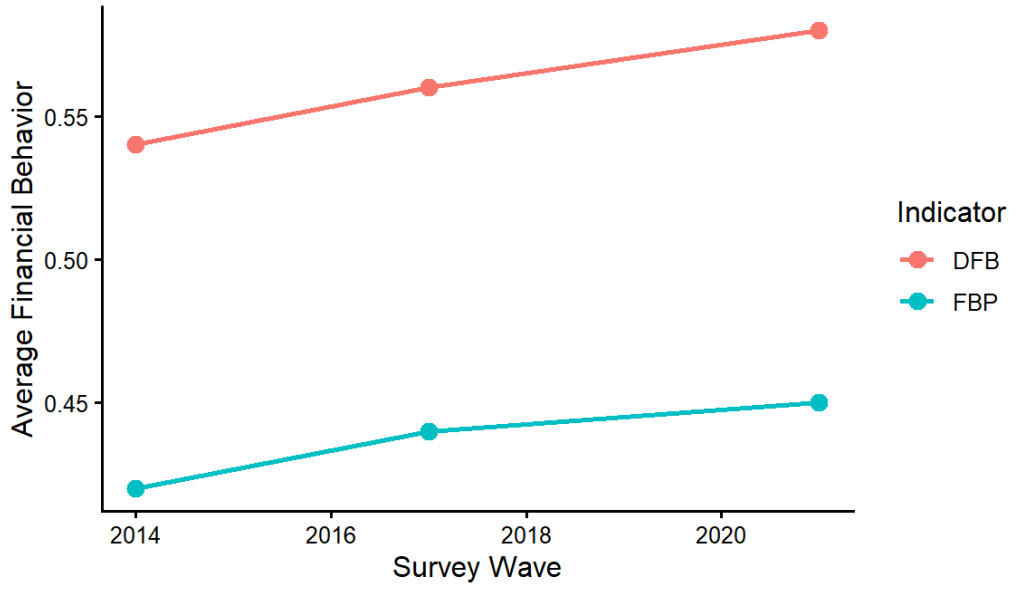

Figure 4. Trends in Financial Behavior Across Survey Waves

The results show a gradual increase in both traditional financial behavior and digital financial behavior during the observation period. As illustrated in Figure 4, traditional financial behavior increased from 0.42 in 2014 to 0.45 in 2021, while digital financial behavior rose from 0.54 to 0.58 over the same period. However, the magnitude of these changes remains relatively modest, suggesting that financial participation tends to evolve gradually over time rather than experiencing abrupt structural shifts during the observed period.

DISCUSSION

This study examines the determinants of financial behavior using cross-country panel data from 42 high-income countries across three survey waves (2014, 2017, and 2021). The findings reveal several key patterns. First, saving behavior shows a consistent and statistically significant positive relationship with both traditional financial behavior and digital financial behavior. Second, financial access does not exhibit a statistically significant direct effect on either type of financial behavior. Third, internet penetration introduces complexity, as it shows a negative direct effect on digital financial behavior. Finally, the interaction between saving behavior and internet penetration is negative and statistically significant, indicating that the positive effect of saving discipline weakens in highly digitalized environments.

The strong effect of saving behavior can be explained by its role as a behavioral foundation rooted in financial discipline, future orientation, and self-control. Individuals or societies with stronger saving habits tend to allocate resources more efficiently, engage in structured financial planning, and maintain more stable financial practices. These behavioral characteristics naturally extend to both traditional and digital financial contexts.

The non-significant effect of financial access suggests that access alone is not sufficient to shape financial behavior, particularly in high-income countries where financial services are already widely available. In such contexts, access becomes a baseline condition rather than a determining factor. This explains why variation in financial behavior is more strongly influenced by behavioral factors than by structural availability.

The negative effect of internet penetration reflects the complexity of digital environments. While digital infrastructure expands access and convenience, it also introduces new behavioral incentives such as instant transactions and easy access to credit. These features may reduce financial discipline and encourage short-term consumption, thereby weakening responsible financial behavior.

The negative interaction between saving behavior and internet penetration further indicates that digital environments may dilute the influence of traditional behavioral discipline. As financial systems become more digitalized, behavioral patterns are reshaped by technological convenience, which may conflict with long-term financial planning.

The findings of this study both confirm and challenge existing literature. First, consistent with behavioral finance studies, the results support the argument that saving behavior plays a critical role in shaping financial decision making (Sadik & Rahman, 2024; Sarwar et al., 2024; Szalai, 2025). This study reinforces the importance of behavioral discipline as a key determinant of financial outcomes. Second, the findings diverge from studies that emphasize financial access as the primary driver of financial inclusion. While previous research assumes that expanding access improves financial outcomes, this study shows that such an effect is not evident in high-income economies (Okrah & Nepp, 2022; Rathod, 2025). This suggests that the effectiveness of financial access depends on context. Third, this study extends the literature on digital finance by showing that digital infrastructure does not uniformly enhance financial behavior. While prior studies highlight the positive role of digital technologies (He & Li, 2019; Hong et al.,

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2014), the present findings reveal a more complex and sometimes negative relationship, particularly in terms of moderating behavioral discipline. Overall, this study contributes to the literature by integrating financial access, behavioral factors, and digital infrastructure within a single analytical framework, addressing gaps in previous research.

From a historical perspective, the findings reflect a transition from traditional financial systems to digitally mediated financial environments. In earlier stages of financial development, access to financial institutions was the primary constraint. However, in advanced economies, where access is nearly universal, the determinants of financial behavior have shifted toward behavioral and digital factors. This transformation is closely associated with the broader process of financial digitalization, where technological advancements such as fintech, artificial intelligence, and digital platforms have restructured financial systems from institution-centered models toward user-centered digital ecosystems (Manta et al., 2025; Urikova et al., 2025). Empirical evidence shows that digital finance improves efficiency and expands access, but also introduces new behavioral dynamics, including changes in consumption patterns and decision-making processes (Basri, 2025; Yeşilyurt & Dilidüzgün, 2020). In high-income economies, where financial inclusion has largely been achieved, the marginal effect of access diminishes, and financial outcomes become increasingly influenced by behavioral capacity and digital interaction. This shift highlights that the evolution of financial systems is no longer driven solely by institutional expansion, but by the complex interplay between digital infrastructure, individual behavior, and technological innovation.

From a social perspective, the results highlight the changing nature of financial behavior in contemporary societies. Digital financial systems reshape how individuals interact with money, introducing new forms of financial engagement while also altering consumption patterns. The weakening role of saving behavior in highly digitalized environments suggests that social norms related to financial discipline may be evolving. This transformation is closely linked to the broader phenomenon of digital financial behavior change, where financial decisions are increasingly influenced by digital financial literacy, psychological factors, and platform design (Jose & Ghosh, 2024; Sarin, 2024). Empirical evidence shows that digital financial literacy significantly enhances individuals' ability to adopt digital financial tools and improve financial decision-making, while behavioral biases and emotional responses—often amplified by digital platforms—can lead to impulsive or short-term financial choices (Chandana et al., 2026; Dandona, 2025). In addition, features embedded in digital financial platforms, such as instant transactions and gamified interfaces, may create feedback loops that encourage consumption-oriented behavior rather than long-term saving (Amin et al., 2025). These dynamics suggest that financial behavior in digital societies is increasingly shaped by social interaction with technology, where convenience, accessibility, and behavioral stimuli collectively influence how individuals manage financial resources.

From an ideological perspective, the findings challenge the dominant assumption in financial inclusion discourse that expanding access is sufficient to improve financial outcomes. Instead, the results suggest that financial behavior is shaped by a complex interaction between structural, behavioral, and technological factors. This implies that financial inclusion should be understood not only as access but also as capability and responsible usage. This perspective aligns with the growing body of literature on financial inclusion beyond access, which emphasizes that the effectiveness of financial inclusion depends on individuals' ability to use financial services meaningfully and responsibly . Empirical evidence shows that financial literacy and capability are critical in enabling individuals to translate access into positive financial outcomes, while a lack of such capability may lead to risks such as over-indebtedness and poor financial decision-making (Jamali et al., 2026; Rathnayake et al., 2026). Moreover, the expansion of digital financial services further complicates this relationship, as technological innovation can both enhance inclusion and

introduce new vulnerabilities related to digital literacy gaps, behavioral biases, and regulatory challenges (Mamun & László, 2025; Showkat et al., 2024). These findings suggest that financial inclusion should be reconceptualized as a multidimensional process that integrates access, capability, and responsible usage within an increasingly digitalized financial ecosystem.

The findings reveal both functional and dysfunctional aspects of digital financial development. On the functional side, digital infrastructure expands access to financial services, improves efficiency, and enables broader financial participation. It facilitates faster transactions and enhances connectivity within financial systems.

However, the findings also reveal significant dysfunctions. The negative effect of internet penetration and its weakening impact on saving behavior suggest that digital environments may undermine financial discipline. The convenience of digital financial tools may encourage impulsive consumption, reduce long-term planning, and increase exposure to financial risks such as over-indebtedness. This pattern is consistent with the growing literature on behavioral risks in digital finance, which highlights that digital platforms often amplify cognitive biases such as overconfidence, present bias, and herding behavior, leading to suboptimal financial decisions (Chen & Xu, 2025). Moreover, the design of digital financial technologies—characterized by instant transactions, algorithmic nudges, and user-friendly interfaces—can create behavioral feedback loops that reinforce consumption-oriented behavior rather than savings (Putri et al., 2026). Empirical evidence also shows that gaps in digital financial literacy increase individuals' vulnerability to impulsive financial decisions, fraud, and over-reliance on automated systems, particularly among users with limited financial capability (Lal et al., 2025; Puri et al., 2025). These dynamics indicate that digital financial environments not only expand access but also introduce new behavioral and systemic risks that may weaken long-term financial stability if not accompanied by adequate regulatory frameworks and user capability development.

Based on these findings, several policy implications can be proposed. First, policymakers should move beyond a narrow focus on expanding financial access and place greater emphasis on strengthening financial literacy and behavioral capability, particularly in addressing behavioral biases and impulsive consumption patterns associated with digital financial environments. Programs that promote saving habits, budgeting skills, and long-term financial planning should be specifically designed to counteract short-term consumption tendencies and over-reliance on digital credit. Second, regulatory frameworks for digital financial services should be strengthened to mitigate behavioral risks, including excessive borrowing, algorithm-driven consumption, and digital financial fraud, by ensuring transparency, consumer protection, and responsible lending practices . Third, policies should integrate technological development with behavioral interventions, where digital financial platforms are intentionally designed to encourage positive financial behavior through features such as automated savings, spending alerts, and friction mechanisms that reduce impulsive transactions. Finally, policymakers should adopt a context-sensitive approach that recognizes the interaction between digital infrastructure and behavioral factors, ensuring that financial inclusion strategies address not only access and technology but also the behavioral and psychological dimensions of financial decision making in increasingly digitalized societies.

CONCLUSION

This study examines the relationship between financial access, saving behavior, internet penetration, and financial behavior across 42 high-income countries using panel data from 2014, 2017, and 2021. The findings highlight several key insights. First, saving behavior emerges as a consistent and statistically significant determinant of both traditional and digital financial behavior, emphasizing the

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central role of financial discipline and long-term planning. Second, financial access does not exhibit a significant direct effect, suggesting that in high-income economies where access is already widespread, financial behavior is shaped more by behavioral characteristics than by institutional availability. Third, the digital environment introduces complexity, as internet penetration shows a negative association with digital financial behavior and weakens the positive effect of saving behavior. These results indicate that financial behavior in advanced economies is influenced by the interaction between behavioral capacity and digital context rather than by access alone .

This study contributes to the literature in several important ways. First, it provides empirical evidence that challenges the conventional assumption that expanding financial access is sufficient to improve financial outcomes, particularly in contexts where access has reached saturation. Second, the study advances the integration of financial inclusion, behavioral finance, and digital finance by demonstrating how behavioral factors and digital infrastructure jointly shape financial behavior. Third, by distinguishing between traditional and digital financial behavior within a cross-country panel framework, this study offers a more comprehensive understanding of financial practices in digitally advanced economies.

Despite these contributions, several limitations should be acknowledged. The analysis relies on observational panel data, which limits the ability to establish causal relationships. The relatively small sample size and country-level aggregation may also obscure individual-level variations in financial behavior. In addition, the measurement of digital financial behavior as a composite indicator may not fully capture differences in the intensity and quality of digital financial usage. Future research could address these limitations by using micro-level data, incorporating additional behavioral and institutional variables, and applying causal inference approaches to better understand the mechanisms linking financial access, behavior, and digital environments.

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APPENDIX

Appendix 1. List of Sample Countries

This study includes 42 high-income countries according to the World Bank income classification. All countries have complete data for the three survey waves used in this study (2014, 2017, and 2021). The countries included in the sample are: Australia, Austria, Belgium, Canada, Chile, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR (China), Hungary, Ireland, Israel, Italy, Japan, Korea (Republic of), Latvia, Lithuania, Malta, Netherlands, New Zealand, Norway, Panama, Poland, Portugal, Romania, Saudi Arabia, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Arab Emirates, United Kingdom, United States, and Uruguay. These countries were selected based on two criteria: (1). Classification as high-income economies according to the World Bank; (2). Availability of complete observations for all variables across the three survey waves.

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