The Non-Linear Relationship between Financial Access and Domestic Savings

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Abstract

This paper examines the impact of financial access on the accumulation of domestic savings in sixteen emerging market economies included in the Morgan Stanley Capital International emerging market index. The countries represent Asia, Latin America, Europe, Middle East, and Africa. We use the System Generalized Method of Moments panel estimation methodology on annual data (representing) spanning the period 1980-2018. Principal component analysis allows us to create a financial access index as a linear combination of two variables measured per 100,000 adults: number of bank branches per and number of ATMs. We also use the common control variables for a domestic saving regression including current account balance, real interest rate, the age dependency ratio, inflation, and domestic credit and private sector growth in our analysis. The results of the paper reveal a convex and non-monotonic statistically significant relationship between financial access and domestic savings. The financial access index has a non-linear effect on domestic savings with a cutoff point of 86.5 points. Our results indicate that improvement in financial access may increase the savings rate initially by 0.0173%, leading to an increase in investments, further improvement in financial access leads to slight decline of about 0.0002% in savings as households' precautionary savings decrease.

I. Introduction

Economists generally agree that domestic savings support economic growth. Solow's growth model (Solow, 1956) postulated that savings increases economic growth, at least in the short term, by increasing the stock of capital per worker. More recent endogenous growth models suggest higher savings predicts longer-term growth because it boosts technological progress, thereby increasing high-tech, high value-added goods and service production (Çiftçi ve Aykaç, 2011). This research has led to initiatives to support domestic savings in developing countries. While in the classical school savings are seen as the source of capital accumulation, the Neoclassical and Keynesian models have focused on impact of both savings and investment on economic growth (Çolak & Öztürkler, 2012).

In developing countries, instability and low savings as well as insufficient investment opportunities have caused low investment and difficulty getting rid of the middle-income trap.

Trade liberalization aims to integrate domestic economies with international markets by abolishing state intervention in the trade of goods and services, while financial liberalization aims to achieve financial integration by abolishing control over financial instruments. The spread of new knowledge among countries, along with trade liberalization, has led to an increase in exports, employment, and consumption, thus increasing countries' aggregate demand and economic growth. Financial liberalization includes the abolition of foreign exchange restrictions and the elimination of interest rate suppression by the government. The increase in the variety of financial instruments along with globalization provides additional resources for developing countries with inadequate domestic savings. However, some developing countries have experienced many crises since 1980.

In a study comparing Southeast Asia with Latin America over the period 1975 – 1995, Thimann and Dayal-Gulati (1997) found evidence that savings support growth. In Southeast Asia, the real per capita gross domestic product (GDP) increased by almost 200 percent while private savings has only increased by 10 percent of GDP. By contrast, in Latin America, the saving rates remained broadly constant and the associated increase in real GDP per capita was only 35 percent. However, a number of studies show that the link between the accumulation of savings and the growth in output is insignificant in financially open economies, which is attributed to the fact that higher savings depend on lower consumption, thus negatively affecting output growth (Gorner, 2006; Monteil and Serven, 2009).

In line with analyzing the determinants of domestic savings, Deaton (1989) explains why the factors affecting the level of savings differ between developing and developed countries. At the micro level, households in developing countries are crowded and poor, dependent on agriculture for income and sustenance, and thus have an uneven income that is difficult to project. However, government officials in both groups are concerned about distortions in savings and savings as a measure of economic performance. A few developing countries such as China, South Korea, Malaysia, and Thailand have a relatively developed financial system that enables them to reduce the volatility in disposable income, output, and employment during times of a crisis. For instance, despite a decrease in household savings rates due to the 2008 crisis, the success of developing Asian countries in terms of savings and financial development is remarkable (Eser and Sinan, 2018).

Another complication for policies that would seek to increase the domestic savings rate is the fact that many variables affect it. For example, growth in per capita income tends to increase savings (Modigliani, 1966, 1970). Gungor, Ciftcioglu, and Balcilar (2014) report that real interest rate also affects savings, although it has opposing effects in the form of substitution and income effects on saving-consumption decisions of households. They also found that higher inflation could either make households save more as a precaution or spend more. Further establishing that the effect of an increase in inflation rate on saving rates is uncertain, expected inflation due to underdeveloped financial markets in less developed countries leads households to purchase durable consumer goods and reduce private savings (Aşırım, 1994).

Several studies have included the role of financial development as an important determinant of domestic savings. Financial development—including increased access to banking systems and availability of diverse savings products—encourages savings by providing savers greater information, incentives, and risk management tools at the lowest possible cost (Ağır, 2009). Increased competition in the banking sector is expected to prompt banks to compress their profit margins, resulting in an increase in interest rates offered on deposits and therefore increasing depositors' incentive to save. However, financial liberalization creates financial market disturbances and even crises that may discourage saving (Balcilar et al., 2016). A study conducted in Turkey measures financial pressure by real interest rates and measures financial market development level by liquidity constraint and financial depth (Çakmak, 2004). Results indicate that financial pressure has no statistically significant effect on savings, but both financial depth and liquidity constraint do. On the other hand, the effect of real income growth on savings has a statistically significant effect, and policies that promote growth and development can also contribute to savings. Horioka and Hagiwara (2012) found no statistically significant relationship between real interest rates and savings in developing Asian countries. Ogaki et al. (1996) found that, in low-income countries, the effect of real interest rates on savings was negative but small, varying by income level.

Increasing depth of financial markets and prudent regulation of financial institutions encourage savings by providing a safe saving environment and variety of financial instruments in some regions, although bank deposits tend to predominate in developing Asian economies (Agrawal et al., 2009: 212). The volatility in the inflation rate in developing countries increases the uncertainty in individual households' expected income, increasing the savings rate, and decreasing consumption (Taner, Alptekin, & Yilmaz, 2017). But large changes in the inflation

rate cause uncertainty in the expected real interest rate (or the expected return on savings) and decrease individuals' tendency to save (Taner, Alptekin, & Yilmaz, 2017).

Bayar (2014) concluded that in emerging Asian economies financial development, economic growth, and real interest rates had a positive effect on domestic savings, while the dependency ratio had a negative effect. Research showing that an increase in dependency rates negatively affects savings has been conducted in South Asia (Agrawal et al., 2009), in developed and underdeveloped countries (Doshi, 1994), and in Pakistan (Ismail & Rashid, 2013). However, the study of Hondroyiannis (2006) indicated that there is a long-run saving function sensitive to real disposable income growth, liquidity, inflation, real interest rate, public finance, and dependency ratio. The empirical results have shown the existence of a long-run saving function in European countries.

A study by Sahoo and Dash (2013) provided further analysis on the determinants of savings by attributing the increase in savings rates in South Asia to financial sector development, income per capita, and GDP growth rate. They found real interest rate has a statistically insignificant impact on savings. Kelly and Mavrotas (2003) examined the effect of financial sector development on private savings using a dynamic panel heterogeneous model for 17 African countries. Their findings with respect to the impact of savings on growth were inconclusive. Though private savings and financial sector development had a positive relationship, financial reforms could not mobilize private saving given the existing level of financial structure. Ang (2011) who analyzed the determinants of the private savings rate in Malaysia, which at the time had one of the highest saving rates in the world, found a positive relationship between financial development and private savings.

Along the same lines, on one hand, McKinnon (1973) and Shaw (1973) have found a positive relationship between real interest rate and savings, while, on the other hand, Hallaq (2003), De Serres and Pelgrin (2003), Bhandari vd. (2007), Güriş ve Özkaya (2019) have found a negative or insignificant relationship. Feldstein and Horioka's (1980) estimation of the relationship between domestic savings-investment and capital movements using data from the 1960-1974 period of 16 industrialized OECD member countries also leaves questions unanswered. They found that in countries where capital is fully mobile, domestic investment and domestic savings have no relationship. While domestic savings depend on international investment opportunities, domestic investment is financed through the international capital pool. Therefore, if capital is fully mobile across national borders, the increase in the domestic savings of each country will be positively related to the total global investments. Another study

concludes that the effect of saving on domestic investments has decreased over the period 1989 – 2015 and that low saving rates do not significantly affect the funding for investment because seigniorage revenues and external borrowing tend to compensate (Alptekin, V., Kasa, H., & Uygun, E., 2018). The saving deficit problem of underdeveloped and developing countries causes sustainable economic growth difficulties with the financing of investments and the increasing current account deficit threat.

Another complication in examining the relationship between saving and growth is that saving is not only a potential source of sustainable economic growth, but also a factor that significantly enhances total factor productivity, especially in emerging countries. Because of this, the development of financial markets will increase capital, improve distribution of risks ,and enhance domestic savings. On the other hand, an increase of external debt opportunities can increase consumption and reduce domestic savings in emerging countries that have consumption-based growth (Edwards, 1996).

In examining the nonlinearity in the relationship between financial development variables and domestic savings, a study by Agrawal et al. (2009) showed that bank density, which is used as an indicator of access to banks in South Asia, positively and significantly affects savings for all countries. On the other hand, Horioka and Hagiwara (2012) found a nonlinear relationship between ease of access to private credit and savings, where the improvement in financial access has a positive impact on domestic savings, but this effect is decreasing at higher level of financial development. Wang et al. (2017) also explain that the savings rate may increase initially through increasing investments, but then it declines, along with further financial development, because precautionary saving by households substantially decreases.

Our literature review indicates that past studies have mainly focused on the link between financial development and domestic savings. However, the channel through which financial development affects domestic savings, through the role played by financial access, has been understudied. To address this, our study examines the effects of the improvement in financial access on domestic savings for a sample of Emerging Markets (EMs). In so doing we measure households and firms' financial access by the number of bank branches (per 100,000 adults), the number of ATMs (per 100,000 adults), and their linear combination using principal component analysis. Additionally, the study uses the common control variables of a savings regression: real GDP growth, current account balance, real interest rates, inflation, and age dependency ratio.

Given the importance of financial access on domestic savings, the study will attempt to answer several questions: Which types of financial access indicators affect domestic savings? Is the relationship linear or non-linear? Is the effect the same across the sixteen EMs in our sample? The rest of this paper will be divided as follows. Section II describes the data used, Section III will highlight the methodology employed and the model specification, Section IV will highlight our results, and Section V will conclude. The appendix is at the end of the paper and includes regression estimation results.

II. Data

The study uses a strongly balanced and time series dominant panel dataset for 16 emerging markets countries over the period 1980-2018. The set of emerging markets is chosen based on the definition of the MSCI emerging markets index, which tracks 27 countries that represent 10 percent of world markets. Due to constraints in data availability, especially on the financial access variables, in our two data sources, the World Development Indicators (WDI) and the Global Financial Development Database (GFDD) of the World Bank, we drop 11 of these. The remaining 16 countries include five in the Americas, four in Europe, the Middle East, or Africa (EMEA), and 7 in Asia. The table below presents a list of countries included in the sample

List of Emerging Countries		
Americas	**EMEA**	**Asia**
Brazil	South Africa	China
Chile	Egypt	India
Colombia	Greece	Indonesia
Mexico	Turkey	Korea
Peru		Malaysia
		Philippines
		Thailand

The literature has identified many potential determinants to explain the variation in the accumulation of savings spanning financial development variables, economic variables, and demographic variables. In addition, other factors affecting saving behaviors are variables related to poverty and inequality, social security variables and external variables (Loayza, Lopez, Schmidt-Hebbel, and Serven,1998).Considering this, we choose the following variables based on their relative importance and data availability.

Following the literature, we focus on two indicators that represent financial access, number of bank branches (per 100,000 adults) and the number of ATMs (per 100,000 adults).

Because of the limited availability of data, number of bank branches and the number of ATMs variables are added to the regression model for the period 2004-2017 only. Using these two measures of financial access, an index of financial access has been created using the principal component analysis. From here onwards this index is referred to as "*finacc*". Additionally, in order to check the potential nonlinear relationship between financial access and the domestic savings, we add the squared term of the *finacc* index to our regression analysis. Table 1 below presents all the definition of financial access variables used in the analysis.

Table 1 - Definitions of Financial Access Variables

Indicator	Source and Periodicity	Definition	Abbreviation
ATMs (per 100,000 adults)	Financial Access Survey, International Monetary Fund 2004-2017	Automated Teller Machines (ATMs). It is the number of ATMs per 100,000 adults.	"*atm*"
Commercial bank branches (per 100,000 adults)	World Development Indicators, World Bank. 2004-2017	The main functions of commercial bank branches are to obtain deposits, which are the most important source of funding which the banks uses to make loans and provide other financial services.	"*bb*"
Financial Access Index	Author computation 2004-2017	The principal component analysis of atm and bb. The index has a mean of 53.06 and a minimum of 4.52 points and a maximum of 216.93 points.	"*finacc*"
Financial Access Index Squared	Author computation 2004-2017	The square of the *finacc* index.	"*finaccsq*"

While examining the nonlinear relationship between financial access and savings, we also include macroeconomic and demographic variables affecting domestic savings in our model. Detailed information about the variables appears in Table 2.

Table 2 - Definitions of Control Variables

Indicator	Source and Periodicity	Definition	Abbreviation
Gross domestic savings (% of GDP)	WDI 1980-2018	Gross domestic savings are calculated as GDP less final consumption expenditure (total consumption).	"sav"
GDP growth (% of GDP)	WDI 1980-2018	GDP per capita is based on constant 2010 U.S. dollars and obtained GDP divided by midyear population. It is also an indicative indicator of the average income level of a country's citizens.	"gr"

Current account balance (% of GDP)	WDI 1980-2018	Current account balance is how much a country's domestic savings (private and public) can cover its investments (private and public). Current balance is sum of foreign trade (export-import balance), services (service purchases-service sales), investment (net factor) revenues, and current transfers balance.	"ca"
Real interest rate (%)	WDI 1980-2018	The real interest is calculated by removing the inflation rate from the nominal interest rate and measured by the GDP deflator. Real interest rates terms and conditions differ by country, however, limiting their comparability.	"intrt"
Inflation, consumer prices (annual %)	WDI 1980-2018	Inflation as measured by the consumer price index measure of the average changes in prices of a certain product and service group (a fixed basket of goods and services) that the consumer purchases. Therefore, it is used as an indicator of the cost of living of a typical household.	"inf"
Age dependency ratio (% of working-age population)	WDI 1980-2018	The age dependency rate is the population except for the age of 15-64. Those dependent people are younger than 15 or older than 64. It is used to describe the economic burden on the productive population. Data are shown as the proportion of dependents per 100 working-age population.	"dep"

The first main indicator is GDP growth (gr), one of the typical proxies for financial development. The model also uses other macroeconomic variables such as inflation (inf), real interest rate (intrt), and current account balance as percentage of GDP (ca) as an indicator of external openness. To account the demographic characteristics, we use age dependency ratio, which measures the number of elderly people as a share of those of working age. The impact of this variable on gross savings is ambiguous since higher "dep" could force either higher precautionary savings or higher expenditure, leading to lower savings.

III. Methodology

The study employs System GMM dynamic panel estimation methodology on annual data for sixteen emerging countries over the period 1980-2018 to analyze the non-linear relationship between financial access and domestic savings. As a first step we estimate the role of financial access in domestic savings. To perform this analysis, dynamic panel regression equation below is used;

$$Sav_{i,t} = \alpha + \rho Sav_{i,t-1} + \beta X_{i,t} + \delta FA_{i,t} + \varepsilon_{i,t} \qquad (1)$$

$$i = 1, 2, \ldots N,\ t = 1980, \ldots T$$

Where $Sav_{i,t}$ refers to gross domestic savings (% of GDP), $Sav_{i,t-1}$ is the lagged saving variable, $X_{i,t}$ is the vector of explanatory variables which include GDP growth (% of GDP), current account balance (% of GDP), real interest rate (%), inflation, consumer prices (annual %), and age dependency ratio (% of working-age population). Additionally, the variable $FA_{i,t}$ reflects financial access indicators which are ATMs (per 100,000 adults), Commercial bank branches (per 100,000 adults), *finacc* index, and the squared term of the *finacc* index, and $\varepsilon_{i,t}$ is the error term for country *i* at time *t*.

The System GMM methodology was developed by Arellano and Bover (1995). Blundell and Bond (1998) improved this estimation method and proved that the first difference is better than the GMM estimator. The validity of the instruments of Arellano- Bover / Blundell-Bond's System GMM is checked with two different post-estimation tests. The Hansen test is used to check on the exogeity of the instruments used in the GMM estimation. The Arellano and Bond (1991) test is used to check the 1st and 2nd order autocorrelations.

Equation (2) represents the first difference of Equation (1). The System GMM combines together Equations (1) and (2) as suggested by Arellano and Bond (1991):

$$\left(Sav_{i,t} - Sav_{i,t-1}\right) = \alpha + \rho\left(Sav_{i,t-1} - Sav_{i,t-2}\right) + \beta\left(X_{i,t} - X_{i,t-1}\right) + \delta(FA_{i,t} - \delta FA_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (2)$$

Furthermore, the System GMM considers two extra assumptions to provide a zero correlation between the list of regressors and the unobserved countries' fixed effects (Emara and El Said, 2015). These added assumptions are shown in Equation (3) as follows,

$$\mathrm{E}\left[\Delta\, Sav_{i,t}\ \varepsilon_{i,t}\right] = 0, \text{For } \mathrm{t} = 2, \ldots, \mathrm{T}$$

$$\mathrm{E}\left[\Delta\, M_{i,t}\varepsilon_{i,t}\right] = 0, \text{For } \mathrm{t} = 2, \ldots, \mathrm{T} \quad (3)$$

where $M_{i,t}$ is the set of all the explanatory variables of Equation (1) or $X_{i,t}$ and $FI_{i,t}$. In order to satisfy these additional moments conditions, the correct set of instruments was chosen by regressing the dependent variable and each of the explanatory variables in levels, each variable in a turn, on all the possible lags of the dependent variable and the explanatory variables in first difference starting from the second lag. This method ensures that the error term is not correlated with any variables at time t-1, but correlated with the variables at real time.

Further, to examine the potential non-linear effect of the financial access variables on domestic savings, the squared term of the FA variable is added to the model as follows,

$$Sav_{i,t} = \alpha + \rho Sav_{i,t-1} + \beta X_{i,t} + \delta FA_{i,t} + \gamma FA_{i,t}^2 + \varepsilon_{i,t} \quad (4)$$

where the total effect of the financial access on domestic savings is estimated by adding the coefficient δ to the coefficient γ and the statistical significance of the effect is estimated using the standard errors of these two coefficients. Finally, to examine the regional differences between Asia, Latin America, and EMEA for the impact of the financial access variables on domestic savings, the data is restricted for each region and Equation (4) is re-estimated for each region in a turn.

IV. Estimation Results

The estimation results obtained using Equation (1) are shown in Table 3 where domestic savings is regressed on the set of five explanatory variables, namely GDP growth, current account balance, real interest rate, inflation, age dependency ratio, and lagged savings variable. The first column represents the result of regression saving on its own lag only showing a short-term positive correlation between saving and its own lag.

The second column shows the regression results where the percentage of GDP growth rate added to the regression where the effect on domestic savings is positive and statistically significant, as expected, and where a one percent increase in GDP growth rate results in an increase in domestic savings by about 0.183%.

The third column shows the regression results, to which the current account balance variable has been added. The coefficient of this variable is positively statistically significant, as expected, where a one percent increase in the current account balance rate results in an increase in domestic savings of about 0.082%. Both GDP growth rate and the current account balance show a statistically significant positive effect on domestic savings consistent with the existing literature and economic theory.

The fourth column shows the regression results to which the inflation variable has been added. The coefficient of this variable is negatively significant where a one percent increase in the inflation rate results in a decrease in domestic savings of about 0.0003%, in line with our expectations. Research indicates inflation has an ambiguous impact on savings because higher inflation can trigger households either to save more as a precaution or spend more. However,

expected inflation due to underdeveloped financial markets in emerging countries will lead economic agents to buy durable consumer goods and reduce private savings.

The fifth column shows the regression results to which the real interest rate variable has been added. The coefficient of the real interest rate does not have a statistically significant effect on domestic savings. In theory, real interest rates affect saving in two ways. The substitution effect of the changing interest rate reduces the savings incentive, as the low-interest rate will yield low earnings. And the income effect of the changing interest rate lowers the income from lower interest rate savings, so people save more to earn more income. However, in emerging economies, the impact of real interest rates on saving, like that of inflation, may not be statistically significant.

The sixth column shows the regression results to which the age dependency ratio variable has been added. The coefficient of age dependency ratio does not have a statistically significant effect on domestic savings. The impact of this variable on gross savings is ambiguous since the higher age dependency ratio could force either higher precautionary savings or higher expenditure and therefore lower savings.

It is also important to note that for all System GMM estimation tables presented in the appendix, the Hansen test confirms that the set of instruments used are exogenous to the error term of the regression and the Arellano Bond Test results have shown no significant evidence of serial correlation in the first-differenced errors at order two for all regressions.

Table 4 provides estimation results of the impact of the financial access variable on the domestic savings rate. Column 1 shows the results of the regression including the number of bank branches (per 100,000 adults). From here onwards this variable is referred to as "*bb*". The results show that the bb variable has a statistically significant effect on domestic savings, where a one unit increase in *bb* results in an increase in savings of about 0.0935% of GDP.

Column 2 shows the results of adding the number of ATMs (per 100,000 adults). From here onwards this variable is referred to as "*atm*". The coefficient of this variable is positively statistically significant on domestic savings where a one unit increase in *atm* results in an increase in savings of about 0.004% of GDP. Similarly, column 3 shows the result of adding the *finacc* index where the coefficient is positively statistically significant, as expected. Column 4 shows the total effect of *finacc* index is statistically significant positive effect on domestic savings for the full sample, where a one-unit increase in the index increases domestic

savings by 0.0173%, however this rate is increasing at a decreasing rate of 0.0004% with a cutoff point of 86.5 points.

Table 5 shows the impact of financial access variables on domestic savings for each region. In Table 5.1 shows the estimation results of restricting the data to the Asian countries only. It has been observed that the GDP growth coefficient is statistically significant and has a positive impact the savings positively. Similarly, the real interest rate coefficient is significant but shows a negative effect on domestic savings. Columns 1 to 3 also shows the addition of the two financial access variables *bb*, *atm*, and their linear combination the *finacc* index, respectively. Furthermore, the results obtained confirm that the impact of these variables on domestic savings is positively and statistically significant, where a one-unit increase in *bb* and *atm* leads to 0.0972% and 0.0049% increase in domestic savings, respectively. Column 4 confirms that financial access has a non-linear effect on domestic savings, where a one-unit increase in the access index leads to a 0.0136% increase in domestic savings however this rate is increasing at a decreasing rate of 0.0006%

Restricting the dataset for the Latin America region, Table 5.2 presents the results While the real interest rate coefficient is significant but impacts savings negatively, the GDP growth, current account balance, and age dependency ratio coefficients are significant and impact savings positively. Again, Columns 1 to 3 presents the results after adding the two financial access variables *bb*, *atm*, *finacc* index, respectively. Similar to the results of the full model and the Asian region, the impact of these variables on domestic savings is positively and statistically significant, where a one-unit increase in *bb* and *atm* and *finacc* index leads to 0.0739%, 0.00166%, 0.0216% increase in domestic savings, respectively. Column 4, however, confirms that financial access does not have a statistically significant non-linear impact on domestic savings.

Finally Table 5.3 presents the results for the EMEA region. We observed that in column 1 the age dependency ratio coefficient is significant but impacts savings negatively. The GDP growth, current account balance, and real interest rate coefficients are significant and impact the savings positively. The results for the financial access variables confirm that the impact of these variables on domestic savings is positively and statistically significant, where a one-unit increase in *bb*, *atm*, and *finacc* index leads to 0.2866%, 0.0293%, 0.0386% increase in domestic savings, respectively. And similar to our results for the Latin American region, Column 4 confirms that financial access does not have a statistically significant non-linear effect on domestic savings.

The last step of our analysis includes a robustness check on the possibility that the inclusion of China is biasing our results. Given the fact that China, which has the highest population density, has huge savings rates because of gender imbalances (due to decades of the one child policy) the robustness check is performed by excluding this country from our panel dataset and re-estimating the model. The results are presented in Table 6.2. As obvious from the table, excluding China does not lead to any significant changes in the magnitudes and the statistical significance of our results.

V. Conclusion

Using System GMM estimation methodology to analyze the relationship between the financial access and domestic savings for 16 emerging market countries over the period 1980-2018, we find that the results of the full sample show that a one unit increase in the number of bank branches (per 100,000 adults) leads to a statistically significant increase in domestic savings of about 0.0935% of GDP. Similarly, the results show that the increase in the number of ATMs (per 100,000 adults) has a statistically significant positive impact on domestic savings, where a one unit increase in ATMs leads to an increase in domestic savings of about 0.0046% of GDP.

Using principal component analysis for the two financial access variables – bank branches variables and ATMs – to create a financial access index, we find the estimation results confirm the presence of a convex and non-monotonic, statistically significant relationship between financial access and domestic savings. More specifically, the first one-unit increase in the financial access index increases domestic savings by 0.0173% of GDP, but while subsequent increases also increase domestic savings, the effect diminishes by 0.0004% of GDP with each unit increase, with a cutoff point of 86.5 points.

Examining regional differences between Asia, Latin America, and EMEA regions for the effect of financial access on domestic savings shows that increasing the number of bank branches and/or ATMs has a positive and statistically significant impact in the three regions. Additionally, for the financial access index, the results show that a one-unit increase in the index increases domestic savings by 0.0066%, 0.0216%, and 0.0386%, respectively, in the three regions. The results show financial access only has an impact in the Asian region, and it is non-linear. The total effect on domestic savings is 0.0136%. This result is supported by related literature emphasizing that financial access indicators have a positively and statistically significant effect on domestic savings in the EMEA region (Neaime and Gaysset, 2018). The

non-linearity of this relationship is not proven for the case of Latin America and EMEA regions.

Our results are in line with the findings of Wang et al.'s (2017) study, which explains that the savings rate may increase initially with financial access through increasing investments, but further financial development leads to a decline because precautionary saving by households substantially decreases.

Finally, the estimation results our robustness check of excluding China from the regression analysis, a country with huge population density and a sharp gender imbalance in its population, shows the robustness of the model in terms of signs and magnitudes of the coefficients.

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APPENDIX

Table 3: SYSTEM GMM - Main Model

Financial Access and Domestic Savings - Main Model - Sys-GMM

Regressor	(1)	(2)	(3)	(4)	(5)	(6)
L.sav	0.9979***	0.9799***	0.9795***	0.9799***	0.9770***	0.9507***
	(0.0087)	(0.0052)	(0.0041)	(0.0045)	(0.0056)	(0.0130)
gr		0.1831***	0.1460***	0.1391***	0.1769***	0.1945***
		(0.0338)	(0.0302)	(0.0307)	(0.0357)	(0.0375)
ca			0.0825***	0.0734***	0.0398**	0.0688**
			(0.0226)	(0.0188)	(0.0144)	(0.0261)
inf				-0.0003**	-0.0002	-0.0002*
				(0.0001)	(0.0001)	(0.0001)
intrt					-0.0027	-0.0093
					(0.0093)	(0.0126)
dep						0.0130
						(0.0075)
N	607	607	605	599	480	480
Arellano-Bond Test						
Order 1 p-value	-2.63	-2.54	-2.51	-2.50	-2.28	-2.28
Order 2 p-value	-1.43	-1.44	-1.50	-1.45	-1.87	-1.88
Hansen Chi- Square	15.09	14.77	14.52	14.54	10.05	13.46

Notes: Standard errors in parentheses * p<0.05, ** p<0.01, *** p<0.001

TABLE 4: SYSTEM GMM - Main Model + Financial Variables

	(1)	**(2)**	**(3)**	**(4)**
L.sav	0.8996***	0.9190***	0.9197***	0.9112***
	(0.0275)	(0.0222)	(0.0266)	(0.0282)
gr	0.3398***	0.3049***	0.3059***	0.3264***
	(0.0704)	(0.0602)	(0.0644)	(0.0606)
ca	0.1203**	0.0996**	0.0935**	0.1033**
	(0.0388)	(0.0351)	(0.0389)	(0.0386)
inf	-0.0655	-0.0705	-0.0719	-0.0612
	(0.0696)	(0.0712)	(0.0715)	(0.0735)
intrt	-0.0239	-0.0114	-0.0116	-0.0190
	(0.0140)	(0.0173)	(0.0173)	(0.0166)
dep	0.0154	0.0231	0.0218	0.0188
	(0.0174)	(0.0155)	(0.0172)	(0.0164)
bb	0.0935***			
	(0.0278)			
atm		0.0046**		
		(0.0017)		
finacc			0.0064**	0.0173
			(0.0026)	(0.0090)
finaccsq				-0.0001
				(0.0000)
Total Effect of Financial Access				**0.0173***
				(0.0089)
N	184	178	172	172
Arellano-Bond Test				
Order 1 p-value	-2.21	-2.27	-2.22	-2.18
Order 2 p-value	-0.99	-0.94	-1.02	-1.03

Hansen Chi- Square	6.26	6.63	5.56	7.01

Notes: Standard errors in parentheses * p<0.05, ** p<0.01, *** p<0.001

Table 5 : SYSTEM GMM - Main Model + Financial Variables + Regions

Table 5.1 : ASIA

	(1)	**(2)**	**(3)**	**(4)**
L.sav	0.9402***	0.9455***	0.9471***	0.9408***
	(0.0120)	(0.0111)	(0.0107)	(0.0127)
gr	0.3353***	0.2912***	0.3288***	0.3330***
	(0.0482)	(0.0437)	(0.0550)	(0.0525)
ca	0.0557	0.0392	0.0487	0.0523
	(0.0442)	(0.0334)	(0.0415)	(0.0442)
inf	0.0579	0.0590	0.0788	0.0960
	(0.0868)	(0.0615)	(0.0666)	(0.0721)
intrt	-0.2185***	-0.1862***	-0.1966***	-0.1969***
	(0.0413)	(0.0416)	(0.0400)	(0.0402)
dep	-0.0051	0.0090	0.0030	0.0013
	(0.0177)	(0.0137)	(0.0147)	(0.0153)
bb	0.0972**			
	(0.0308)			
atm		0.0049***		
		(0.0010)		
finacc			0.0066***	0.0136
			(0.0016)	(0.0086)
finaccsq				-0.00003
				(0.00004)
Total Effect of Financial Access				**0.0136***
				(0.0086)
N	89	90	84	84
Arellano-Bond Test				

Order 1 p-value	-1.67	-2.01	-1.73	-1.64
Order 2 p-value	-0.85	-1.10	-0.88	-0.82
Hansen Chi- Square	0.00	0.00	0.00	0.00

Notes: Standard errors in parentheses * p<0.05, ** p<0.01, *** p<0.001

Table 5.2: LATIN AMERICA

	(1)	**(2)**	**(3)**	**(4)**
L.sav	0.7865***	0.7581***	0.7541***	0.7588***
	(0.0342)	(0.0272)	(0.0277)	(0.0303)
gr	0.2675***	0.3086***	0.3114***	0.3084***
	(0.0480)	(0.0441)	(0.0448)	(0.0433)
ca	0.4538***	0.4985***	0.4964***	0.4930***
	(0.0423)	(0.0449)	(0.0440)	(0.0484)
inf	-0.1041	-0.0320	-0.0466	-0.0455
	(0.1059)	(0.0856)	(0.0860)	(0.0875)
intrt	-0.0308***	-0.0569***	-0.0556***	-0.0583***
	(0.0064)	(0.0139)	(0.0138)	(0.0147)
dep	0.0916***	0.1066***	0.1064***	0.1080***
	(0.0182)	(0.0154)	(0.0155)	(0.0141)
bb	0.0739**			
	(0.0260)			
atm		0.0166***		
		(0.0043)		
finacc			0.0216***	0.0136
			(0.0054)	(0.0197)
finaccsq				0.0001
				(0.0002)
Total Effect of Financial Access				**0.0136**
				(0.0195)
N	68	62	62	62
Arellano-Bond Test				
Order 1 p-value	-2.10	-2.01	-2.02	-2.01

Order 2 p-value	-1.38	-1.82	-1.75	-1.75
Hansen Chi- Square	0.00	0.00	0.00	0.00

Notes: Standard errors in parentheses * p<0.05, ** p<0.01, *** p<0.001

Table 5.3 : EMEA

	(1)	**(2)**	**(3)**	**(4)**
L.sav	0.9046***	0.9301***	0.9260***	0.9487***
	(0.0440)	(0.0287)	(0.0291)	(0.0507)
gr	0.3380***	0.3000***	0.3045***	0.3020***
	(0.0615)	(0.0638)	(0.0639)	(0.0678)
ca	0.1896**	0.1802**	0.1836**	0.1044
	(0.0717)	(0.0580)	(0.0587)	(0.0833)
inf	0.0028	0.0083	0.0076	0.0083
	(0.0481)	(0.0475)	(0.0477)	(0.0463)
intrt	0.3079***	0.3271***	0.3265***	0.3355***
	(0.0100)	(0.0282)	(0.0290)	(0.0357)
dep	-0.0317**	-0.0208	-0.0216	-0.0173
	(0.0112)	(0.0133)	(0.0131)	(0.0143)
bb	0.2866***			
	(0.0851)			
atm		0.0293***		
		(0.0069)		
finacc			0.0386***	-0.0374
			(0.0089)	(0.0281)
finaccsq				0.0011***
				(0.0002)
Total Effect of Financial Access				**-0.0362**
				(0. 0279)
N	27	26	26	26
Arellano-Bond Test				
Order 1 p-value	-1.07	-1.07	-1.08	-1.11
Order 2 p-value	1.18	1.15	1.16	1.20
Hansen Chi- Square	0.00	0.00	0.00	0.00

Notes: Standard errors in parentheses * p<0.05, ** p<0.01, *** p<0.001

Table 6: Robustness Check: Excluding China From Regressions
Financial Access and Domestic Savings - Sys-GMM - With and Without China

	(1)	(2)
L.sav	**0.9507*** **	**0.9538*** **
	(0.0130)	**(0.0142)**
gr	**0.1945*** **	**0.1862*** **
	(0.0375)	**(0.0415)**
ca	**0.0688** **	**0.0647***
	(0.0261)	**(0.0259)**
inf	**-0.0002***	**-0.0002***
	(0.0001)	**(0.0001)**
intrt	**-0.0093**	**-0.0095**
	(0.0126)	**(0.0126)**
dep	**0.0130**	**0.0121**
	(0.0075)	**(0.0081)**
N	**480**	**449**

Notes: Standard errors in parentheses * p<0.05, ** p<0.01, *** p<0.001