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Too Much Finance Redux

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Abstract

This paper revisits the "too much finance" hypothesis by reassessing the relationship between financial depth and economic growth using an expanded dataset (1960–2019) and a systematic estimation strategy that avoids reliance on any single, potentially arbitrary sample window. We estimate both cross-sectional and panel models for all feasible starting periods and focus on transparent specifications. We find a robust inverted-U relationship between private credit and growth: financial depth is growth-enhancing at low and moderate levels but exhibits diminishing returns and eventually becomes negative at high levels. The turning point generally lies between 70 and 120 percent of GDP, almost always below the 90th percentile of the global distribution of credit to the private sector.

JEL Codes: G10; O16; F36; O40

Keywords: Financial depth; Finance-growth Nexus; Too much finance

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1 Introduction

Financial development has long been recognized as a key driver of economic growth. A well-functioning financial sector mobilizes savings, allocates capital efficiently, and enables risk sharing. But is it possible to have too much of a good thing? Answering this question is crucial for policy design. If financial deepening always benefits growth, countries should prioritize policies that expand their financial sector. If, however, finance can become a drag on growth, then policymakers must weigh the advantages of deeper financial markets against potential costs. Understanding whether such limits exist, where they might lie, and whether they have shifted over time is therefore central to debates about financial regulation, macroprudential policy, and the appropriate role of finance in modern economies.

This paper revisits the "too much finance" hypothesis by re-estimating the relationship between financial depth and economic growth using all feasible sample windows rather than a single, potentially arbitrary time period. We begin our analysis with standard cross-sectional regressions and then turn to panel specifications with country and time fixed effects. We favor transparent designs and avoid dynamic panels with multiple instruments, which risk instrument proliferation and overfitting.

Our findings confirm and extend the results of Arcand, Berkes and Panizza (2015*a*). Financial depth exhibits a positive association with economic growth at low and moderate levels, but this effect diminishes as the financial sector expands. At high levels of financial depth, the marginal contribution to growth becomes statistically insignificant and, in many specifications, negative. Critically, this inverted-U pattern is robust across different sample windows and multiple estimation strategies.

The idea that finance plays a central role in economic development is longstanding. Early contributions by Bagehot (1873) and Schumpeter (1911) emphasized that well-functioning financial systems support innovation, productivity, and structural transformation by mobilizing savings, facilitating transactions, and channeling resources toward high-return activities. Levine (2005) synthesizes this literature and describes four core mechanisms through which the financial sector fosters economic growth: pooling household savings, enabling the exchange of goods and services, improving capital allocation through information generation, and increasing investors' willingness to fund new ventures through monitoring and enforcement.

Empirical work initially provided strong support for a positive link between financial development and long-run growth. Goldsmith (1969) documented a robust correlation between financial sector size and economic development across countries. Research in the 1990s and early 2000s—including King and Levine (1993), Levine and Zervos (1998), and follow-up work by, among others, Beck, Levine and Loayza (2000) and Levine, Loayza and Beck (2000)—established a causal relationship between financial depth and growth using various regression techniques, instrumental variables, and panel data approaches. Rajan and Zingales (1998) complemented these findings using a difference-in-differences framework, showing that industries that rely more heavily on external finance grow faster in financially developed economies.

However, the view that "more finance is always better" has faced persistent skepticism. Even Bagehot warned of diminishing returns, noting that excessive financial activity may divert resources from productive investment toward speculation. This skepticism gained prominence in the second half of the twentieth century through the work of Minsky (1974), Kindleberger (1978), and Tobin (1984). Minsky (1974) argued that financial deepening can fuel destabilizing leverage cycles and asset bubbles, where periods of optimism sow the seeds of subsequent crises. Tobin (1984), while acknowledging benefits from financial innovation, worried that an oversized financial sector might attract scarce talent away from productive activities and that complex instruments could generate negative social externalities. Rajan (2005) extended this line of thought, arguing that financial systems may become victims of their own success. In a paper that initially sparked controversy—but proved prescient after the global financial crisis of 2008—he argued that prolonged periods of stability can lead to complacency, hidden risk accumulation, and the creation of increasingly fragile and interconnected systems.

These concerns started being supported by a growing body of empirical evidence. Gregorio and Guidotti (1995) documented that the relationship between finance and growth depends on the sample used, and Rousseau and Wachtel (2011) showed that the positive impact of finance on growth disappears when more recent data were included in the sample. To the best of our knowledge, the first mention of the "too much finance" results with a graph showing a quadratic relationship between finance and growth was in UNCTAD (2009).[1] The "too much finance" result was then explored in greater detail in Arcand, Berkes and Panizza (2015*a*) and Cecchetti and Kharroubi (2012), both originally circulated in 2012.

Why Revisit "Too Much Finance" Now? More than a decade has passed since the publication of the original "too much finance" findings, and the financial landscape has changed in important ways. First, the post-2008 regulatory environment differs substantially from the period studied in earlier work. Basel III implementation has imposed significantly higher capital and liquidity requirements on banks, fundamentally altering the risk profile of traditional financial intermediaries. Macroprudential frameworks have been strengthened globally, with most advanced economies now having in place counter-cyclical capital buffers and borrower-based measures (e.g., loan-to-value and debt-to-income limits) to reduce the effects of credit cycles.

Second, the structure of financial intermediation itself has deeply changed. The rise of FinTech, the expansion of shadow banking, and the growing role of venture capital and private equity have reduced the economy's reliance on traditional bank lending in many contexts. These shifts raise questions about whether historical measures of financial depth, typically based on bank credit to the private sector and stock market turnover, still capture the relevant dimensions of financial development, and whether the mechanisms linking finance to growth have themselves changed.

Third, the macroeconomic environment of the 2010s differed markedly from earlier decades. A prolonged period of near-zero interest rates, large-scale asset purchases, and compressed risk premia altered both the supply of credit and the allocation of financing across sectors. Since 2022, however, as a consequence of high post-pandemic inflation rates, monetary policy in many advanced economies has rapidly shifted toward restraint, with steep increases in policy rates and a shift toward quantitative tightening. This swift shift has exposed new vulnerabilities of the financial system, clearly visible in episodes like the March 2023 banking turmoil in the United States and Switzerland.

[1] Figure 3.1 (p. 90) of the 2009 Trade and Development Report in turn cites an unpublished working paper by Panizza (2009)

These recent developments make a re-examination of the finance-growth relationship both timely and necessary, particularly at a moment when there are strong pressures toward financial deregulation in the United States — the country that sits at the centre of the global financial system and that triggered the global financial crisis. This is especially pertinent given the sweeping policy agenda of the second Trump administration, which includes significant financial liberalization (for a discussion of its broader economic consequences, see Gensler et al., 2025). Nearly a decade of new data, combined with substantial changes in the financial sector and macroeconomic environment, offers an opportunity to assess whether the patterns documented in earlier work remain stable or have changed. By estimating the relationship using all available sample windows rather than a single specific period, we can evaluate the robustness of previous findings, identify potential structural breaks, and better distinguish persistent long-run patterns from period-specific dynamics.

Related Literature The publication of Arcand, Berkes and Panizza (2015*a*) helped shift the finance-growth literature from a predominantly linear view toward the possibility of non-monotonicity, stimulating a substantial body of follow-up work. A parallel contribution by Cecchetti and Kharroubi (2012) reached similar conclusions reinforcing the idea that financial deepening may entail diminishing, and sometimes negative, returns for growth. These studies sparked an active empirical debate focused on whether the inverted-U relationship reflects a genuine feature of the data or the result of specification and identification challenges.

A number of papers examined the empirical robustness of this pattern. Law and Singh (2014) provided early supportive evidence using dynamic panel threshold regressions with endogenous turning points. However, the "too much finance" findings also prompted methodological critiques. Cline (2015*b*) argued that quadratic specifications may spuriously generate inverted-U patterns due to convergence dynamics, and Cline (2015*a*) showed that the negative marginal effects weaken or disappear under alternative variable definitions and estimation choices. Fajeau (2021) raised further concerns about weak instruments and overfitting in GMM settings.

Arcand, Berkes and Panizza (2015*b*) responded by demonstrating that non-parametric and semi-parametric approaches impose minimal assumptions and continue to reject monotonicity in favor of an inverted-U shape. Panizza (2018) summarizes this debate and concludes that, despite specification concerns, the evidence remains consistent with a non-linear relationship between finance and growth. More recently, Cho, Desbordes and Eberhardt (2022) applied a heterogeneous difference-in-differences framework and found no evidence of negative marginal effects at very high levels of financial development.

As the empirical discussion matured, research increasingly focused on exploring possible mechanisms underlying these non-linearities. Arcand, Berkes and Panizza (2013) provide a theoretical rationale by showing how bailout expectations and credit rationing can induce excessive financial sector size. Several recent empirical studies identify additional channels. Zhu, Asimakopoulos and Kim (2020) show that rapid financial expansion can undermine innovation-led growth by diverting resources toward less productivity-enhancing activities. Zhu (2023) document declining market dynamism and higher concentration at high levels of financial development. Castro and Fisera (2022) find that excessive financial depth prolongs post-recession recoveries, particularly in countries with weaker regulatory frameworks. Zeng et al. (2022) show that beyond a threshold, financial development reduces participation in global value chains by reallocating resources toward outward investments.

The remainder of the paper is organized as follows. Section 2 describes our empirical approach. Section 2.2 presents cross-sectional results. Section 2.3 turns to panel specifications. Section 3 concludes by discussing the implications of our findings for policy and identifying directions for future research.

2 Empirical Analysis

2.1 Data

We extend the analysis of Arcand, Berkes and Panizza (2015*a*) using data through 2019, thus excluding the COVID-19 period. Our dependent variable is the average annual growth rate of real GDP per capita at different time horizons. We measure financial depth as credit to the private sector as a share of GDP. Following Arcand, Berkes and Panizza (2015*a*), we include the same set of control variables as Beck and Levine (2004): government consumption

Table 1: **Summary Statistics**

This table reports summary statistics for the variables used in the paper. Data are from the World Bank's World Development Indicators with the exception of years of education, which are sourced from Barro and Lee (2010). GDP growth and inflation are Winsorized at 1%

	N. Obs	Mean	Std. dev.	Min	Max
Average Growth (10 years) %	4,211	1.63	2.35	-5.68	8.24
Average Growth (20 years) %	2,949	1.63	1.89	-3.08	7.65
Average Growth (30 years) %	1,864	1.50	1.61	-2.21	7.55
Credit to Private Sector/GDP %	4,211	41	40	1.00	305
ln(Credit to Private Sector/GDP)	4,211	3.29	0.97	0.00	5.71
ln(Government Consumption/GDP)	4,211	2.64	0.41	0.00	4.33
ln(Years of Education)	4,211	1.67	0.70	0.00	2.61
ln(Inflation)	4,211	1.84	1.16	0.00	5.20
ln(Openness)	4,211	4.13	0.60	1.84	6.09

(to measure the size of the public sector), years of education (to capture human capital), inflation, and trade openness. All control variables are measured at the beginning of the period.

All variables are sourced from the World Bank's World Development Indicators, with the exception of educational attainment, which comes from the dataset constructed by Barro and Lee (2010). Table 1 reports summary statistics for all variables used in the analysis. Our unbalanced panel includes up to 130 countries in the regressions that focus on 10-year growth spells, 109 countries for the regression with 20-year growth spells, and 80 countries for 30-year growth spells.

2.2 Cross-country results

We begin our empirical analysis with long-horizon cross-country regressions to assess whether the non-linear finance–growth relationship is stable across alternative sample windows. Specifically, we run a set of cross-country regressions in which the dependent variable is average annual GDP per capita growth over either 20- or 30-year periods. We estimate specifications both with and without a quadratic term for our measure of financial depth. For each specification and growth spell length, we systematically vary the starting year to assess the stability of the relationship across different time windows. Formally, we estimate the following two models:

$$GR_{i,t/t+n} = \alpha + \beta y_{i,t} + \delta PC_{i,t} + X_{i,t}\Gamma + \epsilon_{i,t} \tag{1}$$

$$GR_{i,t/t+n} = \alpha + \beta y_{i,t} + \delta_1 PC_{i,t} + \delta_2 PC_{i,t}^2 + X_{i,t}\Gamma + \epsilon_{i,t} \tag{2}$$

where $GR_{i,t,t+n}$ is the average annual growth rate of real GDP per capita for country i between year t and year $t+n$ (with n equal to 20 or 30); $y_{i,t}$ is the log of initial GDP per capita; $PC_{i,t}$ is credit to the private sector as a percentage of GDP at the beginning of the period; $PC_{i,t}^2$ is the square of private credit; and $X_{i,t}$ is a matrix of control variables which includes the log of average years of education, the log of government consumption as a share of GDP, the log of trade openness, and log of inflation, all measured at the beginning of the growth spell. The variables of interest are $PC_{i,t}$ and $PC_{i,t}^2$.[2]

For 20-year growth spells spanning 1970–2019, there are 30 possible starting years (1970 through 2000), yielding 90 regressions across our three specifications (Equation 1 with private credit in levels, Equation 1 with private credit in logs, and Equation 2).[3] For expositional purposes, we report full regression results only for the first and last growth spells in Table 2 and present coefficient plots in Figure 1 together with the relevant confidence intervals. These plots show how the estimated effect of financial depth on long-term growth varies when we change the estimation window.

Column 1 of Table 2 shows that for the 1970–1989 period, there is a significant positive association between credit to the private sector and subsequent growth. Column 2 shows this result holds when using the log of credit to the private sector. Column 3, however, suggests the relationship is non-monotonic: growth is maximized when credit to the private sector reaches 72% of GDP.[4] The Lind and Mehlum (2010) test rejects the null hypothesis of a monotonic relationship ($p = 0.026$).

[2] Note that $PC_{i,t}$ is either the level of private credit to GDP or its logarithm, depending on the specification. $PC_{i,t}^2$ is always the level.

[3] For 30-year spells, there are 30 possible starting years (1960 through 1990), yielding 90 regressions.

[4] In 1970, credit to the private sector ranged between 2.4% and 106% of GDP across countries in our sample.

Table 2: **Cross-sectional Regressions: 20-year Growth Spells**

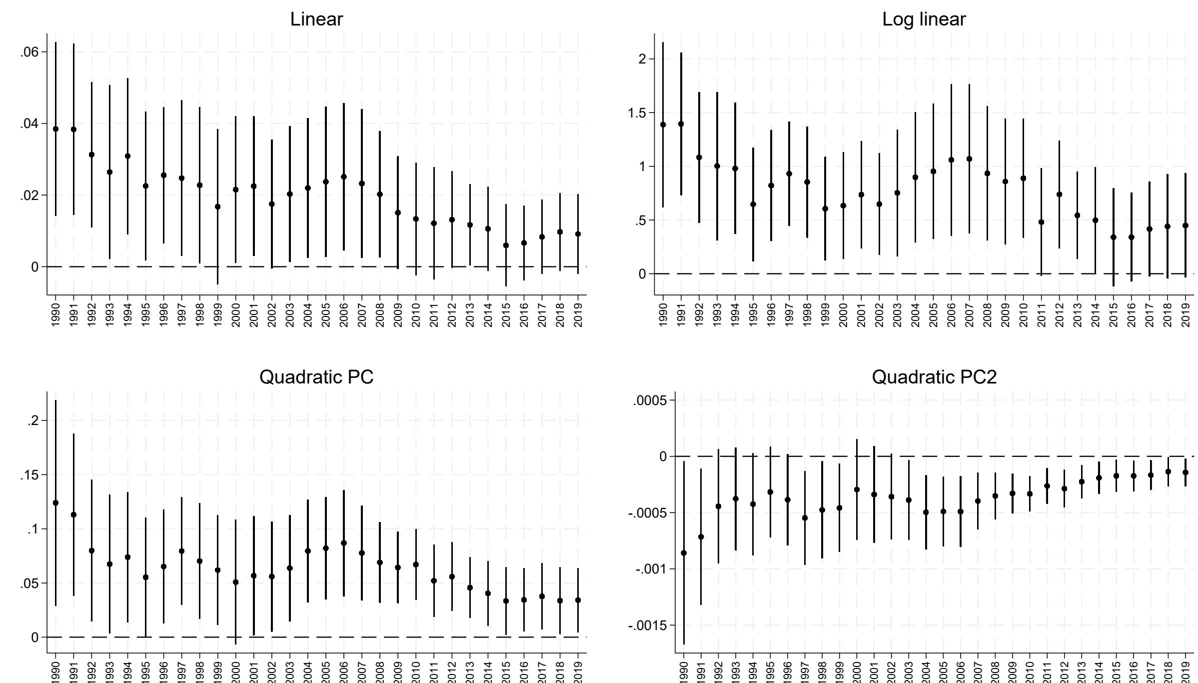
This table reports the results obtained from estimating Equations 1 and 2 using 20-year growth spells for the first possible period (1970–1989 columns 1–3) and the last possible period (2000–2019, columns 4–6). Columns 1 and 4 use the level of credit to the private sector over GDP; columns 2 and 5 use the log of credit to the private sector over GDP; and columns 3 and 6 use both the level and its square (in these columns, the estimated coefficients for PC and PC^2 and are multiplied by 100 for readability). The last two rows of the table report the level financial depth that maximizes growth in the quadratic equations and the p-value of the Lind and Mehlum (2010) test for the presence of a quadratic relationship.

	(1)	(2)	(3)	(4)	(5)	(6)
$y_{i,t}$	-0.870**	-0.960***	-0.971***	-0.855***	-0.894***	-0.937***
	(0.336)	(0.335)	(0.341)	(0.209)	(0.208)	(0.211)
$PC_{i,t}$	0.0385***			0.00913		
	(0.0121)			(0.00561)		
$\ln(PC_{i,t})$		1.388***			0.449*	
		(0.384)			(0.244)	
$PC_{i,t}/100$			12.4**			3.42**
			(4.73)			(1.49)
$PC^2_{i,t}/100$			-0.086**			-0.0142**
			(0.041)			(0.006)
$\ln(GC_{i,t})$	0.959	0.795	0.893	-1.031**	-1.109**	-1.111**
	(0.745)	(0.710)	(0.727)	(0.481)	(0.457)	(0.474)
$\ln(EDU_{i,t})$	1.049*	1.059*	1.061*	1.804***	1.754***	1.787***
	(0.564)	(0.543)	(0.547)	(0.467)	(0.461)	(0.462)
$\ln(INFL_{i,t})$	0.288	0.0766	0.118	0.0983	0.0879	0.128
	(0.378)	(0.357)	(0.355)	(0.190)	(0.188)	(0.191)
$\ln(OPEN_{i,t})$	0.181	0.00799	-0.0442	0.156	0.0961	0.0103
	(0.498)	(0.451)	(0.425)	(0.270)	(0.266)	(0.267)
Constant	2.813	1.771	3.656	7.488***	7.291***	8.430***
	(2.528)	(2.414)	(2.595)	(1.796)	(1.710)	(1.789)
N. Obs	65	65	65	104	104	104
R2	0.190	0.243	0.246	0.339	0.347	0.367
Period	1970–89	1970–89	1970–89	2000–2019	2000–2019	2000–2019
Extreme			72.22			120.04
LM p-value			0.026			0.012

Robust standard errors in parentheses; ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

Figure 1: **Cross Section: 20-year Growth Spells**

This figure reports the results obtained by estimating Equations 1 and 2 for all possible 20-year growth spells. The year displayed on the horizontal axis corresponds to the end of the growth spell (for example, 1990 refers to the 1971–1990 growth spell and matches columns 1–3 of Table 2). The top-left panel reports the coefficient on the level of credit to the private sector over GDP (corresponding to the regressions in columns 1 and 4 of Table 2). The top-right panel reports the coefficient on the log of credit to the private sector over GDP (corresponding to columns 2 and 5 of Table 2). The bottom panels report the coefficients on the level (bottom left) and on the square (bottom right) of credit to the private sector over GDP from regressions that include both terms (corresponding to columns 3 and 6 of Table 2). The dots show the point estimates, and the spikes represent the 95% confidence intervals.



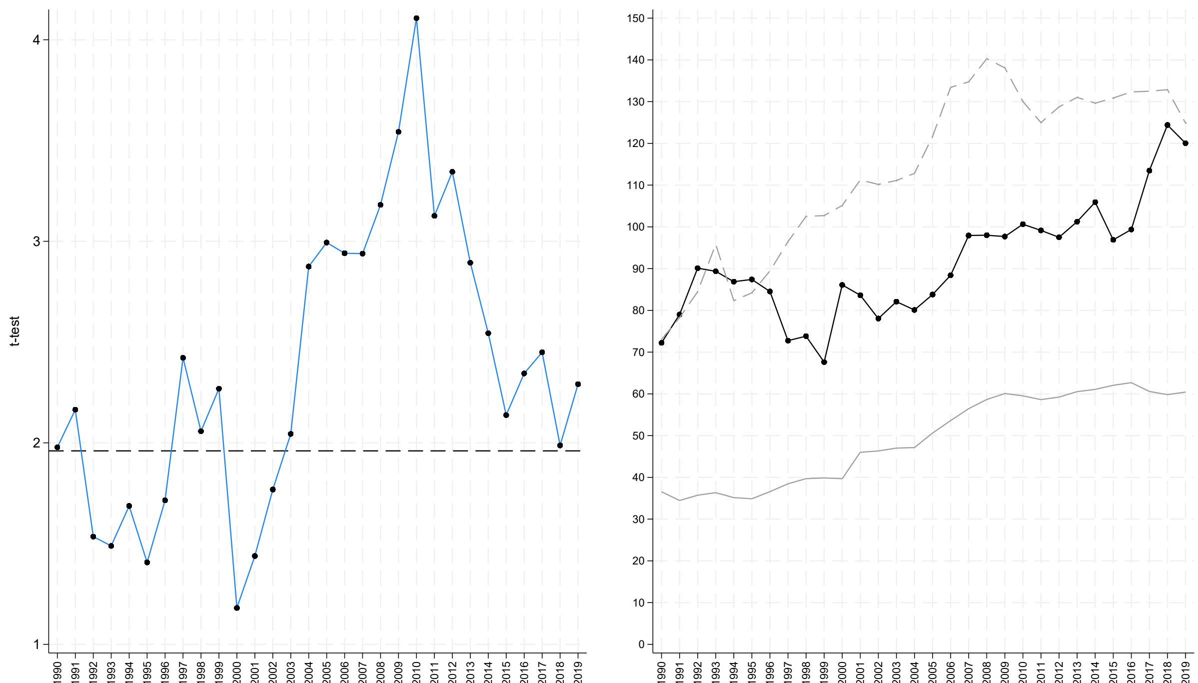
When we move to the most recent estimation period (2000–2019), the relationship between the level of credit to the private sector and future growth is no longer statistically significant (column 4 of Table 2), and the log of financial depth is only marginally significant at the 10% level, with a point estimate roughly one-third that of the 1970–1989 period (column 5). The quadratic relationship, by contrast, remains highly significant, with a turning point at 120% of GDP.[5] The Lind and Mehlum (2010) test again rejects monotonicity with a p-value of 0.012.

The top-left panel of Figure 1 shows that the coefficient on PC in the linear specifica-

[5]In 1999, credit to the private sector ranged between 3.2% and 187% of GDP.

Figure 2: **Lind and Mehlum test and turning point: 20-year Growth Spells**

The left panel of this figure reports the Lind and Mehlum (2010) test for the 20-year growth spell ending in the year shown on the horizontal axis (for example, 1990 corresponds to the 1971–1990 growth spell). In the right panel, the dotted black line shows the level of financial depth that maximizes the relationship between financial depth and growth in the regression for the growth spell ending in the year on the horizontal axis; the solid gray line shows the average value of credit to the private sector at the beginning of the growth spell (thus, the 1990 point reflects the value in 1971); and the dashed gray line shows the 90th percentile of its distribution at the beginning of the growth spell.



tion declines rapidly for growth spells ending between 1980 and 1990, becoming statistically insignificant for spells ending after 2008. The specification using log financial depth shows a similar pattern, although the coefficient remains significant at the 5% level for all growth spells ending before 2015 (top-right panel). The bottom panels show that in the quadratic specification, the linear coefficient is consistently positive and almost always statistically significant, whereas the quadratic coefficient is consistently negative and almost always significant.

The left panel of Figure 2 shows that for all growth spells ending after 2002, we reject the null of a monotonic relationship at a 5% level. The right panel indicates that the estimated turning point ranges between 70% and 120% of GDP and always lies below the 90th percentile of the financial depth distribution.

We now turn our cross-sectional analysis to 30-year growth spells. Table 3 reports detailed results for the first and last possible growth spells, while Figures 3 and 4 present coefficient estimates and confidence intervals across all possible time windows.

The results for 30-year growth spells broadly confirm the 20-year findings but with two notable differences. First, the coefficient on log credit to the private sector declines over time—especially when moving from growth spells ending around 2000 to those ending after 2005—but remains statistically significant at the 5% level across all specifications (top-right panel of Figure 3 and column 5 of Table 3). This contrasts with the 20-year results, where the coefficient becomes insignificant for recent periods. Second, the estimated turning point is substantially lower in the 30-year specifications than in the 20-year specifications, ranging between approximately 50% and 80% of GDP rather than 70% to 120% (compare right panels of Figures 2 and 4).

2.3 Panel Data

We next turn to panel estimations to examine whether the same patterns emerge once unobserved country heterogeneity and common time shocks are accounted for. These panel specifications are based on 10- and 20-year growth spells and use the same control variables as the cross-sectional models but add country and year fixed effects to account for unobserved heterogeneity and common time shocks.

Rather than relying on non-overlapping panels with arbitrary starting years, for our analysis we consider overlapping panels and correct for serial correlation in the error term using Driscoll and Kraay (1998) standard errors, setting the maximum autocorrelation lag to 20.

We estimate the regression model on an expanding window that always begins in 1960. The first 10-year spell is 1960–1969, and the first 20-year spell is 1960–1979. For 10-year regressions, the shortest estimation window includes all growth spells from 1960–1969 through 1991–2000, while the longest includes all spells from 1960–1969 through 2010–2019. For 20-year regressions, the shortest window spans 1960–1979 through 1980-1999, and the longest spans 1960–1979 through 2000–2019. This design allows us to examine how the estimated

Table 3: **Cross-sectional Regressions: 30-year growth spells**

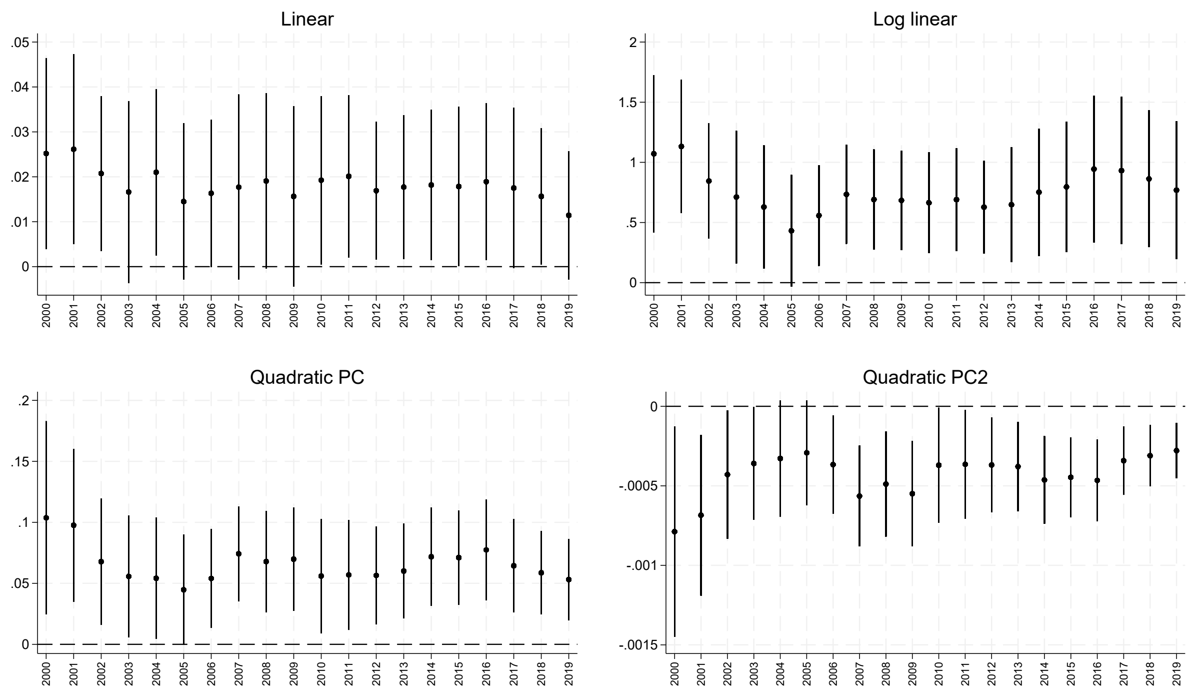
This table reports the results obtained from estimating Equations 1 and 2 using 30-year growth spells for the first possible period (1970–1999, columns 1–3) and the last possible period (1990–2019, columns 4–6). Columns 1 and 4 use the level of credit to the private sector over GDP; columns 2 and 5 use the log of credit to the private sector over GDP; and columns 3 and 6 use both the level and its square (in these columns, the estimated coefficients for PC and PC^2 and are multiplied by 100 for readability). The last two rows of the table report the level financial depth that maximizes growth in the quadratic equations and the p-value of the Lind and Mehlum (2010) test for the presence of a quadratic relationship.

	(1)	(2)	(3)	(4)	(5)	(6)
$y_{i,t}$	-0.835***	-0.941***	-0.927***	-0.686**	-0.764***	-0.743***
	(0.265)	(0.262)	(0.265)	(0.269)	(0.246)	(0.240)
$PC_{i,t}$	0.0252**			0.0114		
	(0.0106)			(0.00713)		
$\ln(PC_{i,t})$		1.071***			0.769***	
		(0.326)			(0.287)	
$PC_{i,t}/100$			0.104**			0.0531***
			(0.0395)			(0.0167)
$PC^2_{i,t}/100$			-0.0788**			-0.0279***
			(0.0330)			(0.0087)
$\ln(GC_{i,t})$	0.965	0.872	0.905	-0.965***	-1.002***	-1.059***
	(0.632)	(0.600)	(0.610)	(0.333)	(0.332)	(0.320)
$\ln(EDU_{i,t})$	1.318***	1.319***	1.329***	1.489***	1.321***	1.347***
	(0.417)	(0.391)	(0.393)	(0.445)	(0.398)	(0.381)
$\ln(INFL_{i,t})$	0.383	0.215	0.227	0.103	0.156	0.101
	(0.315)	(0.299)	(0.295)	(0.108)	(0.116)	(0.109)
$\ln(OPEN_{i,t})$	0.136	0.0102	-0.0706	0.250	0.191	0.0472
	(0.425)	(0.375)	(0.345)	(0.262)	(0.256)	(0.257)
Constant	2.603	1.885	3.377*	5.831***	4.845***	6.704***
	(1.975)	(1.801)	(1.969)	(1.813)	(1.586)	(1.718)
N. Obs	65	65	65	80	80	80
R2	0.279	0.344	0.346	0.323	0.384	0.418
Extreme			65.08			95.26
LM p-value			0.012			0.001

Robust standard errors in parentheses; $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

Figure 3: **Cross Section: 30-year Growth Spells**

This figure reports the results obtained by estimating Equations 1 and 2 for all possible 30-year growth spells. The year displayed on the horizontal axis corresponds to the end of the growth spell (for example, 2000 refers to the 1971–2000 growth spell and matches columns 1–3 of Table 3). The top-left panel reports the coefficient on the level of credit to the private sector over GDP (corresponding to the regressions in columns 1 and 4 of Table 3). The top-right panel reports the coefficient on the log of credit to the private sector over GDP (corresponding to columns 2 and 5 of Table 3). The bottom panels report the coefficients on the level (bottom left) and on the square (bottom right) of credit to the private sector over GDP from regressions that include both terms (corresponding to columns 3 and 6 of Table 3). The dots show the point estimates, and the whiskers represent the 95% confidence intervals.

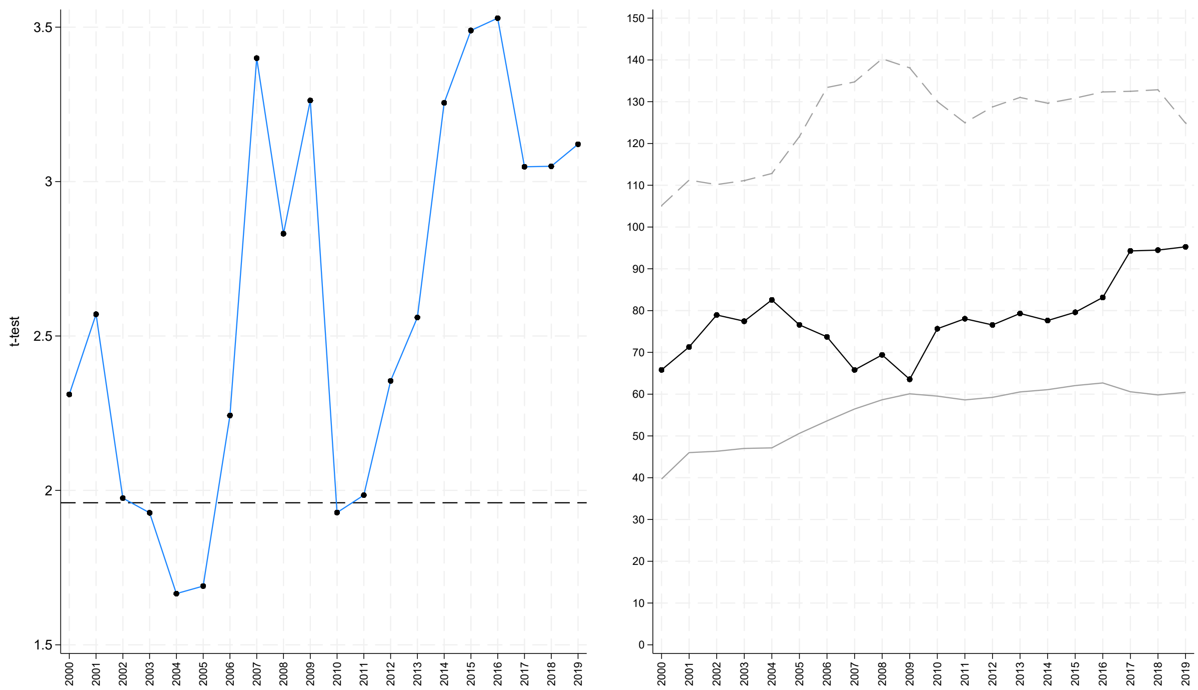


relationship evolves as more recent data are incorporated.

We estimate standard fixed-effects models rather than the dynamic panel estimators proposed by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). Although this choice entails a potential cost—standard fixed effects suffer from Nickell (1981) bias when the lagged dependent variable is included—here, we prioritize transparency by avoiding the arbitrary instrument selection decisions required in GMM estimations.

Figure 4: **Lind and Mehlum test and turning point: 30-year Growth Spells**

The left panel of this figure reports the Lind and Mehlum (2010) test for the 30-year growth spell ending in the year shown on the horizontal axis (for example, 2000 corresponds to the 1971–2000 growth spell). In the right panel, the dotted black line shows the level of financial depth that maximizes the relationship between financial depth and growth in the regression for the growth spell ending in the year on the horizontal axis; the solid gray line shows the average value of credit to the private sector at the beginning of the growth spell (thus, the 2000 point reflects the value in 1971); and the dashed gray line shows the 90th percentile of its distribution at the beginning of the growth spell.



Formally, we estimate the following models:

$$GR_{i,t/t+n} = \beta y_{i,t} + \delta PC_{i,t} + X_{i,t}\Gamma + \alpha_i + \tau_t + \epsilon_{i,t} \tag{3}$$

$$GR_{i,t/t+n} = \beta y_{i,t} + \delta_1 PC_{i,t} + \delta_2 PC^2_{i,t} + X_{i,t}\Gamma + \alpha_i + \tau_t + \epsilon_{i,t} \tag{4}$$

where all variables are defined as in Equations 1 and 2, and α_i and τ_t denote country and year fixed effects, respectively.

As with the cross-sectional results, we report full regression output only for the shortest and longest estimation windows. Tables 4 and 5 present results for 10-year (Table 4) and 20-year growth spells (Table 5), respectively. The regression estimates for the early sample period show a positive and statistically significant relationship between financial depth and 10-year GDP growth (columns 1 and 2 of Table 4). There is no evidence of a quadratic relationship: the quadratic term is negative but statistically insignificant, and the Lind and Mehlum (2010) test fails to reject the null of monotonicity ($p = 0.38$).

The pattern changes drastically when post-2000 data are included. In the long sample, the coefficient on financial depth—whether measured in levels or logs—becomes statistically insignificant (columns 4 and 5 of Table 4). By contrast, the quadratic specification becomes statistically significant, with an implied turning point at 94% of GDP. The Lind and Mehlum (2010) test now rejects monotonicity ($p = 0.029$).

The top-left panel of Figure 5 shows that the coefficient on the level of financial depth becomes insignificant once growth spells ending after 2009 are included, converging toward zero in the full sample. The top-right panel shows that the log specification rarely yields statistically significant coefficients. The bottom panels indicate that the quadratic relationship becomes statistically significant when spells ending after 2003 are incorporated, a finding corroborated by the Lind and Mehlum (2010) test (available upon request). Once growth spells ending after 2005 are included, we find that the level of financial depth that maximizes growth consistently lies below the 90th percentile of the distribution.

We find qualitatively similar results when using 20-year growth spells. The coefficient on the level of financial depth in the linear specification is consistently positive and statistically significant (columns 1 and 4 of Table 5 and top-left panel of Figure 6), although it declines in magnitude as more recent periods are included. By contrast, the coefficient on log financial depth is insignificant in the early sample but becomes larger and statistically significant when growth spells ending after 2014 are incorporated (columns 2 and 5 of Table 5 and top-right panel of Figure 6).

The quadratic relationship, instead, is not statistically significant at the 5% level when the sample is restricted to growth spells ending before 2007 (column 3 of Table 5). However, it becomes statistically significant once recent data are included (column 6 of Table 5). The Lind and Mehlum (2010) test confirms this pattern, rejecting monotonicity for all samples incorporating spells ending after 2007. The estimated turning point ranges between 90% and 120% of GDP.

Table 4: **Panel data: 10-year growth spells**

This table reports the results obtained from estimating Equations 3 and 4 using 10-year growth spells. Estimations always start in 1960–69 and ends in 1991–2000 in columns 1–3 and in 2010–2019 in columns 4–6. Columns 1 and 4 use the level of credit to the private sector over GDP; columns 2 and 5 use the log of credit to the private sector over GDP; and columns 3 and 6 use both the level and its square (in these columns, the estimated coefficients for PC and PC^2 and are multiplied by 100 for readability). The last two rows of the table report the level financial depth that maximizes growth in the quadratic equations and the p-value of the Lind and Mehlum (2010) test for the presence of a quadratic relationship. All estimations use Driscoll and Kraay (1998) standard errors with maximum autocorrelation lag set to 20.

	(1)	(2)	(3)	(4)	(5)	(6)
$y_{i,t}$	-5.139***	-4.871***	-5.097***	-3.812***	-3.846***	-3.873***
	(0.552)	(0.589)	(0.551)	(0.628)	(0.572)	(0.592)
$PC_{i,t}$	0.0280***			0.00114		
	(0.00314)		(0.0137)	(0.00446)		(0.00945)
$\ln(PC_{i,t})$		0.329*			0.152	
		(0.180)			(0.110)	
$PC_{i,t}/100$			3.74**			1.83*
			(1.37)			(0.94)
$PC^2_{i,t}/100$			-0.009			-0.010**
			(0.011)			(0.004)
$\ln(GC_{i,t})$	-0.854***	-0.825***	-0.845***	-0.225	-0.248	-0.234
	(0.203)	(0.203)	(0.205)	(0.345)	(0.342)	(0.342)
$\ln(EDU_{i,t})$	-0.850***	-1.091***	-0.886***	-0.843***	-0.797***	-0.834***
	(0.0972)	(0.0863)	(0.104)	(0.178)	(0.196)	(0.171)
$\ln(INFL_{i,t})$	-0.0674	-0.0900	-0.0643	-0.0869**	-0.0796**	-0.0771**
	(0.0673)	(0.0778)	(0.0733)	(0.0331)	(0.0363)	(0.0333)
$\ln(OPEN_{i,t})$	1.071***	0.999***	1.023***	1.017***	0.970***	0.948***
	(0.144)	(0.161)	(0.150)	(0.213)	(0.174)	(0.186)
Constant	41.58***	39.97***	41.32***	28.79***	28.87***	29.29***
	(4.482)	(4.706)	(4.496)	(4.862)	(4.505)	(4.638)
N. Obs.	2,048	2,048	2,048	4,165	4,165	4,165
N. of Countries	88	88	88	130	130	130
Last growth spell	1991-2000	1991–2000	1991–2000	2010–2019	2010–2019	2010–2019
Extreme			209.5			93.74
LM p-value			0.38			0.029
Country FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓

Driscoll and Kraay (1998) standard errors in parentheses; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 5: **Panel data: 20-year growth spells**

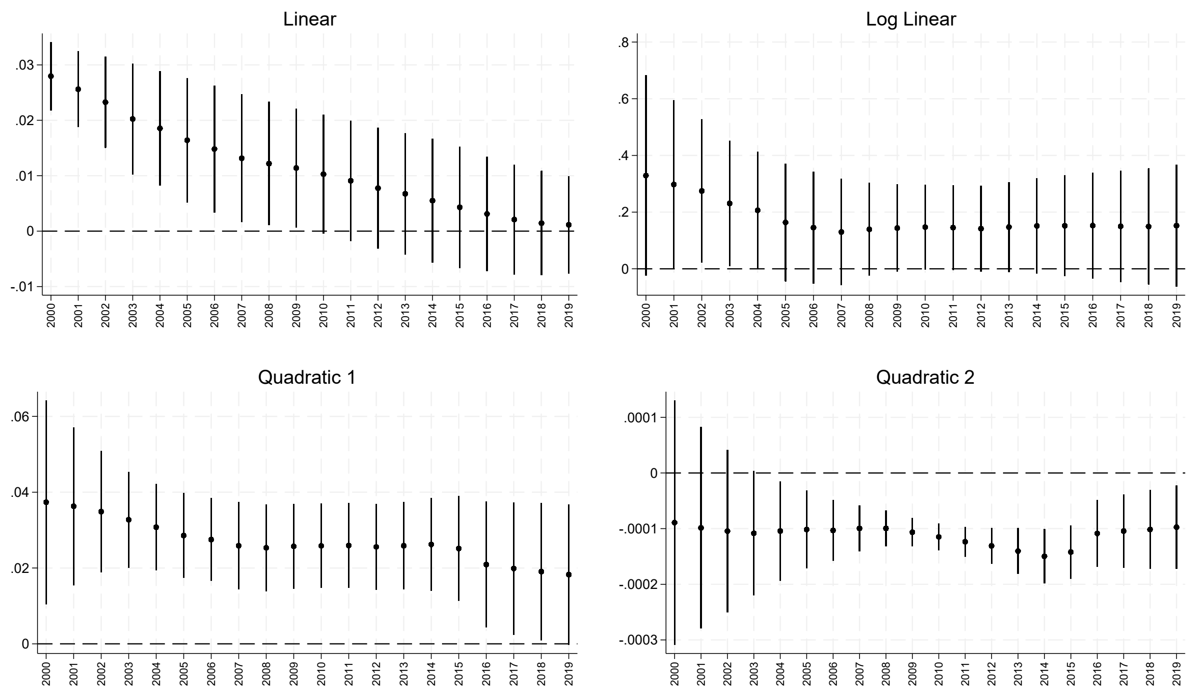
This table reports the results obtained from estimating Equations 3 and 4 using 20-year growth spells. Estimations always start in 1960–79 and ends in 1981–2000 in columns 1–3 and in 2000–2019 in columns 4-6. Columns 1 and 4 use the level of credit to the private sector over GDP; columns 2 and 5 use the log of credit to the private sector over GDP; and columns 3 and 6 use both the level and its square (in these columns, the estimated coefficients for PC and PC^2 and are multiplied by 100 for readability). The last two rows of the table report the level financial depth that maximizes growth in the quadratic equations and the p-value of the Lind and Mehlum (2010) test for the presence of a quadratic relationship. All estimations use Driscoll and Kraay (1998) standard errors with maximum autocorrelation lag set to 20.

	(1)	(2)	(3)	(4)	(5)	(6)
$y_{i,t}$	-3.592***	-3.500***	-3.577***	-3.486***	-3.417***	-3.447***
	(0.042)	(0.062)	(0.043)	(0.148)	(0.166)	(0.139)
$PC_{i,t}$	0.011***			0.0067**		
	(0.0018)			(0.0027)		
$ln(PC_{i,t})$		0.0182			0.210**	
		(0.0291)			(0.0875)	
$PC_{i,t}/100$			1.48***			2.24***
			(0.327)			(0.510)
$PC^2_{i,t}/100$			-0.006*			-0.012***
			(0.003)			(0.002)
$ln(GC_{i,t})$	-0.224***	-0.238***	-0.221***	-0.317**	-0.330**	-0.320**
	(0.073)	(0.080)	(0.071)	(0.142)	(0.144)	(0.138)
$ln(EDU_{i,t})$	0.161	0.0647	0.157	-0.340***	-0.374***	-0.369***
	(0.211)	(0.203)	(0.211)	(0.054)	(0.055)	(0.041)
$ln(INFL_{i,t})$	-0.0045	-0.0075	-0.004	0.094***	0.102***	0.107***
	(0.015)	(0.016)	(0.015)	(0.0088)	(0.0089)	(0.0076)
$ln(OPEN_{i,t})$	0.292***	0.342***	0.279***	0.493***	0.419***	0.408***
	(0.041)	(0.048)	(0.043)	(0.127)	(0.094)	(0.119)
Constant	28.80***	28.27***	28.68***	29.66***	29.08***	29.48***
	(0.363)	(0.484)	(0.354)	(1.354)	(1.492)	(1.289)
N. Obs.	1,241	1,241	1,241	2,938	2,938	2,938
N. of Countries	80	80	80	109	109	109
Last growth spell	1980–1999	1980–1999	1980-1999	2000–2019	2000–2019	2000–2019
Extreme			111.8			94.5
LM p-value			0.088			0.000
Country FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓

Driscoll and Kraay (1998) standard errors in parentheses; $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

Figure 5: **Panel data: 10-year Growth Spells**

This figure reports the results obtained by estimating Equations 3 and 4 for all possible 10-year growth spells. The year displayed on the horizontal axis corresponds to the end of the last growth spell (for example, 2000 refers a panel where the first growth spell in 1960–1969 and the last 1991–2000 and matches columns 1–3 of Table 4). The top-left panel reports the coefficient on the level of credit to the private sector over GDP (corresponding to the regressions in columns 1 and 4 of Table 4). The top-right panel reports the coefficient on the log of credit to the private sector over GDP (corresponding to columns 2 and 5 of Table 4). The bottom panels report the coefficients on the level (bottom left) and on the square (bottom right) of credit to the private sector over GDP from regressions that include both terms (corresponding to columns 3 and 6 of Table 4). The dots show the point estimates, and the spikes represent the 95% confidence intervals.

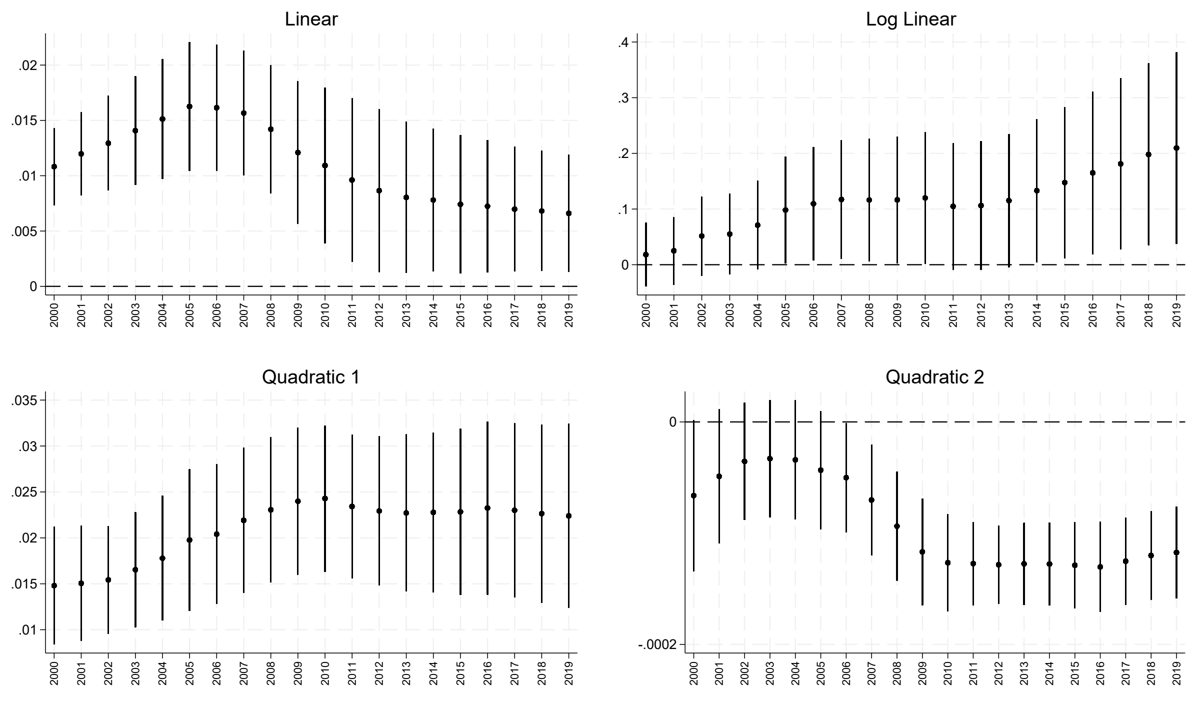


Robustness: Rolling Window Estimation Our baseline panel analyses employ an expanding window approach: the sample always begins in 1960 and progressively incorporates later growth spells. While this design allows us to examine how the relationship evolves as more recent data are added to the panel, it also implies that early observations keep playing a role throughout the empirical analysis, even though the financial landscape has potentially changed importantly between the early and late sample periods. To address this potential concern, we conduct an alternative exercise using a rolling window approach.

With a rolling window approach, we fix the time span of each panel at 30 years and move this window forward through our data. For example, for 10-year growth spells, the first

Figure 6: **Panel data: 20-year Growth Spells**

This figure reports the results obtained by estimating Equations 3 and 4 for all possible 20-year growth spells. The year displayed on the horizontal axis corresponds to the end of the last growth spell (for example, 2000 refers a panel where the first growth spell in 1960–1979 and the last 1981–2000 and matches columns 1–3 of Table 5). The top-left panel reports the coefficient on the level of credit to the private sector over GDP (corresponding to the regressions in columns 1 and 4 of Table 5). The top-right panel reports the coefficient on the log of credit to the private sector over GDP (corresponding to columns 2 and 5 of Table 5. The bottom panels report the coefficients on the level (bottom left) and on the square (bottom right) of credit to the private sector over GDP from regressions that include both terms (corresponding to columns 3 and 6 of Table 5). The dots show the point estimates, and the spikes represent the 95% confidence intervals.



window covers all spells from 1960–1969 through 1980–1989, the second covers spells from 1961–1970 through 1981–1990, and so on. Each window thus contains a 30-year time span, while the beginning of the sample shifts forward. This approach ensures that we compare estimates across windows of identical temporal length.

Figure A1 in the Appendix presents the results for 10-year growth spells. The findings confirm our baseline results. The coefficient on the level of financial depth in the linear specification is positive and significant in windows covering earlier periods, but it declines steadily and becomes insignificant for growth spells ending after 2008. The log-linear specification exhibits a similar pattern. The quadratic specification becomes statistically significant once windows include growth spells ending from 2003 onward, with estimated turning points ranging between 65% and 100% of GDP. However, the Lind and Mehlum (2010) test for the presence of a U-shaped relationship becomes insignificant in windows ending after 2015. This likely reflects a data limitation rather than a weakening of the underlying relationship. Average financial depth and the 90th percentile in the sample lie well above the estimated turning points throughout the period.

Figure A2 presents results for 20-year growth spells, which also confirm our baseline findings. The linear relationship weakens substantially in later windows, becoming insignificant after 2010, while the quadratic term becomes significant, with turning points between 80% and 110% of GDP. Importantly, unlike the 10-year specifications, the Lind and Mehlum (2010) test remains significant throughout the analysis, providing evidence of the inverted-U relationship even in the most recent windows.

3 Conclusion

We re-examine the relationship between financial depth and long-run economic growth using an empirical approach designed to address concerns about sample selection, temporal instability, and methodological sensitivity that have featured prominently in the literature. By estimating all feasible cross-sectional and panel specifications over the period 1960–2019, we assess whether the non-monotonic finance–growth relationship documented in earlier work—most notably the inverted-U pattern in Arcand, Berkes and Panizza (2015*a*)—remains a persistent and economically meaningful feature of the data. Across a wide range of empirical designs, our results confirm that the marginal effect of financial depth on economic growth declines as the financial sector expands and that beyond moderate levels of private credit, additional deepening is associated with weaker, and in many cases lower, future growth.

Cross-country evidence consistently points to diminishing and eventually negative returns to financial deepening. Using both 20- and 30-year growth spells, financial depth is positively associated with growth at low to moderate levels, but this effect weakens and turns negative as credit expands further. The estimated turning points, typically between 70% and 120% of GDP, are remarkably stable across specifications and almost always lie below the 90th percentile of the credit distribution. Importantly, these patterns persist across different starting years and remain visible even when extending the sample nearly a decade beyond earlier studies. The stability of these estimates suggests that the inverted-U shape reflects a structural feature of the finance–growth relationship rather than a sample-specific artifact or the influence of a small number of extreme observations.

The panel-data results, based on overlapping 10- and 20-year growth spells, reinforce this interpretation while shedding light on how the relationship has evolved over time. When growth spells ending before the early 2000s are considered, financial depth exhibits a positive linear association with growth and limited evidence of non-linearities. However, once post-2000 data are incorporated—capturing a period marked by rapid financial innovation, the expansion of shadow banking, low interest rates, and the gradual tightening of macroprudential frameworks—the picture changes. The linear effect of private credit becomes statistically insignificant or economically small, while the quadratic specification becomes consistently significant, with turning points well within the range observed in most financially developed economies.

This temporal shift is particularly revealing. It indicates that the diminishing returns to financial depth may have become more pronounced as financial systems have evolved. The transformation of global finance since the early 2000s, characterized by greater interconnectedness, increased leverage outside the traditional banking sector, and increased exposure to global financial cycles, may have amplified the mechanisms that generate excessive credit expansion, misallocation, and volatility. The weak and statistically insignificant linear effects of financial depth in recent decades, combined with the strong evidence of non-linearities, indicate that the marginal contribution of traditional measures of financial deepening to real economic activity has declined substantially.

Taken together, these findings have important policy implications. First, they underscore that financial development should not be equated with unconditional financial deepening. Although a certain level of credit availability is necessary to support investment, innovation, and structural transformation, expanding financial markets and intermediaries beyond this level provides limited growth benefits and can produce adverse effects through increased fragility, resource misallocation, and the diversion of talent and capital toward low-productivity financial activities. Second, the results suggest that macroprudential regulation plays a critical role in ensuring that financial deepening remains supportive of economic growth. Strengthened supervisory frameworks, countercyclical capital buffers, and oversight of non-bank intermediaries can help mitigate the risks associated with excessive financial depth. Third, the robustness of the inverted-U pattern across specifications and time periods implies that financial policy should focus not only on the quantity of credit, but also on its composition, allocation, and systemic footprint.

Finally, the paper highlights several directions for future research. More work is needed to better identify the mechanisms through which excessive financial depth reduces growth, particularly in environments characterized by rapid technological change and the proliferation of new forms of intermediation. The role of shadow banking, the interaction between financial depth and market concentration, the consequences of prolonged monetary easing, and the impact of cross-border financial integration warrant empirical and theoretical work. Additionally, future work could explore how institutional quality, regulatory capacity, and financial structure shape the strength of the finance–growth relationship, and how these factors affect the location and steepness of the non-linearities documented here.

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A Rolling Window Estimation

Figure A1: **Panel data: 10-year Growth Spells — Rolling Window**

This figure reports the results obtained by estimating Equations 3 and 4 for all possible 10-year growth spells with a fixed sample window of 30 years. The year displayed on the horizontal axis corresponds to the end of the last growth spell (for example, 2000 refers a panel where the first growth spell in 1960–1969 and the last 1991–2000). The top-left panel reports the coefficient on the level of credit to the private sector over GDP. The top-right panel reports the coefficient on the log of credit to the private sector over GDP. The bottom panels report the coefficients on the level (bottom left) and on the square (bottom right) of credit to the private sector over GDP from regressions that include both terms. The dots show the point estimates, and the spikes represent the 95% confidence intervals.

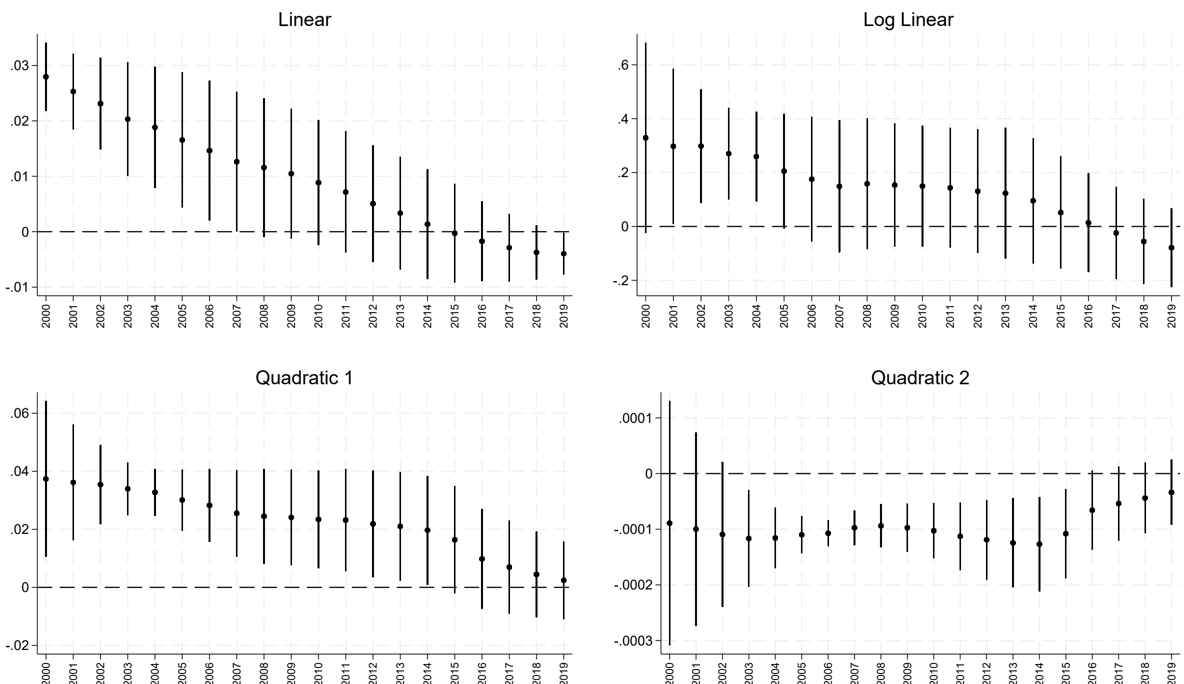

Figure A2: **Panel data: 20-year Growth Spells — Rolling Window**

This figure reports the results obtained by estimating Equations 3 and 4 for all possible 20-year growth spells with a fixed sample window of 30 years. The year displayed on the horizontal axis corresponds to the end of the last growth spell (for example, 2000 refers a panel where the first growth spell in 1960–1979 and the last 1981–2000). The top-left panel reports the coefficient on the level of credit to the private sector over GDP. The top-right panel reports the coefficient on the log of credit to the private sector over GDP. The bottom panels report the coefficients on the level (bottom left) and on the square (bottom right) of credit to the private sector over GDP from regressions that include both terms. The dots show the point estimates, and the spikes represent the 95% confidence intervals.