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THE FINANCE-GROWTH NEXUS IN HIGH AND MIDDLE INCOME ECONOMIES

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Abstract *Despite the abundant literature on the causality between financial development and economic growth; little has been said about the shape of this relationship. In this paper we adopt a nonlinear approach to investigate it in the long run for the G7 and the BRICS economies. We use the Svirydzenka (2016) financial development index which takes into account the depth, the access and the efficiency of both financial markets and financial institutions. The results of the bound testing approach suggest the existing of an inverted U-shaped curve relation in the United States, Japan, Germany, Brazil and Russia which confirms that the "too much finance hypothesis" of Arcand, Berkes and Panizza (2015) not only apply to most high income countries but even to some middle income countries. The U-shaped curve was found in the case of France, the United Kingdom and India. No long run relationship between financial development and economic growth was detected for Italy, Canada, China or South Africa.*

Keywords: Financial development, Economic growth, ARDL.
JEL classification: C13, G00, O40

1. Introduction

It is recognized that an efficient financial system may stimulates economic growth; some authors consider it a crucial determinant (Schumpeter, 1934; Goldsmith, 1969; King and Levine (1993b), while for others it is a factor among others (Robinson, 1952; Lucas, 1988). The channels through which financial development affects economic growth have been discussed by Levine (2005), for whom the financial system's role goes beyond reducing transactions cost. In fact, an efficient financial system is able to successfully manage and diversify risk which in turn improves capital allocation, while its capability of producing reliable information incites investment. However, the idea that financial development plays a positive role in boosting economic growth is not new; it dates back to Bagehot (1873) and

Schumpeter (1911). Later on, the research was carried by Gurley and Shaw (1955), Goldsmith (1969), McKinnon (1973), Shaw (1973) and Fry (1978) among others; and the positive impact of financial development on economic growth was empirically addressed. But it is not until King and Levine (1993a), that the relation was estimated through cross-country regressions. Thus the positive impact of banking system development on physical capital accumulation and economic growth confirmed. For Jayaratne and Strahan (1996) improvements in the quality of bank lending stimulate economic growth. Furthermore Levine and Zervos (1998) Neusser and Kugler 1998; Rousseau and Wachtel (1998); Beck and Levine (2004) affirms that not only banking, but stock market also has a similar impact on economic growth. There is a rich literature on the finance-growth nexus; the relation between these two variables was explored through different estimation methods and multiple proxies for financial development. Harris (1997) with two stages least squares estimation for 49 countries from 1980 to 1991; found a significant impact of the stock market development on economic growth in developed countries. Levine, Loayza and Beck (2000), estimated the effect of private credit on economic growth using the generalized moments method for 74 countries from 1960 to 1995 and found a significant and positive impact. Deidda and Fattouh (2002) with ordinary least square estimation for 119 countries from 1960 to 1989; found a significant impact of financial development on economic growth in developed countries but not in low income economies. Apergis et al. (2007) used panel cointegration test for 101 countries from 1975 to 2000 and found bidirectional causality. On the contrary Caporale et al. (2009) with the generalized moments method estimation technique affirms that the causality is unidirectional and it goes from financial development to economic growth. Laeven et al. (2015) based on data for 56 countries over the period 1960 to 1995, showed that financial innovation is the main driver of economic growth. Research on the non-linearity of the relation between financial development and economic growth was initiated by Greenwood and Jovanovic (1990) who suggested that efficient capital allocation allows a slow economic growth at the early stages of financial development and when income inequality narrows later on, the growth accelerates. Recently, Easterly et al. (2001) found a U-shaped impact of private credit on economic growth volatility. Beck et al. (2014a) affirm that credit expansion affect economic growth up to a threshold. While for Soedarmono et al. (2017) the relation between the two variables is an inverted U-shaped curve.

In this paper we use the autoregressive distributed-lagged model (ARDL) bounding test technique to analyze the shape of the curve which describes the finance-growth nexus in high and middle income economies. To our knowledge this technique was never applied jointly for the G7 and the BRICS countries, which motivates us to fill this gap. We investigate if the "too much finance hypothesis" of Arcand, Berkes and Panizza (2015) only apply to high income countries or is it valid even for middle income countries. The rest of the paper is organized as follows. Section two describes the data and the methodology, while Section three explains the empirical results. The fourth and final section contains the concluding remarks.

2. Data and methodology

The study covers the period 1980-2017, the frequency is annual and the variables are expressed in log. The financial development indicator is from the International Monetary Fund, while the other variables are from the World Bank database. The empirical model is:

$$\ln Y_t = \alpha_1 \ln OP_t + \alpha_2 \ln MV_t + \alpha_3 \ln FD_t + \alpha_4 \ln FD_t^2 + \varepsilon_t \quad (1)$$

Where Y_t is the GDP per capita, OP_t openness to trade, MV_t manufacturing value-added as share of GDP, FD_t the financial development indicator and FD_t^2 is the square of financial development which stands for the non-linear relationship between financial development and economic growth. There is a U-shaped curve relation between financial development and economic growth if $\alpha_3 < 0$ and $\alpha_4 > 0$ or an inverted U-shaped curve if $\alpha_3 > 0$ and $\alpha_4 < 0$.

$$\Delta \ln Y_t = \sum_{i=1}^{n} \alpha_{1,i} \Delta lnY_{t-i} + \sum_{i=0}^{n} \alpha_{2,i} \Delta lnOP_{t-i} + \sum_{i=0}^{n} \alpha_{3,i} \Delta lnMV_{t-i}$$
$$+ \sum_{i=0}^{n} \alpha_{4,i} \Delta lnFD_{t-i} + \sum_{i=0}^{n} \alpha_{5,i} \Delta lnFD_{t-i}^2 + \beta_1 lnY_{t-1} + \beta_2 lnOP_{t-1}$$
$$+ \beta_3 lnMV_{t-1} + \beta_4 lnFD_{t-1} + \beta_5 lnFD_{t-1}^2 + \varepsilon_t \quad (2)$$

Where Δ is the difference operator and n the lag length. The hypothesis of no cointegration $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ is tested against the alternative hypothesis $H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$. In the case of cointegration, the long-run ARDL equation is as follows:

$$\ln Y_t = \sum_{i=1}^{p} \alpha_{1,i}\, \Delta lnY_{t-i} + \sum_{i=0}^{q} \alpha_{2,i} lnOP_{t-i} + \sum_{i=0}^{r} \alpha_{3,i}\, lnMV_{t-i} + \sum_{i=0}^{s} \alpha_{4,i}\, lnFD_{t-i} + \sum_{i=0}^{t} \alpha_{5,i}\, lnFD_{t-i}^2 + \varepsilon_t \quad (3)$$

Where p, q, r, s and t in equation (3) are the optimum lag for the series. The short-run coefficients of the variables are estimated with an error-correction model as follows:

$$\ln Y_t = \sum_{i=1}^{p} \alpha_{1,i}\, \Delta lnY_{t-i} + \sum_{i=0}^{q} \alpha_{2,i} lnOP_{t-i} + \sum_{i=0}^{r} \alpha_{3,i}\, lnMV_{t-i} + \sum_{i=0}^{s} \alpha_{4,i}\, lnFD_{t-i} + \sum_{i=0}^{t} \alpha_{5,i}\, lnFD_{t-i}^2 + \gamma ECM_{t-1} + \varepsilon_t \quad (4)$$

Where γ is the error-correction term and ECM_{t-1} is the speed of adjustment parameter.

3. Empirical results

ARDL model was introduced by Pesaran and al. (2001) and it's useful when variables are integrated in different order as long as it is not I(2) or higher.

Table 1 Unit-Root test for the G7 and the BRICS economies

Var	Level		1st Difference		Level		1st Difference	
	t-stat	prob	t-stat	prob	t-stat	prob	t-stat	prob
	United States				Canada			
LY	-4.888	0.003	-15.255	0.000	-4.628	0.006	-16.192	0.000
LOP	-3.392	0.068	-6.044	0.000	-1.341	0.862	-4.276	0.009
LMV	-1.531	0.783	-4.611	0.009	-1.823	0.651	-1.802	0.069
LFD	-2.105	0.526	-5.290	0.001	-1.137	0.909	-5.533	0.000
LFD^2	-1.891	0.639	-5.373	0.001	-1.047	0.925	-5.467	0.000
	Japan				Brazil			
LY	-6.364	0.000	-10.630	0.000	-3.586	0.064	-10.367	0.000
LOP	-1.918	0.625	-5.694	0.000	-2.575	0.293	-5.709	0.000
LMV	-2.577	0.293	-6.660	0.000	-1.411	0.840	-5.287	0.001
LFD	-2.317	0.415	-4.432	0.006	-2.836	0.194	-6.399	0.000

LFD^2	-2.317	0.415	-4.432	0.006	-2.966	0.155	-6.445	0.000
	Germany				Russia			
LY	-3.466	0.063	-6.489	0.000	-6.352	0.001	-2.878	0.211
LOP	-1.931	0.618	-5.373	0.001	-4.315	0.010	-19.730	0.000
LMV	-5.293	0.001	-6.120	0.000	-1.657	0.719	-3.909	0.042
LFD	-1.580	0.782	-13.414	0.000	-1.851	0.657	-6.117	0.000
LFD^2	-1.547	0.794	-12.933	0.000	-1.564	0.786	-5.920	0.000
	France				India			
LY	-4.449	0.007	-6.727	0.000	-9.021	0.000	-31.746	0.000
LOP	-2.262	0.443	-7.302	0.000	-1.833	0.668	-4.874	0.002
LMV	-1.801	0.684	-4.475	0.006	-2.602	0.282	-5.384	0.001
LFD	-0.703	0.965	-8.012	0.000	-1.949	0.609	-5.014	0.001
LFD^2	-0.809	0.956	-7.324	0.000	-1.919	0.625	-4.981	0.002
	United Kingdom				China			
LY	-6.879	0.000	-6.499	0.000	-2.581	0.290	-6.904	0.000
LOP	-2.280	0.434	-8.911	0.000	-1.345	0.860	-5.407	0.001
LMV	-1.148	0.901	-5.040	0.002	-2.280	0.415	-2.236	0.030
LFD	-1.837	0.666	-8.382	0.000	-2.120	0.517	-5.948	0.000
LFD^2	-1.803	0.683	-8.236	0.000	-2.018	0.571	-6.028	0.000
	Italy				South Africa			
LY	-2.573	0.294	-3.376	0.002	-0.720	0.955	-7.642	0.000
LOP	-2.444	0.352	-6.772	0.000	-2.870	0.183	-5.584	0.000
LMV	-2.577	0.293	-6.660	0.000	-2.769	0.217	-5.565	0.000
LFD	-1.312	0.870	-5.099	0.001	-2.979	0.151	-5.703	0.000
LFD^2	-1.322	0.867	-4.979	0.002	-2.971	0.154	-5.679	0.000

The Phillips-Perron (1988) unit root test results proves that GDP per capita is stationary in level in Brazil and Germany at 10% significance, in Russia, United States, France and Canada at 5% significance, while in India, Japan and United Kingdom at 1% significance. The rest of the series are stationary in first difference except Russia's openness and Germany's manufacturing value.

Now we estimate the optimal lag order with the final prediction error (FPE), the Akaike information criterion (AIC), the Schwarz information criterion (SC) and the Hannan-Quinn information criterion (HQ).

Table 2 Lag length selection for the G7 and the BRICS economies

Lag	LogL	LR	FPE	AIC	SC	HQ
United States						
1	269.8456	107.7550*	4.49e-19*	-28.21713*	-26.74675*	-28.07097*
Japan						
1	-16.15262	4.153118*	1.008993*	2.820350*	3.056366*	2.817836*
Germany						
2	-13.58950	3.722430	0.605613*	2.304647*	2.598722*	2.333878*
France						
2	230.0156	28.42366	1.30e-12	-13.46274	-10.80138*	-12.69636*
United Kingdom						
1	250.3336	136.4471*	1.48e-15*	-20.03032*	-18.54254*	-19.67985*
Italy						
1	-12.58014	1.099788	1.100822	2.858483*	3.119229	2.804888*
Canada						
0	-14.95405	NA*	0.892439*	2.707722*	2.890310*	2.690820*
Brazil						
1	95.38254	131.5788*	2.35e-10*	-8.172817*	-6.724213*	-8.098637*
Russia						
1	3.582681	2.588908	0.103778*	0.439512*	0.656546*	0.302703*
India						
2	-21.35528	0.456508	0.308543*	1.657896*	1.929988*	1.749447*
China						
0	13.64693	NA*	0.015001*	-1.378133*	-1.195545*	-1.395035*
South Africa						
1	148.6428	105.3051*	1.48e-12*	-13.18253*	-11.69858*	-12.97792*

The results in the table above indicate that the optimal choice is one lag for Brail, Russia and South Africa, while it is two lags for India and zero for China. In the case of the G7

economies, the optimal lag is one for all except Germany, France with two lags and Canada with zero lag.

Next, we apply the ARDL cointegration bound test to check the existence of long run relationship. The results concerning the residuals displayed in table 3 prove the absence of serial correlation with the Breusch–Godfrey LM test, the absence of Heteroskedasticity with the ARCH test; while the normality is validated by the Jarque–Berra statistic.

Table 3 Results of the ARDL cointegration and diagnostic tests

United States (1.0.1.1.1)	Japan (1.0.0.0.0)	Germany (1.2.2.0.0)	France (1.1.0.0.2)	Kingdom (1.0.0.0.1)	Italy (1.0.0.0.1)	Canada (1.1.1.1.1)	Brazil (1.1.0.1.1)	Russia (1.1.0.1.1)	India (2.2.2.2.2)	China (1.0.0.0.0)	South Africa (1.1.0.1.1)
F-stat											
17.51	9.24	9.95	5.81	16.20	1.33	2.56	18.7	22.54	4.04	1.27	1.73
Critical values											
1%	1%	1%	1%	1%	10%	10%	1%	1%	2.5%	10%	10%
Lower bound											
3.07	3.07	3.07	3.07	3.07	1.9	1.9	3.07	3.07	2.62	1.90	1.90
Upper bound											
4.44	4.44	4.44	4.44	4.44	3.01	3.01	4.44	4.44	3.90	3.01	3.01
χ^2NORMAL											
0.67	0.99	2.00	0.21	0.41	1.48	0.18	1.09	0.51	0.62	0.65	0.93
(.72)	(.61)	(.37)	(.90)	(.81)	(.48)	(.92)	(.58)	(. 77)	(.73)	(.72)	(.63)
χ^2SERIAL											
3.97	0.01	3.75	1.02	0.80	1.83	0.04	0.55	1.44	0.10	0.37	0.80

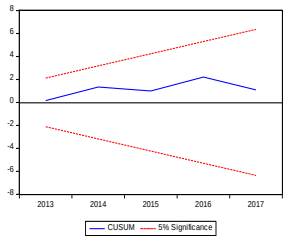
(.08)	(.96)	(.08)	(.38)	(.38)	(.24)	(.85)	(.48)	(.29)	(.91)	(.57)	(.40)
				χ^2ARCH							
0.08	0.67	2.23	0.71	0.86	0.09	0.41	0.00	0.75	0.20	3.05	2.19
(.78)	(.43)	(.16)	(.51)	(.37)	(.77)	(.54)	(.98)	(.42)	(.82)	(.11)	(.17)
				CUSUM							
				stable							
				CUSUMQ							
				stable							

As shown in Table 3, the F-statistic exceeds the upper bound for Brazil, Russia and India at 1%, 1% and 2.5% respectively, while it is below the lower bound at 10% for China and South Africa. Therefore, we conclude that there is a long-run relationship between variables for all BRICS countries except China and South Africa, where the F-statistic is below the lower bound for all critical values. In the case of the G7 economies all F-statistic exceeds the upper bound at 1% level except for Italy and Canada where no long run relationship is found.

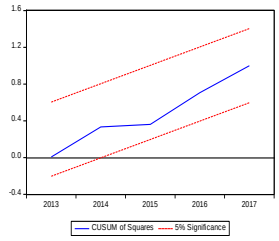
The stability properties are examined with CUSUM and CUSUMQ tests shown in Figure 1, it proves the stability of the regressions and the absence of breakpoints as the model fits the data.

Figure 1 the cumulative sum and the cumulative sum of the squares of recursive residuals

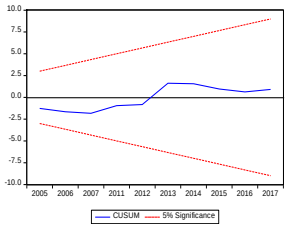
USA CUSUM



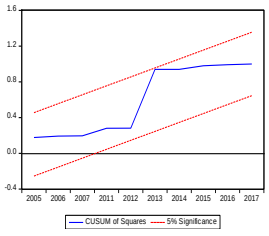
USA CUSUMQ



Japan CUSUM



Japan CUSUMQ



Germany CUSUM

Germany CUSUMQ

France CUSUM

France CUSUMQ

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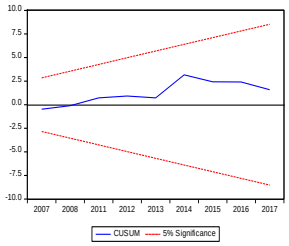
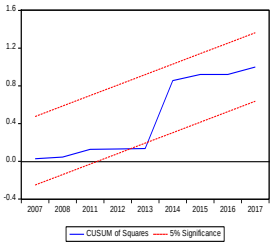


UK CUSUM



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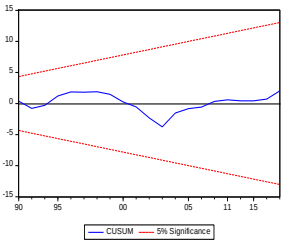
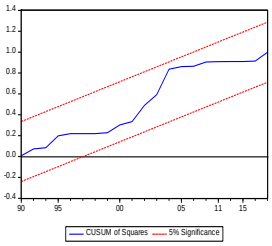
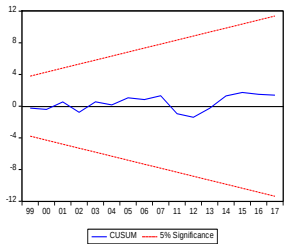


Italy CUSUM



Italy CUSUMQ



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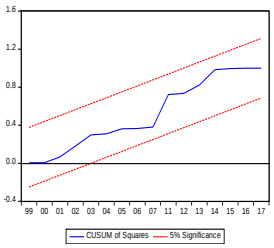
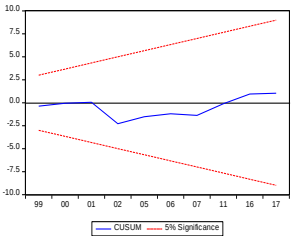
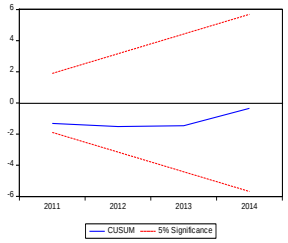


Canada CUSUMQ

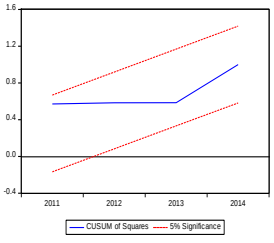


Brazil CUSUM

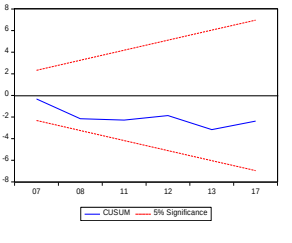
Brazil CUSUMQ



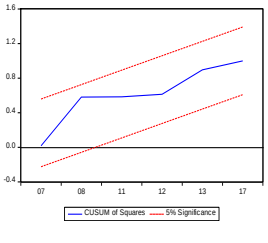
Russia CUSUM



Russia CUSUMQ



India CUSUM



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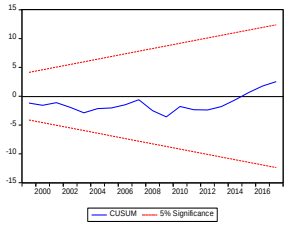
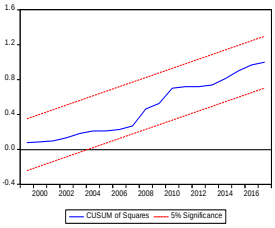
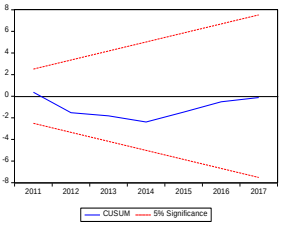


China CUSUM



China CUSUMQ



SA CUSUM

SA CUSUMQ

Next, we examined the short and long-run effects of openness, manufacturing value and financial development on GDP per capita. As expected the sign of the speed of adjustment parameter is negative and statistically significant. In the short run, openness has a positive impact on economic growth for France, Italy, Russia and India; while the manufacturing value has a positive impact on economic growth in the United States, Japan, Brazil, Russia and India.

Table 4 The results of the short run and long run

United States	Japan	Germany	France	United Kingdom	Italy	Canada	Brazil	Russia	India	China	South Africa
Short-run results											
LY											
-1.22	-1.55	-1.60	-0.83	-0.85	-1.17	-1.69	-1.50	-0.84	0.28	-	-
(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.04)	(0.00)	(0.00)	(0.27)		
LOP											
-	-	-9.85	5.38	-	9.77	-	-2.18	5.70	0.86	-	-
		(0.01)	(0.05)		(0.07)		(0.12)	(0.06)	(0.57)		
LMV											
13.48	13.43	-	-	-	-	-	4.21	1.70	5.37	-	-
(0.04)	(0.04)						(0.01)	(0.21)	(0.16)		
LFD											
-148	-22.27	-81.28	-	143.8	-	-	-10.10	-16.48	-20.47	-	-
(0.03)	(0.04)	(0.00)		(0.00)			(0.01)	(0.02)	(0.34)		
LFD^2											
31.29	2.72	10.21	0.59	-16.35	-	-	2.37	2.56	3.20	-	-
(0.03)	(0.09)	(0.00)	(0.08)	(0.00)			(0.00)	(0.02)	(0.31)		
ECT (− 1)											
-1.2	-1.55	-1.57	-0.83	-0.85	-1.18	-1.69	-1.50	-0.84	-1.57	-	-
(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.01)	(0.00)	(0.00)	(0.00)		
Long-run results											

					LY							
-	-	-	-	-	-	-	-	-	-	-	-	-
					LOP							
-	-	-1.59 (0.02)	-	-	-	-	-1.45 (0.09)	6.81 (0.00)	0.86 (0.01)	-	-	
					LMV							
11.03 (0.02)	8.68 (0.02)	35.61 (0.00)	-	-	-	-	2.80 (0.02)	2.04 (0.01)	-2.95 (0.08)	-	-	
					LFD							
-122 (0.02)	-14.4 (0.02)	-50.75 (0.00)	11.06 (0.06)	169.6 (0.00)	-	-	-6.71 (0.00)	-19.70 (0.00)	4.84 (0.08)	-	-	
					LFD^2							
25.60 (0.02)	1.76 (0.04)	6.38 (0.00)	-1.61 (0.07)	-19.28 (0.00)	-	-	1.58 (0.00)	3.06 (0.00)	-0.83 (0.04)	-	-	

On the long run, openness has a positive impact on economic growth in Russia and India; while the manufacturing value affect economic growth positively in the United States, Japan, Germany, Brazil and Russia. For the case of Italy, Canada, China and South Africa no long run relationship has been found.

The coefficients signs of financial development and the square of the financial development suggest the existence and the dominance of the inverted U-shaped curve relation in both the G7 and BRICS economies as it appears in the United States, Japan, Germany, Brazil and Russia. While the U-shaped curve characterize the relation between financial development and economic growth for France, the United Kingdom and India. For the case of the G7 economies our results are similar to those of Arcand, Berkes and Panizza (2015) who also found that on the long run economic growth is negatively affected by financial development. But in our case some of the BRICS economies exhibit similar results despite being from the middle income group.

4. Conclusion

In this paper we investigated the shape of the curve that describes the financial-growth nexus for the G7 and the BRICS countries. We used the bound testing approach for cointegration through an autoregressive distributed lag model over the period 1980 to 2017. Since our

sample is small, the bound testing approach for cointegration appears to be the best approach to investigate the long run relationship between financial development and economic growth.

At high levels of financial depth and according to the "too much finance hypothesis" of Arcand, Berkes and Panizza (2015), more finance leads to less growth. This result is expected in high income countries, given their level of financial development while the economic growth in the middle income countries can still benefits of more financial depthin particular and more financial development in general. But our results suggest that this is not the case for some of the BRICS economies like Brazil and Russia where the relation between financial development and economic growth is an inverted U-shaped curve. It suggests that the BRICS economies way out of the middle income group depends not only on more financial development but also on less income inequality.

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