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# The Threshold Effect of Finance on Growth: Reassessing the Burden of Evidence

**Kul B. Luintel**[1] · **Guangjie Li**[1] · **Mosahid Khan**[2]

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## Abstract

Ronald Coase famously stated, "If you torture the data long enough, it will confess," underscoring the need for the replication of well-accepted empirical results. In Economics, replication is more honoured in the breach than the observance. As a departure, this paper assesses whether the 'burden of evidence' is met for a recent, widely-cited finding, with potentially deep policy implications — that the finance-growth relationship is non-monotonic and has a credit threshold above 100% of GDP that reduces economic growth. If this empirical fact is established beyond a reasonable doubt, then it could be pathbreaking in further developing our understanding of the link between finance and growth. We assemble the 'burden of evidence' through the comprehensive scrutiny of several vital aspects, viz., (i) an exhaustive list of 14 absolute and relative measures of financial development, (ii) replications and extensions across two global datasets, (iii) near exhaustive analytical trajectories, (iv) different functional forms, (v) unifying analytical approach, and (vi) analytical rigor. The 'burden of evidence' from almost 3,000 well-structured cross-sectional and panel estimates do not support the threshold effect, and where evidence is uncovered, the parameters imply the questionable policy implication that advanced economies need to scale back their relative levels of financial development to those of Eastern Europe to avoid the growth costs associated with over-developed financial systems. The findings reject the assertion that finance is excessive and reduces economic growth.


**Keywords** Finance and growth · Non-monotonicity · Credit threshold · Generalized methods of moments

**JEL** Classification E44 · G2 · O11 · O16

Extended author information available on the last page of the article

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## 1 Introduction

The global financial crisis of 2007–2008 (hereafter, the GFC) has called into question the sanguine view that greater financial development promotes economic growth, an idea which featured prominently in policy circles for nearly three decades or so in the run-up to the GFC. The financial sector in general, and the big banks in particular, are deemed culpable for the crisis that led to the longest and most severe post-WWII recession across many industrialized countries, bar the Covid-19 pandemic.[1] Several post-GFC studies are shaping the narrative that 'an oversized financial sector deters growth.' To put them in perspective: the expanded financial sector has led to (i) increased systemic risk taking (Rancière et al. 2008), (ii) a glut of securities and increased financial fragility (Gennaiolio et al. 2012), (iii) wage and income inequality (Philippon and Reshef 2013), (iv) an increased likelihood of financial crisis (Schularick and Taylor 2012), (v) increased systemic risk and reduced economic growth (Langfield and Pagano 2016), (vi) international brain drain and skill mismatch across economic sectors (Philippon and Reshef 2012; Boustanifar et al. 2018), (vii) a direct cost to economic growth, i.e., the inverted U-shaped relationship between finance and growth (Arcand et al. 2015 (hereafter, ABP); Sahay et al. 2015; Gründler 2021), to name but a few.[2]

The inverted U-shaped relationship between financial development and economic growth implies a threshold effect of finance on growth. Analyzing the ratio of private sector credit by intermediaries to GDP (PC) and economic growth (real per capita GDP growth, PYG) in multi-country, cross-sectional, and panel settings, this strand of literature reports that PC significantly augments economic growth at the lower level of credit threshold, but that the effect turns significantly negative once it exceeds 80–100% of GDP. Clearly, viewed from this perspective, the provision of finance is excessive across most industrialized countries and is hurting their economic growth.[3]

The prescribed 80–100% tipping point (TP) also implies that several countries, primarily the major economies, must embark on substantial cuts to their respective levels of bank and/or intermediaries' credit to the private sector in order to avert the negative growth effects of 'too much finance.' In particular, Japan, the United Kingdom, and the United States each need to cut their prevailing levels of total

[1] Reinhart and Rogoff (2009) call the GFC the 'Second Great Contraction' after the Great Depression of the 1930s while Sinn (2010) blames Casino Capitalism for the GFC. While there have been attempts to estimate an optimal level of financial depth under CGE framework (e.g., Bhattarai 2015) but more remains to be seen on this front.

[2] In fact, concerns regarding the burgeoning financial sector predate the GFC. For example, a large financial sector increases the (i) likelihood of a banking and currency crisis (Kaminsky and Reinhart 1999; Loayza and Rancière 2006); (ii) output volatility (Easterly et al. 2001); and (iii) prospects of a 'catastrophic meltdown' (Rajan 2005).

[3] ABP's five-yearly non-overlapping panel dataset, which generates estimates of the TPs of 69–90% reveals that twenty-one of their sample countries have PC of above 125%, and that Japan, the United Kingdom, and the United States, each show PC of 200% or above. These magnitudes of PC appear largely unchanged in the more recent World Bank (WB) dataset (see Box.1; online Appendix A).

private sector credit from intermediaries by almost half, in order not to exceed the prescribed threshold. This is clearly a tall order. In view of these deep policy implications, considerable caution is offered regarding the generality of these findings. Cline (2015a, b) expresses deep skepticisms about these findings. Philippon and Reshef (2012) state that we need more rigorous evaluations for 'a deeper understanding of whether finance is too big, or too expensive….'

Against this backdrop, we aim to scrutinize and gauge whether the 'burden of evidence' establishes the inverted U-shaped relationship between financial development and economic growth beyond reasonable doubt. We believe that a comprehensive, rigorous, and widely replicative empirical evidence—obtained through a unified approach across wide-ranging analytical trajectories—could serve as the 'burden of evidence' and minimize the odds of false positives as emphasized by Coeffman et al. (2017). We assemble the 'burden of evidence' through a comprehensive scrutiny of this issue which encompasses several critical aspects, viz., (i) the exhaustive list of the absolute and relative measures of financial development, (ii) replications and extensions employing these measures across two separate global datasets, (iii) analyses across wide-ranging analytical trajectories, (iv) two functional forms, (v) unifying analytical approaches, and (vi) analytical rigor. We briefly discuss them in turn.

*Measures of financial development*: the finding of the inverted U-shaped relationship between financial development and economic growth has hitherto been reported mainly vis-à-vis PC—an intermediary centered measure of financial depth—except by Sahay et al. 2015 (see Section 6). Clearly, over the last three decades or so, the mainstream literature on the finance–growth relationship has analyzed two separate sets of indicators measuring different aspects of financial development. The first set, originating primarily at the World Bank (WB), consists of five measures of the 'size' and the 'activity' depths of domestic intermediaries, capital markets, and the overall financial sector, which have been extensively used in the literature (Levine et al. 2000; Demirgüç-Kunt and Levine 2001; Luintel et al. 2008; 2016). Following Svirydzenka (2016), we call these the 'five traditional measures' of financial development. The second set consists of the nine relative indices of financial development, constructed relatively recently at the IMF (Svirydzenka 2016). They are relative indices of the depth of, access to, and efficiency of domestic financial institutions and markets, which are consolidated into separate composite indices of relative financial institutional and market developments, and then into an index of overall financial sector development. We call these IMF indices the 'new measures.' These two sets of measures differ in at least two respects: (i) the new measures are broader than the traditional ones, and (ii) the traditional measures are absolute measures, whereas the new ones are relative measures. Together, they constitute fourteen different indicators of financial development inclusive of PC, and we analyze them all while scrutinizing the threshold relationship between financial development and economic growth. These measures are concisely discussed in Section 2. Our analyses basically exhaust the list of indicators explored by the mainstream literature that scrutinizes the finance-growth nexus. Our analysis would also reveal if the tipping point relationship is simply an attribute of PC or if it holds across other measures and dimensions of financial development, which is important from a policy perspective.

*Replications and extensions across two global datasets*: we extend the empirical scrutiny of the inverted U-shaped relationship between financial development and economic growth by employing two related yet separate global datasets: the dataset analyzed by ABP, and our own dataset. We analyze the ABP dataset for broad replicative purposes evaluating if (i) the significant inverted U-shaped effect of PC on PYG, reported by ABP, could be sustained when the analysis is extended across additional analytical trajectories that are common in the literature, and (ii) the non-monotonic relationship reported between PC and PYG—just one measure of financial development—could be sustained vis-à-vis the other eleven (bar two efficiency indices) measures, discussed above, which capture different aspects of financial development. To this end, we (i) restructure the ABP dataset into different analytical trajectories (to be discussed shortly), and (ii) extend the ABP dataset by these thirteen measures of financial development, matching their sample countries and data periods, while maintaining the rest of the covariates and empirical methods in the analyses.[4] Our new dataset, on the other hand, is sourced from the WB (2016) and various other sources (details in Section 2). Scrutiny of tipping point relationship by using these two datasets widens the scope of analysis and adds to the generality of the findings.

*Analytical trajectories*: we cover all the main analytical trajectories employed by the mainstream cross-country finance–growth literature and beyond. We scrutinize the non-monotonic relationship across regions by forming four regional country panels—viz., Africa, Asia, Europe and North America (EU-NA), and Latin America and the Caribbean (LAC), following the United Nations' geoscheme regional classification—from both global datasets. Similarly, we construct four country panels of high-income, upper-middle-income, lower-middle-income, and low-income countries following the WB approach to scrutinize the non-monotonic relationship between financial development and economic growth across country panels based on different levels of economic development.

Often, the levels of economic and financial development are treated in parallel because economically developed countries tend to have developed financial sectors (Demirgüç-Kunt and Levine 1996). However, this parallel is not without exceptions: country clusters based on per capita income levels do not always match those based on levels of financial development (see Section 2). In order to address this issue we take a new approach: countries that take on above median values of each of the fourteen indicators of financial development are classed as financially relatively more developed, while countries that take on median-cum-below-median values are

[4] We conduct wider replications (rather than the point estimates) of the seminal work of ABP, which has stirred the literature on the non-monotonic finance–growth relationship. This is pivotal in generalizing the results and it also captures the spirit of 'promoting replications' in economics, emphasized by Coffman, Niederle, and Wilson (2017); Anderson and Kichkha (2017); Duvendack et al. (2017), among others.

classed as financially relatively less developed (details in Subsection 5.5).[5] We generate fifty-six country panels—twenty-eight each from our and the ABP datasets—of financially relatively more versus less developed countries, based on fourteen indicators, and scrutinize the tipping point relationship across these delineations. Our conjecture is that the countries taking on higher than median values of each of these indicators should be financially more developed and sophisticated than those taking on median-cum-below-median values.

*Functional forms*: we scrutinize the non-monotonic relationship between financial development and economic growth under two functional forms. First, we follow the typical functional form that is widely used in the literature for testing the non-monotonic relationship between financial development and economic growth (e.g., the approach taken by ABP). Second, we reset this typical functional form into a dynamic non-monotonic panel model of financial development and the level of real per capita GDP, like Acemoglu et al. (2019). Gründler (2021) follows this approach and confirms the inverted U-shaped relationship between financial development and the level of real per capita GDP. However, Gründler's conditioning covariates are very different from those of ABP, hence these two sets of results are not comparable.

*Unifying analytical approach*: ABP's seminal work has stimulated the view that the finance–growth relationship is non-monotonic. We therefore maintain uniformity of our approaches to theirs by following precise measurements, specifications, and econometric methods in assembling the 'burden of evidence'. We consciously take this approach to establish the generality of the results vis-à-vis the threshold relationship (the 'too much finance' paradigm) by eliminating any sensitivity in the results due to data measurements, specification, functional form, and the econometric methods, as far as possible. Our approach also goes some way in addressing the concern that the data might have been 'tortured' to establish the hypothesis— 'If you torture the data long enough, it will confess', famously attributed to the Nobel laureate Ronald Coase (Good 1972).

*Analytical rigor*: in addition to the two global panel datasets and their respective country groups (panels) based on different analytical trajectories—regions, level of economic development, and the relative levels of financial development—we also generate further four truncated data subsamples sorted by the 95$^{th}$, 90$^{th}$, 85$^{th}$, and the 80$^{th}$ percentiles of each of the fourteen measures of financial development across each of the data sample that we analyze. Thus, we estimate five sets of results (inclusive of four truncated subsamples) for each data sample/country panel. This rigorous approach reveals the robustness of the results vis-à-vis the sample datapoints, outliers, and changes in country coverage, which are crucial in generating the 'burden of evidence'.

Finally, literature also reports the so-called 'vanishing effects' of finance on economic growth—that the positive effect of financial development on economic growth

[5] To the best of our knowledge, this is the first paper which groups sample countries into panels of financially relatively more versus less developed countries by using median value of each of the fourteen measures of financial development which, we believe, is a more refined approach. Hence, it goes beyond the analytical trajectories covered so far in the literature.

disappears when the dataset is updated beyond the year 2000—under both linear and non-linear specifications (Arcand et al. 2015; Gründler 2021; and the references cited therein). We are also able to assess if evidence supports the 'vanishing effects.'

We report a total of 2,927 sets of carefully structured, cross-sectional and panel estimates (details in Box.2; online Appendix A), and hope that this generates a sufficient 'burden of evidence' vis-à-vis the the inverted U-shaped relationship between financial development and economic growth. As will be clear below, the 'burden of evidence' we put together hardly supports the inverted U-shaped relationship.

The rest of the paper is organized as follows. Section 2 discusses our sample, data, and descriptive statistics. Section 3 briefly outlines the specifications and econometric methods. Section 4 presents the results from extended ABP dataset by four traditional measures exclusive of PC. Section 5 presents the (i) results from our dataset concerning the five traditional measures of financial development covering the full panel and all the analytical trajectories, and (ii) results between PC and PYG obtained by regrouping ABP dataset across different analytical routes. Section 6 presents the corresponding results vis-à-vis the nine (new) relative measures from our and the ABP datasets. Section 7 offers results employing the alternative functional form, and Section 8 concludes.

## 2 Sample, Data, and Descriptive Statistics

Our dataset on the five traditional measures of financial development covers a maximum of 124 countries over 1970–2014. Data on the nine IMF-constructed relative indices cover a maximum of 121 countries over 1980–2016.[6] The ABP dataset covers 133 countries over 1960–2010. Data sources are detailed in Table A.1 (online Appendix A). Figure 1 depicts all the sample countries covered in our dataset on a map of the world.

It is evident that our global panel covers almost all countries of the world. We construct the five traditional measures of financial development, namely, the depth of domestic (i) intermediaries (PC), defined as the bank and non-bank financial intermediaries' total credit to the private sector to GDP ratio, (ii) capital market (SMCR), measured as the ratio of stock market capitalization to GDP, (iii) stock market activity (SMVR), measured as the ratio of stock market value traded to GDP, (iv) financial sector's overall size (AFDR), defined as the ratio of total credit of intermediaries to the private sector plus stock market capitalization to GDP, and (v) financial sector's overall activity (AFAR), defined as the ratio of the sum of total credit by bank and non-bank financial institutions to the private sector and stock market value traded to GDP. As stated above, they are extensively analyzed measures in the finance–growth literature.

The nine relative indices of financial development, obtained from the IMF database, measure the relative depth of, access to, and efficiency of domestic financial institutions

[6] Although the complete IMF dataset covers 183 countries and territories, we could only use a maximum of 121 countries due to the short data spans and other data constraints for the remaining countries and territories.

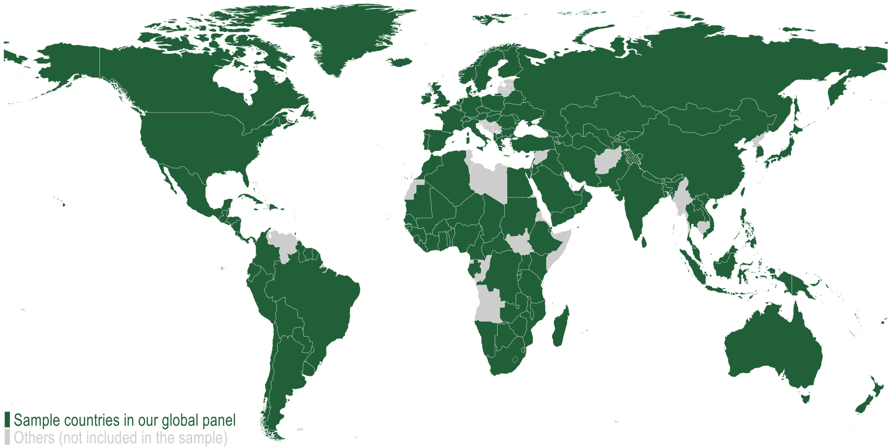


**Fig. 1** The global panel (full set) of sample countries

and markets in each sample country. Specifically, six of them are sub-indices of the depths of financial (i) institutions (FID) and (ii) markets (FMD), the access to financial (iii) institutions (FIA) and (iv) markets (FMA), and the efficiency of financial (v) institutions (FIE) and (vi) markets (FME). The three institutional (FID, FIA, and FIE) and market (FMD, FMA, and FME) sub-indices are further consolidated to generate the composite indices of financial (vii) institutions (FI) and (viii) market (FM) development. The latter two composite indices—FI and FM—are further consolidated to generate the index of (ix) overall (total) financial development (FD).

These indices take values between zero and one and provide a ranking of each sample country vis-à-vis the depth of, access to, and efficiency of institutions, markets, and the overall financial sector relative to the (full) global sample across all countries and years. The maximum (minimum) value of a given indicator across time and countries is normalized to one (zero). For example, the indices of FD, FI, and FM assume the highest index values of 0.951 (Switzerland), 1.00 (Switzerland), and 0.903 (the United States; see Svirydzenka 2016, for methodological details). To put these measures in perspective, a sample country with an institutional depth index of 0.60 implies that 40% of countries globally would have higher and about 60% of countries would have lower institutional depth than this country.[7]

To highlight the importance of taking this analysis beyond the two global datasets, Figs. 2, 3, 4 and 5 show clusters of sample countries based on regions, income levels and their relative levels of financial development, on a map of the world.

Evidently, country panels based on regions and income levels are not the same. As is evident, developed countries mostly have developed financial systems, but

[7] A detailed discussion of these indices can be found in the earlier version of this paper at https://orca.cardiff.ac.uk/id/eprint/163696/1/E2023_8.pdf.

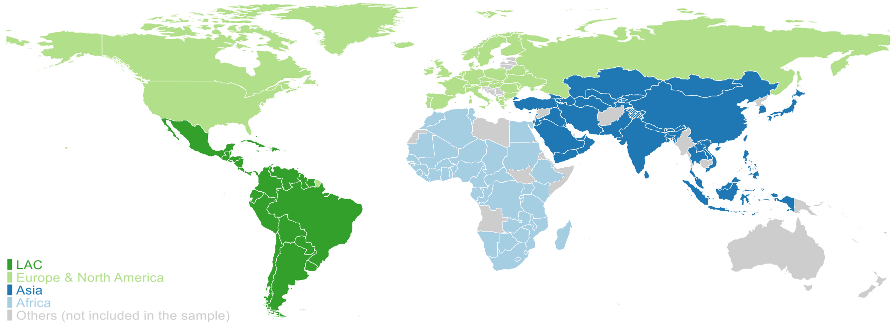


**Fig. 2** Country clusters by region

there are exceptions. For example, China is one of the upper-middle-income countries (Fig. 3), but based on PC (Fig. 4) and FD measures (Fig. 5), the Chinese financial system ranks in the financially more developed category like that of the Europe and North America region.[8] By contrast, India is one of the lower-middle-income countries, but India's level of financial development appears on par with the low-income group. Brazil, an upper-middle-income country, has a relatively more developed financial sector based on FD but a less developed one based on PC. Figures 3, 4 and 5 reveal several such instances. The important messages are: (i) there is no strict parallel between the income level of a country and its level of financial development, and (ii) the relative level of financial development of a country appears sensitive to the measure of financial development employed. Hence our approach of analyzing the finance–growth nexus across all 14 measures and different analytical trajectories is meaningful, and it addresses heterogeneity across different country panels and measures.

The descriptive statistics of all fourteen indicators of financial development from our global panel and separate country panels based on regions, income levels, and the relative levels of financial development are reported in online Table A.2. A notable difference between our dataset and the ABP dataset (full panels) is the minimum value of PC. The revised World Bank dataset includes the Democratic Republic of the Congo (DRC) as a sample country which shows a very low PC in the 1970s, hence the very small minimum value of PC in our dataset. The DRC is not included in the ABP dataset. If we exclude the DRC, then PC resumes a minimum value of 1.26% in our dataset. Some differences in sample mean and median values of PC between the ABP dataset and our dataset reflect the differences in sample periods and country coverage between the two datasets. They also reveal that both datasets are close but not the same.

[8] We acknowledge that whether the Chinese financial sector is as developed as those of the developed western countries is a moot point, however, the widely employed measures of financial development in the literature clearly depict this.

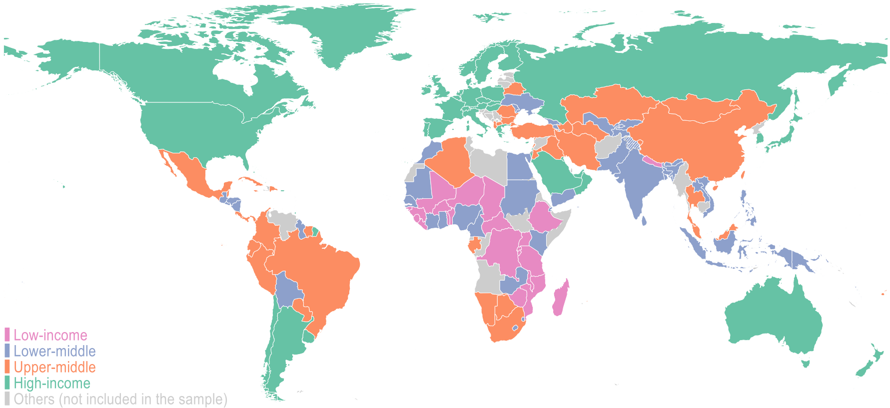


**Fig. 3** Country clusters based on real per capita income levels

Descriptive statistics of data show big differences in the extent of financial development (depths, access, and efficiency) across different country panels. The mean values of these indicators paint a hierarchical picture across country panels based on income levels. They show that the high-income panel has the most developed financial sector, followed by the upper-middle-income, lower-middle income, and low-income panels. This appears to be the case across all fourteen indicators bar two. SMCR appears deeper in the low-income panel than in the upper- and lower-middle income panels. This may be due to the small size of economic activity (GDP) relative to the size of market capitalization in low-income countries. Likewise, FME appears higher in the lower-middle income panel than in the upper-middle-income

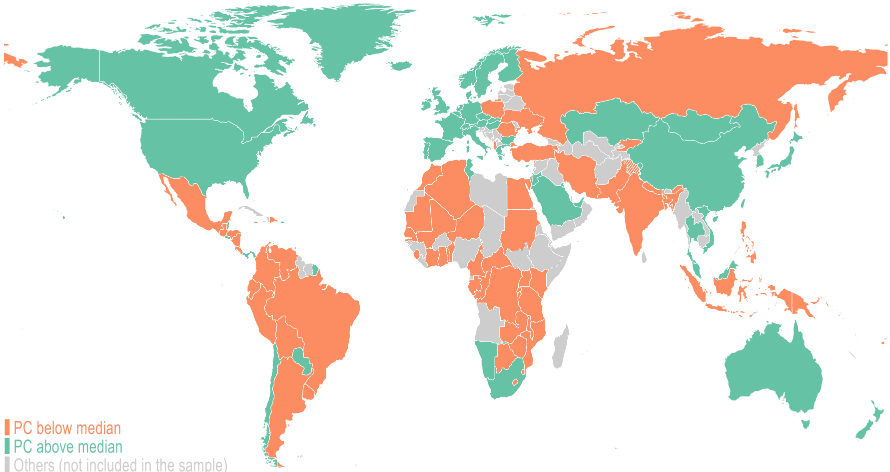


**Fig. 4** Financially relatively more versus less developed country clusters based on PC

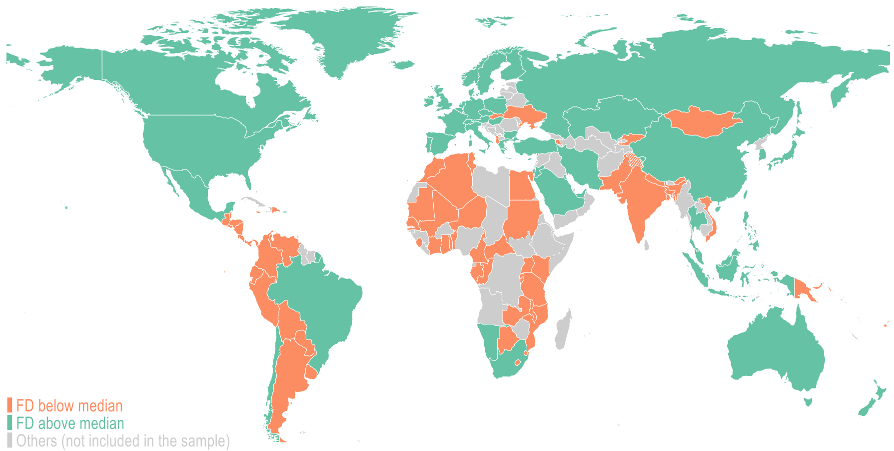


**Fig. 5** Financially relatively more versus less developed country clusters based on FD

panel. The regional country panels also reveal deep heterogeneity. The EU-NA panel shows the highest values of eleven of the fourteen measures of financial development except for AFDR, SMCR and SMVR. The Asia region shows the highest values of the latter three measures, and ranks second in the eleven remaining measures. The LAC region ranks third in the nine measures and fourth (bottom position) in the remaining five. The Africa region ranks third in the five measures of financial development and bottom in the nine relative measures. Overall, evaluated at the mean values of these measures, EU-NA appears to be the most financially developed region, followed by Asia, LAC, and Africa. However, there are a few fascinating exceptions. The Asia region, on average, shows the highest magnitudes of overall financial depth (AFDR), stock market size (SMCR), and activity (SMVR) depths. The Africa region shows somewhat deeper (i) aggregate financial size and activity depths, (ii) stock market size and activity deaths, and (iii) a higher index of financial institutional efficiency than the LAC region. There appears little difference in the indices of financial market efficiency between Asia and the EU-NA regions.

Our classification of the financially relatively more versus less developed country panels shows startling differences in the levels of financial sector development. The five traditional measures appear, on average, 3.99 (AFDR) to 30.42 (SMVR) folds deeper in the financially more developed country panels than in the less developed ones. With respect to the nine new measures, the financially more developed country panels have, on average, 3.55 (FI) to 13.24 (FMD) fold higher indices except for the index of institutional efficiency. The difference in the latter is not as great, just 54% higher. Overall, there is a deep heterogeneity across the panels based on regions, income levels, and relative levels of financial development, which makes it appropriate to analyze them separately.

## 3 Specifications and Empirical Approaches

As stated above, while generating the burden of proof regarding the tipping point relationship between financial development and economic growth, we maintain a uniformity of our approach with that of ABP which stimulated the literature on this front. Under this approach, the typical cross-sectional and panel regressions employed for testing the non-monotonic relationship are:

$$GYP_i = \alpha_{0,j} + \alpha_{1,j}LGDP_{i,0} + \alpha_{2,j}FD_{i,j} + \alpha_{3,j}FD^2_{i,j} + Z_i\gamma + u_i \tag{1}$$

$$GYP_{i,t} = \beta_{0,j} + \beta_{1,j}LGDP_{i,t-k} + \beta_{2,j}FD_{i,j,t} + \beta_{3,j}FD^2_{i,j,t} + Z_{i,t}\gamma + \xi_{i,t} \tag{2}$$

where ($GYP_i$) denotes country specific growth rate of real per capita GDP ($i = 1, \ldots, N$); $GDP_{i,0}$ denotes the initial level of real per capita GDP; $FD_{i,j}$ is the $j^{th}$ measure of financial development, ($j = 1, \ldots, 14$). Subscript 'j' in the parameters denote that the point estimates are likely to differ across financial development measures. $Z_i$ is the vector of other covariates which includes log of average years of schooling ($LEDU$), log of government consumption over GDP ($LGC$), log of openness ($LOPEN$), and log of inflation ($LINF$).[9] Equations (1) and (2) are cross-sectional and panel specifications, respectively. For cross-sectional estimates, data for all variables except the $LGDP_{i,0}$ are sample period averages, which generate a single data point for each sample country; and $LGDP_{i,0}$ is the log of real per capita GDP for 1970. For panel estimates, the dependent variable is the five-yearly non-overlapping average of $GYP_i$, $LGDP_{i,t-k}$ is the five-yearly initial level of real per capita GDP, and the covariates are the five-yearly non-overlapping (log level) values. The time and fixed effects are maintained. Under the cross-sectional setup, OLS and the Rigobon-Lewbel instrumental variable (IV; Rigobon 2003; Lewbel 2012) estimators are used; the latter addresses the problem of endogeneity through internally generated instruments by exploiting the heteroscedasticity. For panel estimates, we employ the two-step system GMM estimator (Arellano and Bond 1991; Arellano and Bover 1995; Blundell and Bond 1998) along with the robust standard errors for finite sample as proposed by Windmeijer (2005).[10] As stated above, we also extend the analysis by scrutinizing the non-monotonic relationship between the levels of real GDP per capita and the measures of financial development in a dynamic panel setting in the spirit of Acemoglu et al. (2019) by estimating:

$$LYP_{i,t} = \lambda_{0,j} + \lambda_{1,j}LYP_{i,t-1} + \lambda_{2,j}LGDP_{i,t-k} + \lambda_{3,j}FD_{i,j,t} + \lambda_{4,j}FD^2_{i,j,t} + Z_{i,t}\theta + \varepsilon_{i,t} \tag{3}$$

9 The log of inflation is calculated as:

$$linf = log[inf + \sqrt{(inf^2 + 1)}]$$

10 ABP instrument all covariates under the system GMM and so do we for the sake of uniformity. Their codes show that, for the cross-section estimates, they regress one period ahead growth rates on covariates. We follow the more common approach of calculating growth as log $(Y_{it}/Y_{it-1})$. This does not alter the results, as we are able to reproduce the point estimates of ABP.

Since $GYP_{it} = LYP_{i,t} - LYP_{i,t-1}$, Eqs. (2) and (3) become equivalent if $\lambda_1 = 1$. However, our estimates and tests reject the null of $\lambda_1 = 1$ in favor of $\lambda_1 < 1$.[11] Hence, Eq. (3) is not strictly equivalent to Eq. (2), nonetheless it is the unrestricted version of (2). In estimation, the dependent variable in Eq. (3) is the five-yearly non-overlapping average of real per capita GDP ($LYP_{i,t}$); and covariates are the same as above plus a lagged dependent variable. Since $LYP_{i,t}$ is a five-yearly non-overlapping average value, the first order lagged dependent variable captures the five-year lagged dynamics of per capita real GDP. Equation (3) is also estimated by the two-step system GMM estimator.

A positive and significant coefficient of $FD_{i,j}$ paired with a negative and significant coefficient of $FD^2_{i,j}$ implies an inverted U-shaped effect of the $j^{th}$ measure of financial development on economic growth. However, for the quadratic relationship to be meaningful, the estimated TP must lie within the sample data points. Lind and Mehlum (2010) propose a joint test (henceforth, the Lin-Meh test) to assess if the estimated TP lies within the sample data points. The joint null of the Lin-Meh test is that the estimated slope of the curve evaluated (i) at the minimum value of the covariate, $FD_{j(min)}$, is negative or zero, and (ii) at the maximum value of the covariate, $FD_{j(max)}$, is greater than or equal to zero. The joint alternative hypotheses are that the slope at (i) $FD_{j(min)}$ is strictly positive, and (ii) $FD_{j(max)}$ is strictly negative. Therefore, a sufficient test for an inverted U-shaped relationship requires statistically significant $\frac{\partial Y}{\partial FD} > 0$ and $\frac{\partial Y}{\partial FD^2} < 0$ ($where\ GYP,\ LYP \in Y$), coupled with the rejection of the joint null by the Lin-Meh test. Even if $\frac{\partial Y}{\partial FD} > 0$ and $\frac{\partial Y}{\partial FD^2} < 0$ are satisfied, the non-rejection of any of the joint nulls by the Lin-Meh test implies that the estimated TP lies beyond the sample data points, which makes the estimated quadratic relationship irrelevant or trivial.

## 4 Results from ABP Dataset Extended by Traditional Measures

In this section, we present results from the ABP dataset extended by the four traditional measures (excluding PC) of financial development, discussed above, and examine whether they depict the non-monotonic relationship with economic growth. Specifically, we extend the ABP dataset by SMCR, SMVR, AFDR, and AFAR, precisely matching their sample countries and data periods, but retaining other covariates. Subsections 4.1 and 4.2 cover these results.

### 4.1 Cross-Sectional Analysis

ABP separately analyze the three sample periods of 1970–2000, 1970–2005, and 1970–2010, and report an inverted U-shaped relationship between PC and PYG

[11] Consistent with the findings of Acemoglu et al. (2019), the Andrew et al. (2002) test rejects the null of unit root in favor of the stationarity of log real GDP per capita $LYP_{i,t}$ in both the panel datasets that we analyze. The test statistics are -8.477 and -11.778 for our and the ABP series of $LYP_{i,t}$ which reject the null at p-vales of 0.000.

under a cross-sectional framework.[12] We use their precise datasets and sequentially generate four truncated subsamples (percentiles) sorted by the 95$^{th}$, 90$^{th}$, 85$^{th}$, and the 80$^{th}$ percentiles of each of the four traditional measures of financial development. We estimate a total of fifteen sets of results—three full samples plus the four truncated percentiles from each of them—under cross-sectional OLS and IV (instrumental variable) estimators each. Thus, we have a total of thirty sets of cross-sectional results to evaluate the non-monotonic relationship for each measure.

Online Table A.3 reports the sixty sets of results involving SMCR and SMVR. SMCR shows complete insignificance in sample 1970–2000 under both OLS and IV estimates. However, the scenario changes in sample 1970–2005; OLS shows a significant inverted U-shaped effect of SMCR across all four truncated subsamples at 10% or better but not in the full sample. The estimated TPs range from 34 to 51%. The IV estimates support the non-monotonic relationship in three of the five cases, with TPs varying from 45 to 155%. Thus, a change in the sample period by five years (from 1970–2000 to 1970–2005) brings dramatic changes in the results; from no effect of SMCR to its significant non-monotonic effect in most estimates. Again, the results change dramatically in sample 1970–2010; SMCR shows the inverted U-shaped relationship in only two of the five cases (at TPs of 39 and 52%) under OLS, while it appears completely insignificant under the IV estimates. Likewise, SMVR also shows mixed results. The OLS estimates show the non-monotonic relationship in only the full sample of 1970–2000 but not in any of the truncated subsamples. By contrast, the IV results show the non-monotonic relationship in three of the five cases at 10% or better with huge variations in TPs, ranging from 9 to 61%. In sample 1970–2005, three of the five cases show the non-monotonic relationship under OLS with TPs ranging from 59 to 17%. The IV results show the only non-monotonic relationship in the full sample. In sample 1970–2010, only one case of non-monotonicity (at the 85$^{th}$ percentile at the TP of 18%) is evident under OLS; there are none under IV. Overall, our analysis of SMCR and SMVR by extending the ABP dataset does not show any consistent evidence in favor of the inverted U-shaped relationship. Instead, both measures appear insignificant in explaining economic growth in a large majority of the estimates. The meager support that exists for non-monotonicity is highly sensitive to changes in data points, sample periods, and estimation methods. Moreover, the estimates of TPs show huge variations across these estimates.

We report parallel sixty sets of results obtained from the extended ABP dataset relating to AFDR and AFAR in online Table A.4. These percentile subsamples differ by two to six data points across three different samples. Under OLS, AFDR appears completely insignificant in explaining PYG across all five sets of estimates in sample 1970–2000; it shows just one count of the inverted U-shaped relationship at 113% TP in sample 1970–2005; and again, appears completely insignificant in sample 1970–2010. Under the IV estimates, AFDR shows one case of the inverted U-shaped relationship each in samples 1970–2000 and 1970–2005 at respective

[12] In fact, ABP also estimate pure cross-country regressions involving a further two samples, 1980–2010 and 1990–2010 as sensitivity checks, but we only focus on the first three sample periods.

TPs of 156 and 130%, one case of a trivially quadratic relationship each in samples 1970–2000 and 1970–2010, and complete insignificance in the rest of the estimates, including those from sample 1970–2010. Overall, AFDR shows the inverted U-shaped relationship in just 10% of the estimates and appears totally insignificant in most cases. The results from the overall activity depth of the domestic financial sector (AFAR) are even more meager. They show just one valid count of an inverted U-shaped relationship (full sample: 1970–2005) at a TP of 174% across thirty sets of OLS and IV estimates. It appears trivially quadratic in four cases, linearly positive and significant in seven cases, and completely insignificant in the remaining estimates. Overall, the size and activity depths of the domestic financial system do not reveal any substantive and credible evidence in favor of the inverted U-shaped relationship between financial development and economic growth. In the sixty sets of cross-sectional OLS and IV estimates, the score in support of the non-monotonic relationship is just 7% (i.e., 4/60) and these results are highly sensitive to sample periods, minor changes in data points, and estimators.

### 4.2 Panel Analysis

In the panel framework, ABP analyze four different sample periods: 1960–1995, 1960–2000, 1960–2005, and 1960–2010. The sample coverage in their panel analyses is much larger than in their cross-sectional analyses; the latter has sixty-seven countries at most and data going back to 1970 only. We analyze all four samples, and as above sequentially truncate each of them sorted by the 95$^{th}$, 90$^{th}$, 85$^{th}$, and the 80$^{th}$ percentiles of each indicator of financial development. Each of these datasets is large enough for panel estimations.

Online Table A.5 reports the forty sets of panel system GMM estimates obtained by extending the ABP dataset through SMCR and SMVR. Data for capital market development indicators are available from 1975 only. None of these forty sets of estimates show a single case of support for the inverted U-shaped relationship. Instead, the 90$^{th}$ percentile of sample 1975–2005 shows a U-shaped rather than an inverted U-shaped relationship between SMCR and PYG, implying too little finance or too small size depths of the domestic capital market. The 80$^{th}$ percentile of sample 1975–2000 shows a trivially quadratic relationship vis-à-vis SMCR at 10% as the estimated TP is zero. Likewise, the 1975–2010 full sample shows parameter estimates consistent with a U-shaped relationship, but the upper *p*-value of the Lin-Meh test cannot reject the null. Surprisingly, SMVR appears completely insignificant across all twenty sets of estimates. Overall, the size and the activity depths of the domestic capital market do not show an inverted U-shaped relationship with economic growth. The most puzzling aspect is that they both appear insignificant in explaining economic growth in the vast majority of estimates. The bottom rows of the table show the standard system GMM diagnostics; the second order residual autocorrelation test (AR2: *p*-value), and Hansen's (1982) test of the validity of overidentifying restrictions (OID: *p*-value). The reported estimates pass these diagnostics.

Likewise, forty parallel sets of results concerning ADFR and AFAR are reported in online Table A.6. Of the twenty sets of estimates across the four samples, AFDR shows an inverted U-shaped relationship in only two cases in sample 1975–2000, and a U-shaped relationship only once in sample 1975–2005. In the seventeen remaining sets of estimates, AFDR appears largely insignificant in explaining PYG. By contrast, AFAR shows mixed results which are highly sensitive to data samples. In sample 1975–1995, AFAR shows an inverted U-shaped relationship in one case (the full sample) and insignificance in the remaining sets of estimates. Interestingly, it shows inverted U-shaped relationships across four of the five sets of estimates of sample 1975–2000, at TPs ranging from 109 to 78%, no inverted U-shaped relationship in sample 1975–2005, just one count of an inverted U-shaped relationship in 1975–2010, and insignificance in vast majority of the remaining estimates. Together, AFDR and AFAR show an inverted U-shaped relationship in eight of the forty sets of estimates, a score of 20%.

Overall, our scrutiny by extending the ABP dataset through a further four traditional measures of financial development that are widely used in the mainstream literature fails to provide any convincing evidence in support of the inverted U-shaped relationship between financial development and economic growth. Specifically, in the 120 sets of replicative cross-sectional OLS and IV estimates involving these four traditional measures across the three ABP samples and their truncations, the replication rate is only 18%. Likewise, under the panel framework, only eight of the eighty sets of estimates across these four measures support the inverted U-shaped relationship, a replication rate of just 10%. All in all, our scrutiny shows that the tipping point relationship between financial development and economic growth is neither compelling nor robust, and hence cannot be taken as a general result. It is also evident that 'vanishing effects' are not supported by these results as all the four traditional indicators appear mostly insignificant in explaining economic growth.

## 5 New Dataset: Analysis of Traditional Measures

In Subsections 5.1 through 5.5, we present the results regarding the five traditional measures of financial development obtained from our (new) dataset, which covers a maximum of 124 sample countries.[13] We analyze the (full) global panel as well as the country panels generated according to *geographic regions*, *income levels*, and the *relative levels of financial development*. We also regroup the ABP dataset across these delineations (country panels) and assess if the non-monotonic relationship between PC and PYG could be sustained. The full panel of our dataset is scrutinized under both cross-sectional and panel frameworks. However, for the sake of brevity, all segregated country panels are scrutinized under the panel framework only.

[13] The number of sample countries varies depending on the indicator of financial development, as is evident in online Table A.2. We set the real per capita GDP of 1970 as the initial income level for the cross-sectional analysis. Sample countries that do not have data on real per capita GDP for the year 1970 are dropped from the analyses, hence the somewhat smaller country coverage in cross-sectional (92) analysis than in the panel (124) analysis.

**Table 1** Cross-sectional results of the non-monotonic relationship between the five traditional measures of financial development and economic growth (new dataset)

| | Sample: 1970–2014 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cross-sectional OLS | | | | | Cross-sectional IV | | | | |
| | 1 | 0.95 | 0.90 | 0.85 | 0.80 | 1 | 0.95 | 0.90 | 0.85 | 0.80 |
| PC | 0.066[a] | 0.083[a] | 0.086[a] | 0.088[b] | 0.093[b] | 0.073[b] | 0.145[a] | 0.154[a] | 0.146[b] | 0.152[b] |
| | (0.015) | (0.026) | (0.032) | (0.039) | (0.045) | (0.030) | (0.048) | (0.050) | (0.070) | (0.072) |
| $PC^2$ | -0.003[a] | -0.001[b] | -0.001[c] | -0.001 | -0.001 | -3e-4[b] | -0.001[a] | -0.001[b] | -0.001 | -0.001 |
| | (0.0001) | (0.0002) | (0.0003) | (0.0005) | (0.001) | (1e-4) | (4e-4) | 5e-4) | (0.001) | (0.001) |
| Turning points | 99.908 | - | - | - | - | 107.010 | 72.120 | - | - | - |
| Maximum | 156.484 | 92.931 | 80.868 | 69.241 | 61.763 | 156.484 | 92.931 | 80.868 | 69.241 | 61.763 |
| Minimum | 1.110 | 1.110 | 1.110 | 1.110 | 1.110 | 1.110 | 1.110 | 1.110 | 1.110 | 1.110 |
| Mean | 42.828 | 37.407 | 32.169 | 27.747 | 25.467 | 42.828 | 37.407 | 32.169 | 27.747 | 25.467 |
| Lower p-value | 0.00002 | 0.001 | 0.004 | - | - | 0.008 | 0.002 | 0.002 | - | - |
| Upper p-value | 0.001 | 0.225 | 0.358 | - | - | 0.018 | 0.024 | 0.129 | - | - |
| Observations | 92 | 86 | 78 | 71 | 67 | 92 | 86 | 78 | 71 | 67 |
| SMCR | 0.001 | 0.030[c] | 0.042[c] | 0.051[c] | 0.051[c] | -0.008 | 0.014 | 0.077[b] | 0.026 | 0.006 |
| | (0.009) | (0.017) | (0.022) | (0.027) | (0.029) | (0.011) | (0.034) | (0.035) | (0.038) | (0.035) |
| $SMCR^2$ | -1e-5 | -2e-4 | -4e-4[c] | -0.001[c] | -0.001 | 2e-5 | -1e-4 | -0.001[b] | -2e-4 | 1e-4 |
| | (2e-5) | (1e-4) | (2e-4) | (3e-4) | (4e-4) | (3e-5) | (2e-4) | (3e-4) | (5e-4) | (1e-3) |
| Turning points | - | - | 55.181 | - | - | - | - | 59.372 | - | - |
| Maximum | 360.675 | 126.756 | 90.362 | 66.835 | 62.191 | 360.675 | 126.756 | 90.362 | 66.835 | 62.191 |
| Minimum | 0.696 | 0.696 | 0.696 | 0.696 | 0.696 | 0.696 | 0.696 | 0.696 | 0.696 | 0.696 |
| Mean | 51.031 | 37.413 | 32.683 | 29.121 | 26.465 | 51.031 | 37.413 | 32.683 | 29.121 | 26.465 |
| Lower p-value | - | - | 0.034 | 0.033 | - | - | - | 0.017 | - | - |
| Upper p-value | - | - | 0.070 | 0.107 | - | - | - | 0.044 | - | - |
| Observations | 71 | 66 | 62 | 58 | 54 | 71 | 66 | 62 | 58 | 54 |

**Table 1** (continued)

| | Sample: 1970–2014 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cross-sectional OLS | | | | | Cross-sectional IV | | | | |
| | 1 | 0.95 | 0.90 | 0.85 | 0.80 | 1 | 0.95 | 0.90 | 0.85 | 0.80 |
| SMVR | 0.036[a] | 0.055 | 0.075[b] | 0.109[b] | 0.146[b] | 0.017 | 0.103[a] | 0.100[b] | 0.118[b] | 0.116 |
| | (0.008) | (0.033) | (0.035) | (0.054) | (0.063) | (0.014) | (0.040) | (0.040) | (0.051) | (0.079) |
| $SMVR^2$ | -2e-4[a] | -0.001 | -0.001[b] | -0.003 | -0.005[c] | -1e-4 | -0.001[b] | -0.002[a] | -0.002 | -0.002 |
| | (4e-5) | (0.001) | (0.001) | (0.002) | (0.002) | (1e-4) | (0.001) | (0.001) | (0.002) | (0.003) |
| Turning points | 109.339 | - | 26.147 | - | 16.130 | - | 39.113 | 29.302 | - | - |
| Maximum | 208.442 | 51.985 | 48.018 | 31.626 | 28.725 | 208.442 | 51.985 | 48.018 | 31.626 | 28.725 |
| Minimum | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| Mean | 21.571 | 15.153 | 12.145 | 9.266 | 8.011 | 21.571 | 15.153 | 12.145 | 9.266 | 8.011 |
| Lower p-value | 2e-5 | - | 0.019 | - | 0.012 | - | 0.006 | 0.008 | - | - |
| Upper p-value | 0.001 | - | 0.023 | - | 0.088 | - | 0.098 | 0.003 | - | - |
| Observations | 69 | 64 | 59 | 54 | 51 | 69 | 64 | 59 | 54 | 51 |
| AFDR | 0.004 | 0.021[b] | 0.027[c] | 0.022 | 0.021 | 0.002 | 0.031[a] | 0.030[b] | 0.017 | 0.015 |
| | (0.005) | (0.010) | (0.015) | (0.015) | (0.017) | (0.007) | (0.011) | (0.012) | (0.016) | (0.019) |
| $AFDR^2$ | -0e-5 | -1e-4[c] | -1e-4 | -1e-4 | -1e-4 | 0 | -1e-4[a] | -1e-4[b] | -3e-5 | -3e-5 |
| | (1e-5) | (4e-5) | (1e-4) | (1e-4) | (1e-4) | (1e-5) | (4e-5) | (1e-4) | (1e-4) | (1e-4) |
| Turning points | - | - | - | - | - | - | 158.207 | - | - | - |
| Maximum | 676.743 | 227.360 | 192.609 | 163.461 | 147.089 | 676.743 | 227.360 | 192.609 | 163.461 | 147.089 |
| Minimum | 18.953 | 18.953 | 18.953 | 18.953 | 18.953 | 18.953 | 18.953 | 18.953 | 18.953 | 18.953 |
| Mean | 101.254 | 92.258 | 84.793 | 78.166 | 72.177 | 110.254 | 92.258 | 84.793 | 78.166 | 72.177 |
| Lower p-value | - | 0.023 | - | - | - | - | 0.002 | 0.008 | - | - |
| Upper p-value | - | 0.129 | - | - | - | - | 0.024 | 0.142 | - | - |
| Observations | 71 | 66 | 62 | 58 | 54 | 71 | 66 | 62 | 58 | 54 |

**Table 1** (continued)

| | Sample: 1970–2014 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cross-sectional OLS | | | | | Cross-sectional IV | | | | |
| | 1 | 0.95 | 0.90 | 0.85 | 0.80 | 1 | 0.95 | 0.90 | 0.85 | 0.80 |
| AFAR | 0.024[a] | 0.034[a] | 0.034[b] | 0.038[b] | 0.031 | 0.012 | 0.074[a] | 0.070[a] | 0.083[a] | 0.083[a] |
| | (0.006) | (0.012) | (0.016) | (0.017) | (0.020) | (0.011) | (0.017) | (0.020) | (0.019) | (0.018) |
| $AFAR^2$ | -5e-5[a] | -1e-4[c] | -1e-4 | -2e-4 | -1e-4 | -2e-5 | -3e-4[a] | -3e-4[b] | -4e-4[a] | -3e-4[b] |
| | (1e-5) | (1.e-4) | (1e-4) | (1e-4) | (2e-4) | (2e-5) | (1e-4) | (1e-4) | (1e-4) | (1e-4) |
| Turning points | 257.304 | - | - | - | - | - | 120.546 | - | - | - |
| Maximum | 437.054 | 163.831 | 131.666 | 124.103 | 116.283 | 437.054 | 163.831 | 131.666 | 124.103 | 116.283 |
| Minimum | 8.147 | 8.147 | 8.147 | 8.147 | 8.147 | 8.147 | 8.147 | 8.147 | 8.147 | 8.147 |
| Mean | 80.255 | 68.899 | 62.054 | 55.876 | 49.316 | 80.255 | 68.899 | 62.054 | 55.876 | 49.316 |
| Lower p-value | 0.001 | 0.003 | - | - | - | - | 2e-5 | 3e-4 | 2e-5 | 1e-5 |
| Upper p-value | 0.002 | 0.410 | - | - | - | - | 0.021 | 0.476 | 0.155 | 0.555 |
| Observations | 69 | 65 | 60 | 55 | 50 | 69 | 65 | 60 | 55 | 50 |

This table reports the results of the non-monotonic relationship between the five traditional measures of financial development and economic growth in cross-sectional framework using our (new) dataset. For the sake of brevity, we only report the parameters associated with the measures of financial development which are of main interest from the perspective of the non-monotonic relationship. In estimations, we include all the control variables used by ABP; details in Section 3. Cross-sectional OLS and IV results for data sample 1970–2014 along with the truncated subsamples sorted by the $95^{th}$, $90^{th}$, $85^{th}$, and the $80^{th}$ percentiles of the measures of financial development are shown across columns 1 through 0.80. For variable mnemonics please refer to Table A.1, and for the specifications to Eq. (1)

### 5.1 Cross-Sectional Results (Global Panel)

Table 1 reports the cross-sectional OLS and IV results concerning the five traditional measures of financial development from the new global panel dataset (1970–2014) and its four truncated percentiles.[14]

Under OLS, PC shows an inverted U-shaped relationship only at the 100th percentile at a TP of 100%, but not in any of the truncated subsamples. The IV estimates largely back up these results; only the 100th and 95th percentiles show the non-monotonic relationship at TPs of 107 and 72%, two appear linearly positive and significant, and one fails the Lin-Meh test.

There is virtually no evidence of the inverted U-shaped relationship between SMCR and PYG. It shows just one count each of a valid inverted U-shaped relationship (in the 90th percentiles) under both OLS (marginal significance) and IV estimates at respective TPs of 55 and 59%; it appears linear and significant in two instances, trivially quadratic in one, and insignificant in the five remaining sets of estimates.

Regarding SMVR, OLS estimates show valid non-monotonicity in three of the five cases, but the TPs are extremely diverse, ranging from 109 to 16%. This degree of variation in TPs is hardly informative from a policy perspective. IV estimates show valid non-monotonicity in two cases at the TPs of 39 and 29%. Thus, there are big divergences in the estimates of TPs, both within, as well as across, the estimators. In its ten sets of estimates, AFDR shows only one case of a valid inverted U-shaped relationship at the TP of 158%. It appears trivially quadratic in two instances, linearly positive in one, and insignificant in six instances. The overall activity depth of the domestic financial sector (AFAR) shows just one case each of the inverted U-shaped relationship under the OLS and the IV estimates, at hugely different TPs estimates of 257 and 121%.

On the whole, the cross-sectional results from our dataset show extremely limited support for the inverted U-shaped relationship between the five traditional measures of financial development and economic growth. In the fifty sets of estimates, only thirteen cases (26%) support the inverted U-shaped relationship. Moreover, this limited empirical support is highly sensitive to estimators, data samples, and provides incredibly divergent estimates of TPs.

### 5.2 Panel Results (Global Panel)

Under panel analyses, we split our dataset into three different sample periods (1970–2000, 1970–2010, and 1970–2014) to shed light on the ‘vanishing effects.’ However, for the traditional measures exclusive of PC, data begin from 1975 only. Each sample is truncated, as above, giving us a total of fifteen datasets across three

[14] We also split the full sample (1970–2014) into 1970–2000, 1970–2005, and 1970–2010, and estimate them separately along with their truncated subsamples. The results in favor of non-monotonicity are virtually nonexistent, hence, for the sake of brevity, we only report the results obtained from the full sample and its percentile subsamples.

**Table 2** System GMM estimates of the non-monotonic relationship between the five traditional measures of financial development and economic growth (full panel: new dataset)

| | Sample: 1970–2000 | | | | | Sample: 1970–2010 | | | | | Sample: 1970–2014 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.95 | 0.90 | 0.85 | 0.80 | 1 | 0.95 | 0.90 | 0.85 | 0.80 | 1 | 0.95 | 0.90 | 0.85 | 0.80 |
| PC | 0.062[a] (0.023) | 0.074[b] (0.0312) | 0.041 (0.059) | -0.014 (0.062) | -0.027 (0.067) | 0.019 (0.019) | 0.033 (0.028) | 0.024 (0.027) | 0.032 (0.036) | -0.012 (0.036) | 0.022 (0.014) | 0.046[c] (0.025) | 0.020 (0.027) | 0.035 (0.025) | 0.044 (0.035) |
| $PC^2$ | -3e-4[b] (1e-4) | -4e-4 (3e-4) | 1e-4 (0.001) | 7e-4 (0.001) | 0.001 (0.001) | -1e-4 (8.8e-5) | -1.9e-4 (2e-4) | -1e-4 (2e-4) | -2e-4 (4e-4) | -3e4 (4e4) | -1.5e-4[b] (6.2e-5) | -3.3e-4[b] (1.6e-4) | -1e-4 (1.9e-4) | -2.3e-4 (2.3e-4) | -4e-4 (4.4e-4 |
| Turning points | 91.76 | - | - | - | - | - | - | - | - | - | - | 68.56 | - | - | - |
| Mean | 38.464 | 33.893 | 30.749 | 27.977 | 25.626 | 42.648 | 37.052 | 33.166 | 29.965 | 27.152 | 45.080 | 39.028 | 34.952 | 31.510 | 28.577 |
| Maximum | 177.117 | 101.142 | 83.524 | 71.005 | 62.279 | 262.458 | 123.392 | 93.956 | 79.705 | 69.934 | 262.458 | 128.011 | 100.6436 | 86.094 | 72.110 |
| Minimum | 2.2e-05 | 2.2e-05 | 2.2e-05 | 2.2e-05 | 2.2e-05 | 2.2e-05 | 2.2e-05 | 2.2e-05 | 2.2e-05 | 2.2e-05 | 2.2e-05 | 2.2e-05 | 2.2e-05 | 2.2e-05 | 2.2e-05 |
| Lower p-value | 0.004 | - | - | - | - | - | - | - | - | - | - | 0.032 | - | - | - |
| Upper p-value | 0.015 | - | - | - | - | - | - | - | - | - | - | 0.02 | - | - | - |
| Observations | 489 | 465 | 441 | 416 | 392 | 715 | 680 | 644 | 608 | 572 | 827 | 786 | 745 | 703 | 662 |
| Countries | 107 | 105 | 103 | 102 | 97 | 120 | 119 | 117 | 116 | 116 | 124 | 123 | 122 | 121 | 120 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.068 | 0.085 | 0.076 | 0.071 | 0.153 | 0.247 | 0.295 | 0.221 | 0.168 | 0.144 | 0.163 | 0.137 | 0.200 | 0.113 | 0.121 |
| OID p-value | 0.426 | 0.508 | 0.764 | 0.716 | 0.805 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

**Table 2** (continued)

| | Sample: 1975–2000 | | | | | Sample: 1975–2010 | | | | | Sample: 1975–2014 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 | 1 | 0.95 | 0.90 | 0.85 | 0.80 |
| SMCR | 0.006 | 0.003 | -0.014 | -0.014 | 0.035 | -0.008 | -0.013 | -0.025[c] | -0.018 | -0.021 | -0.007 | -0.010 | -0.016 | -0.011 | -0.013 |
| | (0.020) | (0.018) | (0.017) | (0.023) | (0.038) | (0.001) | (0.013) | (0.015) | (0.014) | (0.016) | (0.005) | (0.013) | (0.015) | (0.010) | (0.011) |
| $SMCR^2$ | -3e-5 | 6e-5 | 4e-5 | 9e-5 | -0.001 | 3.6e-6 | 4.2e-5 | 1.5e-4[b] | 1e-4 | 1.6e-4 | 4.4e-6 | 4.0e-5 | 1.0e-4[c] | 8.3e-5[c] | 1.0e-4[b] |
| | (8e-5) | (1e-4) | (9.7e-5) | (1.5e-4) | (0.001) | (8.4e-6) | (5.9e-5) | (7.4e-5) | (8.6e-5) | (1.2e-4) | (4.5e-6) | (6e-5) | (6.3e-5) | (4.8e-5) | (4.7e-5) |
| Turning points | - | - | - | - | - | - | - | 85.86 | - | - | - | - | - | - | - |
| Mean | 36.892 | 29.980 | 26.030 | 22.958 | 20.089 | 51.553 | 38.977 | 33.828 | 29.518 | 26.090 | 53.326 | 39.915 | 34.677 | 30.540 | 27.138 |
| Maximum | 257.683 | 116.016 | 87.408 | 73.413 | 64.681 | 714.164 | 155.346 | 118.697 | 93.154 | 77.252 | 1003.41 | 155.346 | 117.769 | 93.154 | 76.067 |
| Minimum | 0.176 | 0.176 | 0.176 | 0.176 | 0.176 | 0.101 | 0.101 | 0.101 | 0.101 | 0.101 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| Lower p-value | - | - | - | - | - | - | - | 0.050 | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | 0.024 | - | - | - | - | - | - | - |
| Observations | 183 | 174 | 165 | 156 | 147 | 348 | 331 | 314 | 296 | 279 | 435 | 414 | 392 | 370 | 348 |
| Countries | 75 | 75 | 74 | 73 | 72 | 89 | 88 | 88 | 86 | 86 | 93 | 92 | 92 | 91 | 91 |
| AR1 p-value | 0.021 | 0.025 | 0.077 | 0.110 | 0.111 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| AR2 p-value | 0.126 | 0.891 | 0.567 | 0.625 | 0.891 | 0.096 | 0.094 | 0.086 | 0.026 | 0.031 | 0.053 | 0.046 | 0.038 | 0.022 | 0.025 |
| OID p-value | 0.998 | 0.999 | 1.000 | 0.999 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| SMVR | 0.002 | 0.036 | -0.016 | -0.064 | -0.105 | -0.013 | -0.002 | -0.007 | 0.020 | 0.018 | -0.005 | -0.005 | 0.001 | 0.020 | 0.023 |
| | (0.027) | (0.066) | (0.089) | (0.093) | (0.104) | (0.014) | (2.824) | (0.016) | (0.017) | (0.027) | (0.012) | (0.012) | (0.015) | (0.015) | (0.018) |
| $SMVR^2$ | -2e-4 | -3e-4 | 0.001 | 0.003 | 0.003 | 2.7e-5 | -4.9e-5 | -2.6e-5 | -1.3e-4[c] | -1.2e-4 | 8.6e-6 | 1.5e-6 | -3.2e-5 | -1.1e-4[c] | -1.4e-4[c] |
| | (2e-4) | (0.001) | (0.002) | (0.004) | (0.004) | (4.5e-5) | (0.014) | (6.6e-5) | (6.8e-5) | (1.1e-4) | (2.6e-5) | (6.3e-5) | (6.7e-5) | (6.6e-5) | (8.1e-5) |
| Turning points | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Mean | 10.930 | 7.667 | 5.962 | 4.864 | 4.097 | 21.594 | 14.138 | 10.295 | 7.884 | 5.952 | 23.836 | 15.4825 | 11.297 | 8.701 | 6.621 |
| Maximum | 137.033 | 42.879 | 30.623 | 18.799 | 14.197 | 303.225 | 103.832 | 64.768 | 42.425 | 30.623 | 589.352 | 110.487 | 71.04723 | 46.1422 | 35.861 |
| Minimum | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |

**Table 2** (continued)

| | Sample: 1975–2000 | | | | | Sample: 1975–2010 | | | | | Sample: 1975–2014 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 | 1 | 0.95 | 0.90 | 0.85 | 0.80 |
| Lower p-value | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Observations | 198 | 189 | 179 | 169 | 159 | 365 | 347 | 329 | 311 | 292 | 452 | 430 | 407 | 385 | 362 |
| Countries | 75 | 74 | 73 | 72 | 71 | 89 | 89 | 89 | 89 | 88 | 93 | 93 | 93 | 93 | 91 |
| AR1 p-value | 0.019 | 0.036 | 0.029 | 0.031 | 0.041 | 0.000 | 0.892 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.186 | 0.124 | 0.117 | 0.112 | 0.174 | 0.017 | 0.837 | 0.02 | 0.017 | 0.027 | 0.016 | 0.01 | 0.013 | 0.016 | 0.012 |
| OID p-value | 0.991 | 0.997 | 0.999 | 1.000 | 1.000 | 0.003 | 0.032 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| AFDR | 0.015 | 0.015 | 0.026 | 0.092[c] | 0.117[a] | -0.005 | 0.001 | -0.001 | -0.002 | 0.006 | -0.004 | 0.005 | -0.003 | -0.004 | 4.1e-5 |
| | (0.015) | (0.024) | (0.025) | (0.048) | (0.040) | (0.004) | (0.012) | (0.014) | (0.016) | (0.028) | (0.004) | (0.010) | (0.011) | (0.011) | (0.011) |
| $AFDR^2$ | -4.8e-5 | -3.7e-5 | -8.6e-5 | -4.6e-4[b] | -6.6e-4[a] | 2.4e-6 | -1.4e-5 | 5.8e-6 | 1.2e-5 | -5.5e-5 | 1.7e-6 | -2.1e-5 | 1.3e-5 | 2.2e-5 | -2.3e-6 |
| | (3.7e-5) | (7.1e-5) | (8.7e-5) | (2.3e-4) | (2.2e-4) | (4.8e-6) | (3.4e-5) | (4.4e-5) | (6.3e-5) | (1.3e-4) | (2.7e-6) | (2.5e-5) | (3e-5) | (3.1e-5) | (2.5e-5) |
| Turning points | - | - | - | 100.54 | 88.24 | - | - | - | - | - | - | - | - | - | - |
| Mean | 96.676 | 86.705 | 79.850 | 74.242 | 69.061 | 112.062 | 97.183 | 88.713 | 80.995 | 75.071 | 116.274 | 100.116 | 91.232 | 83.696 | 77.340 |
| Maximum | 381.651 | 226.351 | 186.552 | 167.059 | 148.522 | 849.802 | 274.306 | 231.281 | 188.711 | 170.422 | 1189.713 | 283.748 | 238.004 | 202.911 | 171.116 |
| Minimum | 4.426 | 4.426 | 4.426 | 4.426 | 4.426 | 3.998 | 3.998 | 3.998 | 3.998 | 3.998 | 3.998 | 3.998 | 3.998 | 3.998 | 3.998 |
| Lower p-value | - | - | - | 0.028 | 0.002 | - | - | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | 0.023 | 0.001 | - | - | - | - | - | - | - | - | - | - |
| Observations | 183 | 174 | 165 | 156 | 147 | 347 | 330 | 313 | 295 | 278 | 430 | 409 | 387 | 366 | 344 |
| Countries | 75 | 74 | 74 | 73 | 72 | 89 | 88 | 87 | 87 | 86 | 93 | 92 | 91 | 91 | 90 |
| AR1 p-value | 0.022 | 0.015 | 0.019 | 0.102 | 0.07 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| AR2 p-value | 0.541 | 0.637 | 0.634 | 0.71 | 0.335 | 0.11 | 0.165 | 0.157 | 0.101 | 0.045 | 0.062 | 0.056 | 0.094 | 0.064 | 0.039 |
| OID p-value | 1.000 | 0.998 | 0.999 | 0.993 | 0.999 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

**Table 2** (continued)

| | Sample: 1975–2000 | | | | | Sample: 1975–2010 | | | | | Sample: 1975–2014 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 | 1 | 0.95 | 0.90 | 0.85 | 0.80 |
| AFAR | 0.062[a] | 0.116[a] | 0.149[a] | 0.160[a] | 0.172[a] | 0.005 | 0.019[c] | 0.016 | 0.046[b] | 0.058[b] | -0.003 | 0.017[b] | 0.012 | 0.011 | 0.007 |
| | (0.021) | (0.036) | (0.036) | (0.053) | (0.054) | (0.007) | (0.011) | (0.014) | (0.021) | (0.026) | (0.004) | (0.008) | (0.009) | (0.009) | (0.020) |
| AFAR$^2$ | -2e-4[a] | -0.001[a] | -0.001[a] | -0.001[a] | -0.001[a] | -2.4e-5 | -8.3e-5[b] | -6.8e-5[c] | -2.4e-4[c] | -4e-4[b] | 1.4e-6 | -6.0e-5[b] | -4.5e-5 | -3.3e-5[b] | -3.5e-5 |
| | (7.0e-5) | (1.9e-4) | (2.3e-4) | (3.6e-4) | (3.2e-4) | (1.7e-5) | (3.7e-5) | (4.1e-5) | (1.3e-4) | (1.8e-4) | (5.9e-6) | (2.4e-5) | (2.8e-5) | (1.9e-5) | (1.3e-4) |
| Turning points | 127.57 | 91.48 | 81.78 | 80 | 71.07 | - | 114.18 | - | 95.08 | 71.01 | - | 138.7 | - | - | - |
| Mean | 68.545 | 61.377 | 56.447 | 52.405 | 49.109 | 81.930 | 70.465 | 62.857 | 57.024 | 52.149 | 86.649 | 73.996 | 66.017 | 59.572 | 54.280 |
| Maximum | 261.175 | 166.743 | 130.481 | 110.480 | 99.241 | 438.863 | 228.093 | 183.034 | 148.991 | 127.477 | 775.655 | 238.186 | 201.954 | 152.715 | 130.481 |
| Minimum | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 |
| Lower p-value | 0.002 | 0.001 | 3.3e-5 | 0.001 | 0.001 | - | 0.040 | - | 0.013 | 0.013 | - | 0.025 | - | - | - |
| Upper p-value | 2.4e-4 | 3.8e-4 | 4.2e-5 | 0.003 | 9.7e-5 | - | 0.011 | - | 0.038 | 0.010 | - | 0.005 | - | - | - |
| Observations | 197 | 188 | 178 | 168 | 158 | 363 | 345 | 327 | 309 | 291 | 446 | 424 | 402 | 380 | 357 |
| Countries | 75 | 74 | 73 | 71 | 69 | 89 | 89 | 89 | 87 | 85 | 93 | 93 | 93 | 91 | 91 |
| AR1 p-value | 0.015 | 0.024 | 0.021 | 0.022 | 0.027 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.119 | 0.041 | 0.112 | 0.106 | 0.146 | 0.011 | 0.017 | 0.026 | 0.025 | 0.051 | 0.015 | 0.019 | 0.034 | 0.033 | 0.041 |
| OID p-value | 0.996 | 0.999 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

This table reports the panel results of the non-monotonic relationship between the five traditional measures of financial development and economic growth obtained from our (new) dataset. AR1 and AR2 are the first and the second order residual serial correlation tests ($p$-values reported). OID is the Hansen (1982) test of over identifying restrictions under the null that GMM instruments are valid. The dependent variable is five-year non-overlapping growth spells. The covariates are time fixed effects, and the initial log level of real per capita GDP ($LGDP_{i,t-k}$), the log of average years of education (LEDU), the log of government consumption over GDP (LGC); and the log of trade openness (LOPEN) and inflation (LINFL); all covariates are the values of the first year of each five-year spells. For variable mnemonics and other descriptions, please refer to the notes for Table 1, and for specifications to Eq. (2) in the text.

samples. Modeling each of the five traditional measures across fifteen panel datasets gives us a total of seventy-five sets of system GMM estimates. These panels embrace important data variations ranging from 69 to 124 countries and 735 to 4,135 country years, depending on the measure of financial development. The results are reported in Table 2.

PC shows just one case each of the inverted U-shaped relationship in samples 1970–2000 (the 100$^{th}$ percentile) and 1970–2014 (the 95$^{th}$ percentile) at respective TPs of 92 and 69%. PC appears mostly insignificant in the thirteen remaining sets of estimates. This overwhelming insignificance of PC in explaining PYG is puzzling. Evidently, there is no empirical support for the 'vanishing effects.'

The two capital market development measures, SMCR and SMVR, do not show even a single case of the inverted U-shaped relationship across each of their fifteen sets of estimates. Instead, SMCR shows one count of the U-shaped relationship in sample 1975–2010, implying too little finance, three counts of trivially quadratic relationships in sample 1975–2014, and complete insignificance in the eleven remaining sets of estimates. SMVR appears trivially quadratic in three cases and completely insignificant in the twelve remaining sets of estimates across three samples. Turning to the overall size and activity depths of the domestic financial sector, AFDR shows just two counts of inverted U-shaped relationships (in the 85$^{th}$ and 80$^{th}$ percentiles of sample 1975–2000), and total insignificance in the thirteen remaining sets of estimates. However, AFAR shows inverted U-shaped relationships in all five sets of estimates of sample 1975–2000, in three cases of sample 1975–2010, and in one case of sample 1975–2014, however the TPs are highly divergent from 71 to 138%.

To recap, in the seventy-five sets of panel estimates involving the five traditional measures, the inverted U-shaped relationship with economic growth is found in thirteen cases, a score of only 17%. Out of these thirteen cases, AFAR alone accounts for nine. Excluding AFAR, the score in favor of the inverted U-shaped relationship across the four traditional measures is just 7%. All five traditional measures appear mostly insignificant in explaining economic growth.

### 5.3 Panel Results (Regional Panels)

We generate four regional country panels—viz., Africa, Asia, EU-NA, and LAC—along the lines of the UN geoscheme classification. Australia is the only dominant country in the Oceania continent, hence we do not include it in any of our continental panels. We include the United States and Canada from North America with the countries of the European continent. Each of these regional panels is estimated by the system GMM estimator. We examine the sensitivity of results by dropping the United States and Canada from the EU-NA panel but find that the quality of reported results remains the same. Scrutiny in this setup would reveal whether the non-monotonic relationship between financial development and economic growth is evidenced across regional country panels. The time span of the measures of capital market development is short for the three regional panels—namely, Africa, Asia,

**Table 3** System GMM estimates of the non-monotonic relationship between the five traditional measures of financial development and economic growth across regional country panels (new dataset)

| | Sample: 1970–2014 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Africa | | Asia | | EU-NA | | LAC | |
| | 1.0 | 0.95 | 1.0 | 0.95 | 1.0 | 0.95 | 1.0 | 0.95 |
| PC | -7.5e-4 | 0.034 | 0.089[c] | 0.069 | -0.034 | -0.030 | -0.060 | 0.056 |
| | (0.034) | (0.066) | (0.049) | (0.137) | (0.025) | (0.020) | (0.049) | (0.323) |
| $PC^2$ | -1.9e-5 | -4.9e-4 | -4.4e-4[b] | -3.5e-4 | 6.9e-5 | 6.7e-5 | 5.7e-5 | 2.9e-4 |
| | (2.3e-4) | (9.7e-4) | (1.9e-4) | (7.7e-4) | (9.1e-5) | (5.9e-5) | (5e-4) | (0.004) |
| Turning points | - | - | 101.59 | - | - | - | - | - |
| Mean | 21.510 | 17.962 | 59.168 | 52.853 | 70.161 | 64.481 | 29.763 | 27.129 |
| Maximum | 141.330 | 65.502 | 239.390 | 156.452 | 262.458 | 151.059 | 98.206 | 67.678 |
| Minimum | 2.2e-5 | 2.2e-5 | 3.613 | 3.613 | 1.259 | 1.259 | 5.632 | 5.632 |
| Lower p-value | - | - | 0.036 | - | - | - | - | - |
| Upper p-value | - | - | 0.006 | - | - | - | - | - |
| Observations | 233 | 222 | 170 | 162 | 227 | 216 | 173 | 165 |
| Countries | 36 | 36 | 31 | 31 | 31 | 31 | 22 | 22 |
| AR1 p-value | 0.012 | 0.015 | 0.050 | 0.118 | 0.001 | 0.139 | 0.053 | 0.067 |
| AR2 p-value | 0.359 | 0.532 | 0.211 | 0.274 | 0.894 | 0.933 | 0.883 | 0.582 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| | Sample: 1975–2014 | | | | | | | |
| | Africa | | Asia | | EU-NA | | LAC | |
| | 1.0 | 0.95 | 1.0 | 0.95 | 1.0 | 0.95 | 1.0 | 0.95 |
| SMCR | -0.021 | 0.021 | 0.005 | -0.038 | -0.004 | -0.01 | -0.003 | -0.061 |
| | (0.025) | (0.067) | (0.147) | (0.545) | (0.014) | (0.017) | (0.032) | (0.067) |
| $SMCR^2$ | 4.6e-5 | -5.4e-5 | -4.1e-6 | 1e-4 | 1.6e-5 | 8e-5 | 4.3e-6 | 1.7e-4 |
| | (5.6e-5) | (1.7e-4) | (1e-4) | (0.001) | (4.9e-5) | (9.7e-5) | (4.7e-5) | (3.9e-4) |
| Turning points | - | - | - | - | - | - | - | - |
| Mean | 45.582 | 33.589 | 71.132 | 50.636 | 52.403 | 44.951 | 34.629 | 23.423 |
| Maximum | 548.566 | 208.828 | 1003.41 | 235.327 | 250.240 | 141.606 | 684.394 | 102.962 |
| Minimum | 0.010 | 0.010 | 0.101 | 0.101 | 0.176 | 0.176 | 0.360 | 0.360 |
| Lower p-value | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | - |
| Observations | 59 | 57 | 112 | 107 | 174 | 165 | 77 | 74 |
| Countries | 15 | 15 | 27 | 27 | 30 | 30 | 19 | 18 |
| AR1 p-value | 0.505 | 0.858 | 0.972 | 0.248 | 0.001 | 0.002 | 0.270 | 0.559 |
| AR2 p-value | 0.378 | 0.820 | 0.993 | 0.969 | 0.217 | 0.214 | 0.708 | 0.085 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| SMVR | -0.197 | -1.056 | 0.007 | 0.017 | -0.029[c] | -0.022 | -0.064 | -0.207 |
| | (0.720) | (2.883) | (0.015) | (0.128) | (0.016) | (0.029) | (0.888) | (0.859) |
| $SMVR^2$ | 0.003 | 0.023 | -8.6e-6 | -1.4e-4 | 1.1e-4 | 6.5e-5 | 0.002 | 0.029 |
| | (0.010) | (0.063) | (2.1e-5) | (8.4e-4) | (7.6e-5) | (1.4e-4) | (0.023) | (0.068) |
| Turning points | - | - | - | - | - | - | - | - |
| Mean | 6.698 | 4.928 | 34.642 | 23.855 | 31.784 | 23.342 | 3.461 | 2.446 |

**Table 3** (continued)

| | Sample: 1975–2014 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Africa | | Asia | | EU-NA | | LAC | |
| | 1.0 | 0.95 | 1.0 | 0.95 | 1.0 | 0.95 | 1.0 | 0.95 |
| Maximum | 61.336 | 50.305 | 589.352 | 130.657 | 250.950 | 136.399 | 34.373 | 12.862 |
| Minimum | 0.001 | 0.001 | 0.002 | 0.002 | 0.008 | 0.008 | 0.002 | 0.002 |
| Lower p-value | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | - |
| Observations | 58 | 56 | 116 | 111 | 180 | 171 | 83 | 79 |
| Countries | 15 | 15 | 27 | 27 | 30 | 30 | 18 | 18 |
| AR1 p-value | 0.517 | 0.713 | 0.168 | 0.083 | 0.005 | 0.056 | 0.807 | 0.480 |
| AR2 p-value | 0.927 | 0.742 | 0.719 | 0.978 | 0.259 | 0.207 | 0.965 | 0.194 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| AFDR | 0.015<br>(0.027) | -0.021<br>(0.037) | -0.001<br>(0.009) | -0.010<br>(0.032) | -0.025<br>(0.02) | -0.005<br>(0.03) | 0.006<br>(0.051) | 0.086<br>(0.18) |
| AFDR$^2$ | -9.6e-6<br>(6.7e-5) | -2.5e-5<br>(1.3e-4) | 1.6e-7<br>(6.5e-6) | 2.8e-8<br>(6.2e-5) | 3.4e-5<br>(3.4e-5) | 5.2e-6<br>(6.5e-5) | 5.8e-6<br>(8.5e-5) | -2.8e-4<br>(8.6e4) |
| Turning points | - | - | - | - | - | - | - | - |
| Mean | 77.408 | 67.370 | 142.343 | 118.250 | 131.844 | 121.261 | 69.289 | 56.673 |
| Maximum | 366.800 | 274.306 | 1,189.713 | 339.115 | 441.664 | 283.748 | 718.405 | 173.067 |
| Minimum | 6.476 | 6.476 | 3.998 | 3.998 | 4.426 | 4.426 | 7.447 | 7.447 |
| Lower p-value | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | - |
| Observations | 58 | 56 | 112 | 107 | 172 | 164 | 76 | 73 |
| Countries | 15 | 15 | 27 | 27 | 30 | 30 | 19 | 18 |
| AR1 p-value | 0.587 | 0.710 | 0.045 | 0.003 | 0.000 | 0.004 | 0.865 | 0.402 |
| AR2 p-value | 0.899 | 0.585 | 0.663 | 0.998 | 0.245 | 0.162 | 0.377 | 0.529 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| AFAR | 0.0143<br>(0.042) | -0.099<br>(0.098) | -0.004<br>(0.014) | 0.023<br>(0.072) | -0.029[a]<br>(0.009) | -0.033<br>(0.026) | -0.097<br>(0.245) | -0.011<br>(0.170) |
| AFAR$^2$ | 2.9e-5<br>(1.4e-4) | 4.3e-4<br>(4.5e-4) | 1.4e-6<br>(1.4e-5) | -8.6e-5<br>(2.0e-4) | 5.5e-5[a]<br>(2e-5) | 5.5e-5<br>(5e-5) | 4.8e-4<br>(0.002) | -2.8e-4<br>(0.002) |
| Turning points | - | - | - | - | 265.4 | - | - | - |
| Mean | 46.831 | 41.363 | 104.757 | 90.530 | 109.133 | 96.090 | 38.270 | 34.903 |
| Maximum | 202.665 | 171.014 | 775.656 | 243.904 | 427.314 | 261.175 | 117.962 | 88.212 |
| Minimum | 4.396 | 4.396 | 5.112 | 5.112 | 4.258 | 4.258 | 5.846 | 5.846 |
| Lower p-value | - | - | - | - | 0.001 | - | - | - |
| Upper p-value | - | - | - | - | 0.005 | - | - | - |
| Observations | 57 | 55 | 116 | 111 | 178 | 169 | 81 | 77 |
| Countries | 15 | 15 | 27 | 27 | 30 | 30 | 18 | 18 |

**Table 3** (continued)

| | Sample: 1975–2014 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Africa | | Asia | | EU-NA | | LAC | |
| | 1.0 | 0.95 | 1.0 | 0.95 | 1.0 | 0.95 | 1.0 | 0.95 |
| AR1 p-value | 0.656 | 0.863 | 0.351 | 0.080 | 0.001 | 0.055 | 0.250 | 0.395 |
| AR2 p-value | 0.523 | 0.827 | 0.817 | 0.478 | 0.461 | 0.277 | 0.478 | 0.364 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

This table reports the results of the non-monotonic relationship between financial development and economic growth across the four regional country panels constructed along the lines of UN geoscheme classification from our global panel dataset. The sample period is 1970–2014. EU-NA and LAC refer to the Europe and North America, and Latin America and the Caribbean regions, respectively. For variable mnemonics, model specifications, and other details, please refer to the notes for Tables 1 and 2

and the LAC. Therefore, we estimate all five percentiles of sample 1975–2014 for PC but just the 100$^{th}$ and 95$^{th}$ percentiles for the four remaining traditional measures of financial development. In view of the similarity of the results, we only report the results of the 100$^{th}$ and 95$^{th}$ percentiles in Table 3, and provide concise narratives of the other results.

The data dimensions of PC for the Africa panel range from a minimum of thirty-four countries with 187 observations (the 80$^{th}$ percentile, not reported) to a maximum of thirty-six countries with 233 observations (the 100$^{th}$ percentile). Since the data points are non-overlapping five-yearly observations, the 80$^{th}$ and the 100$^{th}$ percentiles account for 935 and 1,165 country years, respectively. PC appears insignificant across all five sets of estimates; it shows neither the linear nor the non-linear effect on PYG in the Africa panel. The size and the activity depths of the domestic stock market each have fifteen countries and at least fifty-eight observations in the 100$^{th}$ percentile for the Africa region, covering at least 290 country years. Again, both indicators appear insignificant in explaining PYG. Likewise, the overall size and activity depths of the domestic financial system also appear insignificant in explaining PYG for the Africa panel. There is not a single case of support for the inverted U-shaped relationship across any of the five traditional measures of financial development and economic growth in the Africa region. Surprisingly, all traditional measures of financial development appear insignificant in explaining economic growth for this region under the non-linear specification.

The Asia panel has thirty-one countries with 170 observations for PC in the 100$^{th}$ percentile of sample 1970–2014, while its 80$^{th}$ percentile has twenty-nine countries with 136 observations (not reported). For the four remaining measures, the 100$^{th}$ percentile has at least twenty-seven countries with 112 observations. Again, we estimate all five percentiles for PC, and only two percentiles for the four remaining indicators. Together, we estimate thirteen sets of results. PC shows an inverted U-shaped relationship in one instance (the 100$^{th}$ percentile) and complete insignificance in the rest of the estimates. The four remaining measures of financial development appear completely insignificant in explaining real per capita GDP growth in the Asia panel, hence no trace of inverted U-shaped relationship.

The data dimensions of the EU-NA panel allow us to estimate five sets of estimates for each of the five traditional measures, generating twenty-five sets of results. The results reveal that none of the five measures show an inverted U-shaped relationship with PYG. Instead, PC, SMCR and AFDR appear completely insignificant; SMVR shows one case of a trivially quadratic and one case of a negatively signed and significant parameter while AFAR shows one case (100$^{th}$ percentile) of a significant U-shaped relationship at the TP of 265%, implying too little finance. Overall, there is complete lack of evidence supporting the inverted U-shaped relationship between the five traditional measures of financial development and economic growth in the EU-NA panel, which mostly comprises of developed countries. Like the Asia panel, we estimate thirteen sets of results for the LAC panel. Again, all five measures appear completely insignificant in explaining economic growth.

Overall, the sixty-four sets of estimates scrutinizing the inverted U-shaped relationship between the five traditional measures of financial development and economic growth across the four regional country panels, which cover almost the whole of the globe, show just one case of the U-shaped/inverted U-shaped relationship each. Interestingly, all five measures appear overwhelmingly insignificant in explaining economic growth under the non-linear specifications.

Is this wholesale insignificance of the traditional measures of financial development in explaining real per capita GDP growth across all four regional country panels specific to our dataset? To address this, we construct four parallel regional panels from the ABP dataset (1960–2010) and re-examine the non-monotonic relationship between PC and PYG. The twenty sets of system GMM estimates obtained from these four regional panels, inclusive of data truncations, are reported in online Table A.7. Interestingly, PC appears completely insignificant across all twenty sets of estimates. Moreover, this wholesale insignificance of PC is reinforced by a further sixty sets of results obtained (not reported) from the other three sample periods (1960–1995, 1960–2000, and 1960–2005) analyzed by ABP (inclusive of their truncations), with just one exception: PC shows just one count of an inverted U-shaped relationship in the 85$^{th}$ percentile of sample 1960–2005. These results from the ABP dataset indicate that the complete insignificance of the five traditional measures of financial development in explaining PYG across the four regional country panels, under non-linear specifications, is not unique to our dataset. As is evident, the inverted U-shaped relationship between PC and PYG, reported by ABP, cannot be replicated at all once their global panel is re-grouped into four regional country panels.

### 5.4 Panel Results (Income-Level Based Panels)

The ‘too much finance’ literature suggests that the inverted U-shaped relationship between financial development and economic growth is essentially the preserve of developed countries, presumably due to their large financial sectors creating excessive finance. We scrutinize this premise by forming panels of high-income, upper-middle-income, lower-middle-income, and low-income countries following the WB classification approach. Country clusters based on income levels are widely viewed as reflecting countries’ differing levels of economic development, albeit imperfectly. Hence,

**Table 4** System GMM estimates of the non-monotonic relationship between the five traditional measures of financial development and economic growth across country panels based on income levels (new dataset)

| | High-income | | | | | Upper middle-income | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| PC | -0.005 (0.019) | - | - | - | - | 0.031 (0.070) | - | - | - | - |
| $PC^2$ | -3e-5 (8.1e-5) | - | - | - | - | -1.1e-4 (3.8e-4) | - | - | - | - |
| SMCR | - | 0.007[c] (0.004) | - | - | - | - | 0.009 (0.025) | - | - | - |
| $SMCR^2$ | - | -5.8e-6 (4.1e-6) | - | - | - | - | -5.5e-5 (8.3e-5) | - | - | - |
| SMVR | - | - | 0.002 (0.006) | - | - | - | - | 0.160 (0.097) | - | - |
| $SMVR^2$ | - | - | -1.8e-6 (1.2e-5) | - | - | - | - | -9.8e-4 (7.4e-4) | - | - |
| AFDR | - | - | - | -4.9e-4 (0.004) | - | - | - | - | 0.026 (0.024) | - |
| $AFDR^2$ | - | - | - | 6.8e-7 (2.8e-6) | - | - | - | - | -6.8e-5 (4.6e-5) | - |
| AFAR | - | - | - | - | -0.004 (0.006) | - | - | - | - | 0.053 (0.039) |
| $AFAR^2$ | - | - | - | - | 4.9e-6 (6.8e-6) | - | - | - | - | -1.9e-4 (1.3e-4) |
| Turning points | - | - | - | - | - | - | - | - | - | - |
| Mean | 71.840 | 65.487 | 35.224 | 147.593 | 115.565 | 39.356 | 39.319 | 11.374 | 89.426 | 60.865 |
| Maximum | 262.458 | 1,003.410 | 589.352 | 1189.713 | 775.655 | 141.330 | 257.683 | 144.667 | 381.546 | 226.957 |
| Minimum | 6.138 | 0.360 | 0.002 | 13.840 | 8.150 | 2.803 | 0.010 | 0.008 | 4.426 | 4.258 |
| Lower p-value | - | - | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | - | - | - |

**Table 4** (continued)

| | High-income | | | | | Upper middle-income | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Observations | 326 | 244 | 252 | 240 | 248 | 204 | 109 | 115 | 109 | 114 |
| Countries | 46 | 44 | 44 | 44 | 44 | 30 | 24 | 24 | 24 | 24 |
| AR1 p-value | 0.004 | 0.000 | 0.001 | 0.000 | 0.003 | 0.327 | 0.017 | 0.050 | 0.111 | 0.372 |
| AR2 p-value | 0.189 | 0.061 | 0.044 | 0.040 | 0.027 | 0.334 | 0.203 | 0.225 | 0.285 | 0.312 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| | Lower middle-income | | | | | Low-income | | | | |
| PC | -0.004<br>(0.061) | - | | - | - | -0.409<br>(0.86) | - | - | - | - |
| PC$^2$ | -3.6e-5<br>(4.8e-4) | - | | - | - | 0.005<br>(0.01) | - | - | - | - |
| SMCR | - | 0.021<br>(0.025) | | - | - | - | - | - | - | - |
| SMCR$^2$ | - | 3.9e-6<br>(5.8e-5) | | - | - | - | - | - | - | - |
| SMVR | - | - | 0.041<br>(26.65) | - | - | - | - | - | - | - |
| SMVR$^2$ | - | - | -4.1e-4<br>(0.269) | - | - | - | - | - | - | - |
| AFDR | - | - | - | -0.001<br>(0.027) | - | - | - | - | - | - |
| AFDR$^2$ | - | - | - | 5.1e-5<br>(5.1e-5) | - | - | - | - | - | - |
| AFAR | - | - | - | - | -0.158<br>(0.111) | - | - | - | - | - |

**Table 4** (continued)

| | Lower middle-income | | | | | Low-income | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $AFAR^2$ | - | - | - | - | 0.001 (0.001) | - | - | - | - | - |
| Turning points | - | - | - | - | - | - | - | - | - | - |
| Mean | 22.767 | 31.334 | 7.301 | 63.911 | 39.397 | 12.448 | - | - | - | - |
| Maximum | 98.388 | 684.394 | 96.654 | 718.405 | 123.361 | 50.053 | - | - | - | - |
| Minimum | 1.259 | 0.1001 | 0.001 | 3.998 | 5.112 | 2.2e-5 | - | - | - | - |
| Lower p-value | - | - | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | - | - | - |
| Observations | 207 | 68 | 71 | 68 | 71 | 90 | - | - | - | - |
| Countries | 31 | 20 | 20 | 20 | 20 | 17 | - | - | - | - |
| AR1 p-value | 0.004 | 0.099 | 0.985 | 0.369 | 0.857 | 0.327 | - | - | - | - |
| AR2 p-value | 0.391 | 0.685 | 0.994 | 0.64 | 0.12 | 0.378 | - | - | - | - |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | - | - | - | - |

This table reports the estimates of the non-monotonic relationship between the five traditional measures of financial development and economic growth across the four country panels based on income levels as per the World Bank classification. We construct these country panels from our global panel dataset. The sample period is 1970–2014. For model specifications, variable mnemonics, and other descriptions please refer to the notes for Tables 1 and 2 analyzing them should reveal if the inverted U-shaped relationship between financial development and economic growth is indeed a characteristic of developed countries.

The high- and the upper-middle-income country panels have adequate data points to model all five percentiles across the five traditional measures of financial development. Hence, we estimate a total of fifty sets of results between these two country panels (2 panels × 5 datasets × 5 measures). However, the lower-middle-income panel does not have enough data points, particularly for the capital market variables. For this panel, we estimate a total of nine sets of results: five percentiles for PC but only the 100th percentile each for the four remaining measures. Due to data constraints, we could only estimate PC at the 100th percentile for the low-income panel. Thus, we estimate a total of sixty sets of results across the four country panels based on income levels. The results from the different percentiles show strong qualitative similarity, hence, for the sake of brevity, we only report results of the 100th percentile in Table 4, and where appropriate, provide concise but clear narratives of the other estimates.

Table 4 shows that four out of the five measures appear completely insignificant in explaining PYG in the high-income panel; the only exception is SMCR which shows a linear significance. None of the five measures of financial development exhibit an inverted U-shaped relationship with PYG in any of the twenty-five sets of estimates (truncated sample estimates, not reported) of the high-income panel. The scenario appears similar vis-à-vis the upper-middle-income panel: all five measures appear completely insignificant in explaining PYG across the twenty-five sets of estimates bar one. The lone exception is the trivially quadratic relationship shown by SMVR in the 95th percentile (not reported). Likewise, none of the five measures appear significant in explaining PYG in the lower-middle-income panel across its nine sets of estimates, and PC appears insignificant in explaining PYG in the panel of low-income countries. Overall, in the sixty sets of estimates involving the five traditional measures across four country panels representing the different levels of economic development proxied by their real per capita income levels, not a single inverted U-shaped relationship is found.

We generate four parallel panels of high-, upper-middle-, lower-middle-, and low-income countries from the ABP dataset (1960–2010) and examine the non-monotonic relationship between PC and PYG in an analogous manner. Three of these panels have adequate data points for estimating all five percentiles, however the low-income panel could only be estimated at the 100th percentile. We report these sixteen sets of results in online Table A.8. They show that PC appears totally insignificant in explaining PYG in the high-income, upper-middle-income, and the low-income panels. PC also appears insignificant in all but one case of the lower-middle-income panel: it shows an inverted U-shaped relationship in the 85th percentile at the TP of 22%. Thus, PC appears completely insignificant in fifteen of the sixteen sets of estimates when the ABP dataset is restructured into four income-level based country panels. Hence, the widespread insignificance of financial development measures reported earlier are not unique to our dataset.[15] These results show that the inverted U-shaped relationship

[15] Following ABP, we also estimate the relationship across the sample periods of 1960–2005, 1960–2000, and 1960–1995, inclusive of their sample truncations. PC remains insignificant in most cases across these estimates, and there is hardly any evidence of the inverted U-shaped relationship. These results are available on request.

between PC and PYG, reported by ABP, are not sustained when their dataset is restructured into country panels based on income levels as per the World Bank classification.

### 5.5 Panel Results (Financially More Versus Less Developed Country Panels)

As outlined above, the financially relatively more developed panels consist of sample countries that take on higher than sample median values of each of these indicators, while the relatively less developed panels include countries taking on median-cum-below-median values. We follow two approaches in classifying sample countries into one of these two groups. Our first approach uses the global median value of the $j^{\text{th}}$ indicator as the benchmark and assigns the $i^{th}$ sample country into one of the two groups based on its actual value of the $j^{\text{th}}$ indicator year by year. This approach is dynamic, as the relative positions of sample countries could change over time. Our second approach allocates the $i^{th}$ country into one of the two categories by comparing the median value of its $j^{\text{th}}$ indicator to the global median value. Under our first approach, the panel dimension may change each year, whereas under the second approach it remains fixed. Based on these two approaches and the five measures of financial development, we construct a total of twenty panels (ten panels each) of financially more versus less developed countries from our dataset. We also generate twenty parallel panels from the ABP dataset. As shown in Section 2, the above median countries, on average, are far more financially developed than the median-cum-below median ones in terms of the depth of, access to, and efficiency of financial institutions and markets. Together, we have a total of forty panel datasets: twenty panels each of the financially relatively more versus less developed countries from the two global datasets. The literature suggests that the tipping point relationship between financial development and economic growth is the sole preserve of financially developed countries. Hence, a priori, one would expect relatively more supportive evidence for the inverted U-shaped relationship from the financially more developed panels than from the less developed ones.

We estimate a total of 200 sets of results from these forty panel datasets—sample truncations mean we estimate five sets of results for each panel hence, $40 \times 5 = 200$). In Table 5, we present fifty sets of results pertaining to the financially more versus less developed country panels based on the dynamic approach of country groupings from our dataset. The parallel fifty sets of results obtained from the ABP dataset are shown in online Table A.9. For the sake of brevity, we only provide concise narratives of the hundred sets of results obtained from the country panels based on our second approach to country groupings.

The results do not support the assertion that the inverted U-shaped relationship is the preserve of financially developed countries. Of the five measures, two—AFDR, and AFAR—appear completely insignificant in explaining PYG across both types of country panels (the financially relatively more developed versus the less developed panels). Of the three remaining measures, PC appears completely insignificant in the financially more developed country panel and trivially quadratic in the financially less developed panel. SMCR shows a U-shaped rather than an inverted U-shaped relationship in one count each across both country panels, implying too little finance, and shows complete insignificance in the remaining estimates. SMVR shows one

**Table 5** System GMM estimates of the non-monotonic relationship between the traditional measures of financial development and economic growth across the financially relatively more versus less developed country panels (new dataset)

| | Financially more developed | | | | | Financially less developed | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 |
| PC | 0.013 | 0.009 | 0.027 | 0.012 | -0.005 | 0.118 | 0.084 | 0.077 | 0.079 | 0.078 |
| | (0.018) | (0.020) | (0.028) | (0.029) | (0.03) | (0.075) | (0.064) | (0.080) | (0.080) | (0.078) |
| $PC^2$ | -9.8e-5 | -7.5e-5 | -1.9e-4 | -3.7e-5 | 6.8e-5 | -0.003[b] | -0.003[b] | -0.003[c] | -0.003[c] | -0.003[c] |
| | (7.7e-5) | (10.0e-5) | (1.7e-4) | (1.9e-4) | (2.1e-4) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) |
| Turning points | - | - | - | - | - | - | - | - | - | - |
| Mean | 73.785 | 68.248 | 64.160 | 60.919 | 58.099 | 16.413 | 15.801 | 15.177 | 14.575 | 13.937 |
| Maximum | 262.458 | 151.774 | 128.011 | 113.051 | 100.644 | 29.739 | 27.426 | 26.187 | 25.173 | 24.016 |
| Minimum | 29.873 | 29.873 | 29.873 | 29.873 | 29.873 | 2.2e-5 | 2.2e-5 | 2.2e-5 | 2.2e-5 | 2.2e-5 |
| Lower p-value | - | - | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | - | - | - |
| Observations | 413 | 393 | 372 | 352 | 331 | 413 | 393 | 372 | 352 | 331 |
| Countries | 89 | 89 | 88 | 88 | 87 | 88 | 87 | 86 | 84 | 84 |
| AR1 p-value | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 |
| AR2 p-value | 0.178 | 0.182 | 0.307 | 0.606 | 0.275 | 0.306 | 0.224 | 0.139 | 0.102 | 0.127 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| SMCR | -0.012[b] | 0.015 | -0.020 | -0.022 | -0.036[b] | -0.011 | -0.016 | -0.009 | -0.045[c] | -0.020 |
| | (0.005) | (225,217) | (0.017) | (0.018) | (0.016) | (0.023) | (0.018) | (0.029) | (0.025) | (0.03) |
| $SMCR^2$ | 8.5e-6[c] | -6.8e-5 | 8.2e-5 | 8.5e-5 | 1.9e-4[a] | 8e-5 | 1.1e-4 | 6.8e-5 | 2.3e-4[b] | 1.1e-4 |
| | (5.0e-6) | (391.5) | (7.6e-5) | (7.8e-5) | (6.4e-5) | (1.0e-4) | (8.7e-5) | (1.2e-4) | (1.2e-4) | (1.5e-4) |
| Turning points | - | - | - | - | 96.03 | - | - | - | 95.3 | - |
| Mean | 93.714 | 76.480 | 69.713 | 65.461 | 61.679 | 13.046 | 12.267 | 11.450 | 10.635 | 9.876 |
| Maximum | 1003.41 | 226.219 | 155.346 | 130.1502 | 117.769 | 30.166 | 28.132 | 25.919 | 23.760 | 21.781 |
| Minimum | 30.320 | 30.320 | 30.320 | 30.320 | 30.320 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| Lower p-value | 0.018 | - | - | - | 0.013 | - | - | - | 0.039 | - |

**Table 5** (continued)

| | Financially more developed | | | | | Financially less developed | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 |
| Upper p-value | 0.140 | - | - | - | 0.001 | - | - | - | 0.023 | - |
| Observations | 217 | 207 | 196 | 185 | 174 | 217 | 207 | 196 | 185 | 174 |
| Countries | 65 | 64 | 64 | 64 | 64 | 75 | 75 | 70 | 70 | 69 |
| AR1 p-value | 0.021 | 1.000 | 0.003 | 0.011 | 0.003 | 0.001 | 0.003 | 0.005 | 0.007 | 0.064 |
| AR2 p-value | 0.113 | 1.000 | 0.474 | 0.225 | 0.131 | 0.299 | 0.259 | 0.178 | 0.158 | 0.219 |
| OID p-value | 1.000 | 0.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| SMVR | 0.007 | 0.020 | 0.013 | 0.023[c] | 0.026 | -0.002 | -0.019 | -0.088 | -0.104 | -0.136 |
| | (0.043) | (0.167) | (0.067) | (0.013) | (0.022) | (0.058) | (0.055) | (0.087) | (0.083) | (0.110) |
| $SMVR^2$ | -1.1e-5 | -1.1e-4 | -6.5e-5 | -1.3e-4[b] | -1.4e-4 | -7.2e-5 | 3.5e-5 | 0.001 | 0.001 | 0.001 |
| | (5.7e-5) | (6.5e-4) | (3.4e-4) | (6.4e-5) | (9.3e-5) | (4.7e-4) | (3.9e-4) | (0.001) | (0.001) | (0.001) |
| Turning points | - | - | - | 89.45 | - | - | - | - | - | - |
| Mean | 46.155 | 36.043 | 30.954 | 27.037 | 23.508 | 1.517 | 1.331 | 1.162 | 1.014 | 0.881 |
| Maximum | 589.352 | 144.667 | 110.487 | 87.051 | 71.047 | 5.664 | 4.768 | 4.138 | 3.346 | 2.693 |
| Minimum | 5.901 | 5.901 | 5.901 | 5.901 | 5.901 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| Lower p-value | - | - | - | 0.042 | - | - | - | - | - | - |
| Upper p-value | - | - | - | 0.024 | - | - | - | - | - | - |
| Observations | 226 | 215 | 204 | 193 | 181 | 226 | 215 | 204 | 193 | 181 |
| Countries | 57 | 57 | 57 | 57 | 57 | 78 | 78 | 76 | 74 | 73 |
| AR1 p-value | 0.558 | 0.742 | 0.119 | 0.013 | 0.023 | 0.014 | 0.014 | 0.008 | 0.012 | 0.011 |
| AR2 p-value | 0.931 | 0.602 | 0.094 | 0.053 | 0.111 | 0.232 | 0.224 | 0.305 | 0.189 | 0.193 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

**Table 5** (continued)

| | Financially more developed | | | | | Financially less developed | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 |
| AFDR | -0.005<br>(0.003) | -3.8e-4<br>(0.010) | -0.001<br>(0.012) | 0.001<br>(0.022) | -0.002<br>(0.016) | -0.006<br>(0.014) | -0.004<br>(0.018) | -0.005<br>(0.018) | -0.001<br>(0.021) | -0.016<br>(0.024) |
| $AFDR^2$ | 2.8e-6<br>(2.3e-6) | -7.2e-6<br>(2.0e-5) | -9.3e-6<br>(2.6e-5) | -7.5e-6<br>(4.8e-5) | -6.6e-7<br>(3.5e-5) | 4.3e-5<br>(5.4e-5) | 3.3e-5<br>(6.3e-5) | 3.6e-5<br>(6.4e-5) | 8.4e-6<br>(7.2e-5) | 6e-5<br>(8.2e-5) |
| Turning points | - | - | - | - | - | - | - | - | - | - |
| Mean | 185.948 | 167.731 | 159.425 | 152.960 | 147.024 | 46.599 | 44.705 | 42.673 | 40.672 | 38.6214 |
| Maximum | 1189.713 | 350.158 | 283.748 | 253.643 | 238.004 | 88.462 | 82.671 | 77.336 | 74.289 | 69.541 |
| Minimum | 88.989 | 88.989 | 88.989 | 88.989 | 88.989 | 3.998 | 3.998 | 3.998 | 3.998 | 3.998 |
| Lower p-value | - | - | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | - | - | - |
| Observations | 215 | 205 | 194 | 183 | 172 | 215 | 205 | 194 | 183 | 172 |
| Countries | 57 | 56 | 56 | 55 | 55 | 73 | 71 | 70 | 68 | 65 |
| AR1 p-value | 0.016 | 0.036 | 0.038 | 0.062 | 0.071 | 0.000 | 0.000 | 0.002 | 0.004 | 0.022 |
| AR2 p-value | 0.224 | 0.349 | 0.256 | 0.822 | 0.560 | 0.097 | 0.332 | 0.073 | 0.092 | 0.159 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| AFAR | -0.003<br>(0.006) | 0.006<br>(0.009) | 0.010<br>(0.010) | 0.008<br>(0.012) | 0.008<br>(0.011) | 0.022<br>(0.036) | 0.042<br>(0.029) | 0.015<br>(0.044) | 0.014<br>(0.042) | 0.015<br>(0.043) |
| $AFAR^2$ | 2.9e-6<br>(6.4e-6) | -2.5e-5<br>(1.9e-5) | -3.0e-5<br>(2.2e-5) | -2.6e-5<br>(2.4e-5) | -2.5e-5<br>(2.2e-5) | -9.5e-5<br>(3.6e-4) | -3.5e-4<br>(2.7e-4) | -1.1e-4<br>(4.5e-4) | 1.4e-4<br>(3.6e-4) | -1.5e-4<br>(3.7e-4 |
| Turning points | - | - | - | - | - | - | - | - | - | - |
| Mean | 140.855 | 127.06 | 120.096 | 113.743 | 107.844 | 32.444 | 30.951 | 29.577 | 28.289 | 27.050 |
| Maximum | 775.655 | 292.201 | 238.186 | 216.226 | 201.954 | 63.448 | 57.869 | 53.151 | 49.508 | 47.629 |
| Minimum | 63.776 | 63.776 | 63.776 | 63.776 | 63.776 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 |
| Lower p-value | - | - | - | - | - | - | - | - | - | - |

**Table 5** (continued)

| | Financially more developed | | | | | Financially less developed | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 |
| Upper p-value | - | - | - | - | - | - | - | - | - | - |
| Observations | 223 | 212 | 201 | 190 | 179 | 223 | 212 | 201 | 190 | 179 |
| Countries | 57 | 57 | 57 | 57 | 57 | 74 | 71 | 69 | 65 | 60 |
| AR1 p-value | 0.008 | 0.020 | 0.020 | 0.024 | 0.026 | 0.007 | 0.017 | 0.017 | 0.008 | 0.018 |
| AR2 p-value | 0.164 | 0.131 | 0.234 | 0.465 | 0.699 | 0.164 | 0.154 | 0.119 | 0.15 | 0.389 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

Financially relatively more developed panel consists of sample countries which take on higher than sample median values of each of the indicators of financial development, whereas the financially relatively less developed panel consists of countries taking on median-cum-below-median values. Precise details on construction of these panels are given in Section 5.5. The sample period is 1970–2014. For model specifications, winsorizations, variable mnemonics and other details please refer to the notes for Tables 1 and 2 case of the inverted U-shaped relationship at the 85th percentile of the financially relatively more developed country panel and complete insignificance elsewhere. The fifty sets of results obtained from the ABP dataset reinforce these findings. Overall, in the fifty sets of estimates involving the five traditional measures in our dataset, we find only one instance of the inverted U-shaped relationship: a score of just 2%. This score is nil in the parallel fifty sets of results obtained from the ABP dataset.

Results from our second approach to categorizing the financially relatively more versus less developed country panels also resonate qualitatively the same findings. In the fifty sets of estimates from our dataset, the score in favor of the inverted U-shaped relationship is only 4%; PC (in the 90th percentile of the financially more developed panel) and AFAR (in the 85th percentile of the financially less developed panel) show one case of an inverted U-shaped relationship each. The rest of the parameter estimates appear overwhelmingly insignificant. Parallel results from the extended ABP dataset do not show even a single case of a valid inverted U-shaped relationship and all five measures of financial development appear mostly insignificant in explaining PYG. Overall, there is virtually no support for the inverted U-shaped relationship between the five traditional measures of financial development and economic growth, when both global panel datasets are regrouped into panels of financially relatively more versus less developed countries.

## 6 The New Dataset and the ABP Dataset: Analysis of IMF Relative Indices of Financial Development

We now turn to discuss the results of the non-monotonic relationship between financial development and economic growth obtained by analyzing the nine relative indices of financial development. Sahay et al. (2015) analyze these indices and report findings of the inverted U-shaped relationship, however, their conditioning covariates are very different. We offer far wider and deeper scrutiny. We incorporate these indices into both (our and the ABP) global datasets and scrutinize them following the same analytical trajectories and approaches as above to ensure uniformity of the analyses. Our dataset covers the period of 1970–2014, but the data on IMF indicators are only available for 1980–2016, hence we could only estimate for the sample period of 1980–2014 in our dataset and 1980–2010 in the ABP dataset. For the sake of brevity, we only analyze full samples with percentile truncations and focus on the system GMM panel estimates. The results are organized in Subsections 6.1 through 6.4.

### 6.1 Panel Results (Global Panels)

We report the forty-five sets of panel results relating to the nine relative indices of financial development obtained from our dataset in Table 6; parallel results from the extended ABP dataset are reported in Table B.1 (online Appendix B).

The index of overall financial development (FD), which incorporates the depth of, access to, and efficiency of domestic financial institutions and markets, shows an inverted U-shaped relationship across all five sets of estimates at TPs

**Table 6** System GMM estimates of the non-monotonic relationship between the IMF relative indices of financial development and economic growth (new dataset: full panel)

| Full sample (1980–2014) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.00 | 0.95 | 0.90 | 0.85 | 0.80 | 1.00 | 0.95 | 0.90 | 0.85 | 0.80 |
| FD | 18.78[a] | 21.75[a] | 17.22[a] | 24.42[a] | 25.19[a] | - | - | - | - | - |
| | (4.170) | (5.213) | (5.783) | (7.050) | (7.135) | | | | | |
| $FD^2$ | -18.69[a] | -22.90[a] | -18.01[a] | -28.97[a] | -30.81[a] | - | - | - | - | - |
| | (3.877) | (5.269) | (6.905) | (9.752) | (11.46) | | | | | |
| FI | - | - | - | - | - | 27.65[a] | 24.95[a] | 21.21[a] | 26.49[a] | 28.33[a] |
| | | | | | | (4.697) | (6.212) | (6.487) | (6.946) | (8.458) |
| $FI^2$ | - | - | - | - | - | -22.43[a] | -20.22[a] | -16.96[a] | -22.40[a] | -26.63[a] |
| | | | | | | (4.046) | (5.549) | (6.523) | (7.595) | (9.775) |
| Turning Points | 0.5 | 0.47 | 0.48 | 0.42 | 0.41 | 0.62 | 0.62 | 0.63 | 0.59 | 0.53 |
| Mean | 0.326 | 0.299 | 0.276 | 0.255 | 0.237 | 0.428 | 0.404 | 0.381 | 0.360 | 0.339 |
| Maximum | 0.977 | 0.777 | 0.670 | 0.588 | 0.509 | 0.986 | 0.858 | 0.774 | 0.726 | 0.662 |
| Minimum | 0.042 | 0.042 | 0.042 | 0.042 | 0.042 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 |
| Lower p-value | 3.9e-6 | 1.7e-5 | 0.002 | 2.9e-4 | 2.2e-4 | 3.1e-9 | 3.3e-5 | 0.001 | 7.4e-5 | 4.2e-4 |
| Upper p-value | 1.1e-6 | 1.4e-5 | 0.014 | 0.005 | 0.013 | 6.5e-6 | 0.003 | 0.037 | 0.023 | 0.018 |
| Observations | 699 | 665 | 630 | 595 | 560 | 698 | 664 | 629 | 594 | 559 |
| Countries | 121 | 121 | 121 | 119 | 117 | 121 | 121 | 119 | 116 | 114 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.021 | 0.025 | 0.023 | 0.012 | 0.012 | 0.049 | 0.049 | 0.028 | 0.030 | 0.032 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| FID | 7.967[b] | 8.001[c] | 11.09[b] | 11.02[b] | 12.48[b] | - | - | - | - | - |
| | (3.508) | (4.276) | (5.207) | (5.405) | (5.113) | | | | | |
| $FID^2$ | -8.768[a] | -9.763[c] | -13.56[b] | -13.29[c] | -14.40[c] | - | - | - | - | - |
| | (3.358) | (5.128) | (6.683) | (7.060) | (7.404) | | | | | |
| FIA | - | - | - | - | - | 13.47[a] | 10.72[b] | 10.28[b] | 11.83[c] | 13.21[c] |
| | | | | | | (4.915) | (4.846) | (5.175) | (9.291) | (7.437) |

**Table 6** (continued)

| Full sample (1980–2014) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.00 | 0.95 | 0.90 | 0.85 | 0.80 | 1.00 | 0.95 | 0.90 | 0.85 | 0.80 |
| FIA$^2$ | - | - | - | - | - | -10.80[b] (4.373) | -8.477[c] (4.848) | -8.255 (6.011) | -11.38 (7.888) | -13.11 (10.13) |
| Turning Points | 0.45 | 0.41 | 0.41 | 0.41 | 0.43 | 0.62 | - | - | - | - |
| Mean | 0.294 | 0.262 | 0.235 | 0.209 | 0.184 | 0.318 | 0.285 | 0.255 | 0.227 | 0.200 |
| Maximum | 1 | 0.834 | 0.702 | 0.653 | 0.571 | 1 | 0.876 | 0.781 | 0.699 | 0.599 |
| Minimum | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| Lower p-value | 0.012 | 0.031 | 0.017 | 0.021 | 0.007 | 0.003 | 0.014 | - | - | - |
| Upper p-value | 0.003 | 0.034 | 0.032 | 0.043 | 0.054 | 0.028 | 0.124 | - | - | - |
| Observations | 698 | 664 | 629 | 594 | 559 | 696 | 662 | 627 | 592 | 557 |
| Countries | 121 | 121 | 120 | 118 | 114 | 120 | 119 | 118 | 114 | 109 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.024 | 0.040 | 0.044 | 0.045 | 0.015 | 0.027 | 0.015 | 0.018 | 0.022 | 0.015 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| FIE | 18.43[a] (6.883) | 14.77[b] (7.225) | 16.02[b] (7.140) | 16.58[b] (8.066) | 16.45[b] (7.111) | - | - | - | - | - |
| FIE$^2$ | -12.42[b] (5.949) | -9.273 (5.943) | -10.18[c] (5.975) | -10.46 (6.785) | -10.87[c] (5.903) | - | - | - | - | - |
| FM | - | - | - | - | - | 6.287[b] (2.626) | 6.072[b] (2.892) | 5.436 (3.516) | 12.38[a] (4.02) | 13.35[b] (6.21) |
| FM$^2$ | - | - | - | - | - | -8.977[a] (2.693) | -8.094[b] (3.630) | -8.001 (5.392) | -22.18[a] (7.488) | -27.54[b] (12.98) |
| Turning Points | - | - | - | - | - | 0.35 | 0.38 | - | 0.28 | 0.24 |
| Mean | 0.653 | 0.640 | 0.628 | 0.616 | 0.604 | 0.224 | 0.192 | 0.166 | 0.144 | 0.124 |
| Maximum | 0.993 | 0.873 | 0.846 | 0.824 | 0.811 | 0.995 | 0.751 | 0.574 | 0.498 | 0.416 |

**Table 6** (continued)

Full sample (1980–2014)

| | 1.00 | 0.95 | 0.90 | 0.85 | 0.80 | 1.00 | 0.95 | 0.90 | 0.85 | 0.80 |
|---|---|---|---|---|---|---|---|---|---|---|
| Minimum | 0.107 | 0.107 | 0.107 | 0.107 | 0.107 | 8.4e-11 | 8.4e-11 | 8.4e-11 | 8.4e-11 | 8.4e-11 |
| Lower p-value | 0.004 | - | 0.012 | - | 0.010 | 0.008 | 0.018 | - | 0.001 | 0.016 |
| Upper p-value | 0.1227 | - | 0.204 | - | 0.148 | 7.83e-5 | 0.016 | - | 0.002 | 0.019 |
| Observations | 698 | 664 | 629 | 594 | 559 | 686 | 652 | 618 | 584 | 549 |
| Countries | 121 | 121 | 120 | 119 | 118 | 119 | 119 | 118 | 117 | 116 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.064 | 0.043 | 0.043 | 0.060 | 0.018 | 0.019 | 0.027 | 0.031 | 0.044 | 0.018 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| FMD | 1.794 | 3.056 | 2.409 | 4.874 | 6.876 | - | - | - | - | - |
| | (2.103) | (2.347) | (3.136) | (4.305) | (4.709) | | | | | |
| $FMD^2$ | -3.590[c] | -5.550[c] | -5.378 | -12.94 | -18.78 | - | - | - | - | - |
| | (1.984) | (2.928) | (5.078) | (8.717) | (11.93) | | | | | |
| FMA | - | - | - | - | - | 2.877 | 1.586 | 3.059 | 1.118 | 8.287[c] |
| | | | | | | (2.486) | (2.927) | (4.048) | (2.681) | (4.558) |
| $FMA^2$ | - | - | - | - | - | -4.708[c] | -3.460 | -5.665 | -1.906 | -18.08[b] |
| | | | | | | (2.562) | (3.187) | (5.239) | (3.179) | (8.576) |
| Turning Points | - | - | - | - | - | - | - | - | - | 0.23 |
| Mean | 0.206 | 0.170 | 0.139 | 0.114 | 0.094 | 0.287 | 0.254 | 0.226 | 0.202 | 0.180 |
| Maximum | 0.989 | 0.809 | 0.634 | 0.510 | 0.374 | 1 | 0.815 | 0.694 | 0.573 | 0.514 |
| Minimum | 2.2e-10 | 2.2e-10 | 2.2e-10 | 2.2e-10 | 2.2e-10 | 3.2e-4 | 3.2e-4 | 3.2e-4 | 3.2e-4 | 3.2e-4 |
| Lower p-value | - | - | - | - | - | - | - | - | - | 0.035 |
| Upper p-value | - | - | - | - | - | - | - | - | - | 0.015 |
| Observations | 679 | 646 | 612 | 578 | 544 | 557 | 530 | 502 | 474 | 446 |
| Countries | 118 | 118 | 117 | 116 | 113 | 94 | 94 | 94 | 91 | 89 |

**Table 6** (continued)

Full sample (1980–2014)

| | 1.00 | 0.95 | 0.90 | 0.85 | 0.80 | 1.00 | 0.95 | 0.90 | 0.85 | 0.80 |
|---|---|---|---|---|---|---|---|---|---|---|
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.002 | 0.001 |
| AR2 p-value | 0.020 | 0.027 | 0.016 | 0.026 | 0.022 | 0.036 | 0.063 | 0.057 | 0.095 | 0.113 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| FME | 4.434[c] | 4.434[c] | 4.214[b] | 4.128 | 5.144[b] | | | | | |
| | (2.493) | (2.493) | (1.941) | (2.694) | (2.341) | | | | | |
| $FME^2$ | -4.285[c] | -4.285[c] | -4.330[b] | -4.478 | -4.611[c] | | | | | |
| | (2.422) | (2.422) | (2.002) | (2.862) | (2.636) | | | | | |
| Turning Points | 0.52 | 0.52 | 0.49 | - | - | | | | | |
| Mean | 0.300 | 0.300 | 0.225 | 0.189 | 0.159 | | | | | |
| Maximum | 1.000 | 1.000 | 0.887 | 0.7538456 | 0.591 | | | | | |
| Minimum | 3.1e-4 | 3.1e-4 | 3.1e-4 | 3.1e-4 | 3.1e-4 | | | | | |
| Lower p-value | 0.038 | 0.038 | 0.015 | - | 0.014 | | | | | |
| Upper p-value | 0.055 | 0.055 | 0.024 | - | 0.111 | | | | | |
| Observations | 538 | 538 | 485 | 458 | 431 | | | | | |
| Countries | 93 | 93 | 93 | 90 | 89 | | | | | |
| AR1 p-value | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | | | | | |
| AR2 p-value | 0.101 | 0.101 | 0.110 | 0.148 | 0.161 | | | | | |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | | | | | |

The nine relative indices (measures) of financial development, obtained from the IMF database, are analyzed. They are the relative index of (i) overall financial development (FD), (ii) financial institutional development (FI), (iii) financial market development (FM), (iv) financial institutional depth (FID), (v) access to financial institutions (FIA), (vi) efficiency of financial institutions (FIE), (vii) depth of financial markets (FMD), (viii) access to financial markets (FMA), and (ix) efficiency of financial markets (FME). Full descriptions of these indices are provided in Section 2. Numbers beyond three decimal places are reported as 3.5e-4 = 0.00035. For model specifications please refer to Eq. (2) in the paper, and for diagnostics to Table 2 ranging from 0.50 to 0.41. Parallel results from the extended ABP dataset corroborate these results with TPs of 0.50 to 0.28. Likewise, the index of institutional development (FI), which consolidates FID, FIA, and FIE, also shows an inverted U-shaped relationship in all five sets of estimates at TPs ranging from 0.62 to 0.53. The results from the extended ABP dataset reinforce these findings by showing four cases of the inverted U-shaped relationship at TPs ranging from 0.53 to 0.42. These estimated TPs, and the others reported below, raise deeply uncomfortable policy implications which we shall shortly comment on.

The index of institutional depth (FID) also shows the non-monotonic relationship across all five sets of estimates at TPs ranging from 0.45 to 0.41. However, results from the extended ABP dataset differ: FID shows an inverted U-shaped relationship in only the 95$^{th}$ percentile at the TP of 0.33, a trivially quadratic relationship in the full sample, and insignificance in the three remaining sets of estimates. The index of access to financial institutions (FIA) shows one case of the inverted U-shaped relationship (the 100$^{th}$ percentile), one case of a trivially quadratic relationship (the 95$^{th}$ percentile) as it fails the Lin-Meh test, and linearly significant relationship in three remaining cases. However, results from the ABP datasets show four cases of the inverted U-shaped relationships of FIA at TPs of 0.54 to 0.26. The index of institutional efficiency (FIE) appears only linearly significant in the two cases, and fails the Lin-Meh test in three cases in our dataset. FIE appears totally insignificant in the extended ABP dataset. It is rather surprising that the index of institutional efficiency appears almost totally insignificant in explaining economic growth.

The composite index of financial market development (FM) shows the non-monotonic relationship in four of the five sets of estimates at TPs of 0.38 to 0.24. By contrast, parallel results from the ABP dataset show only two cases of the non-monotonic relationship at the TPs of 0.46 and 0.37. The index of the depth of financial markets (FMD) shows trivially quadratic relationships in two instances, and complete insignificance in the three remaining cases. Likewise, results from the ABP dataset show insignificance of FMD in four instances, and a trivially quadratic relationship in the 80$^{th}$ percentile. The index of access to financial markets (FMA) shows a marginally significant inverted U-shaped relationship at the 80$^{th}$ percentile, a trivially quadratic relationship at the 100$^{th}$ percentile, and insignificance elsewhere. In the extended ABP dataset, FMA appears marginally trivially quadratic at the 80$^{th}$ percentile and insignificant elsewhere. Finally, FME shows inverted U-shaped relationships in three instances at TPs ranging from 0.52 to 0.49, a trivially quadratic relationship in one instance, and insignificance in one instance. Interestingly, results from the ABP dataset show an inverted U-shaped relationship between FME and PYG in all five sets of estimates, with TPs ranging from 0.56 to 0.47. Financial market efficiency showing a tipping point relationship with economic growth is rather surprising.

In total, five of the nine relative measures show the inverted U-shaped relationship in our dataset and four measures do so in the ABP dataset (inclusive of FME in both cases). This suggests that there is some evidence of an inverted U-shaped relationship between these relative measures of financial development and economic growth, which sharply contradicts the results from the five traditional measures, reported above, showing a virtual lack of the inverted U-shaped relationship.

However, the non-monotonic relationships shown by these relative indices are not without difficulties. The estimated tipping points of these indices imply deeply troubling policy implications, particularly for industrialized countries. For example, Australia, Canada, France, Luxemburg, Japan, the United Kingdom, and the United States, all have FD indices of above 0.75 (Svirydzenka 2016; Annex 1). If the estimated threshold of around 0.50 or lower for FD is to be taken as factually accurate, then industrialized countries need to adjust (bring down) their levels of overall financial development to levels comparable to those of Cyprus, Chile, Turkey, Hungary, Slovenia, and/or even lower to avoid the growth costs of having relatively highly developed financial systems. This is bizarre. Likewise, the estimates of tipping points vis-à-vis FIA imply that advanced countries currently offer too much institutional access, at a cost to their economic growth. To evade negative growth effects, they must bring down their levels of institutional access to levels similar to those of Guatemala, Serbia, and Estonia, or even lower. Results also show an inverted U-shaped relationship between FME and economic growth, implying that a highly efficient financial market costs economic growth, which is rather nonsensical. Similarly uncomfortable implications emerge across all relative measures of financial development depicting the inverted U-shaped relationship. We resist from commenting further on such implications, simply because as it turns out, the results from the global panels are not robust. They disappear completely once both global datasets are restructured into country panels, based on regions, income levels, and the relative levels of financial development. We turn to these results in the following sections.

### 6.2 Panel Results (Regional Panels)

We report a total of 180 sets of results pertaining to the four regional panels from our dataset in online Tables B.2 and B.3. They consist of forty-five sets of estimates (9 indices × 5 percentiles of sample 1980–2014) for each of the four regional country panels. The results are quite astounding. In sharp contrast to the results of the global panel, which show some support for the inverted U-shaped relationship (Section 6.1), there is hardly any evidence of inverted U-shaped relationships across these estimates. Specifically, all nine indices appear largely insignificant for the Africa and Asia panels.[16] Likewise, six of the nine indices—FD, FID, FIA, FM, FMA, and FME—appear completely insignificant in explaining PYG in the EU-NA panel. Of the three remaining indices, FI and FIE show one case of an inverted U-shaped relationship each at their 80$^{th}$ percentiles, and overwhelmingly insignificance elsewhere, whereas FMD shows a trivially quadratic relationship in the 90$^{th}$ percentile and total insignificance in the rest of the estimates. Results do not appear any different vis-à-vis the LAC panel either. Six indices—viz., FI,

16 Data dimensions for the FMA and the FME indices are somewhat short for Africa, hence we advise caution regarding the two sets of results for Africa.

FIA, FM, FMD, FMA, and FME—appear totally insignificant across all estimates. Of the three remaining, FD appears linearly negative and significant at the 100$^{th}$ percentile, but positive and significant at the 80$^{th}$ percentile, while FID (at the 80$^{th}$ percentile) and FIE (at the 100$^{th}$ percentile) show one count of the inverted U-shaped relationship each, and complete insignificance in the rest of the estimates. The non-monotonicity of FIE in EU-NA and LAC, albeit in only one instance for each region, is hard to justify because this implies a limit to the institutional efficiency of augmenting economic growth. Thus, in the 180 sets of estimates from our dataset, only two counts of the inverted U-shaped relationship are found, barring FIE, a score of 1%. Similarly, the parallel 180 sets of estimates from the extended ABP dataset also reveal just two counts of the inverted U-shaped relationship (excluding one count associated with FIE), and all nine relative indices appear insignificant in explaining PYG in vast majority of cases (online Tables B.4 and B.5). Overall, the results show hardly any evidence supporting the inverted U-shaped relationships between the nine relative indices of financial development and economic growth in the four regional country panels. The inverted U-shaped relationships found between some of the nine relative indices of financial development and economic growth in the two global panels (Section 6.1) completely disappear once they are regrouped into regional country panels.

### 6.3 Panel Results (Income-Level Based Panels)

Online Table B.6 reports the ninety sets of results pertaining to the high-income and upper-middle-income country panels. Five indices—namely, FID, FIE, FM, FMA, and FME—appear completely insignificant in explaining economic growth in the high-income panel. The four remaining indices—FD, $\left(\frac{1}{5}\right)$ FI $\left(\frac{3}{5}\right)$, FIA $\left(\frac{1}{5}\right)$ and FMD $\left(\frac{4}{15}\right)$—together show nine instances of inverted U-shaped relationships in twenty sets of estimates between them. The place holder $\left(\frac{a}{b}\right)$ denotes instances of the inverted U-shaped relationship over the total estimates for each measure. Parallel results from the extended ABP dataset (online Table B.7) show even fewer cases of the inverted U-shaped relationship for this panel. Six indices—FI, FID, FIA, FIE, FM, and FMA—appear totally insignificant in explaining PYG. The three remaining indices, FD $\left(\frac{1}{5}\right)$, FME $\left(\frac{2}{5}\right)$, and FMD $\left(\frac{1}{5}\right)$ together show four cases of inverted U-shaped relationships across fifteen sets of estimates between them; they appear completely insignificant in the rest of the estimates. As stated earlier, the tipping point relationship shown by FME is rather surprising.

Across the upper-middle-income panels, six of the nine indices appear totally insignificant in explaining PYG. The three exceptions are FD, FMA, and FME, which show one case of the inverted U-shaped relationship each at their lower percentiles. We do not regard data dimension to be an issue here, as the smallest panel has twenty-three countries and 112 non-overlapping five-yearly observations capturing 560 country years. Parallel results from the extended ABP dataset show wholesale insignificance of the nine relative measures across all forty-five sets of estimates but one: the sole exception is the inverted U-shaped relationship shown by FD in the 95$^{th}$ percentile at the TP of 0.30.

The results of the lower-middle- and low-income country panels are shown in online Table B.8. Seven of the indices—viz., FID, FIA, FIE, FM, FMD, FMA, and FME—appear totally insignificant in explaining PYG in the lower-middle-income panel. Of the two remaining indices, FD shows the inverted U-shaped relationship in three cases at TPs ranging from 0.25 to 0.20, while FI shows a linearly significant parameter in just one case (at the 95$^{th}$ percentile). The results from the extended ABP dataset (online Table B.9) reinforce the almost wholesale insignificance of these relative indices for the lower-middle-income country panel: six of the nine indices appear completely insignificant. In the remaining three estimates, FI shows one case of a trivially quadratic relationship, FID shows one negatively significant parameter, while FMA shows two cases of U-shaped relationships; they appear completely insignificant elsewhere.

Data dimension is an issue for the low-income country panel. Our dataset has seventy-two five-yearly non-overlapping data points (i.e., 360 country years) across fifteen countries for the indices of FD, FI, FID, FIA, and FIE for this panel. Data for the rest of the indices are very short. When we combine these five indices into the ABP dataset, the data dimensions of the low-income panel range from seventeen countries with ninety-one five-yearly non-overlapping data points (i.e., 455 country years) to fourteen countries with seventy-four data points (i.e., 370 country years). Given the data constraints with other indices, we focus on these five indices and estimate their 100$^{th}$ percentiles only. As is evident, they all appear totally insignificant across both datasets.

Overall, the support for the inverted U-shaped relationship is meager across the country panels based on income levels. Setting aside the two efficiency indices, we have seventy sets of estimates across seven indices involving our and the ABP datasets for the high-income panel (7 indices $\times$ 2 datasets $\times$ 5 percentiles). The overall score in support of the inverted U-shaped relationship is just 16%, $\left(\frac{11}{70}\right)$, which is confined to four indices—namely, FD, FI, FIA, and FMD—across two datasets. The upper-middle-income panel shows just two counts of the inverted U-shaped relationship in the seventy parallel sets of estimates, a score of 3%. Similarly, in the seventy sets of estimates of the lower-middle-income panel, only FD shows three instances of the inverted U-shaped relationship (a score of just 4%). Finally, the five indices that we model for the low-income panel, all appear totally insignificant in explaining economic growth. To recap, there is hardly any support for the inverted U-shaped relationship between the relative indices of financial development and economic growth across the country panels of high-income, upper-middle-income, lower-middle-income, and low-income countries.

### 6.4 Panel Results (Financially More Versus Less Developed Country Panels)

The results for the financially relatively more versus less developed country panels regarding the nine relative indices of financial development following our dynamic approach of country groupings are reported in online Table B.10. Again, the results do not support the assertion that the inverted U-shaped relationship between financial development and economic growth is primarily associated with financially developed countries. Five of these indices—FIA, FID, FIE, FMA, and FMD—appear totally insignificant across twenty sets of estimates between them in explaining PYG in the panels of financially relatively more developed countries. The four remaining indices—FD $\left(\frac{2}{5}\right)$, FI $\left(\frac{2}{5}\right)$, FM $\left(\frac{3}{5}\right)$, and FME $\left(\frac{1}{2}\right)$—together show eight instances of the inverted U-shaped relationship across the seventeen sets of estimates. Likewise, for the financially relatively less developed country panels, four relative indices—FD $\left(\frac{4}{5}\right)$, FIA $\left(\frac{2}{5}\right)$, FMA $\left(\frac{1}{5}\right)$, and FME $\left(\frac{1}{5}\right)$ —together show eight counts of valid inverted U-shaped relationships across twenty sets of estimates between them. The rest of the estimates and the five remaining indices appear mostly insignificant. Excluding the two indices of efficiency, the overall score in favor of the inverted U-shaped relationship between the seven relative measures of financial development and PYG is 20%, $\left(\frac{14}{70}\right)$, across both the financially relatively more and less developed country panels, although the indices showing non-monotonicity differ across these two panels. Interestingly, both efficiency indices appear either insignificant and/or show a tipping point relationship with PYG which is unexpected.

Parallel results from the extended ABP dataset do not further any evidence in favor of the inverted U-shaped relationship (online Table B.11). Four indices—viz., FD, FIA, FID, and FMD—appear totally insignificant in explaining PYG across the financially relatively more developed panels. Of the five remaining indices, three—FI $\left(\frac{1}{5}\right)$, FM $\left(\frac{2}{5}\right)$, FME $\left(\frac{1}{3}\right)$—show four instances of the inverted U-shaped relationship across the thirteen sets of estimates between them, while the other two—FIE and FMA—show one case of the U-shaped relationship each. The results from the financially relatively less developed country panels reveal eight instances of valid inverted U-shaped relationships across the twenty sets of estimates concerning four relative indices—FD $\left(\frac{1}{5}\right)$ , FIA $\left(\frac{1}{5}\right)$, FMA $\left(\frac{2}{5}\right)$, and FME $\left(\frac{4}{5}\right)$. Of the five remaining indices, three—FIE, FM, and FMD—appear totally insignificant, while two—FI and FID—show one case of a trivially quadratic relationship each. All of the relative indices appear mostly insignificant in the rest of the estimates. The tipping point shown by FME in four of the five sets of estimates is puzzling.

Two clear messages emerge from this analysis. First, there is very limited empirical support for the inverted U-shaped relationship between financial development, measured by these indices of relative financial development, and economic growth across the financially relatively more versus less developed country panels. Excluding the two efficiency indices, results from both datasets show an overall score of only 14% $\left(\frac{10}{70}\right)$ in favor of the inverted U-shaped relationship for financially relatively developed country panels, whereas the proportion is 16% $\left(\frac{11}{70}\right)$ for the financially less developed panels. Second, the efficiency index of financial institutions appears largely insignificant in explaining growth, while the efficiency index of financial markets shows a threshold relationship in most estimates, both of which are unexpected and hard to explain. This lack of a clear-cut support for the assertion that the non-monotonic finance–growth relationship is primarily associated with financially developed countries corroborates the findings from the five traditional measures reported in Section 5.5.

## 7 The Alternative Functional Form: Is there a Tipping Point?

In this section, we present the results regarding the concavity of the finance–growth relationship following an alternative functional form. Specifically, we estimate the non-monotonic relationship between financial development and real per capita GDP (LYP) through the dynamic panel strategy— similar to Acemoglu et al. (2019)—as set out in Eq. (3) above.

### 7.1 Panel Results (Global Panels)

We report fifty sets of results concerning the five traditional measures of financial development from our and the ABP datasets in Table 7.

The results show hardly any support for the inverted U-shaped relationship between the five traditional measures and LYP. All five measures appear overwhelmingly insignificant in explaining LYP, without a single case of the inverted U-shaped relationship in our dataset. In the parallel results from the ABP dataset, PC shows just one instance of an inverted U-shaped relationship at the $100^{th}$ percentile; all the remaining measures and estimates appear mostly insignificant.

The results of the nine relative indices of financial development are reported in Table 8. Six of the indices—FD $\left(\frac{2}{5}\right)$, FI $\left(\frac{1}{5}\right)$, FIA $\left(\frac{1}{5}\right)$, FM $\left(\frac{4}{5}\right)$, FMA $\left(\frac{4}{5}\right)$, and FME $\left(\frac{3}{5}\right)$—show the inverted U-shaped relationship with LYP in one to four cases each in our dataset, with varying degrees of TPs across indices ranging from 0.30 to 0.61. The three remaining indices—FID, FIE, and FMD—appear either mostly or completely insignificant. The parallel results from the ABP dataset are largely corroborative: six of the nine relative indices—FD $\left(\frac{5}{5}\right)$, FI $\left(\frac{2}{5}\right)$, FIA $\left(\frac{5}{5}\right)$, FID $\left(\frac{1}{5}\right)$, FM $\left(\frac{2}{5}\right)$, and FME $\left(\frac{5}{5}\right)$—show inverted U-shaped relationships at differing TPs ranging from 0.62 to 0.32 across these indices, while the three remaining indices—FIE, FMA, and FMD—appear totally insignificant. The inverted U-shaped relationships shown by FME across all five sets of estimates in the extended ABP dataset and in the majority of the estimates in our dataset are puzzling, and so is the total insignificance of FIE across all estimates of both datasets. Efficiency of financial institutions and markets are expected to show neither a tipping point nor irrelevance (insignificance) in explaining real per capita GDP.

Excluding the two efficiency indices, we have a total of seventy sets of estimates from the two global datasets between the seven relative indices of financial development, and the overall score in support of the inverted U-shaped relationship is 34 and 43% in our and the ABP datasets respectively. These scores show some support for the non-monotonic relationship in global panels, but the evidence is hardly compelling. Moreover, this support completely crumbles once both global panels are subject to further scrutiny, by regrouping them into country panels based on regions,

**Table 7** System GMM estimates of the non-monotonic relationship between the traditional five measures of financial development and real per capita GDP

| | New dataset: 1970–2014 | | | | | ABP dataset: 1960–2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 |
| PC | 2.2e-4<br>(2.9e-4) | 3.7e-4<br>(5.5e-4) | 4.1e-4<br>(0.001) | -4.9e-4<br>(0.001) | -5.9e-5<br>(0.001) | 0.076[b]<br>(0.037) | 0.078<br>(0.059) | 0.043<br>(0.060) | 0.003<br>(0.072) | -0.067<br>(0.078) |
| $PC^2$ | -1.5e-6<br>(1.3e-6) | -2.7e-6<br>(3.5e-6) | -2.5e-6<br>(4.6e-6) | 7.1e-7<br>(6.0e-6) | 4.1e-6<br>(1.2e-5) | -0.040[b]<br>(0.018) | -0.033<br>(0.045) | 0.030<br>(0.052) | 0.055<br>(0.079) | 0.160<br>(0.099) |
| Turning points | - | - | - | - | - | 0.96 | - | - | - | - |
| Mean | 46.582 | 40.443 | 36.247 | 32.80472 | 29.742 | 0.409 | 0.352 | 0.312 | 0.280 | 0.252 |
| Maximum | 262.458 | 130.706 | 101.777 | 87.592 | 76.289 | 2.698 | 1.239 | 0.93 | 0.774 | 0.662 |
| Minimum | 2.2e-5 | 2.2e-5 | 2.2e-5 | 2.2e-5 | 2.2e-5 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| Lower p-value | - | - | - | - | - | 0.021 | - | - | - | - |
| Upper p-value | - | - | - | - | - | 0.015 | - | - | - | - |
| Observations | 762 | 724 | 686 | 648 | 610 | 868 | 825 | 782 | 738 | 695 |
| Countries | 124 | 123 | 122 | 121 | 120 | 133 | 132 | 132 | 128 | 125 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 |
| AR2 p-value | 0.819 | 0.878 | 0.702 | 0.837 | 0.619 | 0.726 | 0.770 | 0.834 | 0.881 | 0.906 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| | New dataset: 1975–2014 | | | | | ABP dataset: 1975–2010 | | | | |
| | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 |
| SMCR | -1.3e-4[c]<br>(7.2e-5) | -1.1e-4<br>(2.6e-4) | -2.4e-4<br>(2.3e-4) | -2.9e-5<br>(2.4e-4) | -2.1e-4<br>(3.9e-4) | -2.3e-4[a]<br>(7.9e-5) | -2.0e-4<br>(2.5e-4) | -3.9e-4<br>(2.8e-4) | -1.9e-4<br>(4.8e-4) | -1.7e-4<br>(0.001) |
| $SMCR^2$ | 7.6e-8<br>(7.e-8) | 7.8e-8<br>(1.3e-6) | 1.4e-6<br>(1.1e-6) | 6.9e-7<br>(1.3e-6) | 1.7e-6<br>(2.4e-6) | 2.33e-7[c]<br>(1.2e-7) | -3.1e-7<br>(1.3e-6) | 1.5e-6<br>(2.0e-6) | -1.1e-7<br>(5.0e-6) | -2.4e-6<br>(6.3e-6) |
| Turning points | - | - | - | - | - | - | - | - | - | - |
| Mean | 53.326 | 39.915 | 34.677 | 30.540 | 27.138 | 49.073 | 37.256 | 32.192 | 28.095 | 24.680 |
| Maximum | 1003.41 | 155.346 | 117.769 | 93.1537 | 76.065 | 714.164 | 141.606 | 115.795 | 90.593 | 74.395 |

**Table 7** (continued)

| | New dataset: 1975–2014 | | | | | ABP dataset: 1975–2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 |
| Minimum | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.101 | 0.101 | 0.101 | 0.101 | 0.101 |
| Lower p-value | - | - | - | - | - | 0.002 | - | - | - | - |
| Upper p-value | - | - | - | - | - | 0.183 | - | - | - | - |
| Observations | 435 | 414 | 392 | 370 | 348 | 377 | 359 | 340 | 321 | 302 |
| Countries | 93 | 92 | 92 | 91 | 91 | 96 | 94 | 93 | 93 | 91 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 |
| AR2 p-value | 0.459 | 0.278 | 0.261 | 0.172 | 0.274 | 0.803 | 0.929 | 0.823 | 0.880 | 0.852 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| SMVR | -1.4e-4 (3.2e-4) | -8.4e-5 (3.0e-4) | -5.9e-5 (2.5e-4) | 1.7e-4 (2.8e-4) | 3.6e-4 (3.8e-4) | -3.9e4 (0.005) | -4.1e-4 (1.366) | -1.9e-4 (3.2e-4) | -1.4e-4 (3.3e-4) | -1.5e-4 (0.001) |
| $SMVR^2$ | 2.0e-7 (3.4e-7) | 1.9e-7 (1.8e-6) | -5.3e-7 (1.2e-6) | -1.1e-6 (1.6e-6) | -2.0e-6 (2.0e-6) | 10.0e-7 (3.2e-5) | 6.7e-7 (0.007) | -4.6e-7 (1.3e-6) | -6.1e-7 (1.4e-6) | -4.8e-7 (2.4e-6) |
| Turning points | - | - | - | - | - | - | - | - | - | - |
| Mean | 23.836 | 15.483 | 11.297 | 8.701 | 6.621 | 21.205 | 13.356 | 9.543 | 7.122 | 5.392 |
| Maximum | 589.352 | 110.487 | 71.047 | 46.142 | 35.861 | 331.271 | 103.832 | 61.615 | 41.075 | 28.615 |
| Minimum | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| Lower p-value | - | - | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | - | - | - |
| Observations | 452 | 430 | 407 | 385 | 362 | 389 | 370 | 351 | 331 | 312 |
| Countries | 93 | 93 | 93 | 93 | 91 | 95 | 95 | 94 | 94 | 94 |
| AR1 p-value | 0.032 | 0.002 | 0.000 | 0.000 | 0.000 | 0.952 | 1.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.244 | 0.077 | 0.028 | 0.028 | 0.024 | 0.961 | 1.000 | 0.129 | 0.107 | 0.139 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.058 | 0.000 | 1.000 | 1.000 | 1.000 |

**Table 7** (continued)

| | New dataset: 1975–2014 | | | | | ABP dataset: 1975–2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 |
| AFDR | -6.5e-7 | -7.1e-5 | -7.6e-5 | 4.1e-6 | 9.4e-5 | -1.7e-4[b] | 6.8e-5 | -3.1e-5 | 3.0e-4 | 4.6e-4 |
| | (6.1e-5) | (1.7e-4) | (2.4e-4) | (2.3e-4) | (2.3e-4) | (6.8e5) | (2.0e-4) | (3.4e-4) | (0.001) | (0.001) |
| AFDR$^2$ | 2.8e-8 | -3.6e-7 | 3.9e-7 | 2.2e-7 | -2.2e-7 | 7.5e-8 | -6.6e-7 | -5.0e-7 | -2.0e-6 | -3.5e-6 |
| | (4.7e-8) | (4.6e-7) | (6.1e-7) | (6.3e-7) | (5.0e-7) | (1.1e-7) | (5.9e-7) | (1.4e-6) | (2.7e-6) | (2.5e-6) |
| Turning points | - | - | - | - | - | - | - | - | - | - |
| Mean | 116.274 | 100.116 | 91.232 | 83.696 | 77.340 | 106.264 | 91.723 | 83.080 | 76.318 | 70.312 |
| Maximum | 1189.713 | 283.748 | 238.004 | 202.911 | 171.116 | 849.802 | 268.657 | 226.189 | 176.259 | 161.553 |
| Minimum | 3.998 | 3.998 | 3.998 | 3.998 | 3.998 | 3.998 | 3.998 | 3.998 | 3.998 | 3.998 |
| Lower p-value | - | - | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | - | - | - |
| Observations | 430 | 409 | 387 | 366 | 344 | 373 | 355 | 336 | 318 | 299 |
| Countries | 93 | 92 | 91 | 91 | 90 | 96 | 95 | 93 | 93 | 93 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.608 | 0.509 | 0.462 | 0.246 | 0.172 | 0.832 | 0.997 | 0.939 | 0.990 | 0.684 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| AFAR | -2.7e-5 | 1.4e-4 | 2.0e-4 | 1.8e-4 | 1.5e-5 | -2.2e-6 | 1.8e-4 | 1.8e-4 | 7.9e-4 | 0.001 |
| | (0.001) | (2.4e-4) | (1.5e-4) | (1.7e-4) | (3.7e-4) | (1.3e-4) | (1.6e-4) | (2.0e-4) | (6.5e-4) | (0.001) |
| AFAR$^2$ | -9.3e-9 | -7.8e-7 | -7.6e-7[b] | -4.0e-7 | 1.5e-7 | -3.17e-7 | -1.2e-6[c] | -1.2e-6 | -4.8e-6 | -7.3e-6 |
| | (6.8e-7) | (6.5e-7) | (3.2e-7) | (4.7e-7) | (2.1e-6) | (3.1e-7) | (6.4e-7) | (8.7e-7) | (3.9e-6) | (4.6e-6) |
| Turning points | - | - | - | - | - | - | - | - | - | - |
| Mean | 86.649 | 73.996 | 66.017 | 59.572 | 54.280 | 79.099 | 67.340 | 59.675 | 53.900 | 48.874 |
| Maximum | 775.655 | 238.186 | 201.954 | 152.715 | 130.481 | 438.863 | 228.093 | 181.700 | 143.274 | 121.449 |
| Minimum | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 | 4.258 |

**Table 7** (continued)

| | New dataset: 1975–2014 | | | | | ABP dataset: 1975–2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 | 1.0 | 0.95 | 0.9 | 0.85 | 0.8 |
| Lower p-value | - | - | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | - | - | - |
| Observations | 446 | 424 | 402 | 380 | 357 | 385 | 366 | 347 | 328 | 308 |
| Countries | 93 | 93 | 93 | 91 | 91 | 95 | 95 | 94 | 92 | 90 |
| AR1 p-value | 0.060 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.196 | 0.071 | 0.110 | 0.033 | 0.045 | 0.144 | 0.123 | 0.170 | 0.172 | 0.158 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

Panel results of the non-monotonic relationship between the traditional five measures of financial development and real per capita GDP (LYP), following the alternative functional form, are reported. The dependent variable is LYP. Specification is shown in Eq. (3) of Section 3 in the paper. For variable definitions, please refer to the Table A.1 notes in Appendix A; and, for diagnostics, see the notes for Table 2. Numbers beyond three decimal places are reported as 3.5e-4 = 0.00035

**Table 8** System GMM estimates of the non-monotonic relationship between the IMF relative indices of financial development and real per capita GDP

| | New dataset: 1980–2014 | | | | | ABP dataset: 1980–2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 |
| FD | 0.255[a] | 0.258[b] | 0.166 | 0.202 | 0.196 | 0.386[a] | 0.404[b] | 0.427[b] | 0.439[b] | 0.728[b] |
| | (0.080) | (0.106) | (0.102) | (0.160) | (0.153) | (0.112) | (0.178) | (0.170) | (0.204) | (0.290) |
| $FD^2$ | -0.252[a] | -0.282[b] | -0.171 | -0.198 | -0.187 | -0.358[a] | -0.401[c] | -0.471[b] | -0.538[c] | -0.977[b] |
| | (0.076) | (0.114) | (0.122) | (0.221) | (0.245) | (0.101) | (0.210) | (0.214) | (0.307) | (0.449) |
| Turning points | 0.51 | 0.46 | - | - | - | 0.54 | 0.5 | 0.45 | 0.41 | 0.37 |
| Mean | 0.326 | 0.299 | 0.276 | 0.255 | 0.237 | 0.293 | 0.265 | 0.244 | 0.225 | 0.210 |
| Maximum | 0.977 | 0.777 | 0.670 | 0.588 | 0.509 | 0.977 | 0.733 | 0.603 | 0.507 | 0.447 |
| Minimum | 0.042 | 0.042 | 0.042 | 0.042 | 0.042 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 |
| Lower p-value | 0.001 | 0.007 | - | - | - | 2.9e-4 | 0.012 | 0.006 | 0.016 | 0.006 |
| Upper p-value | 0.001 | 0.008 | - | - | - | 0.001 | 0.057 | 0.028 | 0.066 | 0.024 |
| Observations | 698 | 664 | 629 | 594 | 559 | 708 | 673 | 638 | 602 | 567 |
| Countries | 121 | 121 | 121 | 119 | 117 | 135 | 135 | 133 | 131 | 127 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.469 | 0.488 | 0.424 | 0.274 | 0.237 | 0.123 | 0.108 | 0.061 | 0.040 | 0.046 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| FI | 0.254[b] | 0.141 | 0.127 | 0.174 | 0.176 | 0.382[b] | 0.416[b] | 0.324[c] | 0.423[c] | 0.346 |
| | (0.104) | (0.123) | (0.139) | (0.148) | (0.169) | (0.154) | (0.188) | (0.192) | (0.249) | (0.279) |
| $FI^2$ | -0.210[b] | -0.092 | -0.076 | -0.116 | -0.116 | -0.334[b] | -0.376[c] | -0.287 | -0.437 | -0.310 |
| | (0.088) | (0.107) | (0.129) | (0.148) | (0.190) | (0.135) | (0.195) | (0.196) | (0.275) | (0.358) |
| Turning points | 0.6 | - | - | - | - | 0.57 | 0.55 | - | - | - |
| Mean | 0.428 | 0.404 | 0.381 | 0.359 | 0.339 | 0.395 | 0.370 | 0.347 | 0.325 | 0.306 |
| Maximum | 0.986 | 0.858 | 0.774 | 0.726 | 0.662 | 0.986 | 0.833 | 0.742 | 0.677 | 0.594 |
| Minimum | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 |
| Lower p-value | 0.007 | - | - | - | - | 0.007 | 0.013 | - | - | - |
| Upper p-value | 0.017 | - | - | - | - | 0.015 | 0.061 | - | - | - |

**Table 8** (continued)

| | New dataset: 1980–2014 | | | | | ABP dataset: 1980–2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 |
| Observations | 697 | 663 | 628 | 593 | 558 | 707 | 672 | 637 | 601 | 566 |
| Countries | 121 | 121 | 119 | 116 | 114 | 135 | 134 | 132 | 128 | 121 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.475 | 0.455 | 0.344 | 0.267 | 0.191 | 0.127 | 0.077 | 0.054 | 0.052 | 0.028 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| FIA | 0.170[b] | 0.103 | 0.078 | 0.098 | 0.138 | 0.341[a] | 0.286[b] | 0.316[b] | 0.398[b] | 0.61[a] |
| | (0.071) | (0.098) | (0.095) | (0.108) | (0.139) | (0.126) | (0.119) | (0.136) | (0.169) | (0.22) |
| $FIA^2$ | -0.139[b] | -0.063 | -0.033 | -0.088 | -0.164 | -0.296[b] | -0.231[c] | -0.299[b] | -0.495[b] | -0.954[a] |
| | (0.062) | (0.097) | (0.109) | (0.144) | (0.194) | (0.122) | (0.121) | (0.149) | (0.249) | (0.323) |
| Turning points | 0.61 | - | - | - | - | 0.58 | 0.62 | 0.53 | 0.4 | 0.32 |
| Mean | 0.318 | 0.285 | 0.255 | 0.227 | 0.200 | 0.281 | 0.247 | 0.218 | 0.190 | 0.166 |
| Maximum | 1.000 | 0.876 | 0.781 | 0.699 | 0.599 | 1.000 | 0.834 | 0.729 | 0.625 | 0.539 |
| Minimum | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| Lower p-value | 0.008 | - | - | - | - | 0.004 | 0.008 | 0.010 | 0.009 | 0.003 |
| Upper p-value | 0.044 | - | - | - | - | 0.024 | 0.099 | 0.053 | 0.043 | 0.002 |
| Observations | 695 | 661 | 626 | 591 | 556 | 701 | 666 | 631 | 596 | 561 |
| Countries | 120 | 119 | 118 | 114 | 109 | 134 | 133 | 130 | 125 | 119 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.480 | 0.353 | 0.358 | 0.264 | 0.193 | 0.172 | 0.082 | 0.092 | 0.046 | 0.049 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| FID | 0.084 | 0.014 | 0.023 | -0.029 | 0.037 | 0.079 | 0.143 | 0.232[c] | 0.125 | 0.112 |
| | (0.053) | (0.068) | (0.079) | (0.087) | (0.099) | (0.074 | (0.095) | (0.123) | (0.14) | (0.168) |
| $FID^2$ | -0.099[b] | -0.019 | -0.024 | 0.090 | -0.002 | -0.123[c] | -0.225[c] | -0.364[b] | -0.117 | -0.115 |
| | (0.050) | (0.076) | (0.098) | (0.126) | (0.163) | (0.070) | (0.123) | (0.180) | (0.194) | (0.322) |

**Table 8** (continued)

| | New dataset: 1980–2014 | | | | | ABP dataset: 1980–2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 |
| Turning points | - | - | - | - | - | - | - | 0.32 | - | - |
| Mean | 0.294 | 0.262 | 0.235 | 0.209 | 0.184 | 0.253 | 0.220 | 0.194 | 0.168 | 0.146 |
| Maximum | 1.000 | 0.834 | 0.702 | 0.653 | 0.571 | 1.000 | 0.760 | 0.668 | 0.574 | 0.468 |
| Minimum | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| Lower p-value | - | - | - | - | - | - | - | 0.030 | - | - |
| Upper p-value | - | - | - | - | - | - | - | 0.022 | - | - |
| Observations | 697 | 663 | 628 | 593 | 558 | 707 | 672 | 637 | 601 | 566 |
| Countries | 121 | 121 | 120 | 118 | 114 | 135 | 133 | 132 | 129 | 122 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.514 | 0.592 | 0.551 | 0.531 | 0.309 | 0.144 | 0.128 | 0.089 | 0.065 | 0.068 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| FIE | 0.235 | 0.132 | 0.243 | 0.211 | 0.159 | 0.209 | 0.078 | 0.138 | 0.111 | 0.12 |
| | (0.16) | (0.207) | (0.179) | (0.165) | (0.168) | (0.198) | (0.171) | (0.175) | (0.174) | (0.174) |
| $FIE^2$ | -0.159 | -0.077 | -0.165 | -0.133 | -0.088 | -0.129 | -0.024 | -0.070 | -0.063 | -0.081 |
| | (0.125) | (0.168) | (0.143) | (0.139) | (0.134) | (0.154) | (0.132) | (0.140) | (0.138) | (0.146) |
| Turning points | - | - | - | - | - | - | - | - | - | - |
| Mean | 0.653 | 0.640 | 0.628 | 0.616 | 0.603 | 0.647 | 0.633 | 0.621 | 0.608 | 0.595 |
| Maximum | 0.993 | 0.873 | 0.846 | 0.824 | 0.811 | 0.993 | 0.874 | 0.845 | 0.822 | 0.806 |
| Minimum | 0.107 | 0.107 | 0.107 | 0.107 | 0.107 | 0.107 | 0.107 | 0.107 | 0.107 | 0.107 |
| Lower p-value | - | - | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | - | - | - |
| Observations | 697 | 663 | 628 | 593 | 558 | 707 | 672 | 637 | 601 | 566 |
| Countries | 121 | 121 | 120 | 119 | 118 | 135 | 135 | 135 | 135 | 131 |

**Table 8** (continued)

| | New dataset: 1980–2014 | | | | | ABP dataset: 1980–2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.570 | 0.455 | 0.376 | 0.297 | 0.168 | 0.196 | 0.185 | 0.164 | 0.083 | 0.028 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| FM | 0.118[b] | 0.105[b] | 0.120[b] | 0.207[a] | 0.238[b] | 0.222[a] | 0.226[a] | 0.248[c] | 0.241[c] | 0.166 |
| | (0.052) | (0.053) | (0.059) | (0.073) | (0.104) | (0.062) | (0.084) | (0.144) | (0.128) | (0.198) |
| $FM^2$ | -0.145[b] | -0.135[b] | -0.153[c] | -0.319[b] | -0.400 | -0.235[a] | -0.267[b] | -0.327 | -0.356 | -0.149 |
| | (0.056) | (0.064) | (0.087) | (0.134) | (0.244) | (0.064) | (0.120) | (0.270) | (0.243) | (0.482) |
| Turning points | 0.41 | 0.39 | 0.39 | 0.32 | - | 0.47 | 0.42 | - | - | - |
| Mean | 0.224 | 0.192 | 0.166 | 0.144 | 0.124 | 0.192 | 0.160 | 0.137 | 0.116 | 0.101 |
| Maximum | 0.995 | 0.751 | 0.574 | 0.498 | 0.416 | 0.995 | 0.683 | 0.518 | 0.413 | 0.350 |
| Minimum | 8.4e-11 | 8.4e-11 | 8.4e-11 | 8.4e-11 | 8.4e-11 | 1.6e-10 | 1.61e-10 | 1.6e-10 | 1.6e-10 | 1.6e-10 |
| Lower p-value | 0.012 | 0.025 | 0.021 | 0.002 | - | 1.8e-4 | 0.004 | - | - | - |
| Upper p-value | 0.004 | 0.017 | 0.065 | 0.018 | - | 3.8e-4 | 0.031 | - | - | - |
| Observations | 685 | 651 | 617 | 583 | 548 | 687 | 653 | 619 | 584 | 550 |
| Countries | 119 | 119 | 118 | 117 | 116 | 131 | 130 | 129 | 129 | 126 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.512 | 0.527 | 0.411 | 0.464 | 0.308 | 0.185 | 0.147 | 0.152 | 0.106 | 0.085 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| FMA | 0.062 | 0.093[c] | 0.135[b] | 0.094[c] | 0.177[c] | 0.018 | -0.018 | 0.107 | 0.081 | 0.214 |
| | (0.045) | (0.056) | (0.059) | (0.055) | (0.096) | (0.072) | (0.079) | (0.081) | (0.167) | (0.160) |
| $FMA^2$ | -0.071[c] | -0.105[c] | -0.163[b] | -0.123[b] | -0.295[c] | -0.019 | 0.016 | -0.167 | -0.201 | -0.482 |
| | (0.042) | (0.061) | (0.069) | (0.070) | (0.172) | (0.062) | (0.075) | (0.121) | (0.288) | (0.296) |
| Turning points | - | 0.44 | 0.41 | 0.38 | 0.3 | - | - | - | - | - |
| Mean | 0.286 | 0.254 | 0.225 | 0.201 | 0.1799 | 0.263 | 0.230 | 0.201 | 0.178 | 0.157 |

**Table 8** (continued)

| | New dataset: 1980–2014 | | | | | ABP dataset: 1980–2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 |
| Maximum | 1.000 | 0.815 | 0.694 | 0.573 | 0.514 | 1 | 0.803 | 0.674 | 0.523 | 0.492 |
| Minimum | 3.2e-4 | 3.2e-4 | 3.2e-4 | 3.2e-4 | 3.2e-4 | 3.2e-4 | 3.2e-4 | 3.2e-4 | 3.2e-4 | 3.2e-4 |
| Lower p-value | - | 0.050 | 0.012 | 0.046 | 0.032 | - | - | - | - | - |
| Upper p-value | - | 0.049 | 0.011 | 0.044 | 0.051 | - | - | - | - | - |
| Observations | 556 | 529 | 501 | 473 | 445 | 535 | 510 | 482 | 455 | 428 |
| Countries | 94 | 94 | 94 | 91 | 89 | 101 | 101 | 100 | 96 | 94 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| AR2 p-value | 0.679 | 0.751 | 0.572 | 0.624 | 0.635 | 0.576 | 0.591 | 0.503 | 0.510 | 0.456 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| FMD | 0.004 | -0.004 | 0.018 | -0.034 | -0.041 | -0.032 | -0.014 | -0.121 | -0.061 | 0.112 |
| | (0.039) | (0.049) | (0.060) | (0.084) | (0.105) | (0.060) | (0.090) | (0.113) | (0.151) | (0.162) |
| FMD$^2$ | -0.025 | -0.026 | -0.064 | 0.041 | 0.063 | -0.004 | -0.011 | 0.186 | 0.089 | -0.791 |
| | (0.035) | (0.062) | (0.095) | (0.160) | (0.249) | (0.053) | (0.110) | (0.178) | (0.344) | (0.519) |
| Turning points | - | - | - | - | - | - | - | - | - | - |
| Mean | 0.207 | 0.171 | 0.140 | 0.115 | 0.094 | 0.172 | 0.136 | 0.109 | 0.088 | 0.073 |
| Maximum | 0.989 | 0.809 | 0.634 | 0.510 | 0.374 | 0.989 | 0.750 | 0.529 | 0.376 | 0.288 |
| Minimum | 2.2e-10 | 2.2e-10 | 2.2e-10 | 2.2e-10 | 2.2e-10 | 4.3e-10 | 4.3e-10 | 4.3e-10 | 4.3e-10 | 4.3e-10 |
| Lower p-value | - | - | - | - | - | - | - | - | - | - |
| Upper p-value | - | - | - | - | - | - | - | - | - | - |
| Observations | 678 | 645 | 611 | 577 | 543 | 681 | 647 | 613 | 579 | 545 |
| Countries | 118 | 118 | 117 | 116 | 113 | 130 | 129 | 129 | 126 | 123 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR2 p-value | 0.418 | 0.413 | 0.313 | 0.398 | 0.336 | 0.172 | 0.119 | 0.131 | 0.136 | 0.165 |

**Table 8** (continued)

| | New dataset: 1980–2014 | | | | | ABP dataset: 1980–2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 | 1.0 | 0.95 | 0.90 | 0.85 | 0.80 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| FME | 0.070 | 0.070 | 0.116[b] | 0.109[b] | 0.114[b] | 0.169[a] | 0.169[a] | 0.137[b] | 0.183[b] | 0.178[a] |
| | (0.049) | (0.049) | (0.048) | (0.050) | (0.050) | (0.061) | (0.061) | (0.059) | (0.075) | (0.059) |
| $FME^2$ | -0.067 | -0.067 | -0.128[a] | -0.122[b] | -0.115[b] | -0.147[a] | -0.147[a] | -0.126[b] | -0.168[b] | -0.17[a] |
| | (0.045) | (0.045) | (0.046) | (0.055) | (0.053) | (0.054) | (0.054) | (0.058) | (0.084) | (0.066) |
| Turning points | - | - | 0.45 | 0.45 | 0.5 | 0.57 | 0.57 | 0.54 | 0.54 | 0.52 |
| Mean | 0.301 | 0.301 | 0.225 | 0.189 | 0.159 | 0.259 | 0.259 | 0.181 | 0.149 | 0.124 |
| Maximum | 1.000 | 1.000 | 0.887 | 0.754 | 0.591 | 1 | 1 | 0.825 | 0.608 | 0.471 |
| Minimum | 3.1e-4 | 3.1e-4 | 3.1e-4 | 3.1e-4 | 3.1e-4 | 3.1e-4 | 3.1e-4 | 3.1e-4 | 3.1e-4 | 3.1e-4 |
| Lower p-value | - | - | 0.008 | 0.015 | 0.012 | 0.003 | 0.003 | 0.010 | 0.007 | 0.001 |
| Upper p-value | - | - | 0.001 | 0.018 | 0.038 | 0.008 | 0.008 | 0.049 | 0.067 | 0.024 |
| Observations | 537 | 537 | 484 | 457 | 430 | 536 | 536 | 483 | 456 | 429 |
| Countries | 93 | 93 | 93 | 90 | 89 | 100 | 100 | 99 | 97 | 95 |
| AR1 p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.002 |
| AR2 p-value | 0.849 | 0.849 | 0.709 | 0.767 | 0.652 | 0.339 | 0.339 | 0.28 | 0.371 | 0.209 |
| OID p-value | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

Panel results of the non-monotonic relationship between the nine relative indices (measures) of financial development, obtained from the IMF database, and real per capita GDP are reported following the alternative functional form. The dependent variable is LYP. Definitions of these relative indices are given in the Table 6 notes. Specification is shown in Eq. (3) of Section 3 in the paper. For diagnostics and other details, please refer to the notes for Table 2 income levels, and the relative levels of financial development, which we turn to in the following sections. In fact, these results are similar to those in Subsection 6.1, found with real GDP per capita growth.

### 7.2 Panel Results (Regional Panels)

In this section, we present the results between financial development and real per capita GDP (LYP) obtained from the four regional country panels, discussed above. The Africa region has data constraints; therefore, we could estimate the usual five percentiles for PC only. For the four remaining traditional measures we could only estimate the 100$^{th}$ percentile in our and the ABP datasets. These eighteen sets of results are reported in Table C.1 (online Appendix C). All five traditional measures appear totally insignificant in explaining LYP for the Africa region with just one exception: AFAR shows a marginally significant (at 10%) trivial U-shaped relationship in the ABP dataset. Likewise, a further ninety sets of results concerning the nine relative indices of financial development for the Africa region from our and the ABP datasets are shown in online Table C.2. FMA and FME have relatively short data dimensions, hence we suggest some caution vis-à-vis their results. All nine indices also appear insignificant in explaining LYP across the ninety sets of estimates bar two instances—FMD shows marginally significant U-shaped relationships in two instances at the TPs of 0.25 and 0.13 in our dataset, implying too little finance. We do not find a single case of the inverted U-shaped relationship between any of the fourteen measures of financial development and LYP for this region. Given the low levels of economic and financial development of the Africa region, the lack of an inverted U-shaped relationship may not be surprising, however what is surprising is the almost wholesale insignificance of all fourteen measures of financial development in explaining LYP under non-linear specifications. These results echo those of Subsections 5.3 and 6.2, where these indices appear largely insignificant in explaining economic growth.

The results for the Asia region are reported in online Table C.3. Again, the five traditional measures appear totally insignificant in explaining LYP across the twenty-five sets of estimates from our dataset except on one count: AFDR shows a marginally significant U-shaped relationship at the 80$^{th}$ percentile at the estimated TP of 195%. Parallel results from the ABP dataset show complete insignificance of all five measures across twenty-five sets of estimates. The ninety sets of estimates concerning the nine relative indices for the Asia region are reported in online Table C.4. Seven of these indices appear totally insignificant in explaining LYP in our dataset. Two minor exceptions are that FIA shows one case of a U-shaped relationship in the 90$^{th}$ percentile, and FME shows trivially quadratic relationships in four counts and linearly positive and significant in one count. The results from the ABP dataset are corroborative—all nine relative indices appear insignificant, except in three counts: FI shows a U-shaped relationship at the 85$^{th}$ percentile while FID and FIE show trivially quadratic relationships in one count each. Overall, all fourteen measures of financial development appear virtually insignificant in explaining LYP for the Asia region and we do not find a single instance of the inverted U-shaped relationship.

Likewise, we present the fifty sets of results obtained from our and the ABP datasets for the EU-NA region concerning the five traditional measures in online Table C.5. Only SMCR shows one count of the inverted U-shaped relationship (at the 95th percentile at the TP of 131%) across twenty-five sets of estimates from our dataset; the rest of the measures and parameter estimates are largely insignificant. In particular, three measures—PC, SMVR, and AFDR—appear totally insignificant, while AFAR shows two cases of linearly negative and significant parameter estimates. In parallel results from the extended ABP dataset, PC and SMCR appear totally insignificant. The three remaining traditional measures show that most of their parameter estimates are either insignificant or linearly negative and significant. The scenario does not change vis-à-vis the nine relative indices of financial development. They all appear insignificant in explaining LYP across the ninety sets of estimates involving both datasets bar one exception: FM shows a trivially quadratic relationship at the 90th percentile in our dataset (online Table C.6). This near wholesale insignificance of all fourteen measures of financial development in explaining real per capita GDP across the EU-NA country panels is surprising. The results show just one case of the inverted U-shaped relationship across the 140 sets of estimates in the EU-NA regional panels involving fourteen measures of financial development and LYP across two datasets.

The LAC region also has data constraints. As with the Africa region, we could only estimate eighteen sets of results across our and the ABP datasets involving the five traditional measures for the LAC region. They include all five percentiles for PC but only the 100th percentile for each of the four remaining measures. The eighteen sets of results are reported in online Table C.7. The results reveal that all parameter estimates are totally insignificant except in two counts: PC shows marginally significant trivially quadratic relationships at the 90th and the 95th percentiles of our and the ABP datasets respectively. Thus, the five traditional measures of financial development appear completely insignificant in explaining LYP for the LAC region. The data dimension for these estimates is not an issue as the panels range from a minimum of sixty-one five-yearly non-overlapping observations (305 country years) to a maximum of 185 observations (925 country years). The results do not appear any different vis-à-vis the nine relative indices. Across the forty-five sets of estimates from our dataset concerning these indices, there is not a single result supporting the inverted U-shaped relationship. Instead, all indices appear virtually insignificant in explaining LYP (online Table C.8). The parallel results from the ABP datasets are corroborative. All parameter estimates are largely insignificant except for two instances of U-shaped relationships—FD at the 95th percentile and FMD at the 90th percentile.

Overall, we estimate a total of 496 sets of results—248 from our dataset and 248 from the extended ABP dataset—assessing the inverted U-shaped relationship between the fourteen measures of financial development and real per capita GDP across the four regional country panels of Africa, Asia, EU-NA, and LAC. The evidence supporting the inverted U-shaped relationship is virtually non-existent:

the score in its favor is less than 1% $\left(\frac{1}{496}\right)$ of the total estimates. All fourteen measures of financial development appear insignificant in explaining LYP in the vast majority of estimates.

### 7.3 Panel Results (Income-Level Based Panels)

The fifty sets of results concerning the five traditional measures of financial development and LYP for the panels of high-income countries, obtained from our and the ABP datasets, are reported in online Table C.9. Yet again, all five measures appear totally insignificant in explaining LYP except in two counts: SMCR appears trivially quadratic at the 100$^{th}$ percentile of our dataset but appears linearly positive and significant at the 95$^{th}$ percentile of the ABP dataset. The ninety sets of results pertaining to the nine relative indices are reported in online Table C.10. They also appear completely insignificant except for a few exceptions in the ABP dataset: FMA shows significantly negative linear parameter at the 100$^{th}$ percentile, but a U-shaped relationship at the 90$^{th}$ percentile, while FME shows two counts of trivially quadratic relationships. There is not a single case of empirical support for the inverted U-shaped relationship across the fourteen measures of financial development and LYP for the panels of high-income countries.

Likewise, a total of 140 sets of estimates involving all fourteen measures of financial development for the upper-middle-income panels are shown in online Tables C.11 and C.12. It is evident that the five traditional measures are totally insignificant in explaining LYP across all estimates. Similarly, all nine relative indices also appear virtually insignificant and there is not a single case of support for the inverted U-shaped relationship across these fourteen measures of financial development and LYP for the upper-middle-income country panels.

The parallel results for the lower-middle-income panels also show the complete insignificance of the five traditional measures in their fifty sets of estimates bar two (online Table C.13). These exceptions are the U-shaped relationship shown by AFAR at the 95$^{th}$ percentile of our dataset and the trivially quadratic SMVR at the 80$^{th}$ percentile of the ABP dataset. Among the nine relative indices (online Table C.14), FD shows one case of an inverted U-shaped relationship each in the 80$^{th}$ percentile of our and the ABP datasets. In the rest of the estimates, there is no support for the inverted U-shaped relationship and all nine relative indices appear mostly insignificant.

The low-income panel has data constraints. Therefore, among the five traditional measures, we could only estimate for PC at its 100$^{th}$ percentiles across both datasets; the four remaining measures could not be estimated. Likewise, only five of the nine relative indices could be estimated in our dataset, and only seven could be estimated in the ABP dataset. They are all estimated in the full sample (100$^{th}$percentile) only; no truncated subsamples are estimated. Online Table C.15 reports these fourteen sets of estimates. The data points across these estimates range from a minimum of seventy-two to a maximum of 101 five-yearly non-overlapping observations, covering 355 to 505 country years, respectively. As is evident, six of the eight measures of financial development appear totally insignificant in explaining LYP. The two exceptions are (i) FD which shows an inverted U-shaped relationship at the TP of 0.19 in our dataset, and (ii) FID which shows a U-shaped relationship at the TP of 0.06 in the ABP dataset.

Overall, we have a total of 434 sets of estimates—216 from our dataset and 218 from the extended ABP dataset—assessing the inverted U-shaped relationship between the fourteen measures of financial development and real GDP per capita across the four income-level based country panels. They show just three counts of the inverted U-shaped relationship across the lower-middle-income panels and one count in the low-income panel, which is an overall score of less than 0.7%. The evidence of an inverted U-shaped relationship between financial development and real GDP per capita is simply not evident in the panels of high- and upper-middle-income countries.

### 7.4 Panel Results (Financially More Versus Less Developed Country Panels)

Evidence of the inverted U-shaped relationship between financial development and real per capita GDP from the panels of financially relatively more developed countries is also far from compelling. The five traditional measures appear totally insignificant in forty-seven of the fifty sets of estimates across both datasets (online Table C.16). The three exceptions are (i) SMCR shows a U-shaped relationship at the 80$^{th}$ percentile and (ii) SMVR shows an inverted U-shaped at the 95$^{th}$ percentile of our dataset, while (iii) AFDR shows a U-shaped relationship at the 100$^{th}$ percentile of the ABP dataset. Regarding the nine relative indices, eight of them appear totally insignificant in explaining LYP in our dataset. The exception is FM, which shows two instances of inverted U-shaped relationships and one trivially quadratic relationship (online Table C.17). Parallel results from the extended ABP dataset show six of the nine indices to be totally insignificant. The three exceptions are: (i) one count of a marginally significant linearly negative parameter shown by FMA, (ii) one U-shaped relationship shown by FIE, and (iii) the three cases of inverted U-shaped relationships and one case of linearly positive significance shown by FM. Overall, there is hardly any support for the inverted U-shaped relationship between financial development and the level of real GDP per capita across the financially relatively more developed country panels.

The results of the five traditional measures vis-à-vis the financially relatively less developed country panels are reported in online Table C.18. Of the twenty-five sets of estimates from our dataset, SMVR shows two counts of U-shaped relationships; SMCR shows one count of a U-shaped and two counts of trivially quadratic relationships; and PC shows four cases of trivially quadratic relationships. The rest of the estimates are insignificant. In the parallel results from the ABP dataset, PC shows three counts of inverted U-shaped relationships while the rest of the estimates are totally insignificant. The results of the nine relative indices are reported in online Table C.19. The forty-five sets of estimates from our dataset reveal that FD, FIA, and FIE show four, three, and two counts of inverted U-shaped relationships respectively, while the rest of the estimates appear mostly insignificant. In the parallel estimates from the ABP dataset, FIA and FID show one count of an inverted U-shaped relationship each, while the rest of the estimates appear mostly insignificant.

Overall, the fourteen measures of financial development show hardly any support for the inverted U-shaped relationship with the level of real per capita GDP across the financially relatively more versus less developed country panels. In the 140 sets of estimates for the financially relatively more developed country panels across the two datasets, the score in favor of the inverted U-shaped relationship (excluding the two efficiency indices) is 4% (6/140) and the majority of indices appear overwhelmingly insignificant. In the parallel sets of estimates for the financially less developed country panels, the score in favor of the inverted U-shaped relationship is 10% $\left(\frac{14}{140}\right)$. Interestingly, although both scores are small, the financially relatively less developed panels show a higher (more than double) score of the inverted U-shaped relationship than those from the financially relatively more developed panels, which is quite the opposite of the prediction of the 'too much finance' paradigm.

## 8 Conclusion and Implications

In this paper, we assemble the 'burden of evidence' regarding the inverted U-shaped relationship between financial development and economic growth through arguably the most comprehensive and rigorous scrutiny yet under a unified analytical framework. We summarize our main findings in five broad points.

First, we conduct extended replications of ABP's results regarding PC and PYG precisely using their data, specifications, and econometric methods but restructuring their dataset to accommodate various analytical trajectories. We construct the four regional country panels of Africa, Asia, Europe-North America, and Latin America and the Caribbean. In eighty sets of estimates—encompassing the four regional panels, the four sample periods analyzed by ABP, and their five percentiles (100%, 95%, 90%, 85% and 80%) each—PC shows just one count of an inverted U-shaped relationship, a replication score of just 1.25%. We then rearrange the ABP dataset into panels of high-income, upper-middle-income, lower-middle-income, and low-income countries as per the WB classifications. We focus on ABP's full sample (1960–2010) and estimate sixteen sets of results across these four panels and find that PC shows just one count of an inverted U-shaped relationship in the 85$^{th}$ percentile of the lower-middle-income panel at the TP of 22%. Finally, we regroup the ABP dataset into financially relatively more versus less developed country panels, employing the sample median value of PC as the benchmark. PC does not show a single case of the inverted U-shaped relationship across the financially relatively more versus less developed country panels. Thus, when the ABP dataset is reorganized and analyzed across the important analytical trajectories that are common in the finance–growth literature, there is virtually no evidence of inverted U-shaped relationship between PC and PYG. This suggests that ABP's results of an inverted U-shaped relationship between PC and PYG are specific to their data points and lack generality.

Further, we also extend the ABP dataset by incorporating the remaining four traditional measures of financial development, that are widely used in the literature, and estimate 120 sets of replicative cross-sectional and eighty sets of replicative system GMM panel estimates across the three sample periods analyzed by ABP along with their truncated (percentile) subsamples. The cross-sectional analyses show an inverted U-shaped relationship in 18% $\left(\frac{22}{120}\right)$ of estimates, but these results are extremely sensitive to sample periods, estimation methods, and data truncations. The estimates of TPs also diverge hugely. The system GMM panel estimates reveal a replication rate of just 10% $\left(\frac{8}{80}\right)$. Thus, extending the analysis beyond PC in the ABP dataset by incorporating a further four traditional measures of financial development also fails to reveal any credible evidence in favor of the inverted U-shaped relationship between financial development and economic growth.

Second, we conduct the analyses of the non-monotonic relationship in our dataset, which is a new and updated dataset. Again, the results hardly support the inverted U-shaped relationship. In the fifty sets of cross-sectional OLS and IV estimates involving the five traditional measures, the score in support of the inverted U-shaped relationship is just 26% of the total estimates, and is highly sensitive to estimators, data samples, and data truncations. The estimates of TPs are also incredibly diverse. Evidence from the panel analysis is even weaker. In seventy-five sets of system GMM estimates, only 17% show an inverted U-shaped relationship. Analysis by regrouping sample countries into four different regional country panels produces just one case of an inverted U-shaped relationship in the sixty-four sets of system GMM estimates involving the five traditional measures, a score of 1.6%. Likewise, no evidence supporting the inverted U-shaped relationship is found in the sixty sets of system GMM estimates across the four income-level based country panels. Finally, in the fifty sets of estimates across the financially relatively more versus less developed country panels, only SMVR shows one case of an inverted U-shaped relationship: a score of just 2% across the five measures. Overall, results from our new dataset also fail to reveal any credible evidence in support of the inverted U-shaped relationship between the five traditional measures of financial development and economic growth.

Third, we also scrutinize the issue of non-monotonicity between financial development and economic growth by analyzing the nine relative indices of financial development constructed at the IMF by incorporating them into our and the ABP datasets. While we find some evidence of the inverted U-shaped relationship between these relative indices and economic growth in both global panel datasets, this evidence completely crumbles once both global panels are regrouped into country panels based on regions, income levels, and the relative levels of financial development.

Fourth, we also evaluate the non-monotonic relationship between financial development and economic growth following an alternative functional form as in Acemoglu et al. (2019). We model, in a dynamic panel setup, if the relationship between real per capita GDP (LYP) and financial development is non-monotonic. In the fifty sets of system GMM estimates concerning the five traditional measures from our and the ABP datasets, PC shows just one instance of an inverted U-shaped relationship, a score of just 2%. The results involving the nine relative indices show limited support for the non-monotonic relationship in both global datasets. However, this support completely disappears when the global panels are regrouped into different tracks of analytical routes discussed above.

Fifth, the meagre evidence that we find for the inverted U-shaped relationship is also marred with highly divergent threshold (turning point) estimates, often implying bizarre policy implications. For example, the IMF relative index of overall financial development (FD) shows TPs ranging from 0.50 to 0.33 in our and 0.50 to 0.28 in the ABP global datasets. If these findings are to be viewed from policy perspectives then industrialized countries such as Australia, Canada, France, Japan, Luxemburg, the United Kingdom, and the United States need to adjust down their overall levels of financial development to the levels of countries such as Cyprus, Chile, Turkey, Hungary, Slovenia, and the like, to avoid the growth costs of having relatively more developed financial sectors. This is bizarre. We also find turning points of PC at as low as 16% in the panel of the financially relatively less developed countries with a maximum PC of just 22%. These results show that the prescribed threshold of a private sector credit ratio of 100% neither appears robust nor credible. Often efficiency indices of financial markets and institutions appear insignificant or show tipping point relationships, which is also bizarre. Moreover, all fourteen measures of financial development appear largely insignificant in explaining economic growth under non-linear specifications. This is puzzling in view of the vast literature reporting the significant effect of financial development on economic growth. However, the significance of financial factors for economic growth is widely reported under (log) linear specifications, which differs greatly from our focus and the approaches hence the results are not comparable.

To conclude, our scrutiny across an exhaustive list of measures and analytical trajectories under a unified approach to measurements, specifications, and econometric methods reveals that the ‘burden of evidence’—gleaned through almost 3,000 sets of panels and cross-sectional estimates— does not support the threshold relationship between financial development and economic growth, nor is there any evidence of the ‘vanishing effects.’ Whatever little evidence is uncovered in support of the inverted U-shaped relationship is neither compelling nor robust, hence cannot be generalized; by implication, the ‘burden of evidence’ rejects the assertion that finance is excessive and is hurting economic growth. An important future research agenda would be to establish the veracity and generality of the other widely accepted results in economics through rigorous replicative work. Its significance cannot be overstated given the number of scientific papers retracted by journals in recent years.

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**Data Availability** Data and codes relating to this paper are available at: https://sites.google.com/view/kul-luintel/data-codes.

## Declarations

**Competing Interest** I (Kul B Luintel)—the handling author of this manuscript—am one of the associate editors of this Journal (Open Economies Review). I should therefore not be associated with any reviewing/decision making process of this manuscript.



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## Authors and Affiliations

**Kul B. Luintel[1] · Guangjie Li[1] · Mosahid Khan[2]**

✉ Kul B. Luintel
LuintelK@cardiff.ac.uk

Guangjie Li
LiGJ@cardiff.ac.uk

Mosahid Khan
mosahid.khan@wipo.int

1 Cardiff Business School, Cardiff, United Kingdom

2 World Intellectual Property Organization, Geneva, Switzerland