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Working Paper

Finance and growth: The unpleasant burden of evidence

Cardiff Economics Working Papers, No. E2023/08

Provided in Cooperation with:

Cardiff Business School, Cardiff University

Suggested Citation: Luintel, Kul Bahadur; Li, Guangjie; Khan, Mosahid (2023) : Finance and growth: The unpleasant burden of evidence, Cardiff Economics Working Papers, No. E2023/08, Cardiff University, Cardiff Business School, Cardiff

This Version is available at:

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Cardiff Economics Working Papers



Working Paper No. E2023/8

FINANCE AND GROWTH: THE UNPLEASANT BURDEN OF EVIDENCE

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April 2023

ISSN 1749-6010

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FINANCE AND GROWTH: THE UNPLEASANT BURDEN OF EVIDENCE

'It ain't what you don't know that gets you into trouble.

It's what you know for sure that just ain't so.'

Mark Twain

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(April 2013)

Abstract

A growing body of post-global financial crisis (2007–2008) literature documents several undesirable effects of enlarged financial sectors. One of these effects is the ‘growth cost’ of excessive finance, which reports that the finance–growth relationship is non-monotonic, and that a credit threshold of above 100% of GDP costs economic growth. Since most industrialized countries exceed this threshold by a large margin (reaching as high as 200% in some cases), the policy implications of these findings can hardly be overstated. Moreover, if a tipping point in the finance–growth relationship could be established beyond reasonable doubt then this would be a pathbreaking finding. Extensive, rigorous, and widely replicative empirical evidence—gathered through a unified approach across wide-ranging analytical trajectories—could serve as the ‘burden of evidence’ and minimize the odds of false positives. We offer such scrutiny regarding three propositions of finance–growth nexus: (i) the inverted U-shaped relationship, (ii) the relevance of financial development for growth, and (iii) the ‘vanishing effects.’ We analyze fourteen measures of financial development across twenty-two panels—two global datasets and a

further twenty country panels based on distinct geographic, economic, and the relative financial development characteristics. The ‘burden of evidence’ from more than 7,000 well-structured cross-sectional and panel estimates fails to show any robust support to any of these three propositions. We document several other bizarre findings, viz., that the advanced economies need to scale back their relative levels of financial development to those of Eastern Europe to avoid the growth costs associated with overdeveloped financial systems. Surprisingly, the burden of evidence does not support even the widely reported results that financial development is significant under log-linear specifications. This study is unique in cross checking a set of well-accepted empirical results against the ‘burden of evidence’, and it certainly contests the mainstream cross-country literature. However, this does not disprove the potential role of finance for growth. Alternative approaches that analyze finance and growth at more disaggregated levels by linking sectoral and/or firm-level production initiatives to their sources of finance may be more effective in unraveling the finance-growth nexus.

Keywords: Finance and growth, non-monotonicity, credit threshold, generalized methods of moments.

JEL Classification E44, G2, O11, O16.

*Corresponding Author. *Data and codes are available on request.*

FINANCE AND GROWTH: THE UNPLEASANT BURDEN OF EVIDENCE

I. INTRODUCTION

Public perception regarding financial globalization, one of the pillars of western economic liberalism, has remained antagonistic ever since the global financial crisis of 2007–2008 (hereafter, 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 the majority of industrialized countries, bar the Covid-19 pandemic.¹ This 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.² This has triggered a reassessment of the finance–growth nexus. Interestingly, a growing body of post-crisis literature suggests that the hymn may be changing from ‘greater financial development nurtures growth’ to ‘an oversized financial sector deters growth.’

Several post-GFC studies are helping to shape this narrative. To put them in perspective: the expanded financial sector, which mainly exists within industrialized countries, has led to (i) increased systemic risk taking (Rancière, Tornell, and Westermann 2008), (ii) a glut of securities and increased financial fragility (Gennaiolio, Shleifer, and Vishny 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 2010; Philippon and Reshef 2012; Boustanifar, Grant, and Reshef 2018), (vii) a direct cost to economic growth—dubbed ‘too much finance’ (Arcand, Berkes, and Panizza

¹ Reinhart and Rogoff (2009) call the GFC the ‘Second Great Contraction’ after the Great Depression of the 1930s.

² There exists a long history of studies highlighting the contribution of banks and the financial system to economic development (see, among others, Bagehot 1873; Cameron et al. 1967; Goldsmith 1969), but it was the seminal work of King and Levin (1993) that brought this agenda to the fore. Levin (2005) surveys the voluminous literature that evolved subsequently.

2015 (hereafter, ABP); Cecchetti and Kharroubi 2012; Sahay et al. 2015; Gründler 2021), to name but a few.³

Each of these studies is revealing, however some imply more direct, far-reaching, and ‘provocative’ policy implications than others. ‘Too much finance’ is one such implication, reporting an inverted U-shaped relationship between financial development and economic growth, implying 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 (e.g., ABP, p. 107). Clearly, viewed from this perspective, the provision of finance is excessive across most industrialized countries and is hurting their economic growth.

A close look at ABP’s five-yearly non-overlapping panel dataset, which generates estimates of the turning points (TPs) of 69–90% (ABP’s Table 6: columns 4–7), reveals that twenty-one of their sample countries, most of which are industrialized, record PC of above 125%. Major economies like Japan, the United Kingdom, and the United States, each show PC of 200% or above in their dataset, and this appears largely unchanged in the more recent World Bank (WB) dataset (see Box.1; online Appendix A). Taken literally, the prescribed tipping point 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 private sector credit from intermediaries by almost half, in order not to exceed the prescribed threshold. This is clearly a tall order. It also raises the question of whether credit curbs of these magnitudes are credible and/or desirable, and if they are economically and politically feasible.

³ 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, Islam, and Stiglitz 2001); and (iii) prospects of a ‘catastrophic meltdown’ (Rajan 2005).

Moreover, if the existence of a tipping point in the finance–growth relationship is established beyond reasonable doubt then that would be one of the pathbreaking findings in economics with potentially far-reaching policy implications. Put simply, it would set a limit (upper bound) on the size of the domestic financial sector relative to the size of the economy, beyond which the growth costs of the financial sector would outweigh its benefits. Authorities would have no choice but to restrict the volume of credit or finance in the economy to somewhat below the tipping point (i.e., 100% of GDP) to allow room for maneuver against potential adverse macroeconomic shocks.

In view of these deep policy implications, considerable caution is offered regarding the generality of these findings. Philippon and Reshef (2012), commenting on these findings, state that we need more rigorous evaluations for ‘a deeper understanding of whether finance is too big, or too expensive....’ Likewise, Cline (2015) is highly skeptical of these findings. Most importantly, the literature on this issue is relatively new and inexhaustive, and consequently requires comprehensive and rigorous scrutiny to establish the generality of these findings. Our overarching goal is to do just that. We extensively scrutinize and gauge whether the ‘burden of evidence’ establishes the tipping point relationship between financial development and economic growth beyond reasonable doubt. We believe that extensive, 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, Niederle, and Wilson (2017). This helps establish the veracity (or otherwise) of the hypothesis beyond reasonable doubt. We trust that the weight of the empirical evidence we present—vis-à-vis the ‘too much finance’ hypothesis and the finance–growth nexus in general—meets these criteria and serves sufficiently as the ‘burden of evidence.’

We conduct a comprehensive, rigorous, and systematic analysis of the finance–growth nexus both under linear and non-linear settings, following a unified approach to afford ‘deeper understanding’ of the issues involved. Our analysis is comprehensive in four key respects. First, 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 VI). 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 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, Loayza, and Beck 2000; Demirgüç-Kunt and Levine 2001; Luintel et al. 2008). 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 financial institutional and market developments. The latter two indices are further consolidated to generate a relative 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. We discuss them concisely in Section II. We analyze them all while scrutinizing the finance–growth nexus under non-linear and log-linear setups, which basically exhausts the list of indicators explored by the mainstream literature. Financial development has several dimensions; therefore, a rigorous analysis of the wide-ranging and exhaustive list of financial development indicators is crucial for ‘a deeper understanding’ of the issues. This also reveals whether 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.

Second, we empirically scrutinize the ‘too much finance’ hypothesis through replicative and extended analyses, employing two related yet separate global datasets: the dataset analyzed by ABP, and our own dataset. By reanalyzing the ABP dataset, we assess: (i) if the significant inverted U-shaped effect of PC on PYG, reported by ABP, could be replicated (sustained) when their dataset was truncated to allow for potential data outliers and/or some (minor) variations in their data points, and (ii) if the non-monotonic relationship reported between PC and PYG—just one measure of financial development—could also be replicated vis-à-vis the other thirteen measures which capture different aspects of financial development. To this end, we extend the ABP dataset by these thirteen measures of financial development, matching their sample

countries and data periods as closely as possible, 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 revised and updated dataset from the WB (2016) and various other sources (details in Section II). Revisions over time improve data quality. We believe that scrutiny using these two datasets widens the scope of analysis and adds to the generality of the findings.

Third, we extend the scrutiny of the non-linear (inverted U-shaped) and log-linear relationships between financial development and economic growth beyond the two global datasets by forming country panels based on different analytical trajectories. It is well-documented that the finance–growth nexus varies across countries of different regions as well as across different levels of economic and financial development (Rioja and Valev 2004; Barajas, Chami, and Yousefi 2013). These country clusters allow for potential heterogeneity across country groups, and consequently are important. Specifically, we scrutinize the finance–growth nexus 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. Following the WB approach, we proxy sample countries’ levels of economic development by their per capita gross national income levels, and construct four country panels of high-income, upper-middle-income, lower-middle-income, and low-income countries. 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 II). We take a new approach: countries that take on above median values of each of the fourteen indicators of financial

⁴ Our wider replication of the seminal work of ABP, which has stirred the literature on the non-monotonic finance–growth relationship, is pivotal in generalizing the results. It is also in the spirit of ‘promoting replications’ in economics, emphasized by Coffman, Niederle, and Wilson (2017); Anderson and Kichkha (2017); Duvendack, Palmer-Jones, and Reed (2017), among others.

development are classed as financially relatively more developed, while countries that take on median-cum-below-median values are classed as financially relatively less developed (details in Subsection V.E). 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 finance–growth nexus 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. Indeed, as shown in Section II, our approach generates country panels with distinctly different levels of financial development.

Fourth, we reset the typical specification used for testing the non-monotonic relationship between financial development and economic growth into a dynamic non-monotonic panel model between financial development and the level of real per capita GDP, similar to Acemoglu et al. (2019), who study the effect of democracy on the level of real per capita GDP and conclude that democracy causes growth. This is important from two perspectives: (i) real per capita GDP series are smoother than the growth rate series and show a higher degree of correlation with the measures of financial development, and (ii) this specification allows for rich dynamics of real per capita GDP, as emphasized by Acemoglu et al. (2019). Since this specification is simply the unrestricted form of the typical growth specification used in the literature (see Section III), one would expect it to reinforce the non-monotonic relationship between financial development and economic growth. 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.

Methodologically, we follow the precise specifications and econometric methods employed by ABP across all analyses. We consciously take this approach to establish the generality of the results of the ‘too much finance’ paradigm by eliminating any sensitivity in the results due to specification, functional form, and the econometric methods, as far as possible. In estimating the relationship between financial development and the level of real per capita GDP, we maintain uniformity of the covariates and the estimator, though the specification is dynamic. We follow a rigorous empirical strategy. We do not simply limit our analysis to the two global

panels and their different country groupings based on regions, and the levels of economic and financial development. In addition, we also generate four truncated subsamples sorted by the 95th, 90th, 85th, and the 80th percentiles of each of the fourteen measures of financial development across all the country panels and analyze them. This empirical strategy lends the results a robustness vis-à-vis potential outliers, changes in country coverage and/or data points, crucial in generalizing the results.

One of the most striking results that we encounter, which will be evident below, is the near wholesale insignificance of all fourteen measures of financial development in explaining economic growth. This is surprising as it sharply contradicts the considerable volume of literature that reports a significantly positive effect of financial development on economic growth (among others, Levine 2005 surveys this literature). However, the evidence presented by this strand of literature mostly emanates from (i) the traditional measures of financial development, and (ii) the (log) linear specifications. To unravel this paradox, we re-examine the finance–growth nexus using log-linear specifications across both datasets and all fourteen indicators, following the same analytical approaches and trajectories as above. Finally, literature also reports the so-called ‘vanishing effects’ of finance on economic growth—that the positive effect of financial development on economic growth disappears when the dataset is updated beyond 2000—under both linear and non-linear specifications (ABP 2015; Gründler 2021; and the references cited therein). We are also able to assess if evidence supports the ‘vanishing effects.’

Our empirical strategy covers all the main analytical trajectories employed by the mainstream cross-country finance–growth literature under a unified approach. We report a total of 7,198 sets of well-structured, cross-sectional and panel estimates (details in Box.2; online Appendix A) assessing the finance–growth nexus across two datasets and all the analytical routes and methods discussed above. We hope this generates a sufficient ‘burden of evidence’ vis-à-vis the three contemporary propositions relating to the finance–growth nexus—viz., the issues of ‘too much finance’, the relevance of financial development for economic growth, and the ‘vanishing effects.’ Unfortunately, the ‘burden of evidence’ that we uncover rejects all three propositions and suggests that financial development is largely irrelevant for economic growth.

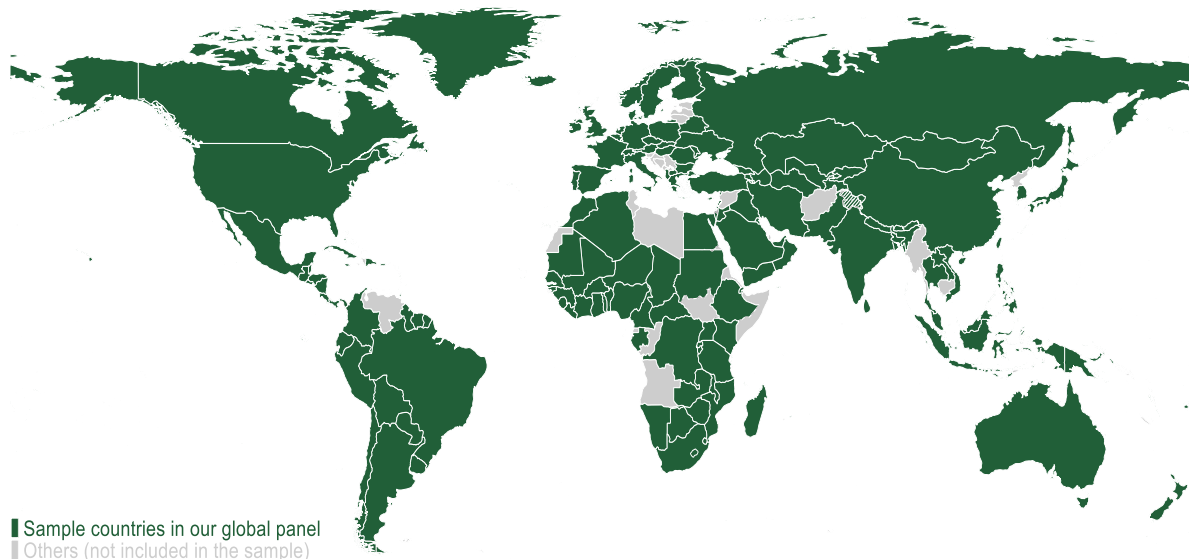
The rest of the paper is organized as follows. Section II discusses our sample, data, and descriptive statistics. Section III briefly outlines the specifications and econometric methods.

Section IV presents a wide array of replicative estimates. Section V presents the results from our dataset concerning the five traditional measures of financial development as well as the parallel results from the extended ABP dataset. Section VI presents the corresponding results vis-à-vis the nine (new) relative measures from our and the ABP datasets. Section VII offers results concerning financial development and the levels of real per capita GDP. Section VIII presents results from log-linear specifications, and Section IX concludes.

II. 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 1980–2016.⁵ The ABP dataset covers 133 countries over 1960–2010. Data sources are detailed in Table A.1 (online Appendix A). Figure I depicts all the sample countries covered in our dataset on a map of the world.

Figure I The global panel (full set) of sample countries



⁵ 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.

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 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 IMF indices differ from the five traditional measures at least in three respects. First, the IMF measures are broad in their coverage. Each of the IMF sub-indices accounts for several underlying economic and policy variables. Hence, they are likely to capture more information and add to the accuracy of the indicators measuring different aspects of financial development across the sample countries. For example, financial institutions' depth sub-index not only accounts for PC (the most widely used traditional measure of intermediaries' depth) but also for assets including pension funds, mutual funds, and the size of life and non-life insurance premiums. Likewise, the sub-index of financial market depth not only accounts for the traditional market capitalization ratio but also for the ratios of stock traded, international debt securities of governments, and the total debt securities of non-financial corporations. The sub-index of

financial market access captures the proportion of market capitalization outside of the top ten largest companies domestically and the total number of distinct (non-repeat) annual corporate debts issued per 100,000 adults. The sub-index of access to financial institutions is enumerated by bank branches and ATMs per 100,000 adults. The sub-index of institutional efficiency accounts for the net interest margin, lending-deposit spread, non-interest income, overhead costs, and the return on equity. Market efficiency is proxied by stock market turnover ratio (stock traded to capitalization) implying that higher turnover leads to increased liquidity, and the increased efficiency of financial markets. Second, the traditional indicators of financial development only measure the size and activity depths of intermediaries, capital markets, and the overall financial sector. They do not measure the access to and the efficiency of financial institutions and markets, whereas the IMF-constructed indices do. Third, the traditional measures are absolute measures of financial development as they measure the size and the activity depths of financial intermediaries and capital markets relative to GDP separately for each sample country. By contrast, the IMF measures are not absolute ratios. They are the normalized relative indices generated through the min–max procedure and the eigenvalue approach of aggregation. 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, 1.00, and 0.903 for Switzerland and the United States, respectively (see Svirydzhenka 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.

Conceptually, it is hard to contemplate limits to (turning points of) the efficiency of financial institutions and markets in enhancing economic growth. However, the same cannot be said regarding access to finance: the easy access to mortgage finance is one of the factors that led to the GFC (Reinhart and Rogoff 2009). Although we estimate the linear and non-linear specifications involving all fourteen measures of financial development, our focus will be on the twelve indicators of financial development from the perspective of the non-monotonic

relationship—namely, the five traditional measures and the seven IMF indices, discounting the two indices of institutional and market efficiency.

To highlight the importance of taking this analysis beyond the two global datasets, Figures II–IV show clusters of sample countries based on regions, income levels and their relative levels of financial development, on a map of the world.

Figure II
Country clusters by region

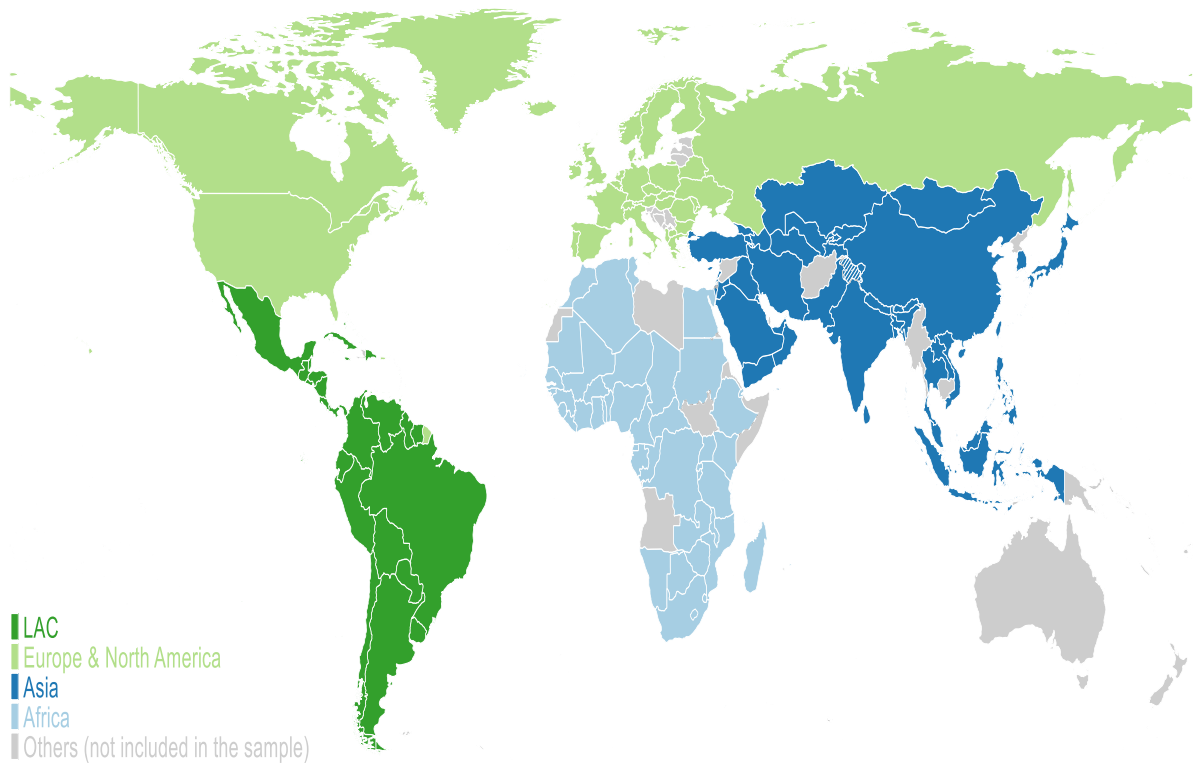


Figure III

Country clusters based on real per capita income levels

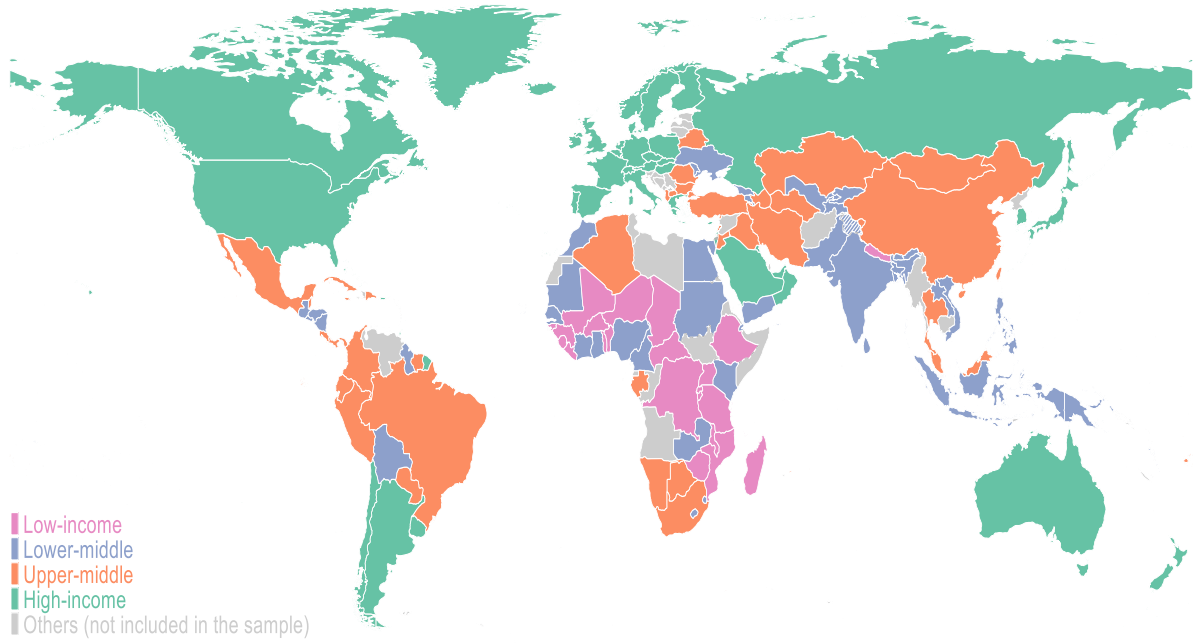
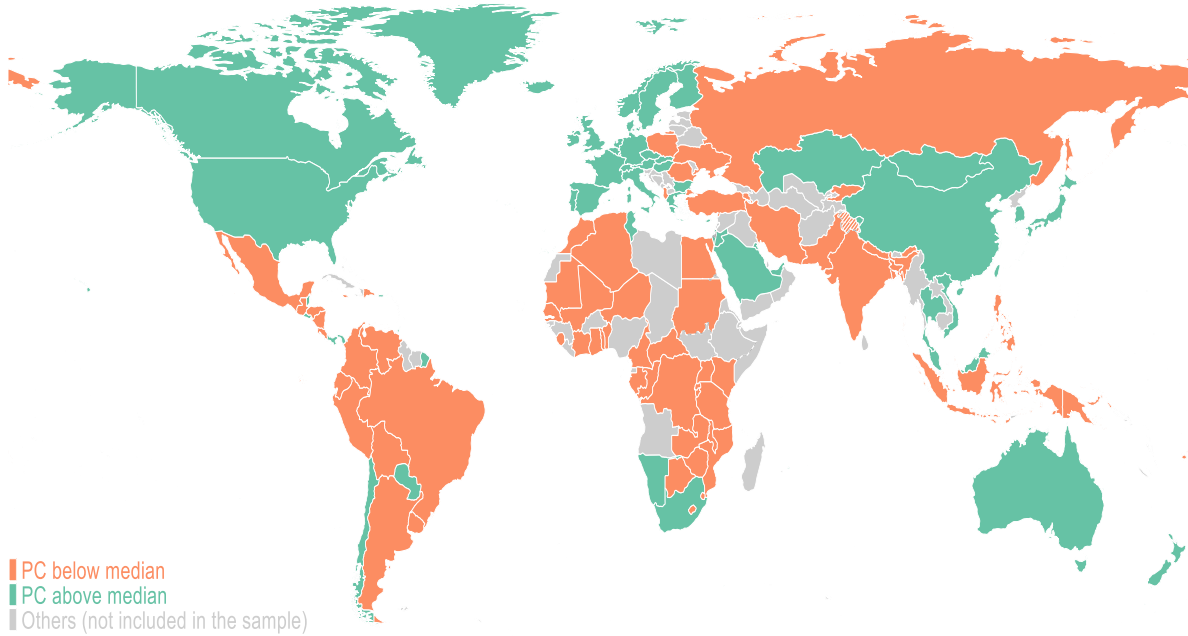


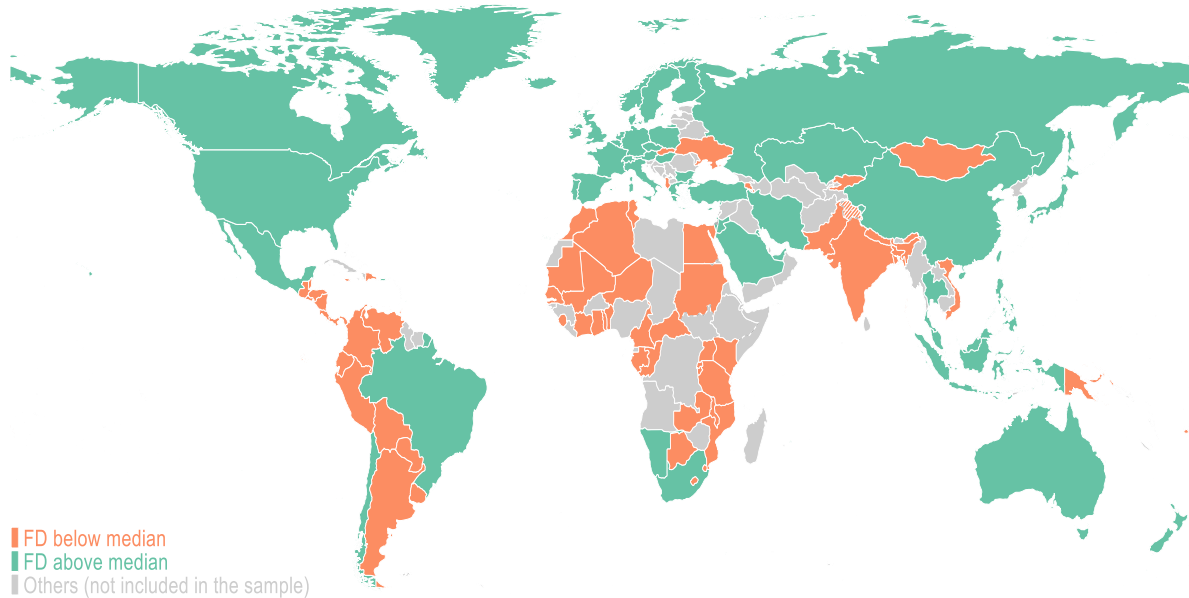
Figure IV

Financially relatively more versus less developed country clusters based on PC and FD

Country clusters based on PC (private credit to GDP ratio)



Country clusters based on FD (the IMF relative index of overall financial development)



Evidently, country panels based on regions and income levels are not the same. As is evident, developed countries mostly have developed financial systems, but there are exceptions. For example, China is one of the upper-middle-income countries (Figure III), but based on PC and FD measures (Figure IV), the Chinese financial system ranks in the financially more developed category like that of the Europe and North America region. 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 III and IV 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 measures and different analytical trajectories is sensible, and 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.

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 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) depth. 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.

III. SPECIFICATIONS AND EMPIRICAL APPROACHES

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

$$(1) \quad GYP_i = \alpha_0 + \alpha_1 LGDP_{i,0} + \alpha_2 FD_{i,j} + \alpha_3 FD_{i,j}^2 + Z_i \gamma + u_i$$

$$(2) \quad GYP_{i,t} = \beta_0 + \beta_1 LGDP_{i,t-k} + \beta_2 FD_{i,j,t} + \beta_3 FD_{i,j,t}^2 + Z_{i,t} \gamma + \xi_{i,t}$$

where GYP_i denotes country specific growth rate of real per capita GDP ($i = 1, \dots, N$); $LGDP_{i,0}$ denotes the initial level of real per capita GDP; $FD_{i,j}$ is the j^{th} measure of financial development, ($j = 1, \dots, 14$); and Z_i is the vector of other covariates. The latter includes log of average years of schooling ($LEDU$), log of government consumption over GDP (LGC), log of openness ($LOPEN$), and log of inflation ($LINF$).⁶ 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

⁶ The log of inflation is calculated as:

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

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).⁷ Besides this, we 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:

$$(3) \quad LYP_{i,t} = \lambda_0 + \lambda_1 LYP_{i,t-1} + \lambda_2 LGDP_{i,t-k} + \lambda_3 FD_{i,j,t} + \lambda_4 FD_{i,j,t}^2 + Z_{i,t} \theta + \varepsilon_{i,t}$$

Since $GYP_{i,t} = LYP_{i,t} - LYP_{i,t-1}$, equations (2) and (3) become equivalent if $\lambda_1 = 1$. However, our estimates and tests reject the null of $\lambda_1 = 1$ in favor of $\lambda_1 < 1$.⁸ Hence, equation (3) is not strictly

⁷ Specifications (1) and (2) as well as the estimators we use are the precise approaches of ABP. They instrument all covariates under the system GMM and so do we. 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 $\log(y_{i,t} / y_{i,t-1})$. This does not alter the results, as we are able to reproduce the ABP results, except for very minor differences, mostly at decimal places.

⁸ Consistent with the findings of Acemoglu et al. (2019), the Levin, Lin, and Chu (2002) test rejects the null of unit root in favor of the stationarity of log real GDP per capita ($LYP_{i,t}$) in both

equivalent to equation (2), nonetheless it is the unrestricted version of (2). In estimations, the dependent variable in equation (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_j paired with a negative and significant coefficient of FD_j^2 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 (turning point) 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 (turning point) 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. If $\frac{\partial Y}{\partial FD} > 0$ and $\frac{\partial Y}{\partial FD^2} < 0$ are satisfied, but the Lin-Meh test fails to reject any of the joint nulls, then that implies the estimated TP lies beyond the sample data points, which makes the estimated quadratic relationship irrelevant or trivial.

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-values of 0.000.

IV. REPLICATIONS AND EXTENSIONS USING THE ABP DATASET

In this section, we address two issues. First, we assess if the significant inverted U-shaped effect of PC on PYG, reported by ABP under cross-sectional and panel frameworks, could be sustained when their sample data points are exposed to some minor variations through sample truncations. Second, we extend the ABP dataset by the (four) remaining traditional measures of financial development, discussed above, and examine whether the non-monotonic relationship could be replicated across these measures. Subsections IV.A and IV.B cover these results.

IV.A. 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 under a cross-sectional framework.⁹ We use their precise datasets and sequentially generate four truncated subsamples (percentiles) sorted by the 95th, 90th, 85th, and the 80th percentiles of PC. This gives us a total of fifteen datasets—full sample and the four truncated percentiles for each of the three samples. The thirty sets of cross-sectional results, obtained from these fifteen datasets following the exact specification and the two econometric methods (OLS and IV) applied by ABP, are reported in Table I.

Table I about here

The first columns of these three samples are the precise ABP datasets; and, as expected, the ABP results of the non-monotonic relationship are replicated by both estimators.¹⁰ However, the results change dramatically across the truncated subsamples. There is not a single case of the non-monotonic relationship between PC and PYG in any of the twelve sets of truncated estimates under OLS. PC appears linearly significant in five cases and insignificant in the rest.

⁹ In fact, ABP also estimate pure cross-country regressions involving a further two samples, 1980–2010 and 1990–2010, but we only focus on the first three sample periods.

¹⁰ There are minor differences in the point estimates of our and ABP's parameters, mostly at decimal places. This is due to the way we and they measure growth rate (see footnote 7). We could exactly reproduce their number when we applied their measure of growth rate.

The degree of replication is also very low under the IV estimates. Of the twelve truncated sub-samples, the non-monotonic effect of PC on PYG is evident in only three cases (in the 95th percentiles of each of the three samples). Although parameter estimates appear to confirm the quadratic relationship in a further four cases under IV, they do not pass the Lin-Meh test. It is also evident that the estimated TPs show large variations ranging from 68 to 99%, despite small variations of just four data points across these samples. Overall, the cross-sectional results of the non-monotonic relationship between PC and PYG cannot be replicated under OLS when the ABP samples are truncated. Under the IV estimates, the rate of replication is just 25% across truncated sub-samples. The estimated TPs also show large variations. The results of the consecutive samples do not show any consistent evidence of the ‘vanishing effects’ either.

Now we turn to evaluate whether the cross-sectional evidence of the inverted U-shaped relationship between financial development and economic growth holds vis-à-vis the other widely analyzed traditional measures of financial development. Specifically, we extend the ABP dataset by SMCR, SMVR, AFDR, and AFAR, precisely matching ABP’s sample countries and data periods, but retaining other covariates. Online Table A.3 reports the 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 85th 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 sample truncations and estimation methods. Moreover, the estimates of TPs show huge variations despite very small changes in the data points.

We report parallel sixty sets of results obtained from the extended ABP dataset relating to AFDR and AFAR in online Table A.4. **These successive truncated (percentile) sub-samples 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 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 the vast majority of cases. The results from the overall activity depth of the domestic financial sector (AFAR) are even 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.

IV.B. Panel Analysis

In the panel framework, ABP analyze four different sample periods (1960–1995, 1960–2000, 1960–2005, and 1960–2010) consisting of 107 to 133 sample countries with 549 to 917 data points across these samples (ABP, Table 6 columns 1–4). 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. As above, we sequentially winsorize each of their four data samples. Each of these datasets is large enough for panel estimations.

Table II about here

Table II reports the twenty sets of replicative panel estimates of PC from the ABP dataset, employing the same specification and the system GMM estimator. The truncated subsamples sequentially differ by one to three countries, except in the 80th percentile. The first column in each of these four samples contains the precise data analyzed by ABP. Our replication reproduces identical results to ABP for sample 1960–1995, however results for the samples 1960–2000 and 1960–2005 are qualitatively the same but the point estimates and their precision differ somewhat. We could not replicate the results of sample 1960–2010 as PC fails significance even at 10%.¹¹ Interestingly, none of the sixteen truncated sample estimates show any statistical support for the inverted U-shaped relationship between PC and PYG. In fact, PC appears insignificant in all but two of these sixteen sets of estimates: marginally linearly positive and

¹¹ This discrepancy in results is due to the way the period dummy variables are handled in the estimations. ABP manually generate separate dummy variables for ten non-overlapping five-yearly periods and drop the last period dummy variable to allow for the intercept. We generate these dummy variables through Stata's internal commands, and by default Stata drops the first period dummy variable to allow for the intercept. Interestingly, when we drop the last period dummy variable, we get identical results to ABP. There appears to be an inadvertent issue with ABP's approach. Their codes for the sample 1960–2005, which only has nine periods, contain nine periodic dummy variables and a constant term. Surprisingly, instead of dropping one of the dummy variables, Stata produces results for all nine period dummy variables and a constant term, which ABP report. Our approach of internally generating dummy variables does not run into such an issue.

significant in the 95th percentiles of samples 1960–2005 and 1960–2010. Thus, the panel results of an inverted U-shaped effect of PC on PYG, reported by ABP, could not be replicated at all when their dataset was subject to some variations through sample truncations. Neither is there any evidence of ‘vanishing effects’ as PC appears mostly insignificant across all samples. 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.

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 90th 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 80th 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.

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%.

The preceding replicative analyses provide us with two insights vis-à-vis the inverted U-shaped relationship between financial development and economic growth, reported in the seminal work of ABP. First, exposing the ABP sample data points to some variations by way of sample truncations does not sustain their main finding of an inverted U-shaped relationship between PC and PYG. In our twenty-four sets of cross-sectional OLS and IV replicative estimates, PC shows only three instances of inverted U-shaped relationships, a replication rate of 12.5%. Under the panel framework with the system GMM estimator, PC shows no inverted U-shaped relationship at all in sixteen sets of replicative estimates. Surprisingly, PC appears completely insignificant. Second, our scrutiny by extending the ABP dataset through a further four traditional measures of financial development that are widely used in the mainstream literature also 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 truncated sub-samples, 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. The burden of empirical evidence appears to be against the ‘too much finance’ hypothesis or the inverted U-shaped relationship. It is also evident that ‘vanishing effects’ are not supported by these results as all the five traditional indicators appear mostly insignificant in explaining economic growth.

V. NEW DATASET: ANALYSIS OF TRADITIONAL MEASURES

In Subsections V.A through V.E, we present the results vis-à-vis the five traditional measures of financial development obtained from our (new) dataset. We construct these measures as well as all the conditioning covariates, the latter as in ABP, from this new dataset

which covers a maximum of 124 sample countries.¹² 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. The full panel is scrutinized under both cross-sectional and panel frameworks. However, for the sake of brevity, the segregated country panels are scrutinized under the panel framework only.

V.A. Cross-sectional Results (Global Panel)

Table III 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.¹³

Table III about here

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 percentiles. This is similar to the parallel (most comparable) results from ABP (1970–2010) where none of the truncated subsamples support the non-monotonic relationship of PC (Table I). 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. These cross-sectional IV results are also like those from the ABP sample 1970–2010, where an inverted U-shaped relationship is found in only the 100th and 95th percentiles.

¹² 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.

¹³ 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 truncated percentiles.

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. In the ABP dataset (1970–2010), SMCR shows two cases of inverted U-shaped relationships under the OLS and none under the IV (online Table A.3).

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.

V.B. 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 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 IV.

Table IV about here

PC shows just one case each of the inverted U-shaped relationship in samples 1970–2000 (the 100th percentile) and 1970–2014 (the 95th 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 1970–2010, implying too little finance, three counts of trivially quadratic relationships in sample 1970–2014, 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 85th and 80th 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.

V.C. 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, and the LAC. Therefore, we estimate all five percentiles of sample 1975–2014 for PC but just the 100th and 95th 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 100th and 95th percentiles in Table V, and provide concise narratives of the other results.

Table V about here

The data dimensions of PC for the Africa panel range from a minimum of thirty-four countries with 187 observations (the 80th percentile, not reported) to a maximum of thirty-six countries with 233 observations (the 100th percentile). Since the data points are non-overlapping five-yearly observations, the 80th and the 100th 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 100th 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. In fact, all traditional measures of financial development appear insignificant in explaining economic growth.

The Asia panel has thirty-one countries with 170 observations for PC in the 100th percentile of sample 1970–2014, while its 80th percentile has twenty-nine countries with 136 observations (not reported). For the four remaining measures, the 100th 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 100th 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.

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 (100th 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. Interestingly, they appear largely insignificant in explaining economic growth. 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. Furthermore, the results are astonishing as all five measures appear overwhelmingly insignificant in explaining economic growth. However, it is important to note that evidence supporting the significantly positive effect of financial development on economic growth, reported in the mainstream literature, emanates from linear specifications which we address in Section VIII.

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 sample

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 85th percentile of sample 1960–2005. These results from the ABP dataset show that the complete insignificance of the five traditional measures of financial development in explaining PYG across the four regional country panels 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.

V.D. 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, 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 x 5 datasets x 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 VI, and where appropriate, provide concise but clear narratives of the other estimates.

Table VI about here

Table VI 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. All measures appear completely insignificant across the sixteen sets of truncated estimates (not reported) for this panel. Thus, 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 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. Finally, PC appears insignificant in explaining PYG in the panel of low-income countries.

Overall, all five traditional measures of financial development appear virtually insignificant in explaining PYG across all four country panels representing the different levels of economic development proxied by their real per capita income levels. In the sixty sets of estimates involving the five measures across these four country panels, not a single inverted U-shaped relationship is found. In particular, the complete lack of support for the inverted U-shaped relationship between financial development and economic growth in the panel of high-income countries does not conform to the prediction of the ‘too much finance’ paradigm.

We further explore whether this widespread insignificance of the five traditional measures of financial development in explaining economic growth across the four income-level based country panels is specific to our dataset. 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%. Overall, 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.¹⁴ These results show that the inverted U-shaped relationship 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.

V.E. Panel Results (Financially More Versus Less Developed Country Panels)

We scrutinize the non-monotonic relationship across financially relatively more versus less developed country panels as the final set of analyses involving traditional measures. 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^{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^{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^{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 of financially more versus less developed countries from our dataset. We also generate twenty parallel panels from the ABP dataset. As shown in Section II, the above median

¹⁴ Following ABP, we also estimate the relationship across the sample periods of 1960–2005, 1960–2000, and 1960–1995, inclusive of their 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.

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, inclusive of their truncations. In Table VII, 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.

Table VII about here

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 panel and the less developed panel). 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 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.

VI. 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. We offer far wider and deeper scrutiny. We incorporate these indices into both 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 focus on the system GMM panel estimates. The results are organized in Subsections VI.A through VI.D.

VI.A. 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 VIII; parallel results from the extended ABP dataset are reported in Table B.1 (online Appendix B).

Table VIII about here

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 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 95th 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 100th percentile), one case of a trivially quadratic relationship (the 95th 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) fails the Lin-Meh test in three cases, and appears only linearly significant in the two remaining 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 80th percentile. The index of access to financial markets

(FMA) shows a marginally significant inverted U-shaped relationship at the 80th percentile, a trivially quadratic relationship at the 100th percentile, and insignificance elsewhere. In the extended ABP dataset, FMA appears marginally trivially quadratic at the 80th 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.

Overall, results from the nine relative indices of financial development appear mixed. Three relative indices—FD, FI, and FME—show inverted U-shaped relationships with PYG in all or the majority of estimates across both (our and ABP’s) datasets. However, FME showing a tipping point relationship with economic growth is puzzling. By contrast, the other three indices—FMD, FMA, and FIE—virtually do not show the inverted U-shaped relationship. Finally, the three remaining measures—FID, FIA, and FM—show contradictory results across two datasets. 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 problems. 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 (Svirydzhenka 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 the Ukraine, 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.

VI.B. 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 x 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 VI.A), 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.¹⁵ 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 80th percentiles, and overwhelmingly insignificant elsewhere, whereas FMD shows a trivially quadratic relationship in the 90th 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, FIA, FM, FMD, FMA, and FME—appear totally insignificant across all estimates. Of the three remaining, FD appears linearly negative and significant at the 100th percentile, but positive and significant at the 80th percentile, while FID (at the 80th percentile) and FIE (at the

¹⁵ 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.

100th 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, barring FIE, only two counts of the inverted U-shaped relationship are found, 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, we find 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 VI.A) completely disappear once they are regrouped into regional country panels.

VI.C. 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 95th 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 95th 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, we focus on these five indices and estimate their 100th 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.

The overall score in support of the inverted U-shaped relationship is just 16% $\left(\frac{11}{70}\right)$ sets of estimates), 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% but confined to FD only). 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.

VI.D. 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 in explaining PYG across 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 $\left(\frac{1}{5}\right)$ —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 nine relative indices, 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 V.E.

VII. FINANCIAL DEVELOPMENT AND REAL PER CAPITA GDP: IS THERE A TIPPING POINT?

In this section, we present the results concerning the non-monotonic relationship between financial development and real per capita GDP (LYP) estimated through the dynamic panel strategy akin to that of Acemoglu et al. (2019), an alternative assessment of the concavity of the finance–growth relationship.

VII.A. Panel Results (Global Panels)

We report fifty sets of results of the five traditional measures of financial development from both datasets in Table IX.

Table IX about here

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 100th percentile; all the remaining measures and estimates appear mostly insignificant.

Table X about here

The results of the nine relative indices of financial development are reported in Table X. 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, 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, income levels, and the relative levels of financial development, which we turn to in the following sections.

VII.B. Panel Results (Regional Panels)

The four regional country panels constructed as above are analyzed. 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 100th percentile each in both 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 both global 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. This echoes the results of Sections V.C. and VI.B, where these indices also 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 80th 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 90th 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 85th 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 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 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 the two 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. 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.

VII.C. 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 the two 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 100th percentile of our dataset but appears linearly positive and significant at the 95th 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 100th percentile, but a U-shaped relationship at the 90th 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 95th percentile of our dataset and the trivially quadratic SMVR at the 80th 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 80th 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 100th 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 (100th 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. Measures of financial development appear mostly insignificant in explaining real per capita GDP across income-level based country panels.

VII.D. 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 80th percentile and (ii) SMVR shows an inverted U-shaped at the 95th percentile of our dataset, while (iii) AFDR shows a U-shaped relationship at the 100th 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.

VIII. RESULTS FROM LINEAR SPECIFICATIONS

Besides the virtual lack of an inverted U-shaped relationship, one of the striking results of our scrutiny so far has been the near wholesale insignificance of all fourteen measures of financial development in explaining economic growth. This sharply contradicts the voluminous literature reporting a significant positive effect of financial development on economic growth (Ross Levine 2005). However, this significance is mainly reported with respect to the five traditional measures and under linear specifications, whereas our results so far are from non-linear specifications. Moreover, the so-called ‘vanishing effects’ are also primarily reported vis-à-vis the linear specifications. In this context, whether our findings of the near wholesale insignificance of these fourteen measures of financial development in explaining economic growth are due to non-linear specification is an important issue. To unravel this paradox, we re-examine the finance–growth nexus and the issue of ‘vanishing effects’ following the log-linear specifications while maintaining uniformity in our analytical approach.¹⁶ We scrutinize the log-linear relationship across both global datasets as well as by reorganizing them into country panels based on regions, income levels, and the relative levels of financial development. Moreover, as above, we split each of these panel datasets into different sample periods and analyze them along with their truncated percentiles, while ensuring that a minimum of seventy non-overlapping five-yearly average data points (350 country years) are maintained in each estimation.¹⁷ This minimum data point rule prevents us from modeling some of the measures

¹⁶ Our log-linear specification utilizes the specification (2) of Section III by (i) dropping the quadratic covariate, and (ii) using measures of financial developments (FD_j) in natural logarithms. The rest of the covariates of specification (2) are maintained.

¹⁷ We split our dataset into the three samples of 1970–1995, 1970–2005, and 1970–2014 for the five traditional measures of financial development. The respective splits for the nine relative indices are: 1980–2000, 1980–2005, and 1980–2014. Following ABP, their dataset is split into four samples of 1960–1995, 1960–2000, 1960–2005, and 1960–2010 for PC. For the four

and/or some country panels, but is nonetheless important in ensuring an adequate degree of freedom in our estimates. Our analytical strategy also helps with scrutiny of the ‘vanishing effects.’

Our analytical approach produces a total of 445 sets of log-linear estimates from the two global datasets—210 from our dataset and a further 235 from the ABP dataset—involving these fourteen measures of financial development.¹⁸ Analysis of country panels based on regions, income levels, and the relative levels of financial development generates a further 3,757 sets of log-linear estimates between the fourteen measures of financial development and economic growth.¹⁹ Together, we have a total of 4,202 sets of log-linear estimates encompassing the fourteen measures of financial development across wider analytical tracks in multi-country panel settings. For the sake of brevity, we report only the results of the two global panel datasets. We offer a clear and concise commentary on the results of the regrouped country panels without reporting the results themselves (data and codes readily replicate all our results). We hope this level of scrutiny provides deep and robust insights on the finance–growth nexus under the log-linear specifications and into the issue of ‘vanishing effects.’ In the following, first we present

remaining traditional measures, the ABP dataset is split into 1975–1995, 1975–2000, 1975–2005, and 1975–2010; and for the nine relative indices the sample splits are: 1980–2000, 1980–2005, and 1980–2010. The discrepancy in the sample split is due to data availability.

¹⁸ 3 samples x 5 datasets each due to sample truncations x 14 indicators give us 210 sets of estimates from our dataset. Likewise, 4 samples x 5 datasets each x 5 indicators give 100 sets of estimates for the traditional measures, and 3 samples x 5 datasets each x 9 indicators give a further 135 sets of estimates for the relative indices from the ABP dataset.

¹⁹ The 3757 estimates include 1480 from the regional panels (824 from our dataset and 656 from the ABP dataset); 1297 from the income-based panels (710 from our dataset and 587 from the ABP dataset); 490 from the financially relatively more developed panels (280 from our dataset and 210 from the ABP dataset); and 490 from the financially relatively less developed country panels (280 from our dataset and 210 from the ABP dataset). Variations in the number of estimates are due to data availability.

the results of the five traditional measures followed by the results of the nine relative measures. The results of the five traditional measures from our full panel dataset are reported in Table XI.

Table XI about here

PC appears completely insignificant across all ten sets of estimates in samples 1970–1995 and 1970–2005 but shows significance at 10% in three of the five sets of estimates in sample 1970–2014 (the 90th through to the 80th percentiles). In parallel results from the ABP dataset (online Table D.1: Appendix D), PC shows three instances of significance in sample 1960–1995 and three in sample 1960–2000, but shows complete insignificance across all the remaining (fourteen) sets of estimates, inclusive of samples 1960–2005 and 1960–2010.²⁰ The results clearly show that even under the log-linear specification, PC appears insignificant in explaining PYG in the vast majority of estimates. Together, PC appears significant in only 26% of the thirty-five sets of estimates across the two datasets, which is hardly compelling evidence. ABP interpret PC’s insignificance in samples 1960–2005 and 1960–2010 as the evidence of vanishing effects but the results from our dataset reveal, albeit mildly, quite the opposite—if anything, the evidence suggests emerging effects, as only the latest sample (1970–2014) shows marginal significance of PC in three of the five sets of estimates. Moreover, ABP’s results that show the significance of PC in samples 1960–1995 and 1960–2000 is also sensitive to data truncations, implying their evidence of ‘vanishing effect’ is neither robust nor compelling.

The four remaining traditional measures paint an even bleaker picture. The results from our dataset reveal that SMCR, SMVR, and AFDR appear totally insignificant in the forty-five sets of estimates between them, except in one instance: SMVR shows a negatively signed and marginally significant parameter in the 85th percentile of sample 1970–1995, which is unexpected. AFAR appears positive and significant in four of the five sets of estimates of sample 1975–1995, but totally insignificant in the rest of the estimates, inclusive of samples 1975–2005 and 1975–2014. The parallel results from the extended ABP data are confirmatory: all four

²⁰ The 100th percentiles across these samples are the precise dataset used by ABP in their log-linear estimations (ABP, Table 5). In our estimations, the point estimates differ slightly due to the way we handle time dummy variables as explained in footnote 11. We could exactly reproduce ABP’s results by following their approach to the dummy variables.

measures appear overwhelmingly insignificant in the eighty sets of estimates across the four sample periods. On balance, the five traditional measures of financial development appear mostly insignificant in explaining economic growth even under log-linear specifications. The results show no credible and consistent evidence of ‘vanishing effects.’

The overwhelming insignificance of the five traditional measures of financial development in explaining economic growth is reinforced when the two global datasets are analyzed by forming country panels based on regions, income levels, and relative levels of financial development. Keeping with our minimum data points rule, we could estimate 20(15) sets of estimates each for PC across the Africa, EU-NA, and LAC regions, and 19(15) sets of estimates for the Asia region from our (ABP) dataset. The results could not be more striking. PC shows not a single case of a significantly positive effect on PYG for the Africa region; instead, it appears significantly negative in two instances. PC appears positive and significant in just two instances for Asia, in one instance for LAC, and completely insignificant for the EU-NA region. Parallel results from the ABP datasets are corroborative: PC appears completely insignificant except for in one instance of a significantly negative effect for Africa and one instance of a significantly positive effect for the LAC regions. Thus, PC’s significantly positive effect on PYG is limited in four of the 139 sets of log-linear estimates (a score of 3%) across the four regional country panels formed from the two global datasets.

The four remaining traditional measures could not be estimated for the Africa region in our dataset, and for the Africa and LAC regions in the ABP dataset as they do not satisfy our minimum data point rule. However, we estimate a total of 129 sets of estimates across four traditional measures and three regions in our dataset. They all appear largely insignificant in explaining PYG. AFAR appears positive and significant in one count in Asia but appears significantly negative in three counts in EU-NA; SMCR appears positive and significant in just one count in EU-NA, and rest of the estimates appear insignificant. The eighty-three sets of parallel estimates from the extended ABP dataset for the Asia and EU-NA regions also fail to show any significantly positive effect of these measures on PYG. Instead, AFDR and AFAR show one case of a significantly negative effect on PYG each.

The above scenario repeats across the country panels based on income-levels. The results from our dataset reveal that PC is significantly positive in nine of the twenty sets of estimates for

the high-income panel but appears negative and significant in two of the twenty sets of estimates for the upper-middle-income panel. Except for these, PC appears completely insignificant in the fifty-six remaining sets of estimates, including all those from the lower-middle-income and the low-income panels. In parallel results from the ABP dataset, PC appears totally insignificant in fifty-six of the fifty-seven sets of estimates across these four country panels. The lone exception is its negative and significant parameter in one of the fifteen sets of estimates for the upper-middle-income panel, which is unexpected. These results sharply contradict the assertion that PC significantly explains economic growth in countries that are at the lower echelon of economic development. The four remaining traditional measures also appear mostly insignificant. AFDR $\left(\frac{2}{20}\right)$, AFAR $\left(\frac{5}{20}\right)$, SMCR $\left(\frac{3}{20}\right)$, and SMVR $\left(\frac{0}{20}\right)$ together show ten instances of significance across eighty sets of estimates for the high-income panel in our dataset, while they appear totally insignificant in the parallel sixty sets of estimates from the extended ABP dataset. These four measures appear largely insignificant in explaining PYG for the upper-middle-income panel across sixty sets of estimates from our and the ABP datasets. For the lower-middle-income panel, we could only estimate eight sets of results involving these four measures (two sets for each of these measures) from the ABP dataset, but only the 100th percentiles of SMVR and AFAR from our dataset. Again, none of the four measures appear positive and significant in explaining PYG in the lower-middle-income panel across these estimates. Due to the short data span, we could not estimate them for the low-income panel.

Likewise, the five traditional measures do not show any credible evidence of a positive and significant effect on PYG across the financially relatively more versus less developed country panels. Although PC shows a positive and significant effect in 50% of the twenty sets of estimates for the financially relatively more developed country panels in our dataset, in the parallel fifteen sets of estimates from the ABP dataset it appears significantly negative in two counts and totally insignificant in the rest of the estimates. Thus, the significance of PC is hardly robust. Surprisingly, the four remaining traditional measures also appear either insignificant or significantly negative in explaining PYG across the 140 sets of estimates for the financially relatively more developed country panels across both datasets, except that SMVR appears positive and significant in 10% (7%) of the estimates of our (ABP) dataset. The five traditional measures also appear mostly insignificant in explaining PYG across the 175 sets of estimates—

20 (15) sets of estimates for each measure from our (ABP) dataset—for the financially relatively less developed country panels. Specifically, PC and SMCR both appear totally insignificant in explaining PYG across both datasets while the rest appear mostly insignificant. Overall, the five traditional measures of financial development appear virtually insignificant in explaining economic growth in the two global panel datasets as well as across country panels capturing other analytical trajectories.

Turning to the nine relative indices, the results from both global panels (Table XII) appear mixed .

Table XII about here

Five of the nine relative indices—FD, FI, FID, FIA, and FIE—appear positive and significant in explaining PYG in a large majority of estimates (Table XII). Together, they appear positive and significant in seventy-one of the seventy-five sets of estimates. Clearly, there is no evidence of ‘vanishing effects’ as these measures appear significant across all three sequentially updated data samples inclusive of truncations. The four remaining indices show mixed results. FM appears positive and significant across all estimates of samples 1980–2000 and 1980–2005 but shows complete insignificance in the estimates of sample 1980–2014. FMD appears positive and significant in sample 1980–2000 but appears virtually insignificant across the estimates of samples 1980–2005 and 1980–2014. FME appears completely insignificant in sample 1980–2000 but positive and significant across most estimates $\left(\frac{7}{10}\right)$ of samples 1980–2005 and 1980–2014. Finally, FMA appears virtually insignificant in all estimates across all three samples.

Parallel results from the extended ABP dataset show that four indices $FD\left(\frac{14}{15}\right)$, $FI\left(\frac{12}{15}\right)$, $FIA\left(\frac{15}{15}\right)$ and $FME\left(\frac{10}{15}\right)$ show a positive and significant effect on PYG in the majority of estimates (online Table D.2), but the five remaining indices appear either wholly or mostly insignificant. Overall, under the log-linear specification, results from our global dataset show that the majority of the relative indices of financial development exert a significantly positive effect on economic growth but the parallel results from the ABP dataset are far weaker. However, the evidence from global datasets is not robust and completely disappears once the global panels are regrouped into

country panels based on regions, income levels, and the relative levels of financial development. The results do not show any consistent evidence of ‘vanishing effects’ either.

The results concerning regional country panels from our dataset show that five of the nine relative indices—viz., FI, FID, FIE, FMA, and FME—are totally insignificant across the sixty-seven sets of estimates between them for the Africa region. Of the four remaining indices, FD and FIA show significance in 10% of the estimates each, while FM and FMD show significance in 5% of the estimates each in their respective twenty sets of estimates. Parallel results from the ABP dataset largely corroborate these results: six of the indices—FD, FIE, FM, FMA, FMD, and FME—appear totally insignificant in the sixty-eight sets of estimates between them. The three remaining indices—FI $\left(\frac{1}{15}\right)$, FIA $\left(\frac{5}{15}\right)$, and FID $\left(\frac{3}{15}\right)$ —show few cases of significantly positive effects in their fifteen sets of estimates each. For the Asia region, six of the relative indices—FD, FIA, FIE, FMA, FMD, and FME—appear totally insignificant in the eighty-nine sets of estimates between them. The three remaining indices—FI $\left(\frac{1}{15}\right)$, FID $\left(\frac{3}{15}\right)$, and FM $\left(\frac{4}{15}\right)$ —appear positive and significant in a minority of estimates. Parallel results from the ABP dataset show eight of the nine indices to be totally insignificant in the 120 sets of estimates between them. The only exception is FID, which shows four counts of significance in its fifteen sets of estimates. Likewise, in the EU-NA panel, five of the nine relative indices appear totally insignificant in the 100 sets of estimates between them in our dataset. Of the four remaining indices, three—FI $\left(\frac{1}{20}\right)$, FIE $\left(\frac{5}{20}\right)$, and FMD $\left(\frac{2}{20}\right)$ —appear significantly positive in a minority of cases, while FM appears significantly negative in one count. The results from the ABP dataset are confirmatory. Six indices—FD, FI, FID, FM, FMA, and FME—appear totally insignificant, while the remaining three—FIA, FIE, and FMD—appear positive and significant in one instance each in their fifteen sets of estimates. Indices of financial development continue to appear overwhelmingly insignificant in explaining PYG in the LAC panel too. Specifically, seven of them appear totally insignificant in the 119 sets of estimates in between. The two remaining indices, FD and FI, show positive and significant parameters in one instance each in the thirty-

six sets of estimates between them. Parallel results from the ABP dataset are similar: the overall score of positive and significant parameters is just under 4% in 130 sets of estimates across these nine indices.

The scenario does not change vis-à-vis the four income-level based country panels. Three indices—FD, FI, FID, and FMD—appear positive and significant in the majority (55 to 100%) of estimates for the high-income country panels, but the five remaining indices appear mostly insignificant across their 180 sets of estimates. In the parallel 135 sets of estimates from the ABP dataset, FI, FIA, and FMD appear positive and significant in the majority of estimates, while the other six indices appear overwhelmingly insignificant. For the upper-middle- and lower-middle-income country panels, all nine indices appear overwhelmingly insignificant in their 310 and 294 sets of estimates across both datasets. Finally, for the low-income panel, we could only estimate five relative indices—FD, FI, FIA, FID, and FIE—from our dataset and seven indices (except FMA and FME) from the ABP dataset, generating a total of forty-four sets of estimates. These appear overwhelmingly insignificant in explaining PYG.

The scenario continues in the financially relatively more developed country panels. In the 180 sets of estimates from our dataset, five indices—FID, FIE, FMA, FMD, and FME—appear totally insignificant, and the other four—FD $\left(\frac{7}{20}\right)$, FI $\left(\frac{2}{20}\right)$, FIA $\left(\frac{1}{20}\right)$, and FM $\left(\frac{3}{20}\right)$ —appear mostly insignificant. The 135 parallel sets of results from the ABP dataset do not reveal these indices to have a role in explaining PYG: FIA and FMD appear totally insignificant, FD, FI, FM, and FME appear mostly insignificant, and the remaining three indices—FID, FIE and FMA—appear either negative and significant or insignificant. For the financially relatively less developed country panels, the 180 sets of results from our dataset depict the seven indices are largely insignificant, while two—FI and FIA—show positive and significant effects in the majority of estimates. Likewise, in the 135 sets of results from the ABP dataset, FI, FIA, and FME appear positive and significant in either all or most estimates, but the six remaining indices appear overwhelmingly insignificant.

Overall, the results from log-linear estimates reveal that the five traditional measures of financial development appear mostly insignificant in explaining economic growth. The nine relative indices show some evidence of financial development explaining economic growth in

both global panels, but this evidence mostly disappears once the global panels are regrouped into country panels based on regions, levels of economic development, and relative levels of financial development. Therefore, in the main, these nine relative indices fail to show any robust results explaining economic growth. There is no consistent evidence of ‘vanishing effects.’ The near wholesale insignificance of the fourteen measures of financial development in explaining economic growth found under non-linear specification is corroborated by the results of the log-linear specifications, therefore the sharp contrast between our results and those of the mainstream literature remains. However, our scrutiny maintains uniformity and consistency across data, specification, and empirical methods while the literature at large is highly divergent in these respects.

IX. CONCLUSION AND IMPLICATIONS

The ‘too much finance’ paradigm—that the finance–growth relationship is inverted U-shaped and a private sector credit to GDP ratio of above 100% is detrimental to economic growth—has come to the fore post-GFC. This credit threshold is at odds with the reality of most industrialized countries—e.g., Japan, the United Kingdom, and the United States have private sector credit to GDP ratios of as high as 200%—and entails deep policy implications with direct bearing on the size and activity depths of their domestic financial sectors. In this context, we provide probably the most comprehensive (exhaustive) and rigorous scrutiny of the three issues that have surfaced in relation to financial development and economic growth—(i) the inverted U-shaped (tipping point) relationship, (ii) the relevance of financial development for economic growth, and (iii) the ‘vanishing effects’—under a unified framework of analysis. This study is unique in scrutinizing a set of well-accepted empirical results against the ‘burden of evidence’, which is acutely lacking in economics. We summarize our main results in the following five points.

First, we conduct an extensive replicative assessment of the seminal work of ABP, which stirred the literature on the inverted U-shaped relationship between financial development and economic growth. Our replicative analyses provide three insights: (i) exposing the ABP dataset to some variations, by way of sample truncations, does not sustain their main finding of an inverted U-shaped relationship between PC and PYG, (ii) scrutiny by regrouping the ABP dataset into country panels based on the UN geoscheme classification, levels of economic development (proxied by gross per capita income levels as per the WB), and the relative levels of

financial development (i.e., the financially relatively more versus less developed country panels) fails to produce any credible evidence in support of the inverted U-shaped relationship between PC and PYG, and (iii) analyses by extending their dataset through a further (four) traditional measures of financial development that are extensively used in the literature—viz., the size (SMCR) and activity (SMVR) depths of the domestic capital market, and the size (AFDR) and activity (AFAR) depths of the overall domestic financial sector—also fails to back up the inverted U-shaped relationship between financial development and economic growth.

Specifically, we estimate twenty-four sets of replicative cross-sectional OLS and IV estimates of the inverted U-shaped relationship of PC by truncating the ABP dataset, and find a replication rate of just 12.5%. Moreover, ABP’s panel results of the inverted U-shaped relationship, based on system GMM estimators, could not be replicated at all in the sixteen sets of replicative estimates through truncating. Surprisingly, PC appears completely insignificant across all panel estimates. Scrutiny by regrouping the ABP dataset into the four regional country panels of Africa, Asia, Europe-North America, and Latin America and the Caribbean, as per the UN geoscheme classification, also fails to produce any credible evidence of the non-monotonic relationship. In eighty sets of estimates across these four regional panels, encompassing the four sample periods analyzed by ABP and their truncated sub-samples, PC shows just one count of an inverted U-shaped relationship and appears totally insignificant in the seventy-nine remaining sets of estimates—a replication rate 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, inclusive of truncations, across these four panels. PC shows just one count of an inverted U-shaped relationship in the lower-middle-income panel and appears completely insignificant in the rest of the estimates. 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, and analyze. PC does not show a single case of an inverted U-shaped relationship across both panels. Our replications cover almost all analytical trajectories that have been employed in the finance–growth literature, and the results reveal that the inverted U-shaped relationship between PC and PYG could not be replicated to any meaningful or credible extent. This suggests that ABP’s results of an inverted U-shaped relationship between PC and economic growth are specific to their data points and lack generality.

Further, we also estimate 120 sets of replicative cross-sectional and eighty sets of replicative system GMM panel estimates by extending the ABP dataset through the other four traditional measures of financial development, that are widely used in the literature, across ABP's three sample periods inclusive of truncations. 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 sample truncations. The estimates of TPs show huge divergence despite slight variation in the data points. 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 through 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 examine 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 scores in support of the inverted U-shaped relationship are just 26% of the total estimates, and is highly sensitive to estimators, data samples, and truncating. The estimates of TPs are incredibly diverse. For example, the estimated TPs of domestic capital markets' activity depths range from 110% (the 100th percentile) to 16% (the 80th percentile). The divergence in estimated TPs is all over. 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 of our dataset by regrouping sample countries into four different regional country panels produces just a single 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%. In the sixty sets of system GMM estimates across the four income-level based country panels, no evidence supporting inverted U-shaped relationship is found. 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. In fact, they appear insignificant in explaining economic growth in the vast majority of estimates.

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 into both 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. We find hardly any evidence of the non-monotonic finance–growth relationship in the 360 sets of estimates involving the nine indices across the four regional country panels formed from the two global datasets: the overall score in favor of the inverted U-shaped relationship *vis-à-vis* the nine relative indices is less than 2% of the total estimates. Likewise, in the seventy sets of estimates involving the seven relative indices (excluding the FIE and FME as we do not expect them to show the non-monotonic relationship) from our and the ABP datasets, the score in support of the inverted U-shaped relationship is just 16% across the high-income, 3% across the upper-middle-income, and 4% across the lower-middle-income country panels. We could only estimate five of the nine indices—*viz.*, FD, FI, FID, FIA, and FIE—across the low-income panel in our dataset due to data constraints, but could estimate seven indices—except FMA and FME—in the ABP dataset, and these all appeared overwhelmingly insignificant in explaining PYG. Likewise, in the seventy sets of estimates (excluding FIE and FME), the overall score in support of the inverted U-shaped relationship is only 14% for the financially relatively more developed country panel and 16% for the financially relatively less developed country panel. Moreover, this meager support is highly sensitive to indices, data samples, and sample truncations.

Fourth, we also evaluate the non-monotonic relationship between financial development and the levels of real per capita GDP (LYP) in a dynamic panel setup, similar to Acemoglu et al. (2019), as an additional course to assess the inverted U-shaped relationship. In the fifty sets of system GMM estimates concerning the five traditional measures from the two global datasets, PC shows just one instance of an inverted U-shaped relationship; the rest of the measures and estimates appear largely insignificant. The results of the nine relative indices show limited support for the non-monotonic relationship in both global datasets. Excluding the two efficiency

indices, the score in support of the inverted U-shaped relationship between the seven relative indices and LYP is 34% in our and 43% in the ABP global dataset. Again, this support completely disappears when the global panels are regrouped into different tracks of country panels. In the 496 sets of estimates across the four regional country panels—248 each from our and ABP’s datasets—involving the fourteen measures of financial development, the score in support of the inverted U-shaped relationship is virtually non-existent (less than 1%); all fourteen measures appear insignificant in explaining LYP in the majority of estimates. Likewise, they also appear insignificant in explaining LYP in the vast majority of the 434 sets of estimates across the four country panels based on income levels—216 from our dataset and 218 from the ABP dataset. There is no evidence of the inverted U-shaped relationship across the high-income and the upper-middle-income country panels. Instead, the lower-middle-income and the low-income panels show two and one counts of inverted U-shaped relationship respectively. Overall, the score for the inverted U-shaped relationship across these four income-level based country panels is below 1%. Similarly, the score in favor of the inverted U-shaped relationship is just 4% across the 140 sets of estimates for the financially relatively more developed country panels and 10% across the parallel estimates for the financially relatively less developed country panels.

Fifth, the near wholesale insignificance of all fourteen measures of financial development under non-linear specifications is puzzling, particularly in view of the vast literature reporting the significant effect of financial development on economic growth under (log) linear specifications. Hence, we conduct an extensive scrutiny of the finance–growth relationship in the log-linear specifications to unravel this puzzle. We estimate 445 sets of well-structured log-linear estimates from two global datasets and a further 3,757 sets of estimates from country panels based on regions, income levels, and the relative levels of financial development. The results from log-linear analyses show that the five traditional measures of financial development continue to appear mostly insignificant in explaining economic growth, and generally, there is no support for the so-called ‘vanishing effects.’ The nine relative indices of financial development show some evidence of positive effects on economic growth in the global datasets, but they completely disappear once the global datasets are reorganized into country panels representing different analytical trajectories.

To conclude, our scrutiny across an exhaustive list of measures and analytical trajectories under a unified approach to data, specifications, and econometric methods reveals that the ‘burden of evidence’ is against all three propositions of the finance–growth nexus: (i) the inverted U-shaped relationship, (ii) the relevance of financial development for economic growth, and (iii) the ‘vanishing effects.’ The evidence in support of the inverted U-shaped relationship is neither compelling nor robust, and hence cannot be generalized; by implication it rejects the assertion that finance is excessive, and is hurting economic growth. The extremely limited 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. Given their similarity across both global datasets, these results would appear robust unless one were to consider further analytical trajectories. If these findings are to be viewed as factual 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 highly 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, which shows a maximum PC of just 22%. These results show that the prescribed threshold of a private sector credit ratio of 100% is simply not credible. Often efficiency indices of financial markets and institutions appear insignificant or show tipping point relationships, which is also unusual. Such results are uncomfortably all over the place. Although the ‘burden of evidence’ we present thoroughly rejects all three propositions surrounding the finance–growth nexus, nonetheless this does not prove that finance is altogether irrelevant. Instead, it may suggest that the multi-country panel and cross-sectional approaches, which use highly aggregative cross-country data and ignore heterogeneity across production sectors and units in different countries, may not be well suited to ascertaining whether and to what extent the provision of finance matters for economic growth. Alternative approaches that analyze finance and real sector growth at more disaggregated levels by linking sectoral and/or firm-level production initiatives to their sources of finance may be more effective in shedding new light.

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