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A reassessment of intermediation and size effects of financial systems

Simon Sturn[1,2] · Klara Zwickl[2]

Abstract Several recent studies on the finance–growth nexus highlight that too much financial development, as it has been established in many advanced economies, harms growth. Beck et al. (J Financ Stab 10:50–64, 2014) criticize this literature for only focusing on intermediation activities of financial systems, even though financial sectors in advanced countries have extended their scope beyond traditional tasks. In line with this argument, Beck et al. find for a panel of high-income countries that financial sector size and non-intermediation activity stimulate growth, while intermediation activity has no effect. However, they focus only on OLS regressions with a very limited number of control variables. We test for the robustness of these results. Our findings show that they depend on outliers and are not robust against alternative specifications or estimation approaches. Further, a big financial sector and too many non-intermediation activities are found to reduce growth in some specifications. Our results suggest that Beck et al.'s criticism of the "too much finance" literature is grounded on thin empirical evidence.

Keywords Financial intermediation · Financial sector size · Finance–growth nexus · Too much finance · Robustness

JEL Classification G10 · G21 · O16 · O40

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1 Introduction

Several recent studies question the pre-crisis consensus that more financial development fuels growth. For example, Philippon and Reshef (2013, p. 92) conclude after an in-depth analysis of several developed countries that "it is quite difficult to make a clear-cut case that at the margin reached in high-income economies, the expanding financial sector increases the rate of economic growth." Masten et al. (2008), based on a sample of European countries, show that less-developed countries gain more from financial development than more developed countries. Bezemer et al. (2014) find a negative relationship between bank credit and growth for 46 mostly developed economies over 1990 to 2011. Rousseau and Wachtel (2011) show for a panel of 84 countries that the finance–growth nexus strongly diminished after the early 1980s. Arcand et al. (2012), Cecchetti and Kharroubi (2012), Law and Singh (2014), and Sturn and Epstein (2014) show for panels of, respectively, 133, 50, 87, and 132 developing and developed countries that the finance–growth nexus is nonlinear, and that the positive growth impact of private credit peaks and turns negative after a threshold value.[1] Even though these studies apply different estimators on different samples, this threshold level of private credit is estimated to lie broadly around 90 % of GDP in all of them. Such a level was reached in the last two decades by a significant number of developed countries.

Several possible explanations for such a nonlinear finance–growth nexus have been put forward. Aghion et al. (2005) present a growth model where financial development induces catching-up and leads to convergence of long-run growth, as financial constraints prevent poor countries from taking full advantage of technology transfers. Rousseau and Wachtel (2011) link it to financial liberalization and frequent financial crises since the late 1980s. Kneer (2013) shows for 13 advanced countries that financial development leads to brain drain to the financial sector, reducing productivity and value-added growth disproportionally in industries which rely strongly on skilled labor. Hung (2009) argues that unproductive consumption loans can generate such an effect, and Beck et al. (2012) present cross-country evidence that household lending has no growth effect, while firm lending has positive effects (see also Bezemer et al. 2014). Sturn and Epstein (2014) show that non-bank lending, a broad measure for shadow banking, affects growth negatively. Both lending to households and lending by non-bank facilities increased strongly in recent decades.

In a recent article, Beck et al. (2014) challenge this literature by arguing that it focuses only on intermediation and ignores the fact that financial sectors in advanced countries have extended their scope beyond traditional tasks:

> [T]he financial sector has gradually extended its scope beyond the traditional activity of intermediation between providers and users of funds toward non-intermediation financial activities. The importance of traditional financial intermediation relative to these non-intermediation financial activities has declined over time as financial institutions have diversified into non-lending activities. […] As a result, the traditional measures of intermediation activities

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[1] Arcand et al. (2012) show that this finding also holds for industry-level data.

have become less and less congruent with the reality of modern financial systems and recent papers are not very informative about the effect of financial sector size on growth and volatility. (Beck et al. 2014, p. 51)

Beck et al. (2014) seek to address this issue empirically by including a measure of financial sector size, the value added of the financial sector, as regressor while controlling for traditional intermediation by including bank credit to the private sector in percent of GDP. They interpret financial sector size, when jointly controlling for bank credit, as proxy for financial activities beyond intermediation. Beck et al. (2014, p. 62) find "a positive growth effect of the size of the financial sector and the non-intermediation component in the subsample of high-income countries." Thus, studies not controlling for such non-intermediation activities might erroneously conclude that the finance–growth nexus became weaker or even negative over time.

Beck et al. (2014) apply a simple OLS estimator. They explain: "[A]s this is an initial exploration […] we focus on OLS regressions, leaving issues of endogeneity and omitted variable biases for future research." (Beck et al. 2014, p. 53). Further, they never jointly include all control variables typically used in the literature. In this replication study, we assess the robustness of these results by applying the original data set of Beck et al. (2014). We re-estimate the original specifications, but add all control variables jointly, not one at a time as in Beck et al. (2014). Further we include country and time fixed effects, and test for the impact of outliers. Finally, we address issues of endogeneity for a larger sample of developed and developing countries.

2 Data and empirical approach

The total sample of Beck et al. (2014) covers 77 countries for the period 1980–2007.[2] Beck et al. (2014) obtain support for their arguments only from high-income countries for the period 1995–2007, while financial sector size is not significant for a larger sample with additional years or more countries. Thus we start out focusing on high-income countries in the years 1995–2007. In further regressions, we then also include the years 1980–1994, and low- and middle-income countries. Following the standard approach in the literature, Beck et al. (2014) average their annual data over non-overlapping 5-year periods.[3]

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[2] Beck et al. (2014) drop all observations after 2007. They justify this as follows: "Although the potential instability associated with a large financial sector is central to our argument, we exclude the recent crisis from the sample period in order to be able to draw more general conclusions. Given the sudden large output declines which are reflected in the data as from 2008, results would be dominated by this event." (Beck et al. 2014, p. 53) This is to say, they include the observations covering the years of the buildup of the financial bubble, where financial development went hand in hand with high but unsustainable growth, but exclude the period of the correction of the bubble. This seems problematic; such a decision potentially biases the results.

[3] This is done to sweep out business cycle fluctuations from the data. Because proxies for financial development are highly pro-cyclical, it is important to address this issue. Sturn and Epstein (2014) show that 5-years averaging does not successfully sweep out business cycle effects, and therefore potentially biases results.

Following Beck et al. (2014), we investigate the impact of financial sector size and intermediation on growth. Thus, size can be interpreted as capturing all non-intermediation activities, like "proprietary trading, market making, provision of advisory services, insurance and other non-interest income generating activities" (Beck et al. 2014, p. 51). The regression specification has the following form:

$$\text{Growth}_{it} = \beta_0 + \beta_1 \text{Size}_{it} + \beta_2 \text{Intermediation}_{it} + \beta_3 X_{it} + \varepsilon_{it} \tag{1}$$

Growth is the annual difference in the logarithm of GDP per capita in constant local currency units for country i in time period t. *Size* is the gross value added of the financial industry as a share of GDP. *Intermediation* is the logarithm of private credit to GDP. X is a vector of control variables typically included in the growth literature (e.g., Arcand et al. 2012). It consists of the logarithm of real *Initial GDP* per capita at the beginning of each 5-year episode, *Education*, measured as average years of schooling of the population above 25 years of age, *Inflation*, the growth rate of the consumer price index, *Openness*, constructed as imports and exports as a share of GDP, and *Government consumption* as a share of GDP (see the Appendix for summary statistics of the variables included).

3 Developed economies, 1995–2007

3.1 Specification details

Our first specification for a sample of developed countries from 1995 to 2007 follows exactly Beck et al. (2014). We estimate Eq. (1) by OLS, controlling for *Initial GDP*, *Education*, and *Inflation*. Our second specification includes two standard control variables, *Openness* and *Government Consumption*, as further regressors. We also include time dummies to control for common unobserved shocks to all countries. Beck et al. (2014) report that they tested for the robustness of their results when including time and/or country fixed effects for the full sample of developed countries. However, they do not test these effects on the sample of developed countries only.

In the third specification, we additionally purge country fixed effects, to control for unobserved heterogeneity of the countries. Note that we explain growth of GDP, and include GDP at the beginning of each 5-year episode as explaining factor, which might be interpreted as dynamic panel.[4] As the fixed effects estimator yields biased results in a dynamic panel setting, especially in short panels (Nickell 1981), we apply the bias-corrected least-squares dummy variable estimator described in Bruno (2005a and 2005b).[5]

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[4] To see why, consider that *Growth* is defined as $\Delta y = y_t - y_{t-1}$, where y is GDP in logarithms. Thus, Eq. (1) can be rewritten as $y_t - y_{t-1} = \beta_1 y_{t-1} + \beta_2 W_{it} + \varepsilon_{it}$, which is identical to $y_t = (\beta_1 + 1)y_{t-1} + \beta_2 W_{it} + \varepsilon_{it}$ (see Bond et al. 2001).

[5] We choose the Blundell and Bond (1998) estimator, designed for highly persistent series as in our case, to initialize the bias correction. However, our results are robust against the use of the Arellano and Bond (1991) estimator instead. Following standard practice when applying this estimator, we estimate standard errors using a parametric bootstrap method (see Bruno 2005b) with 400 resamples. To avoid loosing one

In the fourth specification, we follow Arcand et al. (2012) and others, and include the squared terms of *Intermediation* and/or *Size* as further regressors. This allows us to test whether the effect of financial development on growth is nonlinear. More specifically, we are interested in seeing if a big financial sector diminishes growth.

3.2 Results

We start our analysis by obtaining an exact replication of the first specification in Table 9 of Beck et al. (2014).[6] To get there, we estimate Eq. (1) by OLS, including *Initial GDP*, *Education*, and *Inflation* as control variables. The results are presented in Table 1, Specification 1. We find that *Intermediation* is insignificantly negatively correlated with growth, while *Size* is highly significantly and positively correlated.

Following Beck et al. (2014), this suggests that financial development contributes to growth in rich countries where the amount of bank credit as a share of GDP is already high, and that the driving force behind this effect is related to non-intermediation activities. Thus, studies focusing only on intermediation activities might mistakenly conclude that the finance–growth nexus diminishes in rich countries.

However, as we will see, this result is not robust along several dimensions. Including *Openness*, *Government Consumption*, and time dummies as further controls (Specification 2) reduces the coefficient and significance level of *Size* noticeable, but it is still significant at the 10 % level, while *Intermediation* remains insignificant. Once fixed effects are purged, *Size* becomes negatively insignificantly correlated with growth, while *Intermediation* even becomes negatively significant (Specification 3). When testing for a nonlinear impact of credit and financial sector size, we do not find much support for such effects. Neither *Size* or *Intermediation*, nor their squared terms are statistically significant or have coefficients with the expected signs (Specification 4). So far, we seem to find some modest support for the case of Beck et al. (2014).

A closer inspection of the data yields that Luxembourg is a huge outlier in terms of financial sector size (Fig. 1). The sample mean of financial sector value added as a percentage of GDP lies at 6.1, with a standard deviation of 3.9, while the observations for Luxembourg reach values between 21.7 and 27.2. Thus, Luxembourg is four to five and a half standard deviations away from the sample mean of developed countries. To assess the significance of Luxembourg on the overall findings, we re-estimate Specifications 1–4 without Luxembourg (see Specifications 5–8). This strongly weakens the evidence in support of Beck et al. (2014). *Size* is only statistically significant, and only

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Footnote 5 continued

observation per country when applying this dynamic estimator, we merge data on real GDP in local currency units from the World Development Indicators (WDI). Thus, *Initial GDP* in specifications applying the bias-corrected LSDV estimator slightly differs from *Initial GDP* in the OLS specifications, where it is defined as real GDP per capita in US dollars as in the original data set. All our central findings also hold when applying the uncorrected least-squares dummy variable estimator on the original data set. When applying the system GMM estimator, the coefficients are very imprecisely estimated and all variables measuring financial development are statistically insignificant in all specifications.

[6] Beck et al. (2014) perform this analysis also for a slightly different and smaller sample of 27 developed countries (see their Table 4, Panel A). Our results also hold for this smaller sample, but do not provide additional information, and are thus not reported.

Table 1 Size and intermediation effects of financial systems for developed economies, 1995–2007 (5-year averages)

	(1) Exact replication of 1st specification in Table 9 of Beck et al. (2014)	(2) = (1) plus further controls and time fixed effects	(3) = (2) plus country fixed effects, estimated by bias corrected LSDV estimator	(4) = (3) plus Size and Intermediation squared	(5) = (1) without Luxembourg	(6) = (2) without Luxembourg	(7) = (3) without Luxembourg	(8) = (4) without Luxembourg	(9) = (5) without Intermediation	(10) = (6) without Intermediation	(11) = (7) without Intermediation	(12) = (8) without Intermediation
Size	0.176***	0.121*	-0.003	-0.034	0.262*	0.255	-0.025	0.019	0.245	0.234	-0.025	0.019
	(0.000)	(0.092)	(0.765)	(0.124)	(0.076)	(0.123)	(0.121)	(0.744)	(0.100)	(0.164)	(0.113)	(0.710)
Size squared				0.001				-0.003				-0.003
				(0.129)				(0.430)				(0.379)
Intermediation	-0.171	-0.419	-0.056*	-0.050	-0.245	-0.522	-0.052	-0.078				
	(0.729)	(0.399)	(0.081)	(0.643)	(0.620)	(0.276)	(0.121)	(0.505)				
Intermediation squared				-0.000				0.014				
				(0.992)				(0.782)				
Initial GDP	-2.516***	-2.261***	-0.124	-0.045	-2.574***	-2.355***	-0.039	-0.013	-2.685***	-2.635***	-0.089	-0.069
	(0.000)	(0.000)	(0.111)	(0.621)	(0.000)	(0.000)	(0.670)	(0.897)	(0.000)	(0.000)	(0.297)	(0.430)
Education	0.349***	0.278**	0.021	0.023	0.335**	0.261*	0.024	0.023	0.348***	0.308**	0.027	0.026
	(0.005)	(0.032)	(0.313)	(0.301)	(0.010)	(0.052)	(0.221)	(0.277)	(0.006)	(0.023)	(0.150)	(0.185)
Inflation	-0.145**	-0.150**	-0.007**	-0.007**	-0.151**	-0.154**	-0.008***	-0.007*	-0.141**	-0.140**	-0.009***	-0.008**
	(0.017)	(0.024)	(0.015)	(0.016)	(0.012)	(0.020)	(0.009)	(0.057)	(0.011)	(0.025)	(0.002)	(0.016)
Openness		0.004	-0.000	-0.001		0.005	-0.001	-0.001		0.004	-0.001	-0.001
		(0.361)	(0.675)	(0.324)		(0.258)	(0.194)	(0.262)		(0.348)	(0.159)	(0.198)
Government consumption		-0.021	-0.015**	-0.011		-0.003	-0.010	-0.008		0.004	-0.012	-0.009
		(0.720)	(0.030)	(0.173)		(0.954)	(0.167)	(0.336)		(0.950)	(0.122)	(0.250)
Time fixed effects	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes
Country fixed effects	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Adj. R2	0.405	0.468			0.547	0.578			0.545	0.570		
Observations	78	78	78	78	75	75	75	75	75	75	75	75
Number of countries	27	27	27	27	26	26	26	26	26	26	26	26

*, **, *** indicate significance at the 10, 5, and 1 % level, respectively. OLS specifications include an unreported constant. Cluster-robust standard errors in OLS specifications, bootstrapped standard errors in bias-corrected LSDV specifications; p values in parenthesis. Intermediation in specifications (4) and (8) is not in logarithms

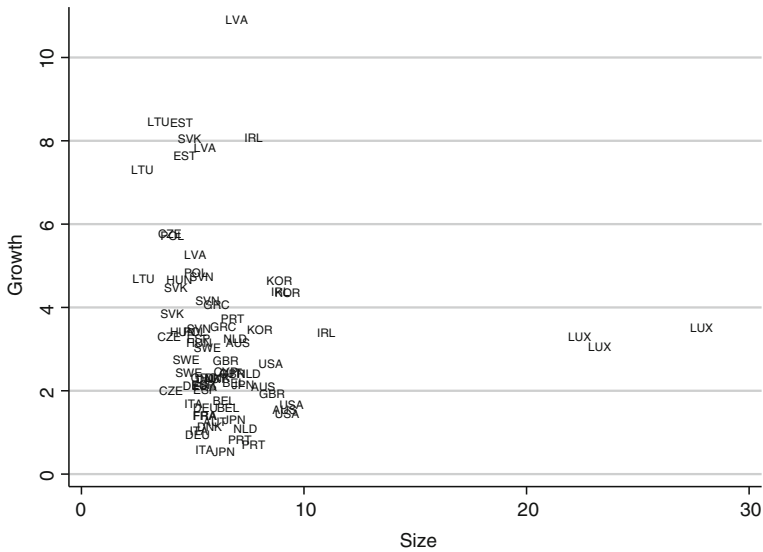*Source* Beck et al. 2014, WDI, own calculations

Fig. 1 Scatter plot between *Growth* and *Size* for 27 developed countries, 1995–2007 (5-year averages). Source: Beck et al. 2014, own presentation

at the 10 % level, in the rudimentary OLS specification (Specification 5). In all augmented specifications it is insignificant, with coefficients close to zero once country fixed effects are purged. *Intermediation* is always insignificant with a negative sign. We further find negative signed squared terms of *Size* and *Intermediation*, but both are insignificant.

Finally, Specifications 9–12 repeat this analysis but only include *Size* as a measure of financial development. It might be that *Intermediation* and *Size* are correlated, and thus that multicollinearity issues are responsible for the mostly insignificant coefficients of *Size* and *Intermediation*. The results, however, are largely identical to Specifications 5–8, with the difference that *Size* is now always statistically insignificant. Overall, the results of Beck et al. (2014) are not robust against reasonable modifications in the specifications, like the inclusion of additional covariates typically included in the literature, purging fixed effects, and the omission of outliers.

3.3 Additional evidence for different measures of financial sector size

We present results for additional proxies of financial sector size obtained from the EU KLEMS database for the same sample of developed countries for the period 1995–2007. Specifically, we include financial sector employment as a share of total employment, hours worked in the financial sector as a share of total hours worked, and the compensation share of the financial sector as alternative proxies for financial sector size.

Beck et al. (2014, p. 62) find "that *size* while controlling for *intermediation* is positively and significantly associated with growth. This holds across all four indicators

of financial sector size—*value added share*, *compensation share*, *employment share* and *share hours*. […] This shows that our results do not depend on the specific size measure used in the main analysis."

Table 2 summarizes our results for the four different specifications with each of the alternative financial size proxies. To save space, we do not present the coefficients and *p* values of the control variables included in the specifications. Specification 13 of Panel A to C provides exact replications of the first column in Table 9 of Beck et al. (2014). We find that all three alternative proxies for financial sector size—*Employment Share*, *Hours Share*, and *Compensation Share*—yield a statistically highly significant positive effect on growth.

However, also this result is not robust. Once time dummies and other control variables typically included in the literature are added, the coefficients of *Employment share*, *Hours share*, and *Compensation share* are substantially lower and the significance is gone (Specification 14). Once fixed effects are purged (Specification 15), their coefficients drop basically to zero. When testing for nonlinearities, all financial development proxies are insignificant (Specification 16). *Intermediation* is insignificant in all specifications. In sum, minor changes in the specifications of Beck et al. (2014) alter the central outcomes considerably.

We proceed by excluding Luxembourg from the sample, and re-estimate these four specifications for three proxies of financial sector size (Table 2, Specifications 17–20).[7] In Specifications 17–19, we find a statistically insignificant coefficient for all three alternative financial size proxies, as well as *Intermediation*.

Once we allow for a nonlinear impact of the financial sector size proxies in Specification 20, we find a statistically significant positive coefficient of *Employment Share* and *Hours Share*, and a significantly negative coefficient of *Employment Share Squared* and *Hours Share Squared*. This suggests that the positive growth impact of the employment and hours share diminishes, and turns negative after reaching a threshold value. This threshold is estimated to lie at 2.3 for the *Employment Share* and 2.6 for the *Hours Share*.[8] Given that the sample means of *Employment Share* and *Hours Share* are at 2.7, in both cases, this result implies that financial sector size is a drag on growth in more than half of the sample. Or to illustrate this result differently, 15 (14) of the 26 countries in the sample have an *Employment Share* (*Hours Share*) above the threshold level in the last period where data are available. The estimates with *Compensation Share* point in a similar direction, but are insignificant.

To assess the robustness of these results, we exclude *Intermediation* from the set of explanatory variables (Specifications 21–24). The results remain very similar to Specifications 17–20. *Employment Share* and *Hours Share* are again found to show a nonlinear impact on growth. Also the threshold values remain virtually identical. These findings are much more consistent with the "too much finance" view than with the outline of Beck et al. (2014).

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[7] Luxembourg is also an outlier regarding *Employment share*, *Hours share*, and *Compensation share*.

[8] This result is confirmed if estimated by the fixed effects estimator, whereas the thresholds are found to lie at 2.5 and 2.8, respectively.

Table 2 Different proxies for financial sector size for developed economies, 1995–2007 (5-year averages), summary results

	Exact replication of 1st specification in Table 9 of Beck et al. (2014) (13)	= (13) plus further controls and time fixed effects (14)	= (14) plus country fixed effects, estimated by bias corrected LSDV estimator (15)	= (15) plus Size and Intermediation squared (16)	= (13) without Luxembourg (17)	= (14) without Luxembourg (18)	= (15) without Luxembourg (19)	= (16) without Luxembourg (20)	= (17) without Intermediation (21)	= (18) without Intermediation (22)	= (19) without Intermediation (23)	= (20) without Intermediation (24)
Panel A												
Employment share	0.348*** (0.000)	0.199 (0.242)	0.004 (0.927)	-0.023 (0.751)	0.191 (0.522)	0.141 (0.671)	-0.021 (0.676)	0.344* (0.014)	0.188 (0.523)	0.124 (0.711)	-0.028 (0.585)	0.362*** (0.008)
Employment share squared				-0.023 (0.751)				-0.074*** (0.005)				-0.078*** (0.002)
Intermediation	-0.091 (0.857)	-0.447 (0.358)	-0.024 (0.308)	-0.036 (0.745)	-0.080 (0.877)	-0.432 (0.386)	-0.021 (0.423)	-0.123 (0.276)				
Intermediation squared				-0.008 (0.871)				0.041 (0.413)				
Adj. R2	0.522	0.561			0.525	0.561			0.525	0.556		
Panel B												
Hours share	0.366*** (0.000)	0.236 (0.209)	-0.006 (0.873)	-0.032 (0.655)	0.273 (0.362)	0.263 (0.465)	-0.030 (0.518)	0.383** (0.025)	0.271 (0.365)	0.250 (0.483)	-0.034 (0.459)	0.392** (0.011)
Hours share squared				0.002 (0.766)				-0.075** (0.011)				-0.076*** (0.004)
Intermediation	-0.084 (0.868)	-0.430 (0.384)	-0.024 (0.328)	-0.033 (0.770)	-0.083 (0.870)	-0.439 (0.370)	-0.020 (0.458)	-0.112 (0.369)				
Intermediation squared				-0.009 (0.860)				0.036 (0.513)				
Adj. R2	0.527	0.564			0.529	0.565			0.529	0.559		
Panel C												
Compensation share	0.162*** (0.000)	0.063 (0.442)	-0.019 (0.229)	-0.044 (0.253)	-0.013 (0.921)	-0.087 (0.541)	-0.025 (0.142)	0.014 (0.887)	-0.015 (0.902)	-0.100 (0.488)	-0.025 (0.145)	-0.003 (0.973)
Compensation share square				0.002 (0.430)				-0.003 (0.732)				-0.002 (0.832)
Intermediation	-0.126 (0.805)	-0.489 (0.314)	-0.025 (0.303)	-0.068 (0.551)	-0.061 (0.906)	-0.403 (0.421)	-0.023 (0.373)	-0.066 (0.576)				
Intermediation squared				0.009 (0.866)				0.007 (0.900)				
Adj. R2	0.512	0.556			0.523	0.562			0.523	0.557		
Initial GDP, Education, Inflation as controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Openness and Government consumption as controls	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes
Time fixed effects	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes
Country fixed effects	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Observations	78	78	78	78	75	75	75	75	75	75	75	75
Number of countries	27	27	27	27	26	26	26	26	26	26	26	26

*, **, *** indicate significance at the 10, 5, and 1% level, respectively. OLS specifications include an unreported constant. Cluster-robust standard errors in OLS specifications, bootstrapped standard errors in bias-corrected LSDV specifications; p values in parenthesis. Intermediation in specifications (16) and (20) is not in logarithms

Source: Beck et al. 2014, WDI, own calculations

4 Developed and developing economies, 1980–2007

4.1 Specification details

As causality might also run from growth to financial development, addressing issues of endogeneity is of particular concern in the finance–growth literature (e.g., Levine 2005). Thus, once we move to the full sample of 77 countries for the period 1980–2007, we follow the standard approach in the growth literature when dealing with "large N, small T" samples with endogenous regressors, and apply the system GMM estimator (see Arellano and Bover 1995; Blundell and Bond 1998) with the asymptotically more efficient two-step procedure described in Arellano and Bond (1991) and the Windmeijer (2005) finite sample correction. The Hansen test of overidentifying restrictions and the Arellano–Bond serial correlation test are reported with the regression results.[9] To avoid bias due to instrument proliferation (see Roodman 2009), we limit the lag-length of the instrumental variables, allowing for a maximum of three lags.[10]

Specifications 25 and 26 in Table 3 include the whole sample of 77 countries with and without squared terms for *Size* and *Intermediation*. Specifications 27 and 28 exclude Luxembourg, and Specifications 29 and 30 further exclude *Intermediation* and *Intermediation squared* from the list of regressors.

4.2 Results

The results are presented in Table 3 and confirm our previous finding that financial sector size does not contribute to higher growth. In line with Beck et al. (2014), who only provide OLS estimates, we do not find any evidence for a growth-enhancing effect of financial sector size or non-intermediation activity once the sample size is increased across time and over countries.[11] *Size* is highly insignificant, mostly with a negative coefficient, as is *Size Squared*. Also *Intermediation* is always statistically insignificant with a negative coefficient. In line with the "too much finance" view, once *Intermediation Squared* is included, *Intermediation* becomes positive, while *Intermediation Squared* affects growth negatively, but both terms are statistically insignificant.

To sum up, we find no empirical support for the view that financial sector size or non-intermediation activity significantly contributes to growth in recent decades for this larger sample. While this finding deviates from the results of several previous studies, which found strong growth-enhancing effects of financial development (e.g., Levine et al. 2000; Beck and Levine 2004; for studies challenging the robustness of these findings see, e.g., Favara 2003; Roodman 2009), it is consistent with the more

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[9] The Hansen tests never reject the null, and thus provide support for the validity of the instruments. All regressions reject the null of no first-order autocorrelation, and do not reject the null of no second-order autocorrelation.

[10] We treat *Education, Openness*, and *Government Consumption* as exogenous. We also experimented with various other specifications—e.g., treating all explaining variables as endogenous, allowing for more or less lags as instruments, collapsing the instrument matrix—with qualitatively similar results.

[11] This result also holds when applying the OLS or fixed effects estimator.

Table 3 Size and intermediation effects of financial systems for developed and developing economies, 1980–2007 (5-year averages)

	= (3) adapted to system GMM (25)	= (25) plus Size and Intermediation squared (26)	= (25) without Luxembourg (27)	= (27) plus Size and Intermediation squared (28)	= (27) without Intermediation (29)	= (29) plus Size squared (30)
Size	-0.026	-0.022	-0.041	0.025	-0.037	-0.041
	(0.686)	(0.921)	(0.695)	(0.953)	(0.729)	(0.913)
Size squared		-0.001		-0.008		-0.005
		(0.933)		(0.705)		(0.827)
Intermediation	-0.352	1.664	-0.331	1.296		
	(0.479)	(0.592)	(0.518)	(0.651)		
Intermediation squared		-1.502		-1.362		
		(0.277)		(0.325)		
Initial GDP	0.073	0.141	0.113	0.252	-0.206	-0.241
	(0.904)	(0.835)	(0.858)	(0.687)	(0.676)	(0.640)
Education	0.167	0.120	0.152	0.073	0.242	0.253
	(0.522)	(0.598)	(0.568)	(0.729)	(0.332)	(0.253)
Inflation	-0.001	-0.001	-0.000	-0.000	-0.001	-0.000
	(0.757)	(0.600)	(0.801)	(0.726)	(0.748)	(0.988)
Openness	0.006	0.007*	0.005	0.006*	0.004*	0.005
	(0.101)	(0.066)	(0.108)	(0.078)	(0.091)	(0.139)
Government consumption	-0.104**	-0.091**	-0.106***	-0.099**	-0.104**	-0.099**
	(0.012)	(0.026)	(0.006)	(0.011)	(0.015)	(0.020)
Time fixed effects	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes
Hansen test (p-value)	0.295	0.896	0.356	0.913	0.291	0.200
Second order serial correlation test (p-value)	0.747	0.895	0.744	0.871	0.881	0.789
Observations	280	280	276	276	276	276
Number of countries	77	77	76	76	76	76

*, **, *** indicate significance at the 10, 5, and 1% level, respectively. Windmeijer robust standard errors; p values in parenthesis. *Size* and *Intermediation* are treated as endogenous, and *Initial GDP* is treated as predetermined

Source Beck et al. 2014, own calculations

recent literature, arguing that the finance–growth nexus strongly vanished in recent decades (e.g., Rousseau and Wachtel 2011; Arcand et al. 2012; Sturn and Epstein 2014).

5 Conclusion

Beck et al. (2014) argue that studies only focusing on intermediation activities of financial systems underestimate their growth effect especially in developed countries. We reassess the impact of financial intermediation, financial sector size, and financial non-intermediation activity on growth in developed countries by including additional control variables, excluding outliers, and apply different estimation techniques. We do not find a robust, statistically significant, and positive growth effect of financial sector size or non-intermediation activity. In fact, financial sector size and non-intermediation activity are generally found to be insignificant, with coefficients close to zero. Once we allow for a nonlinear effect of financial sector size and non-intermediation activity on growth, we find some support for the argument that big financial systems may harm growth in developed countries.

We also reassess the effects of financial sector size and non-intermediation activity on growth for developed and developing countries, thereby also addressing issues of endogeneity. In line with Beck et al. (2014), we find no evidence that size or non-intermediation activity fuels growth for this larger sample. If anything, our overall results tentatively support the "too much finance" view, while soundly refuting the interpretation of Beck et al. (2014).

Appendix

See Tables 4 and 5.

Table 4 Summary statistics for sample of developed economies, 1995–2007

Variable	Obs	Mean	Std. Dev.	Min	Max
Growth	78	3.303	2.130	0.531	10.909
Intermediation	78	−0.390	0.643	−2.253	0.634
Size	78	6.106	3.942	2.070	27.181
Employment share	78	3.013	1.834	1.032	11.398
Hours share	78	2.999	1.826	1.055	11.208
Compensation share	78	5.631	3.321	2.315	21.064
Initial GDP	78	9.542	0.784	7.768	10.858
Education	78	10.069	1.426	6.450	13.086

Table 4 continued

Variable	Obs	Mean	Std. Dev.	Min	Max
Inflation	78	3.643	3.431	−0.525	18.883
Openness	78	95.728	63.496	3.859	328.419
Government consumption	78	19.025	3.706	9.931	26.902

Source: Beck et al. 2014, own calculations

Table 5 Summary statistics for sample of developed and developing economies, 1980–2007

Variable	Obs	Mean	Std. Dev.	Min	Max
Growth	280	2.423	2.161	−5.154	10.909
Intermediation	280	−1.029	0.872	−3.401	0.836
Size	280	5.169	3.331	0.684	29.708
Initial GDP	280	8.228	1.523	5.124	10.746
Education	280	7.241	2.816	0.543	13.004
Inflation	280	19.103	105.849	−3.016	1667.205
Openness	280	82.731	59.810	13.839	399.284
Government consumption	280	15.518	5.321	4.080	28.855

Source: Beck et al. 2014, own calculations

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