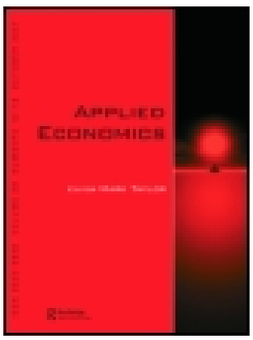

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The quality and quantity of bank intermediation and economic growth: evidence from Asia Pacific

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ABSTRACT

We investigate the impact of the quantity and quality of bank intermediation on economic growth across 14 Asia-Pacific economies over 2003–2015. Measures of bank shareholder value efficiency as well as profit and cost efficiency are used as indicators of intermediation quality. We also employ measures of liquidity creation (fat and nonfat) as a proxy for the quantity of bank intermediation. Our main finding is that the quality of bank intermediation (enhanced credit allocation) is a driver of economic growth in developed Asia-Pacific economies, whereas it is the quantity of bank intermediation (capital accumulation) that positively influences growth in developing nations. From a policy perspective, our findings suggest that policymakers in developed nations should concentrate their efforts on reforms that enhance bank efficiency. Second, reforms that stimulate capital accumulation should be encouraged in developing economies because this is the main channel that spurs economic growth.

KEYWORDS

Bank efficiency; liquidity creation; regional growth; banks in Asia Pacific

JEL CLASSIFICATION

G21; O16; O47; O52

I. Introduction

The global economic crisis from 2008 to 2009 vividly demonstrated that bank development can dramatically affect macroeconomic stability. There are two major channels through which banks exert influence on economic development. The first route is via credit allocation, as emphasized by Schumpeter (1934), who argues that economic growth is driven by innovation and improved financial intermediation. This helps reduce slack in the financial system and enhances capital productivity by boosting investment in innovative firms. A second channel stems from capital accumulation, as advocated by Hicks (1969), who argues that bank intermediation reduces transaction costs and helps diversify risk that mobilizes savings used to finance investment and fostering economic growth. In short, the Schumpeterian theory emphasizes the importance of the quality of financial intermediation in stimulating economic prosperity, whereas the Hicksian theory highlights the importance of the quantity of financial intermediation in spurring economic growth. Goldsmith (1969), McKinnon (1973), and Shaw (1973) are pioneers of the empirical analysis of the close ties between financial development and economic growth. More recently, the seminal work of King and Levine (1993) has resulted in a significant empirical literature that provides evidence on the importance of financial development for economic growth.[1]

The majority of these studies typically focus on the capital accumulation channel using various measures of the quantity of bank intermediation (namely, the ratio of liquid liabilities to GDP; credit issued to private enterprises divided by GDP, and so on) while underplaying the allocative function performed by banks. Only a handful of empirical studies consider both channels. Among them, Lucchetti, Papi, and Zazzaro (2001) are the first to employ cost efficiency (CE) (a proxy for intermediation quality) to directly measure banks' ability to efficiently allocate resources together with conventional quantity indicators for capital accumulation.[2] Using a dynamic panel set-up, they investigate the relationship between the banking sector and economic

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[1]For instance, Levine (1998), Rajan and Zingales (1998), Beck and Levine (2002), Calderon and Liu (2003), Rioja and Valev (2004), Aghion, Howitt, and Mayer-Foulkes (2005), Rousseau and Wachtel (2011), Zhang, Wang, and Wang (2012), Pradhan et al. (2016), among others.

[2]They use three alternative measures of capital accumulation, including the ratio between loans disbursed in the region by banks and special credit institutions and the regional GDP, the share of bank loans granted to the private sector as a fraction of total loans, and the share of loans by cooperative banks on credit provided by all of the commercial banks in the region.

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growth in Italian regions between 1982 and 1994. They find that both intermediation quality and quantity measures have a significant and positive impact on real economic growth, providing evidence for both the Schumpeterian and Hicksian theories. Berger, Hasan, and Klapper (2004) estimate the effects of the relative health of community banks on economic growth using data from 49 countries between 1993 and 2000. They make an important contribution to the literature by including (1) both cost and profit efficiency estimates to measure the quality of bank intermediation and (2) the interaction between quantity and quality indicators (namely, market share and bank efficiency) to capture potential synergy between the two channels. They use the total market share of community banks and their cost and/or profit efficiency to measure banks' relative health, and they hypothesize that countries where community banks have a relatively large market share and are more efficient are more likely to foster development. They also separately examine these relationships for 21 developed and 28 developing nations. Their results show that the coefficients for market share, cost/profit efficiency rank, and interaction terms are significantly positive for both developed and developing economies, which lend support to both the Schumpeterian and Hicksian theories. In a similar vein, Hasan, Koetter, and Wedow (2009) use a GMM approach to examine the finance-growth nexus in 11 European countries between 1996 and 2000 and they also use both cost and profit efficiency estimates as quality indicators of bank intermediation. Similar to Berger, Hasan, and Klapper (2004) they include interaction terms between intermediation quality and quantity indicators in their model. The results show that the quantity effect (as measured using the ratio of bank credit to GDP) had no impact on growth. In addition, all three of the key coefficients (the ratio of bank credit to GDP, CE, and their interaction term) are insignificant. In contrast, the coefficients are significantly positive when profit efficiency is included as the intermediation quality measure, partially supporting both quality- and quantity-effect hypotheses. Employing the same method, Koetter and Wedow (2010) analyse the finance-growth relationship in Germany from 1995 to 2005. They use the ratio of bank loans and securities to GDP as a proxy for the quantity of intermediation and bank CE estimates as the measure of intermediation quality. No interaction terms are included in their estimates. The results show that the quality indicator has a significant positive effect on economic growth, whereas the quantity indicator has no significant effect, providing empirical support for the resource allocation, or Schumpeterian, theory.

As far as we can ascertain these are the only empirical studies that examine the link between intermediation quantity and quality and economic development in order to investigate the Hicksian and Schumpeterian views, they also predominantly focus on advanced European countries.[3] So the empirical findings do not provide much insight as to whether these relationships also hold for banking systems in countries that have noticeably different characteristics. Asia-Pacific economies have financial systems that are quite different from those in advanced Western economies, with predominantly bank-based systems and relatively small capital markets (with limited securitization activity).[4] In recent years, these economies have typically grown more rapidly than their advanced Western counterparts; however, domestic banking sector assets and credit to GDP ratios (in most cases) still fall below those of major advanced economies.[5] Furthermore, since the global financial turmoil of 2008–2009 Asia-Pacific economies generally have grown faster than advanced economies and faced less deflationary pressures.[6] Consequently, the Asia-Pacific region offers a particularly interesting environment in which to investigate whether the quantity and quality of bank intermediation impacts economic development. Against this backdrop, our paper investigates the relationship between bank development and economic growth for 14 Asia-Pacific economies from 2003 until 2015.

We extend the previous empirical literature in several respects. First, we explore the finance-growth nexus with a regional focus, but we consider both developed and developing economies. According to the World Bank, the term 'developing economies' mainly refers to a set of low- and middle-income economies (and for Asia-Pacific this includes China, India, Indonesia, Malaysia, Pakistan, Philippines, Sri

[3]All but Berger, Hasan, and Klapper (2004) focus on Europe and even here, of the 49 nations studied only 7 are in the Asia-Pacific region.
[4]We refer to 'most' economies because, given the IMF's country classification, the Asia-Pacific region includes Australia, Japan, Singapore, and Hong Kong, which have advanced financial systems.
[5]See IMF (2013) for information regarding the recent GDP growth of Asia-Pacific countries and other economies, and see Klapper, Martinez-Peria, and Zia (2014) for a detailed account of banking in developing Asia and a table that summarizes the features of individual countries' banking systems.
[6]With the exception of Japan.

Lanka, and Thailand), whereas 'developed economies' denote a set of high-income economies (including Australia, Hong Kong, Japan, Korea, Singapore, and Taiwan). The Asia-Pacific setting allows us to identify the differences, if any, between these two types of economies in terms of the transmission mechanism between banking sector development and economic growth. Second, previous studies have focused on using cost and/or profit efficiency estimates as measures of the quality of bank intermediation. In this study, we extend the analysis by employing a new quality indicator, shareholder value efficiency (SVE) (a measure developed by Fiordelisi 2007) to capture the potential influence of the opportunity cost of capital on the credit allocation channel. Because cost, profit, and SVE measures gauge the quality of banking sector intermediation from different perspectives, we can draw a more comprehensive picture of the finance-growth nexus by comparing the empirical results that are estimated using these three indicators. Third, in the traditional finance-growth literature, the quantity of banking sector intermediation is usually measured as either the ratio of the liquid liabilities of the banking system to GDP (so as to capture the extent of deposit-taking in the banking system) or the share of private sector credit (or total bank lending) as a fraction of GDP to capture the amount of financing that is intermediated. However, banks generate quantity effects through both sides of their balance sheets in addition to off-balance-sheet (OBS) activities. Thus, traditional quantity measures cover only on-balance-sheet activity so this may lead to an underestimate of the quantity of intermediation. We therefore suggest a more comprehensive measure for the quantity effect, namely, the bank liquidity creation measure as developed by Berger and Bouwman (2009) that captures the contribution of intermediation activities on both sides of the balance sheet as well as OBS activities.

The remainder of the article is structured as follows. Sections II and III outline the methodology and data, respectively. Section IV discusses the empirical results, and we conclude in Section V.

II. Methodology

Main model

To address endogeneity issues and the autoregressive process in the data concerning the dependent variable (economic growth), our main model follows the Beck and Levine (2004) approach and employs a system GMM estimator. We adopt the same approach to investigate the relationship between bank development and economic growth in 14 Asia-Pacific economies between 2003 and 2015. The advantage of using the dynamic panel approach is that it: (1) relaxes the restrictive assumption of a homogenous production functions across regions that are made in cross-sectional studies and; (2) addresses potential endogeneity problems between bank efficiency, liquidity creation, and economic growth (Hasan, Koetter, and Wedow 2009; Koetter and Wedow 2010).[7] Our model has the following general form:

$$\text{Economic Growth} = f(\text{Efficiency},\ \text{Liquidity Creation},\ \text{Control Variables}) \quad (1)$$

Economic growth (GDP growth, GDPG) is defined as real GDP growth. The three alternative proxies we use for the quality of banking sector intermediation include SVE, profit efficiency (PE), and CE. Two alternative measures used for banking sector quantity are fat liquidity creation (FLC) and nonfat liquidity creation (NFLC). Following Hasan, Koetter, and Wedow (2009), we also include one control variable to take account for the accumulation of human capital, which is measured as the rate of population growth (POPU). Finally, a global financial crisis (CRISIS) dummy variable with a value of one for the years 2008 and 2009 and zero otherwise is employed to capture macroeconomic conditions.[8] As noted by Hasan, Koetter, and Wedow (2009), cross-country studies that cover very different economies may suffer from excessive sample heterogeneity, and neglecting regional interdependence may lead to biased results. We therefore analyse developed and developing economies separately after a full sample

[7]Economic conditions may also influence bank efficiency and liquidity creation. For instance, during economic recessions, both the quality and quantity of credit demand and supply can decrease.

[8]We do not include other country-level control variables such as the bank concentration ratio and economic freedom because they are already included in our efficiency estimation models.

analysis to further mitigate the strong assumptions that are involved in international comparison.[9]

Estimation of cost, profit, and SVE

The efficiency estimates in this study are performed using the parametric stochastic frontier approach (SFA). The theoretical stochastic frontier production function was first proposed by Aigner, Lovell, and Schmidt (1977) and Meeusen and van den Broeck (1977), positing the existence of technical inefficiencies of production of firms involved in producing a particular output. Early empirical studies adopt a two-stage approach to address the issue of the explanation of these inefficiency effects (e.g. Pitt and Lee 1981; Kalirajan 1981; among others). However, the two-stage approach involves contradictory assumptions regarding the distribution of the inefficiency effects.[10] Therefore, following Battese and Coelli (1995), this study estimates efficiency in a single step for panel data and assumes that non-negative technical inefficiencies are a function of environmental variables (including bank-specific and country-specific variables) that are independently distributed as truncated normal distributions with constant variances and means that are a linear function of observable variables. Using the single-step method, this study estimates a global frontier that accounts for banking environment variables instead of country-specific frontiers because this approach increases the number of available observations. Details of the CE estimation approach are outlined in Appendix 1.

Furthermore, we also employ alternative PE as another indicator of the quality of bank intermediation. PE measures the extent to which a bank's profits fall below the profits of the best-practice bank under identical assumptions. Berger and Mester (1997) note that when there are significant inter-firm differences in product quality, outputs that are not completely variable, markets that are not perfectly competitive, and/or imperfectly constructed proxies for output prices, an alternative specification of the profit function may produce better results. Thus, we choose alternative PE as a second indicator of bank quality. Following Fiordelisi (2007), and as shown in Appendix 1, net income replaces total cost, and the sign of the inefficiency term is changed (namely, $-u_{it}$) in the translog alternative profit function (input prices and outputs remain identical). Because a few of the banks in the sample incur losses we use the common modification as employed by Liadaki and Gaganis (2010), Lozano-Vivas and Pasiouras (2010), and Radić, Fiordelisi, and Girardone (2012).[11]

Finally, we use the alternative PE approach of Fiordelisi (2007) and Fiordelisi and Molyneux (2010) to derive our third quality measure –SVE. This measure indicates how close a bank comes to earning the maximum shareholder value given specified output levels. Shareholder value efficiencies are estimated using the same translog functional model adopted for the alternative PE (as shown in Appendix 1) but with economic value added (EVA) as the dependent variable. The procedure for estimating EVA for each bank follows Heffernan and Fu (2010)[12]:

$$\begin{aligned}\text{EVA} = {} & \text{Net Operating Profits after Tax} \\ & - \text{Invested Capital} \\ & * \text{Cost of Capital.}\end{aligned} \tag{2}$$

Following Fiordelisi (2007), the cost of capital for listed banks is calculated using the capital asset pricing model (CAPM)[13]:

$$K = r_{\mathrm{f}} + \beta(r_{\mathrm{m}} - r_{\mathrm{f}}), \tag{3}$$

where K denotes the cost of capital; r_{f} denotes the annual free risk return, which is given by rates on 10-year US government bonds; r_m denotes the annual market return; $r_{\mathrm{m}}-r_{\mathrm{f}}$ denotes the market risk premium-[14]; and β denotes the sensitivity of excess asset returns to

[9]For instance, one cannot control for the many differences in terms of regulatory structures, markets, and culture (Berger, Hasan, and Klapper 2004).
[10]In detail, the first stage focuses on the prediction of the technical inefficiency effects by estimating the stochastic frontier production function, assuming that these inefficiency effects are identically distributed; the second stage involves the estimation of the determinants of the estimated technical inefficiency effects, which contradicts the assumption of identically distributed inefficiency effects in the first stage (Battese and Coelli 1995). So the one-stage approach is a preferred.
[11]In order to calculate the natural logarithm, we find the maximum losses among banks and then add the absolute value of these losses plus 1 to all banks.
[12]Following Heffernan and Fu (2010), EVA is normalized by factor inputs to minimize possible heteroscedasticity and scale effects in the model and to ensure its comparability with Tobin's Q.
[13]Following common practice, we calculate a 1-year period local CAPM.
[14]As indicated in Grabowski (2009), cost of capital estimates derived from typical CAPM models may be biased downward during crisis periods, and such estimates may also be subject to 'significant estimation and data input problems' (32). For example, T-bond yields are a typical benchmark used in the CAPM model to estimate the cost of capital. However, these yields were temporarily very low for several months around the 2008–2009 crisis, boosting EVA estimates for this period. Therefore, we adjust the CAPM model by using the market risk premium (MRP) developed by Fernández, Aguirreamalloa, and Corres (2011). As these authors do not provide the MRP for Sri Lanka, we use the average MRP for India and Pakistan as a proxy for Sri Lanka's MRP.

excess market returns. In the case of non-listed banks we proxy the cost of capital as the mean of the cost of capital of all the listed banks in the country.

Because banks may create negative value for shareholders, the common modification described in footnote 12 is also employed in calculating the alternative PE.

Individual bank (in)efficiency scores are calculated from the estimated frontiers as cost efficiency (CEF) = exp(u), PE = exp($-u$) and SVE = exp($-u$) using the FRONTIER 4.1 software package developed by Coelli. CEF takes a value between one and infinity, whereas PE and SVE are between zero and one. To make the efficiency scores comparable, following Liadaki and Gaganis (2010), the index of CE is calculated as CE = 1/CEF. Thus, the cost, profit, and SVE scores can be between 0 and 1, with values that are closer to 1 indicating higher efficiency.

Estimation of liquidity creation

Following Berger and Bouwman (2009), we use a three-step procedure to construct two liquidity creation indicators that differ in terms of how OBS activities are treated. FLC considers both on-balance-sheet and OBS activities, whereas NFLC focuses exclusively on on-balance-sheet activities.[15] As indicated by Berger and Bouwman (2009), the former is preferred to the latter because OBS activities can create liquidity that is functionally similar to on-balance-sheet items. To perform the calculations, we first classify the assets, liabilities, equity, and OBS activities of individual banks as liquid, semi-liquid, or illiquid.[16] The liquidity of assets and OBS activities depends on how quickly they can be sold, whereas the liquidity of liabilities depends on how quickly they can be withdrawn. Equity is illiquid because investors cannot require liquid funds from the bank, and equity is observed as a long-term investment. Second, all bank activities are assigned weights based on the 'intuition' behind liquidity creation.[17] Details of the construction of the liquidity creation measures are shown in Appendices 2 and 3.

III. Data

Our study focuses on 14 Asia-Pacific economies from 2003 until 2015. Accounting and stock price data for commercial banks, which are converted into US dollars, are obtained from the Bankscope database of Bureau van Dijk and supplemented by Datastream of Thompson Financial Limited; macroeconomic information is obtained from the updated version of the World Bank database on financial development structure developed by Barth, Caprio, and Levine (2012), the IMF and the Central Bank of the Republic of China (Taiwan). Information on the institutional environment comes from several sources, including La Porta et al. (1997; 1998), the worldwide governance indicators project and the 2015 index of Economic Freedom, published by The Wall Street Journal and The Heritage Foundation. We exclude banks that have the following features: (1) missing, negative or zero values for inputs and/or outputs (in the efficiency estimates); (2) missing values for total cost and net income (in the efficiency estimates); and (3) missing values for off- or/and on-balance-sheet items (in the liquidity creation estimates).[18]

Table 1 presents descriptive statistics regarding the variables that are used to analyse the relationship between bank efficiency, liquidity creation, and economic growth at the country level. The results show that the average annual economic growth rate is approximately 4.99% for the entire sample. The overall mean scores for SVE, PE, and CE are 0.7360, 0.7428, and 0.7453, respectively, which indicates that the average bank would improve its shareholder value by 26.40%, increase its profits by 23.72%, and reduce its costs by 25.47% in matching best-practice performance. On average, the ratio of FLC to total assets, the ratio of NFLC to total assets, and the rate of population growth are 29.58%, 19.37%, and 1.14%, respectively.[19]

[15]Models with NFLC as the quantity measure for bank intermediation are estimated as robustness checks, and the results are reported in Section 4.2.

[16]Berger and Bouwman (2009) classify loans as liquid, semi-liquid, or illiquid based on category or maturity. We classify loans by category because Bankscope does not provide maturity information for loans that are issued by banks in the Asia-Pacific region. Moreover, according to Berger and Bouwman (2009), classification by category is better than classification by maturity because the ease, cost, and timeliness with which banks obtain liquid funds to satisfy their obligations are more important than the time to self-liquidation.

[17]Berger and Bouwman (2009, 3794) note that the intuition for liquidity creation is that 'banks create liquidity because they hold illiquid items in place of the nonbank public and give the public liquid items'.

[18]Our final sample includes unbalanced panel data for 14 Asia-Pacific economies with 6474 observations for 822 banks, representing over 89% of all commercial bank assets in the Asia Pacific region.

Table 1. Descriptive statistics.

Variable	Observation	Mean	Std. dev.	Min.	Max.
Panel A: All sample economies					
GDP	182	4.9863	3.0616	−5.417	15.24
SVE	182	0.7360	0.2016	0.0545	0.9028
PE	182	0.7428	0.1987	0.0581	0.9040
CE	182	0.7453	0.2805	0.0190	0.9370
FLC	182	0.2958	0.1370	−0.0360	0.6907
NFLC	182	0.1937	0.1181	−0.0800	0.5121
POPU	182	0.0114	0.0087	−0.0146	0.0545
CRISIS	182	0.1538	0.3618	0	1
DEVPED	182	0.4286	0.4962	0	1
Common Law	182	0.5714	0.4962	0	1
KKZ	182	0.3177	0.8806	−1.1782	1.6685
Economic Freedom	182	66.5681	12.1701	51	90.1
Property Rights	182	56.7582	23.4329	20	90
Fiscal Freedom	182	77.0352	8.4033	58.6	93.6
Panel B: Developed economies					
GDP	78	3.5532	3.0540	−5.417	15.24
SVE	78	0.6273	0.2622	0.0545	0.9028
PE	78	0.6397	0.2613	0.0581	0.9040
CE	78	0.5517	0.3405	0.0190	0.8996
FLC	78	0.3106	0.1425	−0.0360	0.6573
NFLC	78	0.2267	0.1288	−0.0757	0.5121
POPU	78	0.0087	0.0103	−0.0146	0.0545
CRISIS	78	0.1538	0.3631	0	1
Common Law	78	0.5000	0.5032	0	1
KKZ	78	1.2443	0.3186	0.6758	1.6685
Economic Freedom	78	78.3603	8.5503	64.3	90.1
Property Rights	78	80.8333	9.5827	70	90
Fiscal Freedom	78	77.1308	11.5868	58.6	93.6
Panel C: Developing economies					
GDP	104	6.0611	2.6035	−1.514	14.2
SVE	104	0.8176	0.0662	0.4708	0.8953
PE	104	0.8201	0.0649	0.4773	0.8966
CE	104	0.8906	0.0427	0.6957	0.9370
FLC	104	0.2848	0.1323	0.0482	0.6907
NFLC	104	0.1690	0.1033	−0.0800	0.4016
POPU	104	0.0134	0.0067	0.0026	0.0392
CRISIS	104	0.1538	0.3625	0	1
Common Law	104	0.6250	0.4865	0	1
KKZ	104	−0.3773	0.3857	−1.1782	0.4764
Economic Freedom	104	57.7240	4.6195	51	70.8
Property Rights	104	38.7019	11.3205	20	70
Fiscal Freedom	104	76.9635	4.8697	65.8	85.1

According to the World Bank, the developing economies in Asia Pacific include China, India, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, and Thailand, whereas the developed economies in Asia Pacific include Australia, Hong Kong, Japan, Korea, Singapore, and Taiwan. The full sample includes both developing and developed economies in Asia Pacific. GDP growth (GDP) measures the real GDP growth rate. SVE measures the extent to which a bank's EVA approaches the EVA for 'best practice' banks under identical assumptions. Alternative PE measures the extent to which a bank's profit approaches the profit for 'best practice' under identical assumptions. Similarly, CE measures the extent to which a bank's cost approaches 'best cost practices'. FLC is the ratio of liquidity creation, including on-balance sheet and OBS activities, to total assets. NFLC is the ratio of liquidity creation, including on-balance-sheet activities only, to total assets. Population growth (POPU) is the rate of population growth. Global financial crisis (CRISIS) is a dummy variable that takes a value of one for the years 2008 and 2009 and zero otherwise. DEVPED is a dummy variable that is equal to one for a developed nation and zero otherwise. Common Law is a dummy variable to differentiate economies with English common law. KKZ is an aggregate index of the level of institutional development. Economic Freedom is an aggregate index that reflects the extent of government intervention in monetary policy, financial regulations, relative openness of trade, and related issues in the economy. Property Rights is an indicator variable measuring the protection of private property rights. Fiscal Freedom is a measure of the tax burden imposed by government. All variables are logarithmic measures in log levels except for the dummy variables. Because GDP, FLC, NFLC, and POPU may be negative, following Levine, Loayza, and Beck (2000), these variables are calculated as log (1+variable).

Compared with developed Asia-Pacific economies, developing economies record higher real GDP growth rates, greater bank efficiency, and faster population growth rates; however, they are also characterized by lower liquidity creation.[20]

IV. Empirical results

Main results

Tables 2–4 present the empirical results obtained by estimating Equation (1) with FLC as the intermediation

[19]These liquidity ratios are similar to those reported for banks in the United States (39%; Berger and Bouwman 2009), in Russia (27–30%; Fungacova, Weill, and Zhou 2010), and in the Czech Republic (15–33%; Horvath, Jakub, and Weill 2014).
[20]The correlation matrix is reported in Appendix 4.

Table 2. Banking sector development (FLC and EFF) and economic growth in all sample Asia-Pacific economies.

	EFF = SVE				EFF = PE				EFF = CE			
	Quantity	Quality	Both	Interaction	Quantity	Quality	Both	Interaction	Quantity	Quality	Both	Interaction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FLC	0.0438**		0.0425***	0.0425***	0.0435**		0.0419**	0.0420**	0.0448***		0.0392***	0.0392***
	(0.0146)		(0.0141)	(0.0140)	(0.0145)		(0.0140)	(0.0140)	(0.0142)		(0.0128)	(0.0129)
EFF		0.0068***	0.0065***	0.0065***		0.0072***	0.0069***	0.0068***		0.0088***	0.0085***	0.0085***
		(0.0015)	(0.0012)	(0.0012)		(0.0016)	(0.0012)	(0.0012)		(0.0015)	(0.0015)	(0.0015)
EFF*FLC				−0.0014				−0.0024				−0.0059
				(0.0102)				(0.0108)				(0.0073)
GDP_{t-1}	0.4241**	0.4140**	0.3908**	0.3908**	0.4241**	0.4136**	0.3909**	0.3909**	0.4219**	0.3279*	0.3102*	0.3119*
	(0.1645)	(0.1685)	(0.1655)	(0.1661)	(0.1646)	(0.1684)	(0.1654)	(0.1660)	(0.1657)	(0.1727)	(0.1713)	(0.1715)
POPU	0.3102	0.3390	0.4138	0.4130	0.3113	0.3384	0.4117	0.4105	0.3369	0.0673	0.1466	0.1411
	(0.4092)	(0.4055)	(0.4280)	(0.4282)	(0.4091)	(0.4058)	(0.4283)	(0.4285)	(0.4169)	(0.3413)	(0.3566)	(0.3574)
CRISIS	−0.0307***	−0.0299***	−0.0304***	−0.0304***	−0.0307***	−0.0298***	−0.0303***	−0.0303***	−0.0307***	−0.0302***	−0.0306***	−0.0306***
	(0.0050)	(0.0049)	(0.0051)	(0.0051)	(0.0050)	(0.0049)	(0.0051)	(0.0051)	(0.0050)	(0.0050)	(0.0051)	(0.0051)
Constant	0.0178*	0.0318***	0.0212**	0.0212**	0.0178*	0.0318***	0.0214**	0.0214**	0.0173*	0.0410***	0.0309***	0.0309***
	(0.0095)	(0.0075)	(0.0096)	(0.0097)	(0.0095)	(0.0075)	(0.0096)	(0.0097)	(0.0094)	(0.0066)	(0.0072)	(0.0073)
Observation	168	168	168	168	168	168	168	168	168	168	168	168
F test	25.82***	25.86***	27.06***	50.98***	25.85***	25.19***	26.09***	40.46***	25.89***	115.45***	161.59***	570.10***
Sargan test	154.19	153.85	155.51	155.52	154.34	153.95	155.62	155.62	157.38	165.59	166.92	166.85
AR(1) test	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AR(2) test	0.64	0.70	0.67	0.67	0.64	0.69	0.67	0.67	0.65	0.69	0.67	0.67

This table presents the results of the system-GMM estimations for the entire sample with the real GDP growth rate (GDP) as the dependent variable. The full sample includes both developing and developed economies in Asia Pacific. The efficiency (EFF) is specified as being predetermined. FLC and the interaction terms are specified as endogenous variables. SVE measures the extent to which a bank's EVA approaches the EVA for 'best practice' under identical assumptions. Alternative PE measures the extent to which a bank's profit approaches the profit for 'best practice' under identical assumptions. CE measures the extent to which a bank's cost approaches the cost for the 'best practice' bank under identical assumptions. FLC is the ratio of liquidity creation, including on-balance-sheet and OBS activities, to total assets. Population growth (POPU) is the rate of population growth. Global financial crisis (CRISIS) is a dummy variable that takes a value of one for the years 2008 and 2009 and zero otherwise. All variables are logarithmic measures in log levels except for the crisis dummy. Because GDP, FLC, and POPU may be negative, following Levine, Loayza, and Beck (2000), these variables are calculated as log (1+variable). ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively. Robust standard errors corrected for heteroscedasticity are in parentheses.

Table 3. Banking sector development (FLC and EFF) and economic growth in developed Asia-Pacific economies.

	EFF = SVE				EFF = PE				EFF = CE			
	Quantity	Quality	Both	Interaction	Quantity	Quality	Both	Interaction	Quantity	Quality	Both	Interaction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FLC	0.0502		0.0367	0.0365	0.0502		0.0364	0.0360	0.0502		0.0301	0.0284
	(0.0351)		(0.0327)	(0.0333)	(0.0351)		(0.0328)	(0.0335)	(0.0351)		(0.0153)	(0.0141)
EFF		0.0075***	0.0063***	0.0062***		0.0079***	0.0066***	0.0066***		0.0094***	0.0090***	0.0089***
		(0.0011)	(0.0012)	(0.0011)		(0.0012)	(0.0013)	(0.0012)		(0.0012)	(0.0008)	(0.0008)
EFF*FLC				−0.0133				−0.0152				−0.0162
				(0.0180)				(0.0190)				(0.0152)
GDP_{t-1}	0.0784	0.0444	0.0360	0.0352	0.0784	0.0435	0.0355	0.0347	0.0784	−0.0727	−0.0781	−0.0715
	(0.1378)	(0.1053)	(0.1230)	(0.1227)	(0.1378)	(0.1052)	(0.1226)	(0.1224)	(0.1378)	(0.0992)	(0.1059)	(0.1062)
POPU	0.8015*	1.1792**	1.0790***	1.0856***	0.8015*	1.1735**	1.0744***	1.0815***	0.8015*	0.7959***	0.7559***	0.7583***
	(0.3401)	(0.3121)	(0.2584)	(0.2558)	(0.3401)	(0.3125)	(0.2592)	(0.2564)	(0.3401)	(0.1540)	(0.1608)	(0.1521)
CRISIS	−0.0438***	−0.0446***	−0.0444***	−0.0446***	−0.0438***	−0.0445***	−0.0443***	−0.0445***	−0.0438***	−0.0446***	−0.0445***	−0.0446***
	(0.0102)	(0.0107)	(0.0101)	(0.0100)	(0.0102)	(0.0107)	(0.0102)	(0.0100)	(0.0102)	(0.0105)	(0.0102)	(0.0102)
Constant	0.0186	0.0350**	0.0257	0.0257	0.0186	0.0350**	0.0258	0.0259	0.0186	0.0477***	0.0397***	0.0400***
	(0.0128)	(0.0089)	(0.0129)	(0.0129)	(0.0128)	(0.0088)	(0.0129)	(0.0129)	(0.0128)	(0.0057)	(0.0050)	(0.0046)
Observation	72	72	72	72	72	72	72	72	72	72	72	72
F test	13.19***	37.50***	87.84***	29.64***	13.19***	34.42***	71.39***	27.68***	13.19***	93.68***	155.94***	54.63***
Sargan test	89.29**	87.55**	88.24**	88.19**	89.29**	87.44**	88.13**	88.06**	89.29**	87.86**	87.99**	87.91**
AR(1) test	0.02	0.04	0.04	0.04	0.02	0.04	0.04	0.04	0.02	0.02	0.03	0.02
AR(2) test	0.55	0.47	0.49	0.50	0.55	0.47	0.49	0.50	0.55	0.39	0.40	0.42

This table presents the results of the system-GMM estimations for the developed economies with real GDP growth rate (GDP) as the dependent variable. The developed economies in Asia Pacific include Australia, Hong Kong, Japan, Korea, Singapore, and Taiwan. The efficiency (EFF) is specified as being predetermined. FLC and the interaction terms are specified as endogenous variables. SVE)measures the extent to which a bank's EVA approaches the EVA for the 'best practice' bank under identical assumptions. Alternative PE measures the extent to which a bank's profit approaches the profit for 'best practice' under identical assumptions. Similarly, CE measures the extent to which a bank's cost approaches the cost for the 'best practice' bank under the identical assumptions. FLC is the ratio of liquidity creation, including on-balance-sheet and OBS activities, to total assets. Population growth (POPU) is the rate of population growth. Global financial crisis (CRISIS) is a dummy variable that takes a value of one for the years 2008 and 2009 and zero otherwise. All variables are logarithmic measures in log levels except for the crisis dummy. Because GDP, FLC, and POPU may be negative, following Levine, Loayza, and Beck (2000), these variables are calculated as log (1+variable). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors corrected for heteroscedasticity are in parentheses.

Table 4. Banking sector development (FLC and EFF) and economic growth in developing Asia-Pacific economies.

	EFF = SVE				EFF = PE				EFF = CE			
	Quantity	Quality	Both	Interaction	Quantity	Quality	Both	Interaction	Quantity	Quality	Both	Interaction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FLC	0.0379**		0.0377**	0.0383**	0.0378**		0.0373**	0.0377**	0.0383**		0.0395**	0.0394*
	(0.0140)		(0.0153)	(0.0133)	(0.0140)		(0.0154)	(0.0131)	(0.0139)		(0.0156)	(0.0172)
EFF		0.0074	0.0013	0.0029		0.0093	0.0030	0.0047		−0.0148	0.0068	0.0070
		(0.0246)	(0.0272)	(0.0219)		(0.0256)	(0.0281)	(0.0227)		(0.0187)	(0.0185)	(0.0175)
EFF*FLC				−0.3779				−0.3850				0.7245**
				(0.2682)				(0.2787)				(0.2988)
GDP_{t-1}	0.4762**	0.4851**	0.4760**	0.4663**	0.4762**	0.4847**	0.4758**	0.4665**	0.4759**	0.4855**	0.4759**	0.4727**
	(0.1603)	(0.1485)	(0.1581)	(0.1702)	(0.1603)	(0.1475)	(0.1572)	(0.1690)	(0.1601)	(0.1548)	(0.1610)	(0.1581)
POPU	−0.1175	−0.3684	−0.1179	−0.0963	−0.1179	−0.3671	−0.1189	−0.1006	−0.1177	−0.4001	−0.0991	−0.0832
	(0.4940)	(0.4300)	(0.5025)	(0.5135)	(0.4940)	(0.4315)	(0.5037)	(0.5115)	(0.4945)	(0.4335)	(0.4931)	(0.4967)
CRISIS	−0.0234***	−0.0228***	−0.0233***	−0.0233***	−0.0234***	−0.0227***	−0.0232***	−0.0232***	−0.0234***	−0.0230***	−0.0234***	−0.0235***
	(0.0049)	(0.0048)	(0.0053)	(0.0051)	(0.0049)	(0.0048)	(0.0053)	(0.0051)	(0.0049)	(0.0046)	(0.0049)	(0.0049)
Constant	0.0261**	0.0397***	0.0264*	0.0269*	0.0262**	0.0401***	0.0269*	0.0274*	0.0261**	0.0369***	0.0263**	0.0264**
	(0.0101)	(0.0101)	(0.0129)	(0.0122)	(0.0100)	(0.0101)	(0.0129)	(0.0121)	(0.0101)	(0.0094)	(0.0101)	(0.0105)
Observation	96	96	96	96	96	96	96	96	96	96	96	96
F test	28.97***	18.28***	26.31***	305.89***	28.94***	18.69***	26.48***	203.57***	28.83***	14.46***	25.52***	24.76***
Sargan test	80.12	80.05	80.07	80.57	80.13	79.97	80.02	80.47	80.17	80.30	80.20	9.75
AR(1) test	0.04	0.03	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.03	0.04	0.04
AR(2) *test*	0.09	0.10	0.09	0.10	0.09	0.10	0.09	0.10	0.09	0.10	0.09	0.10

Notes: This table presents the results of the system-GMM estimations for the developing economies with real GDP growth rate (GDP) as the dependent variable. The developing economies in Asia Pacific include China, India, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, and Thailand. The efficiency (EFF) is specified as being predetermined. FLC and the interaction terms are specified as endogenous variables. SVE measures the extent to which a bank's EVA approaches the EVA for the 'best practice' bank under identical assumptions. Alternative PE measures the extent to which a bank's profit approaches the profit for 'best practice' under identical assumptions. Similarly, CE measures the extent to which a bank's cost approaches the cost for the 'best practice' bank under the identical assumptions. FLC is the ratio of liquidity creation, including on-balance-sheet and OBS activities, to total assets. Population growth (POPU) is the rate of population growth. Global financial crisis (CRISIS) is a dummy variable that takes a value of one for the years 2008 and 2009 and zero otherwise. All variables are logarithmic measures in log levels except for the crisis dummy. Because GDP, FLC, and POPU may be negative, following Levine, Loayza, and Beck (2000), these variables are calculated as log (1+variable). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors corrected for heteroscedasticity are in parentheses.

quantity indicator and various efficiency measures (EFF) as quality indicators for both the entire sample and for developed and developing economies separately. To address potential endogeneity problems we follow Hansan et al. (2009) and specify bank development proxies as endogenous and predetermined variables separately, and we use lagged levels and differences as instruments. Each table contains 12 specifications: (1)–(4) for models where SVE is the banking quality indicator; (5)–(8) for models with PE as the quality indicator; and (9)–(12) using the CE bank quality guide.

Focusing on Table 2, the estimated coefficients for FLC and EFF (measured by SVE, PE, and CE) are significantly positive at the 10% level or better in all 12 cases, which suggests that economic growth in the Asia-Pacific region benefits significantly from both quantity and quality channels. This finding is consistent with Lucchetti, Papi, and Zazzaro (2001) and Berger, Hasan, and Klapper (2004) and lends support to both the Schumpeterian and Hicksian hypotheses. The estimated magnitudes for FLC (0.0425) and SVE (0.0065) show that a 1% increase in banks' ability to accumulate capital and allocate credit spurs economic growth by more than 0.049% in total, of which 87% is contributed through the capital accumulation channel (namely, the quantity effect), whereas the rest is delivered via the credit allocation channel (quality effect).[21] In addition, a 1% improvement in bank liquidity creation has more than six times the effect on growth than a relative improvement in bank SVE, which implies that increases in FLC and SVE by approximately one standard deviation (13.70% and 20.16% as stipulated in Table 1) yield 58 and 13 basis points of additional economic growth, respectively.[22] The results for both PE and CE are quite similar to the aforementioned. However, the gap between FLC and CE in terms of the contribution to economic growth is narrowed – a 1% improvement in bank liquidity creation has about four – rather than six times the effect on growth than does the relative improvement in the CE of banks. Finally, the estimated coefficients for the interaction term EFF*FLC are insignificant in all cases, which suggests that a combination of intermediation quantity and quality might not be an effective channel to spur economic growth in the region.

The results for developed Asia-Pacific economies are reported in Table 3.[23] The estimated coefficients for all EFF measures (SVE, PE, and CE) are significantly positive for all 12 specifications, which supports the Schumpeterian view emphasizing the importance of banks' credit allocation in promoting growth in the developed world. However, the coefficients for both FLC and the interaction EFF*FLC are insignificant in all 12 cases. The estimated magnitudes for SVE, PE, and CE indicate that a 1% increase in banks' ability to allocate credits increases economic growth by approximately 0.01% in total. In addition, increases in SVE, PE, and CE by approximately one standard deviation (26.22%, 26.13%, and 34.05%, respectively) yield 16, 17, and 30 basis points of additional economic growth, respectively.[24] In general, the finding is similar to the conclusions of Hasan, Koetter, and Wedow (2009) and Koetter and Wedow (2010), who only find a significant positive effect of the quality indicator on economic growth for 11 developed European and Germany, respectively. This suggests that in mature economies, quantity effects alone are insufficient to stimulate economic growth, because the ability to efficiently select and monitor projects is more important than the mere availability of finance. The finding also echoes the argument of a recent IMF study, which warns that the role of the financial sector in developed economies has grown too big. Using data for 128 economies over the period 1980–2013, Sahay et al. (2015) establish a 'financial development index' to reflect not only how much raw credit banks issue but also broader measures such as economies' depth of access to bank products. They find that many developed economies such as the U.S and Japan have already crossed a point where financial sector expansion has started to have a smaller impact on growth (eventually becoming negative). In contrast, they also find that most emerging economies have not reached this point yet. In particular, developed economies suffering from

[21] 0.0425 + 0.0065 = 0.049; 0.0425/0.049 = 0.87.
[22] 0.0425 × 0.1370 = 0.0058; 0.0065 x 0.2016 = 0.0013.
[23] The developed economies in Asia Pacific include Australia, Japan, Hong Kong, South Korea, Singapore, and Taiwan.
[24] Hasan, Koetter, and Wedow (2009) find that an increase in PE by one standard deviation yields 48 basis points of additional economic growth (they find that CE has no significant impact on growth).

'too much finance' use their financial resources less efficiently. Overall economic growth slows because these economies allocate less and less to productive activities. Although the aforementioned IMF study does not release data for other developed economies in Asia Pacific, it is well known that finance plays a significant role in these economies. For instance, the financial services industry in Australia is not only the largest industrial segment in its economy but also the largest contributor to its corporate income tax revenues (Auster and Foo 2015). Similar concerns regarding the negative impact of runaway financial sector growth arise, demonstrating that it is quality rather than quantity that matters in the developed economies.

Table 4 presents our results for developing Asia-Pacific economies.[25] In contrast to the above findings for developed economies, the coefficients for FLC are significantly positive for all 12 specifications, which provide support for the Hicksian hypothesis highlighting the importance of banks' capital accumulation in stimulating growth. The estimated magnitudes for FLC indicate that a 1% increase in banks' ability to accumulate capital spurs economic growth by approximately 0.04%. In addition, an increase in FLC by approximately one standard deviation (13.23%) yields 51 basis points of additional economic growth. Hence, the quantity effect found in developing Asia-Pacific nations is much greater than the quality effect demonstrated in developed economies. Coefficients for all EFF measures (SVE, PE, and CE) are insignificant in all 12 cases, which suggest that quality effects alone may be insufficient to generate economic growth in less developed economies. This result might be explained by the fact that developing economies in the Asia-Pacific region are characterized by capital scarcity and inherently high marginal returns on capital. Thus, in the context of economic growth, the capital accumulation function of banks is superior to their credit allocation function as lesser developed economies need to build capital stocks from relatively low bases. Consequently, it appears that the primary role of the banking system in developing economies is to mobilize savings and boost capital.

Another notable finding is that the coefficients on various interaction terms are quite different: they are negative and insignificant when SVE or PE are involved, but significantly positive when CE is included as the quality indicator. This result implies that in relatively immature economies in the Asia-Pacific region, capital accumulation by more shareholder value and/or profit-efficient banks might impede economic growth. In contrast, more capital accumulated by cost-efficient banks fosters economic growth. Such findings are not surprising because the three efficiency measures underscore three different banking goals. SVE and PE embody the goals of shareholder value creation and profit maximization, respectively, which may be quite different from the strategies that banks actually pursue in the developing world. It is well documented that almost all developing countries in this region have adopted 'finance for growth' policies for a long period. Here, major banks are often required by government to channel resources to 'priority sectors' where they can lose the incentive to develop an appropriate credit culture and face relatively high levels of non-performing loans (translating into lower PE and shareholder value creation). In addition, banks are the most important source of public savings in developing countries, which also makes them 'too-big-to-fail' (too systematically important), which could lead to moral hazard problems (Fu, Lin, and Molyneux 2014). Therefore, although SVE and/or PE alone may not have any significant impact on economic growth, the combined forces of SVE/PE and FLC may significantly impede economic growth.

In contrast, CE represents a goal (cost minimization) shared by governments and, to a greater extent, bank owners. As argued by Lucchetti, Papi, and Zazzaro (2001), cost minimization is a necessary condition for efficient allocation of credit, whereas banks' abilities to increase shareholder value and/or profits may not coincide with their ability to finance economic growth. In addition, as small and medium-sized enterprises (SMEs) constitute a major source of bank credit demand in many economies the banking system has struggled to provide appropriate levels of SME credit. Developing countries in the Asia-Pacific region appear to be no exception, as demonstrated in the OECD (2015) report. In China, for instance, SMEs comprised 97% of all firms and accounted for 59% of GDP in 2011. To ensure sustainable growth, the Chinese government issued

[25]The developing economies in Asia Pacific include China, India, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, and Thailand.

broad incentive policies to encourage banks, in particular state-owned banks, to support SMEs, in addition to providing the traditional directed lending to state-owned enterprises. As a result, the total value of SME loans has increased 19% on average since 2009, which comprises a cumulative increase of 67% for the period from 2009 until 2012. In Thailand, SMEs constitute 99.6% of all enterprises, and loans to SMEs increased by 67% over the period from 2007 to 2013.[26] Because cost minimization allows banks in the developing world to better implement the sort of government policies discussed above, a significantly positive relationship between CE*FLC and GDP should be expected.

Robustness

We replace FLC with NFLC and re-run the model specified in Equation (1) using the same system GMM estimators to test the robustness of our main findings. The empirical results are presented in Tables 5–7, and again, each table contains 12 specifications. Overall, the findings are consistent with those reported above, which suggests that excluding OBS activities performed by banks in the Asia-Pacific region does not alter our key findings, namely, that for the entire sample, our results cannot exclude the importance of both channels and/or effects. Developed economies confirm the importance of the quality of bank intermediation in generating growth, whereas for developing countries bank quantity (capital accumulation) appears more important. Another difference is that the coefficients of the interaction variables are no longer significant for the developing world estimates, although the signs are the same, which implies that OBS activities that are performed by these banks may help exaggerate the influence of the effect of the synergy between intermediation quantity and quality on economic growth. In particular, the influence could be significantly negative when these banks simultaneously increase their profit and/or SVE and their OBS activities, although a significantly positive influence could also be achieved when they simultaneously increase their CE and OBS activities. Overall, the results suggest that our main findings are robust to the exclusion of OBS activities from the quantity measures.

Following Berger, Hasan, and Klapper (2004), we also include some institutional variables in the main models to examine their role in the context of finance-growth. For example, the quality effect might be more important in countries with stronger institutions, such as having common law and stronger shareholder protection. Specifically, we include (1) Common Law, a dummy variable to differentiate those economies with English common law because according to La Porta et al. (1997), 1998), common law legal institutions are assumed to offer greater creditor rights and are associated with improved ownership structures; (2) KKZ, an aggregate index of the level of institutional development constructed by Kaufman et al. (2008); and (3) Economic Freedom, an aggregate index that reflects the extent of government intervention in monetary policy, financial regulation, relative trade openness, and related issues in the economy, and this variable ranges from 1 (most freedom/least government intervention) to 100 (least freedom/most government intervention). In addition, we include the 10 factors on which Economic Freedom is measured in our major models to obtain a more thorough understanding of these components.[27] The key results are presented in Table 8, and these again are generally consistent with the major findings presented in Section 4.1.[28] Additionally, the coefficient for Property Rights is significantly positive for developing economies. This variable ranges from 1 to 100, with higher values signifying greater protection of private property rights. The results imply that greater protection of private property rights may benefit economic growth in developing economies. In addition, the coefficient for Fiscal Freedom is significantly negative for developing nations, suggesting that governments that impose lower tax burdens may spark economic growth in developing economies. The results are consistent with findings in the finance-growth literature indicating that greater freedom has beneficial effects (e.g. Berger, Hasan, and Klapper 2004).

[26]Please refer to OECD (2015) for details.
[27]To address potential multicollinearity problems between the institutional variables and the quantity/quality indicators, we follow Klock, Mansi, and Maxwell (2005) and orthogonalize the potentially correlated variables to delineate the incremental effects of the institutional variables.
[28]The 10 factors include: property rights, freedom from corruption, fiscal freedom, government spending, business freedom, labour freedom, monetary freedom, trade freedom, investment freedom, and financial freedom. For the sake of brevity, we only report those with significant coefficients. The remaining results are available upon request.

Table 5. Banking sector development (NFLC and EFF) and economic growth in all sample Asia Pacific economies.

	EFF = SVE				EFF = PE				EFF = CE			
	Quantity	Quality	Both	Interaction	Quantity	Quality	Both	Interaction	Quantity	Quality	Both	Interaction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NFLC	0.0272**		0.0296**	0.0296**	0.0270**		0.0290**	0.0289**	0.0283**		0.0427**	0.0427**
	(0.0117)		(0.0112)	(0.0113)	(0.0116)		(0.0112)	(0.0113)	(0.0115)		(0.0149)	(0.0147)
EFF		0.0068***	0.0070***	0.0070***		0.0072***	0.0074***	0.0074***		0.0089***	0.0096***	0.0096***
		(0.0015)	(0.0013)	(0.0013)		(0.0016)	(0.0014)	(0.0014)		(0.0015)	(0.0016)	(0.0016)
EFF*NFLC				0.0022				0.0028				−0.0054
				(0.0120)				(0.0131)				(0.0082)
GDP_{t-1}	0.4387**	0.4140**	0.4013**	0.4012**	0.4387**	0.4135**	0.4013**	0.4012**	0.4376**	0.3283*	0.3017*	0.3033*
	(0.1629)	(0.1689)	(0.1630)	(0.1630)	(0.1630)	(0.1689)	(0.1630)	(0.1629)	(0.1636)	(0.1724)	(0.1627)	(0.1620)
POPU	0.2954	0.3395	0.4147	0.4160	0.2968	0.3395	0.4125	0.4141	0.3102	0.0550	0.1396	0.1395
	(0.3863)	(0.4106)	(0.4103)	(0.4091)	(0.3858)	(0.4106)	(0.4103)	(0.4092)	(0.3928)	(0.3448)	(0.3406)	(0.3411)
CRISIS	−0.0305***	−0.0299***	−0.0301***	−0.0301***	−0.0305***	−0.0298***	−0.0301***	−0.0301***	−0.0305***	−0.0302***	−0.0305***	−0.0306***
	(0.0048)	(0.0049)	(0.0050)	(0.0050)	(0.0048)	(0.0049)	(0.0049)	(0.0050)	(0.0048)	(0.0050)	(0.0050)	(0.0050)
Constant	0.0237**	0.0318***	0.0266***	0.0266**	0.0237**	0.0318***	0.0267***	0.0267***	0.0234**	0.0412***	0.0346***	0.0345***
	(0.0085)	(0.0075)	(0.0088)	(0.0088)	(0.0085)	(0.0074)	(0.0088)	(0.0088)	(0.0084)	(0.0065)	(0.0074)	(0.0073)
Observation	168	168	168	168	168	168	168	168	168	168	168	168
F test	25.75***	25.89***	27.96***	109.87***	25.80***	25.24***	27.25***	112.40***	25.92***	114.96***	117.96***	95.27***
Sargan test	152.90	154.43	154.45	154.45	153.03	154.52	154.56	154.56	154.83	164.86	165.28	165.20
AR(1) test	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AR(2) test	0.64	0.70	0.66	0.66	0.64	0.70	0.66	0.66	0.64	0.69	0.64	0.64

Notes: This table presents the results of the system-GMM estimations for the entire sample with real GDP growth rate (GDP) as the dependent variable. The full sample includes both developing and developed economies in Asia Pacific. The efficiency (EFF) is specified as being predetermined. FLC and the interaction terms are specified as endogenous variables. SVE measures the extent to which a bank's EVA approaches the EVA for the 'best practice' bank under identical assumptions. Alternative PE measures the extent to which a bank's profit approaches the profit for 'best practice' under identical assumptions. Similarly, CE measures the extent to which a bank's cost approaches the cost for the 'best practice' bank under the identical assumptions. FLC is the ratio of liquidity creation, including on-balance-sheet and OBS activities, to total assets. Population growth (POPU) is the rate of population growth. Global financial crisis (CRISIS) is a dummy variable that takes a value of one for the years 2008 and 2009 and zero otherwise. All variables are logarithmic measures in log levels except for the crisis dummy. Because GDP, FLC, and POPU may be negative, following Levine, Loayza, and Beck (2000), these variables are calculated as log (1+variable). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors corrected for heteroscedasticity are in parentheses.

Table 6. Banking sector development (NFLC and EFF) and economic growth in developed Asia Pacific economies.

	EFF = SVE				EFF = PE				EFF = CE			
	Quantity	Quality	Both	Interaction	Quantity	Quality	Both	Interaction	Quantity	Quality	Both	Interaction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NFLC	0.0284		0.0163	0.0161	0.0284		0.0160	0.0156	0.0284		0.0391	0.0377
	(0.0445)		(0.0396)	(0.0404)	(0.0445)		(0.0397)	(0.0406)	(0.0445)		(0.0220)	(0.0229)
EFF		0.0075***	0.0071***	0.0070***		0.0079***	0.0075***	0.0074***		0.0094***	0.0097***	0.0096***
		(0.0011)	(0.0008)	(0.0008)		(0.0012)	(0.0009)	(0.0008)		(0.0012)	(0.0010)	(0.0011)
EFF*NFLC				−0.0151				−0.0158				−0.0112
				(0.0262)				(0.0283)				(0.0152)
GDP_{t-1}	0.0961	0.0444	0.0441	0.0429	0.0961	0.0435	0.0433	0.0423	0.0961	−0.0727	−0.0859	−0.0817
	(0.1329)	(0.1053)	(0.1151)	(0.1129)	(0.1329)	(0.1052)	(0.1146)	(0.1127)	(0.1329)	(0.0992)	(0.1158)	(0.1184)
POPU	0.8526*	1.1792**	1.1507**	1.1581**	0.8526*	1.1735**	1.1456**	1.1530**	0.8526*	0.7959***	0.7630***	0.7825***
	(0.3894)	(0.3121)	(0.3177)	(0.3204)	(0.3894)	(0.3125)	(0.3184)	(0.3210)	(0.3894)	(0.1540)	(0.1619)	(0.1259)
CRISIS	−0.0440***	−0.0446***	−0.0446***	−0.0448***	−0.0440***	−0.0445***	−0.0445***	−0.0447***	−0.0440***	−0.0446***	−0.0447***	−0.0449***
	(0.0107)	(0.0107)	(0.0106)	(0.0105)	(0.0107)	(0.0107)	(0.0106)	(0.0105)	(0.0107)	(0.0105)	(0.0104)	(0.0103)
Constant	0.0252*	0.0350**	0.0318**	0.0318**	0.0252*	0.0350**	0.0319**	0.0319**	0.0252*	0.0477***	0.0411***	0.0410***
	(0.0109)	(0.0089)	(0.0098)	(0.0095)	(0.0109)	(0.0088)	(0.0098)	(0.0095)	(0.0109)	(0.0057)	(0.0039)	(0.0038)
Observation	60	60	60	60	60	60	60	60	60	60	60	60
F test	16.82***	37.50***	42.28***	11.91***	16.82***	34.42***	35.49***	11.91***	16.82***	93.68***	370.11***	52.32***
Sargan test	88.32**	87.55**	87.53**	87.63**	88.32**	87.44**	87.42**	87.52**	88.32**	87.86**	86.90**	86.90**
AR(1) test	0.02	0.04	0.04	0.04	0.02	0.04	0.04	0.04	0.02	0.02	0.03	0.03
AR(2) test	0.55	0.47	0.48	0.48	0.55	0.47	0.48	0.48	0.55	0.39	0.42	0.43

This table presents the results of the system-GMM estimations for the developed economies with real GDP growth rate (GDP) as the dependent variable. The developed economies in Asia Pacific include Australia, Hong Kong, Japan, Korea, Singapore, and Taiwan. The efficiency (EFF) is specified as being predetermined. FLC and the interaction terms are specified as endogenous variables. SVE measures the extent to which a bank's EVA approaches the EVA for the 'best practice' bank under identical assumptions. Alternative PE measures the extent to which a bank's profit approaches the profit for 'best practice' under identical assumptions. Similarly, CE measures the extent to which a bank's cost approaches the cost for the 'best practice' bank under the identical assumptions. FLC is the ratio of liquidity creation, including on-balance-sheet and OBS activities, to total assets. Population growth (POPU) is the rate of population growth. Global financial crisis (CRISIS) is a dummy variable that takes a value of one for the years 2008 and 2009 and zero otherwise. All variables are logarithmic measures in log levels except for the crisis dummy. Because GDP, FLC, and POPU may be negative, following Levine, Loayza, and Beck (2000), these variables are calculated as log (1+variable). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors corrected for heteroscedasticity are in parentheses.

Table 7. Banking sector development (NFLC and EFF) and economic growth in developing Asia Pacific economies.

	EFF = SVE				EFF = PE				EFF = CE			
	Quantity	Quality	Both	Interaction	Quantity	Quality	Both	Interaction	Quantity	Quality	Both	Interaction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NFLC	0.0458**		0.0455**	0.0458**	0.0458**		0.0453**	0.0455**	0.0448**		0.0485**	0.0482*
	(0.0160)		(0.0150)	(0.0157)	(0.0160)		(0.0148)	(0.0156)	(0.0160)		(0.0187)	(0.0207)
EFF		0.0073	0.0021	0.0025		0.0093	0.0034	0.0038		−0.0148	0.0146	0.0149
		(0.0245)	(0.0244)	(0.0222)		(0.0255)	(0.0252)	(0.0231)		(0.0187)	(0.0235)	(0.0248)
EFF*NFLC				−0.1478				−0.1414				0.6939
				(0.3273)				(0.3488)				(0.6558)
GDP_{t-1}	0.4573**	0.4848**	0.4571**	0.4566**	0.4573**	0.4844**	0.4570**	0.4568**	0.4581**	0.4856**	0.4564**	0.4514**
	(0.1423)	(0.1482)	(0.1410)	(0.1434)	(0.1423)	(0.1473)	(0.1404)	(0.1423)	(0.1428)	(0.1550)	(0.1430)	(0.1432)
POPU	−0.1163	−0.3724	−0.1164	−0.1035	−0.1163	−0.3716	−0.1169	−0.1048	−0.1189	−0.3983	−0.0747	−0.0637
	(0.4474)	(0.4310)	(0.4520)	(0.4700)	(0.4475)	(0.4325)	(0.4545)	(0.4726)	(0.4450)	(0.4309)	(0.4324)	(0.4436)
CRISIS	−0.0231***	−0.0228***	−0.0230***	−0.0231***	−0.0231***	−0.0227***	−0.0229***	−0.0230***	−0.0231***	−0.0230***	−0.0231***	−0.0227***
	(0.0045)	(0.0048)	(0.0048)	(0.0048)	(0.0045)	(0.0048)	(0.0048)	(0.0049)	(0.0045)	(0.0046)	(0.0045)	(0.0046)
Constant	0.0296**	0.0398***	0.0301**	0.0300**	0.0296**	0.0402***	0.0304**	0.0303**	0.0297**	0.0369***	0.0304**	0.0306**
	(0.0112)	(0.0101)	(0.0126)	(0.0126)	(0.0112)	(0.0102)	(0.0126)	(0.0126)	(0.0111)	(0.0094)	(0.0113)	(0.0118)
Observation	96	96	96	96	96	96	96	96	96	96	96	96
F test	18.34***	18.25***	16.54***	20.83***	18.33***	18.65***	16.83***	20.83***	18.53***	14.44***	15.51***	13.12***
Sargan test	80.50	80.31	80.42	80.42	80.50	80.24	80.37	80.36	80.58	80.51	80.62	80.80
AR(1) test	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.04
AR(2) test	0.08	0.10	0.08	0.09	0.08	0.10	0.08	0.09	0.08	0.10	0.08	0.11

This table presents the results of the system-GMM estimations for the developing economies with real GDP growth rate (GDP) as the dependent variable. The developing economies in Asia Pacific include China, India, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, and Thailand. The efficiency (EFF) is specified as being predetermined. FLC and the interaction terms are specified as endogenous variables. SVE measures the extent to which a bank's EVA approaches the EVA for the 'best practice' bank under identical assumptions. Alternative PE measures the extent to which a bank's profit approaches the profit for 'best practice' under identical assumptions. Similarly, CE measures the extent to which a bank's cost approaches the cost for the 'best practice' bank under the identical assumptions. FLC is the ratio of liquidity creation, including on-balance-sheet and OBS activities, to total assets. Population growth (POPU) is the rate of population growth. Global financial crisis (CRISIS) is a dummy variable that takes a value of one for the years 2008 and 2009 and zero otherwise. All variables are logarithmic measures in log levels except for the crisis dummy. Because GDP, FLC, and POPU may be negative, following Levine, Loayza, and Beck (2000), these variables are calculated as log (1+variable). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors corrected for heteroscedasticity are in parentheses.

Table 8. Institutional factors and the finance-growth nexus in both developed and developing Asia-Pacific economies.

	Developed economies					Developing economies				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FLC	0.0456	0.0335	0.0372	0.0367	0.0226	0.0403	0.0379**	0.0385**	0.0307*	0.0358*
	(0.0405)	(0.0290)	(0.0289)	(0.0333)	(0.0340)	(0.0220)	(0.0137)	(0.0137)	(0.0156)	(0.0183)
SVE	0.0083***	0.0065***	0.0063***	0.0063***	0.0067***	−0.0096	0.0031	0.0029	0.0068	0.0012
	(0.0007)	(0.0010)	(0.0014)	(0.0011)	(0.0016)	(0.0252)	(0.0217)	(0.0230)	(0.0218)	(0.0236)
SVE*FLC	−0.0052	−0.0240	0.0091	−0.0135	0.0227	−0.3893	−0.3606	−0.3282	−0.4418*	−0.1895
	(0.0247)	(0.0159)	(0.0143)	(0.0179)	(0.0296)	(0.2588)	(0.2535)	(0.2767)	(0.2317)	(0.2934)
GDP_{t-1}	0.0219	0.0232	−0.0192	0.0311	0.0348	0.4223**	0.4629**	0.4727**	0.4566**	0.4020**
	(0.1104)	(0.1431)	(0.1321)	(0.1260)	(0.1305)	(0.1471)	(0.1783)	(0.1714)	(0.1698)	(0.1697)
POPU	0.7064**	1.0943***	1.0666**	1.0915***	1.1416***	−0.0934	−0.1072	−0.0788	−0.2028	−0.2412
	(0.2479)	(0.2629)	(0.2725)	(0.2588)	(0.2093)	(0.4706)	(0.5210)	(0.5126)	(0.5285)	(0.5648)
CRISIS	−0.0429***	−0.0489**	−0.0462***	−0.0452***	−0.0468***	−0.0237***	−0.0233***	−0.0241***	−0.0225***	−0.0272***
	(0.0089)	(0.0123)	(0.0108)	(0.0104)	(0.0103)	(0.0054)	(0.0050)	(0.0051)	(0.0052)	(0.0057)
Common Law	0.0131					−0.0087				
	(0.0081)					(0.0070)				
KKZ		−0.2276					0.0012			
		(0.1206)					(0.0042)			
Economic Freedom			−0.3251					−0.0659		
			(0.1727)					(0.0496)		
Property Rights				−0.0381					0.0315**	
				(0.0423)					(0.0120)	
Fiscal Freedom					−0.2580					−0.1820***
					(0.1936)					(0.0307)
Constant	0.0219	0.0282*	0.0282	0.0259	0.0295	0.0319**	0.0274*	0.0263*	0.0319**	0.0341**
	(0.0148)	(0.0122)	(0.0143)	(0.0130)	(0.0153)	(0.0120)	(0.0129)	(0.0121)	(0.0126)	(0.0136)
Observation	72	72	72	72	72	96	96	96	96	96
F test	5.96**	16.14***	20.97***	12.13***	20.31***	45.00***	379.97***	130.26***	10,115.31***	3293.86***
Sargan test	87.79**	85.66**	88.00**	88.04**	83.52*	82.86	81.20	80.41	79.90	82.67
AR(1) test	0.03	0.04	0.04	0.04	0.05	0.03	0.04	0.04	0.04	0.05
AR(2) test	0.52	0.58	0.52	0.52	0.52	0.10	0.11	0.10	0.11	0.12

This table presents the results of the system-GMM estimations for both developed and developing economies with real GDP growth rate (GDP) as the dependent variable. The developed economies in Asia Pacific include Australia, Hong Kong, Japan, Korea, Singapore, and Taiwan, while the developing economies include China, India, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, and Thailand. The efficiency is specified as being predetermined. FLC and the interaction terms are specified as endogenous variables. SVE measures the extent to which a bank's EVA approaches the EVA for the 'best practice' bank under identical assumptions. FLC is the ratio of liquidity creation, including on-balance-sheet and OBS activities, to total assets. Population growth (POPU) is the rate of population growth. Global financial crisis (CRISIS) is a dummy variable that takes a value of one for the years 2008 and 2009 and zero otherwise. Common Law is a dummy variable differentiating economies with English common law. KKZ is an aggregate index of the level of institutional development. Economic Freedom is an aggregate index that reflects the extent of government intervention in monetary policy, financial regulations, relative openness of trade, and related issues in the economy. Property Rights is an indicator variable measuring the protection of private property rights. Fiscal Freedom is a measure of the tax burden imposed by government. All variables are logarithmic measures in log levels except for the dummy variables. Because GDP, FLC, and POPU may be negative, following Levine, Loayza, and Beck (2000), these variables are calculated as log (1+variable). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors corrected for heteroscedasticity are in parentheses.

V. Conclusions

This study investigates the finance-growth nexus by focusing on both the quantity and quality of banking sector intermediation. We use various measures of the quality of banking sector intermediation (CE, PE, and SVE) as well as quantity indicators (FLC and NFLC) to examine the link between the banking sector and economic growth in both developing and developed Asia-Pacific economies. We find that in general, economic growth in this region benefits significantly from both quantity (Hisksian) and quality (Schumpeterian) channels. Specifically for developed economies, we find that it is the quality of banking services that stimulates economic prosperity, whereas developing economies rely significantly on the quantity of banking services to boost their economies. We also find that in developing economies, growth requires more cost-efficient banks rather than profit-efficient or shareholder value-efficient banks to reinforce the quantity channel. The robustness tests suggest that such synergies may be induced through the expansion of OBS activities. In addition, enhanced protection of private property rights and lower tax burdens may spur economic growth in developing economies.

These findings highlight several important issues for policymakers in the Asia-Pacific region. First, policy efforts that seek to further improve the quality of banking services are more likely to foster economic growth in developed economies. In other words, policymakers in developed nations should concentrate their efforts on reforms that enhance bank efficiency. Second, reforms that stimulate capital accumulation should be encouraged in developing economies because this is the main

channel that spurs economic growth in these countries. In addition, reforms that improve the protection of private property rights and fiscal freedom should also be advocated in developing nations because such reforms also spark economic growth. Finally, policy-makers in developing countries should be cautious in launching reforms that aim to improve shareholder value and/or PE together with simultaneous capital expansion because such reforms may hinder economic development, particularly the expansion of OBS activities. However, any banking reforms that advocate cost minimization may significantly foster economic growth and lead to greater capital accumulation in the developing world.

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Appendix 1. Estimation of CE using the SFA

CE measures the extent to which a bank's costs approach the costs for a 'best practice' or least cost bank under the same assumption. It is measured by estimating a cost function whereby the dependent variable is the sum of each bank's total costs and the independent variables include the prices of inputs, quantities of variable outputs, differences in the economic environment, random error, and inefficiency. The translog function used to estimate the cost frontier takes the following form[29]:

$$\begin{aligned} ln\frac{TC_{it}}{w_{2it}} = {} & \alpha_0 + \sum_{p=1}^{3}\beta_p lny_{pit} + \sum_{m=1}^{2}\delta_m ln\frac{w_{mit}}{w_{2it}} \\ & + \sum_{p=1}^{3}\sum_{m=1}^{2}\rho_{pm} ln\frac{w_{mit}}{w_{2it}} lny_{pit} + \frac{1}{2}\sum_{p=1}^{3}\sum_{q=1}^{3}\beta_{pq} lny_{pit} \\ & lny_{qit} + \sum_{p=1}^{2}\sum_{m=1}^{2}\delta_{mn} ln\frac{w_{mit}}{w_{2it}} ln\frac{w_{nit}}{w_{2it}} + \eta_1 t \\ & + \frac{1}{2}\eta_{11}t^2 + \sum_{m=1}^{2}\lambda_m t ln\frac{w_{mit}}{w_{2it}} + \sum_{p=1}^{3}\gamma_p lny_{pit} \\ & + \theta_1 lnE + \phi_1 REG1 + \phi_2 REG2 + \mu_{it} + v_{it} \end{aligned} \tag{A1}$$

where

TC_{it} : the total cost of bank i at time t;

y_{pit} : the pth output of bank i at time t (p = 1, 2, 3);

w_{mit} : the mth input prices of bank i at time t (m = 1,2);

t : the time trend;

ln E : the natural logarithm of total equity;

$REG1$: A dummy variable that takes a value of one for Industrialized Asia (including Australia and Japan) and zero otherwise[30];

$REG2$: A dummy variable that takes a value of one for Newly Industrialized Economies (including Hong Kong, South Korea, Singapore, and Taiwan) and zero otherwise;

v_{it} : the random error of bank i at time t with $i.i.d$ normal distribution, $N(0, \sigma_v^2)$; and

u_{it} : the non-negative inefficiency of bank i at time t, which is assumed to be obtained by truncation (at zero) of the $N(m_{it}, \sigma_v^2)$distribution.

Standard symmetry restrictions apply to this function ($i.e.\beta_{pq} = \beta_{qp}; \delta_{mn} = \delta_{nm}$), which is consistent with several recent studies.[31] Moreover, the total cost and input price terms are normalized by $w2$, which imposes linear homogeneity to ensure that the cost-minimizing bundle does not change if all input prices are multiplied by the same positive scaling. Thus, only changes in the ratios of the input prices affect the allocation of inputs.

Based on the intermediation approach, we specify three outputs and two input prices. The output variables include total net loans ($y1$), other earning assets ($y2$), and non-interest income ($y3$), which are commonly used in the extant literature.[32] Owing to the lack of data regarding personnel expenses for most of the sample banks, we follow Hasan and Marton (2003), Soedarmon, Machrouh, and Tarazi (2011), Sun and Chang (2011), and Jiang, Yao, and Zhang (2009), (2013)) and employ only two variables as input prices. The price of purchased funds ($w1$) is measured as the ratio of interest expenses to deposits and short-term funding. The price of physical capital ($w2$) is measured as the ratio of non-interest expenses to total fixed assets.

Appendix 2. Estimation of liquidity creation

Our third measure of the quality of bank intermediation is the liquidity creation indicator proposed by Berger and Bouwman (2009). As we noted earlier, the liquidity of assets and OBS activities depends on how quickly they can be sold, whereas that of liabilities depends on how quickly they can be withdrawn. To create the liquidity creation measures all bank activities are assigned weights according to the 'intuition' behind liquidity creation. The magnitude of these weights is as follows: one dollar of liquidity is created by transferring one dollar of liquid liabilities into one dollar of illiquid assets or illiquid OBS activities, whereas one dollar of liquidity is destroyed by transferring one dollar of illiquid liabilities or equity into one dollar of liquid assets or liquid OBS activities. Berger and Bouwman (2009) assign a weight of 0.5 for illiquid assets, liquid liabilities, and illiquid OBS activities; a weight of 0 for semiliquid assets, semiliquid liabilities, and semiliquid OBS activities; and a weight of – 0.5 for liquid assets, illiquid liabilities, and liquid OBS activities. Third, according to Equations (5) and (6), fat and NFLC are calculated by combining the activities as classified and weighted in steps 1 and 2, respectively. Appendix 3 illustrates the liquidity classification of bank activities and the construction of two liquidity creation measures. Following Berger and Bouwman (2009), we employ the FLC and NFLC ratios separately in the regressions by normalizing the dollar amount of bank liquidity creation by total assets to make them comparable across banks and to avoid giving undue weight to the largest banks.

[29]In this one-step model, following Lozano-Vivas and Pasiouras (2010, 2014), and Radić, Fiordelisi, and Girardone (2012), we also include some environmental variables to model the inefficiency distribution, including the real GDP growth rate, inflation rate, 3-bank asset concentration ratio, the minimum regulatory capital-to-assets ratio, and economic freedom which measures the degree of freedom from government interference afforded to businesses and individuals. A higher value indicates greater freedom. This approach allows us to account for heterogeneity across banks and still benchmark different banks against an identical frontier (Bos et al. 2008).

[30]To estimate CE using bank-level data, we divide the entire sample into three groups according to the IMF's definition of similar regional blocs, namely, Industrialized Asia, Newly Industrialized Economies, and Developing Asia. Consequently, three dummy variables are employed in the CE model to control for different levels of economic development in the Asia-Pacific region. However, when we examine the effects of bank development on economic growth, we have to use country level rather than bank-level data. Given there are only 22 observations for Industrialized Asia, we follow the World Bank's practice to combine Industrialized Asia with Newly Industrialized Economies to form 'developed economies'.

[31]See, among others, Fu and Heffernan (2007, 2009) and Fiordelisi and Molyneux (2010).

[32]See, among others, Stiroh (2000).

$$\begin{aligned} \textit{Fat liquidity creation} = {} & 0.5 * (\textit{illiquid assets} + \textit{liquid liabilities} + \textit{illiquid OBS}) + 0 * (\textit{semiliquid assets} + \textit{semiliquid liabilities} + \textit{semiliquid OBS}) \\ & - 0.5 * (\textit{liquid assets} + \textit{illiquid liabilities} + \textit{equity} + \textit{liquid OBS}) \end{aligned} \tag{A2}$$

$$\begin{aligned} \textit{Nonfat liquidity creation} = {} & 0.5 * (\textit{illiquid assets} + \textit{liquid liabilities}) + 0 * (\textit{semiliquid assets} + \textit{semiliquid liabilities}) \\ & - 0.5 * (\textit{liquid assets} + \textit{illiquid liabilities} + \textit{equity}) \end{aligned} \tag{A3}$$

Appendix 3. Liquidity classification of bank activities and construction of two liquidity creation measures

Assets		
Illiquid assets (weight = 1/2)	Semiliquid assets (weight = 0)	Liquid assets (weight = −1/2)
Corporate and commercial loans	Residential mortgage loans	Cash and due from banks
Other loans	Other mortgage loans	Trading securities and at FV through income
Investments in property	Other consumer/retail loans	Derivatives
Insurance assets	Loans and advances to banks	Available for sale securities
Foreclosed real estate	Reverse repos and cash collateral	Held to maturity securities
Fixed assets		At-equity investments in associates
Goodwill		Other securities
Other intangibles		
Current tax assets		
Deferred tax assets		
Other assets		
Liabilities plus equity		
Liquid liabilities (weight = 1/2)	Semiliquid liabilities (weight = 0)	Illiquid liabilities plus equity (weight = −1/2)
Customer deposits – current	Customer deposits – Term	Senior debt maturing after 1 year
Customer deposits – savings	Deposits from banks	Subordinated borrowing
Derivatives	Repos and cash collateral	Other funding
Trading liabilities	Other deposits and short-term borrowings	Credit impairment reserves
	Fair value portion of debt	Reserves for pensions and other
		Current tax liabilities
		Deferred tax liabilities
		Other deferred liabilities
		Other liabilities
		Insurance liabilities
		Total equity
OBS activities		
Illiquid OBS (weight = 1/2)	Semiliquid OBS (weight = 0)	Liquid OBS (weight = −1/2)
Acceptances and documentary credits reported OBS	Managed securitized assets reported OBS	
Committed credit lines	Other OBS exposure to securitizations	
Other contingent liabilities	Guarantees	

We follow Berger and Bouwman (2009) to classify the on-balance-sheet and OBS items in terms of their liquidity. All variables are obtained from Bankscope.

Appendix 4. Correlation matrix

	GDP	SVE	PE	CE	FLC	NFLC	POPU	CRISIS
GDP	1.000							
SVE	0.226***	1.000						
PE	0.230***	0.999***	1.000					
CE	0.440***	0.471***	0.474***	1.000				
FLC	0.168**	0.053	0.062	0.070	1.000			
NFLC	0.085	−0.020	−0.011	−0.153**	0.821***	1.000		
POPU	0.156**	−0.153**	−0.150**	0.274***	−0.143*	−0.220***	1.000	
CRISIS	−0.358***	−0.035	−0.041	0.015	0.041	0.024	0.047	1.000

GDP growth (GDP) measures the real GDP growth rate. SVE measures the extent to which a bank's EVA approaches the EVA for 'best practice' banks under identical assumptions. Alternative PE measures the extent to which a bank's profit approaches the profit for 'best practice' under identical assumptions. Similarly, CE measures the extent to which a bank's cost approaches 'best cost practices'. FLC is the ratio of liquidity creation, including on-balance-sheet and OBS activities, to total assets. NFLC is the ratio of liquidity creation, including OBS activities only, to total assets. Population growth (POPU) is the rate of population growth. Global financial crisis (CRISIS) is a dummy variable that takes a value of one for the years 2008 and 2009 and zero otherwise. All variables are logarithmic measures in log levels except for the crisis dummy. Because GDP, FLC, NFLC, and POPU may be negative, following Levine, Loayza, and Beck (2000), these variables are calculated as log (1+variable). ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.