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Thresholds in the nexus between financial deepening and firm performance: Evidence from Indonesia☆

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ABSTRACT

Using a survey of 41,862 manufacturing firms in Indonesia from 2004 through 2013, this study documents that firms in provinces with deeper financial infrastructure exhibit better performance in general; but this is true especially for firms with higher financial constraints (measured by a low-intensity use of fixed capital), and only when financial depth at the province level already exceeds a certain level. That is, this paper documents the presence of firm-level and province-level thresholds in the nexus between financial deepening and firm performance. It is important to consider such conditioning factors, in addition to boosting financial development, in order to improve manufacturing firms' performance and thus industrialization in Indonesia.

1. Introduction

This paper aims to extend previous literature on the finance-growth nexus by investigating whether firms located in provinces with greater financial depth exhibit higher performance, and whether certain conditions (the so-called threshold effects) must be fulfilled before this improvement materializes. To the best of our knowledge, this study is the first to integrate province-level and firm-level data to study the nexus between financial depth and firm performance in a single-country setting, which also enables us to investigate the presence of multiple thresholds at the firm and province levels.

Specifically, we use firm-level data from a survey of medium-sized and large manufacturing firms in Indonesia (the IBS survey, or *Survei Industri Besar dan Sedang*), combined with province-level data related to the degree of financial deepening and other macro-economic variables. The IBS survey includes firms that are not listed on the stock exchange, so our study can capture a substantial fraction of the economy that contributes to economic growth—the Indonesian public equity market being relatively small, and publicly traded firms having rather limited influence on economic growth.

Focusing on the case of Indonesia is contextually relevant, because financial deepening has been a longstanding issue for the nation. Soedarmono, Hasan, and Arsyad (2017) document that financial deepening and intermediation, measured by several indicators, are lower in Indonesia than in neighboring countries in Southeast Asia. These shortcomings have prompted the Indonesian government to issue regulations to boost access to finance.

In 2012, Bank Indonesia (BI) implemented a regulation (PBI No. 14/22/PBI/2012) requiring that loans to micro-, small, and

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medium-sized enterprises (MSMEs) constitute at least 20% of each commercial bank's total loan portfolio. In 2014, the Indonesia Financial Services Authority (Otoritas Jasa Keuangan, or OJK) enacted a regulation (POJK No. 19/POJK.03/2014) allowing branchless banking to increase demand for formal savings and to promote greater access to bank credit for small businesses. In September 2016, the government issued Presidential Decree No. 82/2016 on the National Strategy on Inclusive Finance (*Strategi Nasional Keuangan Inklusif*, or SNKI), coordinated by the Coordinating Ministry of Economic Affairs, in order to achieve the target of financial inclusion of 75% of the population by 2019.

The implications of these efforts for firm performance, especially manufacturing firms' performance, are not well understood. Because the manufacturing sector is the largest contributor to aggregate output in Indonesia, reaching 24% of GDP in 2013 (Tijaja & Faisal, 2014), further examination of the linkage between financial deepening and manufacturing firms' performance is needed to understand whether financial deepening spurs economic growth as a whole.

Concomitantly, Indonesia has faced deindustrialization problems in recent years. As described by Tijaja and Faisal (2014), deindustrializaton is a condition in which the growth of the manufacturing sector is lower than the total GDP growth. For Indonesia, in 2011, 2012, and 2013, the manufacturing sector grew by 6.1%, 5.7%, and 5.6%, respectively, while total GDP grew by 6.5%, 6.2%, and 5.8%. Deindustrialization could slow economic growth when combined with an increase in manufacturing firms' financing constraints, although several industrial policy initiatives have been issued to improve the manufacturing industry's competitiveness and strengthen industrialization.[1]

For Indonesia, the role of banking is crucial to alleviate firm financing constraints and boost economic growth, because the banking industry holds 80% of the financial system's total assets. Indeed, banking plays a pivotal role in spurring long-term investment, capital stock accumulation, and economic growth, not only in developing countries, but also in developed countries (see, e.g., Bencivenga & Smith, 1991; Demirgüç-Kunt & Maksimovic, 2002; King & Levine, 1993; Levine, 1998, 2005; Rajan & Zingales, 1998; Trinugroho, Agusman, Ariefianto, Darsono, & Tarazi, 2015). Nevertheless, research shows that greater financial development does not necessarily produce higher economic growth, because there are threshold effects.

This paper is organized as follows. Section 2 highlights our research contribution, in addition to reviewing literature on the occurrence of thresholds in the finance-growth nexus. Section 3 presents data, variables, and econometric methods. Section 4 discusses empirical findings, and Section 5 concludes.

2. Literature review and research focus

Recent theoretical literature suggests that financial development may spur economic growth only if the quality of country-level fundamentals reaches a certain level, which enables higher productivity and competitiveness (Augier & Soedarmono, 2011; Deidda & Fattouh, 2002). Bose and Cothren (1996, 1997) develop a theoretical model in which bank-level fundamentals also can produce a threshold effect. They postulate that banks will encourage higher financial intermediation by providing more competitive lending rates if the bank is more cost efficient in gathering borrowers' information.

In the empirical literature, several approaches document a threshold effect in the finance-growth nexus. Rioja and Valev (2004a) partition countries into three groups—low-income, middle-income, and high-income—by real GDP per capita, and show that the positive effect of financial development on economic growth is more pronounced for countries with higher per capita real income. In a second study (Rioja & Valev, 2004b), they provide evidence that the positive link between finance and growth depends on the degree of financial development. Beck, Georgiadis, and Straub (2014) find threshold effects related to financial cycles and non-intermediation activities that affect the finance-growth nexus. In a single-country study that incorporates province-level datasets from the Philippines, Crouzille, Nys, and Sauviat (2012) report that financial deepening through rural banks increases regional economic growth, but this effect is more pronounced in economically more developed regions.

But there is also empirical evidence from cross-country analyses that “too much finance” impairs economic growth (e.g., Arcand, Berkes, & Panizza, 2012; Cecchetti & Kharroubi, 2012; Samargandi, Fidrmuc, & Ghosh, 2015). That is, greater financial development enhances economic growth, but this relationship is reversed once financial development exceeds a certain level. In a single-country study, Soedarmono et al. (2017) specifically assess the finance-growth nexus in Indonesia and document an inverted U-shaped relationship between financial deepening and regional economic growth, although this relationship depends on type of bank credit: among investment credit, consumption credit, and working capital credit, only the latter has a positive and linear effect on regional economic growth.

By integrating firm-level and province-level datasets, we characterize two types of thresholds in the finance-growth nexus: firm-level and province-level thresholds. Omitting threshold effects in studying this nexus in an emergent economy may lead to inappropriate policy recommendations, because the role of financial development in spurring economic growth relies on the quality of fundamentals within each country or firm that will enable long-term investment (see, e.g., Augier & Soedarmono, 2011; Bose &

[1] In 2007, the government of Indonesia introduced Law No. 27 describing its Long-Term National Development Plan (*Rencana Pembangunan Jangka Panjang Nasional*, or RPJPN) for 2005–2025, which aims to make manufacturing the backbone of Indonesia's economy in the long run. In 2008, a presidential regulation on national industrial policy (PP No. 28/2008) was issued to provide a further long-term vision of industrial development by 2025. The Ministry of Industry issued another regulation in 2010, setting a target contribution of non–oil and gas output to total GDP from around 24% to 30% by 2020. This policy further identifies several action priorities: increasing added value, increasing market share at the local and international level, strengthening innovation and technological capabilities, and broadening industrial development (Tijaja & Faisal, 2014).

Cothren, 1997; Deidda & Fattouh, 2002). Specifically, our paper contributes in two directions.

First, we extend the literature on the implications of financial development and firm financial constraints by exploring whether firms' intensity of fixed capital usage can constrain the relationship between financial depth and firm performance (as distinct from investment). We postulate that firms with higher intensity of fixed capital usage tend to have lower financial constraints. Previous studies (e.g., Agca & Mozumdar, 2008; Rungsomboon, 2005) suggest that firms with higher financial constraints are less able to find external sources of funds and to spur productive investment. For such firms, greater financial depth can reduce firm dependence on internal funding by increasing external funding sources and investment opportunities (e.g. Laeven, 2003; Love, 2003), thus tempering the adverse impact of financial constraints on firm investment (Galindo, Schiantarelli, & Weiss, 2007).[2]

Second, we test for thresholds at the province level. Other studies have found that financial development increases economic growth only in regions with higher per capita income or greater financial depth (e.g., Crouzille et al., 2012; Rioja & Valev, 2004a, 2004b).

3. Data, variables, and method

3.1. Data

We use two types of datasets: firm level and province level. For firm-level datasets, we retrieve firm-level indicators from a survey of medium-size and large manufacturing firms (the IBS survey) provided by the Indonesia Central Statistics Agency (*Badan Pusat Statistik*, BPS). This survey covers 41,862 firms from 2004 to 2013. For province-level datasets, we retrieve data related to financial deepening and sociodemographic information at the province level from Bank Indonesia and BPS, respectively.

The IBS survey is a yearly survey of manufacturing firms with at least 20 workers in all provinces in Indonesia. It records information on identity, equity ownership, employees, fixed assets, revenues, yearly expenses, interest expenses, tax, raw materials, input, output, and added value. Previous studies have also used the IBS survey, although the dataset may have some shortcomings in the number of firms covered within each province, and some of its indicators may not reflect all balance-sheet and income statement information (see, e.g., Blalock & Gertler, 2004; Mursitama, 2006; Takii, 2004).

3.2. Firm performance

The literature has reached no consensus on how to measure firm performance. Delis, Kokas, and Ongena (2017) consider return on assets, Tobin's Q, return on investment, and leverage to represent firm performance in the nexus between bank market power and firm performance. Hasan, Jackowicz, Kowalewski, and Kozlowski (2017), in assessing the impact of local banking market structures on small and medium-sized enterprise (SME) financing and performance, measure performance using investments in tangible assets, sales growth, and return on sales.

Because the IBS survey does not cover all financial statement information, we use three proxies for firm-level performance. First, we use the ratio of total income to total cost of raw materials (productivity, or *PROD*). Higher *PROD* means that firms are using raw materials more efficiently to produce the same amount of output. Second, we use the ratio of total revenues to total input for production (output, or *OUT*). Higher *OUT* is associated with higher firm productivity. Third, we use the ratio of value added to total revenues (*VAL*). Higher *VAL* is associated with higher capacity to innovate, suggesting higher competitiveness that leads to better performance.

3.3. Independent variables

Our explanatory variable of interest in this study is financial deepening, measured using the ratio of bank credit to gross regional domestic product (GRDP) at the province level (*CRDEPTH*). Higher *CRDEPTH* means greater financial deepening in the credit markets.

To control for province-level characteristics, we incorporate employment, per capita income, and population, following Hasan et al. (2017). We measure employment using the ratio of total employment to total labor force (*EMP*). The effect of employment on firm performance is ambiguous, however, because it depends on whether firms are labor intensive or capital intensive. We further control for the variation of income among provinces using the logarithm of real GDP per capita (*LGDPC*). Higher population is associated with greater agglomeration, which is expected to spur firm investment because of increased demand (on agglomeration economies, see Brülhart & Sbergami, 2009). To control for population, we use the logarithm of total population (*LPOP*).

Moreover, we incorporate a set of firm-level variables, including the ratio of fixed capital to total income (*RFCAP*) and the logarithm of firm total income (*SIZE*), as well as the ratios of firm ownership by the central government (*CGOV*), local government

[2] Another strand of literature highlights that better economic performance and firms with higher productivity is likely to spur higher demand for bank credit. Hence, it is economic growth that affects financial development (e.g., Demetriades & Hussein, 1996). In the present paper, we use province-level data to measure financial depth as an explanatory variable of interest, while firm performance as dependent variable is calculated using firm-level data. Consequently, we cannot test whether firm-level performance affects financial deepening at the province level. Regressions of province-level financial depth on firm-level performance have no economic interpretation, because many firms within a single province (with a unique value of financial depth) perform differently.

(*LGOV*), and foreign entities (*FOR*). *RFCAP* is specifically considered to represent the degree of financial constraint. Higher *RFCAP* means lower financial constraint, because firms with higher *RFCAP* have a greater capacity to obtain external financing using their fixed assets as collateral.

3.4. Method

Our empirical method comprises three stages. In the first stage, we assess whether firms located in provinces with greater financial depth exhibit better performance. In the second stage, we assess the presence of a firm-level threshold related to financial constraints measured by the ratio of fixed capital to total income (*RFCAP*). In the third stage, we test the presence of thresholds at the province level, by partitioning provinces according to per capita income or financial depth.

In the first stage, we run regressions of firm performance on financial deepening and a set of control variables, as shown in Eq. (1), in which *i*, *j*, and *t* represent firm index, province index, and time index, respectively.

$$y_{ijt} = \beta_0 + \beta_1 CRDEPTH_{jt} + \sum_{j=2}^{h} \beta_j X_{jt} + \sum_{i=1}^{k} \alpha_i Z_{ijt} + \varepsilon_{ijt} \quad (1)$$

From this stage, we can elucidate whether firms in provinces with greater financial deepening experience better performance. In Eq. (1), *y* is the dependent variable, which could be *PROD*, *OUT*, or *VAL* as defined earlier, while *X* and *Z* are sets of province-level and firm-level independent variables, respectively. *CRDEPTH* is our explanatory variable of interest representing financial deepening.

In the second stage, we explore whether there is a threshold ratio of fixed capital to total income (*RFCAP*) that might affect the nexus between financial deepening and firm performance. For this purpose, we divide firms into two subgroups, less financially constrained firms and more financially constrained ones, taking as the cutoff point the 75th percentile value of the average *RFCAP* for all firms. We create a dummy variable (*DFCAP*) that takes the value of 1 when the firm's average *RFCAP* for 2004–2013 exceeds the 75th percentile value for all firms. We repeat the estimation of Eq. (1) for each subgroup.

In the third stage, we test the presence of thresholds at the province level related to the degree of financial depth and real per capita income. Here, we construct two dummy variables (*DCRE* and *HINC*) at the province level. *DCRE* equals 1 when the average *CRDEPTH* of each province exceeds the 75th percentile of the average *CRDEPTH* of all provinces (calculated over the 2004–2013 period). Similarly, *HINC* takes the value of 1 when the average *LGDPC* of each province calculated from 2004 to 2013 exceeds the 75th percentile of the average *LGDPC* of all provinces over that period. Eventually, we modify Eq. (1) by incorporating the interaction terms (*CRDEPTH* × *DCRE* and *CRDEPTH* × *HINC*) in two separate equations.

In terms of econometric method, we estimate Eq. (1) using a two-way panel fixed effect model, taking into account both firm and year fixed effects. Some previous studies of the finance-growth nexus use dynamic panel data models (e.g., Hasan, Wachtel, & Zhou, 2009; Soedarmono et al., 2017). Because our sample consists of a large number of cross-sections, however, we use a two-way fixed effect panel data method, following Hasan et al. (2017).

4. Empirical findings

4.1. Summary statistics

Initially, we present descriptive statistics for all variables in Table 1 and a correlation matrix in Table 2. In compiling Table 1, to avoid the effects of outliers, we deleted values above the 99th percentile for *OUT* and *PROD*. In Table 2, no notable correlation occurs between independent variables, and hence multicollinearity is of less concern.

Because we investigate the nexus between financial depth and firm performance for different types of firms depending on their ratio of fixed capital, in Table 3a we also present descriptive statistics for subgroups of firms with low financial constraints (high fixed

Table 1
Descriptive statistics.

Variables	Definition	Mean	Max.	Min.	Std. dev.	Obs.
PROD	Ratio of total income to total cost of raw materials	2.5886	34.9785	0.0000	2.8761	229,941
OUT	Ratio of total revenues to total production input	2.2577	25.5709	1.0006	2.1435	240,379
VAL	Ratio of total value added to total revenues	0.4299	1.0000	0.0006	0.2088	243,047
CRDEPTH	Ratio of bank credit to gross regional development product (GRDP) at the province level	0.3081	0.8681	0.0669	0.1431	242,663
EMP	Ratio of employment to labor force at the province level	0.9102	0.9821	0.8109	0.0358	242,203
LGDPC	Logarithm of real GRDP per capita at the province level	−4.0800	−2.0717	−5.8026	0.5959	242,718
LPOP	Logarithm of population at the province level	9.9473	10.7220	6.5341	0.9058	242,718
CGOV	Ratio of central government equity ownership	0.0120	1.0000	0.0000	0.1071	243,037
FOR	Ratio of foreign equity ownership	0.0742	1.0000	0.0000	0.2500	243,047
LGOV	Ratio of local government equity ownership	0.0121	1.0000	0.0000	0.1054	243,037
RFCAP	Ratio of fixed capital to total revenues	0.6321	8.7675	0.0000	0.9500	135,595
SIZE	Logarithm of total revenues	15.4427	25.6291	7.7664	2.1395	243,047
DCRE	Dummy variable, 1 for provinces with greater financial depth	0.2343	0	1	0.4236	243,047
HINC	Dummy variable, 1 for provinces with high per capita income	0.3605	0	1	0.4801	243,047

Table 2
Correlation matrix.

Variables	*PROD*	*OUT*	*VAL*	*CRDEPTH*	*EMP*	*LGDPC*	*LPOP*	*CGOV*	*FOR*	*LGOV*	*RFCAP*	*SIZE*
PROD	1.000											
OUT	0.561	1.000										
VAL	0.479	0.696	1.000									
CRDEPTH	0.024	0.068	0.111	1.000								
EMP	−0.019	−0.007	0.000	−0.228	1.000							
LGDPC	0.019	0.068	0.108	0.637	0.075	1.000						
LPOP	−0.037	−0.050	−0.047	−0.326	0.056	−0.186	1.000					
CGOV	0.020	0.017	0.010	−0.036	0.018	−0.002	−0.025	1.000				
FOR	0.019	0.027	0.022	0.040	−0.100	0.053	−0.070	−0.028	1.000			
LGOV	0.007	−0.003	−0.004	−0.018	−0.044	−0.035	0.014	−0.009	−0.025	1.000		
RFCAP	0.109	0.123	0.196	0.031	−0.058	0.002	−0.031	0.007	−0.019	−0.006	1.000	
SIZE	−0.076	−0.111	−0.207	0.138	−0.081	0.179	−0.102	0.126	0.331	0.049	−0.234	1.000

Table 3a
Descriptive statistics and mean *t*-tests for firms with different degrees of financial constraints.

Variables	*PROD*	*OUT*	*VAL*	*CRDEPTH*
DFCAP = 1				
Mean	3.0583	2.6001	0.4823	0.3142
Max.	34.8945	25.4898	1.0000	0.8681
Min.	0.0000	1.0011	0.0011	0.0669
Std. dev.	3.3398	2.4921	0.2064	0.1497
DFCAP = 0				
Mean	2.4778	2.1448	0.4086	0.2966
Max.	34.9785	25.5709	1.0000	0.8681
Min.	0.0000	1.0006	0.0006	0.0669
Std. dev.	2.7508	2.0215	0.2116	0.1298
Mean test (t-stat.)	37.419***	40.865***	67.916***	25.269***

capital ratio or *DFCAP* equals 1) and firms with high financial constraints (low fixed capital ratio or *DFCAP* equals 0). We also present Table 3b to show that firms located in provinces with different degrees of financial depth and economic development exhibit different characteristics. However, we focus only on our variables of interest, *PROD*, *OUT*, *VAL*, and *CRDEPTH*.

The mean test results in Table 3a show that the average values of our variables of interest differ between the two firm subgroups. Firms with lower financial constraints (*DFCAP* = 1) exhibit higher performance and tend to be located in provinces with greater financial depth than firms with higher financial constraints (*DFCAP* = 0). Clearly, the firm's fixed capital ratio is relevant to the nexus between financial depth and firm performance. But Table 3b shows that our main variables of interest also exhibit different mean values across provinces with different degrees of financial depth and per capita income.

Table 3b
Descriptive statistics and mean *t*-tests for firms operating in different types of provinces.

Variables	*PROD*	*OUT*	*VAL*	*CRDEPTH*	*PROD*	*OUT*	*VAL*	*CRDEPTH*
	DCRE = 1				*HINC = 1*			
Mean	2.6805	2.4087	0.4469	0.4906	2.5207	2.3315	0.4396	0.3169
Max.	34.9750	25.5436	1.0000	0.8681	34.9758	25.5660	1.0000	0.8681
Min.	0.0000	1.0027	0.0027	0.1508	0.0000	1.0006	0.0006	0.0669
Std. dev.	3.0453	2.3024	0.2137	0.4554	2.8670	2.2718	0.2140	0.1961

Variables	*PROD*	*OUT*	*VAL*	*CRDEPTH*	*PROD*	*OUT*	*VAL*	*CRDEPTH*
	DCRE = 0				*HINC = 0*			
Mean	2.5601	2.2113	0.4247	0.2521	2.6267	2.2164	0.4245	0.3031
Max.	34.9785	25.5709	1.0000	0.5023	34.9785	25.5709	1.0000	0.7624
Min.	0.0000	1.0006	0.0006	0.0669	0.0000	1.0008	0.0008	0.0767
Std. dev.	2.8208	2.0900	0.2070	0.6085	2.8805	2.0670	0.2057	0.1015
Mean test (*t*-Stat.)	8.5419***	19.168***	22.173***	491.59***	−8.4849***	12.629***	17.131***	22.857***

Table 4
Financial depth and firm performance.

All firms	Dependent variables								
	PROD	*OUT*	*VAL*	*PROD*	*OUT*	*VAL*	*PROD*	*OUT*	*VAL*
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*	*Model 8*	*Model 9*
Explanatory variables									
CRDEPTH	0.40339*	0.62343***	0.02776*	0.12837	0.48027***	0.01613	0.43751**	0.28847*	0.01994
	(0.257)	(0.198)	(0.017)	(0.248)	(0.181)	(0.015)	(0.266)	(0.156)	(0.017)
EMP	−0.01573	−0.02943***	−0.00121*	−0.02352***	−0.04029***	−0.00171***			
	(0.010)	(0.008)	(0.001)	(0.008)	(0.006)	(0.001)			
LGDPC	0.25078	0.40189**	0.01839	0.13663	0.24103*	0.02513*			
	(0.240)	(0.185)	(0.016)	(0.220)	(0.145)	(0.013)			
LPOP	0.75743**	0.36853	0.03227	0.62657**	0.10302	0.04609**			
	(0.330)	(0.255)	(0.022)	(0.308)	(0.218)	(0.020)			
CGOV	0.27787**	−0.08445	−0.00225				0.27693	−0.08178	−0.00221
	(0.139)	(0.107)	(0.009)				(0.232)	(0.107)	(0.013)
FOR	−0.13397*	0.08518	−0.00597				−0.12964	0.08919	−0.00575
	(0.080)	(0.061)	(0.005)				(0.110)	(0.061)	(0.007)
LGOV	0.23016*	0.13224	−0.00707				0.22325	0.13034	−0.00740
	(0.137)	(0.104)	(0.009)				(0.243)	(0.104)	(0.011)
RFCAP	0.07790***	0.04679***	0.00796***				0.07822***	0.04673***	0.00797***
	(0.011)	(0.008)	(0.001)				(0.016)	(0.008)	(0.001)
SIZE	−0.16604***	−0.22536***	−0.03578***				−0.16598***	−0.22578***	−0.03578***
	(0.010)	(0.008)	(0.001)				(0.016)	(0.008)	(0.001)
Observations	128,568	133,714	135,234	229,165	239,513	242,172	128,794	133,988	135,513
Number of firms	29,009	29,758	29,882	40,423	41,358	41,452	29,176	29,967	30,096
R-squared	0.453	0.381	0.547	0.383	0.289	0.451	0.454	0.381	0.547
Increase in firm performance due to a 1% increase in CRDEPTH	14.03%	29.08%	13.29%	NA	22.41%	NA	15.21%	13.46%	NA

Notes: Regressions are carried out using a panel data analysis with firm-level and time fixed effects. Robust standard errors are in parentheses. Constants are included but not reported. *** indicates statistical significance at the 1% level, while ** and * indicate statistical significance at the 5% and 10% levels, respectively.

4.2. Financial depth and firm performance

Table 4 presents our empirical results regarding the link between financial depth and firm performance. Greater financial depth is associated with higher firm performance. In other words, firms in provinces with substantial financial depth, measured by the ratio of bank credit to GRDP, exhibit better performance regardless of how we measure firm performance (from model 1 to model 3).[3] In order to ensure robustness, we also run regressions without province-level variables, shown in model 4 to model 6, as well as without firm-level variables, reported in model 7 to model 9. Still, the positive relationship between financial depth and firm performance is not only statistically significant, but also economically noteworthy.

For instance, the standard deviation of *PROD* is 2.8761 when we use *PROD* as the dependent variable and incorporate all province-level and firm-level control variables. Because the coefficient of *CRDEPTH* is 0.4033 and the standard deviation of *CRDEPTH* is 0.1431, a one-standard deviation increase in *CRDEPTH* increases *PROD* by 2.0% (0.4033 × 0.1413). Given that the standard deviation of *CRDEPTH* is 0.1431, then a 1% increase in *CRDEPTH* increases *PROD* by 14.03% (2.0% ÷ 0.1431). When we use *OUT* or *VAL* as the dependent variable, a 1% increase in *CRDEPTH* yields increases of 29.08% and 13.29%, respectively. Models without province-level or firm-level control variables produce similar results in which the link between *CRDEPTH* and firm performance is also economically significant, depending on the measure of firm performance.

4.3. Financial depth and firm performance: the influence of firm-level financing constraints

In Table 5, we examine the potential relationship between financial depth and firm performance for a subgroup of firms with low financial constraints, or high fixed capital ratio (*DFCAP* = 1). We find that the link between financial depth and firm performance is not statistically significant for this subsample. In contrast, Table 6 reports that the link between financial depth and firm performance is statistically significant for firms with low fixed capital ratio (*DFCAP* = 0).That is, firms with higher financial constraints located in provinces with greater financial depth experience higher performance. This finding is consistent with previous studies highlighting the importance of financial sector development to overcome financial constraints that preclude firm investment (e.g., Galindo et al., 2007; Laeven, 2003; Love, 2003).

Moreover, the link between financial depth and the performance of firms with higher financial constraints shown in Table 6 is also economically significant. A 1% increase in *CRDEPTH* is associated with an increase in firm performance by 22% to 33% depending on the measure of firm performance, especially when we incorporate all province-level and firm-level control variables (model 1 to model 3).

For instance, the coefficient of *CRDEPTH* is 0.9084 when we use *PROD* as the dependent variable (Table 6), while the standard deviation of *CRDEPTH* is 0.1298 when *DFCAP* equals 0 (Table 3a). Given that the standard deviation of *PROD* for firms with higher financial constraints (*DFCAP* equals 0) is 2.7508, then a one-standard deviation increase in *CRDEPTH* is associated with an increase in *PROD* by 4.28% ([0.9084 × 0.1298] ÷ 2.7508). This also means that a 1% increase in *CRDEPTH* is associated with an increase in *PROD* by around 33% (4.28% ÷ 0.1298). Our results regarding the link between financial depth and the performance of firms with higher financial constraints are robust regardless of whether we exclude province-level or firm-level control variables from the regression models.

Table 6 also shows formal coefficient tests to ensure that the coefficients of *CRDEPTH* are statistically different when *DFCAP* = 1 and when *DFCAP* = 0. Our Chi-square tests reveal that all coefficients of *CRDEPTH* are statistically different for these two subsamples. It is important to point out that the Chi-square test is not directional. Yet, as the estimate of 0.58978 in model 2 of Table 6 is lower than the corresponding estimate of 0.76241 in Table 5, the hypothesis that financial constraints can be a threshold in the nexus between financial deepening and firm performance is not valid when we measure performance as *OUT*. Only the results for PROD and VAL are consistent with the threshold hypothesis, according to which greater financial deepening can boost the performance of firms with higher financial constraints (i.e., lower fixed capital ratio).

4.4. Financial depth and firm performance: Influence of financial depth and per capita income at the province level

Table 7 assesses the presence of thresholds at the province level. Here, we incorporate the interaction terms between financial depth (*CRDEPTH*) and a dummy of financial depth (*DCRE*), and between financial depth and a dummy of real per capita income (*HINC*).

Regardless of whether we use *PROD* or *OUT* as a measure of firm performance, the positive link between financial depth and performance occurs only when financial depth at the province levels exceeds 15.07%, which is the 75th percentile of the average *CRDEPTH* of all provinces from 2004 to 2013. However, the positive link between financial depth and firm performance does not differ between high-income and low-income provinces.

Our results do not support the “too much finance” hypothesis proved by previous studies (Arcand et al., 2012; Cecchetti & Kharroubi, 2012; Samargandi et al., 2015). Nor do they accord with findings documented by Soedarmono et al. (2017), who analyze the finance-growth nexus using a province-level dataset for Indonesia.

[3] Because about half the sample firms are missing observations for *RFCAP*, in Table 4 we also estimate the nexus between financial depth and firm performance for the subsample of firms with missing values of *RFCAP*. However, the results are not significant.

Table 5
Financial depth and the performance of firms with lower financial constraints (i.e., higher fixed capital ratio).

Less financially constrained firms sample (DFCAP = 1)	Dependent variables								
	PROD	*OUT*	*VAL*	*PROD*	*OUT*	*VAL*	*PROD*	*OUT*	*VAL*
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*	*Model 8*	*Model 9*
Explanatory variables									
CRDEPTH	−0.87101	0.76241	−0.00696	−0.33465	0.36201	−0.01981	−0.62374	0.48539	−0.00317
	(0.701)	(0.508)	(0.038)	(0.533)	(0.395)	(0.031)	(0.529)	(0.410)	(0.032)
EMP	−0.01036	−0.01187	−0.00034	−0.02041	−0.02024	−0.00143			
	(0.028)	(0.019)	(0.002)	(0.020)	(0.014)	(0.001)			
LGDPC	−0.15276	0.39555	0.01318	0.00973	0.04184	0.00931			
	(0.738)	(0.494)	(0.040)	(0.493)	(0.347)	(0.029)			
LPOP	0.66311	0.16074	0.04116	0.57484	−0.32693	0.01399			
	(0.922)	(0.648)	(0.054)	(0.743)	(0.529)	(0.044)			
CGOV	0.64544	0.51146**	0.02498				0.64007	0.51434**	0.02478
	(0.405)	(0.259)	(0.027)				(0.404)	(0.259)	(0.027)
FOR	−0.03549	0.04685	−0.00241				−0.03254	0.04840	−0.00230
	(0.286)	(0.184)	(0.016)				(0.286)	(0.184)	(0.016)
LGOV	0.77175	0.39641	0.03734				0.77088	0.39457	0.03696
	(0.688)	(0.318)	(0.024)				(0.688)	(0.317)	(0.024)
RFCAP	0.04447**	0.00155	0.00248**				0.04503**	0.00151	0.00250**
	(0.019)	(0.014)	(0.001)				(0.019)	(0.014)	(0.001)
SIZE	−0.23080***	−0.33401***	−0.04755***				−0.23060***	−0.33391***	−0.04752***
	(0.034)	(0.030)	(0.002)				(0.034)	(0.030)	(0.002)
Observations	30,274	32,295	32,592	46,369	49,511	49,931	30,329	32,369	32,666
Number of firms	7055	7321	7349	7150	7336	7349	7089	7370	7398
R-squared	0.451	0.426	0.520	0.387	0.335	0.423	0.452	0.426	0.521
Increase in firm performance due to a 1% increase in CRDEPTH	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes: Regressions are carried out using a panel data analysis with firm-level and time fixed effects. Robust standard errors are in parentheses. Constants are included but not reported. *** indicates statistical significance at the 1% level, while ** and * indicate statistical significance at the 5% and 10% levels, respectively.

4.5. Robustness checks

In this stage, we modify our models to ensure the robustness of our findings. Specifically, we incorporate a province-level fixed effect in addition to firm-level and time fixed effects to control for different fundamental characteristics within each province.

Table 8 shows that the positive link between financial depth and firm performance remains significant regardless of the measure of firm performance. Table 9 documents that the positive link between financial depth and firm performance is more pronounced for firms with higher financial constraints (i.e., lower fixed capital ratio), or firms located in provinces with greater financial depth. These results are consistent with our empirical results discussed earlier.

The results with province-level fixed effect also indicate that the positive link between *CRDEPTH* and firm performance is at least partially due to the time-series variation in *CRDEPTH* in each province, and not driven only by the (persistent) cross-regional differences in *CRDEPTH*. The existence of this time-series effect mitigates some concerns regarding omitted variables at the provincial level.

5. Conclusion

Looking at data from a broad set of Indonesian manufacturing firms combined with province-level data from 2004 through 2013, we find that firms in provinces with greater financial depth experience better performance in general, no matter how we measure performance. Further investigation, however, suggests that this relationship is conditional on thresholds at the firm and province levels.

Specifically, greater financial depth is associated with better performance for firms with lower fixed capital ratio (i.e., higher financial constraints). Greater external financing opportunities provided by the banking industry temper the adverse effect of financial constraints on firm investment by reducing firm reliance on internal funding, in turn boosting firm performance. Moreover, this relationship is stronger when financial depth at the province level already exceeds a certain threshold. In addition, unlike previous studies highlighting that per capita income can be a threshold in the finance-growth nexus (e.g., Crouzille et al., 2012; Rioja & Valev, 2004a), our study finds that the link between financial depth and firm performance is identical among provinces with different levels of per capita income.

Table 6
Financial depth and the performance of firms with higher financial constraints (i.e., lower fixed capital ratio).

More financially constrained firms sample (DFCAP = 0)	Dependent variables								
	PROD	*OUT*	*VAL*	*PROD*	*OUT*	*VAL*	*PROD*	*OUT*	*VAL*
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*	*Model 8*	*Model 9*
Explanatory variables									
CRDEPTH	0.90844***	0.58978***	0.04816**	0.76322***	0.79604***	0.06512***	0.80442***	0.24134	0.03415**
	(0.390)	(0.286)	(0.026)	(0.326)	(0.229)	(0.020)	(0.307)	(0.222)	(0.021)
EMP	−0.01932	−0.03451***	−0.00141	−0.02148**	−0.04491***	−0.00223***			
	(0.012)	(0.009)	(0.001)	(0.010)	(0.007)	(0.001)			
LGDPC	0.43297	0.41610*	0.02621	0.23862	0.30201*	0.04282**			
	(0.315)	(0.221)	(0.023)	(0.288)	(0.173)	(0.017)			
LPOP	0.77082*	0.45813	0.03294	0.30498	0.07465	0.04131			
	(0.433)	(0.312)	(0.032)	(0.374)	(0.257)	(0.026)			
CGOV	0.15958	−0.29404	−0.01249				0.16145	−0.29180	−0.01235
	(0.276)	(0.228)	(0.015)				(0.276)	(0.228)	(0.015)
FOR	−0.16611	0.08571	−0.00787				−0.16142	0.09108	−0.00760
	(0.117)	(0.086)	(0.007)				(0.118)	(0.086)	(0.007)
LGOV	0.06059	0.04344	−0.02266*				0.05442	0.03948	−0.02297*
	(0.237)	(0.151)	(0.012)				(0.237)	(0.151)	(0.012)
RFCAP	0.16170***	0.14640***	0.02205***				0.16143***	0.14718***	0.02201***
	(0.040)	(0.029)	(0.002)				(0.040)	(0.029)	(0.002)
SIZE	−0.13662***	−0.18184***	−0.03064***				−0.13686***	−0.18217***	−0.03066***
	(0.019)	(0.015)	(0.001)				(0.019)	(0.015)	(0.001)
Observations	98,294	101,419	102,642	142,954	148,008	149,826	98,465	101,619	102,847
Number of firms	21,954	22,437	22,533	22,117	22,480	22,534	22,087	22,597	22,698
R-squared	0.446	0.348	0.538	0.376	0.278	0.463	0.447	0.349	0.539
Increase in firm performance due to a 1% increase in CRDEPTH	33.02%	29.18%	22.76%	27.75%	39.38%	30.77%	29.24%	11.94%	26.31%
Chi-sq. coef. test for *CRDEPTH* compared with Table 5	33.99***	22.77***	34.42***	26.97***	6.01**	3.48*	63.51***	21.76***	24.36***

Notes: Regressions are carried out using a panel data analysis with firm-level and time fixed effects. Robust standard errors are in parentheses. Constants are included but not reported. *** indicates statistical significance at the 1% level, while ** and * indicate statistical significance at the 5% and 10% levels, respectively.

Table 7
Financial depth and the performance of firms in provinces with greater financial depth and those with higher per capita income.

All firms	Dependent variables					
	Effect of financial depth			Effect of per capita income		
	PROD	*OUT*	*VAL*	*PROD*	*OUT*	*VAL*
Explanatory variables						
CRDEPTH	−0.74729	−0.43399	0.02936	0.38509	0.70331***	0.03444*
	(0.577)	(0.446)	(0.039)	(0.265)	(0.204)	(0.018)
CRDEPTH × DCRE	0.87697**	0.80421***	−0.00122			
	(0.394)	(0.304)	(0.026)			
CRDEPTH × HINC				0.07099	−0.31317	−0.02626
				(0.249)	(0.191)	(0.017)
EMP	−0.01741*	−0.03090***	−0.00121*	0.23973	0.44907**	0.02236
	(0.010)	(0.008)	(0.001)	(0.243)	(0.187)	(0.016)
LGDP	−0.07925	0.10032	0.01884	−0.01547	−0.03060***	−0.00131*
	(0.282)	(0.218)	(0.019)	(0.010)	(0.008)	(0.001)
LPOP	0.50391	0.14086	0.03261	0.76174**	0.35193	0.03087
	(0.349)	(0.269)	(0.023)	(0.331)	(0.255)	(0.022)
CGOV	0.27874**	−0.08362	−0.00225	0.27816**	−0.08566	−0.00236
	(0.139)	(0.107)	(0.009)	(0.139)	(0.107)	(0.009)
FOR	−0.13378*	0.08531	−0.00597	−0.13377*	0.08419	−0.00605
	(0.080)	(0.061)	(0.005)	(0.080)	(0.061)	(0.005)
LGOV	0.22620*	0.12848	−0.00707	0.22940*	0.13577	−0.00679
	(0.137)	(0.104)	(0.009)	(0.137)	(0.104)	(0.009)
RFCAP	0.07805***	0.04691***	0.00796***	0.07793***	0.04671***	0.00796***
	(0.011)	(0.008)	(0.001)	(0.011)	(0.008)	(0.001)
SIZE	−0.16576***	−0.22510***	−0.03578***	−0.16607***	−0.22524***	−0.03577***
	(0.010)	(0.008)	(0.001)	(0.010)	(0.008)	(0.001)
Observations	128,568	133,714	135,234	128,568	133,714	135,234
Number of firms	29,009	29,758	29,882	29,009	29,758	29,882
R-squared	0.453	0.381	0.547	0.453	0.381	0.547

Notes: Regressions are carried out using a panel data analysis with firm-level and time fixed effects. Robust standard errors are in parentheses. Constants are included but not reported. *** indicates statistical significance at the 1% level, while ** and * indicate statistical significance at the 5% and 10% levels, respectively.

Table 8
Robustness check: Financial depth and firm performance.

All firms sample	Dependent variables		
	PROD	*OUT*	*VAL*
Expl. variables	*Model 1*	*Model 2*	*Model 3*
CRDEPTH	0.40339*	0.62343***	0.0278*
	(0.257)	(0.198)	(0.019)
EMP	−0.01573	−0.02943***	−0.00121*
	(0.010)	(0.008)	(0.001)
LGDPC	0.25078	0.40189**	0.01839
	(0.240)	(0.185)	(0.017)
LPOP	0.75743**	0.36853	0.03227
	(0.330)	(0.255)	(0.024)
CGOV	0.27787**	−0.08445	−0.00225
	(0.139)	(0.107)	(0.013)
FOR	−0.13397*	0.08518	−0.00597
	(0.080)	(0.061)	(0.006)
LGOV	0.23016*	0.13224	−0.00707
	(0.137)	(0.104)	(0.010)
RFCAP	0.07790***	0.04679***	0.00796***
	(0.011)	(0.008)	(0.001)
SIZE	−0.16604***	−0.22536***	−0.03578***
	(0.010)	(0.008)	(0.001)
Observations	124,144	129,324	130,863
R-squared	0.555	0.492	0.634

Notes: Regressions are carried out using a panel data analysis with firm-level, province-level, and time fixed effects. Robust standard errors are in parentheses. Constants are included but not reported. *** indicates statistical significance at the 1% level, while ** and * indicate statistical significance at the 5% and 10% levels, respectively.

Table 9
Robustness check: Thresholds in the nexus between financial depth and firm performance.

Expl. variables	Dependent variables											
	DFCAP = 1			*DFCAP* = 0			Interaction with *DCRE*			Interaction with *HINC*		
	PROD	*OUT*	*VAL*	*PROD*	*OUT*	*VAL*	*PROD*	*OUT*	*VAL*	*PROD*	*OUT*	*VAL*
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*	*Model 8*	*Model 9*	*Model 10*	*Model 11*	*Model 12*
CRDEPTH	−0.8710	0.76241	−0.00696	0.90844***	0.58978**	0.04816**	−0.74729	−0.43399	0.02936	0.42555	0.74470***	0.03781*
	(0.599)	(0.463)	(0.034)	(0.336)	(0.255)	(0.023)	(0.674)	(0.483)	(0.043)	(0.303)	(0.232)	(0.020)
CRDEPTH × *DCRE*							0.87697*	0.80421**	−0.00122			
							(0.470)	(0.333)	(0.030)			
DCRE							–	–	–			
CRDEPTH × *HINC*										−0.07732	−0.42934*	−0.03570*
										(0.298)	(0.233)	(0.019)
HINC										–	–	–
Observations	29,147	31,196	31,490	94,997	98,128	99,373	124,144	129,324	130,863	124,144	129,324	130,863
R-squared	0.559	0.533	0.613	0.548	0.463	0.627	0.555	0.492	0.634	0.555	0.492	0.634

Notes: Regressions are carried out using a panel data analysis with firm-level, province-level, and time fixed effects. Robust standard errors are in parentheses. All control variables and constants are included, but not reported. *** indicates statistical significance at the 1% level, while ** and * indicate statistical significance at the 5% and 10% levels, respectively.

On the whole, our empirical findings suggest that manufacturing firms in Indonesia may benefit from greater financial deepening, but such benefits are conditional on factors at the firm and province levels. Strategies to enhance greater access to finance for manufacturing firm productivity therefore need to be tailored to firm-level and province-level characteristics.

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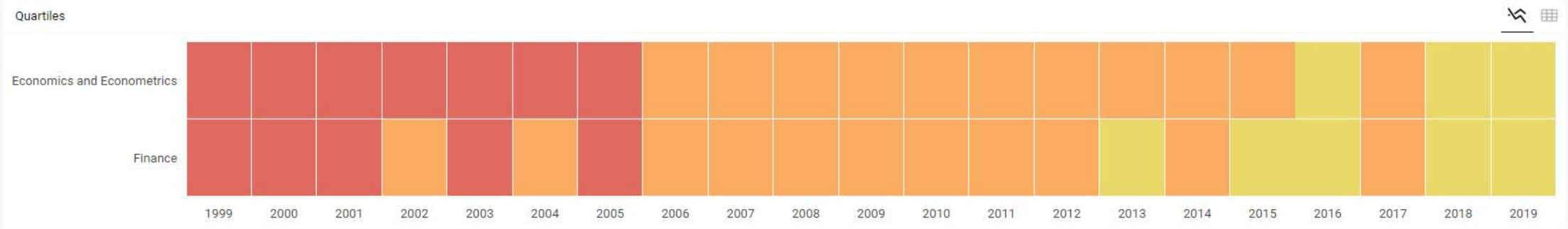
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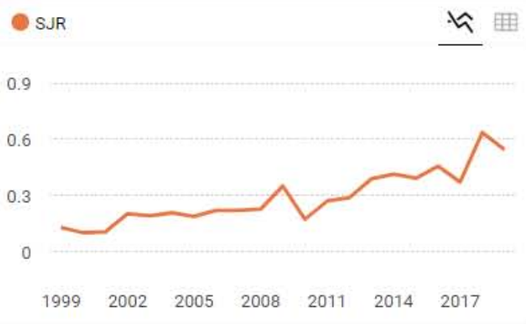

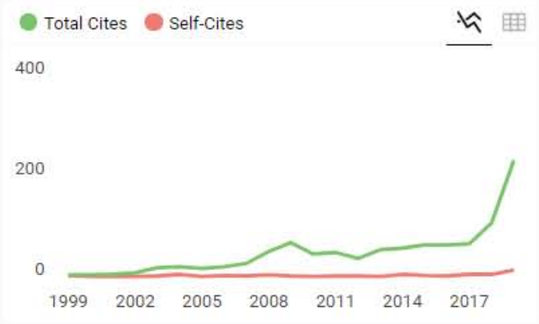

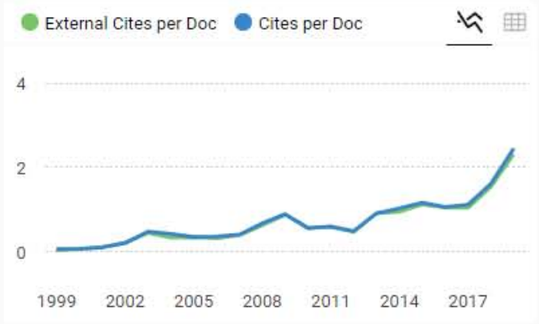

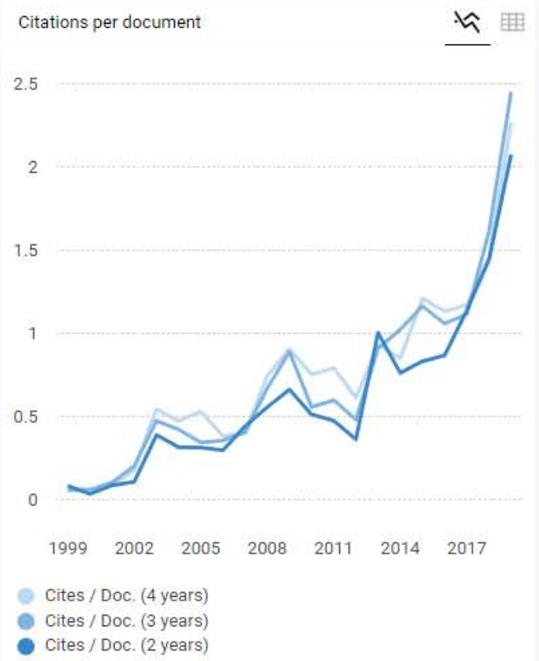

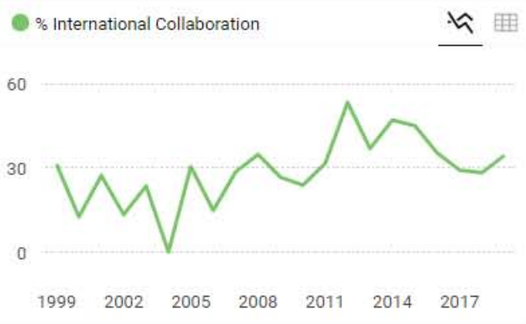

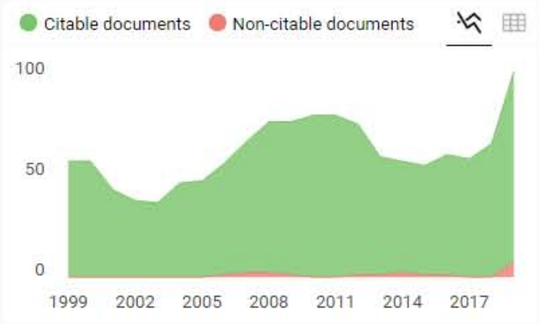

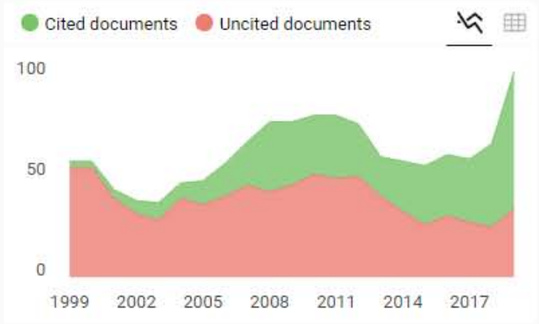

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