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Filling the Gap: Digital Credit and Financial Inclusion**Prepared by Majid Bazarbash and Kimberly Beaton***

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Abstract

Can fintech credit fill the credit gap in the consumer and business segments? There are few cross-country studies that explore this question. Focusing on marketplace lending, an important part of fintech credit, we use data for 109 countries from 2015 to 2017 to study the relationship between fintech credit to businesses and consumers and various aspects of financial development. Marketplace lending to consumers grows in countries where financial depth declines highlighting the role of fintech credit in filling the credit gap by traditional lenders. This result is particularly strong in low-income countries. In the business segment, marketplace lending expands where financial efficiency declines. Our findings show that low-income countries take advantage of the fintech credit opportunity in the consumer segment but face important challenges in the business segment.

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GLOSSARY

APD	Asian and Pacific Countries
AFR	African Countries
CCAF	The Cambridge Center for Alternative Finance
EME	Emerging Market Economies
EUR	European Countries
LIC	Low-Income Countries
MCD	Middle East and Central Asia
P2P lending	Peer-to-Peer Lending
SMEs	Small and Medium-Sized Enterprises
WEF	The World Economic Forum
WHD	Western Hemisphere Countries

I. INTRODUCTION

Limited access to credit is an important hurdle for consumers and small and medium-sized enterprises (SMEs) in many countries, with potentially significant macroeconomic consequences. Research shows that financial development—depth, access and efficiency—is important for enhancing economic growth and lowering inequality.¹ However, the International Finance Corporation estimates that 41 percent of SMEs in the formal sector in developing countries have unmet financing needs.² Barriers to access to credit is also prevalent in the consumer segment. According to the World Bank, about 60 percent of adults in developing countries do not use any formal financial services.³

Smaller borrowers' access to credit is limited by a number of different barriers. At the most basic level, credit constraints can come from lack of physical access to bank branches. More complex barriers may reflect potential borrowers' lack of documentation and credit history, particularly where credit bureaus or registries are not available and legal protection for creditors are weak or inadequate.⁴ In such circumstances, traditional lenders often rely on collateral to manage credit risk, but a weak collateral registry system or absence of a legal framework that allows for use of movable collateral may be other inhibiting factors. All these barriers can reduce credit access and contribute to the relative high cost of finance faced by borrowers with limited credit histories.

In recent years, digital credit has evolved in various forms and holds promise for expanding access to credit by overcoming some of these barriers.⁵ Fintech credit involves new business models that use modern technology to digitize at least some aspect of the credit extension process. Fintech credit could come in form of crowdfunding—also called marketplace lending—where a digital platform is developed that directly connects lenders to borrowers. This paper focuses on this aspect of fintech credit, and when using the term fintech credit it refers to marketplace lending. Another form of digital credit has evolved through non-finance corporations with a critical location in the supply chain that allows them to access digital footprints of borrowers—such as telecom and mobile payment companies like Safaricom or e-commerce platforms like Amazon—and use that information for assessing credit risk and identifying potential demand for credit.⁶ This paper does not cover such fintech lending.

¹ See Sahay and others (2015). Beck et al. (2007) show that financial development accounts for about a third of the variation in poverty reduction rates across countries.

² See <https://www.smefinanceforum.org/data-sites/msme-finance-gap>

³ <https://www.worldbank.org/en/topic/financialinclusion/brief/achieving-universal-financial-access-by-2020>

⁴ See also Carstens (2019), Patwardhan and others (2018) and IFC (2017, 2019) for an overview of the barriers to financial inclusion and how fintech may help to overcome these barriers. See WEF (2015) for a discussion of how fintech could alleviate SME financing challenges.

⁵ See IMF's Bali Fintech Agenda (2018), IMF (2019a, b), and Philippon (2016, 2019).

⁶ For a discussion of applications of machine learning in credit assessment, see Bazarbash (2019).

A growing literature has focused on various aspects of fintech lending using micro-data (de Roure and others, 2016, Zhanga and others, 2016, Freedman and Jin, 2017, Jagtiani and Lemieux, 2017, Berg and others, 2018, Havrylchuk and others, 2019). However, few cross-country studies exist. Data availability is an important reason that has limited cross-country studies. We offer a selective review of literature in the next section.

In this paper, we study the marketplace lending component of fintech financing that is the general universe of any financing activity that leverage innovative technology to issues debt or equity. Marketplace lending consists of lending where the funding is partly or completely open to retail investors.⁷ When funding is entirely open to public and the platform matches borrowers with a pool of lenders, the platform is called peer-to-peer (P2P) lending. If in addition to being open to public investors, the platform uses its own funds in lending to borrowers, this is called “balance sheet lending”.⁸ For the specific purpose of lending against account receivables of business borrowers, the term “invoice trading” is often used. As Figure 1 shows, our sample comprises P2P lending and balance sheet lending (for business and consumer borrowers) and invoice trading.⁹ Our study does not include Big tech lending—such as credit by e-commerce platforms—, digital lending by banks and by mobile platforms as none of these models are open to the public.

Figure 1. Sample Coverage from the Universe of Fintech Financing

Sample includes shaded areas in yellow.

			Source of Funding		
			Public Investors	Own Funds/1	Not open to public/2
Fundraiser Type	Consumer	Personal Loan	P2P Consumer Lending	Balance Sheet Consumer Lending	e-commerce loans, bank online lending, mobile digital lenders (BigTech Lenders)
		Mortgage Loan	P2P Mortgage Lending	Balance Sheet Real Estate Lending	
Business	Account Receivables	Invoice Trading	Invoice Trading		
	Working Capital	P2P Business Lending	Balance Sheet Business Lending		
	Capital Expenditure	P2P Business Lending	Balance Sheet Business Lending		
	Equity	Equity Crowdfunding	Equity funding	Equity funding	

1/ Mix of own funds and funding by the public.

2/ Own funds and/or funds by institutional investors.

⁷ Another common term used is crowdfunding that is any funding (for debt, equity, reward or donation purposes) that is partly or entirely open to the public (the “crowd”). Marketplace lending is the debt component of crowdfunding.

⁸ Pure balance sheet lending where the platform uses its own funds or funds from institutional investors are shown in the last column of Figure 1 and not included in our sample.

⁹ We exclude mortgage lending as it involves particular features such as being highly collateralized that makes its determinants different from other loan types. Similarly, we omit equity crowdfunding. Claessens and others (2018) take a similar approach.

This paper makes several contributions to the fintech literature. First, we document stylized facts of development of marketplace lending across regions and countries. We use data collected by the Cambridge Center for Alternative Finance (CCAF) for 109 countries from 2015 to 2017 for digital credit intermediated via crowdfunding platforms to households and businesses. The CCAF data is currently the only global dataset with a reasonable consistency and coverage of alternative financing. Second, we conduct panel regressions to evaluate the role of economic, technological, and financial development in driving marketplace lending activity in countries. Specifically, we study how marketplace lending in business and consumer segments evolve in response to changes in main subcomponents of financial development—depth, access, and efficiency. Third, we examine the role of economic structural features in explaining cross-country differences in marketplace lending activity. We assess the role of information, regulation, geographical barriers and banking sector profitability and concentration.

The rest of the paper is organized as follows. Section II reviews prior literature. Section III presents stylized facts of the evolution of marketplace lending around the world. Section IV describes the regression analysis to explore enabling conditions for development of marketplace lending. Section V concludes.

II. LITERATURE REVIEW

Several studies have highlighted and discussed limitations of access to credit among small borrowers, including households and SMEs. There is a large literature documenting limited access of SMEs to finance as potentially among the main barriers of the growth of the sector, notwithstanding its large share in aggregate production and employment. Using firm-level data and bank surveys, Ayyagari and others (2017) identify lack of reliable credit information, lack of suitable collateral, and weak legal institutions as the most important constraints that impede access to finance by SMEs.¹⁰ On limitations of households' access to finance, Carstens (2019) lists lack of trust in the financial system, possibly arising from financial illiteracy, unaffordable costs of financial services, and lack of documentation including basic identification document among main barriers to usage of financial services particularly among the poor population. The World Economic Forum (WEF, 2015) attributes the low access to finance by SMEs to their high complexity yet small scale which together make assessing their credit worthiness too expensive for traditional lenders. In addition, WEF cites regulatory pressures to reduce banks' exposure to risky loans, as a factor behind banks' reduced lending to SMEs. From the demand-side, SMEs often lack the skills and resources to seek financing that corresponds to their level of risk (WEF, 2015).

There is growing evidence that fintech has increased access to credit for small borrowers both in advanced and emerging economies. In advanced economies, like the United States

¹⁰ According to Alvarez and others (2011), about 80% of capital stock of enterprises in developing economies was in the form of movable assets such as machinery equipment and receivables, which banks are reluctant to accept as collateral particularly in countries with inadequate legal and regulatory environments.

and the United Kingdom, where credit from traditional lenders is typically widespread, at least some of the borrowers from P2P lending platforms had previously been declined credit from banks before turning to fintech credit (Nesta, 2014, US Department of Treasury, 2016 and 2018, de Roure and others, 2016). Jagtiani and Lemieux (2017) show that consumer lending from Lending Club, a large US-based P2P lending platform, has penetrated areas with a declining trend in the number of bank branches and areas with a more concentrated banking industry. They find that credit scoring by Lending Club contained more information relative to the standard FICO score—an indicator of credit risk of small borrowers commonly used by banks in the United States. The superior credit rating is shown to result in lower interest rates for borrowers from the platform compared with similar borrowers from banks. Hau and others (2018) use data from Alibaba’s ecommerce platform and show that fintech credit can overcome credit frictions such as geographical barriers. More recently, Havrylchyk and others (2019) used data from Prosper, a large US-based P2P lending platform, and Lending Club to explore main drivers of P2P lending to consumers in the United States. Their study shows that P2P credit filled the unmet demand for credit that arose as banks were deleveraging in the aftermath of the global financial crisis.¹¹ However, in contrast with Jagtiani and Lemieux (2017), they find that higher bank concentration adversely affects entry and expansion of P2P lending.

Recent research has studied the interaction between fintech lenders and traditional bank lending.¹² Fuster and others (2019) study P2P mortgage lending in the US and show that the market share of fintech lenders increased from 2 percent to 8 percent from 2010 to 2016. They show that by leveraging digital technology, fintech mortgage lenders increased the speed of application process by 20 percent. P2P mortgage lenders do not appear to target customer lacking access to traditional markets but mostly compete with traditional mortgage lenders. Tang (2019) provides a conceptual analysis and empirically evaluates whether fintech credit is a substitute for bank lending in consumer credit market or fintech complements bank lending by reaching out to lower-quality underserved borrowers. The author exploits the regulatory tightening of underwriting standards by banks in 2010 to find that while P2P lending complements bank lending for small loans and therefore expands access to credit for small borrowers, it competes with banks in capturing high-quality borrowers at similar terms.

Another strand of literature in fintech credit aims at explaining cross-country differences in development of digital credit. Claessens and others (2018) and Rau (2019) use CCAF data to explain cross-country differences in crowdfunding. Claessens and others (2018) find that marketplace lending per capita is higher in countries with higher income per capita. They

¹¹ According to data from TransUnion reported by CNBC, Fintech credit to consumers accounts for 38 percent of personal loan market in 2018 amounting to US\$138 billion surpassing banks, credit unions and other traditional creditors in the market as of 2017. The share of fintech credit to consumers was 5 percent in 2013. (<https://www.cnbc.com/2019/02/21/personal-loans-surge-to-a-record-138-billion-in-us-as-fintechs-lead-new-lending-charge.html>)

¹² For a review of recent fintech literature in finance, see Goldstein and others (2019).

also find that fintech credit per capita is greater in countries where banking sector regulations are less stringent, and the banking sector is less competitive. Rau (2019) finds that aggregate marketplace finance activity (including equity financing, donation and rewards and credit) is positively associated with income per capita, financial depth, profitability of banks, concentration in banking, depth of credit information, and quality of regulation.¹³

III. STYLIZED FACTS

This section takes stock of the evolution of marketplace lending—to businesses and households—across countries and regions and discusses its macrofinancial significance. Data on marketplace lending is scarce. We obtained marketplace lending data from the Alternative Finance Industry Benchmarking Survey of marketplace lenders conducted by CCAF, the most comprehensive global dataset on alternative finance.¹⁴ The survey is annual and includes information on gross new originations of debt, equity, reward and donation-based¹⁵ alternative finance globally. Debt-based alternative finance is disaggregated by new originations of credit to consumers and businesses. The survey is at the level of individual alternative finance providers, supplemented with other publicly available information, and aggregated to country-level data. Data covers 109 countries from 2015 to 2017.¹⁶

Internationally, marketplace fintech lending has been rising rapidly with most of the growth occurring in the consumer segment. Figure 2 displays the international evolution of marketplace lending. Marketplace lending has more than tripled from 2015 to 2017 reaching US\$400 billion. Globally, marketplace lending has been concentrated in consumer credit—69 percent of total marketplace lending originations in 2017—with growth in fintech consumer credit originations significantly outpacing that for fintech business credit originations—62 versus 26 percent in 2017.

Three clusters have emerged for marketplace lending composition across countries. The first group, consisting of mostly low-income countries (LIC), had only consumer fintech activity with a maximum total new origination of US\$30 million in 2017. The second group consists of countries with only marketplace lending to businesses and included seven advanced economies (AE) and two emerging market economies (EME). The relative size of

¹³ Frost (2020) summarizes cross-country evidence on fintech in general and discuss various implications for differences in fintech adoption including fintech credit.

¹⁴ A more comprehensive overview of the survey and its methodology can be found in Rau (2019).

¹⁵ Reward-based crowdfunding platforms contribute money to projects or ideas in exchange for some form of reward rather than shares of the company as in equity crowdfunding. For example, ArtistShare is an example of a fan-funding website who support artists. Donation-based crowdfunding platforms aggregate donations by small donors for good deeds. For example, FundMyTravel hosts campaigns by travelers.

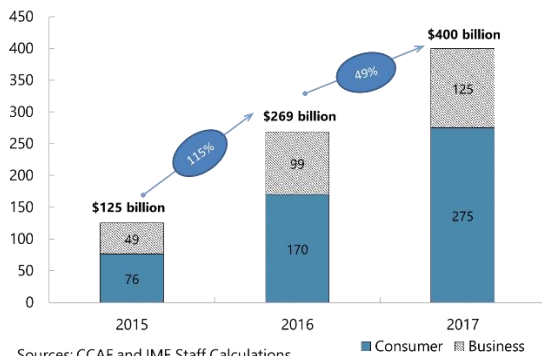
¹⁶ As the CCAF data captures total gross new originations of alternative finance, our definition of fintech credit similarly captures gross new originations of fintech credit. The data does not account for repayments. Therefore, our measure of fintech credit is not directly comparable to traditional indicators of credit to the private sector, measured as an end-of-period stock, or the change in such measures given that the stock reflects debt repayments. Thus, the amount of new fintech credit originated in a given year may be less than the stock of fintech credit if the maturity of fintech credit is very long (short), the amount of new fintech credit originated in a given year may exceed the stock of fintech credit. For example, based on data from WDZJ.com, the average term of a marketplace loan in China was 15.8 months as of April 2019.

marketplace lending activity in this cluster is an order of magnitude larger than the previous cluster. The third cluster consists of countries with marketplace lending activity in both business and consumer segments. This group includes 23 AEs, 23 EMEs and 10 LICs. This group had the highest marketplace lending activity and appeared to be at a more mature stage relative to previous groups.

Figure 2. Marketplace Lending Across the Globe

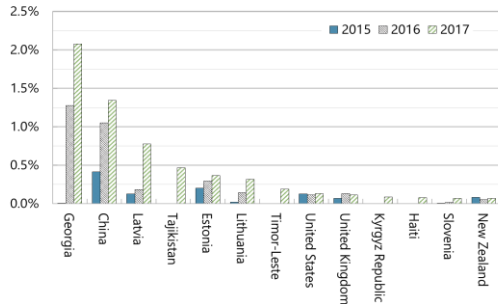
International marketplace lending has been rapidly growing ...

Global Fintech Lending by Main Segments
(in billions of USD)



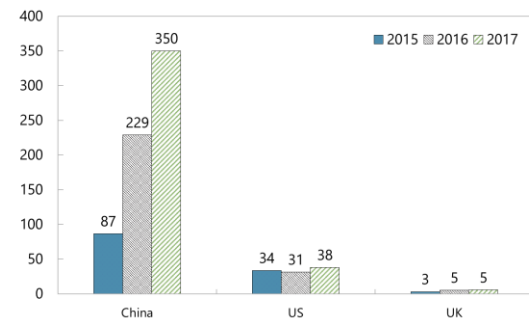
Nonetheless, the size of marketplace lending is still a small share of credit markets ...

Total Fintech Credit in Global Markets
(in percent of credit to private sector by banks)



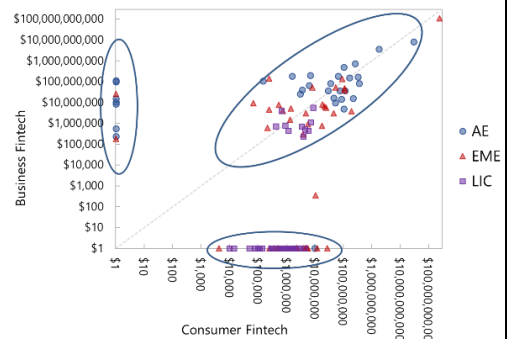
China, US and UK dominate marketplace lending comprising 98.3 percent of global activity.

Fintech Lending in Top Three Markets
(in billions of USD)



... with three clusters of countries emerging in the composition of loans to consumers and businesses.

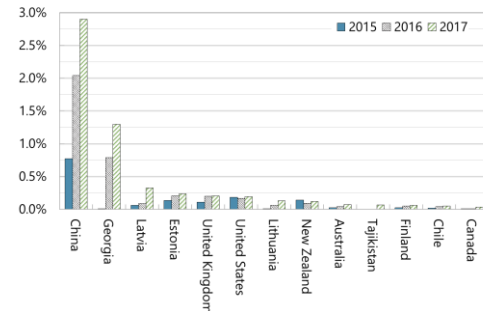
Fintech Credit Composition
(both axes in USD)



Source: CCAF and IMF Staff Calculations. Axes are shown in log scales

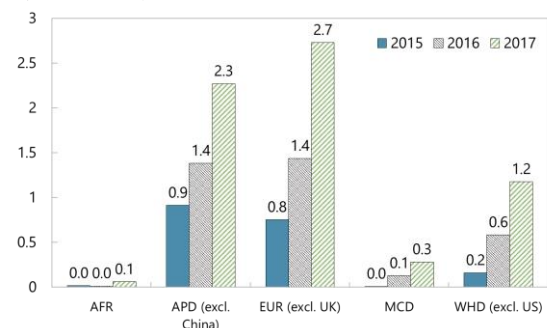
... and less than 0.5 percent of GDP in most countries, therefore it is yet to be systemically important.

Total Fintech Credit in Global Markets
(in percent of nominal GDP)



Marketplace lending has been rising across all regions in the world.

Fintech Lending by Region
(in billions of USD)



Marketplace lending has yet to reach systemic importance or replace incumbent financial institutions. Marketplace lending originations remained universally small as a proportion of credit from traditional financial intermediaries, exceeding 1 percent of credit from traditional intermediaries only in Georgia (2.1 percent) and China (1.3 percent) in 2017, suggesting that fintech has yet to replace the role of incumbent financial institutions in credit provision. Similarly, in terms of GDP, other than these two countries, all other countries had marketplace lending originations less than 0.4 percent. More detailed data for the U.K, for example, suggests that less than 0.1 percent of UK SMEs have borrowed from a marketplace lender and that about 4 of every 1,000 adults has borrowed from a marketplace lender. Similarly, in China, about 5 of every 1,000 adults has borrowed from a marketplace lender compared to over 427 per 1,000 adults from commercial banks (UK P2PFA and the IMF's Financial Access Survey).

Globally, while the volume of marketplace lending is concentrated in three countries, it has been growing rapidly also in Europe, Asia and Western Hemisphere countries. China, the United States, and the United Kingdom are leaders in marketplace lending, accounting for 98 percent of global activity. China alone accounts for 86 percent but has faced challenges in recent years. While at a smaller scale, marketplace lending has been growing robustly across regions with the highest activity occurring in the Europe (EUR), Asian and Pacific countries (APD), and Western Hemisphere (WHD) countries. There is nascent but growing activity in the Middle East and Central Asia (MCD) as well as African (AFR) regions.

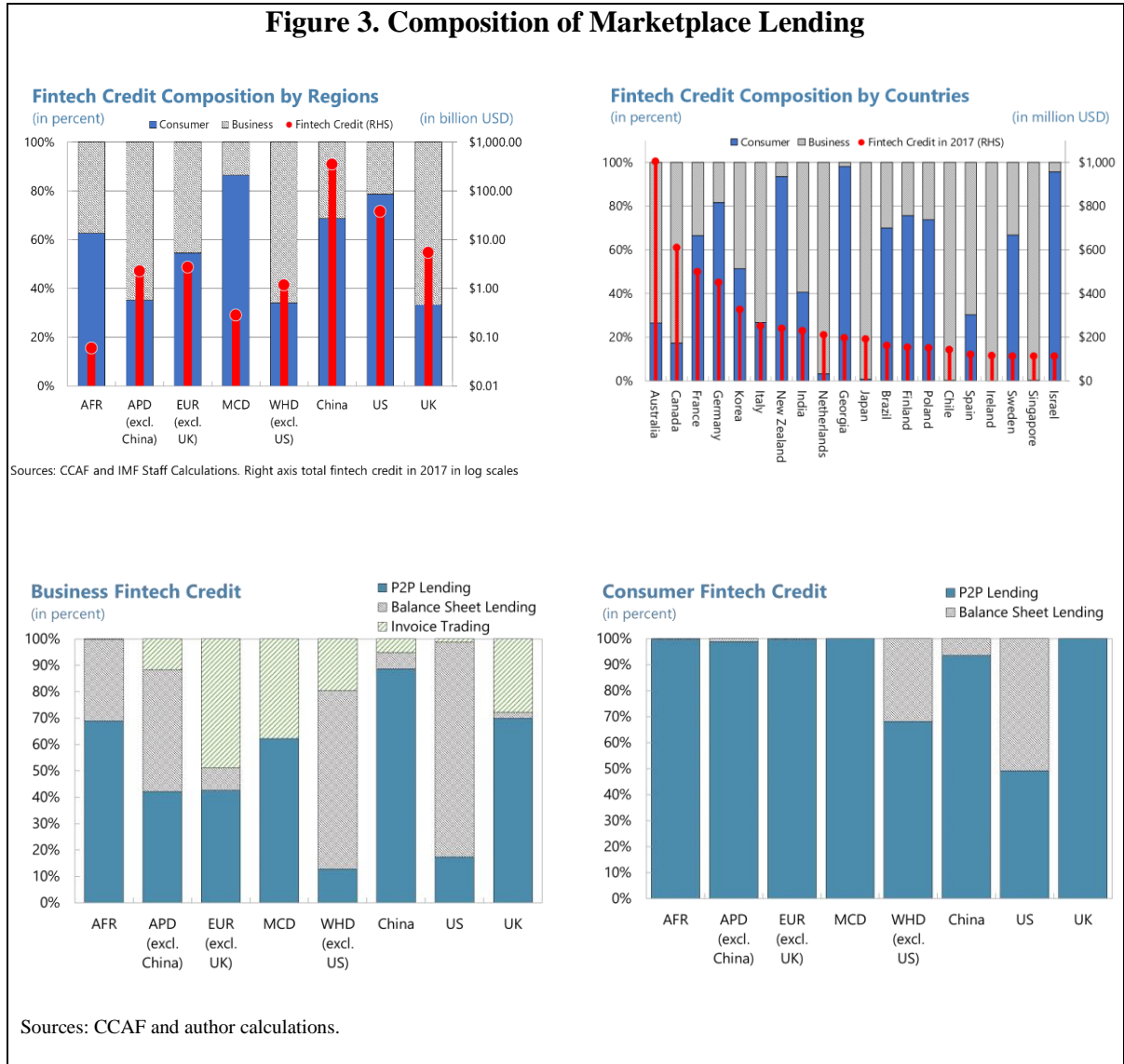
More granular data for China and the UK shows high concentration in the marketplace lending industry. In the UK, three top marketplace lenders facilitating small business loans accounted for 60 percent of all business lending through online crowdfunding platforms in 2017Q1. The total business loans originated by these platforms more than tripled in three years increasing from US\$660 million in 2014 to US\$2.9 billion in 2017. In the P2P lending to consumers market, top two platforms had two-thirds of the market share. There was also a sharp increase in consumer lending by these platforms going up from US\$790 million in 2014 to US\$2.5 billion in 2017. In China, the top five P2P lending platforms (out of more than 500 platforms) had a 25 percent market share in 2019.

Recent data for China suggests that the increasing trend in P2P lending has reversed course since 2017. According to WDZJ.com, the transaction volume of loans originated through P2P lending platforms surged from US\$6 billion in the first quarter of 2014 to US\$113 billion in third quarter of 2017 but declined to US\$30 billion in the third quarter of 2019. Huang (2018) attributed the rapid increase in the period before 2017 to deep penetration of internet, large availability of funds and unmet financial needs especially among small borrowers.¹⁷ This period was, however, associated with platforms that mismanaged funds and engaged in Ponzi schemes inducing a regulatory response that led to closure of many platforms and shrinkage of P2P lending.

¹⁷ According to WDZJ's survey in 2017, more than 80 percent of borrowers from P2P platforms in China were between 20 and 40 years old and more than half of borrowers made a monthly salary less than US\$600.

The composition of marketplace lending differs across regions and countries. The top two panels in Figure 3 show the composition of marketplace lending by consumer and business segments across regions (left) and top 20 countries (right) in 2017. Lending to consumers is the dominant segment in MCD and AFR as well as in China and the US, but no apparent pattern exists across countries by the size of activity. The second row in Figure 3 displays composition of marketplace lending by business models. While P2P lending appears as the dominant form across the board (except for US), there is no consistent pattern for business lending.

Figure 3. Composition of Marketplace Lending



IV. ENABLING CONDITIONS FOR FINTECH CREDIT

In this section, we explore drivers of marketplace lending across and within countries.¹⁸ What is the role of basic infrastructure—technology, information, legal—in the development of marketplace lending? Does marketplace lending develop in countries with more developed financial sector or does fintech lending complement lack of access to finance? Does marketplace lending overcome geographical barriers in access to credit? Do features of banking sector matter for marketplace lending?

A. Methodology

We use panel regression analysis with country fixed effects. We also discuss the results of fixed-effect (within) regressions and between regressions. This approach is useful to address two types of questions. First, what is the effect of a change in a driver on marketplace lending in a specific country controlling for all country-specific features? This question is addressed by the fixed-effect regression. Second, what are potential channels that describe differences in development of fintech across different countries? We address this question by the between regression with the general caveat that the regression could be subject to omitted variable bias.¹⁹ The advantage of the between regression is that it allows for incorporating slow-moving factors that would otherwise be omitted in a fixed-effect regression.

For the dependent variable, we use the logarithm of the total new originations of marketplace lending as a share of a country's nominal GDP. As we do not have separate measures of the number of borrowers from traditional credit market versus fintech lenders, we adopt an indirect strategy to assess the contribution of fintech credit to financial inclusion relative to banks. We hypothesize that fintech credit fills a gap when we find a negative relationship with traditional financial depth—that is when traditional financial depth declines in a country, marketplace lending increases. While a negative relationship could also indicate fintech credit substitutes traditional credit by taking over the market share, success stories of fintech credit and micro-evidence in the literature show fintech credit developed by capturing underserved customers. In the absence of cross-country data that reveals whether fintech borrowers did not have access to traditional markets or preferred to use fintech credit over traditional markets, we assume the former is the dominant case in our sample noting that our sample pertains to early stage of fintech credit development. Therefore, we normalize marketplace lending by nominal GDP to measure the depth of marketplace lending relative to the size of the economy. We run regressions for three output variables—total, business, and consumer marketplace lending.

¹⁸ In this section, we refer to marketplace lending as fintech credit, and marketplace lending to consumers as fintech consumer credit, and marketplace lending to businesses as fintech business credit.

¹⁹ The between regression estimates the relationship between time averages of the dependent variable and independent variables (Baltagi, 2008). Therefore, these results are comparable to prior literature such as Calessens and others (2018) who use cross-sectional regressions.

As seen in the previous section, the size of marketplace lending is insignificant relative to aggregate economic variables, which allows us to assume marketplace lending is not large enough to have a material impact on the behavior of traditional lenders and aggregate economy. As a result, we assume our explanatory variables are exogenous relative to marketplace lending development.

Considering the short sample period, some of the potential drivers of marketplace lending are either slow moving or constant over the sample period and are therefore excluded from the fixed-effect model. To study the potential impact of these variables, we include them in the between regressions. These variables capture availability of information, strength of legal system, geographical barriers and features of the banking sector prior to the sample start date. We include other drivers of fintech in both types of regressions. These aspects are economic development, financial development and adoption of internet. Additionally, we explore interactions between selected drivers, which we describe in more details as we present the results.

Comparison with Prior Literature

Two studies are most closely related to our work: Claessens and others (2018) and Rau (2019). Our approach differs from these studies in three important ways. First, thanks to the most recent sample by CCAF, our sample has a significantly wider coverage—it includes 105 countries and the period from 2015 to 2017 as opposed to data for 63 countries in 2016 in Claessens and others (2018) and data for same number of countries as ours but years 2015 and 2016 by Rau (2019). Second, we use both fixed-effect panel regression and cross-sectional regression to capture different aspects of fintech developments: within country drivers of marketplace lending and cross-country differences. Other studies only use cross-sectional approach. Third, in the absence of inclusion measures such as the number of marketplace lending users without access to formal credit market, we normalize marketplace lending by GDP as a second best alternative that accounts for the scale of the economy. We further use logarithmic transformation to control outliers. Instead, Claessens and others (2018) use marketplace lending per capita without any transformation and control for outlier countries (top three markets) through a dummy variable. Rau (2019) takes a similar approach in dealing with outliers and focuses on aggregate crowdfunding activity as the dependent variable, which includes equity financing, donation and rewards in addition to credit. However, it is unclear if these different forms of crowdfunding are driven by same factors and with similar sensitivities.

B. Results: Fintech Credit Drivers

Table 1 presents selected statistical properties and sources of variables used in our regressions.²⁰ Following our methodology, we present our results in two subsections. In this subsection, we use fixed-effect regressions to explore drivers of marketplace lending within a country. To this end, we use results of Tables 2, 3 and 4 that report estimation results of

²⁰ We used a number of variables in our robustness tests, which we do not report in this table.

fixed-effect regressions using country-level total fintech, business fintech and consumer fintech relative to GDP as the dependent variable, respectively.

Economic Development

We first explore whether higher economic development leads to higher marketplace lending. We expect demand for marketplace lending to grow with higher per capita income as a general channel that raises repayment capacity of borrowers. Higher income per capita could also mean higher supply of credit particularly for fintech credit as marketplace lending enables small investors to lend on the fintech platform.

Results of the fixed-effect regressions show a highly significant effect of increased income per capita for marketplace lending. This relationship holds under different specifications that control for other drivers in addition to country fixed effects. As we do not have data for fintech investment versus borrowing, we cannot distinguish between the supply and demand channels. Tables 3 and 4 reveals that higher income has a positive influence for both consumer fintech and business fintech.

Table 1. Descriptive Statistics of Variables

Variable	Source	Mean	Std. Dev.	Min	Max
log (total fintech credit/GDP)	Fintech credit data by CCAF World Development Indicators by World Bank	-9.62	2.08	-15.87	-3.55
log (business fintech credit/GDP)	Fintech credit data by CCAF World Development Indicators by World Bank	-10.26	2.14	-18.53	-4.70
log (consumer fintech credit/GDP)	Fintech credit data by CCAF World Development Indicators by World Bank	-10.09	2.32	-15.45	-3.92
log (GDP ppp per capita)	World Development Indicators by World Bank	9.39	1.19	6.60	11.48
Advanced Economies Indicator	IMF	0.28		0.00	1.00
Low-Income Countries Indicator	IMF	0.34		0.00	1.00
Internet Users (% of population)	World Bank, International Telecommunication Union, World Telecommunication/ICT Development Report and database.	52.56	28.36	1.76	97.30
Depth of Credit Information	World Bank, Doing Business project	5.70	2.76	0.00	8.00
Financial Development Index	Sahay and others (2015)	0.48	0.22	0.12	1.00
Financial Depth	Sahay and others (2015)	0.34	0.29	0.00	1.00
Financial Access	Sahay and others (2015)	0.39	0.27	0.02	1.00
Financial Efficiency	Sahay and others (2015)	0.67	0.15	0.23	0.89
Average Bank Concentration (2010-2014)	World Bank, Global Financial Development Database	76.01	15.68	27.51	100.00
Traditional Financial Inclusion	Sahay and others (2020)	0.39	0.25	0.02	0.89
Fintech Financial Inclusion	Sahay and others (2020)	0.46	0.22	0.12	1.00
log (Urban area/Land area)	World Bank	-3.21	1.36	-7.36	-0.15
Average Return on Bank Assets (2010-2014)	IMF FSIs	1.29	1.13	-2.78	5.53

Table 2. Drivers of Total Marketplace Lending: Fixed-Effect Regressions

Dependent variable is logarithm of total marketplace lending to GDP. Sample period is 2015 to 2017.

	(1)	(2)	(3)	(4)	(5)
GDP per capita	10.66*** (0.002)	9.94*** (0.007)	13.18*** (0.000)	13.62*** (0.001)	14.11*** (0.000)
internet users	0.26*** (0.000)	0.25*** (0.000)	0.26*** (0.000)	0.29*** (0.000)	0.25*** (0.000)
Financial Development	-5.07 (0.654)	1.50 (0.928)			
AE * Financial Development		-21.61 (0.312)			
LIC * Financial Development		-6.21 (0.778)			
Financial Depth			-24.60*** (0.000)	-43.01*** (0.006)	-54.20** (0.026)
AE * Financial Depth				20.63 (0.159)	
LIC * Financial Depth				-131.43 (0.642)	
Financial Access			4.73 (0.522)	20.92 (0.105)	-38.90 (0.146)
AE * Financial Access				-14.81 (0.342)	
LIC * Financial Access				-143.06* (0.070)	
Financial Efficiency			0.79 (0.834)	0.79 (0.856)	-17.30*** (0.000)
AE* Financial Efficiency				1.61 (0.782)	
LIC * Financial Efficiency				6.46 (0.366)	
Bank Concentration * Financial Depth					0.42 (0.153)
Bank Concentration * Financial Access					0.56 (0.151)
Bank Concentration * Financial Efficiency					0.34*** (0.000)
Constant	-126.70*** (0.000)	-115.98*** (0.001)	-146.74*** (0.000)	-149.28*** (0.000)	-152.62*** (0.000)
Observations	208	208	208	208	207
R-squared	0.52	0.53	0.56	0.60	0.59
Number of Countries	103	103	103	103	102

Robust p-values in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3. Drivers of Business Marketplace Lending: Fixed-Effect Regressions

Dependent variable is logarithm of business marketplace lending to GDP. Sample period is 2015 to 2017.

	(1)	(2)	(3)	(4)	(5)
GDP per capita	14.18*** (0.001)	14.23*** (0.002)	13.09*** (0.001)	13.50*** (0.004)	13.08*** (0.001)
internet users	0.08 (0.527)	0.08 (0.523)	0.08 (0.576)	0.07 (0.695)	0.07 (0.616)
Financial Development	-26.17*** (0.006)	-35.48** (0.019)			
AE * Financial Development		9.42 (0.648)			
LIC * Financial Development		31.58* (0.096)			
Financial Depth			-8.55 (0.463)	6.16 (0.873)	11.11 (0.784)
AE * Financial Depth				-16.96 (0.636)	
LIC * Financial Depth				-80.89 (0.640)	
Financial Access			-17.05 (0.263)	-22.54 (0.580)	-42.61 (0.444)
AE * Financial Access				6.81 (0.852)	
LIC * Financial Access				-186.41*** (0.002)	
Financial Efficiency			-6.55** (0.029)	-12.49** (0.038)	-14.39* (0.072)
AE* Financial Efficiency				9.31 (0.202)	
LIC * Financial Efficiency				16.39** (0.026)	
Bank Concentration * Financial Depth					-0.30 (0.570)
Bank Concentration * Financial Access					0.35 (0.595)
Bank Concentration * Financial Efficiency					0.14 (0.343)
Constant	-142.29*** (0.000)	-141.69*** (0.001)	-129.21*** (0.001)	-130.78*** (0.004)	-127.73*** (0.001)
Observations	154	154	154	154	154
R-squared	0.26	0.27	0.27	0.29	0.27
Number of Countries	68	68	68	68	68

Robust p-values in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4. Drivers of Consumer Marketplace Lending: Fixed-Effect Regressions

Dependent variable is logarithm of consumer marketplace lending to GDP. Sample period is 2015 to 2017.

	(1)	(2)	(3)	(4)	(5)
GDP per capita	8.16*	4.39	12.73***	6.60*	13.29***
	(0.051)	(0.177)	(0.005)	(0.082)	(0.007)
internet users	0.30***	0.31***	0.28***	0.32***	0.27***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Financial Development	5.19	17.80*			
	(0.643)	(0.063)			
AE * Financial Development		-49.68***			
		(0.001)			
LIC * Financial Development		289.72*			
		(0.054)			
Financial Depth			-28.32***	-33.76*	-31.43
			(0.001)	(0.099)	(0.297)
AE * Financial Depth				12.12	
				(0.567)	
LIC * Financial Depth				-979.59***	
				(0.000)	
Financial Access			2.56	23.69	-9.00
			(0.747)	(0.328)	(0.791)
AE * Financial Access				-29.24	
				(0.262)	
LIC * Financial Access				157.15***	
				(0.000)	
Financial Efficiency			6.75**	5.70*	-9.64
			(0.036)	(0.081)	(0.612)
AE* Financial Efficiency				-11.63*	
				(0.056)	
LIC * Financial Efficiency					
Bank Concentration * Financial Depth					0.03
					(0.953)
Bank Concentration * Financial Access					0.14
					(0.746)
Bank Concentration * Financial Efficiency					0.26
					(0.337)
Constant	-110.41***	-83.08**	-144.82***	-66.24*	-147.58***
	(0.005)	(0.011)	(0.001)	(0.079)	(0.001)
Observations	162	162	162	162	161
R-squared	0.57	0.65	0.63	0.70	0.63
Number of Countries	94	94	94	94	93

Robust p-values in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: LIC interaction with Financial Efficiency was dropped out of equation (4) because of multicollinearity.

Technological Infrastructure

We next turn to examine the role of access to internet on the expansion of marketplace lending. As the operating platform of marketplace lending is internet, an increase in usage of internet would be associated with greater marketplace lending activity. A wider use of

internet indicates more stable supply of internet services. Since marketplace lending builds on a large customer base, a greater access to internet is expected to be conducive to higher borrowing from online platforms as well as greater investing in crowdfunding.

In our sample, on average 52 percent of the population use internet. A simple comparison of average marketplace lending relative to GDP in countries with internet usage above the average as opposed to below the average shows that the difference is meaningfully positive. Our fixed-effect regressions confirm that expansion of access to internet is an important driver of marketplace lending. The coefficient is highly significant for various specifications in the total and consumer marketplace lending (Tables 2 and 4) but we do not find a significant effect for business marketplace lending highlighting differences across marketplace lending development across sectors. One explanation could be that the fraction of population using internet may not be a good proxy for reliable access to internet by businesses. As a weak alternative, we used the logarithm of the supply of internet servers and found highly significant coefficients for business fintech, which confirms that development of technological infrastructure is a strong driver of marketplace lending.

Financial Development—Depth, Access, and Efficiency

We now turn to explore the relationship between financial development and marketplace lending. Does fintech credit grow in countries with a less developed traditional financial sector, where existence of important financial imperfections in the traditional finance provides an opportunity for digital lending to grow. As marketplace lending serves a new class of borrowers and lenders—typically small size—, it is expected to increase access to finance. To measure financial development of traditional lenders, we use a composite index

developed by Sahay and others (2015) that is further broken down to capture three aspects of financial development: financial depth, financial access, and financial efficiency.²¹

Our fixed-effect regressions show that the broad index of financial development is strongly significant with a negative sign for business marketplace lending, however, no significant result is achieved for total and consumer marketplace lending. This finding shows that marketplace lending to the business segment tends to fill a gap when credit provided by the traditional financial sector erodes.

We then ask if the relationship between traditional financial development and marketplace lending differs across countries with different degrees of economic development. To this end, we interact the financial development index with economic development indicator, which we

²¹ See Svirydzienka (2016) for a methodological explanation. Financial depth (size and liquidity of markets) is based on private sector credit to GDP and assets of nonbanking financial institutions (pension funds and mutual funds) and insurance premiums to GDP. Financial access (ability of individuals and businesses to access financial services) aggregates bank branches and ATMs per 100,000 adults. Financial efficiency (ability of financial institutions to provide financial services at a reasonable cost) is constructed based on net interest margin, lending-deposit rate spread, non-interest income to total income, overhead costs to total assets, return on assets and return on equity (all variables for commercial banks). All indices are normalized between 0 and 1 with a greater value indicating higher development.

use binary dummy variables for advanced economies (AE) and low-income countries (LIC), while treating developing and emerging economies as the baseline category. Our findings show that in the business segment, the negative relationship is substantially weaker in low-income economies compared to other economies. The implied coefficient for low-income economies is -3.9 compared with -35.5 for advanced and developing economies. This suggests that lower degree of economic development introduces further challenges for low-income economies to take advantage of the fintech opportunity.

Controlling for economic development reveals important differences in the role of traditional financial development for fintech credit development in the consumer segment. We find a highly significant (at 1% level) and negative coefficient for advanced economies with a coefficient estimate of -31.9. The relationship, however, flips sign for other groups, which is 17.8 for developing economies and 307.5 for low-income countries (both significant at 10% level). This result suggests that marketplace lending to consumers in low-income and developing economies is driven by the same factors that drive the traditional financial sector.²²

To examine which component of financial development is important for growth of marketplace lending, in equations (3) and (4), we use sub-indices of financial development and interact them with economic development indicators. The total and consumer fintech credit regressions point at a highly significant and negative effect of financial depth while business fintech credit grows in countries where financial efficiency is lower. Interacting financial development sub-indices with economic development reveals that greater financial access is a key driver of marketplace lending in lower-income countries while there is a strong negative relation with financial depth. This finding is consistent with financial literacy story in an underdeveloped financial sector. Greater financial access signifies a basic increase in financial literacy of unbanked population who have limited access to credit market. By providing small and flexible loans, consumer marketplace lending could attract such users and enhance access to credit.

In equation (5), we investigate the potential role of bank concentration as a barrier to marketplace lending growth where financial development is lagging. It is often believed that in countries with concentrated banking sector, large banks raise entry barriers for instance by pressuring regulators. Regression outputs support that the negative relation between financial efficiency and marketplace lending is weaker in countries with highly concentrated banking sector, that is the positive interaction coefficient. This finding suggests that higher bank concentration is an important impediment for marketplace lending growth to enter credit markets that suffer from high inefficiency in credit pricing.

²² This finding is consistent with the role of traditional financial sector in leading fintech innovations.

C. Results: Cross-country Differences in Fintech Credit

In this subsection, we intend to explain cross-country differences in fintech credit development. To this end, we use between regression outputs reported in Tables 5, 6 and 7.

Economic Development

As we observed in the previous set of result, income per capita is a strong driver of marketplace lending controlling for country-specific features. However, the between regression results show that expansion of marketplace lending is observed in less developed countries (see Table 5). This result is highly significant under the baseline specifications (1). We find some evidence that the inverse relationship between economic development and marketplace lending growth is milder for advanced economies, but the total direction still remains negative. Therefore, we conclude that marketplace lending increases as the income per capita of an economy goes up. However, marketplace lending is more prevalent in less developed economies.

These results differ from findings of Claessens and others (2018) and Rau (2019) who find a positive association between economic development and cross-country marketplace lending. One difference between our approach and theirs is that these studies use per capita marketplace lending as dependent variable against GDP per capita. Since both variables are commonly normalized by population, the direct relationship indicates proportional increase in the size of the economy. Our finding shows that marketplace lending depth is negatively correlated with the economy's size, which is reminiscent of the common wisdom that fintech is a developing economy phenomenon.

Technological Infrastructure

Internet use by the population does not appear to be a distinguishing factor in explaining cross-country differences in marketplace lending development. The coefficient estimate is highly insignificant under various specifications for total, business and consumer marketplace lending. As a robustness check, we used two alternatives, which did not yield a significant coefficient. These were a) an indicator transformation of the variable that takes a value of 1 if internet use is above the sample mean (52 percent) in the country and b) logarithm of the number of internet servers in the country.

Table 5. Cross-Country Determinants of Total Marketplace Lending: Between Regressions

Dependent variable is logarithm of total marketplace lending to GDP. Sample period is 2015 to 2017.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDP per capita	-1.07** (0.042)	-1.26** (0.030)	-0.88* (0.095)	-1.00 (0.119)	-1.01 (0.129)	-1.08 (0.118)	-1.01* (0.053)	-0.84 (0.102)	-1.03* (0.058)
AE * GDP per capita		0.11* (0.073)							
LIC * GDP per capita		-0.05 (0.612)							
Internet users (% of population)	0.02 (0.252)	0.02 (0.320)	0.02 (0.226)	0.05* (0.057)	0.02 (0.292)	0.02 (0.354)	0.02 (0.228)	0.02 (0.222)	0.02 (0.265)
Financial Development	3.90** (0.024)	2.54 (0.173)			3.75* (0.059)	2.43 (0.228)	3.41** (0.048)	10.72*** (0.009)	4.01** (0.023)
Depth of Credit Information	0.15* (0.087)	0.18** (0.049)	0.03 (0.727)	0.10 (0.415)	0.12 (0.249)	0.13 (0.202)	0.17* (0.054)	0.17* (0.052)	0.14 (0.141)
Banking Regulation Stringency	-0.30*** (0.000)	-0.29*** (0.001)	-0.32*** (0.000)	-0.49*** (0.000)	-0.33*** (0.005)	-0.27** (0.022)	-0.28*** (0.001)	-0.30*** (0.000)	-0.30*** (0.001)
Traditional Financial Inclusion			3.10** (0.043)						
Fintech Financial Inclusion				-0.37 (0.753)					
log(Urban Area/Land Area)					-0.01 (0.954)				
AE * log(Urban Area/Land Area)						-0.49** (0.042)			
LIC * log(Urban Area/Land Area)						0.01 (0.973)			
Bank Concentration (past 5 years)							0.02* (0.077)	0.07** (0.013)	
Bank Concentration * Financial Development								-0.12** (0.047)	
Banking ROA (past 5 years)									0.07 (0.712)
Constant	1.16 (0.753)	3.20 (0.483)	1.38 (0.719)	5.09 (0.331)	1.10 (0.826)	1.30 (0.808)	-0.81 (0.830)	-5.09 (0.237)	0.63 (0.875)
Observations	174	174	160	65	153	153	174	174	174
R-squared	0.22	0.25	0.29	0.42	0.21	0.26	0.25	0.29	0.22
Number of Countries	85	85	75	34	71	71	85	85	85

Robust p-values in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6. Cross-Country Determinants of Business Marketplace Lending: Between Regressions

Dependent variable is logarithm of total marketplace lending to GDP. Sample period is 2015 to 2017.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDP per capita	-0.82 (0.271)	-0.57 (0.500)	-0.47 (0.472)	0.30 (0.750)	-0.71 (0.394)	-0.63 (0.441)	-0.80 (0.286)	-0.55 (0.443)	-0.73 (0.377)
AE * GDP per capita		0.02 (0.818)							
LIC * GDP per capita		0.12 (0.403)							
Internet users (% of population)	0.01 (0.677)	0.01 (0.746)	0.01 (0.697)	-0.01 (0.844)	0.01 (0.672)	0.01 (0.772)	0.01 (0.724)	0.00 (0.942)	0.01 (0.749)
Financial Development	3.59* (0.059)	3.39 (0.100)			2.46 (0.212)	1.81 (0.374)	3.43* (0.074)	15.11*** (0.004)	3.68* (0.059)
Depth of Credit Information	-0.13 (0.580)	-0.14 (0.569)	-0.28 (0.140)	-0.41 (0.140)	-0.13 (0.597)	-0.14 (0.548)	-0.10 (0.674)	-0.21 (0.362)	-0.15 (0.544)
Banking Regulation Stringency	-0.36*** (0.003)	-0.35*** (0.004)	-0.45*** (0.000)	-0.61*** (0.000)	-0.40*** (0.001)	-0.36*** (0.004)	-0.34*** (0.006)	-0.42*** (0.001)	-0.36*** (0.003)
Traditional Financial Inclusion			2.00 (0.212)						
Fintech Financial Inclusion				0.75 (0.637)					
log(Urban Area/Land Area)					0.02 (0.942)				
AE * log(Urban Area/Land Area)						-0.27 (0.249)			
LIC * log(Urban Area/Land Area)						-0.08 (0.741)			
Bank Concentration (past 5 years)							0.01 (0.503)	0.10** (0.012)	
Bank Concentration * Financial Development								-0.19** (0.015)	
Banking ROA (past 5 years)									0.07 (0.790)
Constant	1.95 (0.727)	-0.41 (0.950)	2.62 (0.595)	0.33 (0.967)	2.37 (0.713)	1.33 (0.834)	0.76 (0.898)	-4.75 (0.430)	1.22 (0.846)
Observations	128	128	123	48	120	120	128	128	128
R-squared	0.23	0.25	0.37	0.53	0.25	0.28	0.24	0.33	0.24
Number of Countries	55	55	53	23	52	52	55	55	55

Robust p-values in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7. Cross-Country Determinants of Consumer Marketplace Lending: Between Regressions

Dependent variable is logarithm of total marketplace lending to GDP. Sample period is 2015 to 2017.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDP per capita	-0.90 (0.150)	-1.06 (0.108)	-1.15* (0.083)	-1.37* (0.076)	-0.57 (0.479)	-0.61 (0.450)	-0.73 (0.237)	-0.63 (0.312)	-0.89 (0.170)
AE * GDP per capita		0.24*** (0.001)							
LIC * GDP per capita		-0.03 (0.758)							
Internet users (% of population)	0.01 (0.630)	0.00 (0.857)	0.01 (0.796)	0.02 (0.450)	0.01 (0.811)	-0.00 (0.999)	0.01 (0.573)	0.01 (0.563)	0.01 (0.635)
Financial Development	2.49 (0.244)	-0.47 (0.826)			1.68 (0.499)	-0.71 (0.768)	1.57 (0.462)	5.86 (0.222)	2.52 (0.246)
Depth of Credit Information	0.17 (0.126)	0.21** (0.045)	0.13 (0.323)	0.24 (0.129)	0.12 (0.343)	0.14 (0.251)	0.18 (0.105)	0.17 (0.109)	0.16 (0.167)
Banking Regulation Stringency	-0.32*** (0.001)	-0.27*** (0.006)	-0.35*** (0.000)	-0.53*** (0.001)	-0.40*** (0.005)	-0.29*** (0.028)	-0.28*** (0.005)	-0.29*** (0.004)	-0.32*** (0.002)
Traditional Financial Inclusion			4.12** (0.037)						
Fintech Financial Inclusion				-0.64 (0.655)					
log(Urban Area/Land Area)					0.04 (0.894)				
AE * log(Urban Area/Land Area)						-0.90*** (0.002)			
LIC * log(Urban Area/Land Area)						0.01 (0.974)			
Bank Concentration (past 5 years)							0.02** (0.045)	0.05 (0.101)	
Bank Concentration * Financial Development								-0.07 (0.316)	
Banking ROA (past 5 years)									0.03 (0.910)
Constant	0.74 (0.870)	2.31 (0.665)	3.93 (0.426)	8.91 (0.165)	-0.22 (0.971)	-0.72 (0.912)	-2.58 (0.586)	-5.16 (0.340)	0.54 (0.912)
Observations	133	133	121	51	117	117	133	133	133
R-squared	0.16	0.29	0.23	0.40	0.15	0.29	0.21	0.22	0.16
Number of Countries	77	77	68	34	64	64	77	77	77

Robust p-values in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Financial Development—Depth, Access, and Efficiency

Controlling for cross-country differences, using fixed-effect regressions, we found marketplace lending expands when gaps emerge in traditional financial sector. Our between regressions finds a positive relation implying marketplace lending is higher in countries that start from a higher financial development. This is consistent with Rau (2019). In this context, financial development can be interpreted as higher level of financial literacy. When gaps emerge in the traditional financial sector, users can more comfortably transition to using innovative financial services. As a result, fintech credit is more successful in filling gaps in the traditional financial sector in countries that have higher financial literacy.

Sahay and others (2020) propose new composite indices for traditional financial inclusion and fintech-payment financial inclusion. The financial inclusion index extends financial development indices by Sahay and others (2015) but is less frequent.²³ We use this index as an alternative for financial development index in equation 3 of Tables 5 to 8. Results are highly significant and confirm that marketplace lending is higher in countries where traditional financial inclusion is on average higher. Across segments, we find significant results for consumer marketplace lending but fail to see a significant relationship for business marketplace lending.

We use fintech financial inclusion index by Sahay and others (2020) to test if marketplace lending is higher in countries where fintech payment is more prevalent. The coefficient estimates are highly insignificant suggesting that the index does not explain cross-country differences in marketplace lending. This result holds for total marketplace lending and breakdown by segments. It should be noted that available observations for this index is limited—about one third of the sample.

Information Infrastructure

Information (particularly hard information) plays a key role in credit assessment and fintech lending (Liberti and Petersen, 2018). As there is no single variable to capture the quality of information used in credit assessment, we use the depth of information index²⁴ as a proxy. This index measures rules affecting the scope, accessibility, and quality of credit information available through public or private credit registries. Our hypothesis is to observe higher marketplace lending in countries with better informational infrastructure. We find some evidence for the role of information availability in explaining total marketplace lending differences across countries. While we find a highly significant coefficient in equation (1) and (2) of Table 5, estimation outputs of other equations indicate that this result is sensitive

²³ See Khera and others (2020) for an elaborate description of the methodology for developing these indices.

²⁴ The index ranges from 0 to 8, with higher values indicating the availability of more credit information from a public registry or a private bureau.

to specification. Moreover, it holds for consumer marketplace lending but disappears in business marketplace lending.

Regulation and Legal Environment

The goal of regulation of lending institutions is to ensure prudent lending, which naturally limits lending. As a result, we expect a more stringent regulation of fintech lender lead to lower marketplace lending. In the absence of an indicator for regulation of fintech lenders, we use bank regulation stringency index as a proxy for fintech regulation following Claessens and others (2018). We acknowledge an important caveat in using this variable as a proxy that implicitly assumes away regulatory arbitrage that fintech creditors may enjoy as opposed to banks.

Consistent with findings of Claessens and others (2018), we find a strongly negative relationship between marketplace lending in a country and stringency of bank regulation. This result holds up in all specifications and for both consumer and business segments. This finding highlights the significant role of regulations in expansion of marketplace lending. While essential regulations should be in place to ensure prudent lending, burdensome unnecessary regulations should be lifted to support expansion of marketplace lending.

To evaluate the role of general legal environment, in results that we do not report here, we used the strength of legal rights index²⁵ that measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders. While we expect a stronger legal system should lead to more confidence in fintech lending by both investors and borrowers imply no statistically significance coefficient for total and business marketplace lending but significant and positive coefficient for consumer marketplace lending. We acknowledge that the index has various shortcomings that may explain why we do not find evidence for the role of legal infrastructure. the strength of legal rights index (part of the “getting credit” indicator of the Doing Business report) is specifically focused on credit secured with movable collateral that is not immediately relevant for marketplace lending that is generally unsecured.

Geographical Barriers

By building on digital connection rather than branch-based lending by banks, fintech is expected to overcome geographical barriers. Measuring geographical barriers is a data challenge. One option is to assess geographical barriers by the number of commercial bank branches in 1000 square kilometers. This variable overlaps with some of the underlying components of the financial development index. In the regressions that we do not report here, we found highly insignificant coefficient estimates across segments and in total fintech regressions.²⁶ As an alternative, we used the ratio of urban area to land area, which is a proxy

²⁵ The index ranges from 0 to 12, with higher scores indicating that these laws are better designed to expand access to credit.

²⁶ This result is consistent with Jagtinani and Lemieux (2017) who also find no evidence that fintech credit is linked to geographical presence of bank branches.

that shows what fraction of a country's land is more likely to have basic infrastructure available in an urban area and therefore negatively correlates with geographical barriers. The lower the ratio, the higher the likelihood of having remote areas in a country. Using this variable, we find a highly significant effect for geographical barriers in advanced economies but fail to see any effect in other economic development groups (see Equation 6 in Table 5). The negative coefficient of the interaction term shows that marketplace lending is higher in AE countries with geographical barriers. Tables 6 and 7 show that this result holds for consumer segment, but the effect does not appear for the business segment.

Banking Concentration and Profitability

How does underlying features of the banking sector help explain cross-country marketplace lending development? We consider two potentially relevant aspects of banking over the five years to assess if prevailing conditions in the banking sector triggered different levels of marketplace lending across countries.

First, we study the role of bank concentration, which could work in both directions. A highly concentrated banking sector could mean that digital lenders are subject to growth and entry barriers that small banks are exposed to. By contrast, if the nature of such barriers is such that digital technology could effectively overcome, fintech lending is expected to have a positive association with bank concentration.

Consistent with Claessens and others (2018) and Rau (2019), we find higher marketplace lending in countries with more concentrated banking sector. We use market share of the top 5 banks averaged over five years before the sample starts, that is 2010 to 2014. This provides support for the “technological advantage” hypothesis that gives an edge to fintech lenders as opposed to other entrants to the credit market. To study the role of entry barriers, we test if fintech barriers are higher in more concentrated and larger banking sector—that is a higher level of financial development. To this end, we use the interaction between bank concentration and financial development in equation 8. We find strong support that marketplace lending is smaller in countries with a highly concentrated yet large banking sector. This finding suggests the important role of barriers to entry in fintech development. The negative coefficient of the interaction term also implies that marketplace lending is larger when banking sector is more competitive but small, which increases the stakes for marketplace lending development.

Second, we study if marketplace lending emerges in countries with a highly profitable banking sector. While previous literature suggests bank profitability could be a factor, our results do not lend support to this claim. We find a highly insignificant coefficient in all regressions.²⁷

²⁷ ROA is one of the many components in financial development. Results did not change in regressions without the financial development index.

V. CONCLUSIONS

Fintech has emerged in the past decade as a promising way to improve delivery of financial services. This has created hope for low-income and developing economies to take advantage of the fintech opportunity to fill long-lasting gaps in their financial markets. We use data for 109 countries from 2015 to 2017 from CCAF survey to show how marketplace lending in business and consumer segments have evolved across different regions and countries. Marketplace lending is highly concentrated with the top three countries, China, the United States and the United Kingdom, accounting for 98 percent of the market in 2017. While rapidly growing, total marketplace lending was US\$400 billion in 2017, which accounts for a very small fraction of the financial system. As a result, fintech credit remains too small to cause financial stability concerns.

In the analytical section of the paper, we develop a panel regression model to study underlying drivers of marketplace lending and explain cross-country differences in the business and consumer segments. Higher income per capita and better access to internet lead to higher marketplace lending. We then explored the relationship between financial development and marketplace lending in countries with different levels of economic development controlling for country-specific characteristics. We find a negative relationship between traditional financial development and marketplace lending implying that marketplace lending fills a gap where financial imperfections rise. More specifically, in the consumer segment, marketplace lending has a negative relationship with financial depth, which is stronger for low-income countries. In the business segment, marketplace lending increases as efficiency of traditional financial institutions in granting credit declines. Moreover, marketplace lending to businesses increases when access to financial institutions decreases.

Finally, we study the role of potential explanatory variables in explaining cross-country differences in marketplace lending. We find marketplace lending is higher in countries with higher financial development, possibly reflecting the role of financial literacy, which suggests marketplace lending is better able to fill the credit gap in more developed credit markets. We find some evidence that geographical barriers matter for development of marketplace lending in advanced economies. Moreover, we find that marketplace lending is higher in countries with lower income per capita, better access to credit information, less stringent banking regulations and more concentrated banking sector.

REFERENCES

- Ayyagari, M., A. Demirgüç-Kunt; and V. Maksimovic, 2017, SME Finance, The World Bank Group Development Research Group *Policy Research Working paper* 8241
- Alvarez de la Campa, A., 2011. Increasing Access to Credit through Reforming Secured Transactions in the MENA Region. *Policy Research Working Paper* 5613.
- Baltagi, B. (2008). *Econometric analysis of panel data*. John Wiley & Sons.
- Bazarbash, M. (2019). FinTech in Financial Inclusion: Machine Learning Applications in Assessing Credit Risk. International Monetary Fund. Working Paper 19/109
- Beck, T., Demirgüç-Kunt, A., & Levine, R. (2007). Finance, inequality and the poor. *Journal of economic growth*, 12(1), 27-49.
- Berg, T., Burg, V., Gombović, A., & Puri, M. (2018). *On the rise of FinTechs—Credit scoring using digital footprints* (No. w24551). National Bureau of Economic Research.
- Cambridge Centre for Alternative Finance <https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/>
- Carstens, A. (2019) Central banking and innovation: partners in the quest for financial inclusion. *BIS Speech*. Available at <https://www.bis.org/speeches/sp190425.htm>
- Claessens, S., J. Frost, G. Turner, and F. Zhu (2018). “Fintech credit markets around the world: size, drivers and policy issues,” *BIS Quarterly Review*, September.
- De Roure, C., Pelizzon, L., & Tasca, P. (2016). How does P2P lending fit into the consumer credit market? Bundesbank Discussion Paper No. 30/2016.
- Freedman, S., & Jin, G. Z. (2017). The information value of online social networks: lessons from peer-to-peer lending. *International Journal of Industrial Organization*, 51, 185-222.
- Frost, Jon. (2020). The economic forces driving fintech adoption across countries. *BIS Working Paper No. 838*
- Goldstein, I., Jiang, W., & Karolyi, G. A. (2019). To FinTech and beyond. *The Review of Financial Studies*, 32(5), 1647-1661.
- Havrylchyk, O., Mariotto, C., Rahim, T., & Verdier, M. (2018). What has driven the expansion of the peer-to-peer lending. *Universite Paris, Boston University, and the European Commission Working Paper*.
- Hau, H., Huang, Y., Shan, H., & Sheng, Z. (2018). Fintech credit, financial inclusion and entrepreneurial growth. *Unpublished working paper*. Available at <https://efmaefm.org/OEFMAMEETINGS/EFMA%20ANNUAL%20MEETINGS/2018-Milan/phd/001.pdf>
- Huang, R. H. (2018). Online P2P lending and regulatory responses in China: opportunities and challenges. *European Business Organization Law Review*, 19(1), 63-92.
- International Finance Corporation (2017) “MSME Finance Gap: Assessment of the Shortfalls and Opportunities in Financing Micro, Small and Medium Enterprises in Emerging Markets” Available at <https://openknowledge.worldbank.org/handle/10986/28881>
- International Finance Corporation (2019) <https://www.smefinanceforum.org/data-sites/msme-finance-gap>
- International Monetary Fund (2019a). “Fintech—The Experience So Far”, Policy Paper No. 19/024.
- International Monetary Fund, (2019b). “Financial Inclusion of Small and Medium-Sized Enterprises in the Middle East and Central Asia,” Departmental Paper No. 19/02.

- International Monetary Fund (2018). "The Bali Fintech Agenda." October, available at <https://www.imf.org/en/Publications/Policy-Papers/Issues/2018/10/11/pp101118-bali-fintechagenda> (accessed December 17, 2018).
- Jagtiani, Julapa and Catharine Lemieux, 2017. "Fintech Lending: Financial Inclusion, Risk Pricing, and Alternative Information," Federal Reserve Bank of Philadelphia Working Paper No. 17-17.
- Khera, Purva, Stephanie Ng, Sumiko Ogawa, and Ratna Sahay. 2020. "Can FinTech Unlock Financial Inclusion in Emerging and Developing Economies?" IMF Working Paper, International Monetary Fund, Washington, DC. (forthcoming)
- Levine, R. (2005). Finance and growth: theory and evidence. *Handbook of economic growth*, 1, 865-934.
- Liberti, J. M., & Petersen, M. A. (2018). "Information: Hard and soft." *Review of Corporate Finance Studies*, 8(1), 1-41. Bureau of Economic Research.
- Navaretti, G, G Calzolari and A Pozzolo (2017): "FinTech and banks: friends or foes?", *European Economy: Banks, Regulation, and the Real Sector*, December.
- Nesta (2014). Understanding alternative finance. *The UK alternative finance industry report*.
- Patwardhan, A. (2018). Financial inclusion in the digital age. In *Handbook of Blockchain, Digital Finance, and Inclusion, Volume 1* (pp. 57-89). Academic Press.
- Philippon, T. (2016). *The fintech opportunity* (No. w22476). National Bureau of Economic Research.
- Philippon, T. (2019). *On Fintech and Financial Inclusion* (No. w26330). National Bureau of Economic Research.
- Rau, P. Raghavendra, Law, Trust, and the Development of Crowdfunding (May 31, 2019). Available at SSRN: <https://ssrn.com/abstract=2989056>
- Sahay, R., Eriksson von Allmen, U., Lahreche, A., Khera, P., Ogawa, S., Bazarbash, M., & Beaton, K. (2020). *The Promise of Fintech; Financial Inclusion in the Post COVID-19 Era*. IMF Departmental Policy Papers 20/09, International Monetary Fund.
- Sahay, R., Cihak, M., & N'Diaye, P., Adolfo Barajas, Srobona Mitra, Annette Kyobe, Yen Nian Mooi, and Seyed Reza Yousefi, 2015, "Financial Inclusion: Can it Meet Multiple Macroeconomic Goals?" *International Monetary Fund Staff Discussion note SDN/15/17*.
- Sviryzdenka, K. (2016). *Introducing a new broad-based index of financial development*. International Monetary Fund.
- Tang, Huan. "Peer-to-peer lenders versus banks: substitutes or complements?" *The Review of Financial Studies* 32, no. 5 (2019): 1900-1938.
- US Department of the Treasury (2016): *Opportunities and challenges in online marketplace lending*, May.
- US Department of the Treasury (2018): *A financial system that creates economic opportunities: nonbank financials, fintech, and innovation*, July.
- World bank <https://www.worldbank.org/en/topic/financialinclusion/brief/achieving-universal-financial-access-by-2020>
- World Economic Forum (2015). "The Future of FinTech: A Paradigm Shift in Small Business Finance," White Paper. October, available at http://www3.weforum.org/docs/IP/2015/FS/GAC15_The_Future_of_FinTech_Paradigm_Shift_Small_Business_Finance_report_2015.pdf (accessed December 17, 2018).
- Zhang, Y., Jia, H., Diao, Y., Hai, M., & Li, H. (2016). Research on credit scoring by fusing social media information in online peer-to-peer lending. *Procedia Computer Science*, 91, 168-174.