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Do Chinese Infrastructure Loans Promote Entrepreneurship in African Countries?

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ABSTRACT

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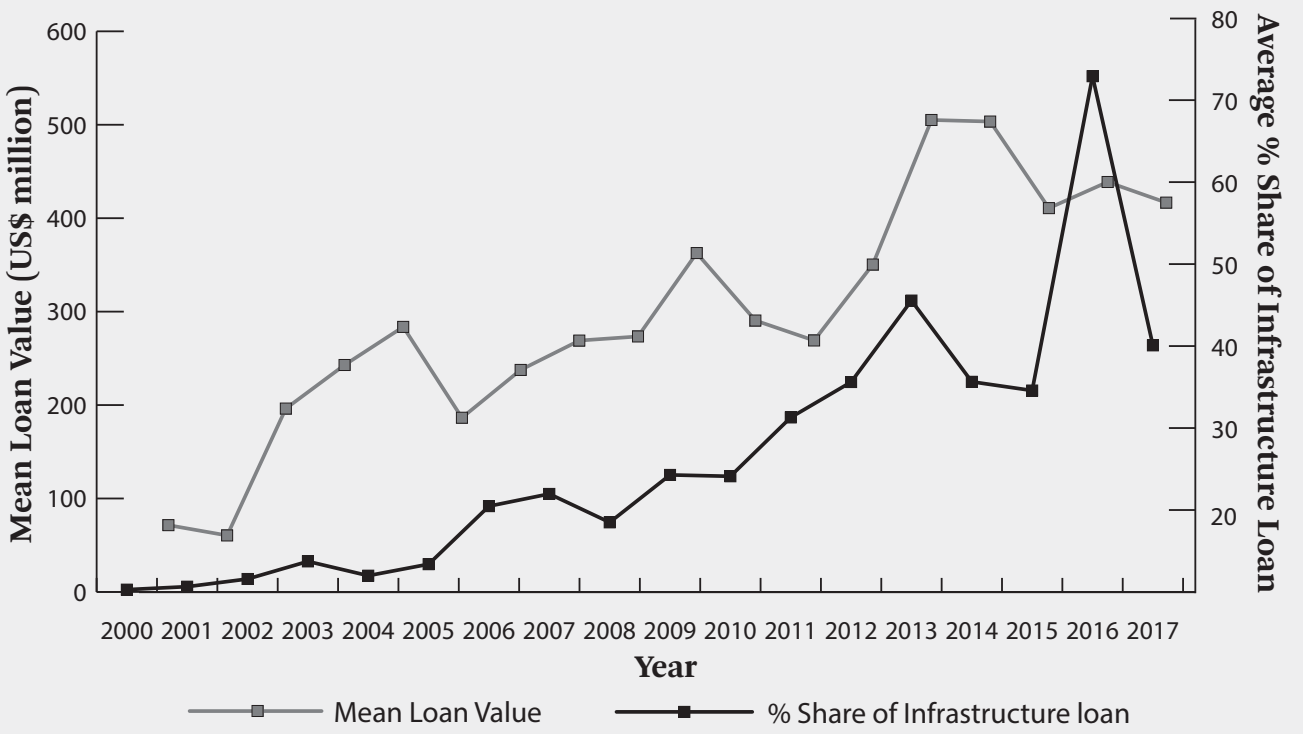
This paper examines the impact of Chinese economic infrastructure loans on entrepreneurship for a sample of African country recipients. A panel dataset spanning the period 2006-2018 is used to conduct the empirical analysis. Consistent with the hypothesis that Chinese economic infrastructure loans promote entrepreneurship by reducing infrastructure related costs and by enabling business opportunities, the findings demonstrate that African countries with a higher percentage of economic infrastructure loans in gross domestic product have greater entrepreneurship in the form of new business startups. In addition, the results also demonstrate that new firm creation is significantly lower in African countries with greater regulation-driven barriers to entry, poor institutional quality, and restricted access to private sector credit.

INTRODUCTION

Africa's dependence on Chinese loans has significantly increased since 2000. Figure 1 chronicles this growing dependence in the average African loan recipient, where the value of total loans from China rose sharply from about US$ 2 million to a peak of about US$ 552 million in 2016. Over the same period, the share of Chinese loans disbursed to finance transport, communication, and energy infrastructure also increased significantly, from 18 percent to 60 percent in the average African recipient country as illustrated by Figure 1. From a development perspective, this surge in infrastructure development finance is quite important, given that inadequate infrastructure is consistently ranked as an important constraint for doing business in investment climate surveys by developing country firms. For example, in investment climate surveys conducted by the World Bank, firms from developing regions in East Asia and the Pacific, Middle East and North Africa, Latin America, as well as sub-Saharan Africa identify problems with electricity, telecommunication, and transport infrastructures as a major barrier to their commercial activities.[1]

Figure 1: China's Average Loans to Africa



Source: SAIS-CARI Chinese Loans to Africa database (https://chinaafricaloandata.org).

Starting with electricity, it has been found that unreliable electricity supply reduces production and/or forces firms to use their own power generators and this significantly raises firm costs and disadvantages new and small firms who may be unable to adapt to high-cost generators. Using data from an investment climate assessment for 26 countries in eastern Europe and central Asia, Iimi finds that power outages induce high costs for firms and estimates that if the power outages are eliminated, firms would on average save between 0.5-1.5 percent of their operating

costs.[2] Losses due to power outages have been found to be a particularly serious problem for firms in Africa (see for example Cole *et al.*), and they significantly diminish the probability that individuals will start their own businesses.[3] In South Africa, electrification has been shown to increase the number of small enterprises and self-employment.[4] Similarly, studies reviewed by Braese *et al.* demonstrate a positive link between electrification and an increase in the number of firms and employment in other countries.[5] Looking at other infrastructure, access to low-cost transport and telecommunication networks is vitally important for entering markets, facilitating interactions and connectivity of people to share knowledge and ideas, and reducing distribution and inventory costs, especially for new and small producers.[6] As a result, barriers to startup activity are reduced, entrepreneurial opportunities are created, and capabilities to act upon those opportunities by starting a new firm are made possible.[7] Audretsch *et al.* consider the direct impact of infrastructure on startup activity in Germany and find that certain types of infrastructure, such as broadband, tend to have a greater positive effect on new firm startups compared to other types of infrastructure, such as highways and railroads.[8]

This paper seeks to examine the hypothesis that Chinese loans to develop African economic infrastructure promote entrepreneurship by reducing business-impeding costs and by enabling business opportunities. The empirical analysis is based on the unbalanced panel dataset made up of 38 African countries that are recipients of economic infrastructure loans from China from 2006-2018. Entrepreneurship is measured by new business density, which is defined as the number of newly registered limited liability firms per 1,000 working-age population (ages 15-64). Data on new business density is drawn from the World Bank's Entrepreneurship Database project, which uses new business density to measure domestic entrepreneurship in 155 economies. The focus on new firm creation is important, given that formation of new firms is often credited for boosting the overall productivity and economic growth of a country through its positive effects on efficiency and innovation.[9] Newly established firms also contribute significantly to job creation.[10] According to Barr, for example, new businesses contributed 40 percent of net new jobs created in the US over the past two decades.[11] Economic infrastructure consists of transport, communication, and energy infrastructures, and the paper exploits data on Chinese loans used to finance African economic infrastructure projects from the SAIS-CARI Loans database.[12]

The results clearly demonstrate that the amount of loans for economic infrastructure plays a crucial role in promoting new business density entrepreneurship: increasing total economic infrastructure loan amount, expressed as a percent of the recipient's gross domestic product (GDP), by one percent is on average associated with a 3.6 percent increase in new business density. This finding can be interpreted as supportive evidence for the hypothesis that Chinese economic infrastructure loans enhance entrepreneurship by reducing infrastructure related costs and by enabling opportunities for startups. The results also demonstrate the significance of other domestic supply constraints which are significant barriers to startup activity in Africa, including entry regulation, institutional quality, and access to credit. New firm creation is significantly lower in African countries with 1) greater regulation-driven barriers to entry, 2) poor institutional quality, and 3) restricted access to private sector credit. Specifically, the results show that increasing entry regulation by one procedure significantly curtails new business density by approximately 8.1

percent. Turning to institutional quality, the paper finds that a one standard deviation increase in institutional quality significantly raises new business density by 77 percent. Two institutional quality dimensions (control of corruption and rule of law) are shown to be especially important for promoting new business density. Lastly, expanding access to private sector credit by just one percent is significantly associated with a 2.3 percent increase in new business density.

While China's engagement with Africa through trade has been widely studied, there has not been comparable research focused on China's lending activities in Africa, which, as discussed above, have significantly expanded in recent decades. The scarcity of data and the fact that China's lending process is not always transparent largely explains why this is the case. As observed by Horn *et al.*, China does not report its official external lending to the world, and as such, there is no comprehensive data on Chinese overseas lending similar to that provided by other major economies.[13] The relatively small recent literature has focused on the determinants of Chinese financing to Africa (for example Horn *et al.* and Dreher *et al.*) and debt sustainability implications for African countries.[14] Using the database of Chinese lending to Africa recently assembled by SAIS-CARI, this paper complements the existing literature on the economic consequences of China's large-scale lending by analyzing how Chinese economic infrastructure loans affect entrepreneurship in Africa.[15]

The remainder of this paper proceeds as follows. Section two develops a conceptual framework which relates entrepreneurship to economic infrastructure loans. The empirical framework is presented in section three, starting with descriptions of the data used to measure entrepreneurship, economic infrastructure loans, and other variables. This is followed by a discussion of country selection, descriptive measures, and the empirical model used in the analysis. The main findings from the empirical analysis are presented and discussed in section four. Section five conducts robustness tests and section six summarizes the main findings and conclusions of the paper.

2. LINKING ECONOMIC INFRASTRUCTURE LOANS TO ENTREPRENEURSHIP: A CONCEPTUAL FRAMEWORK

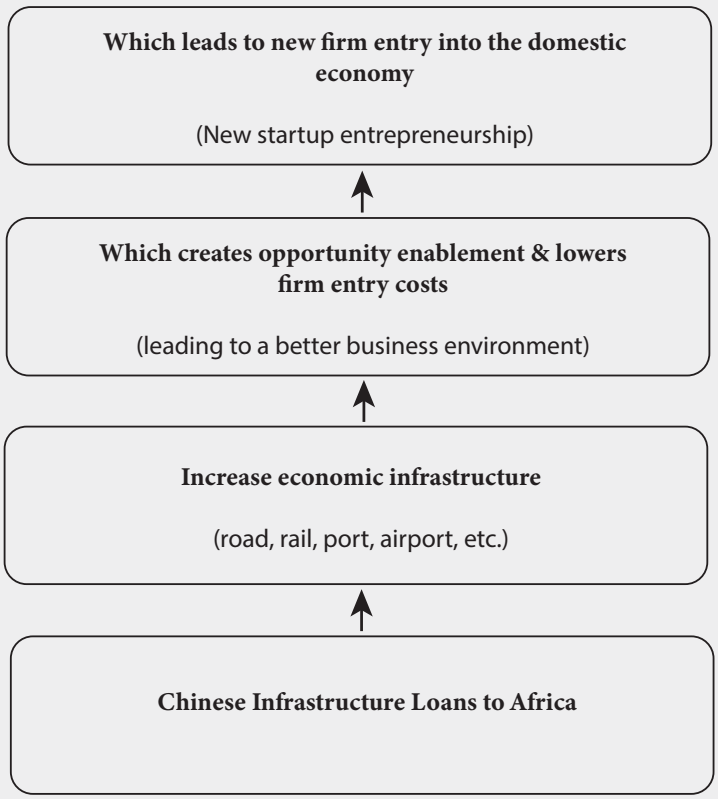
In this study, entrepreneurial activity is conceptualized as the introduction of new firms in the economy. Drawing from Davidsson and Bennett, infrastructure provision is a critical "external enabler" or external condition that acts to promote entry of new firms in domestic markets by creating business opportunities and by reducing the costs of doing business.[16]

Good infrastructure enables opportunities by connecting firms to their customers and suppliers and by helping firms take advantage of modern production techniques.[17] For example, efficient transport infrastructure links create opportunities for firms to buy and sell not only in neighboring markets but worldwide, while access to modern telecommunications services and a reliable electricity supply reduces barriers for new firm entry into markets, and improves their productivity as well.

Conversely, infrastructure inadequacies increase costs and creates barriers to opportunities and impede new firm entry into markets. Poor transport infrastructure (roads, railways, and ports) has been found to account for a large percent of the cost of transport in developing countries, and this cost is much higher in landlocked countries.[18] Transport costs are also affected by other types of infrastructure (other than transport infrastructure), including the extent to which telecommunications systems allow firms to track their goods in transit and how quickly goods are cleared through customs for firms engaged in international trade. Firms also rely on energy (power) infrastructure services as an input into the production of goods and services. Costly and unreliable power networks increase initial input costs (investments) required to start a business, and have adverse effects on the smooth continuity of business. In industries where production is energy intensive (*e.g.*, chemical and textile), new firms might be unable to finance such investments and thus will be shut out of the market completely. This has been confirmed by Alby *et al.*, who find that energy-intensive sectors have a significantly lower share of small firms in countries with frequent outages.[19]

However, building and maintaining economic infrastructure such as roads, ports, electricity grids, and telecommunication networks is expensive. In many developing countries, finding money to undertake these large-scale investments in infrastructure is a big challenge. Therefore, Chinese loans to improve the provision of economic infrastructure services in Africa can have a big impact on the entry of new firms into markets. I therefore propose the following hypothesis:

Figure 2: Chinese Loans and Entrepreneurship-Infrastructure Channel



Hypothesis 1: Economic infrastructure loans are positively associated with new firm entry into the domestic economy.

I examine the effect of economic infrastructure loans on new firm entry into the domestic economy. Figure 2 illustrates the infrastructure channel through which Chinese loans could be expected to have an impact on entrepreneurship: Chinese loans increase economic infrastructure, which enables opportunities and reduces the costs of doing business, making it profitable for new firm startups to enter the domestic market.

3. DATA AND METHODOLOGY

3.1 ENTREPRENEURSHIP

The paper employs a concept of entrepreneurship associated with the introduction of new firms, and these new firms generate Schumpeterian forces of creative destruction (see for example Bjørnskov and Foss).[20] Based on this concept, entrepreneurship is measured by new business density. The data source for new business density is the World Bank's Entrepreneurship Database Project, which uses new business density to measure domestic entrepreneurship in 155 economies.[21] Examples of studies that have employed new business density as the measure of entrepreneurship include Djankov *et al*., Klapper and Love, Klapper *et al*., and Chambers and Munemo.[22]

A major appeal of this measure is that it captures a key aspect of entrepreneurship discussed in Bjørnskov and Foss, which associates entrepreneurship with innovation activities that result from the introduction of new firms, and are the source of Schumpeterian forces of creative destruction.[23] A drawback of this measure is that it only covers the formal sector. The informal sector, which is an important component of entrepreneurship in some African countries, is excluded due to the lack of data on the number of firms operating within that sector. Additionally, the Entrepreneurship Database Project only focuses on firms with limited liability because other types of formal businesses such as partnerships and sole proprietorships differ with respect to definition and regulation, making cross-country comparisons difficult.

3.2 ECONOMIC INFRASTRUCTURE LENDING AND CONTROL VARIABLES

The data source for economic infrastructure loans is the SAIS-CARI Loans Database.[24] Economic infrastructure loans finance three types of infrastructure -- communications, energy, and transport and storage. Examples include loans used for building roads, ports, telecommunication networks, and other types of hard infrastructure. Between 1994 and the present, Chinese lenders significantly increased in Africa.[25] China's main lenders are its two policy banks, Export-Import Bank of China (Eximbank) and China Development Bank (CDB). Other sources of Chinese funding include Chinese commercial banks, the central bank of China, and the Chinese Ministry of Commerce.

Studies that have employed new business density as the measure of entrepreneurship also control for country level measures of institutional quality, access to credit, business regulations, and the overall economic development of a country.[26] Following this literature, institutional quality is measured by governance indicators from the World Bank's Worldwide Governance Indicators (WGI) databank.[27] The methodology used to collect the data is described in Kaufmann *et al*., and they define governance as "the traditions and institutions by which authority in a country is exercised."[28] Based on this definition, Kaufmann *et al*. measure the quality of governance/ institutions along six dimensions: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption.[29]

These six dimensions focus on three key areas of governance: 1) the process by which governments are selected, monitored, and replaced, 2) the capacity of the government to effectively formulate and implement sound policies, and 3) the respect of citizens and the state for the institutions that govern economic and social interactions among them. Each of the institutional indicators is measured on a scale ranging from -2.5 to 2.5, with higher values corresponding to better outcomes. An overall measure of the quality of governance is constructed by taking the simple average of the six governance dimensions described above. To verify that this is an appropriate and informationally efficient way to aggregate these underlying measures, principal component analysis (PCA) was performed to determine the variance-maximizing linear combination of the governance measures. The resulting weights were very similar to the uniform weights from the simple average. Therefore, the overall quality of governance is measured by way of the simple average of the underlying six governance measures. In the previous studies using new business density mentioned above, and in studies employing other entrepreneurship measures, institutional quality is found to be strongly associated with entrepreneurship.[30]

A number of studies including Klapper *et al*. and Dreher and Gassebner find that excessive and costly bureaucratic business regulations such as high startup costs and numerous startup procedures deter the entry of new domestic firms.[31] To measure business regulations, the entry regulation variable from the World Bank's Doing Business database is utilized. Following the previous literature, the number of start-up procedures required to register a business is used as a measure of entry regulation.[32]

It has been shown that access to credit stimulates entrepreneurship by relaxing the constraints to financial credit facing small and medium enterprises (SMEs), as well as new enterprises.[33] Data on domestic credit to the private sector (% GDP) from the World Bank's World Development Indicators (WDI) databank are used to measure access to credit. Previous studies including Djankov *et al*., Klapper *et al*., and Chambers and Munemo find that more economically developed nations (as measured by real per capita GDP) have more formal sector startup activity.[34] Therefore, in the empirical analysis that follows, the level of real GDP per capita from the WDI database is also used as a control variable.

3.3 Country selection and data descriptive measures

While Chinese loan data is available between 2000 and 2018, data on new business density is only available (with gaps) between 2006 and 2018. Thus, combining the above data resulted in an unbalanced panel with 39 countries. Table 1 shows the total number of 39 African countries in the dataset. Description of variables and summary statistics of the data are shown in Table 2.

Table 1: Countries in the Sample (39 total)

Country	Code	Country	Code
Algeria	DZA	Mauritania	MRT
Benin	BEN	Mauritius	MUS
Botswana	BWA	Morocco	MAR
Burkina Faso	BFA	Namibia	NAM
Cabo Verde	CPV	Niger	NER
Central African Republic	CAF	Nigeria	NGA
Chad	TCD	Rwanda	RWA
Comoros	COM	Sao Tome and Principe	STP
Congo, Democratic Republic	COD	Senegal	SEN
Cote d'Ivoire	CIV	Seychelles	SYC
Ethiopia	ETH	Sierra Leone	SLE
Gabon	GAB	South Africa	ZAF
Ghana	GHA	Sudan	SSD
Guinea	GIN	Tanzania	TZA
Kenya	KEN	Togo	TGO
Lesotho	LSO	Tunisia	TUN
Liberia	LBR	Uganda	UGA
Madagascar	MDG	Zambia	ZMB
Malawi	MWI	Zimbabwe	ZWE
Mali	MLI		

Table 2: Definitions and Summary Statistics

Variable	Description	Obs.	Mean	Standard Deviation	Min	Max
	2006-2018					
New business density	New firm registrations per 1,000 people (ages 15-64).	361	1.81	2.89	0.01	20.09
Total loans	Total loan amount to all sectors (% of GDP).	669	0.81	2.41	0.00	39.85
Infrastructure loans	Total economic infrastructure loan amount (% of GDP).	669	0.52	1.72	0.00	24.08
Governance	Average of six governance indicators (control of corruption, government effectiveness, political stability, regulatory quality, rule of law, and voice & accountability).	689	-0.67	0.61	-2.45	0.85
Control of corruption	The extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	689	-0.64	0.62	-1.87	1.04
Government effectiveness	Captures perceptions of the quality of public services, the quality of the civil service and the degress of its indepen-dence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	689	-0.77	0.63	-2.45	1.06
Political stability	Measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence or terrorism.	689	-0.57	0.90	-3.31	1.20
Regulatory quality	Captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private-sector development.	689	-0.71	0.63	-2.65	1.13
Rule of law	Captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	689	-0.70	0.63	-2.61	1.00
Voice & accountability	Captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	689	-0.63	0.75	-2.23	1.00
Entry regulation	Start-up procedures to register a business (number).	667	9.20	3.06	3.00	18.00
Credit	Domestic credit to private sector (% of GDP)	618	23.86	26.08	2.08	160.12
GDP per capita	GDP per capita, PPP (in constant 2017 international $).	656	5,709.07	6,508.68	761.52	41,249.44
GDP per capita initial	GDP per capita, PPP (in constant 2017 international $), beginning period.	663	4,254.54	4,411.54	630.68	19,011.92

3.4 Empirical Model Specification

The effect of economic infrastructure loans from China on entrepreneurship in Africa is empirically examined by estimating a panel data model for the sample of countries in the dataset. Equation 1 below specifies the main panel data model:

$$FirmEntry_{it} = \beta_1 Loan_{it,l} + \beta_2 InstQuality_{it,l} + \beta_3 Reg_{it,l} + \beta_4 Credit_{it} + \beta_5 GDPpc_{it} + \alpha_i + \eta_t + \varepsilon_{it} \quad (1)$$

Subscripts i and t represent country and time respectively, and subscript l denotes a time lag. The dependent variable (*FirmEntry*) is measured by the natural log of new business density. The focal independent variable is total economic infrastructure loans as a percent of GDP (*Loan*). Variables that have been identified by the literature as good predictors of entrepreneurial activity at the country level are included as control variables. The first is *InstQuality* and it represents the six indicators of the quality of institutions (voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption), and overall institutional quality, which is the mean value of these six measures. A second control variable *Reg*, is used to capture the quality of business regulations. It is measured by the number of start-up procedures to register a business (startup regulation). The remaining control variables are access to credit, as measured by domestic credit to the private sector (*Credit*) and economic development, as measured by log per capita real GDP in PPP-adjusted 2017 dollars (*GDPpc*). In addition, the estimation strategy also takes into account country fixed effects (α_i) and time fixed effects (η_t). Country fixed effects are included to control for unobserved time-invariant differences between countries that affect new business formation in the country, while time fixed effects control for unobserved time varying factors that affect new business creation in all countries. The variable ε_{it} is the disturbance term.

4. EMPIRICAL RESULTS

Table 3 summarizes the panel regression results for the effect of Chinese economic infrastructure loans on new business density using different model specifications. Robust standard errors, clustered by country (shown in parentheses) are used to address any serial correlation in the panel data model, and all the estimations reported in columns 1-7 control for country fixed effects and time fixed effects.[35] In all seven model specifications, the estimated coefficient on infrastructure loans ranges in value from 0.031 to 0.038, and is universally statistically significant. Averaging the infrastructure loan coefficient estimates across all seven model specifications, these results imply that increasing infrastructure loans by one percent is associated with a 3.6 percent increase in new business density.

The results provide evidence that high quality institutions promote entrepreneurship -- the overall average measure of institutional quality (governance) and two of the governance indicators (control of corruption and rule of law) have a positive and statistically significant association with entrepreneurship. Focusing on the overall average institutional quality measure (governance), a one standard deviation improvement in institutional quality is associated with a 77 percent

Table 3: Panel Results - Effect of Infrastructure Loans on New Business Density

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Institutional quality measure:	**Governance**	**Control of Corruption**	**Government Effectiveness**	**Political Stability**	**Regulatory Quality**	**Rule of Law**	**Voice & Accountability**
Dependent variable is log new business density							
Infrastructure loans	0.031** (0.015)	0.037* (0.021)	0.038** (0.018)	0.036** (0.015)	0.038** (0.018)	0.032* (0.017)	0.038** (0.018)
Governance	1.267* (0.703)	0.821* (0.461)	0.616 (0.434)	0.321 (0.216)	0.608 (0.515)	0.954* (0.543)	0.096 (0.262)
Entry regulation	-0.088** (0.037)	-0.075** (0.035)	-0.078** (0.031)	-0.086** (0.036)	-0.079** (0.034)	-0.086** (0.035)	-0.078** (0.033)
Credit	0.021* (0.012)	0.018 (0.012)	0.023* (0.013)	0.025* (0.013)	0.022 (0.013)	0.020 (0.012)	0.021 (0.013)
Log GDP per capita	1.089** (0.449)	1.339** (0.513)	1.596** (0.659)	1.540** (0.649)	1.386*** (0.495)	1.128** (0.504)	1.732** (0.808)
Constant	-8.774** (3.876)	-11.077** (4.269)	-13.329** (5.433)	-13.058** (5.444)	-11.585*** (4.141)	-9.181** (4.211)	-14.681** (6.862)
R-squared	0.664	0.679	0.646	0.640	0.632	0.663	0.616
Observations	315	311	315	315	315	311	315
Number of countries	38	38	38	38	38	38	38

Notes: Robust standard errors, clustered by country are shown in parentheses. Fixed effects method used for estimating all model specifications. The superscripts ***, **, and * denote 1 percent statistical significance, 5 percent statistical significance, and 10 percent statistical significance respectively.

increase in new business density. Consistent with Baumol, Djankov *et al.*, and Mehlum *et al.*, this implies that nations possessing strong, producer-friendly institutions attract and foster entrepreneurship.[36] For example, Shepherd *et al.* and Jauregui *et al.* find that too much corruption negatively impacts small businesses and new firm formation in India and Mexico, respectively.[37]

The estimated coefficient on barriers to entry (as measured by the number of startup steps required of new firms) ranges in value from -0.075 to -0.088, and is universally statistically significant at the 5 percent level in every model specification. Averaging the startup regulation coefficient estimates across all seven model specifications, increasing startup procedures by one step is associated with an 8.1 percent decline in new business density. Thus, excessive or burdensome barriers to entry increase the costs of doing business, and significantly dissuade new firm creation. Access to credit has a positive and statistically significant effect in three of the model specifications. Averaging the significant credit coefficient estimates across all three model specifications, a 1 percent expansion in access to credit yields a 2.3 percent increase in new business density. This result supports the prior findings of Beck and Demirguc-Kunt and other studies, which demonstrate that greater credit provision to firms in the economy stimulates entrepreneurship by relaxing the constraints to finance facing SMEs, especially in developing

countries, where SMEs account for a large share of enterprises.[38] Finally, the coefficient estimates on log real output per capita are positive and statistically significant in every model specification, with an average coefficient value of 1.401. Therefore, a 10 percent increase in per capita real output increases new business density by 14.01 percent. One possible interpretation of this result is that more economically developed nations produce a much wider array of goods and services, have households with greater disposable income, and are therefore likely to be more entrepreneurial.

To verify that the regression results reflect causal relationships between new business density and the covariates and are not simply capturing spurious relationships, the augmented Dickey-Fuller (ADF) tests for unit roots were conducted and the results are reported in Table 4. All of the four tests strongly reject the null hypothesis that all the panels contain unit roots at the one percent level of significance, implying that the data are stationary and therefore spurious results are less likely.

Table 4: Augmented Dickey-Fuller Tests

Statistic/p-value	Log New business density	Infrastruture loans	Total loans	Governance	Entry regulation	Credit	Log GDP per capita
Inverse chi-squared	120.509	335.954	343.343	297.885	237.738	263.868	270.256
p-value	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Inverse normal	-4.135	-12.126	-12.545	-10.140	-8.082	-9.472	-8.718
p-value	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Inverse logit	-4.792	-12.441	-12.887	-10.568	-8.293	-9.601	-9.443
p-value	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Modified inv. chi-squared	6.718	16.083	16.596	13.179	9.740	11.587	12.039
p-value	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*

5. ROBUSTNESS TESTS

To test the robustness of the main results, additional panel regression models are estimated and the results are reported in Table 5. To keep the exercise succinct, governance is the only measure of institutional quality considered because it is the broadest measure and is a weighted sum of all of the other underlying measures of institutional quality. It is critical to check that the estimated relationship between economic infrastructure loans (as % of GDP) and entrepreneurship is not being driven by Chinese loans allocated to other sectors. To confirm this, the total amount of Chinese loans (as % of GDP) is used instead of economic infrastructure loans (as % of GDP), and the results are shown in column (1). The estimation reported in column (1) controls for country fixed effects and time fixed effects, and robust standard errors, clustered by country are shown in parentheses. Similar to previous results, the aggregate loan measure has a positive association with entrepreneurship. However, its estimated coefficient is statistically less significant. This finding implies that the estimated relationship between economic infrastructure loans and entrepreneurship is not being driven by Chinese loans allocated to other sectors.

Column (2) drops country fixed effects and substitutes random effects in order to accommodate the addition of initial level of GDP per capita (this is necessary as fixed effects already capture country specific heterogeneity relating to beginning period economic development). Despite this difference in model specification, the results in column (2) confirm that the estimated coefficient on infrastructure loans is positive and statistically significant.

Table 5: Robustness Tests

	(1)	(2)	(3)
VARIABLES	**log new business density**	**log new business density**	**log new business density**
Total loans	0.031* (0.016)	-	-
Infrastructure loans	-	0.036** (0.017)	0.033** (0.016)
Governance	1.276* (0.702)	1.352** (0.558)	0.728*** (0.218)
Entry regulation	-0.088** (0.037)	-0.108*** (0.036)	-0.015 (0.020)
Credit	0.021* (0.012)	0.016** (0.006)	0.003 (0.002)
GDP per capita	1.082** (0.449)	-	0.000* (0.000)
GDP per capita initial	-	0.496** (0.251)	-
Log new business density (lagged)	-	-	0.470*** (0.170)
Constant	-8.713** (3.879)	-3.396 (2.343)	-
Fixed effects?	Yes	No	No
Random effects?	No	Yes	No
R-squared	0.664	0.608	-
Observations	315	315	292
Number of countries	38	38	37
Number of instruments	-	-	7
Arellano-Bond test for AR (2) in first differences *p-value*	- -	- -	-0.52 *0.602*
Sargan test of overid. restrictions *p-value*	- -	- -	0.33 *0.564*
Hansen test of overid. restrictions *p-value*	- -	- -	0.06 *0.804*

Notes: Robust standard errors, clustered by country are shown in parentheses. The superscripts ***, **, and * denote 1 percent statistical significance, 5 percent statistical significance, and 10 percent statistical significance respectively.

As a final robustness check, estimation was performed using the generalized method of moments (GMM), which is a consistent estimator for the parameters of a model in the presence of any endogenous covariates. It is well known that difference GMM suffers from weak instruments. Therefore, the two-step system GMM is performed. However, there is still the problem that the application of GMM estimators leads to instrument proliferation, which in the case of system GMM, also weakens the Hansen test of instrument validity. To limit the number of instruments generated in system GMM and avoid bias in the results, the two-step GMM is performed using collapsed instruments, following Roodman, who describes in detail how this technique can be implemented.[39]

For the first difference equation in column (3), differenced lagged values of infrastructure loans, institutional quality (governance), startup regulation, credit, and output per capita are used as standard instruments, while lagged values of new business density collapsed are used as GMM-type instruments. In the levels equation, the standard instruments are infrastructure loans, governance, startup regulation, credit, and output per capita, and GMM-type instruments are lagged values of new business density (differenced) collapsed.

Implementing the collapsing technique reduces the instrument count from 23 to 7, and both the Sargan and Hansen tests support the null hypothesis that the over-identifying restrictions are valid as shown in column (3) of Table 5. Similar to the results in column (2), the coefficient for infrastructure loans from the two-step system GMM estimation remains positive and statistically significant. Thus, overall, this robustness exercise reaffirms the findings from the main analysis on the relationship between infrastructure loans and entrepreneurship.

The other results are similar to those reported in previous sections and are therefore only briefly discussed. As expected, the coefficient for institutional quality is uniformly positive and statistically significant in all of the model specifications. In line with previous results, we see that the coefficients on startup regulation are negative and statistically significant in columns (1) and (2). Also, as expected, expanding access to credit has a positive effect on entrepreneurship and the estimated coefficient on credit is statistically significant in two of the model specifications. Lastly, the results also confirm a significant positive relationship between output per capita and new business density.

CONCLUSION

This paper examines the relationship between Chinese loans for economic infrastructure development and African entrepreneurship in the form of new business density. In an unbalanced panel of 38 African countries spanning the period between 2006 and 2018, the paper finds robust evidence that loans for economic infrastructure are significantly associated with higher new business density. This evidence supports the hypothesis that Chinese economic infrastructure loans enhance entrepreneurship by reducing infrastructure related costs and by enabling business opportunities. In addition, the results also demonstrate the significance of other domestic supply

constraints which are a major source of business costs that hamper entrepreneurship in Africa --new firm creation is significantly lower in African countries with 1) greater regulation-driven barriers to entry, 2) poor institutional quality, and 3) restricted access to private sector credit.

This paper uses a database of Chinese loans to Africa recently assembled by SAIS-CARI to contribute to the limited literature on the economic outcomes of China's lending to Africa. Although reasons have been provided in this paper as to why new business density is an appealing measure of entrepreneurship, it is important to keep in mind that this measure does not include the informal sector, which is an important component of entrepreneurship in some African countries. Future research should address this shortcoming as data on the number of firms operating within this sector becomes available. In addition, since the concept of entrepreneurship can also be applied to the introduction of new products, it would be useful for future research to analyze the impact of Chinese lending on product dynamics (entry, exit, and survival rates) of African countries. ★

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