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FINTECH IN SUB-SAHARAN AFRICA:
WHAT HAS WORKED WELL, AND WHAT HASN'T

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ABSTRACT

The FinTech sector has begun to grow rapidly in sub-Saharan Africa. I document far greater adoption of social media, digital currency, ride sharing, and other FinTech applications in countries with a common law legal heritage compared to those with a civil law system, suggesting that legal origin plays a critical role in setting the stage for growth through entrepreneurship in the developing world. The electrical, telecom, and Internet infrastructure required for FinTech has been built out more extensively in common law countries. Financial inclusion outcomes are also better in emerging markets that have a common law heritage.

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1. Introduction

In 2017 M-Pesa marked its tenth anniversary as a mobile money transfer service in developing countries. Launched in 2007 in Kenya by Safaricom, an affiliate of Vodafone, M-Pesa in its first decade spread to ten countries in Africa and Eastern Europe, growing to process more than 6 billion transactions a year for a customer base of 30 million people. The service today carries more than half of the GDP of Kenya.

The success of M-Pesa has become a touchstone for the potential of FinTech to improve financial inclusion and raise living standards in sub-Saharan Africa and elsewhere in the developing world. Yet in many ways M-Pesa appears to be an anomaly, a fact not lost on previous authors.¹ Other start-ups, including those in the payments space, have struggled to establish themselves in Africa, South America, and other emerging markets. M-Pesa appears to have been successful because it operates a low-tech FinTech service, meeting the needs of customers who have basic mobile phones that can send text messages but not relying on more advanced smartphones. When the service was replicated in the more advanced economy of South Africa, it

¹ Among others, Beck, Senbet and Simbanegavi (2015) write that “observers still point to the Kenyan story as an outlier.”

was famously unsuccessful due to the existence of a much more advanced banking network that was already meeting the needs of most consumers.²

In this essay I survey the growth of FinTech applications in consumer finance applications such as payments, digital currency, social media, and micro credit. Growth rates of services in these areas have accelerated, but they are building off a very low base, and the overall FinTech sector in sub-Saharan Africa remains small. Earlier this year a research service released a report heralding 2017 as a record year in funding for African technology startups, with 151 ventures raising just under US\$0.2 billion, a 51 percent increase over 2016. The report identified 45 of these ventures as FinTech enterprises.³ In the same period, a separate source indicated that vastly greater amounts were invested in FinTech in the United States (US\$15.2 billion), Europe (US\$7.4 billion) and Asia (US\$3.9 billion).⁴ Figure 1, reproduced from a report by the U.S. International Trade Administration (2016), shows that Africa claimed only a tiny slice of the worldwide FinTech investment from 2010-2014.

The largest impediment to more rapid FinTech growth appears to be the electrical and communications infrastructure in many developing countries, which have only limited, unreliable access to broadband Internet connections and smartphone handsets. Building out this type of infrastructure, under the sponsorship of governments, NGOs, or private industry, may represent the best way to accelerate the spread of FinTech applications and realize their full potential for boosting economic growth and financial inclusion. As Demircü-Kunt et al. (2018) write, “mobile phones and the Internet can drive financial inclusion only if they are

² “Why M-Pesa Failed in South Africa,” <http://www.bbc.com/news/world-africa-36260348> (May 11, 2016).

³ <http://disrupt-africa.com/2018/01/investment-into-african-tech-startups-hit-record-high-in-2017>.

⁴ <https://home.kpmg.com/xx/en/home/media/press-releases/2018/02/global-fintech-funding-tops-us-31b-for-2017-fueled-by-us-in-q4-kpmg-pulse-of-fintech-report.html>.

underpinned by the necessary infrastructure. Physical infrastructure – such as reliable electricity and mobile networks – is key. People will be less inclined to use digital payments if network outages or other technical problems undermine their dependability.” Put simply, FinTech faces a supply problem rather than a demand problem in many emerging economies.

The scale of the problem seems apparent from looking at Figure 2, which depicts the worldwide distribution of nodes on the decentralized Bitcoin blockchain. Nodes relay traffic on the Bitcoin network and include the miners who compete and receive rewards for writing new records to the blockchain every ten minutes. While many proponents of Bitcoin have cited its promise for promoting financial inclusion through cross-border remittances and peer-to-peer payments, the service’s overwhelming concentration in developed economies is strikingly evident from the figure. Bitcoin nodes are concentrated in the United States, Western Europe, and to a lesser extent, the richer countries of the Far East, with very little presence in Africa, South America, or the Middle East. One of the most obvious explanations for the paucity of nodes in the developing world is the lack of an information technology infrastructure, beginning with a reliable electrical grid, which can support them at a reasonable cost.

I use the Law and Finance framework introduced by LaPorta et al. (LLSV) (1997) to examine countries’ FinTech infrastructure and outcomes in financial inclusion and FinTech applications. These authors attribute financial market growth and liquidity to the legal system in place in each nation, and they note that most countries today use derivatives of either the English common law or French civil law systems. In Africa, the large majority of countries belong to one of these two legal families, as imperial conquest of different parts of the continent by different European

nations led to creation of colonial-era legal rules that by and large remain in place today. In a series of papers, LLSV (1997, 1998, 2000) show that common law countries tend to extend better protection to equity and debt investors, and that these countries achieve better financial market outcomes in terms of the cost of capital, the creation of new enterprises, and the liquidity of secondary markets, among other results.

The striking pattern that emerges in my data shows that the FinTech sector is far more vibrant in common law countries than civil law countries in sub-Saharan Africa. I find that financial inclusion outcomes are superior in common law countries, as are the extent to which electrical, telecom and Internet service has been built out in their economies. Common law countries have more use of social media and digital currency, and are more likely to host the Uber ride-sharing service (which relies on smartphones) and more likely to have crowdfunding platforms for microfinance. Interpreting causation with these data is extremely difficult, since common law countries also tend to have higher incomes, and the legal systems of nations are likely associated with other outcomes in critical areas such as education. Nevertheless, the successful extension of the LLSV framework into the FinTech space represents a new insight in entrepreneurial finance; most law and finance research up to now has focused on capital markets in the mature, wealthy economies of the world.

The remainder of this paper is organized as follows. Section II surveys the FinTech sector in sub-Saharan Africa. Section III examines different African countries' outcomes in the areas of FinTech and financial inclusion through the LLSV Law and Finance framework. Section IV discusses implications of the analysis and connects them to emerging regulatory trends around the world in the FinTech sector.

Section V concludes the paper with some suggestions for extending the analysis to include additional types of variables.

II. Survey of FinTech sectors in Africa

A. Payments

The payments industry is the indisputable flagship sector of FinTech in sub-Saharan Africa, a region where historically more than 90 percent of the economy has been cash-based.⁵

Demirgüç-Kunt et al. (2018), in the 2017 edition of the triennial *Global Findex Report*, provide abundant evidence of the spread of digital payments in developing economies. The report states that in 2017, 44 percent of adults in developing economies had made digital payments during the past year, up from 32 percent in the previous survey three years earlier. Only a minority had used mobile phones or the Internet for this purpose, however, with the majority still reliant on debit cards. Sub-Saharan Africa follows a different pattern, the report notes, with 21 percent of adults having a mobile money account, by far the most of any region in the world. In Kenya, an astonishing 73 percent of the population use mobile money, and the fraction exceeds 50 percent in Uganda and Zimbabwe. Figure 3 shows the growth of mobile payments in Africa in the recent 2014-2017 period. The report notes rapid growth of the technology in other developing nations such as Haiti and Bangladesh.

Mobile payments services such as M-Pesa have been most successful in economies with fragile institutional structures, including weak banking systems. Lee and Teoh (2015) attribute the success of M-Pesa and similar services such as AliPay in China to the “LASIC” principles: these services have low profit margins (L), they

⁵ <http://pctechmag.com/2017/03/fintech-a-growth-sector-in-africa/>.

are asset light (A), and their design is scalable (S), innovative (I), and compliance friendly (C).

M-Pesa was launched in 2007 by Vodafone, the U.K.-based telecom giant, in partnership with Safaricom in Kenya and Vodacom in Tanzania. The service has expanded to ten countries over the course of its first decade, including one in Eastern Europe (Romania) and one Pacific island nation (Fiji). Value is conveyed between phone numbers using text messages and PINs, and it can be redeemed at a large network that exceeds 40,000 agents in Kenya alone (Burus, 2016). Famously, M-Pesa has failed to catch on in South Africa, which observers attribute to the relative strength of that country's banking system and the growth of more advanced smartphone technology, both of which make local customers less interested in using the low-tech M-Pesa service. Buckley and Webster (2018) conclude that "M-Pesa leverages existing infrastructure to deliver the simplicity and accessibility required of FinTech offerings in developing countries"

B. Crowdfunded micro-finance

The Financial Stability Board (2017) provides a meta-analysis of recent survey research into micro-credit and other peer-to-peer lending markets. Data indicate that this market is growing rapidly worldwide, but that three countries – the U.S., China, and the United Kingdom – account for the large majority of total activity. African countries do not have a meaningful presence in the international totals, although separate survey evidence indicates the presence of vibrant online micro-credit markets in countries such as Kenya, Nigeria, and the Republic of South Africa. The Cambridge Center for Alternative Finance (2016) provides detail about segments of

the micro-credit markets in Africa and indicates growth rates of 89% in 2014 and 59% in 2015.

C. Cryptocurrency

Since the launch of Bitcoin in 2009 led to a wave of innovation in digital currencies and initial coin offerings (ICOs), the issuance and trading of cryptographic assets has become almost synonymous with the worldwide FinTech movement. Many of these assets are hosted on decentralized blockchain platforms that operate throughout the world, and entrepreneurs have found ICOs to be a quick, unregulated method for raising abundant new capital.

The crypto movement has largely bypassed sub-Saharan Africa to this point. As shown by Figure 2, almost none of the worldwide Bitcoin nodes operates in Africa (the actual fraction is below 0.3%, nearly all of them in the Republic of South Africa), and data indicate that virtually no Bitcoin ATMs are installed on the continent.⁶ Few African countries have taken any position on the controversial questions about the legality of digital currency and ICOs under local tax, securities, and anti-money laundering regulations. There is a nascent ICO movement in Africa. For example, a token called SureRemit, which funded a low-cost remittance service based in Nigeria, raised US\$7 million in February 2018 and saw its market value triple by April.⁷

A severe local spike in the price of bitcoin in Zimbabwe during the period of the military takeover in November 2017 strongly suggested that the limited cryptocurrency market in Africa results from an infrastructure-related supply problem rather than a demand problem. In a climate of political uncertainty in Zimbabwe, and without a bona fide sovereign currency circulating in the economy, the price of

⁶ <https://www.statista.com/statistics/343107/bitcoin-atms-region>.

⁷ <https://cryptocoin.news/icos/africas-indigenous-and-enduring-icos-6254>.

bitcoins rose to a local premium of 80% or more above the levels on worldwide markets, with very large bid-ask spreads observed on Golix, the country's lone cryptocurrency exchange. This price disparity resembled similar episodes in Venezuela and Cyprus in which political turmoil caused a flight to cryptocurrency as a financial safe haven. The local price premiums were symptomatic of the inability of Zimbabweans to access trading markets in other nations, with capital controls and a lack of Internet connectivity both playing a role.

D. Remittances

Choi, Park and Park (2017) discuss the costs of cross-border remittances and the potential for cryptocurrency platforms such as Ripple to reduce those costs. Data from the World Bank quoted by this source puts the transaction costs of remittances to sub-Saharan Africa at just under 10%, the highest in the world. Anti money-laundering compliance requirements represent a large contributing factor to these costs.

E. Blockchain-based identity and verification

A number of entrepreneurs and NGOs, including the United Nations, have promoted decentralized blockchain systems as potential platforms for a variety of political and economic applications, including registration of real estate, monitoring of voting in elections, and biometric identification systems. Often the goal of these programs is to remove data from control of governments and politicians, to defeat the manipulation of election results, the cancellation of passports and other identity credentials, or the reassignment of property titles when political regimes change. Typically these initiatives are targeted at regions of the world with histories of

instability and armed political conflict, such as South America, the Middle East, and especially sub-Saharan Africa.

While actively discussed in conferences by academics and foundations, modest pilot implementations of these systems have only begun to appear in the real world. Some of these initiatives, such as tokenized real estate blockchain platforms in countries like Rwanda and Ghana, take the form of private startups whose connections to the government's official land records are at best tenuous. One Kenyan entrepreneur laconically observed that "We expect some frictions with the authorities because they do not really accept the functionality" of his company's platform.⁸ Nevertheless, a milestone of sorts occurred in March 2018 when a Swiss-based blockchain voting platform was given limited observer status to help verify the accuracy of voting in the first round of a presidential election in Sierra Leone.⁹

F. Central bank digital currency

The most far-reaching proposed FinTech applications involve central banks adopting blockchain technology and transitioning to sovereign virtual currencies. Rather than carrying bills and banknotes, participants in the economy would transact using mobile payment systems, not unlike the large numbers of Kenyans who use M-Pesa or Chinese who rely on AliPay. Central bank digital currency would have vast implications for macroeconomic stability and has the potential to improve tax collection, compliance, and other administrative functions of government. Tunisia and Senegal have been among the earliest adopters of this technology but have done

⁸ <https://www.reuters.com/article/us-africa-landrights-blockchain/african-startups-bet-on-blockchain-to-tackle-land-fraud>.

⁹ <https://bitcoinmagazine.com/articles/sierra-leone-and-blockchain-election-wasnt>.

so in small form and have continued the circulation of their traditional physical currency.

III. FinTech success factors

I study outcomes in the areas of financial inclusion, telecommunications infrastructure, and the introduction and uptake of FinTech services. I study these variables at the country level, using widely recognized sources such as the World Bank's *Global Findex Database* and the periodic reports of the Cambridge Center for Alternative Finance. Further detail that complements this analysis is available from a recent International Monetary Fund manuscript by Maino et al. (2018)

FinTech innovation will improve financial inclusion only if it meets the needs of broad numbers of poor and working class citizens, whose day-to-day finances are often characterized by volatility, complexity, and improvisation (McCaffrey & Schiff, 2017). To be successful, FinTech applications must operate on a reliable electrical grid that permits large numbers of people to connect via mobile phones or the Internet, and the products must be designed with simplicity and low cost. As Ozili (2018) writes, "the goal of financial services made available via digital platforms is to contribute to poverty reduction and to contribute to the financial inclusion objectives of developing economies." The author notes, however, the improperly designed FinTech systems can worsen problems of financial inequality if the services are costly or difficult for the entire population to understand or access.

Table 1 presents country-level averages for three common measures of financial inclusion: whether an adult has a financial account with a bank or mobile company, whether they have saved money in the past year, and whether the individual owns an electronic debit card. I tabulate these averages for 35 countries in sub-

Saharan Africa, excluding a handful that are governed by religious law and a number of the smallest countries that are not always covered by research surveys. There are 20 countries in my sample that use civil law, and 15 countries that follow a common law heritage. Figure 4 shows these countries on a map of the continent, and the similarities between the footprint of common law countries and the growth of mobile payments in various nations, shown earlier in Figure 3, seems unmistakable.

The common law, which generally evolves through caselaw and precedent, has its origins in 12th century England. Legal proceedings occur in an adversarial format, and case-based precedents provide predictability and serve as important guidance to agents in business transactions. Private plaintiffs often have a right to initiate litigation against the government or against private businesses. Civil law, in contrast, tends to arise from legislation and academic treatises, and it represents the byproduct of knowledge rather than experience. The right to initiate litigation is often reserved to government prosecutors in civil law countries, and legal proceedings do not occur in the same type of adversarial framework that exists in common law litigation. Ancient Roman law provides the foundation of modern civil law, and many of the codes adopted around the world today, including those in sub-Saharan Africa, are derived from the French Napoleonic Code that was promulgated approximately two centuries ago. See LaPorta et al. (1997, 1999, 2000), and references therein, for a more complete discussion.

Data tabulated in Figure 1 show that most common law countries in sub-Saharan Africa have average levels of financial inclusion far ahead of most civil law countries. Taking an equal-weighted average across countries, we see an enormous gap in financial account ownership in favor of the common law countries (54% vs. 32%), an even more striking gap in electronic debit card ownership (27% vs. 8%), and

a higher propensity to accumulate savings (57% vs. 46%). All of these differences are statistically significant.

As I stress repeatedly below, inferring causation with these data is quite difficult. Common law countries tend to have higher income levels than civil law countries, and it is easy to jump to the conclusion that differences in financial inclusion are simply an artifact of higher incomes. But income levels themselves are no doubt affected by the legal regime in the economy. We lack a good statistical framework for sorting out the direction of causation in these and other relationships, since they tend to be determined simultaneously in the market.

In Table 2, I investigate the electrical, Internet and mobile phone infrastructure for each country, as well as the nature of the government bureaucracy for entrepreneurs, using the latest available data (generally 2016 or 2017) for each variable. As a measure of bureaucracy, I use World Bank data about the number of days required to start a new business, which encompasses the time necessary to pay fees and obtain licenses and permits from the relevant government ministries.

Reflecting the higher levels of financial inclusion in common law countries, Table 2 shows greater Internet and mobile phone network penetration in these countries as well. The average across countries of Internet availability is 38.5% in the 15 common law countries and much lower at 21.8% in the 20 civil law countries.¹⁰ For mobile phone penetration, the averages are 94.9% vs. 75.0%. Both differences are statistically significant. Note that many countries have mobile phone penetration in excess of 100%, because it is not unusual for people to own more than one phone. The penetration of the electrical grid is also higher on average in common law

¹⁰ Mobile Internet (e.g. broadband data) penetration in Africa is 20% to 25% (Lim, Lakhoua and Mazzawi, 2016.), while it is near 100% in most of the developed world.

countries, although the difference in means between common law and civil countries is not statistically significant at conventional levels, with a p -value of 0.15.

Even though the technological infrastructure for FinTech entrepreneurs seems clearly better in common law compared to civil law countries, Table 2 shows that bureaucracy and regulation for entrepreneurs is more time consuming for the common law countries, implying that the regulatory climate is less favorable for FinTech startups in common law compared to civil law countries.¹¹ While this result may seem surprising in light of the other data in the paper, it may indicate that the common law governments make the commitment to monitor and regulate FinTech providers at a baseline level that is necessary for the industry to win the confidence of customers. The Cambridge Center for Alternative Finance (2016) writes, “The lack of bespoke regulatory regimes and specific alternative finance policy developments is affecting alternative finance industry growth in both Africa and the Middle East. The greatest perceived risk by the industry in Africa and the Middle East region is ‘fraud.’”

In Table 3, I present country means for the adoption of four types of FinTech services. Facebook penetration is the fraction of the population with accounts on the social media platform, the average for common law countries, 16.0%, is nearly double the average for civil law countries, 8.5%, with the difference being statistically significant. Social media networks like Facebook are important FinTech services in their own right, but they also create important side effects by providing referrals of friends to new platforms and services. A robust social media climate may therefore be viewed as part of the infrastructure for other FinTech Services.

¹¹ The U.S. ITA (2016) cites the onerous regulation imposed on the worldwide banking sector in the aftermath of the 2009 Global Financial Crisis as an indirect factor in the emergence of FinTech startups as unregulated competitors with far lower compliance burdens.

Table 3 also shows a measure of cryptographic currency adoption, the cumulative (since 2008) downloads of Bitcoin client software per capita in each country. Although there are numerous ways to acquire and transfer digital currency, perhaps the simplest and most straightforward is to install the Bitcoin client software on one's own personal computer. The data indicate vast differences between common law and civil law countries. Many of the civil law countries appear to have had close to zero contact with Bitcoin, and the country average for common law countries is more than eight times higher than the average for civil law countries.

The other variables studied in Table 3 are an indicator for whether the Uber ride-sharing service exists in at least one city within a particular country, and whether a crowdfunding micro-finance platform located in each country is used as a data source by the Cambridge Center for Alternative Finance (2016) in its survey of Africa and the Middle East. Again, a profound difference exists in the adoption of these two services by common law and civil law countries. With just one exception in each case, all of the Uber service and all of the crowdfunding platforms exist only in common law countries.

Regression analysis in Tables 4, 5, 6, and 7 analyzes the adoption of Bitcoin, Facebook, Uber and crowdfunding platforms, respectively, on a cross-country basis using an ordinary least squares framework (the Uber analysis is a linear probability model). In each table, the dependent variable is regressed against an intercept and an indicator for common law legal heritage in the first column. In the second column, control variables are added to reflect the penetration of the electrical grid, the Internet, and the efficiency of government bureaucracy, as measured by the number of days required to organize a new business. In the right column of each table, additional control variables reflect whether each country falls into the lower-middle or upper-

middle income range according to The World Bank (for the upper-middle income countries, both income variables are set equal to one). Variables are generally measured as of 2017 as described more fully in the tables.

I find a consistent pattern of results across the four tables. In each case, a univariate regression of the FinTech dependent variable against the common law indicator yields a positive and statistically significant estimate, in line with the country-level sample means shown in Table 3. Adding regression controls dramatically improves the fit of each model but generally does not change the estimate for the common law indicator variable very much, as it stays positive in every model and usually remains statistically significant. Among the additional control variables, the most important appear to be the penetration of the electrical grid in each country, which usually exhibits a positive and statistically significant estimate with the dependent variables, and also the indicator for upper-middle income status, which generally coincides with higher FinTech adoption although oddly the opposite seems true for ride-sharing.

Inferring causation from these estimates is extremely difficult, since considerable multicollinearity exists among the explanatory variables, and the common law indicator probably influences aspects of the country's infrastructure as well as its income levels. A proper test would involve either the random assignment of countries to different legal regimes, which is unlikely ever to occur, or finding a suitable instrumental variable associated with a common law legal heritage while not having any predictive association with the various business and economic outcomes studied in the regressions.

IV. Regulatory implications

The data in Table 3 show an overwhelming disparity in the take-up of FinTech services in common law compared to civil law countries in sub-Saharan Africa, and this conclusion is reinforced by the regression analysis in Tables 4 through 7. All of the tables suggest that a common law legal infrastructure can play a significant role in promoting growth. This is consistent with the views in Burns (2016) about the trend over time for developing nations to stress bottom-up, market driven economic development as an alternative to top-down, state ownership driven strategies. Providing the legal conditions for well-functioning markets, which seems to be the signal achievement of common law systems, is a necessary condition for bottom-up development strategies to work effectively.

We know relatively less about the optimal type of regulation to promote FinTech business, and how that regulation might interact with the legal system already in place. To a large extent, sub-Saharan African countries have taken a hands-off regulatory posture toward FinTech.

In general, FinTech regulation touches three broad areas: tax collection, consumer protection, and financial stability. A fourth area would be compliance with anti-money laundering regulations, which would be a special problem for developing nations, such as those in sub-Saharan Africa, that receive remittances or crowdfunding donation streams from abroad over FinTech platforms. Regulating FinTech organizations has been a problem in all countries, even those with the most highly developed institutions, because in many cases the technology is designed to bypass existing regulatory frameworks. Public blockchains, for example, can exist mostly in virtual space with no physical connection to those countries where their users reside, and any regulator seeking to impose sanctions or collect taxes might

have no direct method for doing so other than voluntary compliance by the blockchain promoters.

In addition to the general problems I identify above, Didenko (2018) lists four motivations for FinTech regulation that arise due to the nature and impact of the technology:

- Threats posed by new technology to market incumbents
- Expanded access to financial services by unsophisticated customers
- Rapid growth of new platforms
- Disintermediation or anonymization of service providers that formerly provided market oversight

He notes that FinTech is generally popular in Africa due to the extension of basic financial services into many markets that banks have found unprofitable to enter, as well as the lack of any visible FinTech disasters up to now.

Around the world, most regulators have chosen to adjust existing frameworks to accommodate cryptographic assets rather than write entirely new rules and regulations. However, a wait-and-see approach is attractive to many regulators given the incomplete information available about new technologies (Didenko, 2018).

Governments implementing new regulatory schemes often make use of a provisional “sandbox” form. Regulatory sandboxes, which have proved especially popular in Asia, provide safe harbors for innovators to launch new products and enjoy temporary regulatory exemptions. The usual condition for participating in the sandbox is that a business must stay small. Once it reaches a critical mass, a more formal regulatory scheme will be invoked.

The Cambridge Centre for Alternative Finance (2017) provides a reasonably comprehensive survey of regulation in a number of East African countries with a

focus on the crowdfunding sector. Among other recommendations, the report notes that voluntary codes of conduct and self-regulating industry associations offer attractive alternatives to formal government oversight and regulation. These types of opt-in, private regulatory schemes allow the promoters to signal to the market that they are committed to transparency and have viable business plans, and under certain conditions they may create more credibility than traditional government regulation.

Finally, access to a suitable infrastructure, especially in the form of a national electrical grid, appears to represent a necessary condition for progress in the FinTech area. One cannot use smartphones, digital currency, or social media services without access to reliable electricity. The determinants of the growth of African electricity systems is the subject of a large development literature that beyond the scope of this paper. As an example of a recent policy paper, Blimpo, McRae and Steinbuks (2018) argues that low electrification rates on the continent may arise as a byproduct of low tariff rates that discourage utilities from making capital investments.

V. Conclusions

This paper studies the success factors for FinTech in sub-Saharan Africa. The payments sector, and in particular Safaricom's M-Pesa, have come to dominate public consciousness about the potential for FinTech to promote financial inclusion and raise living standards in a part of the world that is under-served by the traditional banking system. However, the striking success of M-Pesa in Kenya appears to be an outlier, as FinTech firms have been slow to penetrate other sectors and other countries, and have only recently entered a period of rapid growth building off a small base.

FinTech platforms can only succeed where an infrastructure of electric power, telecommunications, and Internet providers are available to support them. These

industries vary widely in scope and quality in sub-Saharan Africa. One clear pattern in the data is that the infrastructure required for FinTech has been built out much more extensively in countries with a common law legal system, compared to those with a civil law system. The common law countries typically provide more investor protection and achieve lower costs of capital and greater liquidity for investors, and this seems to have supported the growth of FinTech platforms in those nations. The results are broadly consistent with a 115-country study by Beck, Demirgüç-Kunt and Levine (2003) that pre-dates the FinTech movement by more than 15 years and concludes that the greater flexibility of common law systems provides an advantage in fostering economic development.

Best practices in regulation for FinTech companies in the developing world remain largely unknown, partly because of the immaturity of regional political institutions, and partly because of the novelty of the technology, which has posed challenges for regulators even in very advanced economies. Regulatory sandboxes that offer safe harbors have been the preferred approach of many governments, while various forms of private self-regulation have begun to play an important role as well.

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Table 1
Financial inclusion indicators

Nation	Legal heritage	Population (millions)	Bank or mobile account (adult %)	Savings in past year (adult %)	Debit card ownership (adult %)
Benin	Civil law	11.1	38%	49%	11%
Burkina Faso	Civil law	19.2	43%	54%	12%
Cameroon	Civil law	24.1	35%	57%	11%
Central African Rep.	Civil law	4.7	14%	40%	4%
Chad	Civil law	14.9	22%	27%	3%
Congo, Democ. Rep.	Civil law	81.3	26%	39%	6%
Congo, Rep. of	Civil law	5.3	26%	46%	12%
Côte d'Ivoire	Civil law	24.3	41%	49%	7%
Ethiopia	Civil law	105.0	35%	62%	4%
Gabon	Civil law	2.0	59%	60%	16%
Guinea	Civil law	12.7	23%	39%	7%
Madagascar	Civil law	25.6	18%	44%	3%
Mali	Civil law	18.5	35%	54%	10%
Mauritania	Civil law	4.4	21%	42%	10%
Mozambique	Civil law	29.7	42%	43%	20%
Niger	Civil law	21.5	16%	25%	3%
Rwanda	Civil law	12.2	50%	64%	5%
Senegal	Civil law	15.9	42%	45%	10%
South Sudan	Civil law	12.6	9%	34%	2%
Togo	Civil law	7.8	45%	45%	13%
Botswana	Common law	2.3	51%	47%	27%
Ghana	Common law	28.6	58%	50%	19%
Kenya	Common law	49.7	82%	70%	38%
Lesotho	Common law	2.2	46%	40%	20%
Liberia	Common law	4.7	36%	68%	4%
Malawi	Common law	18.6	34%	52%	11%
Mauritius	Common law	4.4	90%	60%	74%
Namibia	Common law	2.5	81%	63%	65%
Nigeria	Common law	190.9	40%	62%	32%
Sierra Leone	Common law	7.6	20%	54%	2%
South Africa	Common law	56.7	69%	59%	34%
Tanzania	Common law	57.3	47%	48%	13%
Uganda	Common law	42.9	59%	69%	17%
Zambia	Common law	17.1	46%	59%	20%
Zimbabwe	Common law	16.5	55%	54%	22%
Means	Civil law		32%	46%	8%
	Common law		54%	57%	27%
<i>p</i> -value, difference in means			.00	.00	.00

Sources: United Nations Statistics Division (2017) (population); World Bank Global Findex Database (2017)

Table 2
FinTech infrastructure

Nation	Legal heritage	Electrical penetration	Internet penetration	Mobile phone penetration	Days to start a new business
Benin	Civil law	32%	33.1%	88.1%	9
Burkina Faso	Civil law	20%	18.8%	79.8%	13
Cameroon	Civil law	63%	24.8%	79.5%	17
Central African Rep.	Civil law	3%	5.4%	27.3%	22
Chad	Civil law	9%	5.0%	39.0%	60
Congo, Democ. Rep.	Civil law	15%	6.1%	49.5%	7
Congo, Rep. of	Civil law	43%	12.0%	104.4%	49
Côte d'Ivoire	Civil law	62%	26.3%	109.9%	7
Ethiopia	Civil law	45%	15.3%	42.4%	33
Gabon	Civil law	90%	47.7%	146.2%	33
Guinea	Civil law	20%	12.3%	89.5%	8
Madagascar	Civil law	23%	7.2%	44.1%	8
Mali	Civil law	41%	65.3%	129.9%	9
Mauritania	Civil law	31%	17.8%	87.5%	6
Mozambique	Civil law	29%	17.3%	71.9%	19
Niger	Civil law	11%	4.3%	45.0%	7
Rwanda	Civil law	30%	29.8%	75.3%	4
Senegal	Civil law	64%	59.8%	99.9%	6
South Sudan	Civil law	1%	17.3%	24.4%	13
Togo	Civil law	35%	11.3%	65.5%	6
Botswana	Common law	55%	39.6%	157.3%	48
Ghana	Common law	84%	34.3%	126.9%	14
Kenya	Common law	65%	85.0%	79.8%	25
Lesotho	Common law	34%	27.7%	98.4%	29
Liberia	Common law	12%	8.1%	81.2%	5
Malawi	Common law	11%	9.5%	37.4%	37
Mauritius	Common law	100%	63.4%	139.9%	6
Namibia	Common law	56%	30.8%	105.1%	66
Nigeria	Common law	61%	50.2%	83.2%	19
Sierra Leone	Common law	9%	11.7%	78.2%	11
South Africa	Common law	86%	53.7%	159.2%	45
Tanzania	Common law	33%	38.9%	73.6%	28
Uganda	Common law	19%	42.9%	50.4%	24
Zambia	Common law	34%	41.2%	71.8%	9
Zimbabwe	Common law	34%	40.2%	80.9%	61
9Means	Civil law	33.4%	21.8%	75.0%	17
	Common law	46.2%	38.5%	94.9%	28
<i>p</i> -value, difference in means		.15	.01	.10	-.06

Sources: www.internetworldstats.com; databank.worldbank.org; International Energy Agency (https://www.gogla.org/sites/default/files/resource_docs/weo2017specialreport_energyaccessoutlook.pdf).

Table 3
FinTech indicators

Nation	Legal heritage	Facebook penetration	Uber service	Funding platforms surveyed	Bitcoin clients per million
Benin	Civil law	8.0%			13
Burkina Faso	Civil law	4.3%			3
Cameroon	Civil law	10.9%			19
Central African Rep.	Civil law	2.0%			0
Chad	Civil law	1.7%			0
Congo, Democ. Rep.	Civil law	2.5%			1
Congo, Rep. of	Civil law	11.1%			11
Côte d'Ivoire	Civil law	15.3%			39
Ethiopia	Civil law	4.2%	Yes		3
Gabon	Civil law	30.0%			33
Guinea	Civil law	11.5%			2
Madagascar	Civil law	6.5%			8
Mali	Civil law	7.9%			4
Mauritania	Civil law	17.0%			11
Mozambique	Civil law	5.9%			6
Niger	Civil law	2.0%			1
Rwanda	Civil law	3.9%			9
Senegal	Civil law	17.8%		1	18
South Sudan	Civil law	1.4%			
Togo	Civil law	7.0%			13
Botswana	Common law	35.6%			120
Ghana	Common law	16.6%	Yes	2	85
Kenya	Common law	13.7%	Yes	2	46
Lesotho	Common law	13.7%			6
Liberia	Common law	6.6%			4
Malawi	Common law	3.8%			3
Mauritius	Common law	55.2%			436
Namibia	Common law	22.0%			127
Nigeria	Common law	8.7%	Yes	2	17
Sierra Leone	Common law	5.6%			3
South Africa	Common law	27.9%	Yes	8	363
Tanzania	Common law	10.3%			37
Uganda	Common law	5.9%	Yes	1	9
Zambia	Common law	9.1%			6
Zimbabwe	Common law	5.2%			11
Means	Civil law	8.5%			10
	Common law	16.0%			85
<i>p</i> -value, difference in means		.05			.02

Sources: www.internetworldstats.com; www.uber.com; Cambridge Center for Alternative Finance; <https://sourceforge.net/projects/bitcoin/files/stats/map> (2008-18 downloads / 2017 population).

Table 4
Bitcoin client downloads since 2009

Ordinary least squares estimates of cumulative Bitcoin client downloads since launch of the service in 2009, as reported by Sourceforge. Internet penetration is the number of Internet users as reported by Internet World Stats. Electrical penetration is reported by the International Energy Agency Energy Access Outlook. The number of days to start a new business is reported by The World Bank Doing Business Project. All variables are measured as of 2017. Standard errors are shown below each coefficient estimate in parentheses.

Dependent variable: Bitcoin client downloads per capita, 2009 to date

Intercept	9.7 (88.4)	-57.1 (70.2)	-15.9 (58.5)
Common law indicator	75.2^{**} (30.2)	55.7^{**} (28.5)	50.9^{**} (24.0)
Internet penetration		-70.5 (90.1)	-49.3 (74.8)
Electrical penetration		251.2 ^{**} (66.0)	160.8 ^{**} (79.7)
Days to start a new business		-0.1 (0.7)	-1.0 (0.6)
Lower middle income indicator			-33.8 (30.7)
Upper middle income indicator			163.6 ^{***} (38.8)
Observations	35	35	35
R ²	0.16	0.50	0.70

Significant at 1% (***), 5% (**), and 10% (*) levels.

Table 5
Facebook adoption per capita

Ordinary least squares estimates of the frequency of Facebook usage, based on subscription data as reported by Internet World Stats. Internet penetration is the number of Internet users as reported by Internet World Stats. Electrical penetration is reported by the International Energy Agency Energy Access Outlook. The number of days to start a new business is reported by The World Bank Doing Business Project. All independent variables are measured as of 2017. Standard errors are shown below each coefficient estimate in parentheses.

Dependent variable: Facebook subscribers per capita

Intercept	9.7 (88.4)	-0.02 (0.07)	0.04 (0.04)
Common law indicator	0.07** (0.04)	0.04 (0.03)	0.02 (0.02)
Internet penetration		-0.06 (0.09)	0.01 (0.06)
Electrical penetration		0.35*** (0.07)	0.13** (0.06)
Days to start a new business		-0.0002 (0.001)	-0.001 (0.001)
Lower middle income indicator			0.03 (0.03)
Upper middle income indicator			0.20*** (0.03)
Observations	35	35	35
R ²	0.11	0.65	0.86
Significant at 1% (***), 5% (**), and 10% (*) levels.			

Table 6
Uber ride sharing service availability

Ordinary least squares linear probability estimates of the presence of Uber service in different countries, as reported by the company's website in mid-2018. Internet penetration is the number of Internet users as reported by Internet World Stats. Electrical penetration is reported by the International Energy Agency Energy Access Outlook. The number of days to start a new business is reported by The World Bank Doing Business Project. All independent variables are measured as of 2017. Standard errors are shown below each coefficient estimate in parentheses.

Dependent variable: Indicator for Uber service in at least one urban area

Intercept	0.05 (0.36)	-0.12 (0.36)	-0.28 (0.34)
Common law indicator	0.28** (0.12)	0.19 (0.14)	0.26* (0.14)
Internet penetration		0.31 (0.45)	0.12 (0.45)
Electrical penetration		0.28 (0.33)	0.90* (0.48)
Days to start a new business		0.0002 (0.004)	0.003 (0.004)
Lower middle income indicator			-0.11 (0.18)
Upper middle income indicator			-0.50** (0.23)
Observations	35	35	35
R ²	0.14	0.23	0.35

Significant at 1% (***), 5% (**), and 10% (*) levels.

Table 7
Crowdfunding platforms

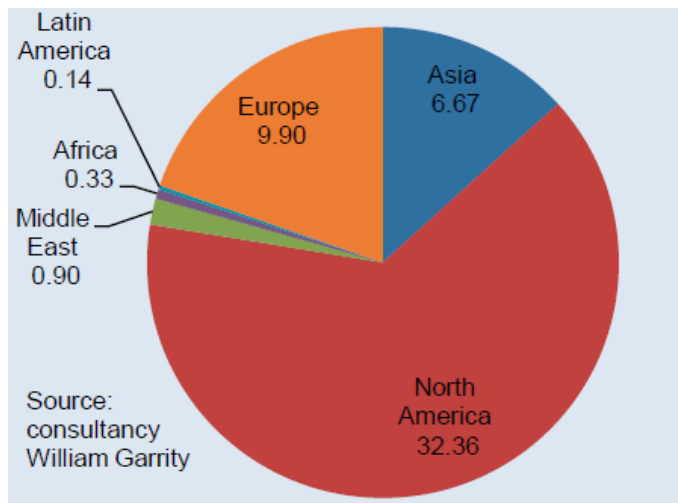
Ordinary least squares estimates of the number of crowdfunding platforms as reported by the Cambridge Center for Alternative Finance (2016). Internet penetration is the number of Internet users as reported by Internet World Stats. Electrical penetration is reported by the International Energy Agency Energy Access Outlook. The number of days to start a new business is reported by The World Bank Doing Business Project. All independent variables are measured as of 2017. Standard errors are shown below each coefficient estimate in parentheses.

Dependent variable: number of crowdfunding platforms

Intercept	0.05 (1.38)	-0.79 (1.32)	-0.72 (1.36)
Common law indicator	0.95** (0.47)	0.53 (0.53)	0.60 (0.57)
Internet penetration		0.77 (1.67)	0.61 (1.79)
Electrical penetration		1.73 (1.22)	2.14 (1.91)
Days to start a new business		0.006 (0.01)	0.006 (0.02)
Lower middle income indicator			-0.31 (0.74)
Upper middle income indicator			0.08*** (0.93)
Observations	35	35	35
R ²	0.11	0.26	0.26

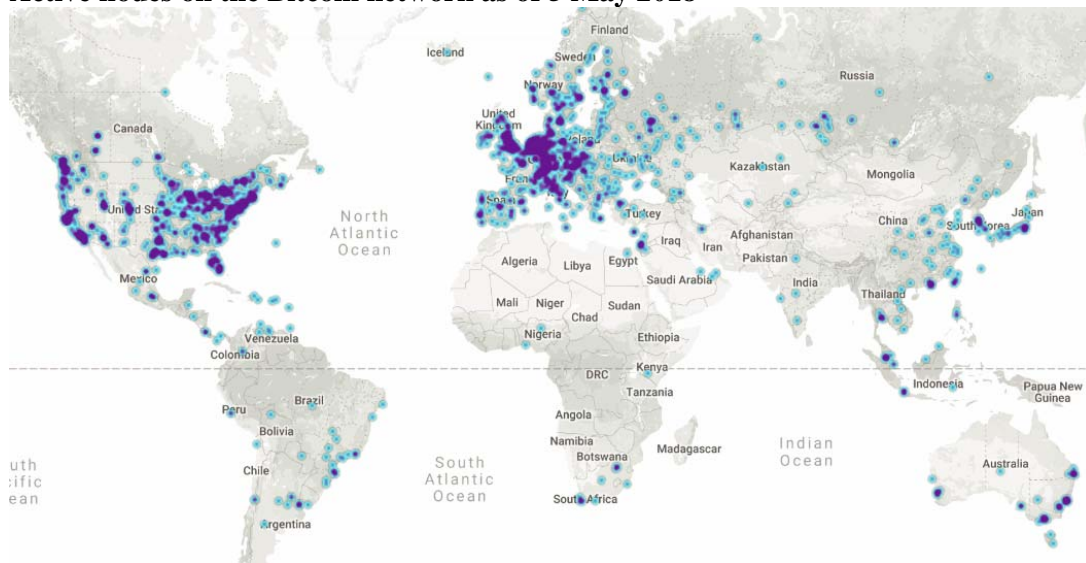
Significant at 1% (***), 5% (**), and 10% (*) levels.

Figure 1
FinTech investment, 2010-2014



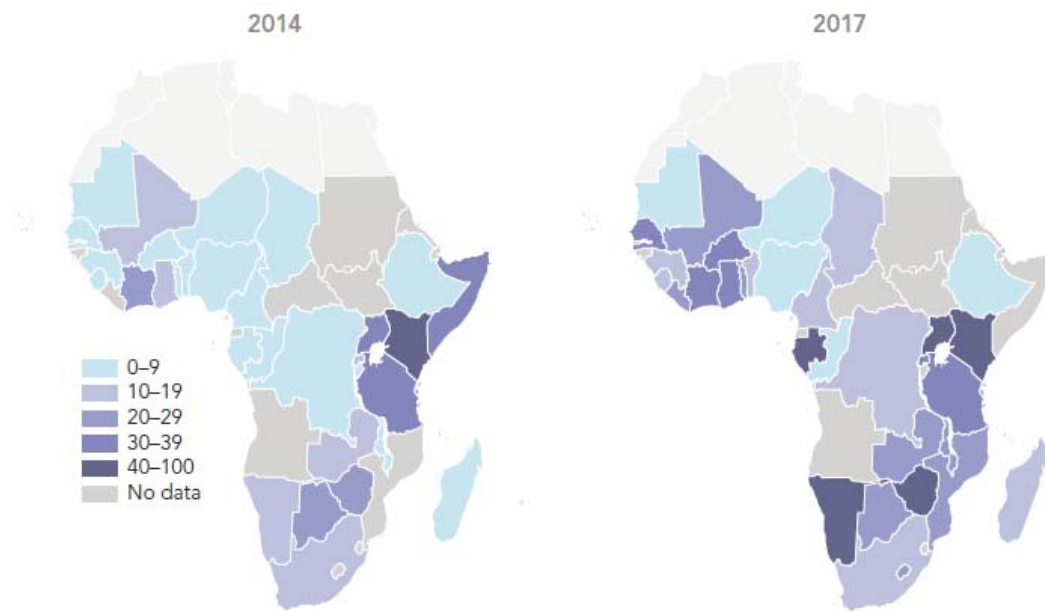
Source: U.S. International Trade Administration (2016)

Figure 2
Active nodes on the Bitcoin network as of 5 May 2018



Source: www.bitnodes.earn.com

Figure 3
Mobile payments as a share of GDP in different Africa countries



Source: Global Findex Database

Figure 4
Common law (red) and civil law (blue) countries in sub-Saharan Africa

