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Abstract

Mobile phones promote financial inclusion in developing nations by enabling access to credit savings, and transfer services. These payment systems rarely achieve nationwide usage that is sufficient for network effects, a problem that existing literature attributed to exogenous factors such as regulations, poverty, and infrastructure costs. This paper argues that banks, telecoms, and governments are incentivized to inhibit the spread of mobile payments because the systems harm their institutional stability. The paper presents theoretical and empirical scenarios in which each actor would be incentivized to restrict mobile payments. The conclusion is that support for mobile payments is not universal, and future endeavors must account for the incentives of relevant actors.

Keywords

mobile phones, economic development, incentives, poverty, Africa.

Disciplines

Business

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Abstract: Mobile phones promote financial inclusion in developing nations by enabling access to credit savings, and transfer services. These payment systems rarely achieve nationwide usage that is sufficient for network effects, a problem that existing literature attributed to exogenous factors such as regulations, poverty, and infrastructure costs. This paper argues that banks, telecoms, and governments are incentivized to inhibit the spread of mobile payments because the systems harm their institutional stability. The paper presents theoretical and empirical scenarios in which each actor would be incentivized to restrict mobile payments. The conclusion is that support for mobile payments is not universal, and future endeavors must account for the incentives of relevant actors.

Key words: mobile phones; economic development; incentives; poverty; Africa.

Actor-based incentives for the restriction of mobile payments in developing countries

Dylan Adelman | December 2015
The University of Pennsylvania

Mobile phones are a *deus ex machina* for the plights of the bottom billion. From Guadalajara to Gujarat, the mobile phone has jumpstarted an unforeseen communications revolution for those living on less than \$2.00 daily. Nearly 650 million adults in sub-Saharan Africa, about 70% of the population, have access to a mobile phone—more than the population of North America.¹ The adoption rates for mobile phones have shot from 10% to 90% in parts of Africa and Latin America within the last decade, rivaling the usage numbers of developed nations.² For many, accessing a mobile phone is easier than accessing a toilet.

Phones are useful for more than just placing calls, and communicative benefits have proliferated. Residents of Kathmandu can access the latest data on Himalayan earthquakes.³ Tanzanian farmers can receive daily texts updates on the spot price for coffee in Dar es Salaam.⁴ In Ghana, users of the health application mPedigree can check for counterfeit pharmaceuticals.⁵ Economic benefits also abound: studies have found that 10 additional mobile phones per 100 people in a developing country will raise GDP by as much as 1.2%.⁶ Mobile phones also play a critical role in promoting financial inclusion by obviating the need for physical banks. Although 85% of sub-Saharan Africa lacks access to a formal savings account, mobile banking has informally filled the void by enabling millions to access services for savings, loans, transfers, and financial planning.⁷

Of these services, *transfers* may prove the most consequential. Mobile payments, as transfers are commonly known, enable the virtual exchange of units of value from one phone to another. The units of value are legally mandated to maintain 1:1 parity with the national currency, and the exchange is usually controlled by a telecom (sometimes in conjunction with a bank). Mobile payments services worldwide numbered 263 by August 2015, with dozens more in trial phase.⁸

Arguably the most famous mobile payments service is Kenya's M-Pesa ("mobile money" in Swahili). Started in 2007 by telecom Safaricom, this creatively named service annually handles transactions amounting to 60% of Kenya's GDP.⁹ The most immediate benefit of mobile payments is a reduction in transfer costs: the cost to send 1000 Kenyan Shillings (\$15 USD) from Nairobi to Turkana (from central to northwestern Kenya) via M-Pesa is just 7% of the cost to send money via *matatu* buses, the traditional method of informal money transfers.¹⁰ M-Pesa saves users an average of \$3 per transaction, remarkable when one considers that Kenya's per-capita GDP is \$1358.¹¹ With time, the

¹ Sambira, Jocelyne. "Africa's mobile youth drive change." *Africa Renewal, United Nations*, May 2013, 19.

² Etzo, Sebastiana, and Collender, Guy. "The mobile phone 'revolution' in Africa: rhetoric or reality?" *African Affairs* 109 (2010): 659-68.

³ "Mobile phone data helps ongoing quake relief effort in Nepal." *University of Southampton*, 9 November 2015.

⁴ Stolle, Sophie. "Why farmers in Tanzania are using Tigo Kilimo." *Tech Change*, 3 June 2015.

⁵ Talbot, David. "The mPedigree Network." *MIT Technology Review*, 2014.

⁶ "What is the impact of mobile telephony on economic growth?" *GSM Association* (2012): 1-32.

⁷ Kendal, Jake, and Voorhies, Rodger. "The Mobile-Finance Revolution: How Cell Phones Can Spur Development." *Foreign Affairs*, March/April 2014.

⁸ "MMU Deployment Tracker." *GSM Association*, August 2015.

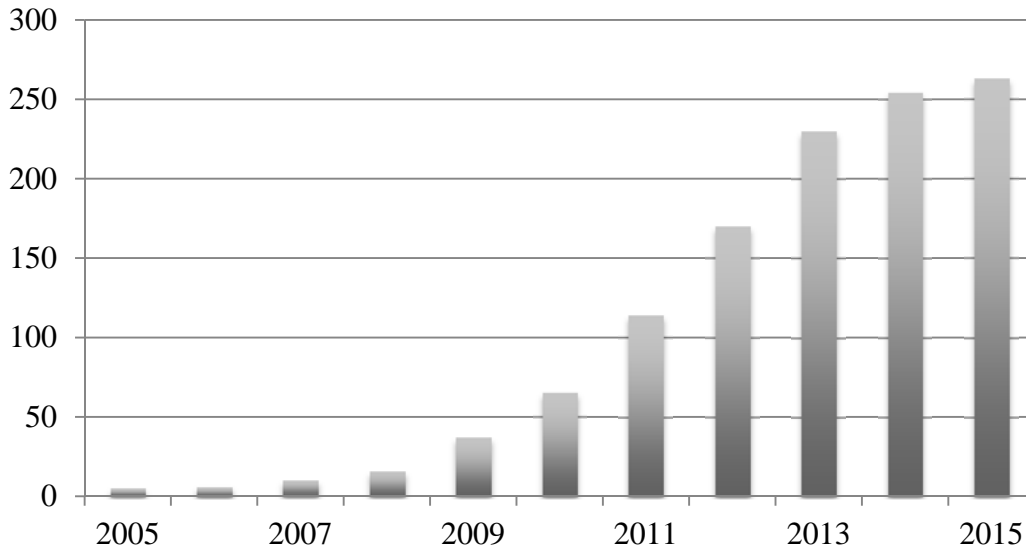
⁹ Heinrich, Erik. "The apparent M-Pesa monopoly may be set to crumble." *Fortune*, 27 June 2014.

¹⁰ Morawczynski, Olga, and Miscione, Gianluca. "Examining trust in mobile banking transactions: the case of M-Pesa in Kenya." *International Federation For Information Processing*, Vol. 282 (2008): 287-98.

¹¹ Gencer, Menekse. "The Mobile Money Movement: Catalyst to Jumpstart Emerging Markets." *Innovations*, Winter 2011, 3-19.

reduced friction in payments has important microeconomic effects: income levels of households using M-Pesa rose by as much as 30% within three years of adoption, relative to peers.¹²

Mobile payments systems worldwide, 2005-2015



The counterrevolution

The universal recognition of mobile payments as crucial to the war on poverty has not translated to universal success. The omnipresent example of M-Pesa belies the reality that only 21 mobile payments services claim greater than one million users. Despite the ubiquity of mobile payments, less than 1 in 10 sub-Saharan Africans are active users of mobile payments—a ratio skewed upward by the success of Kenya and Tanzania.¹³ If mobile transfers are crucial to alleviate poverty, then why does the probability of success for a typical mobile payments system rival the acceptance rate of Harvard College?

The existing literature explains this dissonance in several ways. First, regulatory barriers related to international AML/CTF/KYC¹⁴ requirements hamper telecoms’ ability to sign up new users because the world’s poorest lack the necessary paperwork for self-identification.^{15,16} Second, the abjectly poor are uninterested in mobile money because of a predilection for cash, a misunderstanding of transfers, or a perceived lack of utility from its usage.¹⁷ Third, the cost of physical infrastructure related to mobile transfers (such as

¹² “Why does Kenya lead the world in mobile money?” *The Economist*, 27 May 2013.

¹³ “State of the Industry: Mobile Financial Services for the Unbanked.” *GSM Association*, December 2014.

¹⁴ “Anti Money Laundering/Counterterrorism Financing/Know Your Customer.” These are three sets of international regulations meant to inhibit cross-border illicit financial activities. The regulations often require identification paperwork, a physical address, and proof of citizenship.

¹⁵ Winn, Jane K. “Governance of global mobile money networks: the role of technical standards.” *Washington Journal of Law, Technology & Arts*, Vol. 8 (2013).

¹⁶ Nyaga, Joseph Kariuki. “Mobile banking services in the East African Community (EAC): challenges to the existing legislative and regulatory frameworks.” *Journal of Information Technology*, Vol. 4 (2014),

¹⁷ Ssonko, George Wilson. “The role of mobile money services in enhancing financial inclusion in Uganda.” *BOUWP*, August 2010.

agent networks that handle conversion between physical and electronic money) offset expected returns, a cost compounded by the dispersed nature of rural populations.¹⁸

While important, these factors do not explain the extent of this failure because of their *passivity*. That is, these factors are non-incentivized and exogenous barriers that can be overcome by parties interested in the success of mobile payments. Regulations can be streamlined under governments wishing to promote mobile payments, as demonstrated by Kenya and Tanzania. The abject poor can learn the benefits of mobile transfers with targeted education programs, as demonstrated by successful programs in Zambia and Mexico.^{19,20} Infrastructure barriers are a red herring: telecoms can leverage pre-existing airtime distribution networks for the provision of mobile payments, as demonstrated by Safaricom in its usage of pre-existing airtime agents for the M-Pesa rollout.^{21,22} By emphasizing passive factors, the existing literature assumes that all major actors—banks, telecoms, and governments—are incentivized to foment the success of mobile payments, and that failure is exogenous to their decisions. That assumption is false.

This paper argues that banks, telecoms, and governments are incentivized to *actively* inhibit the success of mobile payments. The paper is divided into sections based on the relevant actors, providing theoretical and empirical warrants for actors' incentives to restrict the dispersion of mobile payments systems. This thesis is entirely novel in the existing literature on mobile payments, likely explained by the conflation of benefits for *users* and benefits for *providers*. Existing literature does not fully recognize that relevant actors do not always benefit from increased mobile payments adoption. This paper aims to widen the circle of academic discussion on mobile payments to include actor-based incentives, necessary for a more holistic understanding of factors undergirding the future of mobile payments in developing countries.

The incumbent

Payments are the lifeblood of banks. Between interchange fees and inter-account transfers, payments netted \$1.3 trillion USD for banks worldwide in 2012—an estimated 34% of global profits. Banks fear a future in which payments are not tied to formal bank accounts, as this would eliminate the opportunity for lucrative processing fees. Banks see this future unfolding in real time: in 2012 alone, mobile money subscribers in Uganda tripled from 2.9 million to 8.9 million as total bank accounts sat stagnant at 4.9 million. At least a dozen African countries, from Cameroon to Zambia, have more mobile money users than bank account holders.²³ In the event that automatic clearinghouse (ACH) systems for the processing of formal money transfers are outmoded by mobile payments, many banks will be relegated to the low-margin and commoditized provision of loans.

Banks cannot capture the nascent market for mobile payments, as these systems are squarely in the domain of telecoms. Telecoms are the natural providers of mobile

¹⁸ “Mobile-money services: let us in.” *The Economist*, 25 August 2012.

¹⁹ Lee, Julie. “Consumer education and mobile money adoption.” *Consultative Group to Assist the Poor*, 18 January 2013.

²⁰ Casanova, Martha. “Unlocking barriers: advances in rural mobile banking in Mexico.” *Consultative Group to Assist the Poor*, 20 August 2012.

²¹ “Safaricom inks M-Pesa agent financing deal with KCB.” *Telecompaper*, 10 February 2011.

²² All telecoms have large airtime networks because these networks are the primary sales method for new minutes on prepaid phones, which are more common than monthly phone plans in developing countries.

²³ “The end of a monopoly.” *The Economist*, 10 May 2014.

payments services because they own the phone networks on which the transfers function. Compounding this *prima facie* uphill battle is the advantage that telecoms gain from pre-existing airtime distribution networks: the small shops that have sold pre-paid minutes to mobile phone users for years can be converted to mobile money agents with minimal incremental expenditures. Safaricom converted 22,000 airtime distributors into mobile money agents prior to the launch of M-Pesa, juxtaposed against the 4,000 bank branches among *all* Kenyan banks at this time.²⁴ Telecoms derive a third advantage from lighter regulations governing airtime agents relative to traditional bank branches, meaning that costs for new bank branches surpass those of similarly functional telecom agents.²⁵

Agents and bank branches per 100,000 adults, select countries

<u>Country</u>	<u>Banks</u>	<u>Agents</u>
Bangladesh	8.1	508.3
Cote d'Ivoire	4.6	107.3
Dem. Rep. of Congo	4.6	88.1
Haiti	2.7	21.6
India	11.4	18.3
Kenya	5.5	484.6
Madagascar	1.7	34.3
Mexico	14.5	32.6
Nigeria	5.8	36.5
Pakistan	9	149.8
Philippines	8.1	39.4
Rwanda	76	212.2
South Africa	10.4	10.6
Sri Lanka	17.5	114
Tanzania	2.2	564.6
Uganda	2.6	276.2
Zimbabwe	7.1	80.5

Checkmate on the economic chessboard leaves banks with little recourse but to leverage regulatory channels against telecoms. In 2013, the Bankers Association of Zimbabwe successfully lobbied the central bank for a 5% fee increase on each mobile money transaction run by telecoms like Econet Wireless. This doubling of per-transfer costs likely served little purpose beyond discouraging the usage of mobile payments.²⁶ Banks pressure regulators to require telecoms to partner with banks on the provision of mobile payments, claiming (perhaps fairly) that telecoms lack the expertise necessary for

²⁴ Etzo and Collender (2010).

²⁵ “Why does Kenya lead the world in mobile money?” *The Economist*, 27 May 2013.

²⁶ Severino, Mavhiki, Tonderai, Nyamwanza, and Life, Rhumba. “Impact of mobile banking on traditional practices in Zimbabwe.” *International Journal of Economics, Commerce, and Management*, 3.1 (2015).

taking deposits. This has proven successful in some instances, with governments such as Uganda and Nigeria drafting legislation aiming to formally require these partnerships.^{27,28}

Banks may be defending themselves by lowering the utility that individuals can derive from adopting mobile payments. Increasing access to formal banking services is one method to achieve this end, as the presence of a large banked population frequently suffocates mobile payments. The formally banked population of South Africa increased from 46% to 75% during 2004-2014, driven by a multi-bank partnership that sought to provide low-cost *Mzansi* bank accounts to the rural poor.²⁹ During that time, M-Pesa twice failed to enter the South African mobile transfers market despite skyrocketing growth in Kenya and Tanzania. Across the developing world, countries with higher levels of formally banked citizens exhibit diminishing success for mobile payments.³⁰

Financial services companies, which benefit from the success of banks, have also entered this fray. MasterCard works with Nigeria's government to issue national IDs that double as prepaid bank cards, an effort meant to increase formal financial services among the world's poorest.³¹ If the purpose of mobile payments is to provide financial inclusion for those excluded from the traditional banking system, then formally banking excluded citizens reduces much of this demand. Smaller banks that cannot face the high costs of new infrastructure will not pursue this option, but banks with sufficient infrastructure that have, until now, chosen to exclude the poorest populations (due to low transaction volumes) may see low-cost bank accounts as sufficient for profitability. This logic of mutual exclusivity explains the low usage of mobile payments in the developed world: if users have access to formal financial services, then informal services may not generate sufficient incremental utility to justify adoption.

Banks will not disappear. Mobile payments may supplant the role of transfers, but banks still offer beneficial services that require ample capital. Telecoms will likely not be financing mortgages or offering car loans in the near future, and in-person financial help will always trump mobile-based financial advisory services. But assuming that banks will accept relegation to the low-margin provision of loans is wishful thinking. *Hannibal ad portas*, and banks will not lose business to mobile payments without a protracted fight.

The disruptor

Telecoms enable mobile payments, supplying the services via pre-existing airtime networks. Airtime networks are common in developing countries because prepaid phones are more popular than expensive monthly contracts; 90% of mobile phones in sub-Saharan Africa are pay-as-you-go.³² Airtime distributors are generally local shops that sell airtime alongside other basic convenience items. Before the existence of mobile money, airtime

²⁷ Paelo, Anthea. "Mobile money: Taking on big banks." *CCRED Review*, 2014, 1-3.

²⁸ Future research should address whether mobile payments experience a change in growth after the creation of bank-telecom partnerships, and whether these partnerships are more effective at expanding mobile payments systems than standalone telecoms.

²⁹ Khumalo, Jabulani. "FinScope South Africa 2014." *Finmark Trust*, 2014, 1-12.

³⁰ Evans, David, and Pirchio, Alexis. "An empirical examination of why mobile money schemes ignite in some developing countries but flounder in most." *Coase-Sandor Working Paper Series in Law and Economics*, No. 723, 2015

³¹ "The end of a monopoly" (2014).

³² James, Jeffrey, and Versteeg, Mila. "Mobile Phones in Africa: How Much Do We Really Know?" *Social Indicators Research* (2007): 117-126.

served a secondary and unofficial role as a means of transferring value: since all mobile phones required airtime, top-up minutes could function as a de-facto currency with relatively consistent value across a country.³³ This functionality still exists. Nigerians in Lagos can text airtime codes to family members in Kano, who either redeem the airtime for minutes or sell the airtime codes back to an airtime agent at a slight discount; selling airtime back to the airtime agents allows one to cheaply cash out. Airtime transfers are immensely profitable for telecoms: airtime is a currency produced at nearly zero cost, then exchanged for real currency that flows directly to the bank's bottom line.^{34,35}

Telecoms will favor mobile money if revenues exceed costs. Theory dictates that mobile money transactions are profitable because banks can charge small fees on each transfer; research has found that mobile money can be profitable for near-monopolistic providers.³⁶ Proponents of this analysis rightfully account for higher initial and recurring costs, such as costs of agent conversion and cost of AML/CTF/KYC compliance, which arise with the adoption of mobile payments systems. However, this analysis misses revenue cannibalization: mobile payments supplant more profitable airtime channels. Mobile money causes a direct loss of revenue from airtime transfers because consumers will not use both: mobile money offers consumers marginal benefits due to regulation-guaranteed parity to the national currency.³⁷ Mobile money threatens the more profitable revenue stream of airtime transfers, and telecoms are thus incentivized to actively inhibit this threat.

Regulations threaten telecom profitability with requirements for telecom-bank partnerships. As noted above, these requirements arise when banks lobby the government about what constitutes a *deposit*, as deposit acceptance is usually the dominion of banks. South Africa broadly defines deposit acceptance as any movement of funds, effectively mandating bank participation.³⁸ In contrast, Kenya considers mobile money a deposit only when the telecom earns interest on the electronic currency, allowing Safaricom to operate sans heavy restrictions. When banks lobby to change this definition, telecom profits suffer: the aforementioned case of Econet in Zimbabwe resulted in a push “to force Econet to open up bank participation.”³⁹ This threat varies from country to country, but can incentivize telecoms to preemptively suffocate nascent mobile payments systems.

Regulations further harm telecom profitability via requirements for inter-telecom agent interoperability. Agent networks are a major competitive advantage for telecoms: Safaricom achieved early dominance with M-Pesa largely thanks to its network of 22,000 agents (since expanded more than four-fold). Interoperability levels the playing field by making agent networks a public good for all telecoms, regardless of size. This creates a

³³ “Airtime is money: the use of pre-paid mobile-phone minutes as a currency.” *The Economist*, Jan. 2013.

³⁴ Madise, Sunduzwayo. “Mobile money and airtime: emerging forms of money.” *Malawi Law J.* (2015).

³⁵ Further research should measure if countries where airtime transfers are illegal exhibit greater success for mobile payments, as telecoms may be more likely to support formal mobile transfers under legal mandate versus the status quo of maintaining low-cost airtime transfer networks.

³⁶ Leishman, Paul. “Is there really an money in mobile money?” *GSM Association*, October 2010.

³⁷ McKay, Claudia, and Pickens, Mark. “Why Distributing Mobile Money Is Harder than Airtime for MNOs.” *Consultative Group to Assist the Poor*, 21 June 2011.

³⁸ Bold, Chris. “Branchless Banking in South Africa.” *Consultative Group to Assist the Poor*, 28 June 2011.

³⁹ Robb, Genna, Tausha, Isaac, and Vilaakazi, Thando. “Competition and regulatory issues in emerging mobile payments markets: a case study of Zimbabwe.” *Centre for Competition, Regulation and Economic Development*, 6 March 2015.

free-rider problem,⁴⁰ since a small telecom could compete with Safaricom on mobile payments without up-front investment in an agent network—after all, Safaricom has already done the heavy lifting.⁴¹

These requirements are not fictitious: in July 2014, the Competition Authority of Kenya (CAK) forced Safaricom to open its network of 85,000 agents to competitors after successful lobbying by rival Airtel.⁴² Safaricom is a near-monopoly in Kenyan payments and is unlikely to change its stance on M-Pesa due to this regulation. Nonetheless, the regulation is a warning for telecoms with more nascent mobile payments systems: Nigeria, Uganda, South Africa, and multiple other nations have seen pushes for agent interoperability. If telecoms believe that regulations will force the sharing of expensive agent networks with smaller rivals, they may calculate that this is a losing operation and be incentivized to halt the progression of mobile payments.⁴³

SMS usage before and after interoperability, select countries

Country	Interoperability established	Pre-interoperability usage (mil/month)	Post-interoperability usage (mil/month)	One-year increase
Australia	Apr. 2000	50	500	1350%
U.K.	Apr. 1999	52	180	700%
Portugal	Feb. 2000	47	162	368%

Opposition to interoperability is problematic for the success of mobile payments. The high degree of network effects required for mobile payments means that, whenever monopolistic dominance is not present, telecoms must connect their systems in order to achieve sufficient scale.⁴⁴ The early history of text messages in developed countries gives credence to this, as various countries experienced exponential growth in SMS usage directly after implementing network interoperability.⁴⁵ When interoperability regulations tip the scales against profitability for telecoms, rationality dictates that telecoms will not choose to expand mobile payments. Compound this with the cannibalization of airtime revenues, and the incentives of telecoms will often align against mobile payments.

The arbiter

Political theory asserts that governments should favor mobile money. If the state exists to serve its citizens, then the welfare enabled by financial and communicative gains provides ample incentives for governments to back this development. State support is the most important factor for the success of mobile payments because the state can shift the incentives of banks and telecoms to favor its emergence; for example, subsidies for first-movers on infrastructure and streamlining AML/CTF/KYC requirements might alter the

⁴⁰ Musa, Omoneka, Niehaus, Charles, and Warioba, Martin. “How Tanzania Established Mobile Money Interoperability.” *Consultative Group to Assist the Poor*, 4 March 2015.

⁴¹ Handford, Richard. “Ending M-Pesa’s solo story.” *Mobile World Live*, 19 August 2014.

⁴² “The end of a monopoly” (2014).

⁴³ Winn (2013).

⁴⁴ Leibbrandt, Johan Gottfried. “Payment systems and network effects.” *3 June 2004*.

⁴⁵ Saxena, Amitabh. “Three insights for digital payments interoperability.” *Digital Disruptions*, June 2015.

cost-benefit analysis for many telecoms. Kenya, Tanzania, and India are evidence of this possibility. However, state support is not the norm. Governments believe that the benefits of mobile money are negated by the specter of macroeconomic instability.

Governments fear the loss of seigniorage revenues. Seigniorage results from the central bank profiting on the difference between interest receipts on securities acquired from banks in exchange for newly printed currency, and the production costs for the new currency. These revenues are an important source of risk-free profits for the government, but the power to extract seigniorage is dependent on control over the unit of exchange. If citizens choose to use the mobile money instead of the legal tender, then printed currency will not be loanable to consumers (they will not accept it). Banks will not accept money that cannot be loaned for profits, and seigniorage will become untenable.⁴⁶

Seigniorage revenues as % of GDP in 2014, select countries⁴⁷

Country	Seigniorage
Colombia	1.08%
Kenya	1.69%
Mozambique	3.67%
Nigeria	0.87%
Paraguay	3.44%
Sierra Leone	2.70%
Serbia	2.39%
Thailand	0.71%
Tanzania	1.52%
Uganda	2.51%
Zambia	0.36%

Governments with higher seigniorage revenues as a percentage of GDP appear to have less successful mobile payments systems relative to peers, although further analysis is difficult due to constraints on seigniorage data.⁴⁸ The general threat of losing seigniorage is nonetheless omnipresent: without seigniorage, the GDP of some countries would fall as much as 0.7%.⁴⁹ Even if states can offset revenue losses via new taxes on mobile money, the loss of seigniorage still induces anxiety because the method functions as a last resort for revenue extraction via a de-facto inflation tax.

Governments also fear debasement of the legal tender caused by competition with mobile money to be the dominant unit of exchange. If the state does not monopolize the unit of exchange, then monetary policy is ineffective.⁵⁰ The central bank cannot control

⁴⁶ Arnone, Marco and Bandiera, Lucas. “Monetary Policy, Monetary Areas, and Financial Development with Electronic Money.” *IMF Working Paper*. July 2004.

⁴⁷ Seigniorage is estimated by multiplying notes and coins outstanding by the long-term rate of interest on government securities. Data from World Bank (2015).

⁴⁸ Further research should explore the relationship between seigniorage revenues and the success of mobile payments systems; this will require a more measurable definition of what constitutes a “successful” system.

⁴⁹ Leibbrandt (2004).

⁵⁰ Rolnick, Arthur J. “Panel: Thoughts on the Future of Payments and Central Banking.” *Journal of Money, Credit, and Banking*, vol. 31, No. 3 (1999): 674-76

the money supply to influence the price level because consumption is no longer driven by supply and demand of legal tender, but rather of the competing electronic currency. For this reason, every state requires a 1:1 peg between mobile money and legal tender: if the electronic currency is fixed at the value of the national currency, then no fluctuations are possible and the electronic currency is a functional extension of the legal tender.

These regulations fail when parity is (illegally) eliminated. In 2013, the Ugandan Anti-Corruption Court issued fines to MTN Group for illegally generating 146 billion UGX (50 million USD) in electronic currency not backed by any legal tender, which was then cashed out by conspiring bankers. Reflecting on MTN's ability to produce its own shillings, one observer noted that the stolen money was "printed by MTN itself."⁵¹ This situation is not unique: Rwanda has witnessed similar fabrication by telecom Tigo, which generated 495 million francs (170,000 USD) without physical backing in 2014.⁵² Vigilant monitoring of telecoms can mitigate this threat, but states must live with the fear that illegal float generation could kill trust in the legal tender and cause rampant inflation.

Unregulated payments systems also threaten currency parity. Bitcoin is the most famous example of an unregulated currency, and its near-global condemnation by states is widely attributed to government fears of a competing currency.⁵³ Another example is airtime, which functions as a unit of exchange and has value derived from its local supply and demand. The best glimpse into state fears of mobile money is provided by QQ coin, an electronic currency developed by Chinese firm Tencent.⁵⁴ The currency was created as an online payment system for electronic greeting cards, virtual games, and software, but grew so powerful that one Chinese official claimed, "QQ coin is challenging the status of the Renminbi [Yuan] as the only legitimate currency in China." The Chinese government is now restricting issuance of QQ coins by Tencent, and is cracking down on vendors that accept the currency in lieu of legal tender.⁵⁵

These scenarios threaten central banks. The primary function of a central bank is to prevent price indeterminacy, which leads to inflation when there is no mechanism to tie down the price level. Central banks traditionally tie down the price level using short-term interest rates that prevent currency oversupply, but mobile money threatens this dynamic since the short-term interest rate cannot be controlled when the unit of exchange is no longer the legal tender.⁵⁶ If the central bank wishes to create liquidity for another bank, it cannot meet this demand with "a stroke of the pen." The central bank will instead need to borrow the mobile currency using collateral, and then lend the mobile currency to the commercial bank.

One crucial problem arises with collateral: it is not infinite, and will require the

⁵¹ Kiyonga, Derrick, and Mewsigwa, Alon. "Mobile money fraud: witnesses pin former bosses, Mwami exonerated." *The Observer*, 18 February 2015.

⁵² Morawczynski, Olga. "Fraud in Uganda: how millions were lost to internal collusion." *Consultative Group to Assist the Poor*, 11 March 2015.

⁵³ "Examining the future of Bitcoin." *Stratfor*, 28 February 2014.

⁵⁴ Kuo, Lily. "China's trillion dollar mobile payments industry is under attack." *Quartz*, 25 March 2014.

⁵⁵ Fowler, Geoffrey A; Qin, Juying. "QQ: China's New Coin of the Realm?" *WSJ*, 30 March 2007.

⁵⁶ This problem still exists for 1:1 currency regimes due to the higher velocity of mobile money. Refer to the monetary equation of exchange, $MV=PY$. While the M (money) value will be known due to 1:1 fixed value, the velocity of the money increases with mobile money due to less transactional friction. If the mobile money is a sufficiently large portion of total transactions in the economy, and the central bank does not know the velocity of mobile money, its estimates of inflation will not reflect reality. This can lead to counterproductive monetary policies and an inability to hold down prices.

central bank to hold liquid securities purchased on the market.⁵⁷ Even more important is that collateral creates an arbitrage opportunity for commercial banks. Rising interest rates on mobile money require the central bank to borrow money at that higher rate, but still lend it back to other banks at a lower-than-market rate (the desired level) in order to lower rates. The result is unavoidable: commercial banks will borrow from the central bank at the desired rate and lend back the same money back to the central bank at the market rate; this will produce unlimited gains for banks and correspondingly unlimited losses for the central bank. Lacking a monopoly on liquidity generation, the central bank loses its ability to reliably control short-term rates.⁵⁸

Governments recognize the benefits of mobile payments for poverty alleviation, but also recognize the threat of adverse macroeconomic outcomes. Governments that rely on seigniorage revenues or fear that 1:1 currency pegs will be difficult to maintain will likely see long-term risks that cannot justify microeconomic advances. The state faces a Collingridge dilemma in that it must restrict mobile payments systems while they are still nascent.⁵⁹ Until the link to the macroeconomic risks can be controlled, states will often be incentivized to inhibit the spread of mobile payments.

The groundswell

The future of the world's poorest citizens is contingent on the spread of mobile payments. Lower transaction costs, faster remittances, and access to financial services are all necessary conditions for the end of poverty. Successful systems can alter the national economy of the host country: \$40 billion USD flowed through M-Pesa in 2013, compared to \$27 billion in mobile transfers handled by PayPal *worldwide* in that same time.⁶⁰ The dominance that mobile payments can achieve often threatens its own success, since critical actors view this growth as a risk to the stable status quo. For the banks, telecoms, and governments that dictate the emergence of mobile payments, the benefits to citizens do not outweigh the costs to their respective institutions.

To be certain, each institution has myriad incentives both for and against mobile payments. These incentives will vary for each actor. M-Pesa is not the same as Econet or Airtel, and Zimbabwe is not the same as Zambia. *Lex parsimoniae* will fail in some cases, and policymakers must be careful not to cut their throats on Occam's razor. The common incentives that undergird decision-making for each actor nonetheless provide a guide for future research. Resolution may require a *deus ex machina* on par with mobile phones.

⁵⁷ The central bank could opt to receive liquid securities directly from the Treasury, but this violates central bank independence that is a cornerstone of monetary systems today.

⁵⁸ Costa, Cláudia and De Grauwe, Paul. "Monetary policy in a cashless society." *SUERF Meeting*, 2001.

⁵⁹ Liebert, Wolfgang, and Schmidt, Jan C. "Collingridge's dilemma and technoscience: an attempt to provide clarification from the perspective of the philosophy of science." *Focus* (2010): 55-71.

⁶⁰ Heggestuen, John. "Alipay overtakes PayPal as the largest mobile payments platform in the world." *Business Insider*, 11 February 2014.