

ABSTRACT

Title of Dissertation:

**MONEY MATTERS: PIONEERING OF
PLATFORMS UNDER INSTITUTIONAL
UNCERTAINTY IN THE GLOBAL
MOBILE MONEY INDUSTRY**

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This dissertation seeks to better understand the phenomenon of industry emergence in settings characterized by high uncertainty. To examine mechanisms underlying industry emergence and growth, I compiled a unique, hand-collected, comprehensive quantitative and qualitative dataset of the global mobile money industry.

The first study examines variation in pioneering firm characteristics on choices to integrate capabilities within or across firm boundaries and to create network externalities through open or closed end user access to the mobile money platform. An analysis of the census of mobile money pioneering firms extends theories developed in traditional industrial settings by showing that pioneers were equally likely to engage in external and internal integration, with diversifying entrants less likely to internally integrate than startups. A deep data dive reveals how capabilities and motivations can be brought together to understand heterogeneity in firm choices for platform ecosystem development and underscores the importance of experimentation to resolve demand and ecosystem uncertainty to generate direct and indirect network effects.

This study unpacks the relationship between institutional uncertainty and industry emergence by examining two sources of institutional uncertainty: pre-existing market institutions (*e.g.*, impersonal rule of law) and industry-specific institutions (*e.g.*, regulations). As more industries of today are emerging globally, additional research is needed to understand how industry emergence

may be affected by institutional uncertainty that differs from one country context to the next. This study examines the emergence of the mobile money industry across the African continent to understand 1) how variation in market institutions across countries influences firm entry and 2) the ways in which market institutions influence the regulatory approach for developing industry-specific institutions. My findings reveal that pre-existing market institutions related to colonial history are associated with variations in both entry patterns and approaches to developing industry-specific institutions. This study sheds light on the path dependencies at play across these two types of institutions, industry emergence, and innovation diffusion, enhancing our theoretical understanding of industry emergence across countries that vary in market-supporting institutions.

Together, this body of research underscores the importance of uncertainty reduction and experimentation for innovative solutions that provide a sustained solution to thorny societal problems. This is particularly critical in the poorest nations in the world, where underlying market institutions may be missing or inadequate, but can emerge and grow with industries.

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IN THE GLOBAL MOBILE MONEY INDUSTRY

by

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CHAPTER 1: INTRODUCTION

At the turn of the 21st century, more than 50% of the worldwide population—2.5 *billion* individuals—remained unbanked, lacking access to formal financial institutions such as bank branches or ATMs (Chaia et al., 2010). In sub-Saharan Africa alone, 80% of the adult population were considered unbanked. Improving access to financial services has been a global issue for some time now, formally identified in 2000 as a part of the United Nations Millennium Developmental Goals to address world poverty (Hughes & Lonie, 2007). The mobile money industry was pioneered and diffused by enterprising firms, allowing individuals to deposit, send, and withdraw funds from a virtual account on their cell phones without requiring a formal bank account (Wormald et al., 2021). In doing so, these pioneers transformed the economic landscape by enabling the world's poor to borrow and save, start businesses, survive economic shocks, and invest in the futures of their children and families (Cull et al., 2014; Demirgüç-Kunt et al., 2015; World Bank, 2014). Because mobile money addressed these critical unmet needs, it experienced dramatic growth. In 2000, it was available in only two countries, but by 2021, it had spread to over 90 countries, comprising 1.35 billion registered accounts and processing \$1 trillion annually (GSMA, 2021).

Not only is mobile money an important phenomenon to study as a solution to a critical social problem, but it also represents a unique opportunity to learn more about industries based on digital platform ecosystems as well as firm and industry emergence across countries that vary in market-supporting institutions. This dissertation, grounded in the phenomena of the mobile money industry's emergence, includes two studies that extend the boundary conditions of the literature on industry emergence by examining a nascent industry in a global context that includes developing countries. Study 1 (chapter 2) extends theory based on traditional industrial contexts to a digital platform ecosystem context, explicating how founding characteristics (capabilities and motivations) of pioneering firms and their platform choices shaped their ability to create network effects and their ultimate outcomes. Study 2 (chapter 3) embraces the global,

developing countries context of mobile money to extend theory based on studies of nascent industries in single country and developed country contexts that take well-functioning market institutions as given to parse out institutional uncertainty for a richer understanding of how pre-existing market institutions and industry-specific institutions matter for industry emergence.

The importance of experimentation for uncertainty reduction emerges as the common thread across both studies. In study 1 (Chapter 2) resolving demand and ecosystem uncertainty through experimentation to understand local needs within countries is critical for harnessing network effects and ultimately pioneering firm survival. In study 2 (Chapter 3), the need for experimentation to devise appropriate industry-specific institutions for an emerging industry is observed for regulators who are trying to address institutional uncertainty. Together, both studies highlight the need for experimentation by both market actors such as firms and nonmarket actors such as regulators to reduce uncertainty as an industry emerges in a global, developing countries context that has been overlooked by the literature thus far.

Brief Literature Review

Research using a strategic, organizational, or technology management lens has examined industry emergence in developed country settings through microprocesses of uncertainty resolution in key dimensions. Meanwhile, existing research using an economics lens for examining diffusion of mobile money has adopted either a single-country case study approach (particularly of M-PESA in Kenya) to examine mobile money emergence and adoption, or a cross-sectional approach for identifying country-level differences.¹ I provide a brief review of each literature stream below.

¹ Several additional studies examine the outcomes of mobile money adoption (Aker & Mbiti, 2010; Suri et al., 2021) including risk-sharing (Batista & Vicente, 2013; Jack & Suri, 2014), savings behaviors (Blumenstock et al., 2018; Munyegera & Matsumoto, 2016a) and transfers (Sekabira & Qaim, 2017; Suri & Jack, 2016) as well as inflation (Aron et al., 2015; Weil et al., 2012), though these studies are more limited and largely concentrated on East Africa.

Studies of Uncertainty Reduction for Industry Emergence

A robust body of work in management digs into the processes of diffusion and industry emergence through agentic actors. This work has documented that nascent industries are characterized by considerable uncertainty in technological, demand, ecosystem and institutional dimensions (Moeen et al., 2020). Accordingly, this literature documents how uncertainty reduction is critical for nascent industries to reach commercial viability (Adner & Levinthal, 2001; Aldrich & Fiol, 1994; W. Mitchell, 1989; Rosenberg, 1982; Tushman & Anderson, 1986). With a focus on nascent industries that emerge in traditional industrial settings and developed country contexts, scholars have noted that experimentation by for-profit actors (established firms or new ventures created by users, scientists or employees of existing organizations) builds knowledge to address uncertainty, so that nascent industries can achieve important milestones of commercialization, firm, and sales takeoff (Moeen et al., 2020).

When examining pioneering advantage in digital platform ecosystem contexts, several insights from traditional settings merit re-examination. One such insight is that pioneers of traditional industries have addressed technological convergence by internally integrating capabilities (Helfat, 2015; Moeen, 2017). However, digital platform providers may also engage in external coordination of “resources, tasks, investments, and goals with alliance partners” (Helfat and Raubitschek, 2018: 1396) because digital platforms involve technological convergence and often require an ecosystem of firms to provide requisite complementary capabilities to drive network effects (McIntyre and Srinivasan, 2017). Theoretically, it is unclear if there is heterogeneity among digital platform pioneers regarding integrating capabilities within or across firm boundaries, and how such heterogeneity may affect the development of platform ecosystems and pioneers’ abilities to drive network effects for the creation of successful platforms.

Turning to institutions, scholars note that institutions as the “rules of the game” play a fundamental role (North, 1990), and have highlighted the high institutional uncertainty present in nascent industries. However, given the predominant focus on industry emergence in developed

countries, these studies take as given strong market-supporting institutions such as property rights, judicial systems, and financial systems (Gustafsson et al., 2016; Moeen et al., 2020). Accordingly, prior work provides limited insights for how industries may emerge to provide solutions to critical unmet needs in developing economies. We lack studies of industry emergence in developing countries characterized by institutional voids and multiple sources of market failure that create challenging initial conditions in which an industry may emerge. For example, regulations may be either too strict or too lenient; the judicial system may work inefficiently or enforce laws unpredictably; or corruption may be rampant (Chakrabarty, 2009; Khanna & Palepu, 1997). As more industries of today are emerging globally, additional research is needed to understand how different dimensions of uncertainty can be resolved within complex country-specific institutional environments.

Studies of Mobile Money Diffusion

Scholars have conducted in-depth single-country case studies to understand the roles of private and public sector ecosystem actors in enabling mobile money adoption within the country. Here, many studies have focused on the M-PESA platform in Kenya (Lashitew et al., 2019; Oborn et al., 2019; Shah et al., 2017) to reveal interactions among for-profit and non-profit enterprises (Vodafone and subsidiary Safaricom; microfinance institutions), an aid agency (UK DFID) and public sector regulators (Central Bank of Kenya) for successful launch of the platform. Other scholars (Bilodeau et al., 2011; di Castri & Gidvani, 2014; Flaming et al., 2015; Varshney, 2014) have studied countries ranging from low (*e.g.*, Brazil, Cambodia, and India) to high (*e.g.*, Tanzania, Uganda) levels of mobile money adoption. However, summarizing insights from these studies, Aron (2017, p. 41) cautions that “since institutional structures, regulation and demand patterns differ across countries, generalisations of evidence need to be made cautiously.”

Among cross-country studies, several scholars have linked mobile money adoption to country level characteristics such as financial literacy, available alternative payments, and income dispersion (*c.f.*, Aker & Mbiti, 2010; Munyegera & Matsumoto, 2016; Weil et al., 2012).

However, these characteristics seem to have limited explanatory power; for example, Lashitew et al. (2019) conducted a quantitative analysis of over 100 countries with mobile money and found that country level factors such as level of financial access or rate of mobile phone penetration alone do not explain the uneven adoption patterns observed across developing countries. In reviewing the extensive literature, Aron (2017, p. 41) notes that “*many studies of adoption of mobile money fail to control for the often-important regulatory determinants and regime changes.*” The importance of regulatory determinants is also underscored by Evans and Pirchio (2014), who analyze successful and unsuccessful mobile money launches across 22 developing economies to note that platform failure is associated with heavy regulation, particularly when banks play a primary role in developing mobile money-specific regulations. Similarly, Gutierrez & Singh (2013) focus on country-level regulations to explain mobile money usage in 35 countries and find that a supportive regulatory framework is correlated with higher usage of mobile money by both unbanked and banked populations.

While these studies have provided some initial insights, they do not examine temporal processes at play connecting entry of mobile money platforms with timing and nature of mobile money specific regulations across multiple country settings and how these may be connected to the broader formal institutional environment, nor do they focus on the interaction between entrants’ founding characteristics, platform choices, and network effects.

A published paper of my own (Wormald et al., 2021), as a precursor to this dissertation, bridges studies of mobile money diffusion with studies of industry emergence by investigating how pioneering firms’ characteristics and strategies for capability development and deployment resulted in international expansion and global diffusion of the mobile money industry. This study shows that among the mobile money pioneers (31 firms across 20 countries), developing country startups—presumably disadvantaged by their both their country of origin and size—overshadowed multinational mobile network firms in terms of subsequent platform launches by

“specializing in generality” (Conti et al., 2019; Gambardella & McGahan, 2010). This study sets the stage for the studies in this dissertation.

Research Objectives and Questions

Study 1

The first study of this dissertation focuses on the 31 firms who pioneered the mobile money industry globally to shed light on how demand uncertainty and ecosystem uncertainty may be resolved in a nascent industry setting based on digital platform ecosystems. While an extensive literature has examined traditional industrial contexts to study the effect of pioneering firm characteristics and capabilities on firm strategy and survival (Bayus & Agarwal, 2007; Helfat, 2015; Klepper & Simons, 2000; Qian et al., 2012), relatively less work has examined industry emergence for industries based on digital platform ecosystems. We lack an understanding of how network effects interact with the prior experience of entrants to nascent industries, their decisions to integrate capabilities internally or externally, and what these imply for more vs. less successful business models under uncertainty.

Answering calls for research examining the capabilities and strategies of firms who orchestrate digital platform ecosystems and their performance consequences (Helfat & Raubitschek, 2018; Jacobides et al., 2018; McIntyre & Srinivasan, 2017), this study asks: *How do pioneering firm characteristics affect their choices for platform creation? And, in turn, how do these choices shape subsequent challenges, strategies and outcomes for pioneering firms and their platforms?*

Study 2

The second study of this dissertation zooms out to focus on the emergence and growth of the mobile money industry across the 51 countries of the African continent. This study unpacks

the relationship between institutional uncertainty and industry emergence by examining two sources of institutional uncertainty: pre-existing market institutions (*e.g.*, impersonal rule of law) and industry-specific institutions (*e.g.*, regulations). As more industries of today are emerging globally, additional research is needed to understand how industry emergence may be affected by institutional uncertainty that differs from one country context to the next (Moeen et al., 2020).

This study asks: *How do the pre-existing market institutions of a country influence industry emergence in that country? And, in what ways do pre-existing market institutions influence the regulatory approach for setting industry-specific institutions in a nascent industry?*

Novelty and Significance

Together, this body of research underscores the importance of uncertainty reduction and experimentation for innovative solutions that provide a sustained solution to thorny societal problems. This is particularly critical in the poorest nations in the world, where underlying market institutions may be missing or inadequate, but can emerge and grow with industries. Two aspects of this dissertation make it novel and address limitations of current research to provide insights for theory. First, is the development of a unique longitudinal database of the mobile money industry that includes the census of pioneering firms across the world as well as across all countries in Africa. Careful triangulation across rich qualitative and quantitative data addresses the limitations of cross-sectional, single country cases and the focus on only developed country contexts in the siloed approaches in existing literatures noted above. Second, by taking a deep dive into the phenomena of the mobile money industry's emergence, this dissertation advances our theoretical understanding of industry emergence.

The first study contributes to the literature on the pioneering of new industries by examining the applicability of theories largely developed in manufacturing and industrial settings

to the context of digital platform settings. Some received wisdoms based on traditional industry contexts, such as the tendency for firms to integrate value chain activities and capabilities internally with diversifying entrants more likely to do so than startups, do not hold in the mobile money digital platform ecosystem context. Instead, pioneers were equally likely to integrate complementary capabilities internally and externally, and diversifying entrants were *less* likely to internally integrate than startups. This study indicates motives provide a guide for the search for complementary capabilities, with motivations differing across firms based on their pre-entry experience and capabilities.

This study further contributes by detailing how the characteristics and capabilities of entrants interact with network effects for the emergence of nascent industries based on digital platform ecosystems. Founding characteristics of pioneering firms and their platform choices shaped their ability to create network effects and their ultimate outcomes. Survivors share two key similarities: they were able to build relationships with committed partners who stayed the course through uncertainty, and they tapped into a user base and ecosystem wherein they could experiment and actively learn about distinct demand segments and their unmet needs and create customized solutions to develop value propositions. In these ways, pioneers developed robust installed bases of end users as well as ecosystem partners to generate both direct and indirect network effects for the creation of digital platform ecosystems.

For entrepreneurs and managers of digital platforms, this study underscores the importance of experimenting on a targeted set of users to understand local needs within country contexts. In this way, firms can find the right value proposition for their platforms and quickly grow a larger user base and harness network effects.

The second study, to the best of my knowledge, is the first to examine market institutions and industry-specific institutions in a nascent industry while taking advantage of the fact that the mobile money industry emerged almost simultaneously in multiple countries. In doing so, this study incorporates both variation in “starting” conditions via pre-existing market institutions and the ensuing approaches undertaken to developing industry-specific institutions in the presence of facilitators and bottlenecks that enable or inhibit industry emergence. My findings reveal that pre-existing market institutions related to colonial history are correlated with variations in both entry patterns and approaches to developing industry-specific institutions. By drawing on the New Institutional Economics perspective (North, 1990) to highlight the path-dependent nature of formal institutions as a mechanism that shapes industry emergence, this study makes a theoretical contribution to the literature on industry emergence.

Additionally, whereas previous research on nascent industries has focused on ways in which firms can resolve the multiple dimensions of uncertainty characteristic of nascent industries, particularly demand and technology dimensions (Moeen and Mitchell, 2020; Pillai et al., 2020; Thomke, 2003), this study points to the importance of regulators themselves as actors involved in contributing to or resolving industry-specific institutional uncertainty and ultimately industry emergence. This study helps to shed light on how the institutional knowledge base of the industry is shaped through experimentation by both commercializing firms and regulators by highlighting the evolutionary and path dependent process by which industry-specific institutions are created and revised and the implications for industry emergence.

Through these two studies, this dissertation examines important aspects of industry emergence that have not yet been closely studied by existing work: digital platform ecosystems (study 1) and variation in formal institutions (study 2). In doing so, I help extend our theory of

industry emergence. The results have important implications for firm strategy and performance, non-market actors such as regulators, and thinking through how other societal issues can be resolved through market enterprise (*e.g.*, mobile platforms for improved access to healthcare or education).

Dissertation Outline

The remainder of this dissertation is comprised of two individual studies (Chapters 2 and 3). Supplemental materials are contained in the Appendix.

CHAPTER 2: PIONEERING DIGITAL PLATFORM ECOSYSTEMS: THE ROLE OF ALIGNED MOTIVES AND CAPABILITIES IN EXPERIMENTATION AND PERFORMANCE OUTCOMES²

Abstract

In the digital platform ecosystems context of mobile money, we examine variation in pioneering firm characteristics on choices whether to integrate capabilities within or across firm boundaries and create network externalities through open or closed end user access. We triangulate across rich qualitative and quantitative data on the census of mobile money pioneering firms. Our analysis extends the theories developed in industrial settings by showing that pioneers were equally likely to engage in external and internal integration with diversifying entrants less likely to internally integrate than startups. A deep data dive reveals how capabilities and motivations can be brought together to understand heterogeneity in firm choices for platform ecosystem development and underscores the importance of experimentation to generate direct and indirect network effects.

2.1 Introduction

Pioneering new industries has high risks and rewards—firms who manage to survive under extreme uncertainty enjoy superior performance (Lieberman & Montgomery, 1988; Suarez & Lanzolla, 2007). An extensive literature has examined traditional industrial contexts to study the effect of pioneering firm characteristics and capabilities on firm strategy and survival (Bayus & Agarwal, 2007; Helfat, 2015; Klepper & Simons, 2000; Qian et al., 2012). Many contemporary and emerging industries, however, are based on digital platform ecosystems (Teece, 2018). Digital platform ecosystems are unique in that they involve technological convergence and require an ecosystem of firms to provide requisite complementary capabilities to drive network effects. Network effects, in particular, play an important role for the development of digital platform ecosystems (McIntyre & Srinivasan, 2017); however, we lack a deeper understanding of how founding characteristics and capabilities may interact with network effects for the emergence of digital platform ecosystems.

A first set of research gaps concerns digital platform ecosystem development through internal versus external integration of complementary capabilities. Scholars note that while

² This chapter is co-authored work with Sonali K. Shah, Serguey Braguinsky, and Rajshree Agarwal.

pioneers of traditional industries have addressed technological convergence by internally integrating capabilities (Helfat, 2015; Moeen, 2017), digital platform providers may also engage in external coordination of “resources, tasks, investments, and goals with alliance partners” (Helfat & Raubitschek, 2018, p. 1396). In adapting his classic Profiting from Innovation framework for digital platforms, Teece (2018: 1367) notes “complementary assets (vertical and lateral) in the digital context are no longer just potential value-capture mechanisms... they may well be needed simply for the technology to function.” It is unclear if there is heterogeneity among digital platform pioneers regarding integrating capabilities within or across firm boundaries, and how such heterogeneity may affect the development of platform ecosystems and pioneers’ abilities to drive network effects for the creation of successful platforms.

A second research gap stems from the important challenge for firms pioneering digital platform ecosystems to build a critical mass of users to create network externalities. Though this feature existed in some traditional settings (*e.g.*, telecommunications, railroads), its prominence is higher in digital platform contexts. Here, platform architecture decisions regarding access and incentives for participation may help or hinder the growth of a platform’s user base (Helfat & Raubitschek, 2018; G. G. Parker et al., 2016). While open access platforms increase user acceptance and closed access platforms favor value appropriability (Boudreau, 2010; West, 2003), this tradeoff may or may not hold in nascent industry contexts where choices among alternative value propositions are not obvious *ex-ante*. This creates fundamental uncertainty about the “right” strategy for growing the size of users within and across distinct user groups. Opening end user access may enable increased platform acceptance with a wider population base of end users to draw upon; however, closing end user access may facilitate faster diffusion and penetration rates within targeted populations where the value proposition may be more clearly

identified. Moreover, which value propositions ultimately prevail may itself be endogenous to pioneer strategies and responses to path-dependent implementation challenges encountered due to these platform architecture decisions.

Helfat & Raubitschek (2018, p. 1391) note that “business models for digital platform-based ecosystems rarely emerge fully formed,” and their call for research examining capabilities and strategies of firms who orchestrate them and their performance consequences is also echoed by others (Helfat & Raubitschek, 2018; Jacobides et al., 2018; McIntyre & Srinivasan, 2017).

We answer these calls by asking: *How do pioneering firm characteristics affect their choices for platform creation? And, in turn, how do these choices shape subsequent challenges, strategies and outcomes for pioneering firms and their platforms?*

We examine these questions using a two-part inductive approach in the context of mobile money, a digital platform where wireless and software technologies complement each other to enable financial transactions between two or more parties. We start with a quantitative analysis to identify empirical patterns using the census of pioneering firms and platforms of the global mobile money industry, and to conduct survival analysis as is consistent with industry evolution studies. We find that firms predominantly make two platform choices related to capability integration and end user access: 1) multi-firm platform provision through externally integrated capabilities with closed end user access and 2) single-firm platform provision through internally integrated capabilities with open end user access. We then present evidence gathered from rich historical archival data to dig deeper into how the motives and capabilities of pioneering firms translated into these platform choices; how initial characteristics and strategic choices cascaded into different sets of opportunities and challenges; and how successfully navigating these challenges shaped outcomes.

Our study contributes to the literature on the pioneering of new industries by examining the applicability of theories largely developed in manufacturing and industrial settings to the context of digital platform settings. Some received wisdoms based on traditional industry contexts, such as the tendency for firms to integrate value chain activities and capabilities internally with diversifying entrants more likely to do so than startups, do not hold in the mobile money digital platform ecosystem context. Instead, we find an equal likelihood of internal vs. external integration of complementary capabilities and that diversifying entrants were *less* likely to internally integrate than startups. Our study indicates motives provide a guide for the search for complementary capabilities, with motivations differing across firms based on their pre-entry experience and capabilities.

Our study further contributes by revealing how the characteristics and capabilities of entrants interact with network effects for the emergence of nascent industries based on digital platform ecosystems. Founding characteristics of pioneering firms and their platform choices shaped their ability to create network effects and their ultimate outcomes. Survivors across the two dominant types of platforms share two key similarities: 1) they were able to build relationships with committed partners (for platform co-provision or access to complementary resources) who stayed the course through uncertainty, and 2) they tapped into a user base and ecosystem wherein they could experiment and actively learn about distinct demand segments and their unmet needs and create customized solutions to develop value propositions. In these ways, pioneers developed robust installed bases of end users as well as ecosystem partners to generate both direct and indirect network effects for the creation of digital platform ecosystems.

2.2 Pioneering Firms in Traditional Industries: Capabilities, Strategies & Outcomes

Scholars studying traditional (*i.e.*, industrial or manufacturing) contexts have highlighted those industries emerge through the efforts of a few pioneers (Gort & Klepper, 1982). Pioneers may be startups or diversifying entrants, as the knowledge of technology or use may be possessed by individuals who create new firms as well as firms in related industries (Agarwal & Shah, 2014; Carroll et al., 1996; Klepper & Simons, 2000). Importantly, pioneers face high risks and rewards as they navigate through technological and demand uncertainty to determine core value propositions and address ecosystem- and industry-specific institutional uncertainty to enable industries to take off in terms of subsequent firm entry and growth in sales (Agarwal & Bayus, 2004; Buzzell & Gale, 1987; Golder & Tellis, 1997; Gort & Klepper, 1982; Lieberman & Montgomery, 1988). Often these uncertainties can only be addressed through experimentation by pioneering firms (Moeen et al., 2020).

A stylized fact regarding industry pioneers is that they are more likely to integrate capabilities internally than rely on external relationships (Helfat, 2015). This is because nascent periods of an industry are usually characterized by small market size in terms of both producers and consumers (Stigler, 1951; Williamson, 1975). Additionally, a lack of product and process standardization creates asset specificity to raise transaction costs for innovators in sourcing necessary inputs and complementary assets (Jacobides & Winter, 2005; Qian et al., 2012; Williamson, 1975). For example, Langlois (1992, p. 116) highlights integration of value chain activities stemming from “(dynamic) transaction costs of persuading, negotiating with and coordinating among, and teaching outside suppliers in the face of economic change or innovation.” Empirically, scholars have documented high vertical integration by firms in nascent industries (Bresnahan & Greenstein, 1999; Klepper, 1997; Langlois & Robertson, 1989; Malerba

& Orsenigo, 1996). Furthermore, firms differ in their integrative capabilities, defined as “the capacity for effective communication and coordination of activities, resources (including knowledge) and capabilities, investments, and objectives” within a firm’s boundary (Helfat & Raubitschek, 2018; p. 1396). Here, scholars have documented that among pioneers, diversifying entrants with greater integrative capabilities are more likely to vertically integrate than startups (Hoetker, 2005; Moeen, 2017; Qian et al., 2012).

In terms of performance, startups may benefit from flexibility (Carroll et al., 1996) and enter with superior innovative knowledge (Khessina & Carroll, 2008). However, access to complementary assets (W. Mitchell, 1991) and pioneers’ need to vertically integrate value chain activities are key reasons identified for a diversifying firm advantage over startups. Scholars have linked diversifying entrants’ internal integrative capabilities to superior ability to configure dispersed capabilities investments in nascent industries (Moeen, 2017) and deal with subsequent impediments to growth (Chen et al., 2012), both of which associate with higher performance (Afuah, 2001; Kapoor & Adner, 2012). We note, however, that a diversifying firm advantage is largely based on industry evolution scholars’ focus on only product market commercialization. Early work often explicitly assumed that markets for technology/ideas or markets for corporate control are absent in nascent industry stages (Gort & Klepper, 1982; Stigler, 1951; Williamson, 1975). However, recent work demonstrates all three markets may simultaneously exist even in the incubation and pre-take-off industry stages to show how pioneering firms, particularly startups, may capture value through alliances and seeking acquisitions (Moeen & Agarwal, 2017; Moeen & Mitchell, 2020; Wormald et al., 2021).

To summarize, the received wisdoms from the pioneering firm literature are: a) experimentation by pioneering firms is critical to address uncertainty, b) pioneers are likely to

vertically integrate value chain activities, c) diversifying entrants, with higher internal integrative capabilities, are more likely to integrate than startups, and d) diversifying firms have an advantage relative to startups with greater integrative capabilities, under the assumption of competition in product markets.

2.3 Research Context: The Global Mobile Money Industry

Mobile money is “a service in which a mobile phone is used to access financial services” such as (but not limited to) transferring money and making payments (GSMA, 2010). A unique feature of mobile money is that users do not need to have a bank account, so “unbanked” individuals can make financial transactions through mobile phones (Aker & Mbiti, 2010).³ Mobile money transactions initially occurred through text messaging features (*e.g.*, SMS, USSD), and continue to do so on many platforms across the world today, in addition to some, more sophisticated smartphone enabled mobile money platforms. Mobile money has enabled unprecedented financial access in developing countries: prior to its advent in 1997, there were 2.3 billion unbanked individuals worldwide (Demirgüç-Kunt et al., 2015). By 2021, there were 1.35 billion registered mobile money accounts offered on 310 platforms worldwide (GSMA, 2021).

Mobile money conforms to the definition of a digital platform ecosystem as “any combination of hardware and software that provides standards, interfaces, and rules that enable and allow providers of complements to add value and interact with each other and/or users”

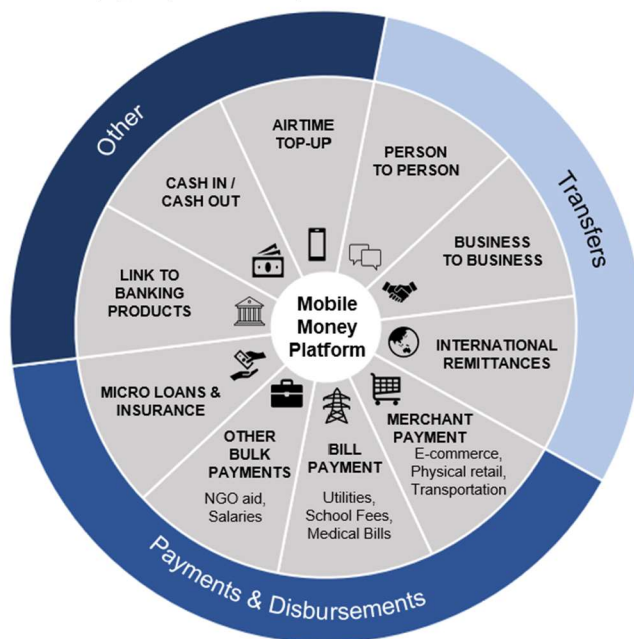
³ In contrast to mobile money which does not *require* a bank account, “mobile banking” or “mobile wallets” services are provided by the conventional financial industry as additional features for *only* those who have access to a bank account. For example, mobile banking/wallet platforms such as Venmo, PayPal, Zelle, Apple Pay, and WeChat Pay all offer mobile phones as another channel to access traditional banking products and are linked to a user’s bank account or credit card. Near Field Communication (NFC) is another type of digital payment technology that has become more commonplace in the last ten years (Kazan & Damsgaard, 2013). NFC chips can be found in SIM cards, handheld devices, as well as payment cards. This technology is outside the scope of this paper.

(Teece, 2018, p. 1375). It represents the convergence of two complementary and equally critical capabilities: mobile networks via wireless technology and financial transactions-enabling software. Figure 1 provides a visual representation of the mobile money ecosystem, adapted from GSMA (2017). Several features of the mobile money ecosystem are noteworthy in how it maps onto key sets of actors and concepts defined in the digital platform ecosystems literature.

First, at the core is the platform *provider(s)*—the firm(s) that creates the platform interface by combining complementary capabilities and provides services to different types of users (Eisenmann et al., 2009; Ondrus et al., 2015). The platform provider(s) decides the rules of engagement across the platform ecosystem, including conditions that determine access and incentives for participation (Helfat & Raubitschek, 2018; G. G. Parker et al., 2016). Mobile money platforms may be open-access (*i.e.*, software is “universally” complementary to any mobile network and can be used by any individual on any mobile network), or closed-access (*i.e.*, software is tightly coupled with a specific mobile operator, and thus can be used only by subscribers of a particular mobile network).

Figure 1

Mobile money platform ecosystem



Notes: Adapted from GSMA (2017)

Second, most mobile money platforms (pioneering and contemporary day) enable person-to-person (P2P) transactions as a principal feature. Because these transactions occur between *end users* “on the same side,” direct network effects within a large installed base—defined as a user’s benefit from using the platform increases with the number of other users using the same platform (Katz & Shapiro, 1986)—is critical for a platform’s sustainability and growth. Business-to-business (B2B) transactions work similarly, involving businesses as the end users rather than individuals.

Third, a mobile money platform can be used for payment and disbursement services, including individuals making bill payments (*e.g.*, utilities, hospitals, schools), merchant payments (*e.g.*, retail trade, transportation, e-commerce), other bulk payments (*e.g.*, government agencies, NGOs), and individuals receiving salary disbursements (*e.g.*, organizations, government, nonprofits), and loan/insurance management (*e.g.*, microfinance). Other services

offered by the mobile platform may include individuals being able to link mobile money accounts to other banking products (*e.g.*, debit cards), cash-in/cash-out, make transfers internationally via an intermediary (*e.g.*, Western Union), and purchase airtime minutes on different mobile networks. These services require cultivation of *ecosystem partners* who make platform-specific investments (Hagiu & Wright, 2015). Many ecosystem partners also represent distinct organizational user groups where respective members consistently play a single role in transactions (Armstrong, 2006; G. G. Parker & Van Alstyne, 2005; Rochet & Tirole, 2003). The distinction between user groups and ecosystem partners is blurred within mobile money. The same organizations may represent a particular side of users and also ecosystem partners in the classic sense (*e.g.*, suppliers, complementors), along with for-profit firms, financial and/or regulatory institutions (*e.g.*, commercial banks, microfinance, government regulatory bodies) and investors (*e.g.*, venture capital firms, grant awarding organizations) that interface with platform providers and other user groups. Because payment, disbursement and other services entail transactions between users “on multiple sides” of the platform, they require capitalizing on indirect network effects where the presence and size of one or more user groups reinforces and increases the value of the platform for the focal user group (Boudreau & Jeppesen, 2015; Evans, 2003; G. G. Parker & Van Alstyne, 2005). For example, offering salary disbursement services requires mobile money platform providers to work with employer(s) for seamless integration of the platform with their human resource/payroll infrastructure.

The global mobile money industry provides an ideal setting for our study, inasmuch as it manifests critical features of digital platform ecosystems as noted above. Moreover, mobile money represents a radical technology (Arthur, 2007), relying on a combination of financial software and mobile technology distinctly different from the existing set of options available to

conduct financial transactions, both formally through banks/financial institutions and informally through middlemen (*e.g.*, hawalas).⁴ In the initial stages of this industry, pioneers took different approaches to assembling the necessary software and mobile network capabilities, and because mobile money was pioneered by firms who launched mobile money platforms in different countries almost concurrently, the context enables us to study within-industry variation in pioneering characteristics—strategies—performance.

2.4 Data and Methods

Our study uses quantitative and qualitative data during the 1997-2017 period compiled for the census of mobile money pioneers worldwide from several sources. Due to the recency of industry inception (post digitization of data), the industry's earliest years and earliest entrants are well documented in online and archival sources. We started with data compiled by the GSMA, the global industry association for mobile network operators. This data is the GSMA's mobile money deployment tracker that reports on the mobile money industry starting in 2010. Though GSMA reported the year of first launch of a platform that preceded 2010, it had missing and inaccurate information on some pioneers—particularly those that did not survive the early years. To ensure accuracy and completeness, we painstakingly appended and refined the GSMA data and corroborated these efforts across multiple sources.⁵ We did so by conducting extensive

⁴ One founder described his conceptualization of mobile money: “*We would build a financial transacting system that ran on devices that many consumers already had. The mobile phone – a technology that was really still in its infancy then... Nobody (or very few people) at that time had thought about using the phone for anything but talking. ... Thinking up a product from first principles was a difficult task. We had to solve many complex problems on a conceptual level and design the architecture of the product to sustain massive volumes. For instance, we decided to create a push payment system. ...at that stage, no working example of a push consumer payment system existed anywhere in the world*” (van Rensburg, 2016, l. 318-386).

⁵ See <https://www.gsma.com/mobilefordevelopment/m4d-tracker/mobile-money-deployment-tracker> [last accessed 1/30/2019]. To be defined as a pioneer, a platform had to be commercially launched (*i.e.*, we exclude platforms announced but never initiated operations—interested readers may refer to such platforms in (Ondrus et al., 2015; van Rensburg, 2016). In addition to appending the GSMA data with missing information, we resolved internal discrepancies in the GSMA database regarding the launch year of a pioneering platform by investigating the histories of each platform. The main discrepancy arose from GSMA attributing launch date of an acquired platform

searches to ensure, to the best of our knowledge, that we had captured the full census of pioneering platforms and firms. We accessed data from multiple sources, including industry reports, company annual reports, corporate press releases and websites, media coverage, and first-hand published accounts of platform and firm development communicated by managers and founders (when available) (Table 1). We accessed roughly 17,000 pages of materials in total, with material on each platform ranging from 9 to over 3,000 pages. We also benefitted from recordings or transcripts of over 40 interviews with firm founders conducted by the mainstream press. These interviews often provided significant detail on our questions of interest (how pioneering firms made and implemented their platform strategies) and verified archival data.

Table 1

Data sources

Data Source	Details
Interviews	• 12 written accounts by individuals who pioneered mobile money platforms (books or blog posts) • 44 audio files or transcripts of interviews with mobile money pioneers conducted by journalists, ranging from 10 to 55 minutes, published by the business/trade press
Media coverage, third party industry reports, published cases, additional articles and commentaries	• Over 70 articles and comments/commentaries published in the business/trade press and blogs between 1997 and 2017, accessed through extensive Google searches • Over 60 GSMA, CGAP, other 3rd party reports • 4 cases published by universities (e.g., Harvard Business School, Columbia Business School) • 16 academic publications on mobile money and telecom industry downloaded through keyword searches on Business Source Complete and Google Scholar
Corporate websites	• Over 400 annual reports, corporate presentation slide decks, press releases, ‘About’ webpages between 1997 and 2017

to the date of its most recent ownership (provider) change. We kept the original launch date upon ascertaining that such acquisitions resulted only in rebranding of existing services.

Identification of Mobile Money Pioneers and Assembly of Business Histories

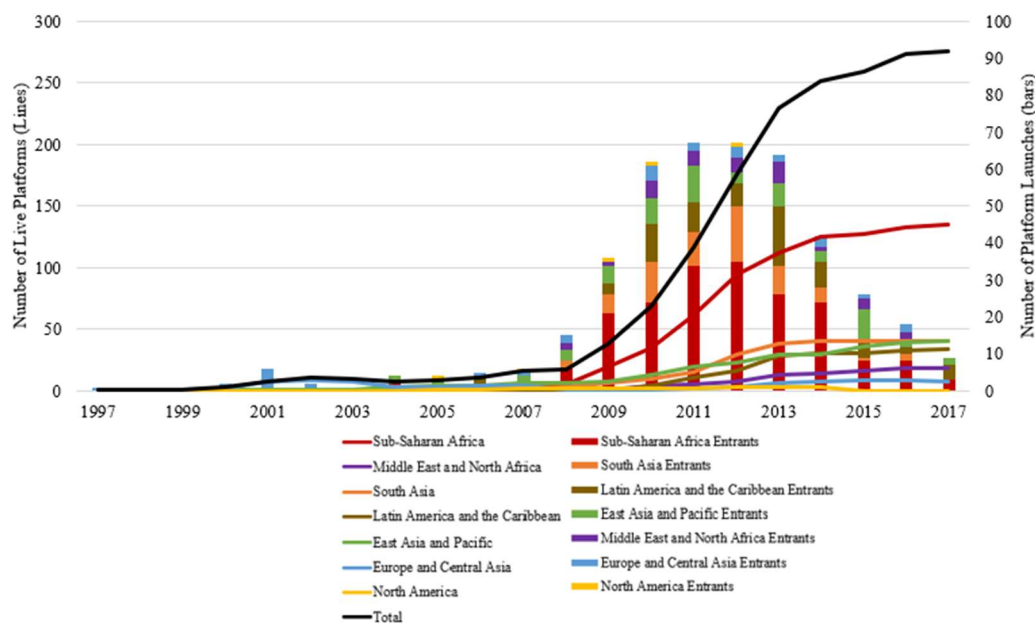
Pioneers are often distinguished from later entrants based on whether they entered in the “pre-firm takeoff” stage—the period from first commercial introduction to the year preceding a sharp increase in entry into the industry (Gort & Klepper, 1982; Moeen et al., 2020). We follow the discriminant analysis used in Gort and Klepper (1982) to define 1997-2007 as the pre-firm takeoff period of the industry.⁶ This method results in the identification of 31 pioneering firms across 20 countries that resulted in 30 platform launches.⁷ Figure 2 depicts the number of platforms in existence (lines) and launched (bars) each year from industry inception through 2017 by region. During the pre-firm takeoff stage, the modal number of platforms in each country was one; eight countries had entry by two platforms, and one country had entry by three platforms. In all but two countries with more than one pioneering platform, entry was within two successive years.

⁶ Specifically, this procedure uses net entry rates in the industry to identify years that are clearly in the pre-take off stage, and years that are clearly in the growth stage. The net entry in each of the “in-between” years of the two adjacent stages is then compared to the mean entry rates in each stage. The cut-off year is chosen based on minimizing the difference between the net entry in that year and the mean of net entry of the stage to which it could potentially be classified.

⁷ There is no one-to-one correspondence between the 31 pioneering firms and 30 pioneering platforms launched across the various countries. There are two reasons for this: some firms launched pioneering platforms in multiple countries simultaneously or in quick succession during the 1997-2007 period; and, some firms co-provided a pioneering platform with other firms, while others operated independently.

Figure 2

Number of live platforms & platform launches over time



Source: Authors calculations using GSMA data

For each pioneering firm and platform, we drew on the above sources to compile comprehensive quantitative data and business histories from inception through exit or end of study period in 2017. As to be expected, there is variation in data availability across each firm and platform, with those that are more successful being better documented. Appendix Table A4 provides details on data availability (*i.e.*, notes cases for which limited or conflicting data exist).

Analytic Approach

We used an inductive analytical approach rooted in grounded theory building to uncover and investigate patterns pertaining to the characteristics, strategic choices, and survival of mobile money firms (Glaser & Strauss, 1967; Langley, 1999). The key components of this approach are grounding, organizing, and replicating. As is common in qualitative research, these steps were iterative and not strictly sequential: as patterns came into focus, we often went back to the data to gather more nuanced information, and, we had moments where we realized revisions were

needed to better capture what was going on in the data. Below, we describe these steps in the context of how our study unfolded.

Guided by the above call for research on how digital platform ecosystem pioneers vary in their strategies and performance, we began by creating codes (grounding) to capture high-level characteristics of mobile money pioneer firms and their platform creation choices. At this early stage in the analytic process, we used codes that reflected characteristics highlighted in prior research. Specifically, we coded for: pre-entry experience (*i.e.*, startups vs. diversifying entrants), multinational experience, presence of software capabilities or mobile network capabilities, platform provision (single vs. multiple firms), platform user access (open or closed), socioeconomic development (developed or developing country based on OECD classification), and services offered.

We then sought to identify potential linkages between these factors and survival (organizing and replicating). We were intrigued by patterns that emerged when we grouped the population of mobile money platforms according to two strategic choices: platform provision (single- or multi-firm) and platform access to end users (open or closed). Three things struck us as potentially interesting and worthy of further exploration. First, although all four combinations of the two choices are observed, the vast majority of pioneers launch multi-firm provision, closed user access (MC) platforms or single-firm provision, open user access (SO) platforms. Second, the survival rates of platforms in each of the two predominant combinations differed; however, some platforms in each of the two combinations were successful, suggesting deeper patterns to be explored. And third, we observed some patterns that ran counter to received literature. Because our data represent the entire population, not sample, of mobile money pioneers, findings

pertaining to these patterns are reported as simple count measures (*i.e.*, means and standard deviations).

Our next task was to understand how these aggregate patterns emerged by examining our data in a more detailed and nuanced way. We focused on the two predominant combinations to understand how each firm's strategic choices arose, the second-order challenges that they generated, and their associations with survival.⁸ We analyzed the business histories of each firm/platform for each combination of platform provision and platform end user access separately. We undertook another round of coding focused on factors that gave rise to strategic choices and the opportunities and challenges that arose due to these strategic choices (grounding); these codes emerged organically from the data and included actions and reactions by focal firms, individuals (founders and product champions), users, and partners of various types. For example, across the sample, startup founders were committed to satisfying unmet needs and improving financial access, while also building a viable business; however, MC startup founders focused in on the unbanked in a specific country, whereas SO startup founders had a strong commitment to creating a *universal* platform. This difference in motivation appears to have led to different choices regarding platform provision and platform end user access and, therefore, different subsequent challenges. We then sought to build a series of logical associations between our codes to construct patterns in the data pertaining to the causes and consequences of different strategic choices (organizing), or as Glaser (1978) puts it, "weave the fractured story back together" (p. 72). For example, this included understanding how particular strategic choices led to specific implementation challenges and the pursuant firm responses, and

⁸ We thank a reviewer for the suggestion to use Table 2 to frame our findings and then conduct an in-depth analysis of the two more populated cells to understand how pioneers implemented their chosen strategies.

ultimately resulted in the construction of Tables 5 and 6 (shown later). Lastly, we used a replication logic to ensure that the patterns we found held throughout the sample (Bechky & O'Mahony, 2015): we revisited each business history to check if associations held, and if they did not, we revised our associations or created alternative paths. For example, we noticed differences in partnering choices between SO firms and sought to explain how and why these different choices appear to be associated with different survival outcomes. Appendix Table A4 provides quotes documenting patterns across cases (replication). Patterns held across most cases, and we note in Appendix Table A4 when data on a particular issue were not available for all cases. In rare instances of observed differences, we note these in the findings and Appendix Table A4. Through these efforts, we ultimately arrived at a framework that was consistent with our data.

2.5 Analysis and Findings

Our framework illuminates patterns relating to how two key platform choices—single- or multi-firm provision and open or closed end user access—were made, the challenges they create, and how they affect service offerings and survival. We begin by describing the population of firms and platforms in the mobile money industry. We then describe our findings in two steps: we first show that these key strategic choices affect survival and ecosystem development, and then dig deeper to reveal the factors that give rise to these choices and their consequences.

Characteristics of the Population of Pioneering Firms

We briefly report on several key characteristics of the 31 pioneering firms. Regarding pre-entry experience, 17 (55%) pioneers are diversifying entrants, of which 14 (45%) are mobile network operators. Fourteen pioneers (45%) are startups with mobile money financial software capabilities. Regarding capabilities, 17 (55%) firms possess only software capabilities, 10 (32%)

firms possess only network capabilities (including access to target markets) and 4 (13%) firms possess both.

Categorizing Pioneering Platforms: Provision and End User Access

Table 2 categorizes pioneering firms and their platforms according to two key choices: provision and end user access. We see that firms overwhelmingly chose two combinations of these choices: of the 30 platforms, 12 are multi-firm, closed end user access platforms (Cell 1; hereafter labeled MC) and 14 are single-firm, open end user access platforms (Cell 4; hereafter labeled SO). Interestingly, only two mobile network operators chose to develop software capabilities inhouse, representing the two platforms in Cell 2 (SC); and only two platforms were provided by multiple firms with open end user access (Cell 3: MO).⁹

Within Cell 1 (MC), platforms were launched through alliances between a diversifying entrant—mobile network operator (MNO)— and either another diversifying entrant or a startup with software capabilities, thus reflecting external integration of complementary capabilities. In terms of target markets, these platforms naturally restricted end user access to subscribers of the MNO. Some pioneering MC firms (*e.g.*, Fundamo, Utiba) engaged in alliances with different partners across countries in quick succession; as a result, the 12 MC platforms are associated with 11 distinct MNOs and eight distinct software providers. In Cell 4 (SO), *all* of the pioneering platforms were launched by startups who designed the software for their platforms to utilize universal features of mobile phones (*e.g.*, SMS, USSD) and opened the platform to end users across all mobile networks to develop their ecosystems. This required them to integrate software and market-facing capabilities internally. Several of these startups launched pioneering platforms

⁹ The two platforms in Cell 3 (MO) were open end user access: Mobipay was launched by a consortium of major mobile operators and thus open to all networks' subscribers, and Yandex.Money was launched by a startup Internet provider, Yandex—so it did not require *mobile* network capabilities.

in multiple countries in quick succession, and collectively, the 14 SO platforms are associated with 9 distinct startups.

Table 2 *Mobile money platforms by provision and end user access*

	Multi-Firm Provision (14 platforms)	Single-Firm Provision (16 platforms)
Closed End User Access (14 platforms)	Cell 1 (MC): 12 platforms launched through alliances across 18 distinct pioneering firms BillPay (Bangladesh, Launched: 2006) Network: Grameenphone (DE); Software: Comviva (SU) Celpay (Zambia, Launched: 2001) Network: Celtel (DE); Software: Fundamo (SU) Celpay (DRC, Launched: 2004) Network: Celtel (DE); Software: Fundamo (SU) GCash (Philippines, Launched: 2004) Network: Globe (DE); Software: Utiba (SU) M-Money (Malaysia, Launched: 2007) Network: Maxis (DE); Software: Utiba (SU) mPay (Thailand, Launched: 2005) Network: AIS; Software: NTT DoCoMo (DE) MTN MobileMoney (South Africa, Launched: 2005) Network: MTN (DE); Software: Fundamo (SU) M-PESA (Kenya, Launched: 2007) Network: Vodafone (DE); Software: Sagentia (DE) Oi Paggo (Brazil, Launched: 2006) Network: Telemar Norte Este (DE); Software: Paggo (SU) Osaifu-Keitai (Japan, Launched: 2004) Network: NTT DoCoMo (DE); Software: Sony (DE) Smart Money (Philippines, Launched: 2000) Network: Smart (DE); Software: Sonera Zed (DE) True Money (Thailand, Launched: 2005) Network: True (DE); Software: Utiba (SU)	Cell 2 (SC): 2 platforms launched by 2 distinct pioneering firms Sonera Mobile Payments (Finland, Launched: 1997) Network & Software: Sonera (DE) T Cash (Indonesia, Launched: 2007) Network & Software: Telkomsel (DE)
Open End User Access (16 platforms)	Cell 3 (MO): 2 platforms launched through an alliance across 2 pioneering firms + a consortia MobiPay (Spain, Launched: 2002) Network & Software: consortium of 36 mobile operators, financial institutions and card payment processing companies (DE) Yandex.Money (Russia, Launched: 2002) Network: Yandex (DE); Software: Paycash (SU)	Cell 4 (SO): 14 platforms launched by 9 distinct pioneering firms Eko (India, Launched: 2007) Software: Eko (SU) Mcash (Brazil, Launched: 2006) Software: Mcash (SU) Mint (Sweden, Launched: 2001) Software: Mint (SU) Monitise (UK, Launched: 2006) Software: Monitise (SU) Monitise (USA, Launched: 2007) Software: Monitise (SU) Obopay (USA, Launched: 2005) Software: Obopay (SU) Paybox (Germany, Launched: 2000) Software: Paybox (SU) Paybox (Austria, Launched: 2001) Software: Paybox (SU) Paybox (Sweden, Launched: 2001) Software: Paybox (SU) Paybox (Spain, Launched: 2001) Software: Paybox (SU) Paybox (UK, Launched: 2001) Software: Paybox (SU) PayMate (India, Launched: 2006) Software: PayMate (SU) Suvidha (India, Launched: 2007) Software: Suvidha (SU) WIZZIT (South Africa, Launched: 2004) Software: WIZZIT (SU)

Pioneering Firm and Platform Survival and Ecosystem Development

At the firm level, Table 3 provides the fraction of surviving firms one, five and 10 years after platform launch.¹⁰ Diversifying entrants and startups have similar survival rates for the first five years, but the 10-year survival rate is lower for startups than diversifying entrants. When further distinguishing pioneers based on internal or external integration of capabilities, Table 3 shows that single-firm provision startups had notably lower odds of survival (44% at age 10), relative to multi-firm provision startups (80% at age 10) or diversifying entrants (81% or higher at age 10).¹¹

Table 3

Fraction of firms surviving, diversifying entrants vs. startups

Time (years)	Startups	Multi-firm Provision Startups	Single-firm Provision Startups	Diversifying Entrants	Multi-firm Provision Diversifying Entrants	Single-firm Provision Diversifying Entrants
1	0.93 (0.07)	0.80 (0.18)	0.89 (0.11)	0.94 (0.06)	0.93 (0.06)	1.00
5	0.71 (0.12)	0.80 (0.18)	0.67 (0.16)	0.87 (0.08)	0.86 (0.09)	1.00
10	0.56 (0.14)	0.80 (0.18)	0.44 (0.17)	0.81 (0.10)	0.79 (0.11)	1.00

Note: Standard errors are reported in parentheses.

¹⁰ Acquisitions represent successful exit (Graebner & Eisenhardt, 2004), or an option used by firms facing insolvency (Fortune & Mitchell, 2012). We utilized the fate of the platform post-acquisition and corroborating qualitative information to distinguish between the two. We coded firm acquisition as a censored event if the associated platform continued operations, and as failure if it was discontinued (and acquirers retained only the firm's software capabilities).

¹¹ In the Appendix, we report on potential additional explanations for differences in performance. Specifically, we found that among diversifying entrants, possession of network vs. software capabilities did not seem to matter for survival (Appendix Table A3). Also, overall survival outcomes of diversifying entrants and startups were similar in both developed and developing countries (Appendix Figures A3a & A3b).

Table 4*Average number and type of services offered by platforms*

	MC Platforms				SO Platforms			
	Average Number of Total Services	Average Number of Same-Side Services	Average Number of Multi-Side Services	Fraction of Platforms Surviving	Average Number of Total Services	Average Number of Same-Side Services	Average Number of Multi-Side Services	Fraction of Platforms Surviving
Launch Year	4.58 (0.62)	0.75 (0.18)	3.83 (0.52)	100%	2.29 (0.32)	0.64 (0.13)	1.64 (0.27)	100%
2010	4.75 (0.83)	0.83 (0.21)	3.92 (0.66)	100%	3.89 (0.50)	0.78 (0.15)	3.11 (0.45)	64%
2017	5.75 (0.80)	1.13 (0.30)	4.63 (0.63)	67%	4.67 (1.50)	1.67 (0.33)	3.67 (2.03)	21%

Note: Standard errors are reported in parentheses.

In Table 4, we examine platform outcomes, focusing our attention on MC and SO platforms because we cannot draw meaningful conclusions or suggest patterns for the non-dominant MO and SC cells that contain only two platforms each, where one survived and the other failed.¹² Here, in addition to survival, we report the number of services offered (based on Figure 1), including those that involve users on the same side of the platform (*e.g.*, person to person or business to business transfers) and those that involve users on multiple sides of the platform through ecosystem partners (*e.g.*, payments, disbursements and other services). Appendix Table A1a defines each service offered by the pioneering mobile money platforms, and whether the service involves users on the same or multiple sides of the platform. There are two same-side services and eight multi-side services. In Table 4, we provide survival and user services statistics for the year of pioneering platform launch, year 2010 (the first year GSMA collated this information) and year 2017 (the end of the study period).

¹² See Appendix Figure A1 for Kaplan Meier survival curves and Appendix Table A1b for number and types of services. We conduct survival analyses at both the firm and platform levels because there is no 1-1 correspondence between firms and platforms: some platforms were launched by two firms working together, and some firms launched multiple platforms. Hence both levels of analyses are needed to distinguish between outcomes at each level.

Table 4 reveals distinct differences in survival rates: 67% of the MC platforms survive, compared to only 21% of SO platforms.¹³ Moreover, in the first year of launch itself, the 12 MC platforms offered more services, particularly more multi-side services (an average of 4.58 total, 0.75 same-side, and 3.83 multi-side services respectively), than did the 14 SO platforms (an average of 2.29 total, 0.64 same-side, and 1.64 multi-side services). Most MC and SO platforms relied on a combination of same-side and multi-side services, offering them the possibility of generating both direct and indirect network effects. Table 4 reveals that by 2010, there was a “survival of the fittest”: 100% of the MC platforms but only 64% of the SO platforms survived. However, the surviving SO platforms introduced more multi-user services compared to their initial service offerings, becoming closer to the average number of services offered by surviving MC platforms (on average, MC: 4.75 total, 0.83 same-side, and 3.92 multi-side; SO: 3.89 total, 0.78 same-side, and 3.11 multi-side services). This trend continues, with both surviving MC and SO platforms growing their services through the end of the study period in 2017 (on average, MC: 5.75 total, 1.13 same-side, and 4.63 multi-side; SO: 4.67 total, 1.67 same-side, and 3.67 multi-side services).

A closer look at the types of services offered on the platforms in Figure 3a shows that most MC platforms offered the same three services initially, and the majority of MC platforms continued to offer those services in 2010 and 2017: airtime top-up, bill payment, and P2P transfers. Most SO platforms also initially relied on a mix of services that involved users on both the same side and multiple sides of the platform, though they started with a slightly different set of most-popular service offerings: link to other banking products, P2P transfers, and merchant

¹³ In additional analysis, Appendix Table A2 provides survival rates by age (given that launch year differs by platform). All but one MC platform were launched in a developing country, thus precluding an analysis of differences in this cell. Within SO platforms, developing country launches had a slightly higher likelihood of survival (Appendix Figure A3).

payment, and this composition of services changed over time (Figure 3b). In 2010, the majority of SO platforms shifted to include airtime top-up and bill payment in addition to the initial three services. By 2017, B2B transfer was the only service offered by all surviving SO platforms. In conjunction with Table 4, these data suggest a treatment effect at play in which surviving SO platforms not only increased the number of services they offered over time but also adapted which services they offered as they sought to find the right value proposition to leverage network effects. In contrast, the surviving MC platforms slightly increased the number of services they offered over time and largely continued to offer the same services they started with.

Figure 3a

Services offered based on share of MC platforms over time

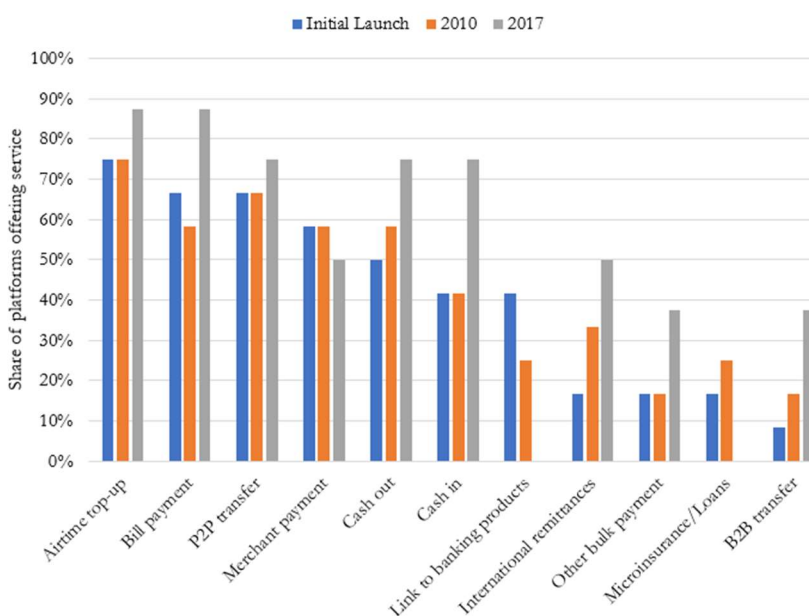
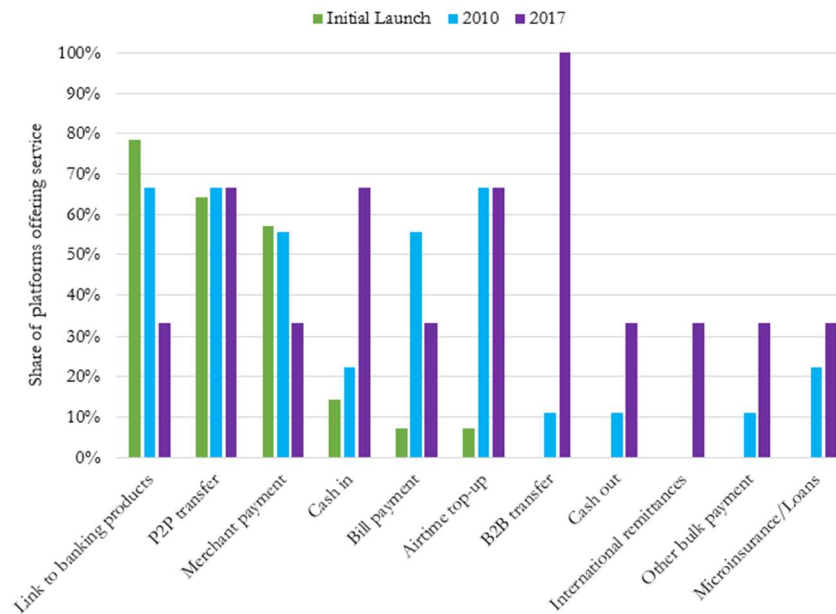


Figure 3b

Services offered based on share of SO platforms over time



Source: our calculations using GSMA and hand collected data

We now dig deeper into how pioneering firms' motives and capabilities translated into key strategic choices regarding platform provision; how these characteristics and strategic choices turned into different sets of opportunities and challenges; and how outcomes were shaped by the ways in which firms traversed these challenges.

Digging Deeper: MC (Multi-Firm, Closed End User Access) Platforms

Our analysis of the 12 platforms in the MC Cell reveals systematic patterns (Table 5). Each platform was created by a pair of firms that included a mobile network operator (MNO) and a financial software provider; these pairs possessed complementary capabilities. The pairs of firms generally had aligned motives that supported working together to create platforms that limited end user access to MNO subscribers. These platform choices required firms to address three challenges: coordinating between platform co-providers, identifying a value proposition to

attract end users, and driving increased usage through ecosystem development and indirect network effects.

Table 5

Cell 1 (MC) patterns in founding characteristics, key platform choices, challenges, and outcomes

Founding Characteristics: Resources & Capabilities, Motives	Key Platform Choices	Implementation Challenges & Firm Responses	Outcomes
Resources & Capabilities • Mobile Network Operators: possessed network capabilities and complementary assets needed to grow the platform (e.g., existing customer bases, brand names, established telecommunication ecosystems) • Software Providers: possessed or developed financial software capabilities Motives for Entering the Mobile Money Industry • Mobile Network Operators: sought to improve customer retention by reducing “churn”; increased revenue streams; some possessed motives related to improving financial inclusion • Software Providers: nearly all had motives related to improving financial inclusion	• Platform provision: Multi-firm • Platform access to end user: Closed	• Challenge 1 – Coordinating between Platform Co-Providers: Coordinating between platform co-providers to deploy mobile money platforms Response: Strong and consistent communication and collaboration between platform co-providers (i.e., practices that resulted in the development of external integrative capabilities). • Challenge 2 – Identifying an Attractive Value Proposition: Identifying a clear value proposition attractive to end users in an uncertain environment Response prior to launch: MC platform co-providers took different approaches to developing their initial service offerings: some built on observations of the pre-existing customers’ innovative uses of airtime, while others relied on their own perceptions of market needs. Response after launch: MC platform co-providers actively observed how end users utilized their platforms to create additional or alternative functionality for the platforms. Some firms formalized an explicit experimentation approach with small end user groups in pilot programs. • Challenge 3 – Driving Increased Usage through Ecosystem Development/Indirect Network Effects: Cultivate ecosystem partners to grow the platform and drive increased usage Responses: MNOs leveraged their pre-existing relationships with airtime resellers and forged connections with other large firms to develop their ecosystems and add more users to their platforms. Software providers tailored platforms to meet the needs of diverse users across the ecosystem to improve platform functionality and increase the overall platform user base.	• All pioneers were able to address all three challenges. Most survived; a few failed for idiosyncratic reasons. ○ 67% of firms survived ○ 67% of platforms survived

MC Pioneering Firm Characteristics: Resources and Capabilities.

MNOs and software providers possessed distinct resources and capabilities. The MNOs had requisite network capabilities and complementary assets such as knowledge of telecommunication regulations, pre-existing customer bases, brand names and established telecommunication ecosystems. For example, when Japan's leading MNO entered the mobile money industry, financial analysts remarked on the strength of its capabilities:

What sets it [NTT DoCoMo] apart...is the sheer level of dominance it exerts over the mobile market (with an impressive 80 million customers) and the ecosystem around it. ... The sheer muscle that [NTT DoCoMo] brings is unparalleled. Analysts, Osaifu-Keitai, Japan (Mas & Rotman, 2008, p. 21)

Software providers, in contrast, possessed or developed financial software capabilities. We saw three types of software providers: two were mobile network operators who had launched prior mobile money platforms during the pre-takeoff stage of the industry, two were established firms with business units in information technology, and four were startups whose founders had prior work experience in financial services industries or payment software solutions for mobile telecommunications. For example,

[Founder] Fujimoto began in eFinance in 1996, setting up internet banking for Brazilian bank Unibanco. He worked on the [MNO] Oi start-up...before leaving to run Paggo as a separate entity. [He commented,] "This mix gave me the experience to run a mobile payments company." Massayuki Fujimoto, Paggo/Oi Paggo, Brazil (Gemalto, 2012)

MC Pioneering Firm Characteristics: Motives for Entering the Mobile Money Industry.

Most MNOs expressed multiple motivations for entering the mobile money industry. All MNOs sought to reduce customer "churn" (stemming from customers' ability to swap SIM cards from competing mobile network operators) and increase revenue streams through diversification.

...the reason that so many telecoms companies are interested in mobile money services is "churn reduction", or customer retention. Telcos' main concern is to retain customers for mobile services, and the rationale is that customers switch networks less frequently if their

bank account [or means of accessing financial services] is associated with their SIM card. Susie Lonie, Vodafone/M-PESA, Kenya (Yin, 2015)

Many MNOs and nearly all software providers were committed to increasing financial inclusion for low-income individuals in the developing countries in which they operated:¹⁴

We aspired to solve a hard problem, which was to give underserved people affordable access to banking and electronic payments. At the same time, we knew this too would bring social, economic, and government improvements to the Philippines. Jojo Malolos, Smart/Smart Money, Philippines (Realini & Mehta, 2015, p. 48)

We believed that we could further enhance livelihoods of lower income segments by providing them with access to financial and banking services-and from this was born the mobility [mobile money technology] concept. We wanted to develop a solution that would interface with banks and with telecom operators, so that the end offering to the consumer was as functional as possible. Sanjiv Mital, Bharti Telesoft (later renamed Comviva)/Billpay, Bangladesh (Philip, 2007)

Key Platform Characteristics: Closed End User Access Provided by Pairs of Firms.

The capabilities and motives of MNOs and software providers influenced the key strategic choices these firms made with regards to their platforms. The choice to restrict their platforms to MNO-specific end users was logically consistent with MNOs' motives to reduce customer churn. However, these MNOs lacked the software capabilities to develop a mobile money platform, and it therefore made sense to collaborate with a software provider:

The interesting thing about MSI was that we did not go out to find them -- they found us. ... MSI was used to working with smaller, faster and more innovative companies ... We definitely fitted into that category...they clearly recognised that we owned a great product and that we were skilled and knowledgeable about the industry. Hannes van Rensburg, Fundamo/Celpay, Zambia (van Rensburg, 2016: 960-992)

In turn, software providers also benefitted from working together with MNOs: established providers of IT services drew revenue, and startups were able to learn, benefit from MNO capabilities (e.g., customer bases, brand names, and established telecommunication

¹⁴ The exception—the Osaifu-Keitai platform (Japan, NTT DoCoMo/Sony)—sought to target users intrigued by the technology by making transportation/commerce payments more convenient (Mas & Rotman, 2008).

ecosystems), and work to build platforms that would increase financial inclusion in their countries.

One of the first prospects we started working on was MTN. ... As one of the two biggest operators in South Africa, MTN was growing at the speed of light as more people were starting to use mobile phones. ... It turned out they had been researching mobile banking ...[and] wanted to see what we knew and what we were doing. Hannes van Rensburg, Fundamo/MTN Mobile Money, South Africa (van Rensburg 2016: 1979-1989)

In addition, nearly all software providers (6 of 8) expressed an early interest in extending services to other nations. An additional benefit of partnering with MNOs was potentially opening up future growth opportunities through building subsequent platforms in other countries with the same MNO (if multinational) or with other MNOs.

'We are delighted with this new partnership [with Smart]. International distribution and content deals are vital for [Sonera] Zed's development into a worldwide transaction and content service provider,' says [Sonera Zed CEO and president] Verallus. Sonera Zed/Smart Money, Philippines (AsiaPulse News, 2000)

Addressing Implementation Challenges of MC Platforms in an Uncertain Landscape.

Three common challenges arose for co-providers of MC platforms, detailed below. These challenges appear to reflect their resources and capabilities, key choices involving multi-firm provision and closed end user access, and the uncertainties inherent in a nascent industry. Resolving these uncertainties was often difficult, but all platforms managed to overcome these challenges.

Challenge 1: Coordinating between Platform Co-Providers.

The pioneering platforms were not only first in their countries, but among the first in the world. Problems routinely arose, requiring co-providers to work closely and repeatedly on technological issues involving platform functionality, and also on (often unanticipated) problems at the intersection of technology and country-specific factors (e.g., regulatory compliance with

respect to both the banking and mobile phone industries, institutional hurdles, language idiosyncrasies, etc.). Many of these questions were not straightforward and required co-providers to invest the time and resources to develop routines and problem solve:

Sagentia worked with Vodafone throughout the development phase of both the pilots and the full roll out. This included running extensive market needs analysis for potential users and stakeholders and extensive prototyping so that the service and user interface would be accepted. Throughout Sagentia used innovative approaches to help solve the myriad of challenges faced in deploying an audited financial service into a mobile network operating into emerging markets. Sagentia/M-PESA, Kenya (Sagentia, 2015)

Over time, these practices resulted in the development of what may summarily be referred to as “external integrative capabilities.” Take for example, MNO Celtel (formerly MSI) and software provider Fundamo who together deployed the first Celpay platform in Zambia and then another in the Democratic Republic of Congo (DRC):

[MSI] worked through difficult times and pushed us to get everything into production. ... Their situation forced us to work out how to deploy our systems on a shoestring, but also how to do so well and accurately. It was the perfect learning experience... Hannes van Rensburg, Fundamo/Celpay, Zambia (van Rensburg, 2016: 1097-1113)

After Celtel’s success with the Celpay deployment in Zambia, it was decided to launch Celpay in...the DRC [which]...had suffered decades of fighting...[and was] not exactly optimal for deploying highly complex technology solutions for managing high-volume financial transactions. [A low-key trial] became both an immediate success and a disaster at the same time. ...we were struggling to keep the system operational due the [higher than expected] volume usage. I was on the phone with an exasperated [Celtel CFO turned head of Celpay] Kamiel on a daily basis. He told me that he had never in his entire career experienced such a disaster. ... A system running on sophisticated hardware in one of the most remote cities in the world was misbehaving. With the way customs worked in the DRC, we would be lucky to get more hardware into the country within a few months. We had to find a way to tune the system to deal with the massive volumes using its existing hardware. ... It took early believers like...[Celtel] to embrace our mad ideas and to trust us to pull it off, even when we were not entirely sure that we could. Hannes van Rensburg, Fundamo/Celpay, DRC (van Rensburg, 2016: 1215-1280)

Challenge 2: Identifying an Attractive Value Proposition.

A second challenge arose with respect to deciding what features and services to offer; recall that demand uncertainty was high due to the nascency of the industry—no one knew what

services would be most valuable to end users—and no clear value proposition existed for mobile money technology. All MC platforms initially launched with at least two types of multi-user services as a way to leverage indirect network effects, and 8 out of 12 (66.7%) platforms launched with at least one same-side service, typically P2P transfer, to leverage direct network effects.

MC platform provider pairs took different approaches to developing their initial service offerings: some built on observations of the pre-existing customers' innovative uses of airtime, while others relied on their own perceptions of market needs. As an example of the first, some MNOs, prior to creating their initial platforms, observed that their customers used *existing* airtime services in non-traditional ways and leveraged such user innovation in several early mobile money platforms. For example, in the Philippines:

...users bought scratch cards from the telecom operator Smart with the expected use of topping-up their mobile voice and data credits. Yet, some of them, instead of using the scratch-card credits themselves, were sending the activation codes via SMS to distant relatives who would use the codes to top-up their own airtime credits. ... Shortly after..., Smart...realized the potential of this service and launched PasaLoad, which allowed electronic airtime transfer among customers. Smart Money, Philippines (Van der Boor et al., 2014, pp. 1595, 1601)

As an example of the second, other MNOs focused on a need they believed existed in the market. For example, competing MNOs in Thailand each launched a platform catering to different needs:

TrueMoney is a subsidiary of True Corporation, a conglomerate with interests in mobile and fixed line phones, pay TV, broadband Internet, radio, coffee shops, and online gaming. ... TrueMoney was introduced to enable customers to top up many prepaid services and to pay their various True Corporation bills more easily. Analysts, True Money, Thailand (International Finance Corporation, 2011, p. 30)

Many small businesses still provide business payments in cash. [Mobile money platform] Advanced MPay has seen an opportunity to provide m-money to these small businesses... This service was established mainly to pay the 200,000 AIS airtime resellers efficiently and for them to buy airtime stocks, but it has now expanded to include other businesses. Analysts, MPay, Thailand (International Finance Corporation, 2011: 8, 32)

Following the launch of their initial platforms, all MC platform providers actively observed how end users utilized their platforms to create additional or alternative functionality for the platforms. Some firms formalized an explicit experimentation approach with small end user groups in pilot programs. These pilots not only provided feedback on functional aspects as noted in the M-PESA quote in Challenge 1, but also unexpected ways in which end users used the platform. These innovative uses sometimes resulted in key pivots, as when the providers of the M-PESA shifted from the initial value proposition of repaying microfinance loans to P2P payments:

...we had inadvertently identified one of Kenya's biggest financial challenges... What we found in practice was that people who received the loans were sending the money to other people hundreds of miles away. Michael Joseph, Vodafone/M-PESA, Kenya (Joseph, 2017)

In the Philippines, the G-Cash platform added an automated salary disbursement option called 'Text-a-Sweldo' after the platform providers discovered that one rural Filipino bank president was paying his 250 employees their salaries out of his G-Cash wallet (Chemonics International Inc, 2012). Other businesses had similar needs:

[A leisure resort] had about 800 employees, and every payday, it had to withdraw sufficient funds, prepare employees' pay envelopes one-by-one, and have a cashier hand the envelopes to employees. The company was desperate for a more cost-efficient method of handling its payroll and was happy...to improve operations [through G-Cash]. Analysts, G-Cash, Philippines (Chemonics International Inc., 2012)

Overall, all MC software providers used their MNOs' pre-existing customer bases to test ideas for services and features to gain further insight into end user needs.

Challenge 3: Identifying an Attractive Value Proposition.

Increased platform usage benefits both software providers and MNOs; one way of increasing usage is by convincing various organizations to join the ecosystem and to use the platform as well. However, this was often challenging, because the newness of mobile money

made many organizations (businesses, utilities, nonprofits, etc.) wary of using it for financial transactions. MNOs were able to persuade these user groups by building on pre-existing supply chain relationships with airtime resellers, who in turn saw the opportunity to grow their own businesses. Also, MNOs were able to forge connections with other large organizations.

True delivered on the promise of higher volumes by partnering with multiple Thai businesses that sold services on a prepaid basis... True provided the dealers, sub dealers and retailers with volume that they previously would not have captured by simply selling prepaid airtime scratch cards... Ultimately, True's desire to penetrate the massive third party bill payment market in Thailand prompted them to augment their distribution strategy... Analysts, True Money, Thailand (Leishman, 2010, p. 4)

In the next few years, we will embed mobile money services into other industries beyond banking and financial services... Smart's affiliate companies in this group include, among others, the major power distribution company..., one of two major water distribution companies..., the largest tollways operator..., one of the largest television and satellite broadcast networks..., and the biggest hospital chain... Mobile payments will be a key enabler and enhancer of business for these companies ... And key to our mobile money ecosystem is the network of more than 1.3 million load retailers all over the country who are users of [the mobile money platform] and also function as merchants. Orlando Vea, Smart Communications/Smart Money, Philippines (Reyes, 2011)

Software providers, in turn, tailored the platforms to meet the needs of a diverse set of users across the ecosystem. This customization facilitated platform functionality for different types of users and helped drive overall growth of the platform user base through indirect network effects:

But how do you acquire a critical mass of users[?]... The solution was to provide the dealers with a mobile handset with a modified menu customized to their needs... to support different activities from those of the consumers; [e.g.,] to be able to register customers and manage the store's M-PESA accounts. Employees, Sagentia/M-PESA, Kenya (Wooder & Baker, 2012, pp. 15–17)

...the challenge lies in converting inactive users to active users. ... We are constantly exploring new avenues and creating new synergies with our partners and clients to enable mobile money services across the board. ... [For example,] Merchant payments are 10 times bigger than P2P transfers... [a] step to boost merchant payment is the ...open loop payment system [which] expands the merchant acceptance network, increasing adoption of mobile money... Srinivas Nidugondi, Comviva/BillPay, Bangladesh (Connecting Africa, 2015)

Outcomes for MC Platforms.

All 12 MC platforms were able to address all three challenges. Each platform introduced multiple services catering to multiple user groups in the launch year and increased their offerings over time (see Table 4), creating conditions for platform ignition. For example, Thailand's True Money's efforts for ecosystem development enabled indirect network effects and scale to 6 million customers and 120 million transactions within five years (Leishman, 2010). In Kenya, the M-PESA platform leveraged direct network effects through P2P transactions and scaled the platform to 1.2 million users within the first year and 14.9 million registered customers within five years (Joseph, 2017; Safaricom, 2012). Both co-providers of the MC platforms achieved their goal of serving the unmet needs of the unbanked population in the countries of launch. Eight (67%) of the pioneering MC platforms continued to operate through the end of the study period in 2017 (Table 4), and exits were driven by idiosyncratic reasons rather than misalignment among partners or strategies.¹⁵

Digging Deeper: SO (Single-Firm, Open End User Access) Platforms

Our analysis of the 14 platforms in the SO Cell reveals several systematic patterns (Table 6). Each platform was created by a startup with strong software capabilities. Their founders were motivated to create a platform that could be used by *any* end user, and thus was mobile-operator agnostic. As a result, SO firms had to address three implementation challenges: secure key resource partners for financing and access an initial end user base; retain key resource partners;

¹⁵ The Oi Paggo platform (created by Oi and Paggo) in Brazil ended in 2016 when MNO Oi filed for bankruptcy (DeGrasse, 2016). The MTN platform (MTN and Fundamo) in South Africa was shut down due to “a lack of commercial viability” stemming from competition from the country's well-established banking sector (Chutel, 2016). Celpay (Celtel and Fundamo) operations in Zambia could not be sustained due to competitive pressures from follower platforms launched by larger MNOs; and the Celpay operations in the DRC were discontinued related to civil war conflicts (Malakata, 2014). However, Fundamo—the software provider in the latter three pioneering platforms—went on to ally with several other firms to launch over 50 follower platforms across 40 multiple countries (S. Thomas, 2015).

and identify value propositions to attract end users. SO pioneers varied in their approach to addressing these challenges, and this led to differences in survival and platform ecosystem growth.

Table 6

Cell 4 (SO) patterns in founding characteristics, key platform choices, implementation challenges, and outcomes

Founding Characteristics: Resources & Capabilities, Motives	Key Platform Choices	Implementation Challenges & Firm Responses	Outcomes
Resources & Capabilities • Founders/founding teams: possessed technological expertise and/or entrepreneurial experience • Founders: created strong teams passionate about making change by building a mobile money platform Motives for Entering the Mobile Money Industry • Founders: envisioned making payment transactions easier and more accessible to individuals regardless of their geographic location or level of access to financial services	• Platform provision: Single-firm • Platform access to end user: Open	• Challenge 1 – Securing Key Resources: Finding funding and an initial end user base Response: Some startups used a “coupled” strategy that involved attracting a single key resource partner that provided both funding and initial end users; others used a “decoupled” strategy, relying on two different key resource partners for funding and initial end users. • Challenge 2 – Retaining Key Resource Partners: Maintaining access to funding and end users Response: Startups following a coupled strategy had difficulties maintaining relationships with key partners, whose business interests and strategy shifted over time; as a result, they subsequently had difficulty accessing needed resources. In contrast, startups following a decoupled partnering strategy did not face this challenge because their key resource partners shared a vision for the future or desire to reach the unbanked. These committed relationships allowed access to partner resources as needed over time. • Challenge 3 – Identifying an Attractive Value Proposition: Identifying a value proposition to attract end users Response: All initially believed simplifying payments for end users was their platforms’ value propositions. Startups following a coupled strategy believed convenience would drive uptake; however, this did not occur due to payment alternatives available in their markets. Startups following a decoupled strategy worked diligently to understand the needs of all potential end users, conducted small-scale pilots, and built trust. Some pivoted based on different types of end users and their needs.	• Pioneers able to address all challenges survived. Pioneers unable to address all challenges were acquired for their software capabilities, or ceased operations. ○ 33% of firms survived ○ 21% of platforms survived

SO Pioneering Firm Characteristics: Resources and Capabilities.

Founders of startups that provided SO platforms stemmed from related industries—telecommunications, banking, or enterprise software—and the majority (6 of 9) of these firms had entrepreneurial experience in addition to software expertise:

After graduation [with a master's degree in computer science] I started my career as a technical person. I took a job as a software developer working for a mainframe company and developed operating system software. I spent 12 years there and in the early 80's got involved...in a startup within a big company. I got hooked on building new things and the innovation it required. Carol Realini, Obopay, USA (S. Mitra, 2008)

I started my career [as a software engineer] with Satyam Computers and worked for their telecom division for [a] couple of years. I soon realized that I wasn't cut out for the corporate grind. In 2002, I left Satyam and cofounded ... a telecom value added services provider... I exited [that venture] in February 2007 to start [mobile money startup] Eko. Abhishek Sinha, Eko, India (India Microfinance, 2009)

The founders of six of nine startups spoke about how they leveraged their industry networks to build their teams.¹⁶ They sought out team members who were passionate about the opportunity to make change by building a mobile money platform, with several founders expressing a belief that this passion would propel the team through the many uncertainties—and the ups and downs—that accompany building a venture in a nascent industry.

To the question of his secret to building [mobile money startup] Monitise from seed to profitable corporation, [founder] Lukies points to his knack for team-building, crediting the clever idea to Steve Atkinson, his ex-Vodafone co-founder: 'I met this guy who was much cleverer than me, who had a good idea for what would happen to the mobile money space. I get a huge amount of pleasure out of putting a team together. ... You have to really be part of your flock, really understand everything about your team and what motivates them. The tech guys are motivated by different things than sales guys'. Alastair Lukies, Monitise, UK & USA (Furseth, 2013)

...you always want to hire the most skilled people with a successful track record to help you build the business—this is standard. But more importantly you are looking... [for] the core team, to be able to survive ups and downs that ... [are] almost guaranteed and the ability of

¹⁶ There are no comments in the archival records on this topic for the other three firms.

the core team and employees to weather these storms and survive critical periods to win in the long run. ... The other important skill which needs to align with the purpose of the startup itself is the desire to make a change, make an impact, improve things and disrupt status quos. Ajay Adiseshann, PayMate, India (inventiva, 2018)

SO Pioneering Firm Characteristics: Motives for Entering the Mobile Money Industry.

Not surprisingly, the above founding team formation strategy was aligned with the motives of the founders themselves: founders of SO platform providers sought to create a platform that made financial transactions easier and more accessible to individuals regardless of geographic location or access to financial services. A corollary to this was a commitment to creating a universal platform serving as many end users as possible.

It's such a big idea to take the phone that's already in your hand... and turn that into an access to all financial services. ...We deliberately looked at both developed markets as well as emerging markets. We were very deliberate in saying, look, this is a network problem because systems like this are more powerful and add more value with more participants... I want to build something that will give everybody access. I want to reach both the traditionally banked, and I want to reach the traditionally unbanked. And if I can do that with a common platform then we could start to operate services like mobile money transfer, mobile bill pay, mobile banking... in a new way, leveraging this increased connectivity and power in everyone's hands. Carol Realini, Obopay, USA (Prows, 2010)

Key Platform Characteristics: Open End User Access Provided by a Single Firm.

The above capabilities and motives logically resulted in the key platform characteristics of the SO cell. Founders were deliberate in their decision to *not* forge exclusive alliances with a particular network operator that would have restricted number and type of end users, given their overarching vision to reach as many individuals as possible.

We wanted a solution that could work on any handset, any SIM card and across all networks. We felt very strongly...that you cannot exclude a person from financial services by virtue of the network subscription that they have. Brian Richardson, WIZZIT, South Africa (Mondato, 2014)

What is most important...is to make Paybox widely available... Although it is not an easy task to establish a new payment channel if you are not a big telco or credit card organisation, we are trying it. And that means that we are not willing to accept partners who insist on a proprietary solution [emphasis ours]... At first sight it may look like as if a proprietary solution

could be a competitive advantage, but in fact every exclusion of networks, merchants or customers would be stupid. Fragmentation is of no use for anyone. Peter Seipp, Germany, Austria, Spain, Sweden, UK (Rader & Maghiros, 2001, pp. 19–20)

Addressing Implementation Challenges of SO Platforms in an Uncertain Landscape.

Three common challenges arose for the startups creating SO platforms, detailed below.

These challenges appear to reflect their resources and capabilities, key strategic decisions involving single-firm provision and open end user access, and the uncertainties inherent in a nascent industry. Resolving these challenges was difficult and many startups experienced insurmountable complications related to partnerships with resource providers.

Challenge 1 – Securing Key Resource Partners for Financing and an Initial End User Base.

As new ventures in a new industry, SO platform providers had to simultaneously secure financing and gain initial end users. SO providers varied in how they did so, following either a “coupled” strategy or a “decoupled” strategy to gain access to these two key sets of resources.

Four out of the nine SO startups followed a coupled strategy, relying on the same key resource partner to provide access to *both* funding and access to potential end users.¹⁷ Of these four firms, three launched platforms in developed countries, and one launched a platform in a developing country. Their partners tended to be large, well-established firms in the financial sector.

We did your typical small seed round, primarily led by the principles who put money down to build the first prototype. ... Citibank has also been an investor. ... We did a good job of bringing the right resources and investors to the table. ... To be in financial services you need capital. Carol Realini, Obopay, USA (Mitra, 2008)

¹⁷ In several cases, founders noted that these key resource partners also conferred legitimacy. This is likely true across all startups, but explicitly mentioned by three. “*In Germany the Deutsche Bank, now 50% owner of Paybox, is our strategic partner. And we are very happy with Deutsche Bank, because it is exactly the German bank with the most developed payment network world wide, and that makes it easy to clear and settle payments*” Peter Seipp, Paybox, Germany, Austria, Spain, Sweden, UK (Rader & Maghiros, 2001: 20).

This is all about money and who your providers are. The bank is an underlying provider of core services to us, so we do not take that decision lightly. If you look at what we are doing with Citibank, ...that relationship is unique. Citibank ... will allow Obopay to connect directly to their customer accounts. We are excited about the possibility of this service taking off and other banks wanting similar services. Carol Realini, Obopay, USA (Mitra, 2008)

Five out of nine SO startups followed a decoupled strategy, relying on two different key resource partners for funding and initial end users. Of these five firms, four launched platforms in developing countries, and one launched in a developed country. Financing came from development-focused organizations (e.g., Consultative Group to Assist the Poor, International Finance Corporation) or venture capital funds.¹⁸

International Finance Corporation (IFC), a member of the World Bank Group, has signed a partnership agreement to take a 10 percent equity stake in WIZZIT Bank, a division of South African Bank of Athens Limited that specializes in banking services to the poor through mobile phones... The WIZZIT partnership is part of IFC's focus on bringing financial services to the poor in Africa to help lift them out of poverty. News Article, WIZZIT, South Africa (Duscha, 2008)

'I first heard of what [PayMate co-founders] Ajay and Probir were doing in March, and I decided to check it out. It did not take us too long to decide to put money in them,' says Sandeep Murthy, Partner, Sherpalo and India representative of KPCB [Kleiner Perkins Caufield & Byers], both of which have put a total of \$5 million (Rs 23.5 crore) in Paymate. Sandeep Murthy, Sherpalo/PayMate, India (K. Mitra, 2006)

To gain access to an initial set of end users, four of the five startups partnered with large firms in the financial sector (the fifth, Mint, partnered with a city government) who already possessed an established customer base and sought to expand their offerings to the un/underbanked while also extending services offered to their current customer base.

We have...entered into partnerships with very large players who are best-in-class. ... Our partnerships are our biggest achievement. The fact that despite being a start-up we have been able to partner with India's biggest public-sector bank SBI, the biggest private sector bank ICICI, and one of the leaders in life insurance Bharti AXA as partners is very special for us. Abhishek Sinha, Eko, India (Your Story, 2010)

¹⁸ Development organizations funded WIZZIT (South Africa) and Eko (India). Venture capitalists provided funding for Mint (Sweden), Eko (India), and PayMate (India). Suvidha (India) relied on funding from the founder and his family.

Challenge 2 – Retaining Key Resource Partners.

SO startups who used a coupled strategy experienced difficulties maintaining relationships with their key partner. Mobile money was not their partners' primary business, and partner strategies often shifted over time. For example, Deutsche Bank was Paybox's key resource partner:

In Germany, the Deutsche Bank, now 50% owner of Paybox, is our strategic partner. And we are very happy with Deutsche Bank, because it is exactly the German bank with the most developed payment network world wide, and that makes it easy to clear and settle payments. Peter Seipp, Paybox, Germany, Austria, Spain, Sweden, UK (Rader & Maghiros, 2001: 20)

However, the partnership dissolved when Deutsche Bank

...changed their strategy. ...They said we're doing investment banking now, and we're getting rid of all of our subsidiaries. Eckhard Ortwein, Paybox, Germany, Austria, Spain, Sweden, UK (Mixergy, 2019)

Without Deutsche Bank's support, Paybox discontinued operations as a customer-facing platform provider and restructured itself into a pure technology provider (*i.e.*, developing underlying technology for other customer-facing mobile money providers). In 3 of 4 cases, key partners chose to end their relationship, and the abandoned SO startups had difficulty securing both alternative sources of funding and attracting end users (see Challenge 3).

[Monitise] kicked off 2014 with a market capitalisation of £1bn and high expectations among investors. Yet, almost immediately, things started to go badly wrong. Profit forecasts were downgraded twice in 2014, and after announcing widening annual pre-tax losses, Visa, one of Monitise's largest shareholders [and key resource partner], offloaded its entire 5.5pc stake. The move wiped a third off the value of the shares. ...both the industry and the stock market appear to think its [Monitise's] prospects are dim. The company tried but failed to sell itself over the summer, and on Tuesday its share price was languishing at just 2.65p, having lost 90pc of its value this year. Analyst on Monitise, UK & USA (Marlow, 2015)

In contrast, SO startups who used a decoupled strategy did not face this challenge. Their key partners—for both financing and accessing an end user base—shared their commitment to mobile money. For financing partners, mobile money was an important way to build a better future.

Helping the financial sector become more inclusive by extending bank services to the poor is an important part of IFC's strategy to strengthen Africa's private sector... WIZZIT's innovative technology and marketing strategy are already having a strong impact by helping create opportunity for more South Africans. Lars Thunell, IFC/WIZZIT, South Africa (Bassiri, 2007)

...we believe mobile electronic payments and remittances are the way of the future in India and we believe PayMate is the leader in this category. PayMate has figured out how to unleash the potential of the phone which is becoming the primary transaction terminal for the over 260 million mobile users in India. This investment fits into our Mayfield India strategy extremely well. Nikhil Khattau, Mayfield/PayMate, India (Wadhavkar & Shah, 2008)

For partners who provided access to initial end users, the SO platforms presented a business opportunity for engaging with a market segment that had previously been difficult and often financially unviable to reach—the un/under-banked:

We [at the startup Eko] are providing an infrastructure and servicing layer supported by technology, user-interface and processes that allows traditional financial institutions like banks, insurance companies to extend last mile reach and convenience to small ticket customers – who may be un-served or under-served. To our partners, we bring the ability to reduce the transaction costs to a level that makes it viable to serve this customer. ... We have designed our technology and back-end processes for scale and entered into partnerships with very large players who are best-in-class. Abhishek Sinha, Eko, India (YourStory, 2010)

As a result, SO startups following a decoupled partnering strategy continued to receive funding and were able to conduct multiple experiments on initial end users and develop insights that guided the development of their core value propositions (see Challenge 3).

Challenge 3: Identifying an Attractive Value Proposition.

SO startups—like all mobile money entrants—needed to clearly identify a value proposition to attract and retain end users as well as harness network effects. All SO startups, regardless of partner strategy, started with an initial and general value proposition focused on simplifying payments for end users:

While walking [in Germany], the founder of Paybox.net AG, Mathias Entenmann, observed that he often left home without his wallet, but never without his mobile phone. So the question came up why can't we pay with our mobile phones in a simple way? Peter Seipp, Paybox, Germany, Austria, Spain, Sweden, UK (Rader & Maghiros, 2001: 18)

I realised that the movement of cash was marred by inefficiency. For instance, when my chauffeur in Delhi wired money to his village for his ailing mother via telegraph, it did not reach them on time. Firmly focused on easing cash transfers, I had talks with...several banks and non-banking financial companies... Streamlining financial transactions seemed a far-fetched idea to most. Anand Shrivastav, Suvidha, India (Sharma, 2013)

However, coupled and decoupled SO startups had different assumptions about the validity of their initial value proposition. Coupled startups believed that their platforms' convenience would drive uptake. All coupled startups started by offering a service that would link their platforms to other banking products, and 78% (7 out of 9) also started with merchant payment, focusing on these multi-user services to drive indirect network effects. Implicit here was the assumption that organizational users would join the platform as ecosystem partners, providing them and end users with additional functionality on the platform.

The potential for mobile money is vast, and the channel is beginning to transform the way we bank, pay and shop. ...there are many things that you can do in almost any situation at the touch of a button. That opens infinitely more opportunities for people to spend, shop, invest, transfer funds, pay bills and dozens of other activities right around the clock at a time and place convenient to them. Mobile is also the only channel that bridges the gap between the on-and offline worlds: it allows you to be engaging in any type of online activity while still going about your daily life. Alastair Lukies, Monitise, UK & USA (The Marketing Society, 2012)

Given the many and widespread payment alternatives available to potential end users in their initial base of banked customers (e.g., debit/credit cards, checkbooks), platforms created by coupled SO startups were not widely adopted by either organizational or end users. The lack of a compelling value proposition hindered direct and indirect network effects. According to analysts:

[For] many people...making electronic transactions are part of everyday routines for them. After all, who would think twice about making a payment or getting cash from a debit or credit card? ... [Mobile money initiatives] to drive out cash beyond debit cards have failed, because customers often are not convinced of the need or practicality of these systems. (Mas & Rotman, 2008)

In contrast, decoupled SO startups worked diligently to understand needs of *all* potential end users. Decoupled SO platforms started with a variety of different types of services: one

platform exclusively started with link to banking products; two platforms focused exclusively on P2P transfer, and two platforms offered a mix of same-side and multi-side services. In addition to understanding the needs of their partners' banked end users, they also sought to understand the needs of un/under-banked end users; an action which ultimately led to expand the user base for themselves and their partners. They found deep differences between these two groups and adjusted their features and services over time.

Wizzit director Pakie Mphahlele...says that during the company's pre-launch phase, it very quickly became clear from talking to potential customers that these were people who could not understand the concepts of being charged a monthly fee or of having to keep a minimum balance in their accounts. [As a result,] 'Wizzit has no monthly fees and no minimum balance requirements, and there are no penalties for non-use and also no penalties for excessive use. You only pay for what you use.' News Article, WIZZIT, South Africa (Savant, 2007)

By conducting small-scale pilots in one or more locations, they realized the importance of building trust with both end and organizational users.

We also faced...challenges like building trust of both the customers and merchants. Unless the merchant was paid, he wouldn't provide the service, and unless the service was provided to customers, they wouldn't put in the money. So, instead of going for mass advertising, we went to small locations and conducted 8-week promotions and live demonstrations. Anand Shrivastav, Suvidha, India (Sharma, 2013)

With a stronger value proposition in hand, they were able to attract various ecosystem partners which in turn increased the use possibilities for their platforms, and they began to offer more multi-side services on their platforms to increasingly leverage indirect network effects.

PayMate...in association with Tata Indicom and Corporation Bank launched Green Money Transfer- a person-to-person mobile money transfer facility. PayMate [also] has tie-ups with over 30 banks including SBI, IDBI Bank, Standard Chartered Bank, Corporation Bank, Royal Bank of Scotland. Ajay Adiseshann, PayMate, India (Nag, 2012)

Learning from failure was also key for decoupled SO startups; not having enough demand from individual end users for profitable operations caused some to pivot by creating new

ecosystem partnerships (even with competitors) to target new end user segments, particularly the B2B segment, or expand existing ones.

...we did realise along the way that while individuals had little reason to migrate to digital payments at the time and in fact businesses had a greater incentive to ease their financial supply chain, thereby reducing time and resource costs... That's when we pivoted our business model [to focus on B2B transfers]. Ajay Adisesshann, PayMate, India (inventiva, 2018)

We were confident in our ability to deliver our core services to our core segments in our core geographies. But we were realistic about the fact that we cannot be all things to all people. So we let other providers — sometimes competitors — leverage our systems and regulatory expertise to develop their own apps that can...create a digital wallet and enable cash-in, instant P2P transfers, and merchant payments. ... Through these partners, who bring a better understanding of the diverse needs and cultures of other regions than we could on our own, we have now managed to reach customers in every state and union territory across India. Abhinav Sinha, Eko, India (Sinha, 2017)

Outcomes for SO Platforms.

Outcomes for SO providers and their platforms mirrored one another. All four coupled SO startups were unable to successfully address Challenges 2 and 3. One failed, and acquirers of the other three struggling startups ceased their platform operations and leveraged their software capabilities to serve as software providers to firms in financial, telecommunications or information technology.¹⁹ Three of the five decoupled SO startups (Eko, Paymate and WIZZIT) successfully addressed their challenges to survive (see Table 4), relying on B2B transfers to drive direct network effects and a variety of multi-side services to drive indirect network effects. Of the other two, Suvidha and its platform ceased operations, while Mint merged with another firm to create a mobile-enabled parking solution, leveraging Mint's software capabilities.

¹⁹ Unable to combat Challenges 2 and 3, these startups were acquired for substantially less than their peak valuations and/or investor expectations. The archival data clearly show their acquirers were chiefly interested in the underlying software capabilities and discontinued the nine platforms associated with these four startups. Consider the acquisition of Paybox by Sybase, an enterprise software firm: *Mobile payments are an increasingly critical part of mobile computing, a core component of our Unwired Enterprise strategy... This acquisition extends our offerings and capabilities to enable this mobile economy* (Business Wire, 2009; Marty Beard, President, Sybase 365).

2.6 Discussion and Conclusion

Motivated to understand whether insights from studies of industries based in traditional industrial or manufacturing settings hold for industries based on digital platform ecosystems, we examine the emergence of the global mobile money industry. Industries based on digital platform ecosystems require pioneers to navigate through both technological convergence by determining how to integrate complementary capabilities that reside in different related industries and also through demand uncertainty by uncovering value propositions that will result in direct and indirect network effects. While Figure 1 depicts the robust ecosystem of the global mobile money industry as of 2017, such a landscape took almost 20 years to evolve. At inception, many features of the ecosystem were simply unknown. In focusing on two platform choices pioneering firms made for ecosystem development (capability integration and end user access), we link these choices with pioneering firms' pre-entry characteristics and elucidate the path-dependencies between pioneering firm characteristics, platform choices, implementation challenges, and ultimate outcomes.

Our study's triangulation of rich data on the population of pioneering platforms in the global mobile money industry shows an almost perfect "diagonalization" with almost all platforms either provided by multiple firms through externally integrated capabilities and closed end user access (MC) or by single firms with internally integrated capabilities and open end user access (SO). We now turn to reconciling the received literature on pioneering firms with the findings from our inductive study examining the evolution of a nascent, platform-based industry. In so doing, we revisit important theoretical questions and re-address them in the context of digital platforms, thereby extending and providing new insights to the literature. Table 7 provides a summary.

Linking Pioneering Firms Characteristics to Key Platform Choices (research question 1)

Scholars examining traditional industry contexts have documented that pioneers typically integrate value chain activities and capabilities internally, with diversifying entrants more likely to do so than startups (Helfat, 2015; Qian et al., 2012). This is true even in industries representing technological convergence such as agricultural biotechnology (Moeen, 2017) and fiber optics (Cattani, 2006). However, patterns in the mobile money industry run counter to these stylized facts: we find an equal likelihood of internal vs. external integration of complementary capabilities and that diversifying entrants were *less* likely to internally integrate than startups.

Our data allow us to suggest why this might be the case. The data reveal the importance of *motives* in guiding the search for complementary capabilities. All startups possessed or developed financial software capabilities through founding team prior experience. However, some were motivated by a vision of creating universal platforms that were mobile operator-agnostic and transcended geographical boundaries, and thus chose to be a single platform provider. Others, instead,

Table 7 Summary of findings & theoretical contributions

Received Wisdom from Pioneering Firm Literature	Comparison of Study Findings with Received Wisdom	Novel Theoretical Implications
Linking Pioneering Firm Characteristics to Key Platform Choices <i>Research question 1: How do pioneering firm characteristics affect their choices for platform creation?</i>		
a) Pioneers are likely to vertically integrate value chain activities. b) Diversifying entrants, with higher internal integrative capabilities, are more likely to integrate than startups.	a) Contrasts with received wisdom. We find an equal likelihood of internal vs. external integration of complementary capabilities. b) Contrasts with received wisdom. We find diversifying entrants were less likely to internally integrate than startups. <i>Our study reveals why:</i> motives provide a guide for the search for complementary capabilities, with motivations differing across firms based on their pre-entry experience & capabilities.	-Our study shows how capabilities & motivations can be brought together to understand heterogeneity in firm choices for platform ecosystem development.
Linking Pioneering Characteristics & Platform Choices to Implementation Challenges & Performance <i>Research question 2: And, in turn, how do these choices shape subsequent challenges, strategies & outcomes for pioneering firms & their platforms?</i>		
a) Experimentation by pioneering firms is critical to address technological, demand, ecosystem & institutional uncertainty & for industries to take-off. b) Diversifying entrants, with greater integrative capabilities, are more likely to survive relative to startups.	a) Consistent with received wisdom. All mobile money pioneers experimented to discover & create core value propositions for their novel financial access technology & build a robust ecosystem within endogenously evolving country-specific institutions. Founding characteristics & platform choices shaped strategies for creating network effects & resulted in different forms of experimentation for MC & SO platforms. <i>Our study provides an empirical contribution</i> by illustrating the various ways in which pioneers experiment. <i>For direct network effects:</i> -MC providers actively experimented within MNOs' closed user bases & leveraged user innovation to determine core value propositions. -SO providers also experimented, but coupled startups struggled when their initial assumptions for open-access end use did not bear fruit; further difficulties in pivoting when their partners abandoned them. <i>For indirect network effects:</i> -MC providers aligned incentives of MNOs' existing ecosystem partners, & software providers matched these efforts by customizing platform features to develop value propositions that would capitalize on indirect network effects. This enabled them to offer a variety of services from the onset & grow them rapidly. -SO providers had to develop ecosystem partners/organizational users from scratch, so their initial service offerings were limited in comparison. Coupled SO providers struggled, but decoupled SO providers were able to grow ecosystem partners through trial & error.	-We connect pioneering characteristics to platform choices that in turn create path-dependent implementation challenges that need to be addressed for performance consequences. In particular, prevailing value propositions are endogenous to pioneer characteristics & platform choices & responses to implementation challenges inherently linked to network effects. -Startups themselves are important complementary asset providers, particularly when they can develop external integrative capabilities.

	b) Partially consistent with received wisdom. Diversifying entrants & startups have similar survival rates for the first 5 years, but the 10-year survival rate is lower for startups than diversifying entrants. However, survival stems, not from diversifying firms possessing greater integrative capabilities, but from an interaction between 1) building relationships with committed partners (for platform co-provision and/or access to complementary resources) & 2) tapping into user bases to experiment & develop attractive value propositions to generate network effects. This is true of both MC & SO startup survivors as well as MC diversifying entrant survivors.	
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started with a more “modest” focus on increasing financial inclusion in the developing region where they were based.²⁰ The latter approach generated many benefits. These startups accessed complementary capabilities through alliances with MNOs and developed platforms with operator-specific technological features. Such alliances provided necessary financing in early years of existence, and a user base within which to experiment across value propositions and gain knowledge to launch subsequent platforms with the same or other MNO partners in other countries.

For their part, diversifying entrants—largely MNOs—were motivated to expand into mobile money for two reasons. One, mobile money provided the opportunity to increase revenue streams through diversification. For MNOs that launched platforms in developed countries, these revenue streams stemmed from the convenience of using the phone to make payments (*e.g.*, Sonera and NTT Docomo) and subsequent deployment of their mobile money capabilities in other countries. In developing countries, these revenue streams stemmed from providing financial services to the un/underbanked population segments.²¹ A second motivation for MNOs was the reduction of churn in their mobile subscriber base, particularly in (developing) regions where it was inexpensive and often commonplace for customers to purchase SIM cards tied to different mobile operators. Lacking financial software capabilities (and concomitant knowledge of financial compliance requirements), the MNOs were willing to engage in alliances with firms (other diversifying entrants or startups) who had these complementary capabilities. We know less about why MC MNOs chose to *not* develop these capabilities inhouse. However, we note

²⁰ We note that over half of the SO startups also expressed motivations for making financial transactions more accessible for the unbanked. This was true of SO startups that launched platforms in developed countries (Obopay, Monitise) as well as developing countries (Eko, Suvidha, WIZZIT).

²¹ The launch of M-Pesa in Kenya by U.K. headquartered Vodafone is illustrative of how product champions such as Nick Hughes within multinational MNOs were driven by this purpose (Hughes & Lonie, 2007).

that mobile money was an emerging industry. Startups like Fundamo, Utiba and Comviva had developed mobile money solutions, including the all-important issue of making financial transactions secure, so even when the idea to launch a mobile money platform originated within an MNO (as with Vodafone, MSI (Celtel) and MTN), critical product champions within the MNO actively sought alliance partners with the requisite technological capabilities.

Regardless of who sought whom, what we do observe from the close collaboration of diversifying entrants and startups in MC platforms is the deep-seated interest and desire for the technology to serve unmet needs amongst both founders and product champions. Though the pioneering firm literature has overwhelmingly focused on capabilities, motivations are known to be critical drivers of behavior in many contexts (Latham & Pinder, 2005; T. R. Mitchell & Daniels, 2003), including innovation and entrepreneurship (Agarwal, 2019; Gambardella et al., 2016; Sauermann & Cohen, 2010; Smith & Shah, 2013). Our study shows how these concepts—capabilities and motivations—can be brought together to understand heterogeneity in firm choices and, ultimately, performance.

The choice of open vs. closed end user access followed from the above choice of single- vs. multi-firm provision of the platform to create network externalities. Startups who wanted to be operator-agnostic chose open end user access to appeal to all end users. In contrast, MNOs had incentives aligned to create closed end user access for their own subscribers.²² In turn, they ensured alignment of their partner firms providing software capabilities, who also saw growth opportunities for leveraging their pioneering capabilities in other countries (with the same or different MNO partner). The dominant MC and SO cells are thus the outcome of a logical correspondence between the component platform choices. Within the digital platforms literature,

²² Mobipay (Spain)—launched through a consortium of MNOs—is the exception that pursued open end user access.

scholars have examined tradeoffs between opening and closing platforms at different levels (*e.g.*, ownership, technology, users) (Eisenmann et al., 2009; Jacobides et al., 2018). We append to this literature by providing empirical evidence on the relationship between platform provision and platform end user access. We turn to the next research question to unpack how these choices shaped pioneers' ability to drive network effects and their ultimate outcomes.

Linking Pioneering Firm Characteristics and Platform Choices to Implementation Challenges and Performance (research question 2)

Scholars examining nascent industries have noted that experimentation by pioneering firms is critical to address technological, demand, ecosystem and institutional uncertainty and for industries to take-off (Moeen et al., 2020). All mobile money pioneers had to experiment to discover and create core value propositions for their novel financial access technology and build a robust ecosystem within endogenously evolving country-specific institutions. Moreover, consistent with the digital platform ecosystems literature (McIntyre & Srinivasan, 2017; Teece, 2018), the overarching challenge—creation of network effects through growth in installed user base and ecosystem partners—was the same for all pioneers. Our study extends these insights by revealing path-dependencies in implementation challenges and experiments. It illuminates how the founding characteristics of pioneering firms and their platform choices shaped their strategies for creating network effects and their ultimate outcomes. In doing so, this study contributes to the literature on the pioneering of new firms by providing implications for different approaches to developing a platform ecosystem that hinged on strategic considerations of network effects.

How did MC and SO Platform Providers Differ in Creation of Direct Network Effects?

Given the nascency of the industry, all pioneers faced significant demand uncertainty:

Who were the potential end users? What were their unmet needs? And, what distinctive

competencies had to be developed to address them? For example, *ex-ante*, mobile money could appeal equally to developed country users who desired mobile and convenient options for financial payments through inter-operable systems (*i.e.*, untethered by bank or mobile accounts),²³ and to developing country users who had mobile phones but were un/underbanked. Also, *ex-ante*, it was entirely possible that developed country users may have exhibited a higher willingness to pay than developing country users. Similarly, what features of the technology appealed to which distinct set of users within or across developed or developing countries was unknown. Rather than it being obvious *a priori* as to which users would be attracted to what value, the development of a robust installed base was contingent on experimenting to generate the knowledge necessary to address extensive demand uncertainty.

Here, our study reveals the critical role of alignment of objectives between firms seeking to bring together complementary capabilities for ecosystem development and create value in an uncertain context where there is no guarantee of profitability and few, if any, examples to follow (Adner, 2017; Moeen et al., 2020).²⁴ Put differently, successful platforms were the result of partners “sticking together” to conquer challenges. For MC platform providers, the development of external integrative capabilities hinged on alignment among committed partners who exhibited flexibility and willingness to learn and invest effort in spite of uncertainty. While SO providers did not have to engage in such external integration for the platform’s (technological) development, the importance of aligned purpose was critical here as well. Partners who provided coupled financing and end user access ended up being less committed under uncertainty, because the marginal monetary value-add of mobility and convenience for existing users of these

²³ Over time, this value proposition has indeed come to fruition through present day options such as Venmo and Zelle.

²⁴ The non-diagonal case of Mobipay is also illustrative of when a lack of such alignment among a consortium of MNOs and financial institutions resulted in platform failure, even in the presence of complementary capabilities.

(financial sector) partners was not compelling enough. This left SO providers using a coupled strategy scrambling in spite of an initially optimistic outlook. However, SO providers who had separate partners for financing and end user access were able to retain alignment with financing partners (venture capital or institutional investors) as well as with user-access partners—here the common goal was to find cost-effective solutions for increasing financial access to un/underbanked segments of the population.

The logical connection between multi-firm provision and closed end user access, and single-firm provision and open end user access also resulted in substantive differences in the nature of experimentation undertaken by MC and SO providers. Scholars have noted that direct network effects can be achieved by enabling increased platform acceptance with a wider population base of end users (E. Lee et al., 2006), or facilitating faster diffusion and penetration rates within targeted closed-access populations where the value proposition may be more clearly established (Yoon, 2014). We see both strategies in play. Specifically, MC platform providers actively experimented within the closed user base of MNO subscribers and leveraged user innovation to determine core value propositions that satisfied the most acute of user needs. SO providers also experimented—but coupled startups experienced significant struggles because their initial assumptions for open-access end use did not bear fruit, and they found it difficult to pivot without enough of a financial runway when their partners abandoned them.

How did MC and SO Platform Providers Leverage Ecosystem Partners for Indirect Network Effects?

To leverage indirect network effects, digital platform providers have to create a robust ecosystem of users who are attracted by the quantity and quality of users on other sides of the platform (Boudreau & Jeppesen, 2015; Evans, 2003; G. G. Parker & Van Alstyne, 2005). Here too, experimentation was critical for MC and SO pioneers. MC platform providers actively

aligned incentives of existing ecosystem partners of the MNOs, and the software providers matched these efforts by customizing the platform features to develop value propositions that would capitalize on indirect network effects. This enabled them to offer payment and disbursement services from the onset and grow them rapidly. Specifically, over two-thirds of MC platforms initially offered both airtime top-up and bill payment, services that MNOs could easily tap into by building on their pre-existing relationships with airtime resellers and other large organizations. SO providers in contrast had to develop ecosystem partners/organizational users from scratch, so their initial service offerings were limited in comparison (79% of SO platforms only offered one multi-side service initially: link to other banking products). Moreover, SO providers exhibited greater variance in outcomes, in line with whether they had followed a coupled or decoupled strategy for complementary assets. Coupled SO providers struggled, but decoupled SO providers were able to grow ecosystem partners through trial and error.

How did Pioneering Characteristics and Strategies Manifest in Performance Differences?

As discussed above, distinct founding characteristics (*i.e.*, firm resources, capabilities, and founder motives) systematically appear to have led firms to launch either MC or SO platforms, which in turn led to the need to respond to different implementation challenges. Across both MC and SO platforms, survivors shared two common factors: they were able to develop lasting partner relationships (for platform co-provision or access to complementary resources) even amidst uncertainty, and they experimented and actively learned from their user bases and ecosystems to determine distinct demand segments, their unmet needs, and create customized solutions to develop value propositions to generate network effects. The lower average survival rates of SO platforms relative to MC platforms stems from the greater

difficulties encountered due to the interaction of these factors, perhaps most starkly observed when comparing startup pioneers.

As mentioned, decoupled SO startups who formed and retained core ecosystem partners, and MC startups who actively sought and worked with MNOs for co-provision, had higher survival rates at both platform and firm levels relative to coupled SO startups who could not maintain key partnerships, requiring them to conduct costly pivots or cease operations entirely. SO startups' choice of open end user access could in principle have led to high adoption levels due to a *wider potential* user base and ecosystem of partners; however, experimenting and actively learning about unmet needs within distinct segments was costly in practice. In contrast, closed end user access enabled a focus on a *narrower actual* user base for rapid experimentation and coordination to identify value propositions and orchestrate ecosystems.

The above insights refine understandings from the received literature. For instance, prior literature has shown diversifying entrants are more likely to survive relative to startups given improved access to complementary assets through vertical integration (Bayus & Agarwal, 2007; Carroll et al., 1996; Chen et al., 2012; Klepper & Simons, 2000; W. Mitchell, 1991). A coarse analysis of the global mobile money pioneers may suggest support of this stylized fact because MC platforms (where two-thirds survive) are visibly associated with MNOs who were diversifying entrants, and SO platforms (where less than a quarter survive) were provided by startups. Indeed, MNOs likely had an advantage relative to startups given their pre-existing network capabilities and user bases as well as know-how in forming external partnerships (e.g., with airtime resellers), suggesting prior experience with integrative capabilities that could be relied upon in developing external integrative capabilities with mobile money technology providers and additional relationship with valuable ecosystem partners. However, we also see

evidence of startup pioneers who actively sought to *collaborate* rather than compete with diversifying entrants (including both MC startups and decoupled SO startups) and in doing so learned to develop their own external integrative capabilities not only for the performance of pioneering platforms, but also for pioneering firms who subsequently leveraged these capabilities in *other* alliances or countries. Furthermore, we show within-variation among startups: all four MC startups were “successfully” acquired for high valuations (Fundamo, Comviva, Utiba, and Paggo); three out of four coupled SO startups (Obopay, Monitise, and Paybox) discontinued their platforms with acquirers interested in leveraging firm technological capabilities; three out of five decoupled SO startups’ (Eko, PayMate, and WIZZIT) platforms continue to grow at the end of the sample period, and one merged with another firm to leverage its software capabilities for the creation of a parking app (Mint).²⁵ Thus, our study underscores the importance of *startups* as complementary asset providers, in contrast to the traditional assumption of established firms having these assets (Teece, 1986) and provides empirical support for Helfat & Raubitschek’s (2018) concept of external integrative capabilities.

Within the digital platforms literature, our study complements work on how network effects may drive “winner-take-all” dynamics for single or dual platform dominance (Eisenmann, 2006; Hagiu, 2009; Teece, 2018). We show that network effects are critical for success but *need not* result in winner-take-all dynamics because multiple pioneer (and follower) platforms can co-exist within and across countries. Also, digital platform models have focused on *supply-side* openness of platforms when discussing tradeoffs between open and closed user access, such that open user access enables multiple firms to serve as providers, and closed user access relies on a single firm, often diversifying entrant, provider (Boudreau, 2010; Yoon, 2014). We complement

²⁵ Two SO startups failed, one coupled (mCash) and one decoupled (Suvidha).

this work by highlighting the importance of choices of open or closed end user access on the *demand-side*. This results in the existence of closed end user access provided by multiple firms, in addition to open end user access platforms provided by startups (similar to providers such as Uber, Lyft and Airbnb). Our study not only demonstrates that both models may be deployed within the same industry, but also shows that each leads to path-dependent challenges and outcomes. We find that both models can lead to success when platform providers are able to find committed partners to access complementary resources and develop the platform ecosystem as well as experiment with a user base to develop attractive value propositions, thereby generating both indirect and direct network effects for the growth of their platforms.

Limitations & Future Research

Our study is the first, to the best of our knowledge, to systematically study variation among pioneers of a digital platform ecosystem in terms of their characteristics and platform choices and how these shape their implementation challenges and outcomes. Although our study's inferences are based on the entire population of mobile money pioneers, ours is a single-industry study and findings may or may not generalize more broadly. However, anecdotal evidence suggests that our findings—particularly on multi-firm provision of pioneering platforms—may generalize to at least some other contexts. For example, in the nascent PC industry, integrated startup Apple ended up ceding market share to the alliance of diversifying entrant IBM and startups Microsoft and Intel. Later, in the nascent smartphone industry, Apple launched its platform under a closed user access with AT&T in an effort to gain market share through swift diffusion in AT&T's existing user base, before opening up to other mobile operators. These anecdotes, coupled with studies which show industries may fail to emerge altogether due to a lack of alignment among alliance partners (Ozcan & Santos, 2015) suggest

the need for future research to examine “selection” effects more closely. These selection effects may operate at both firm level (*i.e.*, “invisible” startups who choose to operate in markets for technology and corporate control), and at the industry level (*i.e.*, failure of entire industry emergence due to lack of alignment among complementary capability providers).

Our study limitations open up areas for future research. First, while we kept industry factors constant, the “globally-born” nature created country-level variations (*e.g.*, developing vs. developed country of launch) that are comingled with pioneering characteristics and strategies, and may well have affected outcomes. In distinguishing between developed vs. developing in our analyses, we are capturing at a high level differences in user demand for alternatives or modifications to traditional financial services. We note that both banking infrastructure and mobile network infrastructure exist to varying degrees for both the developed and developing countries of our sample. However, the higher number of unbanked individuals in developing countries creates user demand for mobile money in developing countries that does not exist to the same extent in developed countries where the banking infrastructure is more prevalent and more secure. Future work could examine in much greater detail other aspects of the institutional environment and how it relates to user demand that we are unable to explore in depth in this paper, including the role of trust in formal institutions as well as the firm-level challenge of educating potential users who lack financial literacy. Also, mobile money is at the confluence of two heavily regulated industries worldwide. Differences in regulations across countries, including whether financial organizations or MNOs represented public-private ownerships, may have affected where, when and how mobile money platforms were launched. We provide some initial insights in the Appendix where we find no clear evidence that public ownership offered performance advantages over private ownership in our sample. In addition to examining the role

of such country variation, future research could examine how non-market strategies of for-profit firms combine with efforts by non-profit organizations and public agencies to shape the (co) evolution of regulatory institutions to address institutional uncertainty, and affect industry and firm level outcomes.

Second, the nascent stage of the mobile money industry preceded the advent of smartphones, which eased interoperability and removed the need to create mobile operator specific features by utilizing standardized features of the smartphone operating systems (*e.g.*, iOS, Android). Such technological development may well facilitate success of startups providing open end user access; alternatively, it may enhance or reduce variation in their performance across countries based on extent of global access. Thus, future research could explore the extent to which our findings are conditioned by contextual factors (state of technological development, level of globalization, etc.) that correlate with the timing of the industry's emergence. Third and as noted above, the "roles" of ecosystem partners and users had fuzzy boundaries in mobile money: future research can examine industries where these roles are more distinct or reconcile across various existing theoretical models in digital platforms literature to acknowledge such "real world" fuzziness. Also, and as noted above, we complement studies of single or dual firm dominance by showing that multiple pioneers and follower platforms coexisted within and across countries. Future research could examine why and how digital platform ecosystems may evolve into monopoly, oligopoly or monopolistically competitive industry structures. We would encourage scholars to study additional industries to help us build a corpus of knowledge about nascent industries based on digital platform ecosystems.

Taken together, the existence of multiple motives within firms, heterogeneous motives across firms, and the need for co-provision and ecosystem partnership development raises an

important question for future research: how can firms work to create alignment such that the goals of each firm and the partnership are met? This is particularly critical in contexts—like nascent industries—where there is no guarantee of success, and the challenges are steep, but there is high potential to provide great benefit to both society and the firms that meet these challenges.

Conclusion

At the turn of the 21st century, more than 50% of the worldwide population—2.3 *billion* individuals—remained unbanked (Demirgüç-Kunt et al., 2015). Financial inclusion is a critical factor in alleviating poverty because individuals and economies benefit from financial access due to better management of risk/financial shocks, entrepreneurship, and investment in health/education (Cull et al., 2014; Demirgüç-Kunt et al., 2015; World Bank, 2014). Our work has showcased how enterprising for-profit firms pioneered and diffused mobile money. Their willingness to experiment in the face of extreme uncertainty bore fruit and paved the way for follower platforms: by 2021, over 1.35 billion registered mobile money accounts existed in over 90 countries, processing \$1 trillion annually (GSMA, 2021). Such a successful industry take-off and growth, as revealed by our inductive analysis, was contingent on aligned motives among co-providers and critical partners possessing complementary capabilities. Moreover, it required the pioneers to exhibit a growth mindset—evidenced by willingness to develop external integrative capabilities, experiment and leverage user innovation—and invest cognitive and physical capabilities and resources to create a robust ecosystem for network effects. We illuminate why and how pioneer motives and capabilities influenced key platform choices, and shaped subsequent implementation challenges, strategies, and outcomes, extending our understanding of industry emergence to digital platform ecosystem contexts. We hope other scholars will embark

on additional studies of digital platform ecosystems that serve important unmet needs by providing new technological solutions.

CHAPTER 3: INSTITUTIONAL UNCERTAINTY AND EMERGENCE OF THE AFRICAN MOBILE MONEY INDUSTRY

Abstract

This study unpacks the relationship between institutional uncertainty and industry emergence by examining two sources of institutional uncertainty: pre-existing market institutions (*e.g.*, impersonal rule of law) and industry-specific institutions (*e.g.*, regulations). As more industries of today are emerging globally, additional research is needed to understand how industry emergence may be affected by institutional uncertainty that differs from one country context to the next. This study examines the emergence of the mobile money industry across the African continent to understand 1) how variation in market institutions across countries influences firm entry and 2) the ways in which market institutions influence the regulatory approach for developing industry-specific institutions. My findings reveal that pre-existing market institutions related to colonial history are associated with variations in both entry patterns and approaches to developing industry-specific institutions. This study sheds light on the path dependencies at play across these two types of institutions, industry emergence, and innovation diffusion, enhancing our theoretical understanding of industry emergence across countries that vary in market-supporting institutions.

3.1 Introduction

Industry emergence is characterized by considerable uncertainty, and research across theoretical perspectives indicates that uncertainty reduction is critical for nascent industries to reach commercial viability (Adner & Levinthal, 2001; Aldrich & Fiol, 1994; W. Mitchell, 1989; Rosenberg, 1982; Tushman & Anderson, 1986). Institutions as the “rules of the game” play a fundamental role in reducing uncertainty, acting as constraints on different types of actors (North, 1990; Ostrom, 1986; Williamson, 1991), but institutional uncertainty—the incomplete knowledge that both market actors such as firms and nonmarket actors such as regulators have about the institutions that dictate patterns of exchange (Moeen et al., 2020)—abounds in nascent industries. To better understand the relationship between institutional uncertainty and industry emergence, this study focuses on two main sources of institutional uncertainty: pre-existing market institutions (*e.g.*, impersonal rule of law) and industry-specific institutions (*e.g.*, regulations). This study examines industry emergence across multiple countries to understand 1) how variation in pre-existing market institutions across countries influences firm entry and 2) the

ways in which market institutions influence the regulatory approach taken for developing initial industry-specific institutions. In doing so, this study sheds light on the path dependencies at play across these two types of institutions, industry emergence, and innovation diffusion.

As more industries of today are emerging globally, additional research is needed to better understand the ways in which industry emergence may be affected by institutional uncertainty that differs from one country context to the next. Prior industry studies are largely based on single-country contexts (Agarwal & Kim, 2021) with the implicit assumption that all firms encounter the same set of market institutions. However, industry emergence across multiple countries requires us to re-examine this assumption. Furthermore, much of the research on industry emergence has focused on empirical contexts in developed countries, where strong market-supporting institutions such as protected property rights and robust judicial and financial systems can be taken as given (Gustafsson et al., 2016; Moeen et al., 2020). In contrast, developing countries are often characterized by a lack of supportive market institutions that contribute to multiple sources of market failure (McMillan, 2008). These so-called institutional voids may make it more difficult for firms to enter these contexts (Khanna et al., 2006). Missing or dysfunctional market institutions may also make the creation of industry-specific regulations more challenging: regulations may be either too strict or too lenient; the judicial system may enforce laws unpredictably; or corruption may be rampant (Chakrabarty, 2009; Khanna & Palepu, 1997). Developing country contexts thus call into question whether the theoretical insights gained from studying developed country contexts continue to generalize. This study argues we need a better understanding of the role market institutions play in industry emergence through an examination of multi-country contexts that include developing countries.

Accordingly, this study asks: *What is the relationship between market institutions, industry-specific institutions, and industry emergence?*

To answer the above research questions, I conduct a detailed, abductive empirical examination of the nascent mobile money industry throughout Africa. The mobile money industry represents an ideal context in which to examine market institutions, industry-specific institutions, and industry emergence for multiple reasons. First, the African setting includes multiple countries in which robust market-supporting institutions cannot be assumed. Second, because the mobile money industry sits at the convergence of two highly regulated industries—telecommunications and financial services—as the mobile money industry emerges, regulatory concerns (*e.g.*, money laundering, funding terrorism, increasing a country’s money supply, and preventing provider risk-taking) need to be addressed through the creation of new formal regulations or the adaptation of existing regulations. I am able to observe heterogeneity in regulatory approaches to the introduction of mobile money across countries within the same industry setting. Finally, mobile money is an important phenomenon to study as a solution to a critical social problem: in sub-Saharan Africa, 80% of the adult population in the early 2000s did not possess a bank account and were excluded from formal financial services (Demirgüç-Kunt et al., 2015). Understanding institutional factors underpinning mobile money’s emergence across Africa may be useful in thinking about how other societal issues can be addressed through market enterprise (*e.g.*, mobile platforms for improved access to healthcare or education). This study sets the stage for future scholarly work to examine both market and industry-specific institutions, as well as other types of institutions, to develop theories for industry emergence that take seriously developing country contexts.

The sample includes 51 African countries and 106 firms that introduced 189 mobile money platforms between 2001 and 2017 in these countries. Due to the need for a better understanding of how market institutions and industry-specific institutions influence industry emergence and limited empirical evidence on my research questions, I rely on an abductive approach to analyze quantitative as well as qualitative data (A. King et al., 2020; Pillai et al., 2021). This methodological approach improves the richness of the descriptions and explanations yielded by statistical analysis alone. Statistical analyses of the quantitative data document associations and patterns in the data; while the qualitative data provide contextualization for these patterns and help rule out plausible alternative explanations for the patterns observed. Together, these analyses enable inferences to the best explanation to interpret these relationships and patterns.

My findings reveal that pre-existing market institutions related to colonial history are associated with variations in both entry patterns and approaches to developing industry-specific institutions. Being a former British colony is correlated with a higher likelihood of entry in the first place, and former British colonies experienced faster mobile money entry than countries that were not former British colonies. Colonial history and its connection to transplanted legal traditions is further correlated with countries' approach to industry-specific institutions. Across the African continent, there were two approaches to developing industry-specific institutions in the nascent mobile money industry: some countries enacted mobile money-specific regulations prior to allowing entry of mobile money in their countries (I refer to this approach as "Regulations First"), while other countries followed an "Entry First" approach, waiting to pass any mobile money-specific regulations until after firms had the opportunity to launch mobile money platforms. Former British colonies tended to take an Entry First approach consistent with

a common law legal tradition based on limited laws; while, non-British colonies (predominantly former French colonies) took a Regulations First approach in line with a legal tradition based in civil law that emphasizes widespread written laws and codes.

In turn, the approach to industry-specific institutions shaped timing of firm entry. Countries with the Regulations First approach experienced systematically later entry compared to countries with the Entry First approach. In practice, the initial mobile money-specific regulations developed under the Regulations First approach needed to be substantially revised when they proved to be too restrictive or too vague. In contrast, the Entry First approach enabled mobile money-specific regulations to co-emerge with the needs of the industry and the needs of the unbanked. Furthermore, the choice of regulatory approach had implications for user adoption of mobile money: in countries with the Regulations First approach, the unbanked population was delayed in benefitting from mobile money until these regulations were revised to enable additional entry.

To the best of my knowledge, this study is the first to disentangle market institutions and industry-specific institutions in a nascent industry while taking advantage of the fact that the mobile money industry emerged almost simultaneously in multiple countries. In this way, I exploit cross-country variation in pre-existing market institutions as well as in regulatory approaches to develop industry-specific institutions. I find, in contrast to other studies that have found effects of modern measures of country-level market institutions on aspects such as entry mode decision (Brouthers, 2002) and performance (Cuervo-Cazurra & Dau, 2009), that these institutions played a minor role in shaping the emergence of the mobile money industry. Rather, the type of approach to enacting industry-specific institutions influenced industry emergence, and these approaches are associated with institutions developed under colonial rule that have

persisted. This finding suggests that studies that focus only on country-level variation, while neglecting the interaction between country-level and industry-level variation, may overlook an important piece of the puzzle. Taken together, this study's findings provide novel insights to the literature on nascent industries, contributing to the knowledge base on the requirements for firm and industry emergence across countries that vary in market-supporting institutions, and building theory on how industry-specific regulations may emerge along with and influence firm entry and may themselves be shaped by historical market institutions. More broadly, this study has implications for other globally-born nascent industries (*e.g.*, micro-mobility) and may be relevant for policy debates around regulating industries based on digital platforms (*e.g.*, ridesharing, social media).

3.2 Conceptual Background

Underpinning industry emergence is a complex knowledge-generating process that involves diverse actors who work to resolve uncertainty across technological, demand, ecosystem, and institutional dimensions (Moeen et al., 2020).²⁶ New industries often emerge due to technological discoveries and/or innovations to address unmet needs (Agarwal et al., 2017), but industry emergence is not a foregone conclusion if uncertainty across these dimensions cannot be resolved. This study focuses on understanding the interplay between industry emergence and institutional uncertainty.

Institutional uncertainty refers to the partial knowledge both market and nonmarket actors have about the institutions that specify their interactions (Moeen et al., 2020). In line with the New Institutional Economics view of institutions, institutional uncertainty can be broadly related to both formal (*e.g.*, laws, regulations, and legal guidelines) and informal (*e.g.*, norms, ethics)

²⁶ Building on Moeen et al. (2020), this study relies on the Knightian understanding of uncertainty as partial knowledge (Knight, 1921).

types of institutions (North, 1990; Williamson, 2000).²⁷ This study examines two sources of institutional uncertainty related specifically to formal institutions—pre-existing market institutions and industry-specific institutions in the form of regulations—as they pertain to industry emergence.

Pre-existing market institutions & industry emergence

The rich literature on industry emergence is largely based on a conceptualization of a broader set of *pre-existing market institutions* that are assumed to be well-functioning and market-supporting that set the “rules of the game” or initial conditions in which an industry might emerge (North, 1990). Given that most industry studies are based on single country contexts (Agarwal & Kim, 2021), market institutions can be treated as exogenous, with firms competing with each other within the bounds of a single institutional environment. The assumption of efficient market institutions is fair when considering developed country contexts: components of the pre-existing institutional environment within these countries, such as well-defined property rights and enforceable contracts and laws supported by effective judicial systems, are typically present and market-supporting (McMillan, 2008). In contrast, developing countries are often characterized by institutional voids, which are inefficient or missing institutions that lead to sources of market failure (Arrow, 1969; Dutt et al., 2016; Khanna & Palepu, 1997). Such sources of market failure include (though are not limited to) imperfect information, high transaction costs, ill-defined property rights, and the inability to enforce

²⁷ Rather than conceptualizing institutions as constraints on organizations within a transaction costs framework (North, 1990), Neo-Institutional Theory characterizes institutions as socially constructed and slow to change; institutions provide regulative, normative, and cognitive pressures towards isomorphism and legitimacy (Meyer & Rowan, 1977; Powell & DiMaggio, 1991; Scott, 1995). Much work has been done with this more sociological theoretical lens in both industry emergence (Georgallis et al., 2019; Hiatt & Park, 2013) and international business (Kostova, 1997). Given this study’s interest in country-level formal market institutions and regulations in contexts characterized by institutional voids, I choose to rely on the New Institutional Economics perspective in this study.

contracts (North, 1991; Williamson, 1991). Inefficient market institutions at the country-level create hurdles for industry emergence. For example, intellectual property rights may be enforced unpredictably or not protected, or corruption may be widespread, discouraging firm investments (Hoskisson et al., 2000; Khanna & Palepu, 1997). These institutional voids characteristic of developing country contexts thus contribute to increased levels of institutional uncertainty. However, industry emergence studies, in focusing on developed country contexts, have bounded out considerations of market institutions as sources of institutional uncertainty, limiting our understanding of industry emergence in developing country contexts.

While the industry evolution literature has focused on within-country dynamics, a parallel literature stream in international business has examined institutional distance to understand the variety of institutional environments firms encounter while doing business in multiple countries (see for review Kostova et al., 2020). Classic work in this domain examines home and host country characteristics to understand firms' internationalization strategies, including location choice, mode of entry, and mode of establishment (Ghemawat, 2007; Johanson & Vahlne, 1977; Kostova, 1997). A subset of this body of work relies on the New Institutional Economics view of institutions, highlighting variation in quality of institutions across countries by examining the degree to which institutions promote economic activity, tending to focus predominantly on formal market institutions (Kostova et al., 2020). Firms moving from a country with more developed formal market institutions to a country with less developed formal market institutions have a different set of considerations than firms moving in the opposite direction due to differences in transaction costs. Prior work has shown that firms with low-quality institutions in their home country may "escape" to countries with higher quality institutions (Barnard & Luiz, 2018; Witt & Lewin, 2007); while, Cuervo-Cazurra & Genc (2008) show how firms moving

between countries with similarly low-quality institutions can rely on their experience in their home countries to outperform others in host countries. While this literature underscores the importance of understanding differences in market institutions across countries, it has largely focused on multinational firms in mature industry contexts, limiting our understanding of how different types of firms and nonmarket actors in nascent industries understand and respond to variation in the market institutions they encounter.

To better understand theoretically how industry emergence is affected by differences in pre-existing market institutions, I ask:

Question 1: How do the pre-existing market institutions of a country influence industry emergence in that country?

Pre-existing market institutions & industry-specific institutions

Institutional uncertainty also pertains to the creation of specific rules for the new industry—these are referred to as *industry-specific institutions*. In regulated industries, the existing regulatory framework and the uncertainty around how it might change is particularly salient. Firms need to be legally compliant in order to operate, but in nascent industries, industry-specific regulations may not yet exist. Uncertainty exists around whether new industry-specific regulations will be introduced, or whether and how existing regulations of adjacent industries may be applied to the new industry. For example, the rise of digital platform-based firms like Airbnb and Uber have introduced questions as to whether they should be held to the same regulatory standards as hotels or taxis, respectively. As firms make technological advances and innovate, existing regulatory institutions become outdated and need to change (North, 1993; Tushman & Rosenkopf, 2002). In the nascent stage of an industry's lifecycle, regulators may lack the knowledge to accommodate these innovations (Aldrich & Fiol, 1994; Polidoro, 2020),

creating a source of uncertainty with regards to industry-specific institutions as firms have difficulty predicting how regulators will react, if at all, which may deter further entry (Uzunca et al., 2018).

Extant research has focused on how firms combat uncertainty around industry-specific regulations. For example, firms may choose to actively influence regulations through lobbying (Dean & Brown, 1995; Maijor & Witteloostuijn, 1996) or act as “regulatory entrepreneurs” by making changes to laws a significant part of their business plans (*e.g.*, Uber, Tesla, or DraftKings) (Pollman & Barry, 2016). Other firms pursue strategies to keep their businesses out of the regulator’s sight (Gao & McDonald, 2020; Gurses & Ozcan, 2015; Ozcan & Gurses, 2018). The nonmarket strategy literature has extensively documented the various kinds of nonmarket strategies firms employ to influence regulatory outcomes (Dorobantu, Kaul, and Zelner, 2017), yet most of these studies have been focused on mature industries where industry-specific regulations are already in place, rather than nascent industries where industry-specific regulations may not be established yet (Gao & McDonald, 2020). We thus have an incomplete understanding of how industry-specific regulations come to be in nascent industries.

Furthermore, these studies have primarily focused on firms as the focal actor of interest. The predominant view is that regulations governing industries evolve and change due to the activities of firms and interest groups that compete for their own interests (Dorobantu et al., 2017; Henisz & Zelner, 2005, 2006; B. G. King & Pearce, 2010). Understudied in the industry emergence literature is the role pre-existing market institutions may play in the development of industry-specific regulations.

Industry-specific institutions do not emerge out of thin air; they may be shaped by pre-existing market institutions and/or existing industry-specific institutions. Relatively recent work

in management has begun to examine the ways in which regulations of adjacent industries may be used for the creation of regulations for new industries. The introduction of e-cigarettes in the U.S. raised questions as to whether the new technology should be regulated as a drug delivery device or as a tobacco product (Tharchen, 2017). Similarly, the nascent drone industry faced uncertainty around the extent to which regulations governing manned aircrafts would be applied to the drone industry (Andersen et al., 2020). Economic historians have long studied the path-dependent nature of institutions (North, 1990), and a large body of work in both economics and finance has documented the relationship between market institutions and economic growth of countries, finding that both historical and modern market institutions can have persistent long-run effects on economic growth, investment, and financial development (Acemoglu et al., 2005; Acemoglu & Johnson, 2005; la Porta et al., 1998; Rodrik, 2007).

Accordingly, I explore whether the historical origins of a country's legal system may influence the approach for developing new industry-specific institutions. Of relevance to this study, given the African empirical context, is the persistence of institutions introduced and imposed by colonial powers. Colonialists left their mark on a variety of areas, including local governance and legal systems, as well as culture, education, and infrastructure (Klerman et al., 2011). Scholars have highlighted two main methods of colonial governance in Africa: indirect and direct rule (Crowder, 1964). Indirect rule, primarily used by the British, utilized "indigenous African rulers within the colonial administration" preferring to keep existing local African rulers in power (Exploring Africa, 2022a). This decentralized approach "appealed to the British both because it appeared to respect native traditions and because it economized on money and manpower" (A. Lee & Schultz, 2012, p. 11). Direct rule, favored by the French, Belgians, Germans, and Portuguese, relied on centralized administrations in urban areas. These

“colonialists did not try to negotiate governance with indigenous African rulers and governments,” preferring instead to promote assimilation to European traditions (Exploring Africa, 2022a; J. Parker & Rathbone, 2007).

These differences in governance are reflected in two predominant legal traditions: common law and civil law (la Porta et al., 2008).²⁸ The common law tradition stems from England and is characterized by a limited number of laws and use of judicial precedent to resolve legal disputes in the absence of laws. In contrast, the civil law tradition stemming from Napoleon’s reign relies on a large number of laws, rules, and codes and is associated with more “centralized and activist government” (Mahoney, 2001). La Porta et al. (1997) first introduced the idea that countries’ historical legal origins were correlated with the strength of modern-day laws protecting investors, and since then, many follow-on studies have investigated the associations between legal origin, regulations, and economic outcomes (la Porta et al., 2008). A main finding is that countries with French civil law origins regulate more heavily compared to countries with common law origins (Djankov et al., 2002). Civil law countries are also associated with higher corruption and larger informal economies compared to common law countries (la Porta et al., 2008). This study will build on prior work to explore the link between historical market institutions related to colonial history and legal origins and approaches to developing industry-specific institutions.

Overall, existing research on nascent industries leaves unexplored the relationship between pre-existing market institutions and industry-specific institutions and the implications for industry emergence. To better understand this relationship, I ask:

²⁸ The civil law system has several sub-traditions: French, German, Scandinavian, and socialist. I focus on French civil law given the prevalence of French colonization in Africa. Other colonial powers such as Italy, Portugal, and Belgium also fall under the Napoleonic civil law tradition.

Question 2: In what ways do pre-existing market institutions influence the regulatory approach for setting industry-specific institutions in a nascent industry?

This study utilizes an abductive, research-questions based approach (as opposed to a hypothesis testing approach), and the two questions posed above provide a guide for this study's exploration of the relationship between institutional uncertainty and industry emergence. Specifically, I examine whether and how industry emergence may be affected by market institutions (both historical and modern) and industry-specific institutions, and the path dependencies at play.

3.3 Emergence and Evolution of Mobile Money in Africa

At the turn of the 21st century, more than 50% of the worldwide population—2.3 *billion* individuals—remained unbanked (Demirgüç-Kunt et al., 2015). In Sub-Saharan Africa alone, 80% of individuals lacked access to formal financial institutions such as bank branches or ATMs and relied heavily on cash. Improving access to financial services has been a global issue for some time now, formally identified in 2000 as a part of the United Nations Millennium Summit's developmental goals to address world poverty (Hughes & Lonie, 2007). Financial inclusion is critical in alleviating poverty because individuals and economies benefit from financial access due to better management of risk and financial shocks, entrepreneurship, and investment in health and education (Cull et al., 2014; Demirgüç-Kunt et al., 2015; World Bank, 2014).

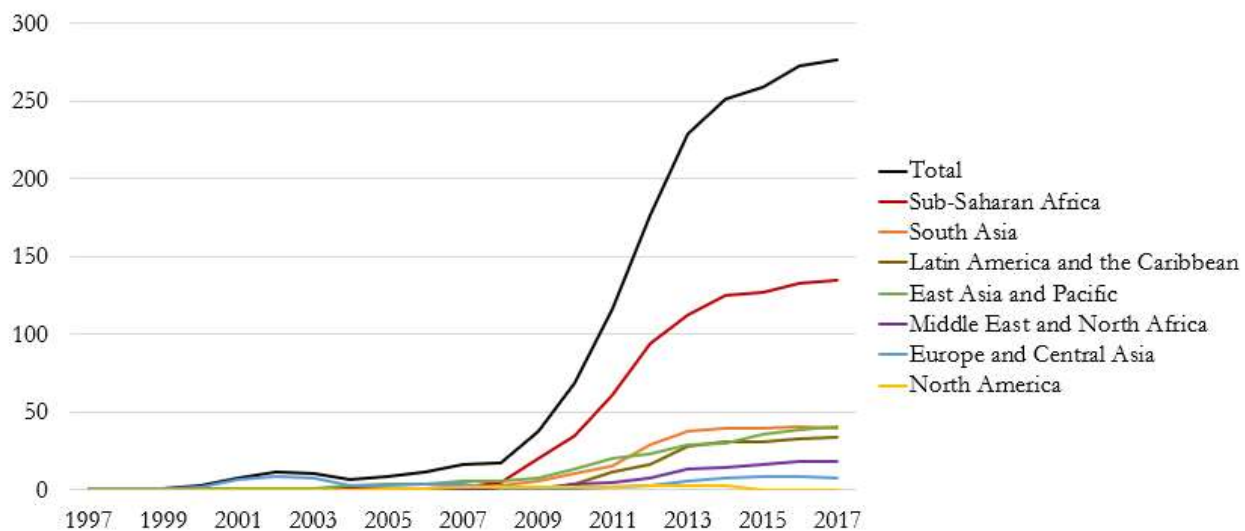
Mobile money emerged as a novel way in which individuals can access financial services such as (but not limited to) transferring money and making payments via very basic mobile phones (GSMA, 2010). The advent of the mobile money industry preceded smartphones; thus, these transactions initially occurred through text messaging features such as SMS or USSD, and continue to do so on many platforms, particularly in developing countries where smartphone

penetration is still less than 50% (Silver, 2019). Mobile money is unique in that it can be used by “unbanked” individuals who have access to mobile phones but lack formal bank accounts (Aker & Mbiti, 2010). In contrast, “mobile banking” or “mobile wallet” services are provided by the conventional financial industry as additional features for those who have access to a bank account or credit card (*e.g.*, Venmo, PayPal, Zelle, Apple Pay, and WeChat Pay).

As a born-global industry, mobile money platforms were launched in both developed and developing countries with pioneering startups from developing countries overshadowing pioneering multinational mobile network operators through the launch of subsequent platforms internationally (Wormald et al., 2021). From the pre-takeoff to takeoff stage of the industry, mobile money experienced dramatic growth: in 2000, it was available in only 2 countries, but by 2021, it had spread to over 90 countries, comprising 1.35 billion registered accounts and processing \$1 trillion annually (GSMA, 2021). However, the diffusion of mobile money has not been uniform across countries in the world. Figure 1a depicts the number of platforms in existence each year from industry inception in 1997 through 2017 by region. Notably, sub-Saharan Africa is home to the highest number of live platforms, but mobile money is not evenly distributed geographically across the African continent (Figures 1b and 1c). As this study will show, industry emergence was not just based on which firms launched entrepreneurial platforms, but also the degree to which pre-existing market institutions and industry-specific regulatory institutions influenced firm entry patterns.

Figure 1a

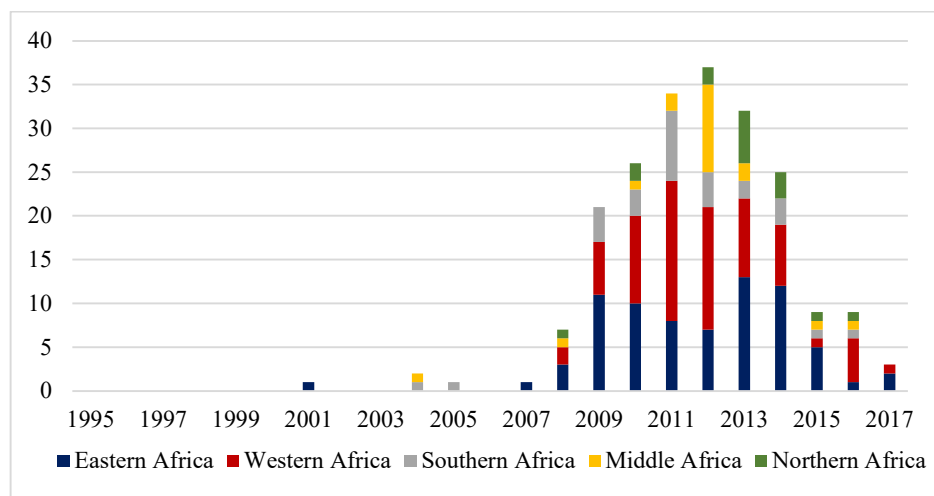
Number of live mobile money platforms



Source: author calculations using GSMA data

Figure 1b

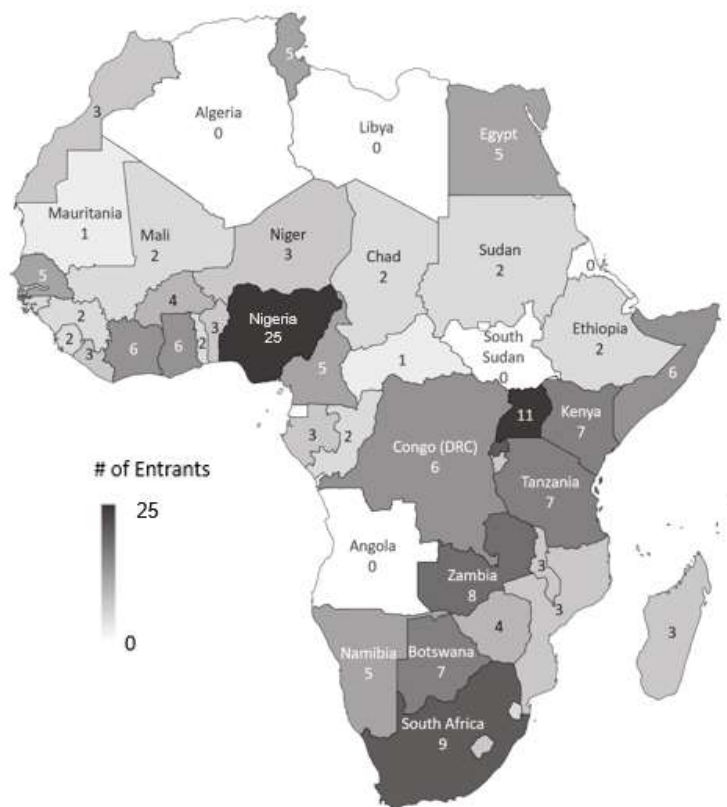
Variation in number of mobile money platform launches across Africa by region



Source: author calculations using GSMA data

Figure 1c

Number of mobile money platform launches by country



Source: author calculations using GSMA data

3.4 Data and Analytical Approach

Data sources

I gathered three main categories of data in order to compile a unique and comprehensive longitudinal dataset of the mobile money industry in Africa between 1996 and 2017. Table 1 documents the types of sources accessed. At the country-level of analysis, panel data from 1996 to 2017 was collected on 51 African countries recognized by the United Nations, regardless of whether mobile money was introduced in each country.²⁹ By using data from 1996, I am able to

²⁹ The United Nations formally recognizes 54 countries in Africa. Djibouti, South Sudan, and Somalia are excluded from my analyses due to extremely limited data availability (sometimes no data availability) across multiple sources.

obtain a portrayal of country-level differences *prior* to the first African introduction of mobile money in Zambia in 2001.³⁰ This data includes measures of economic development and demographics (*e.g.*, GDP per capita, adult population) from the World Bank’s World Development Indicators as well as statistics on related industries (*e.g.*, number of commercial bank branches, bank concentration, and number of mobile cellular subscription) from the World Bank’s Global Financial Development Data. To capture modern-day country-level *market institutions*, I obtained data from the World Bank’s Worldwide Governance Indicators (*e.g.*, Rule of Law, Control of Corruption) and from the Polity V Database (*e.g.*, the Polity Index) from 1996 to 2017. To obtain a measure of historical market institutions, I relied on information on each country’s legal origins and colonial ties from Juriglobe’s database and datasets compiled by other researchers such as La Porta et al. (1998). Further description of each variable used can be found in in Appendix B.

The second category of data is panel data on the timing of *industry-specific regulations* for the 43 African countries that had a least one mobile money entrant between 2001 and 2017. A research assistant and I individually examined each country’s laws to ascertain whether and when mobile money-specific regulations were introduced and coded these laws based on whether they permitted non-bank actors to offer mobile money services. If our coding disagreed, we returned to the underlying sources to determine why we disagreed and came to a resolution. Additionally, I checked this data with several other types of sources to ensure consistency in coding. These sources included: country-specific analyses from policy experts (CGAP, 2010; International Finance Corporation, 2011), academics (Aron, 2017; Evans & Pirchio, 2014), the GSMA’s own Regulatory Index database, which was released beginning in 2018 (GSMA, 2018),

³⁰ 1996 also predates the first worldwide introduction of mobile money in Finland in 1997.

and six semi-structured interviews with firms to better understand the different regulatory environments that firms encountered and the complexities involved in the creation of new regulations or adaptation of existing regulations for mobile money. Because the mobile money industry represents a convergence of two highly regulated industries—telecommunications and financial services—the emergence of mobile money was associated with numerous regulatory concerns (*e.g.*, financial risk-taking by providers, money laundering, funding terrorism, or inadvertently increasing in a country’s money supply). Regulators across countries differed in their approach to these concerns, and the data I have assembled captures at a high level their approaches using archival quantitative and qualitative data.³¹

The final category of data is at the *firm-level*. These data consist of the census of pioneering firms and platforms in the mobile money industry from first commercialization in Africa in 2001 through the end of the pre-takeoff stage in 2007 as well as a near-census of follow-on firms and platforms from 2008-2017. The sample includes 106 firms that introduced 189 mobile money platforms in 43 African countries during this timeframe. I assembled this data from two main sources: 1) archival quantitative data from GSMA’s mobile money deployment tracker and 2) archival qualitative data from first-hand published accounts of platform and firm development communicated by managers and founders, industry reports, company annual reports, corporate press releases and websites, legal documents, media coverage, and over 30 interviews with firm founders as well as regulators conducted by the mainstream press. I accessed roughly 23,000 pages of materials in total, with material on each firm ranging from 9 to

³¹ A design choice was made to focus on breadth rather than depth in this study given the large number of countries analyzed. For this reason, timing of mobile money regulations is the central focus of this study. Follow-on studies could examine the content of individual regulations.

over 3,000 pages. These data are used in aggregate to capture industry emergence via the number of entrants in each country and timing of entry.

Table 1

Data sources

Country-Level: Pre-existing Market Institutions	
Archival data, 1996-2017	• World Bank's World Development Indicators • World Bank's Global Financial Development Data • World Bank's Worldwide Governance Indicators • Polity V database • Juriglobe Legal Origins database
Country-Level: Industry-Specific Regulations	
Archival data, 1996-2017	• GSMA's regulatory index for 2018 (the first year it came out)
Legal documents, policy expert reports, additional articles & commentaries	• Over 50 legal documents pertaining to mobile money, mobile banking, and electronic money • Over 50 country-specific analyses from policy experts • 16 academic publications on mobile money and telecom industry downloaded through keyword searches on Business Source Complete and Google Scholar
Interviews	• 6 semi-structured interviews with representative firms
Firm-Level	
Media coverage, third party industry reports, published cases, corporate websites	• Over 70 articles and comments/commentaries published in the business/trade press and blogs between 1997 and 2017, accessed through extensive Google searches • Over 60 GSMA, CGAP, other 3rd party reports • 4 cases published by universities (<i>e.g.</i>, Harvard Business School, Columbia Business School) • Over 400 annual reports, corporate presentation slide decks, press releases, 'About' webpages between 2001 and 2017
Archival Primary Sources	• 7 written accounts by founders (books or blog posts) • 38 audio files or transcripts of interviews with mobile money founders or regulators conducted by journalists, ranging from 10 to 55 minutes, published by business/trade press

Analytical approach

Altogether, this rich database enables me to systematically study variation among market institutions and industry-specific regulations across multiple countries to understand their influence on industry emergence while keeping industry factors constant due to the globally born nature of the industry. Given limited theory and empirical evidence on industry emergence and

institutional uncertainty across multiple countries, I analyze this data abductively, guided by the research questions raised in the Conceptual Background section. I use the quantitative data to establish associations and patterns and qualitative data to provide additional context and validity for the measures and findings (Braguinsky & Hounshell, 2016; Wormald et al., 2021). In this way, I am able to explore and rule out potential alternative explanations, making inferences to the best explanation (IBE) to interpret relationships (A. King et al., 2020; Pillai et al., 2021). The analyses in this study should be interpreted as correlational in nature, not causal, due to several sources of endogeneity.

3.5 Findings

Pre-existing Market Institutions and Industry Emergence

Descriptive statistics.

The first set of analyses examines measures of pre-existing market institutions to better understand their relationship to industry emergence by looking at 1) firm entry patterns and 2) timing of entry.

Outcome variables. The first outcome variable *Country with Mobile Money* is a time-invariant dummy equal to one if a country has at least one mobile money platform launch during the sample period 2001-2017; zero otherwise. The second outcome variable *Mobile Money Entry* is a country-year specific dummy variable of entry into the mobile money industry.

Explanatory variables. Of primary interest are a set of variables that measure the quality of market institutions at the country level. Measures of modern-day market institutions are captured in 1996 (or earliest available) for each country, preceding the entry of mobile money globally. Robustness checks relying on data captured in different years (*e.g.*, 2007, at the start of the takeoff stage) can be found in Appendix B. In line with prior studies of the mobile money

industry (Lashitew et al., 2019; Pelletier et al., 2019), I rely on three main variables.³² The *Polity Index* from the Polity V database measures how market-supporting each country's political regime is and has been rescaled to range from -10 (total autocracy) to 10 (total democracy). To capture the extent to which corruption may be present, the variable *Control of Corruption* from the World Bank's World Governance Indicators (WGI) measures the perception in each country of the extent to which public power is exercised for private gain and ranges from 0 (high levels of corruption) to 100 (low levels of corruption) and provides a proxy for a country's rule of law.³³ The variable *ICT Regulatory Index* from the International Telecommunication Union captures the level of regulatory authority (e.g., to what extent the regulator functions separately from the government) and the extent regulations foster competition in the information communication technology (ICT) sector in each country and ranges from 0 (poor or limited regulatory practices) to 100 (internationally recognized regulatory best practices). Appendix B contains additional information on these variables, including my criteria for inclusion.

I also include a measure of historical market institutions based on the idea that countries have “legal origins” that matter for legal and economic outcomes, and some of the institutions imposed by European colonial powers across Africa may persist in countries' legal systems today (Acemoglu & Johnson, 2005; la Porta et al., 1998). Specifically, I include a time-invariant dummy for whether a country was a *Former British Colony*. This variable is highly correlated with a common law legal system that is composed of a limited number of laws and is also

³² I restrict my analyses to these three variables due to the small sample size and concerns about overspecification. I also tested these variables for multicollinearity and found VIF values under 3, indicating an acceptable level (Hadi & Chatterjee, 2015).

³³ The World Bank World Governance Indicators do have a separate measure *Rule of Law* that “captures perceptions of the extent to which agents have confidence in and abide by the rules of society” (Kaufmann et al., 2010). In my sample, this variable is highly correlated with Control of Corruption ($\rho > 0.8$) and moderately correlated Polity Index with ($\rho > 0.4$). Because Polity Index and Control of Corruption are not highly correlated with each other, I rely on Control of Corruption rather than the Rule of Law measure in the analyses conducted in this study.

associated with “indirect rule,” a decentralized governance approach (Crowder, 1964; J. Parker & Rathbone, 2007). In contrast to the common law system is the civil law system, most prevalently imposed by French colonizers in Africa, that is based on extensive codification and is associated with a large number of legal rules and provisions (la Porta et al., 1998; Mancuso, 2008).³⁴ Like France, the other colonial powers in Africa (Portugal, Italy, Belgium, and Germany) also relied civil law traditions and favored a governance approach known as “direct rule” which featured centralized administrations and was based on policies of assimilation (Exploring Africa, 2022a). Britain and France were the dominant colonial powers in Africa, with an historical presence in 37 of the 51 contemporary countries in my sample (73%). Accordingly, a variable for former French colony and variable that groups all non-British former colonies are reported in the descriptive statistics. In regression analyses the variable *Former British Colony* is used to capture the potential imprinting of former colonizers’ transplanted market institutions on modern day market institutions. Robustness checks with alternative specifications related to colonial history can be found in Appendix B.³⁵

Control variable. To capture levels of development, I include *GDP per capita* of each country in 1996, logged to ensure normality. Other variables of interest. Measures of the *adult population* and *government spending* are provided for descriptive purposes as are other variables related to the emergence of the mobile, including mobile phone subscriptions, prevalence of bank branches, concentration of the telecommunications and banking industries at the country level. The variables shown reflect data captured in 1996 (or earliest available), several years

³⁴ The modern-day legal systems of African countries should not be coded dichotomously into common law or civil law traditions due to the amalgamation of customary laws that predate colonizers, influence of religious law (Islam), and in some countries a history of multiple colonizers, all of which have given rise to hybrid law systems (Mancuso, 2008).

³⁵ Appendix B also contains additional details on Africa’s colonial history.

prior to the first introduction of any mobile money platform. Together, these variables provide a picture of market institutions at the country level prior to start of the mobile money industry and are used to assess cross-country differences (inter- variation), rather than differences within a country over time (intra- variation), in line with the study's goal of examining industry emergence in a multi-country context.

Table 2 provides descriptive statistics and compares the baseline set of characteristics in 1996 for the sample of countries that experienced at least one introduction of a mobile money platform to the sample of countries that did not experience any introduction of mobile money during the sample period. Countries with no mobile money platform launches can be considered cases of extreme failure of industry emergence.

T-tests of the means of the two sub-samples indicate no significant differences for most of the variables. Countries with no mobile money entry have higher GDP per capita on average and lower adult populations on average compared to countries with mobile money entry. While not reported in Table 2, the difference in means for the log transformed GDP per capita is weakly significant ($t = -1.7791$, $p = 0.0814$), and the difference in means for the log transformed adult population is significantly different across the two sets of countries ($t = 2.384$, $p = 0.021$). The other variables related to factors that may influence supply or demand for mobile money (*e.g.*, mobile phone subscription or bank branch prevalence) do not reveal significant differences in means between countries that ended up with mobile money vs. countries that had no mobile money entry during the sample time period. Measures of polity, control of corruption, and the ICT regulatory index also do not have significant differences in means across the two sets of countries. In looking at the entire sample of countries, Table 2 shows that 37% of countries had British colonizers, 37% had French colonizers, and 2% of countries had no colonizers. The

remaining 24% of countries had other European colonizers (Belgian, Portuguese, German, or Italian). While former French colonies can be found in both countries with and without mobile money, former British colonies present a more striking pattern: 43% percent of countries that have mobile money are former British colonies, while 0% of the countries that never have mobile money were British colonies ($t = 2.2608$, $p = 0.0282$).

Table 3 provides pairwise correlations to account for the limited amount of missing data in certain variables. GDP per capita is positively correlated with both mobile phone subscriptions and bank branches, indicating that wealthier countries have higher numbers of mobile phone subscriptions and bank branches. The mobile phone subscription variable is also positively correlated with the number of bank branches, the polity index, and control of corruption, indicating that countries with higher levels of mobile phone subscriptions have higher numbers of bank branches per 100,000 adults, more democratic political regimes, and lower levels of corruption. Control of corruption is positively and significantly correlated with government spending, which is a proxy for the size of government. The variable former French colony is negatively correlated with the variable former British colony. This correlation reflects historical colonization patterns in which few countries in Africa had both British and French colonizers.³⁶ Because of this high correlation, I rely only on the former British colony dummy variable in regression analyses. Consistent with Table 2, the former British colony variable is moderately correlated with the dummy variable country with mobile money that indicates whether a country has any mobile money entry during the sample period ($\rho > 0.3$).

³⁶ Cameroon is the only country in African that was under the influence of both British and French colonial powers.

Table 2

Descriptive statistics comparing countries with and without mobile money, 1996

Variables	Countries with Mobile Money (n=43)		Countries with No Mobile Money (n=8)		t-test	All Countries (n=51)			
	Mean	S.D.	Mean	S.D.	Pr(T>t)	Mean	S.D.	Min	Max
Adult Population	8,584,141	12,000,000	4,212,504	6,629,633	0.352	7,984,113	11,400,000	52,821	61,800,000
GDP per Capita (constant 2010 US\$)	1,646.13	2,260.36	2,741.46	2,780.95	0.254	1,796.47	2,338.14	199.923	11,470.16
Government Spending (% of GDP)	14.59	7.50	16.00	8.34	0.571	14.34	7.54	0.91	38.73
Mobile Phone Subscriptions per 100 adults	0.17	0.47	0.01	0.02	0.377	0.15	0.44	0.00	2.26
Bank Branches per 100,000 adults	4.06	7.06	5.66	5.49	0.571	4.29	6.83	0.13	42.34
Bank Concentration (%)	87.35	17.25	92.95	11.07	0.531	87.87	16.75	36.64	100
Mobile Network Operator Concentration (%)	60.05	21.23	73.90	37.98	0.161	61.95	24.16	0	100
Polity Index	-0.51	5.22	-1.33	5.99	0.724	-0.61	5.26	-7	10
Control of Corruption	35.14	22.30	33.79	29.82	0.888	34.96	23.12	0	83.33
ICT Regulatory Index	43.31	17.97	30.79	22.56	0.104	41.59	18.92	2.50	81
Former British Colony	0.43	0.50	0	0	0.028	0.37	0.49	0	1
Former French Colony	0.39	0.49	0.29	0.49	0.617	0.37	0.49	0	1
Former non-British Colony	0.57	0.50	0.71	0.48	0.476	0.59	0.49	0	1
Never Colonized	0.02	0.15	0	0	0.694	0.02	0.14	0	1

Notes. The following countries are missing data on some variables: Central African Republic, The Gambia, Guinea-Bissau, Liberia, and Seychelles (refer to Appendix Table B1 for details). 1996 data was not available for all variables. In these cases, the earliest data available is used: 2004 data for Bank Branches per 100,000,000 adults; 2007 data for Mobile Network Operator Concentration (%).

Table 3*Pairwise correlation matrix for full sample of countries*

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Adult Population														
2	GDP per Capita (2010 US\$)	-0.09													
3	Government Spending (% of GDP)	-0.31	0.32												
4	Mobile Phone Subscriptions per 100 adults	0.05	0.56*	0.20											
5	Bank Branches per 100,000 adults	-0.10	0.57*	0.44*	0.54*										
6	Bank Concentration (%)	-0.55*	0.05	0.20	0.03	-0.01									
7	MNO Concentration (%)	-0.19	-0.08	0.28	-0.13	-0.02	0.25								
8	Polity Index	-0.19	0.01	0.08	0.38*	0.18	0.16	0.10							
9	Control of Corruption	-0.19	0.23	0.66*	0.38*	0.50*	0.06	0.02	0.32						
10	ICT Regulatory Index	0.29	-0.12	-0.02	0.10	0.08	-0.37	-0.26	-0.02	0.22					
11	Former British Colony	0.26	0.08	0.06	0.29	0.19	-0.13	-0.25	0.02	0.18	0.31				
12	Former French Colony	-0.16	0.09	-0.11	-0.15	-0.16	-0.05	-0.11	-0.11	-0.18	-0.09	-0.51*			
13	Former non-British Colony	-0.15	-0.07	0.04	-0.26	-0.15	0.13	0.13	-0.02	-0.05	-0.13	-0.84*	0.56*		
14	Never Colonized	-0.08	-0.07	-0.13	-0.05	-0.07	.	-0.16	0.02	-0.20	-0.03	-0.11	-0.11	-0.17	
15	Country with Mobile Money	0.13	-0.16	-0.08	0.13	-0.08	-0.10	-0.20	0.05	0.02	0.23	0.31	0.07	-0.10	0.06

Notes: * $p < 0.01$. N= 51, except for correlations including the Polity Index where N= 50. Polity Index is missing data for Seychelles.

Likelihood of entry.

To isolate whether market institutions within a country may have facilitated or impeded the introduction of mobile money, I used a linear probability model to regress the country with mobile money dummy variable on the pre-existing country level factors associated with modern and historical market institutions, controlling for GDP per capita. Based on data availability, the final sample used in regression analysis included 49 countries. Table 4, column 1 reports the results. The coefficient on log GDP per capita is negative ($\beta = -0.13392$, $p = 0.031$), indicating a one unit increase in log GDP per capita is associated with a 13.4% lower probability of mobile money entry. The coefficient on former British colony is positive, and marginally statistically significant ($\beta = 0.1782$, $p = 0.041$). In terms of economic significance for the linear probability model, being a former British colony increases the probability of mobile money entry in a country by 0.18 compared to countries that are not former British colonies. The other variables are not statistically significant: the coefficient on polity is close to zero, and the coefficients on control corruption and ICT regulatory index are positive, suggesting that countries with lower levels of corruption and with ICT regulations that promote competition are associated with higher probabilities of mobile money entry.

Table 4*Correlations between pre-existing market institutions and country level outcomes*

	Country with Mobile Money (1=Yes)
Variables	OLS
Polity Index '96	0.002 (0.07)
Control Corruption '96	0.182 (0.267)
ICT Regulatory Index '07	0.238 (0.250)
Former British Colony	0.178** (0.085)
Log GDP per Capita '96	-0.134** (0.06)
Constant	1.58*** (0.354)
Observations	49
R-Squared	0.2500

Notes. Robust standard errors are reported in parentheses. * $p < 0.1$; ** $p < 0.05$;

*** $p < 0.01$. $n=49$; two countries are dropped due to missing data on the Polity Index variable (the island nations of Seychelles and São Tomé & Príncipe).

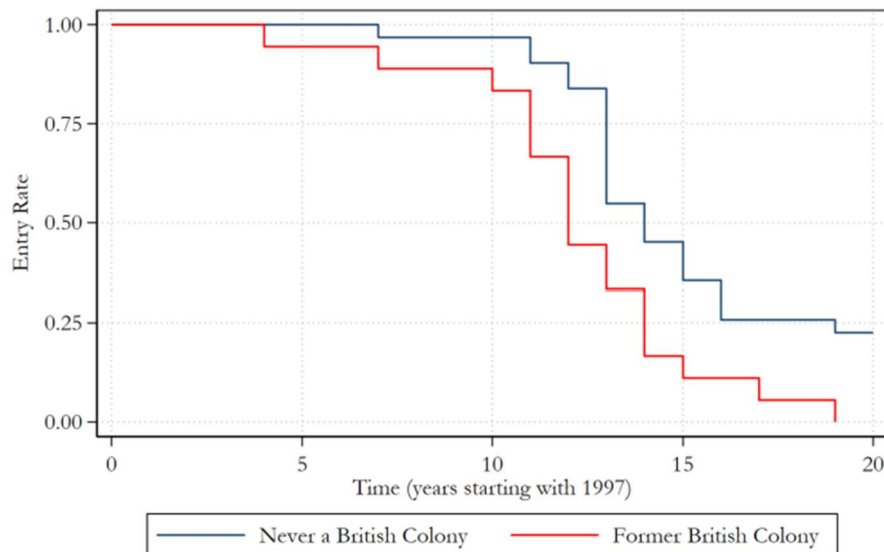
Time to first entry.

Using a Cox proportional hazards regression, I modeled the time to first entry in each country. Table 5 reports the hazard ratios. Model (1) reports the baseline results with only the GDP per capita control included. Models (2) – (5) add each independent variable individually. Model (6) includes the full set of variables. The hazard ratios on polity index, control of corruption, ICT regulatory index, and log GDP per capita are all insignificant in Model (6). However, the hazard ratio for former British colony in Model (6) indicates countries that were former British colonies experienced faster time to entry than countries that were never former British colonies with a rate of entry 1.96 times higher ($p=0.062$). Figure 2 provides the Kaplan Meier curves, illustrating faster entry for countries that were former British colonies.

Table 5*Proportional hazards analysis of time to mobile money entry*

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Polity Index '96		1.16 (0.333)				1.71 (0.367)
Control Corruption '96			1.18 (0.792)			0.63 (0.536)
ICT Regulatory Index '07				7.29** (6.19)		5.14 (5.266)
Former British Colony					2.26*** (0.718)	1.96* (0.706)
Log GDP per Capita '96	0.78 (0.131)					0.742 (0.138)
LL	-138.84	-139.83	-139.93	-137.07	-136.82	-133.76
Chi-Square	2.23	0.26	0.80	5.78	6.27	12.39

Notes. n= 49.; Standard errors are reported in parentheses. * p < 0.1; ** p < 0.05; *** p < 0.01.

Figure 2*Kaplan-Meier curves***Implications.**

From the correlational evidence provided in these analyses, modern-day pre-existing market institutions do not have a substantial influence on the introduction of mobile money or time to entry. In contrast, being a former British colony is associated with both a higher

likelihood of mobile money entry and faster time to entry. Whether being a former British colony with ties to a common law legal tradition and a legacy of decentralized governance matters for the creation of industry-specific regulations is investigated in the next section.

Pre-existing Market Institutions and Industry-Specific Institutions

Heterogeneity in regulatory approaches

Industry experts agree that mobile money, at the intersection of banking and telecommunications sectors, introduces legal complexity when it comes to determining how it should be regulated (di Castri, 2013; Porteous, 2006). Countries may implement varying degrees of know-your-customer requirements, consumer protection rules, transaction limits, or authorization of international remittances. Additionally, countries may differ in the types of firms eligible to operate a mobile money platform (*e.g.*, banks, mobile network operators, technology startups). These numerous regulatory concerns can be addressed a number of ways. Hence, countries cannot be assumed to be uniform in their approaches to developing industry-specific regulations, particularly in the industry's nascent stage when several of these issues had not yet been fully identified.

One major way in which countries differed in their regulatory approaches was in their decision to allow firm entry into the mobile money sector prior to enacting industry-specific regulations or not. Empirically, the variable *Entry Prior to Regulations* is coded 1 if a country allowed firms to launch mobile money platforms prior to setting regulations that specifically discussed mobile money. This variable is coded 0 if a country applied regulations to the mobile money sector prior to allowing any mobile money platform launches. Among 43 countries with at least one mobile money entrant during the sample period, 20 countries allowed market entry

prior to setting industry-specific regulations, and 23 countries applied industry-specific regulations prior to allowing market entry.

Primary and archival qualitative evidence revealed further differences between the two regulatory approaches. Countries that applied regulations for mobile money prior to allowing firms to launch mobile money platforms adopted what I have termed a “Regulations First” approach. Some countries drafted entirely new regulations for the mobile money sector, while others adapted their existing regulations for the financial services sector to accommodate mobile money. Many of these countries’ regulators realized over time that they needed to revise these initial regulations for mobile money to better customize them to the particularities of mobile money as they learned more about mobile money about over time. A regulator in Namibia reflects on the country’s approach to regulating mobile money initially and the need for subsequent modifications:

The first full license for MPS [mobile payment services] in Namibia...used the existing regulatory framework for payment systems. After issuing this first license, BON [Bank of Namibia] realized the need to develop a specific regulation that catered to the uniqueness of [mobile money] (GSMA, 2012).

In contrast, countries that allowed entry into the mobile money market prior to introducing industry-specific regulations took an “Entry First” approach.³⁷ Before setting any industry-specific regulations, these countries’ regulators observed live deployments of mobile money, allowed firms to experiment with different business models, and then set mobile money specific regulations several years after first commercialization of mobile money within their

³⁷ The label “Entry First” specifically refers to firm entry into the mobile money market in a given country. Firms entering mobile money could be startups or diversifying entrants. In the case of diversifying entrants, many of these firms had pre-existing operations in the countries in which they launched mobile money platforms (e.g., as mobile network operators or banks).

countries. Take for example, one regulator's characterization of how the Central Bank of Kenya reacted to the first mobile money deployment:

We did not give them [the mobile money provider] a license. We did not give them authority. We gave them...a Letter of No Objection... [and] gave them leeway (Odero, 2021).

The majority of these countries (14 of 20) eventually created mobile money-specific regulations by the end of the sample period in 2017. These industry-specific regulations were enacted, on average, 4.5 years after the first entry into a country's mobile money market. In aggregate, the evidence reviewed suggests that grandfathering clauses for firms that entered Entry First countries prior to the enactment of mobile money specific regulations did not seem to occur with any frequency. Instead, firms, many of which also operated in the highly regulated financial services or telecommunications sectors, knew they would need to be legally compliant with mobile money-specific regulations that would eventually be released. To that end, many firms collaborated with each other and with the regulators in the countries they operated in to help craft the eventual regulations. In Kenya, mobile money specific regulations were introduced four years after Safaricom launched Kenya's first mobile money platform M-PESA. According to Susie Lonie, co-creator of M-Pesa:

The Central Bank of Kenya clearly needed to be engaged regarding financial service regulation... The better the regulator understands the capabilities and limitations of [mobile money], the better and more appropriate the regulation will (Hughes & Lonie, 2007, pp. 79–80)

In consultation with stakeholders including Safaricom, the CBK [Central Bank of Kenya] issued its Electronic Payment Guidelines of 2011 and Retail Electronic Transfer Guidelines of 2011 (Buku & Meredith, 2013, p. 395).

In the Democratic Republic of Congo, two firms with the leading mobile money platforms Tigo Cash and Airtel Money, motivated to increase user adoption, worked together to propose to the

regulator nuanced KYC rules (know-your-customer) to verify customers' identities, particularly in cases where customers lacked formal identification:

we could have two tiers...a 'low KYC' and a 'full KYC' [with] ...different limits in the [mobile money] wallets and in the usage of what they [the users] could do with their wallet at first. ... So that was a joint proposal that we agreed on and that was submitted to the regulator, and the regulator accepted..., and that's what also helped in terms of getting more active users (Primary interview, June 2021).

Firms also proactively created internal practices that would enable them to quickly be compliant with new regulations. Again in Kenya:

[Safaricom] developed and implemented a comprehensive set of internal AML [anti-money laundering] policies and procedures including: (1) agent training, (2) internal KYC [know your customer] policies, and (3) strict transaction monitoring (Buku & Meredith, 2013, pp. 396–397).

However, in some cases, firms did not alter their practices until legally required. In Uganda, the dominant mobile money provider MTN did not discontinue agent exclusivity until formal rules banning this practice were introduced in 2013, four years after MTN started operating its mobile money platform (Macmillan et al., 2016). In practice, it took a few months for MTN to become compliant.

Descriptive statistics.

Table 6 provides summary statistics, comparing country averages under each regulatory approach. The variables shown are related to economic and demographic conditions (*e.g.*, GDP per capita, population) as well as variables of interest to the emergence of the mobile money industry (*e.g.*, mobile phone subscriptions, prevalence of bank branches, concentration of the telecommunications and banking industries). The variables shown reflect a two-year lag either from the first year mobile money was launched for each Entry First country or from the first year mobile money specific regulations were in place for each Regulations First country. Appendix B contains summary statistics for variables captured in different years and shows similar patterns.

On average, there are limited differences across the two groups of countries. T-tests comparing the means of countries under the two regulatory approaches reveal that the only statistical difference is in the variables related to colonial history: 60% of Entry First countries are former British colonies (20% former French colonies), and 57% of Regulations First countries are former French colonies (30% former British colonies). These data also suggest that initial conditions related to supply and demand for mobile money were not significantly different on average for countries that took different regulatory approaches.

Table 7 provides pairwise correlations related to the outcome variable entry prior to regulations for the sample of 43 countries with at least one mobile money entrant. Consistent with Table 6, entry prior to regulations is moderately positively correlated with former British colony ($\rho = 0.30$) and moderately negatively correlated with former non-British colonies ($\rho = 0.30$; with $\rho = -0.37$ for former French colony). Together, these patterns are consistent with the distinctions between common law and civil law practices. Regulators in countries that were former British colonies tended to wait to set industry-specific regulations, consistent with common law legal origins based on limited laws and reliance of precedent; while regulators in countries that were former non-British colonies (e.g., French, Portuguese, Belgian, Italian, or German) tended to enact industry-specific regulations prior to allowing entry, consistent with civil law legal origins that encourage codification.

Table 6*Descriptive statistics comparing countries by regulatory approach, lagged 2 years*

Variables	Entry First (n=20)		Regulations First (n=23)		Pr(T>t)
	Mean	S.D.	Mean	S.D.	
Adult Population	11,500,000	12,300,000	11,800,000	19,200,000	0.960
GDP per Capita (constant 2010 US\$)	1,808.39	2,219.33	2,193.63	2,989.53	0.638
Government Spending (% of GDP)	15.29	7.42	13.87	4.91	0.458
Mobile Phone Subs. per 100 adults	34.31	31.41	33.91	37.80	0.970
Bank Branches per 100,000 adults	4.90	5.45	4.95	9.93	0.983
Bank Concentration (%)	75.13	15.68	82.24	17.43	0.183
Mobile Network Operator Concentration (%)	55.68	14.70	50.80	21.16	0.392
Polity Index	2.60	4.97	1.00	4.90	0.300
Control of Corruption	34.66	24.74	32.01	20.09	0.700
ICT Regulatory Index	52.28	16.15	44.32	17.49	0.130
Former British Colony	0.60	0.50	0.30	0.47	0.053
Former French Colony	0.20	0.41	0.57	0.51	0.014
Former non-British Colony	0.40	0.51	0.69	0.47	0.476
Never Colonized	0	0	0.04	0.21	0.357

Notes. For Entry First countries, a 2-year lag is taken from the first year a firm launches a mobile money platform. For Regulations First countries, a 2-year lag is taken from the first year in which mobile-money specific regulations are enacted. The Bank Concentration variable is missing data for the following Regulations First countries: Central African Republic, Guinea-Bissau, and Liberia. The Polity Index is missing data for Seychelles (Regulations First). The Bank Branches variable is missing data for D.R. Congo (Entry First).

Table 7*Pairwise correlation matrix for countries with mobile money entry*

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Adult Population														
2	GDP per Capita (constant 2010 US\$)	-0.10													
3	Government Spending (% of GDP)	-0.27	0.29												
4	Mobile Phone Subscriptions per 100 adults	-0.17	0.78*	0.18											
5	Bank Branches per 100,000 adults	-0.10	0.80*	0.36	0.76*										
6	Bank Concentration (%)	-0.22	0.03	0.08	0.04	-0.04									
7	Mobile Network Operator Concentration (%)	-0.08	-0.06	0.43*	-0.21	-0.01	0.08								
8	Polity Index	-0.04	0.18	0.11	-0.12	0.05	0.06	-0.19							
9	Control of Corruption	-0.21	0.49*	0.62*	0.29	0.49*	-0.13	0.29	0.30						
10	ICT Regulatory Index	0.17	0.11	-0.03	0.27	0.24	-0.39	-0.36	0.16	0.24					
11	Former British Colony	0.22	0.25	-0.03	0.18	0.22	-0.19	-0.17	0.16	0.13	0.23				
12	Former French Colony	-0.23	-0.10	-0.16	0.01	-0.18	0.00	-0.19	-0.17	-0.22	-0.05	-0.60*			
13	Former non-British Colony	-0.17	-0.25	0.00	-0.21	-0.23	0.13	0.18	-0.22	-0.12	-0.22	-0.91*	0.60*		
14	Never Colonized	-0.09	-0.09	0.01	-0.02	-0.04	.	-0.15	0.14	-0.02	0.05	-0.13	-0.12	-0.17	
15	Entry Prior to Regulations	-0.01	-0.07	0.12	0.01	-0.00	-0.22	0.13	0.16	0.06	0.24	0.30	-0.37	-0.30	-0.14

Notes: * $p < 0.01$. *Entry prior to regulations* = 1 for each country that allowed entry prior to passing industry-specific regulations (e.g., Entry First), and = 0 for each country that did not allow entry prior to setting industry-specific regulations (e.g., Regulations First). Country-level analysis. $n = 43$, except for the following missing data cases: $n = 42$ for Bank Branches (D.R. Congo) and Polity (Seychelles); $n = 39$ for Bank Concentration (Central African Republic, Guinea-Bissau, and Liberia). Variables are based on a 2-year lag. For Entry First countries, a 2-year lag is taken from the first year a firm launches a mobile money platform. For Regulations First countries, a 2-year lag is taken from the first year in which mobile-money specific regulations are enacted.

Table 8 documents the number of countries by region under each regulatory approach. Notably, Eastern Africa has 10 countries that allowed entry prior to setting industry-specific regulations, compared to only 3 countries that set industry-specific regulations prior to allowing entry. In Western Africa, this pattern is reversed: only 2 countries allow entry prior to industry-specific regulations versus 13 countries that enact industry-specific regulations first. Geographically, the large presence of Regulations First countries in Western Africa compared to Entry First countries is consistent with historical French colonization of several West African countries (see Appendix B for a map of former colonies).

Table 8

Mobile money across regions of Africa

Region of Africa	# of Countries with Entry First Approach	# of Countries with Regulations First Approach	# of Countries with No Platform Launches	# of Countries with Platform Launches	# of Platform Launches 2001-2017
Eastern	10	3	1	14	67
Western	2	13	1	15	71
Southern	3	2	0	5	28
Middle	2	4	3	6	19
Northern	3	1	2	4	16

Likelihood of a country allowing entry prior to passing mobile money specific regulations.

Next, I used a linear probability model to regress *entry prior to regulations* on the pre-existing country level factors associated with modern and historical institutions, controlling for GDP per capita. This regression is restricted to the 43 countries that have at least one mobile money entry event during the sample period, and based on data availability, the final sample used in regression analysis includes 42 countries. Table 9 reports the results. Here, the coefficients on polity index and control of corruption are small and statistically insignificant. The coefficient on ICT regulatory index, while statistically insignificant, is positive, suggesting

countries with more market-supportive regulations in the ICT sector are associated with a higher likelihood of allowing mobile money entry prior to creating mobile money specific regulations. The coefficient on former British colony is positive and weakly statistically significant ($\beta=0.318$, $p=0.058$). In terms of economic significance for the linear probability model, being a former British colony increases the probability of country taking an Entry First approach by 0.32 compared to countries that are not former British colonies.

Table 9

Correlations between pre-existing market institutions and regulatory approach

Variables	Entry Prior to Regulations OLS
Polity Index	0.009 (0.017)
Control of Corruption	0.069 (0.414)
ICT Regulatory Index	0.568 (0.450)
Former British Colony	0.318* (0.163)
Log GDP per Capita	-0.076 (0.083)
Constant	0.560 (0.571)
Observations	42
R-Squared	0.491

Notes. Robust standard errors are reported in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. *Entry prior to regulations* = 1 Entry First countries, and = 0 Regulations First countries. Variables have been lagged two years from either first mobile money entry or first mobile money specific regulations, depending on regulatory approach. $n = 42$; Seychelles is dropped due to missing data on the Polity Index variable.

Taken together, these results suggest that modern measures of pre-existing market institutions do not strongly influence a country's regulatory approach. However, the historical measure of market institutions continues to matter: countries that are former British colonies and have legal origins based on precedent and limited laws allow mobile money entry prior to

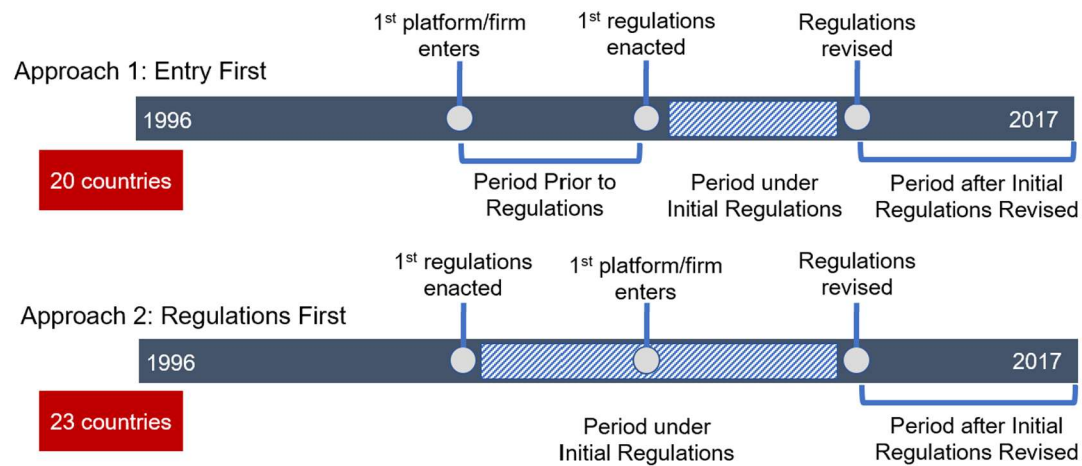
establishing industry-specific institutions; while, former French colonies proactively enact mobile money-specific regulations prior to allowing entry, in line with French civil law traditions that emphasize written laws and codes.

Implications for industry emergence.

In this section, I explore the linkage between countries' regulatory approaches to mobile money and firm entry. In terms of calendar years, entry occurred simultaneously across countries with different regulatory approaches. To compare entry levels across the two regulatory approaches, I differentiate between two different periods, which is illustrated conceptually in Figure 3. For Entry First regulators, the two periods are: a) the period prior to regulations, which starts with the year of first commercialization of mobile money within a country and ends in the year prior to the year in which the first industry-specific regulations were enacted, and b) the period under regulations, which starts with the year the first industry-specific regulations were put in place through the end of the sample period (2017). For Regulations First countries, the two periods are: a) the period under initial mobile money specific regulations, which starts with the first year a country introduced industry-specific regulations and ends in the year prior to the year in which these initial regulations were revised, and b) the period after initial mobile money specific regulations were revised, which starts with the year in which industry-specific regulations were revised and ends in 2017, the end of the sample period.

Figure 3

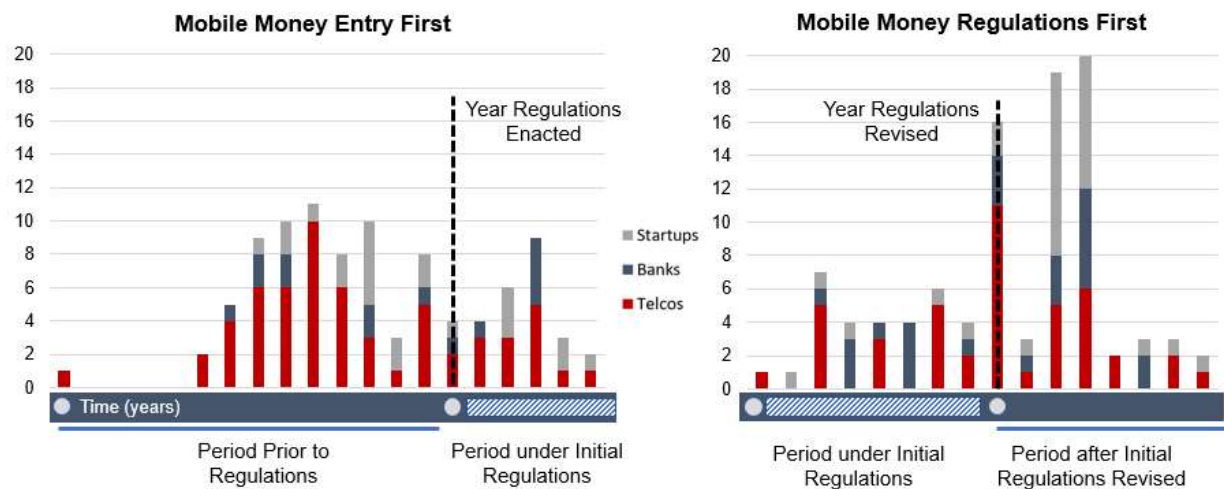
Conceptual depiction of the two regulatory approaches



Across the sample period from 2001-2017, there were similar numbers of entrants across countries with these two different regulatory approaches (92 platforms in Entry First countries and 97 platforms Regulations First countries), but entry was systematically *later* in countries with the Regulations First approach. This pattern is illustrated in Figure 4. In Entry First countries, high levels of entry occurred in both time periods, as firms did not have to wait for regulators to have all the details figured out to enter. In contrast, in Regulations First countries, there was dampened entry during the period under initial regulations. As can be seen in Figure 4, entry only took off *after* regulations were revised: firm entry increased by over 300%. Of note is the share of regulators that revised initial industry-specific regulations. During the sample time period, 82% of Regulations First countries formally altered their first sets of mobile money regulations. In contrast, only 19% of Entry First countries modified the initial regulations put in place.

Figure 4

Implications for entry based on type of regulatory approach



Implications for innovation diffusion.

Timing of entry also had implications for individuals. Figure 5a shows that in Entry First countries, user adoption of mobile money, as measured by the average number of registered mobile money accounts per 1,000 people, was higher than in Regulations First countries, and that this difference remained throughout the sample period. As another indication of the implications regulatory approach had on user adoption, Figure 5b plots the average number of mobile money transactions per 1,000 people in Entry First countries versus Regulations First countries. Not only did countries with an Entry First approach have higher numbers of registered accounts, but the individuals using these accounts conducted a higher volume of transactions compared to individuals in countries with a Regulations First approach. In 2017, individuals in countries under the Entry First approach conducted on average 1.8 times the number of transactions than individuals in countries under the Regulations First approach. These charts are suggestive of the costs individuals bore while waiting for regulators in Regulations First countries to revise their mobile money regulations.

Figure 5a

Implications of entry timing on user adoption of mobile money

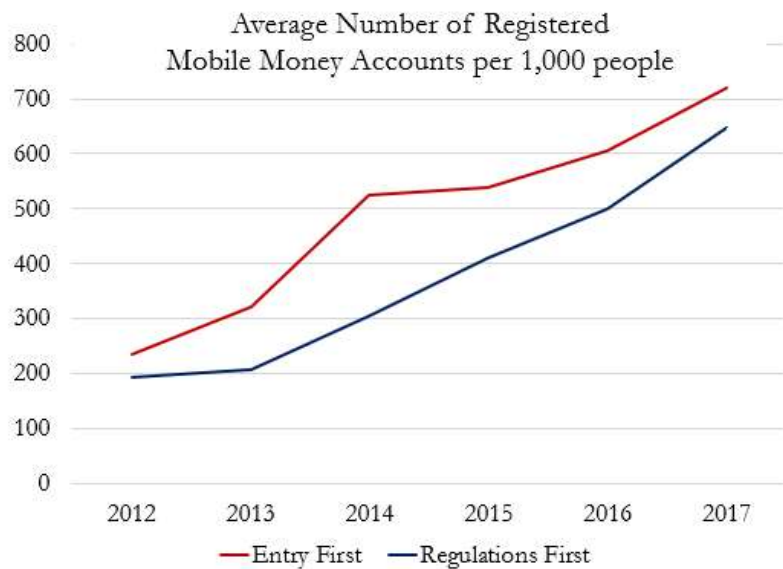
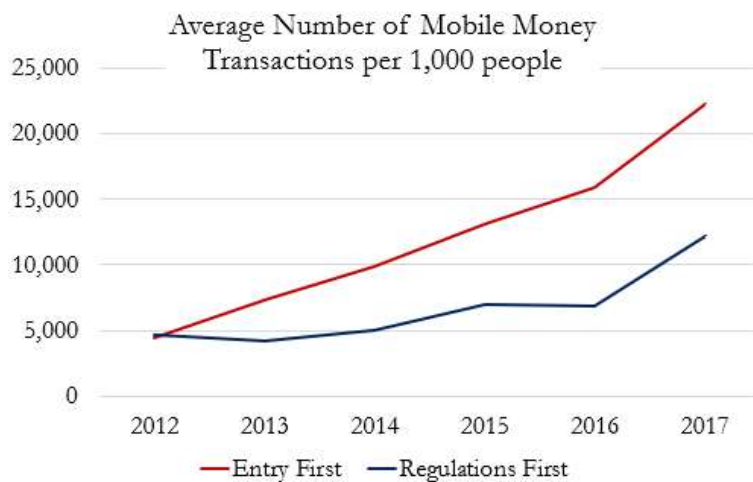


Figure 5b

Implications of entry timing on user adoption of mobile money



Source: Author calculations using IMF Financial Access Survey data

As another way to examine mobile money adoption, I regress three different outcome variables on the pre-existing country level factors associated with modern and historical market institutions as well as on the regulatory approach towards mobile money, controlling for GDP

per capita. The outcome variables of interest include: a) *mobile money accounts (%)*, the percentage of adults who use mobile money to pay bills or send or receive money in the last year; b) *sending money (%)*, the percentage of adults who use mobile money to send money in the past year; and c) *paying bills (%)*, the percentage of adults who use mobile money to pay bills in the past year. These data come from the World Bank's Global Financial Development database and are available for 2014 and 2017, and data is available for 18 Entry First countries and 19 Regulations First countries.

Table 10a reports the descriptive statistics. On average, across all countries, 17% of the adult population have mobile money accounts for the two years for which data is available. T-tests (not reported in Table 10) indicate no significant difference in means for percent of mobile money accounts between Entry First countries (mean = 19.5%) and Regulations First countries (mean = 14.5%; $t = -1.31$, $p = 0.1956$), though the mean is higher for Entry First countries. 12.5% of the population uses mobile money to send money on average across all countries. Entry First countries (mean = 15.3%) send money using mobile money accounts more than Regulations First countries (mean = 10.2%) on average ($t = -1.76$; $p = 0.0836$). On average, less than 5% of the population uses mobile money to pay bills (5.7% in Entry First countries; 3.6% in Regulations First countries; $t = -1.38$; $p = 0.1735$). Table 10b reports the pairwise correlations. Sending money (%) is positively moderately correlated with ICT Regulatory Index and Former British Colony (similarly so for mobile money accounts (%) and paying bills (%)). There is also a smaller positive correlation between the Entry First regulatory approach and the three outcome variables.

Table 10a*Descriptive statistics on mobile money adoption*

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
<i>Outcome variables</i>					
Mobile money accounts (%)	68	16.92	15.92	0.03	72.93
Sending money (%)	62	12.51	11.54	0.11	50.12
Paying bills (%)	63	4.65	6.18	0	37.10
<i>Explanatory variables</i>					
Entry Prior to Regulations	74	0.49	0.50	0	1
Polity Index	74	2.30	4.65	-6.00	10.00
Control Corruption	74	33.80	21.53	2.87	82.04
ICT Regulatory Index	74	49.40	15.56	17.50	83.00
Former British Colony	74	0.41	0.49	0	1
Former French Colony	74	0.46	0.50	0	1
Non-British Former Colony	74	0.59	0.49	0	1
Log GDP per Capita	74	6.97	0.96	5.62	9.05

Notes: Independent variables are lagged two years the from first year a mobile money platform was launched or first mobile money specific regulations enacted, based on each country's regulatory approach. Data is available for 18 Entry First countries and 19 Regulations First countries for 2014 and 2017. Additional information on missing data for the dependent variables can be found in Appendix B.

Table 10b*Pairwise correlation matrix for countries with mobile money entry*

		1	2	3	4	5	6	7	8	9	10
1	Mobile money accounts (%)										
2	Sending money (%)	0.97*									
3	Paying bills (%)	0.88*	0.82*								
4	Entry Prior to Regs	0.16	0.22	0.17							
5	Polity Index	0.22	0.12	0.25	0.08						
6	Control Corruption	0.00	-0.01	-0.01	0.18	0.49*					
7	ICT Regulatory Index	0.23	0.37*	0.22	0.30	0.08	0.41*				
8	Former British Colony	0.26	0.34*	0.27	0.41*	0.32*	0.12	0.22			
9	Former French Colony	-0.30	-0.36*	-0.25	-0.46*	-0.35*	-0.26	-0.17	-0.65*		
10	Non-British Former Colony	-0.20	-0.27	-0.20	-0.41*	-0.40*	-0.12	-0.20	-0.89*	0.65*	
11	Log GDP per Capita	-0.06	0.00	0.02	0.03	0.14	0.44*	0.26	0.20	-0.01	-0.2

Notes: * $p < 0.01$.

Each of the outcome variables represents percentages and are thus censored between 0 and 100. A nonlinear two-limit Tobit model is used to account for this censoring. Table 11 reports the marginal effects of the censored, observed adoption rates. Across all three models, the marginal effects of the Entry First Regulatory approach are somewhat large and positive, though not statistically significant. This effect is in line with the other evidence that indicates greater mobile money adoption in Entry First countries. The marginal effects on the Polity Index across the three models indicate that countries with more democratic political regimes have increased mobile money adoption. The negative coefficients on Control of Corruption indicate that countries with higher control of corruption (and thus lower levels of corruption) have lower levels of mobile money adoption, suggesting that mobile money adoption is more prevalent in countries with higher levels of corruption. Countries with higher quality ICT regulations have increased mobile money adoption.

Table 11

Tobit regression results on mobile money adoption

	(1) Mobile Money Accounts	(2) Sending Money	(3) Paying Bills
Entry Prior to Regulations	2.51 (3.70)	3.60 (2.68)	1.31 (1.26)
Polity Index	9.60** (4.35)	4.46 (3.48)	4.19*** (1.48)
Control of Corruption	-15.60 (10.90)	-13.81* (7.85)	-7.36** (3.70)
ICT Regulatory Index	23.40* (12.75)	28.04** (9.50)	7.83* (4.32)
Log GDP per Capita	-0.98 (2.05)	0.64 (1.56)	0.17 (0.70)
Observations	68	62	63

Notes: Standard errors are reported in parentheses. * $p < 0.1$, ** $p < 0.05$; *** $p < 0.01$. Marginal effects on the censored, observed outcome are reported.

Summary of Findings

In exploring how industry emergence may be affected by institutional uncertainty that differs from one country context to the next, this study examined two sources of institutional uncertainty: pre-existing market institutions and industry-specific institutions. The first part of this study examined the relationship between pre-existing market institutions and industry emergence, and found that variation based on colonial history influenced industry emergence. Specifically, being a former British colony was correlated with countries having mobile money entry in the first place, and former British colonies experienced faster entry than countries that were not former British colonies. Measures of pre-existing modern market institutions did not reveal any strong associations with entry or timing of entry.

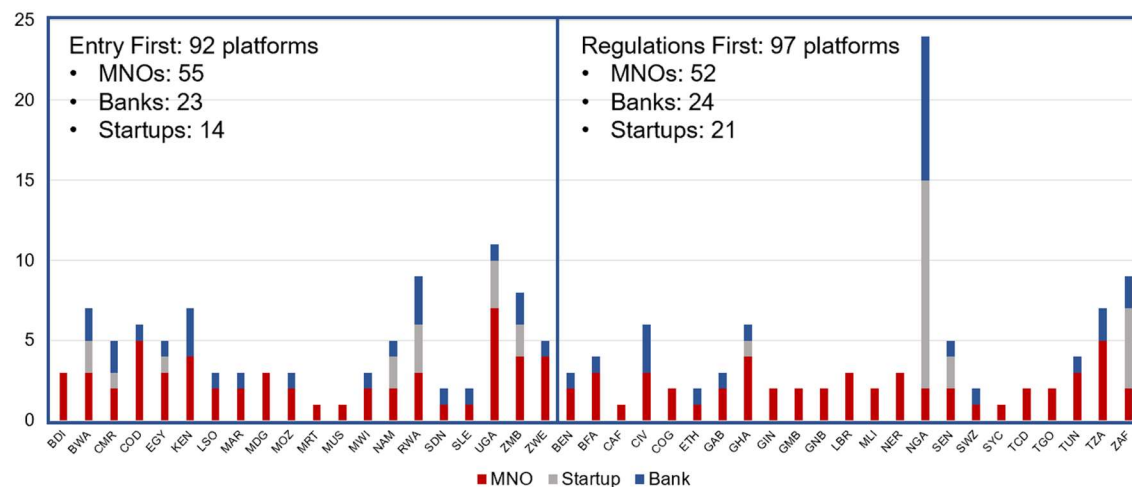
The second part of this study explored the relationship between pre-existing market institutions and the approach to developing industry-specific institutions. Countries took two main approaches to regulating mobile money: the Entry First Approach or the Regulations First Approach. Here, too, the historical measure of market institutions matters. Being a former British colony is correlated with an Entry First regulatory approach, consistent with a legal tradition influenced by British common law which is characterized by limited laws. In turn, the regulatory approach had implications for both firm entry and user adoption. Regulations First countries had delayed firm entry compared to Entry First countries, and user adoption remained lower in Regulations First countries throughout the sample period. Together, these analyses illustrate a path dependence between colonial legacies, regulatory approaches to setting industry-specific institutions, and industry emergence.

Strategic Considerations for Firms

I now provide some preliminary strategic considerations for firms. Figure 6 shows the number of mobile money platform launches by country for the entire sample period (2001-2017). This figure splits the countries based on regulatory approach and reveals the three different types of firms that launched platforms: mobile network operators (MNOs), banks, and startups. As can be seen in the figure, every country has at least one platform launched by an MNO (the red bars). MNOs, compared to banks and startups, launched the highest number of platforms in both Entry First and Regulations First countries, and eighteen countries have platforms launched exclusively by MNOs (39% of the sample).

Figure 6

Number of mobile money platform launches by country, 2001-2017



Source: Author's calculations using GSMA data.

Over half of all platforms are launched by multinational firms with 40% of platforms launched by multinational MNOs (37 platforms in Entry First countries and 42 platforms in Regulations First countries). Clearly multinational MNOs play an outsized role in diffusing this industry. In deciding to launch a mobile money platform, firms make strategic choices related to where and when to launch a platform. A firm considers which country it might want to enter

given the country's regulatory approach to mobile money, and the firm considers whether it should enter early versus late. There are tradeoffs for these choices. For example, a firm that is the first mover in an Entry First country has a potential advantage to be able to influence mobile money regulations that have not yet been created. However, the firm has the potential challenge of needing to educate the regulator. One mobile network operator in Kenya, an Entry First country, commented:

We had met with the [central] bank during the pilot... There followed a series of product demonstrations, requests for documentation, ...more questions... E-money products...are new to Kenya so there is no clear regulation yet in place. It is our intention to work with the Central Bank to provide the information required to make informed decisions as formal controls are introduced (Hughes & Lonie, 2007, pp. 79–80).

A firm that chooses to enter a Regulations First country knows that all firms must play by the same rules; however, as one firm interviewed indicated, the initial regulations may not be the firm's liking:

The central bank made the regulations without including us. They did not even consider who the services benefited most. [The central bank should] revise the regulations together with service providers. In that way, we will, together, decide on appropriate regulations needed for our services (Habonimana, 2017).

The qualitative evidence I have collected indicates that firms encounter variation even across countries that take the same regulatory approach. Take for example a multinational MNO's experience in two different Regulations First countries:

Nigeria was quite a tough nut... it's hard to say the regulator was against mobile money, but was definitely not for it. ...almost everyone who runs the Central Bank came from the banking industry and has some relationship with the banking industry. ...banks felt that [mobile network operators] going into mobile money would eat into their bread and butter (Primary Interview, October 2020).

In Seychelles, they had no idea about mobile money. We literally had to educate the regulator, 'This is how it happens, this is what it does, this is how you have to do the law.' I think [we spent] between six to nine months trying to explain all the possibilities. ... In most countries, we were educating. Over time, we figured out all the questions [the regulator] could ask (Primary Interview, April 2021).

In Nigeria, the firm encountered a less-than-friendly regulatory environment; while, in Seychelles, the regulator was open to learning from the firm as to how to create mobile money specific regulations. These data suggest that a firm's location choice may be based on the firm's ability to act differently based on the regulatory environment encountered, and this ability may be shaped by whether a firm has prior experience launching a mobile money platform in another country.

Future work can examine firms' entry choices empirically. For example, a multinomial logit model could examine the relationship between country characteristics (*e.g.*, market institutions, variables related to supply and demand of mobile money), firm characteristics (*e.g.*, prior experience launching a platform, multinational or not, state owned or not), and the choice of where and when to enter (*e.g.*, Entry First country prior to mobile money regulations, Entry First country after mobile money regulations are passed, Regulations First country before regulations are revised, Regulations First country after regulations are revised).

3.6 Discussion

Motivated by an incomplete understanding of the relationship between industry emergence and institutional uncertainty, this study examines two sources of institutional uncertainty—pre-existing market institutions and industry-specific institutions—through an abductive analysis of the mobile money industry's emergence across the African continent. Empirically, this paper makes a contribution as one of the first studies, to my knowledge, that examines nascent industry emergence across multiple developing country contexts, answering calls for more research in global contexts (Moeen et al., 2020) and in Africa specifically (Mol et al., 2017; Zoogah et al., 2015). In doing so, this study offers theoretical implications for industry emergence and innovation diffusion. A key insight from this study is that the emergence of an

industry is shaped by historical pre-existing market institutions. In particular, legal origins from being a former British colony persist and have path-dependent outcomes for industry emergence, including influencing both firm entry patterns and the type of regulatory approach for developing industry-specific institutions.

By drawing on the New Institutional Economics perspective (North, 1990) to highlight the path-dependent nature of formal institutions as a mechanism that shapes industry emergence, this study makes a theoretical contribution to the literature on industry emergence by providing novel insights related to sources of institutional uncertainty and industry emergence. Prior work has documented a positive relationship between legal origins based in British common law and lighter regulation, which in turn is associated with lower levels of corruption at the country level (Djankov et al., 2002; la Porta et al., 2008). Building on these insights, this study finds a correlation between former British colonies and the Entry First approach to regulating mobile money, a light-touch approach to developing industry-specific institutions. Former British colonies were also more likely to experience mobile money entry and have faster time to entry, and they had higher user adoption compared to countries that were not former British colonies. Surprisingly, this study does not find a strong relationship between measures of modern pre-existing market institutions (e.g., control of corruption, quality of ICT regulations) and industry emergence or regulatory approach. Why do historical market institutions matter while modern ones do not?

One possibility is that the two different approaches to developing industry-specific institutions, rooted in differences in colonial legacies, created different ways in which regulators experimented to build their own knowledge bases around a new industry. Entry First countries tended to be former British colonies, which relied on decentralized governance approaches via

indirect rule (Crowder, 1964) and common law traditions emphasizing limited laws (la Porta et al., 2008). Consistent with this more hands-off approach, when it came to developing industry-specific institutions for mobile money, these countries waited to implement any regulations or restrictions. Instead, regulators in these countries observed firms operating in their local context and engaged with firms and other stakeholders right from the very beginning to determine how mobile money-specific regulations should be crafted. These interactions included regulators soliciting detailed input from firms as to how mobile money worked to understand the similarities and differences between mobile money and more traditional banking services.

In contrast, Regulations First countries, which tended to be former French colonies (or other non-British colonies), had a legacy of centralized governance approaches known as direct rule (Crowder, 1964), strong assimilation practices, and civil law traditions that emphasized large numbers of laws (Mahoney, 2001). In these countries, regulators utilized regulations that already existed for the formal financial sector prior to allowing any firm entry, in line with these countries' colonial histories. These regulations, designed for brick-and-mortar banks, often proved to be overly restrictive or cumbersome for mobile money. Over time, these countries underwent a more formal experimentation process through a series of revisions to the initial regulations they put in place. But by not engaging in the experimentation process initially, Regulations First countries introduced industry-specific regulations that discouraged or prevented firm entry, which resulted in delays for the diffusion of mobile money as solution for the unbanked in these countries.

Whereas previous research on nascent industries has focused on ways in which firms can resolve the multiple dimensions of uncertainty characteristic of nascent industries, particularly demand and technology dimensions (Moeen and Mitchell, 2020; Pillai et al., 2020; Thomke,

2003), this study points to the importance of regulators themselves as actors involved in contributing to or resolving industry-specific institutional uncertainty and ultimately industry emergence. This study helps to shed light on how the institutional knowledge base of the industry is shaped through experimentation by both commercializing firms and regulators by highlighting the evolutionary and path dependent process by which industry-specific institutions are created and revised and the implications for industry emergence. In unpacking sources of institutional uncertainty, this study helps to build theory on the ways in which industry-specific institutions can facilitate or impede industry emergence and innovation diffusion.

This study also opens up new avenues for theorizing. Future research can explore the pathways by which uncertainty is resolved through experimentation and knowledge building. For example, regulators can learn from multinational firms who operate mobile money platforms in a number of countries as well as from regulators in Entry First countries. Anecdotally, my data suggests that in Regulations First countries, revisions to the initial regulations often came at the behest of multinational firms who had mobile money operations in Entry First countries. In many cases, multinational mobile network operators were instrumental in connecting Regulations First regulators with Entry First regulators in other countries, helping to diffuse knowledge related to industry-specific regulations and best practices.

What we did, was to put our regulator in touch with the one of Kenya because we knew that was a country that's really advanced with mobile money. They knew what they were doing...what was working, what was not working. [In our country], the regulation wasn't complete... [The regulator] kept on working on it. (Primary Interview, May 2020)

Regulatory lag (Norton, 1987) and regulatory sandboxes (Ahern, 2021) are relevant phenomenon in this regard. Future research can examine in greater detail how regulators learn about new technologies and/or innovations, and how regulations evolve over time with implications for the types of innovations that firms commercialize.

Additionally, more research is needed that integrates the role of market and nonmarket actors, including nonprofits and industry associations (among other types of intermediaries), to develop a theory related to the co-emergence of industries and industry-specific regulations. In developing countries in particular, supra-national organizations like the World Bank's International Finance Corporation or United Nations' various development organizations may be needed in an industry's nascent stages to help navigate fundamental uncertainty and build relevant knowledge, infrastructure, and institutions by acting as a bridge between for-profit firms and public regulators (Mair et al., 2012).

This study is subject to certain limitations that could also provide opportunities for future research. The findings of this study are grounded in data from African countries. The historical legacy of colonialism on legal systems and industry-specific regulations may be unique to this setting. Other regions of the world may have a different set of variables related to pre-existing market institutions that matter. Additional research that examines different parts of the world, particularly developing economies is needed to better understand industry emergence and institutional uncertainty. Additionally, this study has focused on the timing of regulations, as opposed to the content of the regulations. Qualitative differences in the specifics of mobile money regulations are something future research should examine to determine whether certain policies constrained or enabled firm entry.

Practical implications

This study's results also have important implications for policy makers. Understanding how regulatory approaches may encourage or deter new industries from emerging is an important piece to consider as new laws are enacted, particularly for industries under high regulatory purview (*e.g.*, drug manufacturing, agriculture production, sports betting) and for

industries that represent sustained value propositions for critical unmet needs. The generalizability of this study's findings may be limited in its insights due to its reliance on a single industry context, and an industry subject to regulatory oversight. More research that examines other industry contexts, both regulated and non-regulated, will help us understand the boundary conditions of these findings. For regulated industries in particular, understanding the tradeoffs between more experimental versus more cautious regulatory approaches is needed. This study highlights the costs of the Regulations First approach in terms of delayed benefits to the unbanked through slower user adoption of mobile money; however, the Entry First Approach was not without its own costs. Limited regulatory oversight created opportunities for corrupt practices, including identity theft, money laundering, and fraud, though comprehensive data on the prevalence of these issues is scarce at this time.³⁸

This study also highlights the importance of innovative solutions to market failures amidst institutional voids and answers calls to examine institutional readiness and adaptability as it pertains specifically to digital money (Dodgson et al., 2015). A story from one of my interviews provides a compelling reason for more research in this vein. Prior to the introduction of mobile money in the Democratic Republic of Congo, civil servants were paid their salaries in cash, creating long lines on pay day and opportunities for greedy superiors to skim off the top.

Describing the day her firm launched its mobile money platform:

We were in the area where people used to be paid by cash, and they didn't know what was their real salary. When they got it through their mobile money, it was like a surprise. They were just like, 'Oh my God, I didn't know that was my salary! Someone was giving me half of the salary that I should get.' It was really an experience beyond words. I can't express what it

³⁸ As an example, Uganda's largest mobile money provider provided lost \$3.4 million in 2011 due to embezzlement and fraud by company employees. The mobile money platform did not have certain systems in place to prevent this from happening, highlighting the need for regulators "to adequately oversee that sufficient internal controls are in place. ... [However] the central bank will not have the legal authority to regulate the payments sector until ... and a payments law enacted" (Morawczynski, 2015).

was feeling like you are useful. You're bringing the light to someone who even didn't know that what was his salary (Primary Interview, May 2020).

Conclusion

Our knowledge of the important role institutions play for industry emergence is preliminary, and many questions and issues remain to be explored. In this study, I investigated issues pertaining to two sources of institutional uncertainty, focusing on formal institutions, and showed that industry emergence was based not only on which firms launched mobile money platforms, but critically the ways in which industry-specific regulations emerged to support this industry and were themselves shaped by historical market institutions.

APPENDICES

Appendix A. Supplemental Materials for Chapter 2

Additional Survival Analyses

At the platform level of analysis, Figure A1 provides the Kaplan Meier platform survival curves based on the 2x2 delineation used in the main text. Table A1a describes the different types of services offered by the platforms, and Table A1b provides the number and types of services. Table A2 provides survival rates by age (given that launch year differs by platform) for all four cells of Table 2's 2x2.

Figure A1. *Platform survival*

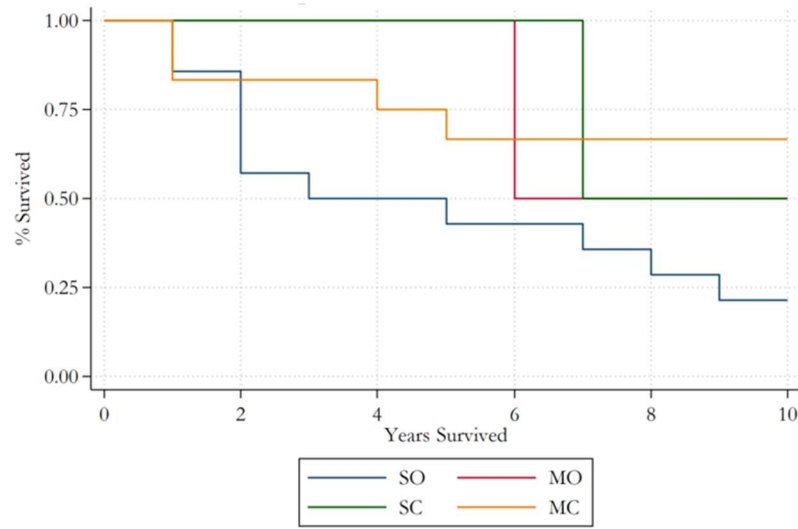


Table A1a. *Types of services offered by mobile money platforms*

Service	Definition	# of Sides of Platform
Person to person (P2P)	Transfer made from one person to another person.	Same-side
Business to business (B2B)	Transfer made from one business to another business.	Same-side
International remittances	Cross border transfer from one person to another person. This transaction may require an intermediary (e.g., Western Union).	Multi-side
Bill payment	Payment made by a person to a biller or billing organization via a mobile money platform in exchange for services provided (e.g., utility bill).	Multi-side
Merchant payment	Payment made from a mobile money account via a mobile money platform to a retail or online merchant in exchange for goods or services.	Multi-side
Other bulk payments	Payment made by an organization via a mobile money platform to a person's mobile money account (e.g., salary payments, NGO aid disbursements).	Multi-side
Micro loans & insurance	Payments or disbursements comprising of micro loans or micro insurance.	Multi-side
Link to other banking products	Customers link their mobile money accounts to other banking products, either directly or indirectly via a debit or credit card.	Multi-side
Cash in	The process by which a customer credits the mobile money account with cash. This is usually via an agent who takes the cash and credits the customer's mobile money account.	Multi-side
Cash out	The process by which a customer deducts cash from his mobile money account. This is usually via an agent who gives the customer cash in exchange for a transfer from the customer's mobile money account.	Multi-side
Airtime top-up	Purchase of airtime via mobile money. The airtime does not have to be the same organization as the mobile money platform provider.	Yes

Table A1b. *Average number and type of services offered by platforms*

	MC Platforms				SC Platforms			
	Average Number of Total Services	Average Number of Same-Side Services	Average Number of Multi-Side Services	Fraction of Platforms Surviving	Average Number of Total Services	Average Number of Same-Side Services	Average Number of Multi-Side Services	Fraction of Platforms Surviving
Launch Year	4.58 (0.62)	0.75 (0.18)	3.83 (0.52)	100%	3.50 (2.50)	0.50 (0.50)	2.00 (0.00)	100%
2010	4.75 (0.83)	0.83 (0.21)	3.92 (0.66)	100%	4.00	1.00	3.00	50%
2017	5.75 (0.80)	1.13 (0.30)	4.63 (0.63)	67%	6.00	1.00	5.00	50%
	MO Platforms				SO Platforms			
	Average Number of Total Services	Average Number of Same-Side Services	Average Number of Multi-Side Services	Fraction of Platforms Surviving	Average Number of Total Services	Average Number of Same-Side Services	Average Number of Multi-Side Services	Fraction of Platforms Surviving
Launch Year	2.50 (0.50)	0.50 (0.50)	3.00 (2.00)	100%	2.29 (0.32)	0.64 (0.13)	1.64 (0.27)	100%
2010	4.00	1.00	3.00	50%	3.89 (0.50)	0.78 (0.15)	3.11 (0.45)	64%
2017	7.00	2.00	5.00	50%	4.67 (1.50)	1.67 (0.33)	3.67 (2.03)	21%

Notes: Standard errors are reported in parentheses. For the MO & SC platforms for 2010 and 2017, no standard errors are reported as only 1 firm is left.

Table A2. *Fraction of platforms surviving based on age*

Time (years)	MC Platforms	SC Platforms
1	0.83 (0.11)	1.00
5	0.67 (0.14)	1.00
10	0.67 (0.14)	0.50 (0.35)
	MO Platforms	SO Platforms
1	1.00	0.85 (0.09)
5	1.00	0.43 (0.13)
10	0.50 (0.35)	0.21 (0.11)

Note: Standard errors are reported in parentheses.

Alternative Explanations

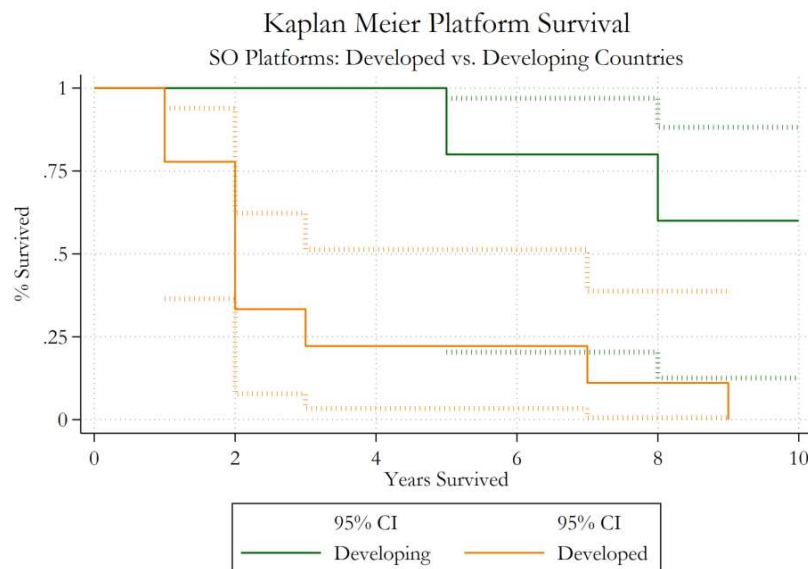
We examine three alternative explanations related to performance outcomes for pioneering firms and platforms. One potential explanation of the outcomes observed in the data is that diversifying entrants who had mobile network operations were more likely to survive than other types of firms. Table A3 provides details on firm outcomes as of 2017. Looking at capabilities (which were not mutually exclusive), 33% (7 out of 21) of firms with software capabilities survived, 43% (9 of 21) were acquired, and 24% (5 of 21) failed. Among firms with network capabilities, 64% (9 out of 14) survived, 21% (3 of 14) were acquired, and 14% (2 of 14) failed. Among diversifying entrants, possession of network vs. software capabilities did not seem to matter for survival: 57% (4 of 7) of diversifying entrants with software capabilities survived compared to 64% (9 of 14) of diversifying entrants with network capabilities.

Table A3. *Pioneering firm outcomes based on firm characteristics & capabilities*

	Startup			Diversifying Entrant			All Firms		
	Number Survived (Percent Survived)	Number Acquired (Percent Acquired)	Number Failed (Percent Failed)	Number Survived (Percent Survived)	Number Acquired (Percent Acquired)	Number Failed (Percent Failed)	Number Survived (Percent Survived)	Number Acquired (Percent Acquired)	Number Failed (Percent Failed)
Software Capabilities	3 of 14 (21%)	8 of 14 (57%)	3 of 14 (21%)	4 of 7 (57%)	1 of 7 (14%)	2 of 7 (29%)	7 of 21 (33%)	9 of 21 (43%)	5 of 21 (24%)
Network Capabilities	0 of 0 (0%)	0 of 0 (0%)	0 of 0 (0%)	9 of 14 (64%)	3 of 14 (21%)	2 of 14 (14%)	9 of 14 (64%)	3 of 14 (21%)	2 of 14 (14%)
All	3 of 14 (21%)	8 of 14 (57%)	3 of 14 (21%)	11 of 17 (65%)	3 of 17 (18%)	3 of 17 (18%)	14 of 31 (45%)	11 of 31 (35%)	6 of 31 (19%)

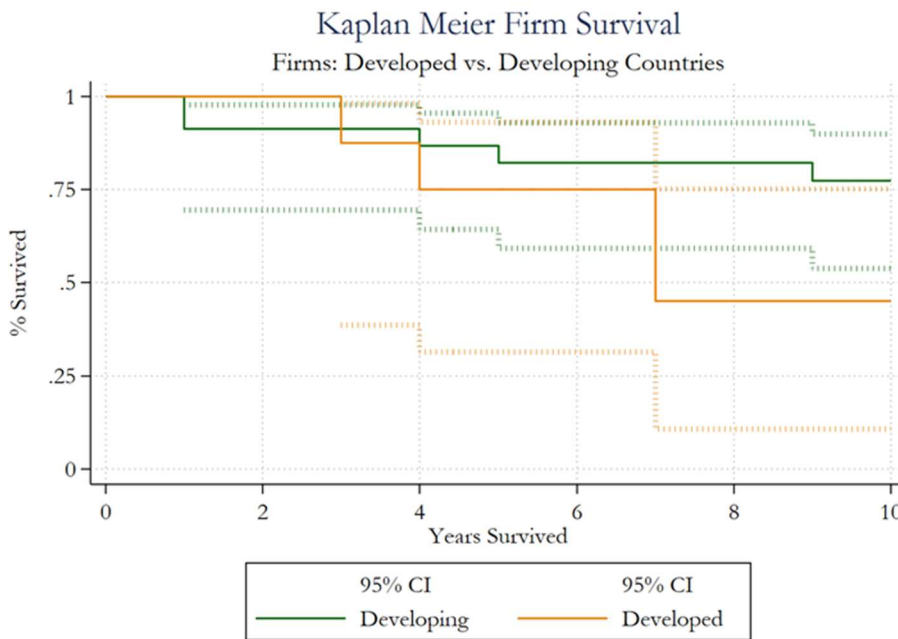
A second alternative explanation is that firms and platforms launched in developing countries were more likely to succeed than firms and platforms launched in developed countries. We start by examining the developed versus developing country comparison at the platform level. All but one of the MC platforms was launched in a developing country, thus precluding an analysis of differences in this cell. Within the SO platforms, launches in developing countries had a higher likelihood of survival than platform launches in developed countries (see Figure A2a). Figure A2b plots the survival of firms with platform launches in developed vs. developing countries with an insignificant t-test comparing the two groups. Figures A3a and A3b show that survival outcomes of diversifying entrants and startups are similar in both developed and developing countries. T-tests comparing the two groups in each figure are insignificant. We caution overinterpreting these results due to the small sample sizes involved in parsing the data in these ways.

Figure A2a. *SO platform survival, developed vs. developing countries*



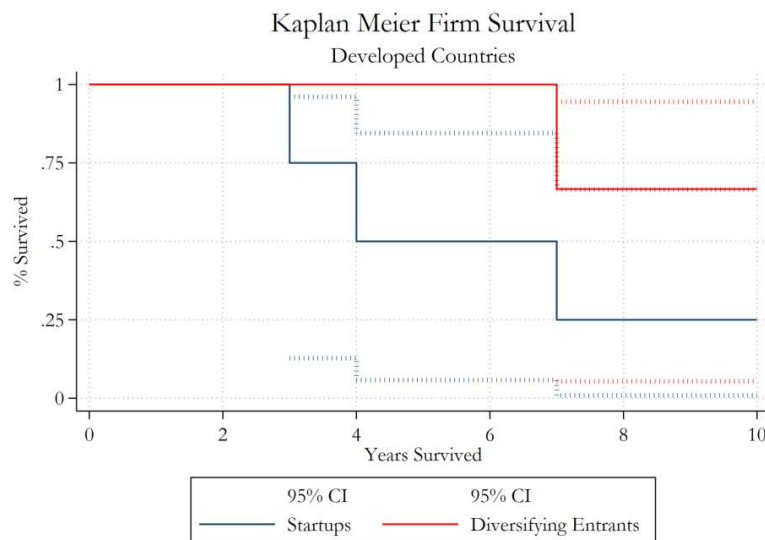
Note: In a t-test of these two groups, $t = -3.4017$ (p-value = 0.0053)

Figure A2b. *Firm survival, developed vs. developing countries*



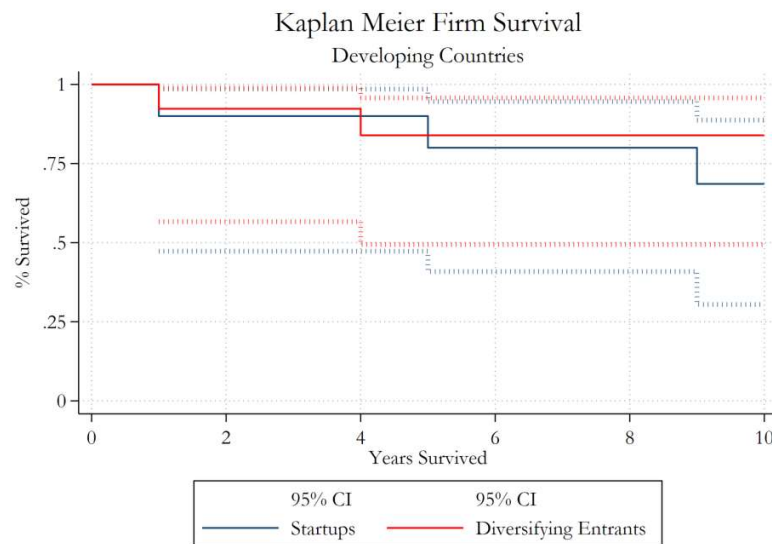
Note: In a t-test of these two groups, $t = -1.5248$ (p-value = 0.1381)

Figure A3a. *Survival of startups vs. diversifying entrants in developed countries*



Note: In a t-test of these two groups, $t = 1.4142$ (p-value = 0.2070)

Figure A3b. *Survival of startups vs. diversifying entrants in developing countries*



Note: In a t-test of these two groups, $t = 0.8177$ ($p\text{-value} = 0.4227$)

A third alternative explanation related to regulatory knowledge and capture is that firms with partial ownership by governments were more likely to survive. Related to the alternative explanation above, firms in both developed and developing countries had state governments as partial owners, such as: Sonera (Finland), NTT DoCoMo (Japan), and Vodafone's subsidiary Safaricom (Kenya). We note that *all* firms needed to comply and work closely with governing and regulatory bodies in their countries of launch due to the nature of providing financial services (*e.g.*, know your customer concerns related to money laundering and funding terrorism, inadvertently increasing a country's money supply, and consumer privacy/protection). Having a government as a partial owner may have been an advantage related to setting favorable terms and policy for mobile money platforms (*e.g.*, M-PESA continues to survive in Kenya), but it was not a guarantee (*e.g.*, Sonera Mobile Payments failed in Finland). Furthermore, our data includes many successful startups and diversifying entrants that had no state ownership (*e.g.*, Eko, PayMate, WIZZIT, Smart, Globe, MTN). This is left for future work to examine in greater detail.

Supplemental Materials for Inductive Analysis

Table A4 Data supporting key patterns³⁹

MC (Cell 1): Firms choosing multi-firm provision & closed end user access for their platforms
Availability of Empirical Data: 11 firms with relatively rich data: AIS, Comviva, Fundamo, Globe, MSI (Celtel), MTN, NTT DoCoMo, Sagentia, Smart, Utiba, Vodafone 6 firms with limited data: Grameenphone, Maxis, Sonera Zed, Sony, True, Paggo 1 firm with no available data: Telemar Norte Este (Oi) 0 firms with conflicting data
Founding Characteristics Resources & Capabilities: Mobile network operators (MNOs, all diversifying entrants) had network capabilities and complementary assets such as existing customer bases, brand names, and established telecommunication ecosystems. <i>AIS (mPay, Thailand, with software provider NTT DoCoMo):</i> mPay is “a subsidiary of AIS, the largest company in the mobile segment [in Thailand] according to market share with 44 per cent...[and] 32 million subscribers” (Riffler, 2011: 36). <i>MSI (renamed Celtel; Celpay, Zambia & DRC, with software provider Fundamo):</i> “By 2004—six years after we’d launched [Celtel]—...we had 5.2 million managed customers and operations in 13 countries, with revenue of \$614 million and a \$147 million net profit. Celtel was a strong, rapidly growing business” (Ibrahim, 2012: 7–8). <i>Vodafone (M-PESA, Kenya, with software provider Sagentia):</i> “Vodafone is a world leader in providing voice and data communications services... Our 302.6 million...mobile customers include private consumers and corporate customers [in over 20 countries] around the world” (Vodafone Group, 2009: 3). Software providers possessed or developed deep financial software capabilities. <i>Utiba (GCash, Philippines, with MNO Globe):</i> Co-founder Justin Ho: “[My first venture] e-business Asia was a auction portal in dot com 1.0 that I started, and it was my first failure...that was originally a site designed to aggregate small artisanal craftspeople...and give them access to overseas markets...That one didn't work out, but it was a great lesson” (CIO Pakistan Web Studio, 2012). <i>Sonera Zed (Smart Money, Philippines, with MNO Smart Communications):</i> Ian Wilson, senior operations advisor of Smart Money: “SmartTrust [Sonera’s wholly-owned subsidiary] has more experience and expertise in delivering mobile service platforms than anyone else in the market... We were very comfortable working with SmartTrust to launch Smart Money and are delighted to be collaborating in introducing Smart Money’s mobile commerce system to the rest of the world” (Reyes, 2001).

³⁹ For brevity, two to three illustrative quotes are chosen and presented for each point made in the table.

Motives: MNOs sought to improve customer retention by reducing “churn” & to increase revenue streams through diversification.

AIS (mPay, Thailand, with software provider NTT DoCoMo): “AIS originally saw m-money as an additional revenue stream in a competitive mobile market” (International Finance Corporation, 2011a: 31).

Globe (GCash, Philippines, with software provider Utiba): “[Globe] confirmed that the introduction of the service [G-Cash] had stabilized network churn to a remarkable extent” (infoDev, 2006: 26).

MTN (MTN MobileMoney, South Africa, with software provider Fundamo): “MTN envisioned MobileMoney as a means to reduce customer churn” (CGAP, 2010).

Some MNOs and nearly all software providers had motives related to improving financial inclusion.

Grameenphone (BillPay, Bangladesh, with software provider Comviva): Founder of Grameenphone Iqbal Quadir: “I...had in mind the conditions I have seen in Bangladesh. I was always on the lookout for good ideas that could do something about it. ...I realized that if Moore’s Law is bringing down the price of connectivity, connectivity would be a profound force in transforming these [low-income] countries. ...if we find fantastic innovations that are empowering at the bottom, then those innovations are to be embraced and people advance that way” (Knowledge @ Wharton, 2016).

Vodafone (M-PESA, Kenya, with software provider Sagentia): Co-founder Susie Lonie: “M-PESA was born thanks to a Challenge Fund set up by the department of international development of the UK government, which supported any industry that could find a way to deepen financial inclusion in certain African countries. The co-founder of M-PESA, Nick Hughes, was head of Vodafone Group’s corporate social responsibility at that time. After doing much research to prove that mobile phones would benefit the emerging markets, he wanted to do something more constructive to move things forward” (Yin, 2015).

Fundamo (Celpay, Zambia & DRC, with MNO MSI; MTN MobileMoney, South Africa, with MNO MTN): Founder Hannes van Rensburg: “I was convinced that we had to innovate around the new platform called mobile phones. I also realised (early on) that we had to look at solutions to benefit lower-income people by creating a better and more efficient financial system” (van Rensburg, 2016: 313).

Utiba (GCash, Philippines, with MNO Globe): Co-founder Justin Ho: “...we started the company very much with a view to how the mobile phone is going to impact people’s lives and very much with a view to making a difference at the bottom of the pyramid to help people alleviate poverty, to help people to get out of circumstances where they can participate in the commerce sector more efficiently—get access to banking services and financial inclusion. For me that’s been a very important personal journey” (CIO Pakistan Web Studio, 2012).

Key Platform Characteristics

MNOs lacked the software capabilities to develop a mobile money platform, and it therefore made sense to collaborate with a software provider.

Sagentia (M-PESA, Kenya, with MNO Vodafone): Co-founder Susie Lonie: "...we [Vodafone] tendered for an external software developer; and chose Sagentia, a British company specializing in 'blue sky' strategic development... it was important that Sagentia be extremely open-minded and flexible, create a very configurable system, and show a strong willingness to get involved in defining the detailed functionality. In fact, Sagentia demonstrated the required skill set and attitude many times during this project" (Hughes and Lonie, 2007: 70–72).

NTT DoCoMo (Osaifu-Ketai, Japan, with software provider Sony): NTT DoCoMo and Sony created a joint venture "to develop new services based on mobile phones equipped with Sony's contactless IC Card technology FeliCaR. ... Through this platform, customers will be able to use their mobile phones to enjoy services previously only available with IC cards, such as transport system payments, electronic money and personal ID security. In addition, use of the telecom infrastructure for mobile phones will also enable new capabilities, such as the direct downloading of value (prepaid money) and additional content-based data" (Light Reading, 2003).

Software providers benefitted from partnering with MNOs to leverage MNOs' customer bases, brand names, and established telecommunication ecosystems. An additional benefit of partnering with MNOs was potentially opening up future growth opportunities through building subsequent platforms in other countries with the same MNO (if multinational) or with other MNOs.

Utiba (GCash, Philippines, with MNO Globe): Co-founder Justin Ho: "Now when we started the first ecosystem of mobile payments [with mobile operator Globe], one of the first in the world in the Philippines, one of the key initiatives that was brought to bear was the ability to be able to remit money directly to a mobile wallet. And on top of that [a few years later], the ability to pay a bill from overseas at a low cost directly to the billing party. ... The opportunities are really boundless. ...building...a vast agent network [with mobile operators]...gives you wide and deep distribution into the rural heartland and [the ability]...to layer services and products that target those particular markets" (CIO Pakistan Web Studio, 2012).

Fundamo (Celpay, Zambia with MNO MSI): Founder Hannes van Rensburg: "Not only was it [the platform] the first real production system of many for us, it was also the first of several other deployments worldwide. Zambia not only proved that it was possible to deploy these types of solutions, but also to do so profitably... Their situation forced us to work out how to deploy our systems on a shoestring, but also how to do so well and accurately. It was the perfect learning experience" (van Rensburg, 2016: 1103).

Fundamo (MTN MobileMoney, South Africa, with MNO MTN): Founder Hannes van Rensburg: "We [Fundamo] were ushered into a small meeting room in the executive suit, where we met Irene [Charnley, a director at MTN]. ... At the end of the meeting she told us that if we improved our delivery and demonstrated that we could meet her expectations, she would like to discuss our supplying mobile money services to all the countries in which MTN operated. The stakes, suddenly, were much higher" (van Rensburg, 2016: 2142).

Implementation Challenges & Firm Responses:

Challenge 1: Coordinating between Platform Co-Providers

Response: Strong and consistent communication and collaboration between platform partners (i.e., practices that resulted in the development of external integrative capabilities).

Fundamo (MTN Mobile Money, South Africa, with MNO MTN): “Of course, it is never easy to build a new partnership with just anybody. Each party has its own ideas about how to proceed, ideas that do not always align. It takes a lot of discussion and flexibility to make a partnership work. ... Our first focus was to make sure that our product and services were exemplary. To this end we applied our best people to MTN, made changes to our internal processes and monitored and reported back on how we were progressing against our new targets. While it was impossible for new technology supporting applications that few understood at the time to be foolproof, we focused on constant improvements” (van Rensburg, 2016: 1532; 2691).

Smart Communications (Smart Money, Philippines, with software provider Sonera Zed): “Smart [Money]’s implementation was innovative and groundbreaking. The idea was simple, but the implementation was complex. It required many years of hard work on the product, the agent relationships and technology, the treasury management, and the marketing to drive adoption of a new category of banking service to a customer base that was mostly unfamiliar with banks” (Realini and Mehta, 2015: 49).

Challenge 2: Identifying an Attractive Value Proposition

Response prior to launch: MC platform provider pairs took different approaches to developing their initial service offerings: some built on observations of the pre-existing customers’ innovative uses of airtime, while others relied on their own perceptions of market needs.

Globe Telecom (GCash, Philippines, with software provider Utiba): “...‘The success of our reloading and load-sharing services inspired us to incorporate the convenience and ease of use of over-the-air mobile transactions into another category that addressed our subscribers’ urgent concerns,’ said Mr. Gerardo C. Ablaza, President and Chief Executive Officer at Globe Telecom” (Sim, 2004).

NTT DoCoMo (OsaiFu-Ketai, Japan, with software provider Sony): “OsaiFuKeitai, a mobile wallet platform enabling quick, contactless transactions for 20 applications...was launched in...Japan, [where] public transport is the primary demand, with more than 2.2 billion passenger trips per month. ... Japanese consumers require fast, high-volume payments, which are starting to cross over from micropayments for public transport to larger payments in the retail sector” (International Finance Corporation, 2011b: 38–39).

Vodafone (M-PESA, Kenya, with software provider Sagentia): “We had to find customers with a real market need to use the service. This may appear obvious, but the mobile commerce market is strewn with technical solutions looking for a problem. We partnered with Faulu Kenya, a local MFI (microfinance institution) with several thousand borrowers, who typically run small businesses. ... The weekly loan repayment ritual is time-consuming, costly, and keeps people away from their businesses. Here, we agreed, was a real market need where mobile commerce could make a significant difference to people’s lives” (Hughes and Lonie, 2007: 70).

Response after launch: MC platform providers actively observed how end users utilized their platforms to create additional or alternative functionality for the platforms. Some firms formalized an explicit experimentation approach with small end user groups in pilot programs.

True Corporation (True Money, Thailand, with software provider Utiba): “TrueMoney is also launching a pilot TrueMoney Machine at Siam Square’s Digital Gateway and at Fortune IT Mall. This fully automated machine can take cash and scan barcodes for bill payments, as well as link to all TrueMoney services without requiring staff. Piyachart said he got the idea from the security guard at his office who complained to him that it would be nice to be able to top up his phone with 10 baht credit a day instead of a big 50 baht credit. The machine can do that and more (and please the security guard at True Tower)” (Leesa-Nguansuk, 2013).

Paggo (Oi Paggo, Brazil, with MNO Telemar Norte Este/Oi): ““In Brazil, there are many street vendors, door-to-door sales people and informal shopkeepers... They don’t work with credit cards, only cash or checks’... But they do all have phones... independent vendors will be able to receive card payments using any Oi cellphone... A pilot scheme is under way” (Gemalto, 2012).

Challenge 3: Driving Increased Usage through Ecosystem Development/Indirect Network Effects.

Response: MNOs leveraged their pre-existing relationships with airtime resellers and forged connections with other large firms to develop the ecosystem and add more users to their platforms.

Grameenphone (BillPay, renamed MobiCash, Bangladesh, with software provider Comviva): “MobiCash was established on the strong distribution foundation built by Grameenphone, leveraging its current network of 600,000 airtime resellers and other mobile communication products and infrastructure throughout the country, as well as its seasoned experience managing these resellers. MobiCash has been able to quickly build its own network of 61,000 agents around the country... The five banks that MobiCash currently serves have a total of six million mobile enabled client accounts. ... Through MobiCash, participating banks increase the range of touch points available to their clients, while reducing the need to invest in building their own agent networks. For individual agents, the platform simplifies the need to maintain separate systems for each bank it serves” (Noor and Shrader, 2015).

NTT DoCoMo (Osaifu-Keitai, Japan, with software provider Sony): NTT DoCoMo’s “core belief ... is that use of payment services will be pulled by the presentation of a range of services to the customer. Therefore, [NTT DoCoMo] has developed a very structured approach to enticing partners onto its content and payment platforms... [NTT DoCoMo] recognized the challenge of convincing retail chains to accept their mobile money scheme. They were deliberate in stressing to these agents the ways in which Osaifu-Keitai would increase both customer convenience and value for their businesses through (1) process speed, (2) versatility, and (3) security” (Mas and Rotman, 2008: 20).

Smart Communications (Smart Money, Philippines, with software provider Sonera Zed): Don Rae, early project leader: ““One of the real insights that gets frequently overlooked is what it takes to make a payment system prosper... It’s a classic chicken-and-egg situation--no volumes and no business... The thing that drove Smart Money adoption was that there was a high volume day-one merchant, which was Smart itself and the [airtime] top-up business. By marrying these two products, we were able to get over the volume hump by being our own biggest merchant with high volumes. ... You need volume and repeatability on day one; after you have that base you can add other streams on top incrementally”” (Realini and Mehta, 2015: 49).

Response: Software providers tailored the platforms to meet the needs of diverse users across the ecosystem to facilitate platform functionality and increase the overall platform user base.

Fundamo (Celpay, Zambia & DRC, with MNO MSI; MTN MobileMoney, South Africa, with MNO MTN): Founder Hannes van Rensburg: “In a vast country like Zambia, with road infrastructure not always at its best, it is a challenging task to distribute fast-moving consumer goods. Companies like Coca-Cola and the local brewery faced many challenges in distributing stock to retail outlets...and collect[ing] cash payments for every consignment. ... Truck drivers would often spend a whole afternoon...trying to reconcile their cash collections with their delivery notes... after years of high inflation, the cash collected could fill a sizable suitcase at the end of a day... many mistakes were made and much time was wasted. [The platform] Celpay offered a logical alternative ... After identifying the opportunity, we started extending the system to

support a cash-on-delivery solution for truck drivers. Truck drivers immediately fell in love with the solution as it reduced the complexity working with cash and improved their sense of security... it was the truck drivers who forced very small shops selling Coca-Cola or beer to subscribe to Celpay, as this was the only way they could receive the stock” (van Rensburg, 2016: 1067).

Utiba (GCash, Philippines, with MNO Globe & M-Money, Malaysia with MNO Maxis): Co-founder Justin Ho: “...[the] big challenge has been about helping the people running these services to make them as successful as possible and here is where Utiba brings its strength to making that successful because implementing a mobile payments system is about bringing essentially three parties together: a [mobile] carrier, a bank, and a merchant ..., so bringing those people together is challenging and bringing a business model together that makes sense for all of those parties is challenging as well. Building that ecosystem is something that we have a long heritage and experience, and what we’ve done out of that experience is build our technology in a way that it helps to accelerate the building of that ecosystem...” (CIO Pakistan Web Studio, 2012).

SO (Cell 2): Firms choosing single-firm provision & open end user access for their platforms

Empirical Data:

7 firms with relatively rich data: Monitise, Obopay, Paybox, Suvidha, Eko, PayMate, WIZZIT

2 firms with limited data: Mint, MCash

0 firms with no available data

1 firm with partial conflicting data: Mint

Founding Characteristics

Resources & Capabilities: Founders/founding teams possessed technological expertise and/or entrepreneurial experience.

PayMate (India): Founder Ajay Adieseshann: “PayMate is my third venture as an entrepreneur, and each of the ventures I set up has enriched me with experience and knowledge that ends up being the biggest asset any entrepreneur can count on. I have a strong penchant for technology and all my ventures thus far have been centered on leveraging technology in order to create disruption in traditional spaces or improve efficiencies” (inventiva, 2018).

WIZZIT (South Africa): Co-founder Brian Richardson: “I have a BCom degree and MBA; I started my career in the Banking industry; rose to position of AGM at age of 27; left and started my own consultancy business and then joined Charles Rowlinson, and got the rights for Thomas International – a personality profiling business which we built into a franchised operation in 37 countries; In 2002 with Charles founded WIZZIT in South Africa and went live in 2004” (Rottok, 2018).

MCash (Brazil): “I worked for almost 20 years in electronic payments industry, including...Visa... In 2002, I left Visa to have an entrepreneur experience with my own consultancy company, the GMATTOS Projetos de Marketing. Nowadays, GMATTOS is reaching its 8th year, developing works and projects [with] Philips, VR, Redecard, Cinemark, Visanet, Visa, Citibank, Paypal and others. ... In 2006, I...negotiated its [MCash’s] first contracts with HSBC and Sodexo” (Gastao Mattos LinkedIn Profile, 2015).

Founders created strong teams that were passionate about making change by building a mobile money platform.

Eko (India): Abhishek Sinha, co-founder: “...we found a team that has shown exceptional commitment in most trying circumstances. When one has so few people, they end up doing everything – some things they’re good at, and others not so; but I have found that if you have passionate

people with the right attitude and believe in the business, you'll be ok. Moving from chaos to order is an integral part of the start-up journey" (India Microfinance, 2009).

WIZZIT (South Africa): Co-founder Brian Richardson: "Having excellent people who shared our passion and enthusiasm and who can execute is critical and we are very blessed to have a truly remarkable team of very talented people" (Ayemoba, 2019).

Motives for entering mobile money: Founders sought to create a platform that made financial transactions easier and more accessible to individuals regardless of geographic location or access to financial services. A corollary to this was a commitment to creating a universal platform serving as many end users as possible.

Eko (India): Co-founder Abhinav Shina: "there was a lot of conversation in the country around financial inclusion and you know a lot of Indians not having a bank account" (The Brand Called You, 2019). Eko "developed a solution that enables customers to do secure financial transactions on a mobile phone...which works beautifully across languages and literacy levels... It is the most secure, usable and universal solution that works on all mobile phones, including ultra low-cost phones, across device manufacturers, operating systems and mobile network operators" (Lahiri, 2014: 42).

Monitise (U.K., U.S.): Founder Alastair Lukies: "Wherever you go in the world, you [the consumer] still want to be able to get access... Every consumer has a mobile phone. They want to be able to bank. They want to be able to pay people, pay bills, pay their friends. And they want to be able to buy stuff... [Our platform is] agnostic. That's the really important thing. We're agnostic to all technology" ("Alastair Lukies, Chief Executive Officer, Monitise Is Interviewed on Bloomberg TV," 2014).

Suvidha (India): Founder Anand Shrivastav: "'It struck me that I could use SMSes for transactions. ... At that time, streamlining financial transactions seemed like a far-fetched idea to most, but I knew this was what I wanted to do.' ... [Suvidha's platform] Beam allows banked and unbanked customers to transact with anyone, anywhere, anytime" (Pal, 2013).

Key Platform Characteristics

Founders were deliberate in their decision to *not* forge exclusive alliances with a particular network operator that would have restricted number and type of end users, given their overarching vision to reach as many individuals as possible.

Obopay (U.S.): Founder Carol Realini: "I want to build something that will give everybody access. ... We're about getting the platform capability and service to as many users as possible, consumers and merchants" (Prows, 2010).

PayMate (India): "When we started out in 2006, mobile phones were available in different Operating Systems and to make a product that works on every single system proved to be a challenge. To tackle this, we introduced SMS based transaction model that worked on 70% of phones. Then, with the entry of smartphones, applications worked to 90% phones" (inventiva, 2018).

Implementation Challenges & Firm Responses:

Challenge 1: Securing Key Resource Partners for Financing and an Initial End User Base

Response: Four startups used a “coupled” strategy, relying on the same key resource partner to provide both funding and access to potential end users. Their partners tended to be large, well-established firms in the financial sector.

Paybox (Germany, Austria, Spain, Sweden, U.K.): Co-founder Eckhard Ortwein: “[Paybox] was so brand new...we said, okay, let’s immediately raise money from investors. ... We raised money from Deutsche Bank. ...we launched the German market ... and [took] the first five months to build the propositioning... What happened after the launch, Deutsche Bank got so excited about it and said, ‘Well, we have to do this across Europe... you will now do Paybox in four other markets, which was Austria, Sweden, the UK, and Spain’” (Mixergy, 2019).

Monitise (U.K., U.S.): Metavante and Monitise formed a joint venture: “Metavante delivers banking and payment technologies to more than 8,600 financial services firms and business worldwide, including 91 of the top 100 U.S. banks... By mobilizing their market reach as well as their breadth of capability ...we are creating an advanced system at a key stage in the evolution of payments innovation” (Baumgarten, 2007).

Response: Five startups used a “decoupled” strategy, relying on two different key resource partners for funding and initial end users. Financing came from development-focused organizations or venture capital funds.

Eko (India): “[Eko] got two grants from CGAP” (Yadav, 2010).

Mint (Sweden): VC firm Ledstiernan invested MSEK 45.3 million in Mint (approximately \$3.5 million) (Ledstiernan, 2001: 16).

Access to an initial set of end users resulted from partnerships with larger firms in the financial sector that already possessed an established customer base.

PayMate (India): “PayMate has tie-ups with over 30 banks including SBI, IDBI Bank, Standard Chartered Bank, Corporation Bank, Royal Bank” (Nag, 2012).

Suvidha (India): Founder Anand Shrivastav: “we decided to start with cash management for a few banks—HSBC, Deutsche Bank, HDFC Bank, and ICICI Bank” (Sharma, 2013).

WIZZIT (South Africa): “Wizzit aims at partnering with either existing banks or microfinance institutions (MFIs)... Using Wizzit South Africa as a test and reference site, Wizzit has taken its mobile banking and branchless banking model to leading banks in emerging markets...” (Realini and Mehta, 2015: 123).

Conflicting data: Mint (Sweden) partnered with the Stockholm City Government (Ledstiernan, 2001: 20).

Challenge 2: Retaining Key Resource Partners

Response: Startups following a coupled strategy had difficulties maintaining relationships with key partners, whose business interests and strategy shifted over time; as a result, they subsequently had difficulty accessing needed resources.

Obopay (U.S.): “early on in our evolution we got very large companies to make commitments to us” (S. Mitra, 2008). Obopay was able to raise almost \$150 million in funding, but “in 2013, Nokia — Obopay’s biggest investor and client — withdrew... [Obopay] imploded and investors wrote off their contributions. It was put on a fire sale” (Gupta, 2017).

Startups following a decoupled partnering strategy did not face this challenge because their key resource partners shared a vision for the future or desire to reach the unbanked. These committed relationships allowed access to partner resources as needed over time.

Mint (Sweden): “We are convinced that we are moving into a new phase of growth and development within IT and telecom, and that the unique competence in mobility - and the opportunities and challenges it presents - possessed by our portfolio companies [including Mint] will make many of our companies winners on the global markets of tomorrow” (Ledstiernan, 2001: 12).

Eko (India): “Branchless banking offers the potential to fundamentally transform the way low-income clients can access financial services and to help them move forward to full financial inclusion. ... The CGAP Technology Program used grant funding to seed...branchless banking implementations [such as Eko] beginning in 2005, when the branchless banking concept was still nascent” (Martinez and McKay, 2011).

Suvidha (India): Founder Anand Shrivastav: “Banks were happy to have our services because they were getting authentic data, faster and cheaper... [At first, the platform] was limited to banked customers...[eventually it] enable[d] transactions for unbanked citizens as well” (Pal, 2013).

Challenge 3: Identifying an Attractive Value Proposition

All initially believed simplifying payments for end users was their platforms’ value propositions.

Mint (Sweden): Value proposition: “Mint’s business idea is to provide a solution for mobile payments, integrated with loyalty programs. Its vision is to move everything in peoples wallets on to a server, including cash, plastic cards (such as credit cards and bonus cards) and eventually even IDs, membership cards and drivers licenses. All you should need to have to access this wallet is your mobile phone, together with a PIN code” (Ekdahl and Pettersson, 2001).

Obopay (U.S.): Founder Carol Realini: “I felt there was a real possibility of banking looking really different. ...Conceptually it [mobile money] is really easy for everyone to understand. I take a mobile phone and set up an account... Once I set it up it gives me access to however much money I have and allows me to do something which is very important – I can send it to any other mobile phone. If you give me your cell phone number I can send you money without knowing what bank you are with” (Mitra, 2008).

PayMate (India): Founder Ajay Adiseshann: “We believe that mobile payments will be the wave of the future as it offers convenience, ease of use and security. Not having to divulge credit/debit card information or carry bundles of cash, puts a lot of consumers at ease” (Business Standard, 2006).

Response: Startups following a coupled strategy believed convenience would drive uptake; however, this did not occur due to payment alternatives available in their markets.

Obopay (U.S.): Founder Carol Realini: “[In the US] you have a very large underbanked society, you have very large numbers of...working people who could benefit from new tools... Mobile [money] will give them convenience, new management tools, will give them some new

kinds of products... I think there's a huge opportunity in the underserved merchant and working family, and that is a growing segment of our society" (Prows, 2010).

Obopay (U.S.): "...in the U.S. the adoption of mobile payments is significantly slower than the rest of the world... The challenge is that there are many alternative payment methods and no differentiating factors or obvious substantial benefits that consumers can see yet" (Federal Reserve Banks of Boston and Atlanta, 2010: 4).

Paybox (Germany, Austria, Spain, Sweden, U.K.): COO Peter Seipp: "To be accepted a payment instrument needs to be widespread and convenient. Although we do not publish concrete figures, it is safe to say that the real trend is surpassing our expectations by far. ...within two months we have overtaken all other new internet payment systems in Germany... Paybox is especially attractive for Internet merchants, because it can potentially be used by a very large group of customers, it is secure, and installation costs are low" (Rader and Maghiros, 2001).

Paybox (Germany, Austria, Spain, Sweden, U.K.): "Paybox tried to establish itself as a payment system in the same vein as credit card giants such as Visa and Mastercard but has been forced to admit defeat... the company has decided to restructure and end its consumer service. [It] blamed its demise on the slow growth of the numbers of people willing to use their phone as a way to pay" (BBC News, 2003).

Response: Startups following a decoupled strategy worked diligently to understand the needs of all potential end users, conducted small-scale pilots, and built trust. Some pivoted based on different types of customers and their needs.

Eko (India): "we have done a lot of local level marketing initiatives to try and talk to customers one on one. We are now seeing that our financial service provider partners are becoming more open to spending marketing dollars to educate this customer base of the veracity of the services being offered. That will go a long way in helping us" (Your Story, 2010).

Suvidha (India): "To market Beam's services, he [the founder] went to small locations and conducted promotions and live demonstrations... 'When customers see a successful transaction in front of their eyes, they start trusting. We also provide financial literacy programs in vernacular languages'" (Pal, 2013).

WIZZIT (South Africa): "a pilot programme designed to make it easy to open accounts, and get preferred pricing, at clothing retailer Dunns' has been launched. If successful, this trial will expand to 289 stores throughout the country. To encourage sign-ups and use, customers will be given incentives to make purchases with their [WIZZIT account]... rather than cash" (Finextra, 2009). "Banking is about trust... It's about money, which is serious business. We want our low-income customers to trust the programs we're offering to them. We also must earn the trust of our bank partners. They need to know that the technology is totally reliable, and that by working with us their reputations will not only not be damaged, but will be enhanced" (Realini and Mehta, 2015: 123).

Conflicting data: Mint, based in Sweden, did not attempt to understand the needs of all potential end users (namely they did not focus on unbanked end users).

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Appendix B. Supplemental Materials for Chapter 3

Documentation of Variables

Table B1. *Variable definitions and data sources*

Variable Name	Variable Definition	Data Source	Coverage
<i>Dependent Variables</i>			
Country with Mobile Money	Dummy equal to one if a country has at least one mobile money platform launch during the sample period 2001-2017; zero otherwise	GSMA	Time invariant
Mobile Money Entry	Country-year specific dummy variable of entry into the mobile money industry	GSMA	2001-2017
Entry Prior to Regulations	Coded 1 if a country allowed firms to launch mobile money platforms prior to setting regulations that specifically discussed mobile money	Author's coding based on several sources	2001-2017
Mobile money accounts (%)	Percentage of adults who use mobile money to pay bills or send or receive money in the last year	World Bank, Global Financial Development Data	2014, 2017 Missing data in 2014 for: Liberia, Morocco, Lesotho, Central African Republic, Mozambique; Missing data in 2017 for: Central African Republic
Sending money (%)	Percentage of adults who use mobile money to send money	World Bank, Global Financial Development Data	2014, 2017 Missing data in 2014 for: Liberia, Egypt, Lesotho, Mauritius, Tunisia, Central African Republic, Ethiopia, Morocco, Mozambique; Missing data in 2017 for: Mauritius, Egypt, Morocco
Paying bills (%)	Percentage of adults who use mobile money to pay bills	World Bank, Global Financial Development Data	2014, 2017 Missing data in 2014 for: Burkina Faso, Lesotho, Morocco, Mozambique, Malawi, Central African Republic, Guinea, Niger, Liberia, Chad, Mali
<i>Explanatory Variables</i>			
GDP per capita	Captures levels of development and economy labor costs; logged for normality	World Bank, World Development Indicators	1996-2017
Population	Proxy for size of market; adult population in 100,000s, logged to ensure normality	World Bank, World Development Indicators	1996-2017
Government Spending (% of GDP)	Proxy for size of government; level of government expenditures as a percentage of GDP	World Bank, World Development Indicators	1996-2017 No data for São Tomé and Príncipe

Mobile Phone Subscriptions per 100 adults	Mobile cellular subscriptions (per 100 people)	World Bank, World Development Indicators	1996-2017
Bank Branches per 100,000 adults	Number of commercial bank branches per 100,000 adults.	World Bank, Global Financial Development Data	2004-2017 No data for DR Congo and Eritrea
Bank Concentration (%)	“Ratio of assets of the three largest commercial banks to total commercial banking assets”	World Bank, Global Financial Development Data	1996-2017 No data for Central African Republic, Comoros, Equatorial Guinea, Guinea-Bissau, Liberia, São Tomé and Príncipe
Mobile Network Operator Concentration (%)	HHI at the country-year level calculated based on the market share of each mobile network operator in a given country-year	TeleResearch Labs, a Washington DC based Mobile Operator Research & Statistics Centre	2007-2016
Polity	Polity Index: a measure of the market supporting character of the political regime and ranges between -1 (total autocracy) and 1 (total democracy)	Polity V database; this variable has been rescaled from its original -10 to 10 range	1996-2017 No data for São Tomé and Príncipe and Seychelles
Control of Corruption	Captures perceptions of 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	World Bank, Worldwide Governance Indicators	1996-2017
ICT Regulatory Index	Captures level of regulatory authority, mandates, regime, competition framework for ICT sector (0 to 1)	International Telecommunication Union	2007-2017
Former British Colony	Dummy = 1 if Britain was a colonial power in this country	La Porta, et al. 1998	Time invariant
Former French Colony	Dummy = 1 if France was a colonial power in this country	La Porta, et al. 1998	Time invariant

Additional Details on Measures of Pre-existing Market Institutions

To capture measures of pre-existing market institutions, I relied on three main categories of data: general country-level market institutions from modern times; general country-level institutions based on history; country-level market institutions from industries closely related to mobile money (e.g., telecommunications and financial services). Additional detail on the main variables used throughout the study can be found in the following sub-sections.

General country-level market institutions from modern times

Two general country-level measures of market institutions from modern times are used in my study: Polity Index and Control of Corruption. Consistent with other cross-country studies (Acemoglu et al., 2005; Acemoglu & Johnson, 2005) and studies on mobile money (Pelletier et al., 2019), I used the variable *Polity Index* to capture how market-supporting each country's political regime is by year. The variable I use is the same as the POLITY2 variable found in the Polity V database and ranges from -10 (total autocracy) to 10 (total democracy) (Marshall & Gurr, 2020). This variable is based on two annualized composite indices that capture a series of indicators for democracy and autocracy that are a part of the larger Polity V database. The Polity Project data dates back to the mid-1970s (Gurr, 1974), and has since gone through several iterations to facilitate comparative quantitative analysis across polities and time. For a detailed description of how these data have been coded, updated, and checked for consistency as well as for the full description of how the POLITY2 variable is computed, please refer to Marshall & Gurr (2020).

Before determining whether to include this variable in regression analysis, I checked the correlations between this variable and several other variables, including the World Bank World Governance Indicators (see more detail below) and the Political Constraint Index (POLCON) dataset (Henisz, 2017). The Polity Index and several measures of the POLCON data are highly correlated, given that part of the POLCON data relies on part of the Polity IV data (a previous iteration to Polity V). At the time of writing, the POLCON data had been released through 2016, creating one year of missing data for my sample. For these reasons, I relied on the Polity V data.

To capture the extent to which corruption may be present, the variable *Control of Corruption* from the World Bank's World Governance Indicators (WGI) measures the

perception in each country of the extent to which public power is exercised for private gain and ranges from 0 (high levels of corruption) to 100 (low levels of corruption) and provides a proxy for a country's rule of law (Kaufman & Kraay, 2019). In a white paper describing the methodology for creating the WGI, the WGI are described as “six composite indicators of broad dimensions of governance covering over 200 countries since 1996: Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. These indicators are based on several hundred variables obtained from 31 different data sources, capturing governance perceptions as reported by survey respondents, nongovernmental organizations, commercial business information providers, and public sector organizations worldwide” (Kaufman et al., 2010). For the Control of Corruption variable, such sources include Transparency International's Global Corruption Barometer Survey, the Institutional Profiles Database, the Varieties of Democracy Project, the World Justice Project Rule of Law Index, and so on; a full list can be found at <http://info.worldbank.org/governance/wgi/Home/Documents#wgiDataSources>. Another WGI variable *Rule of Law* “captures perceptions of the extent to which agents have confidence in and abide by the rules of society” (Kaufmann et al., 2010). This variable is relevant to my study and has been used in prior work on mobile money (Lashitew et al., 2019). In my sample, this variable is highly correlated with Control of Corruption ($\rho > 0.8$) and moderately correlated Polity Index with ($\rho > 0.4$). Because Polity Index and Control of Corruption are not highly correlated with each other, I rely on Control of Corruption rather than the Rule of Law measure in the analyses conducted in this study. The Control of Corruption variable can also be found in recent work on mobile money (Pelletier et al., 2019).

Alternative indices exist that provide measures of general country-level market institutions. Two common indices include the Heritage Foundation's Economic Freedom Index and the Fraser Institute's Economic Freedom of the World Index. Both indices provide measures that capture the degree to which economies are free from government interference. Scholars have pointed out that these indices may have "a slight ideological bend...anchored in neo-liberal philosophy and the assumption of free market superiority" (Kostova et al., 2020). The interested reader can refer to Ochel & Röhn (2006) for an in-depth examination of these two indices. For my purposes, I did not use the Fraser Institute's data because the yearly data collection starts with 2000, and it was missing information for around 30% of the African countries in my dataset, particularly in the earlier years of my sample.

I examined components of the Heritage Foundation's index, most notably its measure *Financial Freedom*, which is a "measure of banking efficiency as well as a measure of independence from government control and interference in the financial sector" (<https://www.heritage.org/index/financial-freedom>). This measure has been used in prior work on mobile money (Pelletier et al., 2019) and could have provided a measure of market institutions for the financial services sector. However, this variable was missing data for multiple years for 20 countries in my sample (representing over 10% of the data), and it was moderately correlated with Control of Corruption ($\rho = 0.3931$). I chose to rely on the World Governance Indicators' data given that "WGI might be more in line with the conceptual essence of North's formal institutions" (Kostova et al., 2020) and because the Control of Corruption variable had no missing data.

General country-level market institutions based on history

I also included a measure of historical market institutions based on the idea that countries have “legal origins” that matter for legal and economic outcomes, and some of the institutions imposed by European colonizers across Africa may persist in countries’ legal systems today (Acemoglu & Johnson, 2005; la Porta et al., 1998). Specifically, I included a time-invariant dummy for whether a country was a *Former British Colony*, consistent with how this variable is measured in prior work. A variable for former French colony is reported in the descriptive statistics and robustness checks using this variable can also be found in this Appendix. The variable former French colony is negatively and statistically significantly correlated with the variable former British colony: $\rho = -0.51$ for all African countries in my sample, and $\rho = -0.6$ for countries with mobile money entry. Because of this high correlation, I rely only on the former British colony dummy variable in regression analyses. This correlation reflects historical colonization patterns in which only present-day Cameroon had both British and French colonizers. Of the 51 African countries in my sample, 19 have British colonial history, 19 have French colonial history, 13 countries have some other colonial history (e.g., German, Italian, Portuguese), and 1 has no colonial history (see Table B5).

The variable *Former British Colony* is highly correlated with a common law legal system that is composed of a limited number of laws ($\rho > 0.8$). In contrast to the common law system is the French civil law system, most prevalently imposed by French colonizers in Africa, which is based on extensive codification and is associated with a large number of legal rules and provisions (la Porta et al., 1998; Mancuso, 2008). I chose to rely on colonial history variables rather than the common law or civil law variables based on scholarship that has shown that the modern-day legal systems of African countries should not be coded dichotomously into common

law or civil law traditions due to the amalgamation of customary laws that predate colonizers, influence of religious law (Islam), and in some countries a history of multiple colonizers, all of which have given rise to hybrid law systems (Mancuso, 2008). The colonial history variables are thus used to capture potential imprinting of former colonizers' transplanted market institutions on modern day market institutions.

Country-level market institutions from industries closely related to mobile money

Beyond general market institutions at the country level, I also wanted to capture institutions relevant to the mobile money industry. These would be measures that captured market institutions related to the telecom and financial services sectors. In order take into consideration differences in regulatory quality in the telecom sector, and to be consistent with prior work on mobile money (Lashitew et al., 2019) and prior work that has examined the competitiveness of the telecom sector (Waverman & Koutroumpis, 2011), I included the variable *ICT Regulatory Index* publicly available from the International Telecommunication Union (ITU) (for full details on how this index is created, refer to <https://app.gen5.digital/tracker/metrics>).

This variable is based on 50 indicators that have been grouped into four main clusters:

“Regulatory authority (focusing on the functioning of the separate regulator), Regulatory mandates (who regulates what), Regulatory regime (what regulation exists in major areas) and Competition framework for the ICT sector (level of competition in the main market segments).

Data is available at the country level dating back to 2007 and ranges from 0 (poor or limited regulatory practices) to 100 (internationally recognized regulatory best practices). This data “is based on self-reported information gathered via official ITU Surveys to Member States Administrations, datasets compiled by international organizations as well as desktop research

based on official government sources and direct outreach to national telecom/ICT regulatory authorities” (<https://app.gen5.digital/tracker/metrics>).

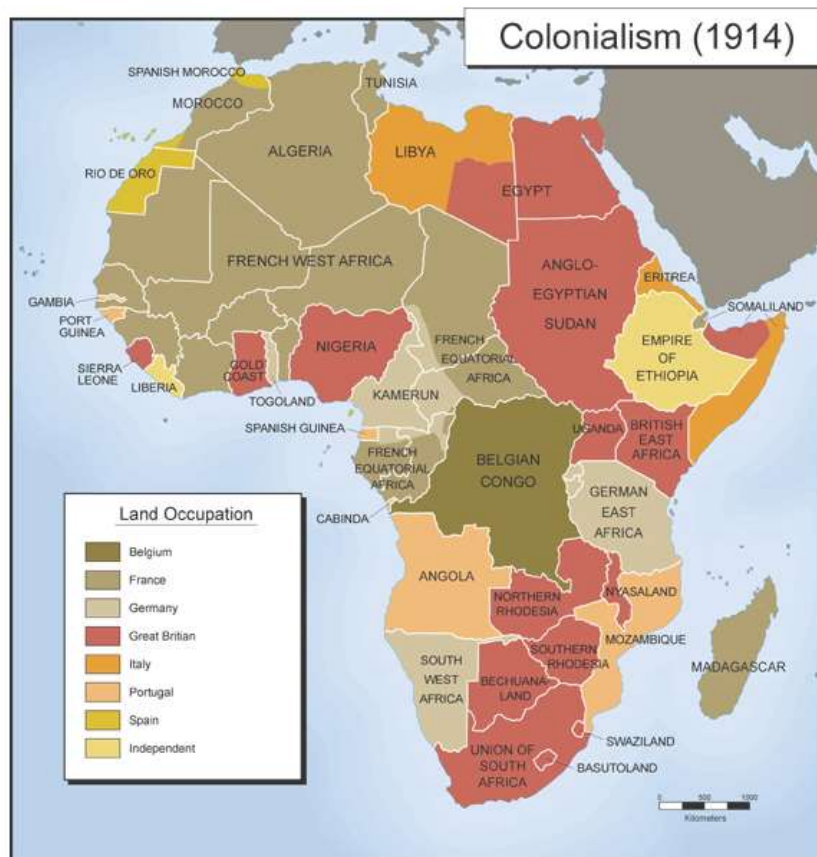
I explored multiple measures related to market institutions for the financial sector, but ultimately did not use any in my regression analyses. One of the most used data sources in scholarly research has been the World Bank’s Doing Business database, which provides yearly indicators related to the efficiency of a country’s financial infrastructure (e.g., contract enforcement, getting credit); however, this database has recently come under scrutiny for “data irregularities” related to ethical concerns about the way in which the data was collected and has since been discontinued (The World Bank Group, 2021). Given the lack of credibility with this data source, I elected not use any of these measures. I also examined measures from the Heritage Foundation’s Freedom Index – see discussion of the Financial Freedom measure above for why I did not include it. I did include related measures from the World Bank’s Global Financial Development Data such as the prevalence of bank branches and the concentration of the banking sector in this study’s descriptive statistics. Some of these data only date back to 2004 and some of these data was missing for close to 30% of the data, making imputation difficult and limiting their applicability in capturing market institutions that predate the mobile money industry.

Additional Details on Africa’s Colonial History

European colonization of Africa began in the late 19th and early 20th centuries, and the colonial period was largely over by the 1960s (Duignan & Gann, 1967; J. Parker & Rathbone, 2007). The major colonial powers included Britain, France, Germany, Portugal, Italy, and Belgium. Figure B1 provides a map of colonialism in Africa circa 1914, reproduced from Exploring Africa (2022b). Table B5 categorizes the number of contemporary countries based on colonial history. Notably, Britain and France colonized most contemporary countries in Africa;

together, they colonized 37 out of 51 countries (73%). Table B6 documents which countries took an Entry First vs. Regulations First approach to mobile money based on British or French colonial rule.

Figure B1. *Map of colonialism in Africa, 1914*



Source: African Studies Center at Michigan State University, Exploring Africa Program
<http://exploringafrica.matrix.msu.edu/colonial-exploration-and-conquest-in-africa-explore/>

Table B5. *Number of African countries based on colonial history*

Colonial Power	Total # of Countries	# of Countries with No Mobile Money	# of Entry First Countries	# of Regulations First Countries
British	19	0	12	7
French	19	2	4	13
Italian	3	2	0	1
Portuguese	5	3	1	1
German	6	0	4	2
Belgian	2	0	2	0
None	1	0	0	1

Notes: n= 51. Liberia is the only African countries with no colonial history. Cameroon had British, French, and Germany colonizers. Tanzania had British and German colonizers. Libya had French and Italian colonizers. Togo had French and German colonizers. Rwanda had German and Belgian colonizers. Spain is not represented in this table as it controlled a few smaller territories.

Table B6. *Countries with mobile money based on regulatory approach and history of British/French colonizers*

	Entry First		Regulations First	
Former British Colony	Botswana Egypt Lesotho Mauritius Sierra Leone Uganda Zimbabwe	Cameroon* Kenya Malawi Nigeria Sudan Zambia	Eswatini/Swaziland Gambia Ghana Nigeria Seychelles South Africa Tanzania	
Former French Colony	Cameroon* Madagascar Mauritania Morocco		Benin Burkina Faso Chad Congo Cote d'Ivoire Gabon Central African Republic	Guinea Mali Niger Senegal Tunisia Togo

Notes: Cameroon was both a British and French former colony. Countries with mobile money that were neither a British nor French former colony include: Burundi, DRC, Ethiopia, Guinea-Bissau, Liberia, Mozambique, Namibia, and Rwanda.

European governance of colonies took two major forms: direct rule and indirect rule (Crowder, 1964). Direct rule, favored by the French, Belgians, Germans, and Portuguese, relied on centralized administrations in urban areas. These governance systems were “erected on an ethnocentric assimilationist paradigm that refused to interpret culture as a dynamic process and, accordingly, to incorporate African cultural elements, preferring instead to dismiss, repudiate and systematically erase African identity” (D. Thomas, 2006, p. 9). In contrast, indirect rule,

primarily used by the British, utilized “indigenous African rulers within the colonial administration” and often kept existing rulers in power (Exploring Africa, 2022a). This was a more decentralized approach, and political scientists suggest that indirect rule “appealed to the British both because it appeared to respect native traditions and because it economized on money and manpower” (A. Lee & Schultz, 2012, p. 11). Other scholars have drawn a connection between indirect rule and ‘decentralized despotisms’ in creating “illegitimate power structures that survived the end of colonial rule and...in part explain the political authoritarianism of contemporary Africa” (Mamdani, 1996; J. Parker & Rathbone, 2007, p. 111). Historians John Parker and Richard Rathbone summarize, “The more we discover about colonial rule, the more fragmented, contradictory, and malleable it appears to be, dependent on the active participation of some Africans and full of autonomous spaces within which others pursued their own agendas” (J. Parker & Rathbone, 2007, p. 109).

Additional Descriptive Statistics

Table B2. *Descriptive statistics comparing countries with and without mobile money, 2007*

Variables	Countries with Mobile Money (n=43)		Countries with No Mobile Money (n=8)		t-test	All Countries (n=51)			
	Mean	S.D.	Mean	S.D.	Pr(T>t)	Mean	S.D.	Min	Max
Adult Population	11,500,000	16,000,000	5,882,440	9,166,242	0.367	10,800,000	15,300,000	64,272	82,100,000
GDP per Capita (constant 2010 US\$)	1,976.53	2,576.04	6,183.15	6,406.10	0.003	2,553.91	3,573.36	225.86	18,243.24
Government Spending (% of GDP)	14.65	6.87	12.49	3.51	0.456	14.39	6.57	3.21	35.29
Mobile Phone Subscriptions per 100 adults	29.39	23.53	36.83	28.96	0.455	30.41	24.15	1.50	86.12
Bank Branches per 100,000 adults	4.06	7.06	7.61	7.03	0.301	5.07	6.94	0.36	40.44
Bank Concentration (%)	76.84	16.99	85.71	10.55	0.315	77.66	16.61	44.35	100
Mobile Network Operator Concentration (%)	60.05	21.23	73.90	37.98	0.161	61.95	24.16	0	100
Polity Index	-0.51	5.22	1.00	7.32	0.761	1.65	5.52	-9.00	10
Control of Corruption	35.14	22.30	30.31	26.86	0.792	32.32	21.48	2.43	80.10
ICT Regulatory Index	43.31	17.97	30.79	22.56	0.104	41.59	18.92	2.50	81
Former British Colony	0.43	0.50	0	0	0.028	0.37	0.49	0	1
Former French Colony	0.39	0.49	0.29	0.49	0.617	0.37	0.49	0	1
Never Colonized	0.02	0.15	0	0	0.694	0.02	0.14	0	1

Notes. The following countries are missing data on some variables: Central African Republic, The Gambia, Guinea-Bissau, Liberia, and Seychelles. Appendix Table B1 contains more detail.

Table B3. *Descriptive statistics comparing by regulatory approach, 1996*

Variables	Entry First (n=20)		Regulations First (n=23)		Pr(T>t)
	Mean	S.D.	Mean	S.D.	
Adult Population	8,717,777	9,451,838	8,791,826	14,100,000	0.984
GDP per Capita (constant 2010 US\$)	1,331.71	1,418.74	1,955.04	2,833.37	0.378
Government Spending (% of GDP)	5.48	4.77	5.22	3.64	0.841
Mobile Phone Subs. per 100 adults	14.59	7.23	12.64	5.89	0.337
Bank Branches per 100,000 adults	0.13	0.41	0.21	0.54	0.579
Bank Concentration (%)	3.96	4.50	4.14	8.74	0.935
MNO Concentration (%)	86.95	16.99	87.77	17.96	0.884
Polity Index	60.90	20.32	57.57	21.08	0.602
Control of Corruption	-0.20	6.07	-0.55	4.42	0.833
ICT Regulatory Index	36.83	22.12	32.07	21.79	0.482
Former British Colony	49.49	16.76	38.77	17.77	0.049
Former French Colony	0.60	0.50	0.30	0.47	0.053
Never Colonized	0.20	0.41	0.57	0.51	0.014

Table B4. *Descriptive statistics comparing countries by regulatory approach, 2007*

Variables	Entry First (n=20)		Regulations First (n=23)		Pr(T>t)
	Mean	S.D.	Mean	S.D.	
Adult Population	11,700,000	12,700,000	11,800,000	18,800,000	0.983
GDP per Capita (constant 2010 US\$)	1,748.68	2,051.84	2,228.52	3,025.08	0.552
Government Spending (% of GDP)	15.19	7.17	13.70	6.42	0.476
Mobile Phone Subs. per 100 adults	26.74	20.81	32.84	25.64	0.401
Bank Branches per 100,000 adults	4.60	4.89	4.68	8.34	0.968
Bank Concentration (%)	75.34	16.42	78.41	17.88	0.579
MNO Concentration (%)	60.90	20.32	57.57	21.08	0.602
Polity Index	3.00	5.08	1.00	5.26	0.218
Control of Corruption	34.71	23.41	30.60	19.18	0.531
ICT Regulatory Index	49.49	16.76	38.77	17.77	0.049
Former British Colony	0.60	0.50	0.30	0.47	0.053
Former French Colony	0.20	0.41	0.57	0.51	0.014
Never Colonized	0	0	0.04	0.21	0.357

Robustness Checks

The following sub-sections present robustness checks for the models presented in the main text. The variable *Former British Colony* is replaced with a variable *Former French Colony* as well as a variable *Non-British Former Colony*.

Likelihood of entry

Table B5 reports the coefficients of a linear probability model, regressing the dummy variable for whether a country experiences mobile money entry on pre-existing country level factors associated with modern and historical market institutions, controlling for GDP per capita. The two models include different measures related to historical market institutions. Model (1) includes a dummy variable for *Former French Colony*; while model (2) includes the dummy variable *Non-British Former Colony*. The coefficients in model (1) are relatively similar in sign and magnitude to the coefficients reported in Table 4 in the main text that uses the *Former British Colony* dummy. In model (1) the coefficients on control of corruption and ICT regulatory index are slightly larger than they are in Table 4, but the sign is the same and both are insignificant. The biggest difference between the two models is that the coefficient on former French colony in model (1) is almost half the size as the coefficient on former British colony in Table 4, and it is not statistically significant. In model (2), the coefficient on non-British former colony is small, negative, and statistically insignificant. In terms of economic significance, being a non-British colony decreases the probability of mobile money entry in a country by 0.05 compared to countries that are former British colonies. Together these two models support the evidence reported in the main text related to the persistence of historical institutions, particularly for former British colonies.

Table B5*Correlations between pre-existing market institutions and country level outcomes*

Variables	(1)	(2)
Polity Index '96	0.007 (0.080)	0.001 (0.079)
Control Corruption '96	0.234 (0.282)	0.215 (0.280)
ICT Regulatory Index '07	0.391 (0.255)	0.357 (0.277)
Former French Colony	0.083 (0.086)	
Non-British Former Colony		-0.051 (0.105)
Log GDP per Capita	-0.131** (0.06)	-0.130** (0.061)
Constant	1.51*** (0.332)	1.58*** (0.426)
Observations	49	49
R-Squared	0.3100	0.3139

Notes. Robust standard errors are reported in parentheses. * $p < 0.1$; ** $p < 0.05$;

*** $p < 0.01$. $n=49$; two countries are dropped due to missing data on the Polity Index variable (the island nations of Seychelles and São Tomé & Príncipe).

Time to first entry

Using a Cox proportional hazards regression, I modeled the time to first entry in each country. Table 5 reports the hazard ratios. Models (1) and (2) report results with only the variable for Former French Colony and Non-British Former Colony. Models (3) and (4) include the full set of variables. In Models (3) & (4), the hazard ratios on polity index, control of corruption, and log GDP per capita are all insignificant; while, the hazard ratios for the ICT Regulatory Index are significant.

The hazard ratio for former French colony in Model (3) is close to 1 and insignificant, indicating that countries that were former French colonies did not experience faster time to entry compared to countries that were not French colonies. In Model (4) the hazard ratio on non-British former colony is < 1 , suggesting a slower time to entry, though it is not significant.

Table B6*Proportional hazards analysis of time to mobile money entry*

Variables	(1)	(2)	(3)	(4)
Polity Index '96			1.10 (.344)	1.14 (0.350)
Control Corruption '96			0.81 (0.671)	0.727 (0.585)
ICT Regulatory Index '07			10.46** (10.12)	10.51** (10.37)
Former French Colony	0.970 (0.306)		1.14 (0.372)	
Non-British Former Colony		0.724 (0.227)		0.76 (0.242)
Log GDP per Capita '96			0.75 (0.137)	0.74 (0.140)
LL	-139.95	-139.43	-135.43	-135.22
Chi-Square	0.01	1.04	9.06	9.48

Notes. n= 49.; Standard errors are reported in parentheses. * p < 0.1; ** p < 0.05; *** p < 0.01.

Likelihood of a country allowing entry prior to passing mobile money specific regulations

In these models, the coefficients on polity index and control of corruption continue to be small and statistically insignificant. Similarly, the coefficients on ICT regulatory index, while statistically insignificant, is positive, suggesting countries with more market-supportive regulations in the ICT sector are associated with a higher likelihood of allowing mobile money entry prior to creating mobile money specific regulations. In Model (1) the coefficient on former French colony is negative and statistically significant ($\beta=0.381$, $p<0.05$). This coefficient is of similar to magnitude to the coefficient of former British colony found in the main text, but the signs are reversed. In terms of economic significance for the linear probability model, being a former French colony decreases the probability of country taking an Entry First approach by 0.38 compared to countries that are not former French colonies. The coefficient on Non-British Former Colony in Model (2) shows similar results to Former French Colony in Model (1).

Table B7*Correlations between pre-existing market institutions and regulatory approach*

Variables	(1)	(2)
Polity Index	0.008 (0.016)	0.007 (0.017)
Control Corruption	-0.129 (0.392)	0.097 (0.409)
ICT Regulatory Index	0.691 (0.430)	0.578 (0.448)
Former French Colony	-0.381** (0.150)	
Non-British Former Colony		-0.315* (0.164)
Log GDP per Capita	-0.015 (0.075)	-0.077 (0.083)
Constant	0.435 (0.522)	0.872 (0.619)
Observations	42	42
R-Squared	0.4777	0.4919

Notes. Robust standard errors are reported in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. *Entry prior to regulations* = 1 Entry First countries, and = 0 Regulations First countries. Variables have been lagged two years from either first mobile money entry or first mobile money specific regulations, depending on regulatory approach. $n = 42$; Seychelles is dropped due to missing data on the Polity Index variable.

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