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Keith Breckenridge

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The global ambitions of the biometric anti-bank: Net1, lockin and the technologies of African financialisation

Keith Breckenridge

Wits Institute for Social and Economic Research (WISER), Johannesburg, South Africa.

ABSTRACT

This paper follows the development of Net1 UEPS—the firm that, until recently, delivered social grants to a third of the South African population—from its origins in the precocious interbank networking systems that developed here in the early 1980s to its position as the outstanding international agent of biometric banking for the world's poor. The paper shows that an unrelenting engineering effort lay behind the company's growing infrastructural dominance. Two decades ago Shapiro and Varian labelled this strategy lockin, and the paper shows that Net1 followed their suggestions to the letter until the very recent public debacle that shattered the company's control over its South African market. The paper also suggests that networked financialisation should be understood as the product of carefully and consistently engineered technological interventions designed to address political and economic interests in the face of political and legal constraints and regulation. This is to argue for a return to the idea of soft determinism in the study of financialisation: that key technological changes are motivated by and support political interests.

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Net1 UEPS is a South African financial services and network systems developer that is listed on the NASDAQ and the Johannesburg Stock Exchange. The company was founded in 1989 by Serge Belamant, a French-South African engineer, and he has been its indefatigable and controversial champion, strategist and lead engineer. As I explain below, by the early 2000s Net1 was responsible—through its South African subsidiary Cash Paymaster Services—for the bulk of the cash grants paid to millions of the poorest people in South Africa. By 2010 Net1 was the outstanding global champion of biometric cash transfers. From February 2012, the company secured the single national contract for the payment of 16 million grants using a new biometric identification database and biometric authentication. Net1's post-2012 biometric monopoly kindled long-held public worries about the firm's exploitative relationship with the grant recipients as customers, and growing national outrage about its ties with key figures in the state. In a series of rulings between September 2012 and May 2014 the South African constitutional court invalidated Net1's national contract and then moved

CONTACT Keith Breckenridge keith@breckenridge.org.za

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to take control of the tender away from the state. Public concerns reached the status of a national panic in February of 2017 as it became clear that the officials at the South African Social Security Agency (SASSA) responsible for the tender planned to ignore the court's instructions to appoint a new contractor. The Net1 crisis quickly became embroiled in the high-stakes struggle between factions of the ANC, and the officials closest to the company were conspicuous losers in the outcome of that conflict. By November 2017 a new, court-supervised, tender for the social grants had been awarded to the South African Post Office.

Over the last five years thousands of newspaper reports and opinion pieces have been written by the conspicuously well-intended, condemning the company as an agent of state capture, widespread corruption, fraudulent deductions, usurious lending to the poor and the aged, and illegal exploitation of welfare data for the purposes of selling financial products. Most of these charges are overstated and some are groundless. Almost all of them ignore the existing context of bitter conflict within the ruling African National Congress—pitting supporters of a provincial faction backing Jacob Zuma against supporters of a Treasury faction backing Cyril Ramaphosa—and the recent history of explosive lending, intensive credit surveillance and ongoing reluctance from the large banks to offer services to the rural poor (James 2015).

Yet beneath all of the outraged charges lies an indisputable problem about the firm's current arrangements for the distribution of social grants. For millions of the most vulnerable people—especially those living in the poorest regions of the country—only Net1 can deliver the grants. It is this fact, the state's reluctance to act to undo it over many years and the implication that the company is holding a 'gun to the country's head' that prompted loud protests from NGOs, the courts and the press (this metaphor is commonplace. See Thamm 2018, 2017; de Goede 2017). The tension between the company's monopoly power and the state's regulatory responsibility generated a national political crisis of the first order. This is important beyond South Africa in two ways. The story highlights the dangers—for regulators and firms—of the intractable politics of infrastructural lockin, and especially its paradoxical and destructive effects in the context of a national moral panic. The Net1 history demonstrates the explosiveness of the coercion implied in technological lockin—some of it implied by Shapiro and Varian (1998) in their original analysis—but that rarely forms part of the contemporary discussions of the dangers of network effects. Focus on lockin, and on the careful and deliberate elaboration of software and network dependencies in the evolution of the company over decades, also makes another important and neglected point. It demonstrates – after a decade of interest in over-determined actor-networks – that many of the key features of financialised capitalism have been carefully engineered in order to circumvent reforms and policy constraints. At a preliminary level of change—in the design of firms and their strategies—I want to propose a more technologically deterministic and engineered explanation of the politics and economics of financialisation than is currently influential in either the linguistic or the materialist schools of research on this subject (Çalışkan and Callon 2009; Çalışkan, 2010; Appadurai 2015).

This is to apply to the African continent the arguments and insights of the school of economic sociology that runs from Winner to MacKenzie, and especially Poon's work on the financial market-making effects of the data gathering and scoring pursued by the American credit rating agencies. The Anglophone scholarship invokes the authority,

especially, of Michel Callon's work on the effects of devices on the development of markets, but it is also noticeably less preoccupied with the French and American pragmatist reconstruction of successful economic arguments (or with the development of neologisms) and more concerned with the old Marxist worries about capital and exploitation (Castells 1996; MacKenzie 2006, 2008; Poon 2007; Muniesa, Millo, and Callon 2007; Çalışkan and Callon 2009; Çalışkan, 2010). In that sense in this work there is a soft technological determinism attributing new methods for extracting value and fostering capital accumulation to the network, the devices and the mathematical algorithms for measuring risk that combines them (MacKenzie and Wajcman 1999, chap. Introduction).

The most well-developed critique of this materialist sociology and, indirectly, of the emphasis I place on the technological influences on financialisation has emerged from a group of scholars associated with the Cultures of Finance Group in New York. Appadurai's *Banking on Words*, which tries to show that networked finance remains essentially the same linguistic practice as the seventeenth century Calvinists' 'gamble on God's grace,' summarises this position clearly (Appadurai 2015, 42). Appadurai draws on Ayache's *Blank Swan* to urge us to see that the networked financial transactions of our era remain subject to the same anthropological analyses of rules and processes that have long been taught in Anthropology and Sociology. In building this optimistic case for our ability to escape the mathematical 'prison-house of probability' Appadurai draws on Holmes' study of the rhetorical obsessions of the German and New Zealand central banks—the efforts to use 'open mouth policy' to shape public expectations and cultures around the money market. 'Words,' as Holmes explains, 'came to mediate the evolution of prices' (Holmes 2014, chap. 6). He shows that in the real world of central banking 'walking about'—in contrast with the 'pseudoworld of econometrics'—was ethnographic in its practice and best studied using the tools of traditional anthropology (Appadurai 2015, chap. 11). A similar, although more troublesome, point emerges from Appadurai's use of Riles' study of the administrative paperwork required to create collateral behind the enormously valuable derivatives trading of the largest Japanese banks. Here, Riles insists, the contracts between traders were 'made up of very ordinary, mundane practices, techniques, theories, ethical positions, and subjects, very much like those found in other aspects of law and markets or indeed, of social life more broadly' (Riles 2011, 259). Her study is richly illustrative of the mundane forms of paper-based contracting required to create collateral properties—the virtual "second nature" of capital that has been made famous by de Soto. (de Soto, 2000, 44–5) But Riles' story is also unreliable evidence for Appadurai's case because so many of the mundane paperwork processes described in her study have been automated since the publication of her book (ISDA Collateral Steering Committee 2013).

Biometric cash transfers—like the finance economy in general—can be fruitfully studied using the long-established tools of philosophical and sociological analysis. The recent work by Ferguson on the Basic Income debate and Schraten's philosophical analysis of consumer debt in South Africa after 2005 both succeed in doing this (Ferguson 2015; Schraten 2018). The key local protagonists of what can be called the biometric revolution—Serge Belamant in South Africa, Nandan Nilekani in India, Mwende Gatabaki in Kenya, or Nigeria's Chris Onyemenam—offer philosophically competent explanations of what they are trying to do. (The same can be said of the global advocates, like ID4Africa's Joseph Atick.) But these

philosophical justifications are also thin and forced, usually presenting some well known line from de Soto's argument about the mysteries of capital or an exhortation from the founder of the Grameen bank. They have, as I show below, only a tenuous link to the technological drivers of biometric finance. Close attention to the computational work of the Net1 engineers shows the impressive effort to bypass and rework legal limits and their financial effects on millions of ordinary people. This suggests that the discursive analysis of the normative and institutional rules on financial contracts, which, as Schraten shows, worked to constrain 'the initial equality of contracting parties,' may understate the informational and economic imbalance and asymmetries of power (Schraten 2018, 86). Of course those, following Appadurai, who insist on the explanatory power of linguistic analyses can point to the great normative crisis—triggered by the abhorrent facts of Net1's control of the grant recipients—as the final determinant of the form of the financial technologies, and, indeed, of the fate of the company. But that is also to jump over the most interesting elements of this story.

The politics of lockin

Lockin is a familiar, almost banal, indicator of success in the contemporary information economy. Old and young people now routinely make decisions about devices, software and services with the suite of interdependent products, and users, that each supports clearly in mind. Blackberry, Microsoft, Apple, Samsung, Android—the names mark out bounded networks of compatible resources and fiercely defended terrains of control over the global market in personal communications. 'The great fortunes of the information age,' Shapiro and Varian observed 20 years ago, 'lie in the hands of companies that have successfully established proprietary architectures that are used by a large installed base of locked-in customers' (Shapiro and Varian 1998, 145). Lockin, in other words, is both the determinant and the measure of business success in the network economy. It is also complicated and tricky, involving existential battles to secure an installed base of customers, the elaboration of dependent products and struggles over open or closed standards that can strengthen or destroy firms. And lockin routinely leads to bitterly fought out legal battles over monopolisation on both the supply and demand sides of markets (Varian, Farrell, and Shapiro 2005, 90–93).

Yet, because successful lockin is often a result of network resources generated by other users' adoption of a specific product—here Apple and Google are only the most recent examples of companies exploiting networks dating back to the nineteenth century—it is not at all obvious whether locked-in customers (and suppliers) are beneficiaries or victims. What is clear is that a heavy burden falls on the regulators of what are often 'natural monopolies' to maintain the balance between benefits and switching-costs, and, importantly, to control the potentially destructive forms that competition may take—transfers to consumers, bribes to officials, wasted infrastructural capacity—between these firms (Varian, Farrell, and Shapiro 2005; 42–43; Shapiro and Varian 1998; 152–94).

The Net1 story is a case study of how very effective lockin can go wildly wrong, and—like the recent public revulsion confronted by Uber and Facebook—it suggests that the dangers of successful lockin need to be more clearly articulated. The firm history of Net1 is in part the familiar predicament of vendor lockin—where the state must confront large, perhaps unsustainable, switching costs to break free of its dependence on the company for grant delivery

and data processing. This is a point that was made frequently by both the SASSA officials and the company over the last ten years. Vendor lockin, where the company licenses an indispensable service to the state and the public over several contract cycles, is a common feature of the information technology landscape, and, as the struggle over the current South African population register shows, it is not easily avoided (Breckenridge 2008).

Net1's case is unusual because, in addition to the common elements of proprietary products, platforms and data-processing, the company has specialised, from its origins in the late 1980s, in providing payment services in the regions of the country least served by the state, by other companies and by the public infrastructures of roads, power and communications. These are also the regions—in the former bantustans—in which the majority of the country's poor currently live. It is this infrastructure lockin that lies behind the irritable recalcitrance of the SASSA officials responsible for managing the grant contracts and, more obviously and controversially, the insouciance of the company's founder, Serge Belamant's claim, that the state 'will need to use pigeons' to deliver social grants without them. (Mzekandaba 2017) Infrastructure lockin—especially in the deep rural areas of the country—is key to the history of Net1, but in this paper I want to draw attention to a more general interest in lockin as strategy and to explain the unanticipated and devastating reaction it has provoked.

Net1 seems to have followed the instructions of *Information Rules* step by methodical step. In the development of their own revolutionary technology, the securing of an installed base of customers, the licensing of their product to the global monopoly and the development of an interdependent product suite on their own platform, the evolution of the company bears a striking resemblance to the plan laid out in the best-selling guide to the dotcom boom that was subtitled the *Strategic Guide to the Network Economy*. Until the legal battles that followed the awarding of the single national tender for social grants in 2012—also predicted by Shapiro and Varian—the company achieved distinctive, indeed startling, international success in attracting investors and marketing its technology. Ultimately, however, the company's technical obsessions and success with lockin encouraged over-reach and hubris, which provoked broad and reinforcing progressive outrage, especially as the technological monopoly reached into parts of the South African economy—like the townships adjacent to Cape Town and the markets of the largest banks—ill-matched to the coercive and severe infrastructures the company developed for the political-economy in the bantustans.

The global smart card infrastructure

Net1 is now often described as a biometrics company, but the company's distinctive technologies all operate on smart cards—the ubiquitous 'tamper resistant mobile computer' of our age.(Guthery and Cronin 2002, 124) These tiny, impenetrable, and cryptic miniature computers were adopted on billions of cellphones and payment cards during the 1990s. This is an important point because it underscores three features of Net1's success as a company that would also be replicated by Safaricom a decade later in Kenya relying on the cheapness, simplicity and uniformity of the global pool of smart cards. It is simplicity, in particular, that requires some emphasis because it is rarely visible—smart cards are tiny programmable computers, capable only of presenting a starkly limited menu of options, designed to communicate with each other in encrypted

formats best measured in bits. This informational simplicity also supports extremely slender forms of communication between cards (and across networks) and it stands in contrast with the smart phones of our own era, which are massively more demanding of power, computational resources and networking. Smart cards, despite their name, are ideal forms of computational parsimony. That is also why they have been so successful —especially on the African continent where electricity, hardware and communications are all scarce (Anderson 1994, 4). (This is a point that should be born in mind by the current enthusiasts for smart-phone-based distributed ledgers as the solution to all the developmental problems of the continent.)

Because of this simplicity smart cards make up an unusual digital network, one distinguished by its demographic richness and geographical scope. Smart cards are now, literally, everywhere, affecting the lives of citizens in the wealthiest countries and the very poorest people in the poorest countries. Some countries have adopted them as the basis of powerful and complex IDs and passports but—because they are more expensive than plastic and paper—smart cards in official documents are still unusual. Few countries on the African continent have successfully issued a smart-card-based identity card and the Indian Aadhaar project makes no use of them. South Africans, however, have both banking and identity smart, cards that date from the late 1990s.

The international story of the application of the cards in banking has also been complicated. After smart cards were required by the Europay-Mastercard-Visa (EMV) technical specification in 1994, they have become banal, often invisible, elements of every day life in many parts of the world. Banks, and their customers, in the US have successfully resisted them for two decades, and in the poorest countries banking still does not reach the ordinary poor. It is for this reason that the main driver of the global proliferation of smart cards lies not in banking but in telecommunications, especially in the development of the Global System for Mobile Communications (GSM) for mobile phones in the first half of the 1990s. Yet the distinction between the familiar SIM (Subscriber Identity Module) and the smart card embedded on a plastic payment card should not be overstated. 'That is all a SIM is,' the textbook for mobile application development explains, 'a garden-variety smart card without the plastic' (Guthery and Cronin 2002, 124).

In the early 1990s companies like Gemplus were producing tens of millions of the cards, mainly for French banks and public telephone systems in Europe. Towards the end of that decade, global annual production—still concentrated in the hands of European companies like Gemalto and Oberthur—was approaching 1 billion cards. By 2016 it had reached nearly 10 billion units, one third embedded onto payment cards. Smart cards—in phones and on cards—have become genuinely ubiquitous, and, because the global population remains dependent on cellular access to the Internet, they underpin many of the extravagant plans for networked social revolution: Big Data, the Internet of Things, Mobile Money and Distributed Ledger Technologies all depend on them.

We are used to interacting obsessively with our devices and that makes it easy to miss the essential nature of smart cards, which is that they are simply very small computers. Under a gold-plated contact sheet, they combine operating software, a CPU and memory—all of which normally lies dormant until it is attached to an outside power source. Unlike the other computers we interact with, smart cards are rigidly limited in their functions and capacities, by design. Their tiny form means that they have almost none of the volatile memory that

allows programming flexibility, and almost all of the storage capacity, usually less than 128kB, is devoted to EEPROM—a storage medium that retains its values after power has been disconnected from the card. These severe storage limits mean that extreme parsimony is one of the distinctive features of smart card computing. Another is cheapness: the most popular cards have long been available in bulk for under $5 a piece.

Another hidden characteristic of smart cards is that, like birth certificates, their function is primarily identification, whether inside a phone or attached to a card. In order to do this reliably, and to frustrate impersonation after the data has left the cards, they must also work as little machines of encryption. Each card contains a very long numerical key issued by the manufacturer that must be used to identify it, and encode and decode its communications. This encryption process doubles as authorisation and protection and it works because the smart card is the only bearer of the key that can lock and unlock its communications. (The security of the manufacturers' keys, and their capacities to resist brute force attacks, has been part of an ongoing contest between the companies, researchers and the US National Security Agency since the 1980s, but, in comparison with older forms of identification, and especially with written documents, smart cards are impressively resistant to fakery, especially given their now ubiquitous distribution.) Their circuitry can be exposed using volatile acids and expensive microscopes, but—outside of a well-equipped laboratory—what distinguishes the cards' material form is its impenetrability (Anderson and Kuhn 1996; Kömmerling and Kuhn 1999; The Economist 2015). This resistance to communication extends beyond the closed form of the chip to the software it contains, and to its relationships with the rest of the network. Heng Guo expressed this well: 'Until presented with convincing evidence to the contrary smart cards don't trust the hosts they are inserted into and smart card hosts don't trust cards that are inserted into them. A smart card program only trusts itself.' (Guo 2001, 5). The foundation of this narrow system of trust is encryption, both of the communications between cards and of the data they bear. A device more resistant to the conventional forms of linguistic negotiation is hard to imagine.

Net1's UEPS—like Britain's *Mondex* offline card payment system—was a payment platform built to exploit the developing global infrastructure of smart cards that proliferated from the end of the 1980s.(Clemons, Croson, and Weber 1996; Mas and Rotman 2008) The Net1 system is both like and unlike the contemporary smart card schemes in the wealthy countries—Britain's *Mondex*, France's *Carte Bleue* or Spain's *Mobipay*—which all collapsed in the face of the international Visa and Mastercard duopoly. Over time, in contrast, the UEPS became a credible and competitive alternative to the dominant international standards on payment cards and phones. Over a 25 year period Net1 persuaded many investors and institutions that its proprietary technology was well suited to the thin communications infrastructures and weak regulation of the poorest countries on the planet. Which is to say that, gradually, the company found itself playing a very high stakes game framed by the potentially global scope of its technological platform.

Net1's smart card platform, 1984–1988

Net1's origins track back to the 1980s through two company histories that have each contributed a distinctive set of technologies to the current firm's core product. The key ideas about distributed computing, off-line card transactions, auditing and encryption all

emerged from the conflicts between the South African banks over the development of the SASWITCH automated teller network in the late 1980s. Net1's founders—André Mansvelt and Serge Belamant—were, respectively, the political and engineering leaders of the emerging centralised bank switch. The company's interests in bank switching and, importantly, financial services date mainly from this genealogy, and began in earnest as a separate company in 1990. Ten years later, Net1 purchased Cash Paymaster Services (CPS) from First National Bank, and that moved biometric identification and social grant payments into the company's core business. I have explained how CPS came to take on the state's work of delivering pensions in the KwaZulu bantustan elsewhere (Breckenridge 2014, chap. 6), but for our purposes here it is important to notice that the merger placed a layer of cheap biometric devices, and automated biometric identification databases, on top of the existing Net1 card technologies. It was through Datakor, the South African subsidiary of Unisys, that the CPS interest in biometric technology bolted generic MS Windows-compatible software and peripherals on top of their database and switching products.

Net1's interest in the tiny computing and storage platforms on smart cards dates from an extravagant, failed effort to address the core weaknesses of the Saswitch interbank network in its early years. From its beginnings in 1984, Saswitch, the South African interbank ATM transaction database, had been plagued by conflicts over computer hardware and networking standards between the banks using IBM kit (Standard, UBS, Volkskas and, later, the Post Office) and the 11 others that adopted the switch built by the Danish company, Christian Rosving. This split endured for five years, and it was exacerbated by the Danish firm's sanctions-era withdrawal from the country. Belament was the lead engineer at Saswitch during this period. As the system expanded he was forced by the sanctions on international computing companies to rebuild the 'entire switch from scratch' (M. Sergeant 1984; Belamant 2016; for quote, 2006; R. Anderson 2018).

By the end of the decade the split between the two groups of banks had been mostly resolved, and they began to plan to add networked electronic retail payments to the existing ATM switch (Financial Mail 1987). Belamant was responsible for the plan to expand the interbank switch from 3000 ATMs to the cash registers of tens of thousands of retailers. The bank cards were dependent on simple magnetic strips that contained basic account information that had to be authenticated by a live connection to a central bank computer using a PIN, and this was all before the Internet had any meaningful footprint in South Africa outside of the universities. His plan called for the establishment of dedicated network nodes 'everywhere in the country' and—at the eye-watering price of R500 million in 1990—it was simply too expensive for the banks to consider. It was the failure of this plan that pushed Belamant to think about doing 'something differently—by going offline and using smart cards' (Belamant 2016).

The card transaction technology that Net1 developed was called the Universal Electronic Payment System (UEPS) and it was patented by Mansvelt and Belamant as a Funds Transfer System in the early 1990s (1990; R. Anderson 1992; and Funds transfer system 1997). Unlike the existing banking systems, with their 'long history of design evolution, and many frauds result[ing] from unforeseen loopholes which appear after seemingly unrelated changes,' the UEPS was designed from scratch as a complete system (R. Anderson 1994, 18). In addition to their own experience on the Saswitch project, Net1 recruited Ross Anderson, who would go on to be appointed as professor of Security Engineering at

Cambridge's Computer Laboratory. Together they designed the encryption processes of the smart cards' communications. Anderson had worked extensively as an expert witness in the proliferating court cases contesting liability for electronic banking fraud in Britain in the 1980s, and he brought an obsession with accountability and legal scrutiny to the security of the card system. This combination, and the ability to design from first principles using formal mathematical models, produced a banking system with conspicuous forms of innovation that achieved many of the core elements of the current obsession with distributed ledger technologies, but on the cheapest available devices.

The design hinged on three principles: explicitness, distributed computing and auditing. All transaction applications were shared between two connected smart cards. Messages between the cards and between the clearing system and the individual banks included distinguishing and encrypted identifying elements for every transaction in both requests and responses, and, most importantly, individual transaction reports were daisy-chained sequentially to each other. A paired and encrypted audit trail was written on both of the connected cards, the central system and—again with the courts in mind—on paper receipts issued to both parties. Finally—reflecting Anderson's research on the importance of insider attacks on banking systems (R. Anderson 1993)—the system allowed for recording the internal agent of each transaction into the database record itself (Mansvelt and Belamant 1990; R. Anderson 1994, 1, 8, 10, 11).

Banking on the poor, 1988–1999

The UEPS was first used as a card-based banking system for the SA Perm, a Building Society that Bob Tucker turned into a commercial bank during the 1980s. Because of a long tradition of lower handling fees and slightly better interest rates on small deposits, the Perm had many black customers. Before 1986 most of these people were bound to live in the countryside by influx controls, and many of them 'only had savings book accounts' (R. Anderson 1994, 11). After the Perm merged with the much smaller and much richer Nedbank in 1988, Belamant's new consulting company, Net1, was commissioned to design a card product that would allow the 3 million savings accounts to transact without the high fees and manual processing of cheques (Belamant 2016; R. Anderson 1994; 11). The UEPS was the result, and from the beginning it was aimed at poor, rural black clients with limited literacy and flimsy telecommunications. In the early 1990s, before a retailing network existed, the card simply ignored Visa and Mastercard, connecting borrowers offline to the chains of furniture retailers in provincial towns that had long prospered on the basis of high interest credit sales to African customers (Financial Reporter 1990; James 2015; chap. 3).

In the absence of a competing payment infrastructure, the UEPS spread quickly from the high veld towns into the core of the South African economy along the electrical pathways provided by the banks' ATMs, the retailers' points of sale (POSs) and the new telephone switches that connected them. With the backing of the Perm and Nedbank, Net1's smart card platform was adopted by the other large banks without resistance. Between 1991 and 1995, the four big banks—ABSA, FNB, Nedbank and Standard—began to collaborate on the development of a local standard and they conducted public trials for the South African interbank smart card, based on Net1's UEPS, in 1994. By the end of that year the UEPS had passed these tests and the banks announced that they

were adopting a new electronic banking infrastructure. Belamant was about to license his card payment system to the entire South African banking industry.

No sooner had the local company secured this precocious success than it was snatched away by the international prestige of the Visa and Mastercard duopoly. First, following the factional divisions of the original Saswitch conflicts, in 1996 ABSA and Standard Bank withdrew from the interbank collaboration to adopt the Mastercard-Mondex platform. And then Net1's patrons—Nedbank and FNB—announced that they too would be abandoning the UEPS to join the EMV smart card consortium; offering their wealthy customers the ability to draw cash from their current accounts using EMV compatible ATMs in London (no small freedom, as Keith Hart often observes, for South Africans accustomed to rigid foreign exchange controls) (Financial Mail 1995; 1996a, 1996b.; Bidoli 1998; Stones 1998; R. Anderson 1994; 11).

With the local market for the UEPS suddenly ripped from its grasp, Net1 was left with little option but to offer the license for its off-line debit system to the global monopoly (as Varian and Shapiro had predicted). In February, 1998, the company announced that it had granted Visa International a license to use their 'exclusive worldwide patent and technology rights to smart card-to-smart card value transfer techniques' (BusinessWire 1998; Funds transfer system 1997; Shapiro and Varian 1998; 205). The resulting VISA COPAC off-line smart card system was marketed specifically in Eastern Europe and the Soviet Union, and in Ghana by Standard Chartered, stripped of its association with the South African company that produced it (Guseva and Rona-Tas 2014, 299 Fn 24; 'Visa Appoints Prism to Deliver Smartcard Payment Scheme' 2000).

After being pushed from the heights of the formal banking industry, Net1 pivoted back to the poor as the customer base for its payment system. Late in 1997, the company listed on the Johannesburg Stock Exchange as Net1 Applied Technology Holdings (Aplitec) with the specific goal of putting 'smart cards in minibus taxis across the country' in order to create an 'audit trail for every trip.' Belamant quickly negotiated contracts with the Bara City Taxi Association—one of the largest in Johannesburg—in 1998 and then with the SA Local & Long Distance Taxi & Bus Association on the Soshenguve to Pretoria routes to introduce their smart cards as a pre-paid cashless payment system. By the end of 1999, they had issued 100,000 cards in the Pretoria area alone and were processing payments on 1,000 taxis in 'excess of R400 million per year.' Some owners were clearly pleased about the control that the cards offered over the vehicles' cash-flows, and the associations promised that the new system held out the possibility of new forms of regulation in a wild industry. 'If the limit is 15 and 17 people are loaded,' SALLDTBO's chairman promised 'the card shows us this and we can deal with the driver responsible.'

But from the beginning the drivers hated the cards. They went on strike on the Bara—City route immediately after they were introduced. Many owners also started to worry about the formalisation of their income, and having to share it with Net1 and the tax collector. The most serious problem, however, was that the company had completely under-estimated the intensity of the conflicts between rival taxi associations, and the ease with which they resorted to violence and assassinations. By the end of 1999, eight people had been killed in Soshenguve in the conflict between Net1's customers and a competing taxi association locked-out of the digital payments stream. Here was a market reaction to lockin reminiscent of the nineteenth century rail network battles that Shapiro and Varian

had ignored. The company protested, naively, that 'smart cards don't kill people,' and—announcing that they were 'not deterred by violence'—they promised to expand the platform to a further 6,000 taxis in the Western and Eastern Cape, and the Nelspruit Area. But it was bluster. Early in 2000—confronted by angry government complaints that they were pre-empting, and endangering, the state's own long-planned (and never materialised) formalisation project—they announced that they had 'resolved to cease the group's operational activities in the minibus taxi industry' (Getz 1997; Shiba 1998; Quotes from Hi-Tech Security Solutions 1999; Meintjies 1999; Mthimkulu 1999; Aplitec 2000; 46; On the associations, see Dugard 2001).

Coinciding with this ill-considered attempt to capture the taxi operators' customers (during 1998) Net1 negotiated alliances with two new pretenders in the market offering financial services to the poor. In October of that year Cosatu's new investment house, Kopano ke Matla, bought half of the equity of Prosperity Holdings, an insurer that had been based in the Transkei (with central government support) from the 1950s, to offer insurance products to the two million members of the union federation. Prosperity and Aplitec shared a common founding chairman in Michael 'Motty' Sacks, one of the mavens of the JSE and also chairman of the Netcare hospitable group. The following month, with the public endorsement of Zwelinzima Vavi, Cosatu's champion of socialism, the company announced that it was launching Prosperity Bank using a 'national payment network that is not constrained by expensive or burdensome infrastructure' in order to provide 'financial products and services to the unbanked people of South Africa.' The new bank was to purchase the rights to use Net1's UEPS, and, as soon as Prosperity had completed its listing on the Johannesburg Stock Exchange, it promised to purchase all of the issued shares in Belamant's company. But before Prosperity's JSE listing could take place Net1 had found another partner, a more pliant installed customer base, and a much better source of profit (Spira 1980; *Volkshandel* 1980; Business Reporter 1998a; Patrick Wadula 1998; SAPA 1998; Business Reporter 1998b; Business Report 1999).

The grants machine, 1999–2005

In March 1999, Net1 announced that it was buying Cash Paymaster Services (CPS), the subsidiary of First National Bank (FNB) that had pioneered the development of biometric cash transfers in the late 1980s as the solution to the intractable problems of pension payments in the KwaZulu Bantustan (Breckenridge 2014, chap. 6). FNB seems to have been eager to rid itself of responsibility for paying out pensions to the rural poor as they practically gave away the company. Belamant paid R54 million for CPS, through the issuing of new stock that was itself guaranteed by FNB, a bank well on its way to becoming the richest and the most influential firm in the country. In exchange Net1 inherited an installed customer base matching Varian and Sharpe's textbook recommendation—an infrastructure of 5,000 fixed and mobile payment points paying out pensions to 1,200,000 people in six provinces chiefly in the former bantustans: KwaZulu-Natal, Mpumalanga, Northern Cape, Northern Province (later Limpopo). This close correlation between Net1's CPS and the former bantustans was strengthened over the next two years as they quickly lost the Gauteng grants contract to ABSA's Allpay, and then in 2003, won control of grants distribution in the Eastern

Cape. By the end of 2003 the company was paying out cash transfers to the poor in the most underdeveloped regions of the country—all of the former bantustans.

The timing of the Net1 purchase was also important as it equipped the company with a national payments infrastructure as the state announced new plans to expand the budget of social grants to cover all poor children. It also suggests that, notwithstanding their earlier investments and humanitarian declarations, that FNB had no appetite for being the vehicle for grant payments to the large numbers of the very poor living on tribal land. From the start Net1's lockin plans, in contrast, were elaborate and clear: they planned to weave a thick web of inter-related loan products around the new customer base. 'To date, CPS has limited itself primarily to the payment of pensions.' Belamant explained to his new investors, most of them South African banks:

> "Aplitec intends to issue each pensioner with a smart card, containing individualbiometric identification data, that will be used to distribute that beneficiary's pension. In effect, this provides pensioners with access to basic "banking" services and the other value added services Aplitec, directly and indirectly, intends providing (e.g. Burial insurance, loan products, savings facilities, etc.)

Leveraging control of the CPS customer base by elaborating the credit products available on the smart card in order to strengthen the UEPS as a payment platform was the original plan, and the company never deviated from it.

Net1's lockin imperative ran in two directions. It travelled downstream towards the poor—to the individual recipients of the child support grant and old age pensions—by offering a variety of credit products: high-interest short-term loans, funeral and life insurance policies and, eventually, air-time and prepaid electricity. But it also worked upstream to the merchants, lenders, banks and insurers by offering them a host of interlocking payment streams and short-cuts to the revenues provided by the new cash transfers. These latter transactions for life-insurance, loans, air-time and prepaid electricity provided a rich and vaguely legal field of opportunity to reward politically connected rent-seekers who sold on commission. And they were a much richer source of revenues in the first decade of the company's life than the interest on short-term loans.

By the time that the legal crisis over the SASSA contract erupted in February 2017, thousands of merchants, wholesalers, salesmen and contractors were—like the state itself and the grant recipients—locked into a payment platform that was separate from, and opposed to, the network used by the largest banks. Public outrage was provoked by the government's apparent reluctance to break itself free from Net1 as the provider of grants, and there was little sympathy for the officials' protests that they had no option but to use the company to deliver the grants to the 3 million people who live in the poorest regions of the country. There was also no public appreciation of the legal and economic implications of Net1's card-based computing platform.

Bypassing regulation on the card, 2000–2005

For Net1 the UEPS card technologies provided a deft finesse for the state's slow and sweeping efforts to impose limits on the most coercive and reckless forms of lending. In June 2000 the Ministry of Finance announced that it was going to retract (and prohibit) the 500,000 automatic salary deduction agreements that government employees had

agreed with micro-lenders. This change threatened to kill off the R10 billion micro-lending industry that had mushroomed, especially amongst state employees, in the years immediately after the end of Apartheid (Financial Mail 2000; James 2015; chap. 2). In the same months as Net1 was arranging the purchase of CPS it bought controlling stakes in two microlending companies, Moneyline and New World Financial Services. By the middle of 2000, when the ban on government Persal salary deductions and the criminalisation of lenders' attaching ATM cards (and pins) were announced, Net1 already had a network of 100 micro-lending branches across the country, and it was earning a fifth of its revenues and over a third of its after-tax profit in financial services (which included a charge for the opening of the UEPS account for each grant recipient). The company was well motivated to find an alternative solution.

The Persal ban brought to an abrupt end a frenzied decade of unregulated, high-risk and lucrative lending to salaried black people (who had mostly been denied access to bank credit under Apartheid) (James 2015; chap. 2; Porteous 2004; chap. 4). It also triggered a collapse in debt recoveries across the South African financial sector that culminated in the collapse of the sixth largest bank, Saambou, panic amongst the depositors of the fifth largest, BoE, and the collapse of Unifer, the micro-lending subsidiary one of the big four banks (ABSA). The crisis prompted some critical reflection in the industry and it made visible the high-pressure, commission-based brokerage sales of loans and the lenders' reckless provision of credit to people who often had no hope of sustaining repayments.(Joffe 2002)

The bank collapses of 2002 strengthened the hand of those pushing for more powerful information-based systems of regulation and decision-making, especially Gabriel Davel, who was the driving force behind the industry's Micro Finance Regulatory Council and future National Credit Regulator. The MFRC's model—in contrast to Net1's lockin plan—was derived from the US and UK precedents of cooperative data-sharing of positive (payments) and negative (borrowing and defaults) transaction information to solve the problems of asymmetrical information—borrowers know much more about their ability to repay—that confront all lenders. The resulting credit registries have provided powerful and precise, and automated, tools for measuring the risk of default while, at least in theory, protecting loan customers by discouraging reckless lending.(Porteous 2004; 93–97; Evans and Schmalensee 2005; chap. 7; Poon 2007; Miller 2003; chap. Introduction, 1 and 3)But the shared credit registries' effectiveness is determined by the scope of the information that they gather, and the withdrawal of a single major lender can wreck the value of participation for all the others. Net1 was developing precisely such a competing and subverting mechanism for limiting risk, one which locked in its grant receiving customers' cards and locked out the other lenders from the payment stream that ran through their cards.

In place of the salary-run deductions, Net1 offered micro-lenders (including its own companies) what it called the Millennium Payment System (MPS or Milpay), which installed a program on the smart card to schedule deductions against the holders' balance while simultaneously sending a message to credit the account of the micro-lender (using the UEPS). By writing the 'pre-authorised' deduction schedule into the smart card and transferring debtors' salary payments onto their accounts, Net1 was able to achieve the same risk-free control over repayments that the earlier salary-run deductions had offered micro-lenders, without any of the costs or regulatory risks of

debit orders on bank accounts. By the end of that first year the company had sold 400 licenses of the MPS system to other micro-lenders and by 2004 that figure had reached 1000—certainly a large portion of the existing industry. In that same year the Micro Finance Regulatory Council had signed up 1300 lenders as members of its self-regulating body (Porteous 2004**, 86).**

In effect, the UEPS moved the point of the automatic payment from the salary run to the individual's card. This 'technological solution for the micro-finance industry,' as the company guilefully explained, which 'complies with current legislation, will provide the platform for the orderly growth of the industry' (Quote from Aplitec 2000; NET 1 UEPS TECHNOLOGIES, INC 2004; 25). There is also no evidence that anyone in the state (or the corps of journalists writing on Net1) noticed the regulatory implications of the UEPS evasion, or the implications of moving programming onto the account holder's card. The Persal crisis signalled the exhaustion of the salary-based micro-lending boom. By the end of 2004, the MFRC was tracking 3 million employed micro creditors whose capacity for borrowing had been exhausted (Porteous 2004, 90–92). At the same time Net1's strategy was working to open an entirely new market that would, by the end of 2017, reach 2 million of the poorest people servicing debts, insurance and services on the company's own Easypay Everywhere cards. This struggle over platforms and customers set up an ongoing conflict between the financial industry's regulatory model of cooperative information-sharing, which would come to form the foundation of the National Credit Act in 2005, and the ring-fenced and locked-in infrastructure provided by Net1's smart cards

Enforcing the loan payments programmatically on the card was Net1's initial micro-lending innovation but the company also drew on the tools of risk assessment that the MFRC was developing at this time. Initially the MPS module ran a check for existing Net1 loans on the account-holder's card, querying for other deductions, before allocating the borrower a credit worthiness score that was visible to the staff locally. The back-office processes of the MPS also connected to the new National Loans Register (NLR)—a database that was set up by the MFRC late in 2000 to share and centralise information about all loans (borrowing and repayments). The loan register was developed and managed by the two big international credit bureaus, Experian and ITC, and it began to collect information about all transactions on loans—borrowing, payments and defaults—from the members of the MFRC. It was also meant to serve as the precursor for a state-owned loan and assets register, which the National Credit Act of 2005 placed under the new regulator. But this state-owned national loan register, which was aimed at controlling the indebtedness of the poor and at encouraging informal businesses to create assets, never materialised. The state never achieved control over the flow of information between the commercial credit bureaux, the power to compel full disclosure from lenders, or the ability to corroborate the identification data in the credit databases with the Population Register. Instead, the credit information economy remained a voluntary arrangement between lenders and the bureaux. It moved, overwhelmingly, into the hands of the two American companies, which compiled profiles on 25 million individuals to provide scores for all borrowers and identify a very large group—in 2017, 10 million people—with impaired credit.(Nxumalo 2000; NET 1 UEPS TECHNOLOGIES, INC 2004; 25; Khuzwayo 2008; Tonny Mafu 2007; Crotty and Rees 2014; Goodwin-Groen and Kelly-Louw 2006; 54)

While Net1 complied with the reporting requirements of the MFRC—sharing information about their borrowers' debts and payments with the other registered lenders—their

strategy was to build a proprietary connection to the grant recipients, and a separate, card-based, tool for assessing the risks of default. By the middle of 2005, as the universal reporting and assessment requirements of the National Credit Act were being aired publicly, Net1 had moved the most important processes of credit assessment, decision making, auditing and payment onto their cards. The act—like the earlier Persal prohibitions—marked an era in the economics of South African micro-lending. It imposed a web of regulatory constraints under the loose control of the new National Credit Regulator. The rules included explicit disclosure of the real costs of credit, a new set of maximum interest rates under the control of the regulator (although, in practice, it continued to allow very high service fees) and formal processes for debt counselling and rehabilitation. But the main changes, for the micro-lending industry in general, were that all creditors were required to report information about their loans to a credit bureau and to undertake a 'proper assessment' of the borrower's ability to pay. In both cases, however, enforcement and penalties were weakly specified in the Act, which relied, instead, on the rewards of collaboration to encourage compliance. The office of the regulator could only act by bringing charges against delinquent lenders in the National Consumer Tribunal. (For more on the limits of the act, see Schraten 2018.) The absence of the authoritative loan register, meant that the question of what was entailed in a 'proper assessment' of the ability to service debt, including the debtor's 'repayment history,' was conveniently open, and muddied by the ambiguous position of the commercial credit information services. In this space of uncertainty Net1 built its own off-line biographical credit engine.

As the act came into operation, Net1 offered new credit products that worked directly on the account holder's card. The first was a cash advance programme, aimed at the employers who were beginning to adopt Net1's UEPS cards to replace cash salary payments, which had become very dangerous. The programme added a 'Cash Advance' option to the menu that workers would see after inserting their cards into the POS screen on pay day. The software on the borrower's card would determine the size of the eligible loan 'taking into account the monthly salary or wage income previously received by the card as well as any current deductions in respect of short or medium term loans.' At the next salary payment the card also 'automatically deducted and remitted to the financier' whatever was owed on the cash advance 'plus associated finance charges.' The company advertised its Cash Advance product as an affordable and convenient way to access and manage credit, without the dangers and inconvenience of handling cash, because the 'credit check is performed by the client card itself.' The thousands of merchants who were taking on the rental of Net1's POS machines—, and who were decisive for the growth of the company's rural infrastructure and its plans for lockin—, also benefitted from the automated credit, as they were 'paid a fee for each Cash Advance loaded.'(NET1 UEPS TECHNOLOGIES, INC 2006, 155–56 and subsequent Annual Reports) Net1 marketed a very similar programme, called 'Loans to Card', to micro-lenders, which worked in the same way and allowed for longer periods of borrowing. In both cases, the decision making, and the information about loans and payments, was generated and stored on the cards.

HANIS, global success and merchant lockin, 2005–2012

Almost from the beginning of its social grant work in 1999 the company had faced the real existential risk that it would be stripped of the contracts that provided the bulk of its

revenues. This, after all, was precisely what had happened with the interbank smart cards and the Taxi payment scheme. Every year the risk took form in a significant shift in state planning around the provision of grants. Shortly after taking up the provincial grants in 2000, the company confronted the Department of Home Affairs' elaborate plan to introduce a biometric smart card equipped identity card (called the Home Affairs National Identity System). The new ID card was designed specifically 'for the management, payment and distribution of benefits and grants to millions of Social Welfare beneficiaries' and, at least in the early years of the long-delayed project, it posed a real threat to the bulk of Net1's revenues. The company responded by increasing its efforts to sell credit products to the grant recipients in 'in order to ensure their long term loyalty and support.' The initial instrument of this part of the lockin strategy was the funeral insurance offered by 'Age Secure, a new division of Aplitec, whose mission is to provide banking facilities and products to the elderly people of South Africa' (Aplitec 2001; 5; Breckenridge 2008).

This strategy of selling insurance (and short-term loans) to the poor and the elderly, and especially to the mothers of the country's poorest children, has long provoked progressive outrage. Yet, lost in the public agitation has been the fact that the company made hardly any money from these sources—not least because the National Credit Act and SASSA have successfully regulated these activities. In 2008, for example, the income from all card-based lending amounted to less than R20 million (about 1 per cent of their total revenues), and the annual margin on that small fraction was only 23% over the year—nothing approaching the 30% per month Belamant had originally suggested might be available, and less than the company's annual average growth in revenues. Lending to the poor was a way to bind them to the UEPS cards in the event that the state gave the contract for grant payments to another firm. It was much more important as a means of hedging against the loss of their installed customer base than as a source of profit. It was also not the only strategy.

As the state's enthusiasm for the Home Affairs smart card sank beneath the confusion of bitter inter-departmental conflicts and hidden struggles over technical standards, Net1 confronted other serious challenges to the security of the grants tender. Beginning in 2004, with the announcement of the establishment of the South African Social Services Agency the company confronted the very real prospect of being entirely stripped of all of the grant tenders. SASSA was specifically charged with converting the 11 different provincial grant delivery contracts—half of them in Net1's hands—into a single, centralised system (something that would only happen early in 2012 after years of confusion). It was explicitly to confront and deflect this threat that the company began energetically in July 2004 to market its POS machines to the merchants in the countryside. The initial attraction for the retailers—who had to pay Net1 rental and transaction fees from the machines—was that it brought the only significant source of cash in the poorest parts of the country right inside their shops. For the grant recipients it expanded the number of possible payment points and the hours in which they could load credit onto their cards. For everyone—citizens, merchants and Net1—it reduced the expensive and very dangerous problem of trucking large amounts of cash under guard in to or out of the rural areas. Because Net1 sold their card system to wholesalers and to the largest rural retailers it provided an alternative to the banks payment system for the merchants in the countryside —small and large businesses could effectively exchange the credits from the grant

transfers directly between their own smart cards (NET1 UEPS TECHNOLOGIES, INC 2006; 151–52, 188; Net 1 UEPS Technologies, Inc 2007).

It was this thick infrastructure of merchant payment points that became the company's main instrument of lockin after the middle of 2004. Within two years Net1 had installed 4000 POS devices on the premises of 2400 merchants in the most under-served regions of the country. By the end of 2007 Net1 was paying over 1 million of their 4 million grantee customers directly through POS machines rented by merchants in the countryside. As the public contestation and uncertainty grew around the provincial contracts between 2007 and 2012, with contract renewals taking place on an ad hoc basis and for one year at a time, the company came to place increasing emphasis on the value of its payment infrastructure. After the purchase of Prism technologies in 2006 they began to contemplate converting all of the 50,000 retail payment machines (most of them in the cities) that came with that firm's Easypay switch to the biometrically enabled UEPS standard. That shift would have been nothing short of a political and economic revolution, effectively dispossessing the four very large banks of their own EMV payment system. It was clearly beyond Belamant's capital resources but the plan was also a sign of how confident the company had become of its control over its customer base and the infrastructure that was serving it (NET 1 UEPS TECHNOLOGIES, INC 2008; 209; Net 1 UEPS Technologies, Inc 2007; 7; NET 1 UEPS TECHNOLOGIES, INC 2009; 66).

As Figure 1 shows, Net1 has generated impressive financial growth in the 20 years in which it has been responsible for the delivery of welfare payments. The South African revenues of the company have grown, on average by 25% per annum over that period,

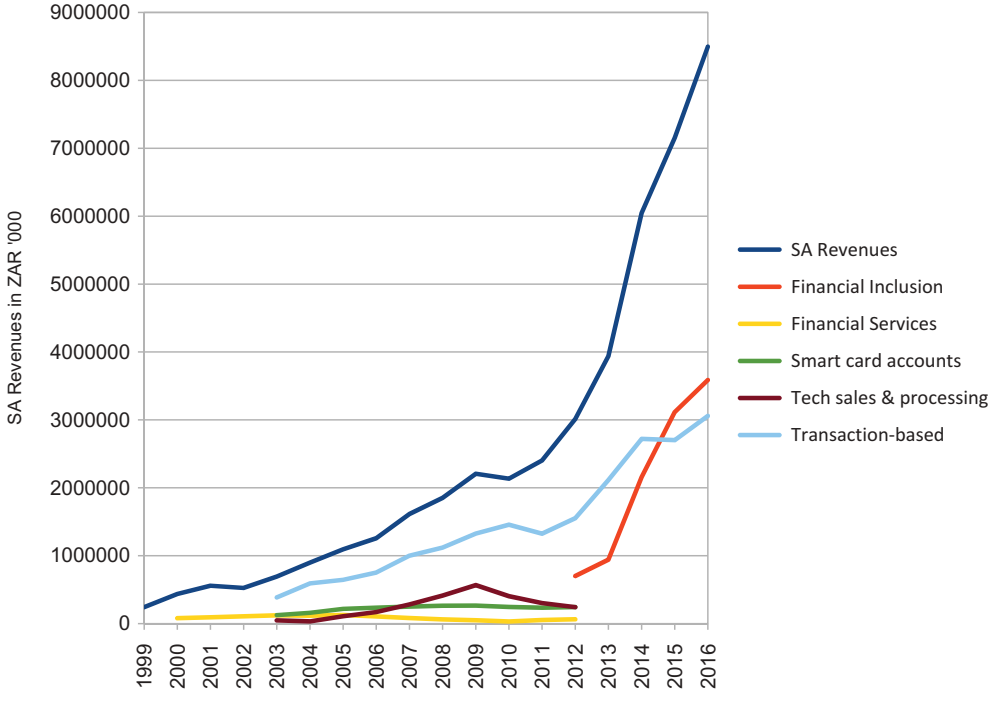

Figure 1. Net1 Revenues in R '000.

and, as the big contracts for grants were secured in 1999, 2003, 2007, 2012, the company experienced dramatic surges of growth and profitability. This exponential growth was clear from the first year of the grants contract in 1999, as the company exulted over a 1000% increase in turnover, and a similar improvement in operating profit. Certainly by the time that Nedcor bought a quarter of the company for R114 million in March 2000 it was clear that Belamant was onto something promising. A year later Net1 sold a real-time banking switch to the central bank of Malawi and persuaded that government (and some other large employers) to use the UEPS cards for salary payments. The tender for the Eastern Cape grants, in 2003—in a conspicuously unsavoury alliance with local partners—marked the consolidation of its control over the welfare infrastructures in the former bantustans. By the end of that year Net1 had consolidated its place as an important local company, and—apart from its alliance with Nedcor—it had attracted significant investments from a cross-section of the local fund managers: Allan Gray, African Harvest, Franklin Templeton, Investec and Coronation.

The transformation of Net1 from a rapidly growing South African financial services company into a global firm—'the Visa of the unbanked'—was triggered by, and reflected in, its unusual listing on the NASDAQ in 2004. The US version of the company had been created to hold the international patent rights in the hope that licensing the UEPS to VISA would earn significant revenues in hard currency. These did not materialise—not least because the European patent for the UEPS was revoked in 2002—and that made it difficult to extract licensing fees from the companies using the COPAC card in Eastern Europe. Instead, with Brait's advice Net1 used the US shell to transfer its share listing from the JSE to the Californian exchange. The US company paid $127m for its South African twin and issued a six-to-one stock split. The new NASDAQ shares were massively over subscribed because the Net1 managers, with Brait's support, had spent the preceding month selling the company to institutional investors in the US. A year after the move the stock was valued at nearly $30 a share, or $1.7 billion in total, which, when added to the cash bonuses that were paid to South African investors, amounted to a 22-fold increase in the value of the original shares. Most of the South African investors' shareholdings in the new company—amounting to 26% of the US equity—were moved into an opaque trust controlled by Brait in the Cayman Islands (West 2003; Belinda Anderson 2003; B. Sergeant 2005b; B. Anderson 2005; B. Sergeant 2005a).

The listing in the US equipped the company with an equity war-chest that dwarfed anything that was possible in South Africa. It was the NASDAQ capital that made it possible, in 2006, for Net1 to buy up Prism Technologies and the Easypay Switch. These purchases equipped the company with a national on-line payment and settlement infrastructure that rivalled the consortium of the four big banks. Belamant was able to use his American capital to acquire the Austrian company, BGS Smartcard Systems, that had reneged on the payment of license fees after he lost the European patent for the UEPS. But the US listing also massively increased the stakes of the game for Net1, and for Belamant, as the test of the company's investment promise shifted from its South African revenues to its potential to displace the EMV consortium in poor countries around the world. The international successes that followed immediately after the Nasdaq listing—the E-zwich contract for Ghana's biometric money(Breckenridge 2010) and the tender for grants and pensions in Iraq in 2008—served only to raise

the stakes of what seemed possible internationally. As speculators began to look closely at the company as a plump and vulnerable target for shorting attacks, the requirement that Net1 hold on to its South African revenues and lock its customers onto the UEPS—regardless of the state's plans or expectations—became a billion dollar imperative.

Technologically-bound contracts, 2012–2017

The company's growing hold over the welfare arms of the state was a product of the success of the project of lockin in both directions. Especially after they gained control of all grants in 2012, Net1 had conspicuous success amongst the recipients, who were encouraged to buy airtime and life insurance against their cash transfers. By the end of 2017, two million people had signed up for the Easypay Everywhere UEPS card that they used to deliver the loans, and a further 200,000 had purchased life insurance policies from Net1's Smart Life on the same cards. This targeting of the grant recipients as thinly contracted and technologically bound loan customers had long received progressive media attention, and over the last decade outrage has built slowly over the high interest charges (Ross 2001; "Pensioen 2004; Nombulelo Damba-Hendrik 2016; McKune 2017).

In the early years Net1 routinely charged 30% nominal interest *per month*, but over time—and under continuous public pressure from journalists, the Black Sash and the legal constraints of the National Credit Act—they have gradually reduced the rates that they charge their customers. Their current nominal interest rates range from 50 to 90% per annum, which, as the company and its auditors insist, compares well with the rates of the other micro-lenders (KPMG 2017). Of course, Net1 is in no sense a conventional micro-lender. It has privileged access to millions of customers and, more importantly, to the R150 billion that they receive in grants from the state. Unlike the informal money lenders, the company faces no meaningful risks of default.

The plan to exploit the market for credit amongst the poor was always explicit from the outset. It was justified using the most famous quotes from Hernando de Soto's argument about the need for poor countries to turn 'the assets of the poor into liquid capital' and it was presented to institutional investors as the reason behind the purchase of the social grants company (Ross 2001; NET 1 UEPS TECHNOLOGIES, INC 2004; 'EasyPay Everywhere' n.d.). Yet in the period between 1999 and 2012 (as Figure 1 shows) the company actually had great difficulty extracting revenues directly from its poor customers. It was, instead, dependent on the transaction fees, machine rentals and bank charges that it was able to levy against its government contracts and the merchant customers who were buying access to the streams of social grant funding by renting POS machines, buying their own smart cards and paying transaction fees. Even after 2014—when the company added sales of prepaid airtime to millions of its grant-receiving customers—the most substantial revenues came from Vodacom as normal resellers' commission.

The company's obsession with elaborating credit products, life insurance and, eventually, airtime on top of the grant payments, and using the same infrastructure of POS machines distributed to thousands of merchants, was not a search for revenues. It was reinforcing its control over its customer base—what Shapiro and Varian had called entrenchment. 'Your work is not done once a customer joins your installed base,' they warned: 'Your goal is to structure your relationship with customers to simultaneously offer them value and induce them to become more and more committed to your products, your

technology, or your services.' (Shapiro and Varian 1998, 166). Again what it is important, and neglected, in the immense public discussion of Net1's activities, is that the company built up a set of products on the smart cards themselves that offered merchants, lenders and large employers irresistible tools for managing their monetary relationships with the poor, with each other, and with the large banks. Here, they were following Shapiro and Varian. 'The revolution strategy involves brute force: offer a product so much better than what people are using that enough users will bear the pain of switching to it.' (Shapiro and Varian 1998, 204).

Unlike the general pattern of financial data processing in this period, which exploits large on-line databases and automated transaction reporting, Net1's technologies worked card-to-card and they were designed to function almost entirely without accessing the banks' on-line account databases (Poon 2007; Browning 2007; MacKenzie 2008; Poon 2009; Amoore and Piotukh 2015). This meant that much of the public outrage aimed at the violation of the privacy rights of grant recipients and the commercialisation of their personal financial data in cross-selling financial products was simply misplaced. Data-sharing between businesses was not the problem. The most important data, the decision making and the transactions were all on the grant-holders' own cards.

Conclusion

A critical evaluation of the hundreds of breathless accusations that have been levied against Net1 since the awarding of the single national contract in 2012 would require a detailed and comparative investigation of the distinct threads of the crisis: the diverse corruption allegations dating back to the 1990s, including the global anti-corruption discourse and its foundations in the manic news cycle of the free on-line media; a reminder of the recent history of the enormous credit economy aimed at the poor in South Africa; of the effectiveness of the government regulator (the South African Social Services Agency, SASSA) in constraining the Net1 monopoly; of the political storm that formed around the notorious minister and vocal Zuma supporter, Bathabile Dlamini; of Net1's record as an agent of universal grant delivery over three decades in comparison with the previous system and the likely performance of the Post Office as replacement; and, finally, some assessment of an activist apex court's decision to control both the design and the supervision of tendering processes. Happily, space—and my reader's patience—prevents such a project.

In this paper I have, instead, tried to show that the national crisis around the state's reluctance to find an alternative to Net1 followed from the company's tenacious and very successful engineering effort to build a locked-in infrastructure and multi-layered and dependent customer base. As the current reports about hundreds of thousands of grant recipients being denied their monthly payments suggest, that lockin process was also a function of the great success, and care, with which Net1 delivered the grants. The same effort to deliver grants outside of the conventional channels of the banks' payment system—far from the working road and telecommunications infrastructures—helps to account for the SASSA officials' disbelief in the possibility of a workable alternative. The company also had similar ideas in mind. Indeed, when, in June 2015, Net1 announced that it would not be participating in the new round of court supervised tenders for

payment systems it announced that the grant recipients were already firmly locked in to their payments machine. Time will tell whether that confidence is correct. The main conclusion of this story is that the relentless pursuit of lockin, and the hubris that it can encourage, can drive even the most successful and innovative of networked firms to the point of existential crisis.

Disclosure statement

No potential conflict of interest was reported by the author.

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Appendix: Net1 Chronology

1989 Net1 Investment Holdings established by Belamant and Mansvelt

1995 June—trials of the UEPS as the South African interbank switch

1996 June—banks abandon the UEPS for the global Europay-Mastercard-Visa standard

1997 November—Aplitec lists on JSE; plans payment system for taxi industry

1998 November—Aplitec, Kopana ke Matla and Prosperity announce plans for new bank

1999 March—Net1 buys Cash Paymaster Services from FNB for R54m;

– – – Net1 acquires 1,200,000 pension customers in six provinces in South Africa and Namibia

– – Net1 loses Gauteng contract to ABSA's Allpay

– – Net1 buys micro-lenders Moneyline and New World Finance

– – – October—Pick 'n Pay sells its in-house Transwitch to Prism Technologies

– – – June Usury Act Exemption recognises Micro Finance Regulatory Council as sole regulator

2000 July—Nedcor buys 26.2% of Net1 for R114m

– – July Minister of Finance announces prohibition of Persal deductions

– – November MFRC launches National Loan Register

2001 November—Malawi adopts Net1's Malswitch and UEPS payment cards and POSs

2002 February—Saambou Bank & ABSA's Unibank collapse owing to micro-loan bad debts

– – March—State guarantees deposits after run on Bank of Executors

– – April—Nedcor purchases BoE

2003 Net1 takes over the Eastern Cape grants contract

– – – February—eligibility for Child Support Grant extended to 14 years, increased from R100 to R230 per month.

2003 October—Net1 (US) buys out Net 1/Aplitec (SA); lists on the NASDAQ; Market Cap increases 15-fold from $100m to $1.5bn; South African investors formed into Cayman Islands trust managed by Brait.

2005 April—South African Social Services Agency established with the task of designing a single social grants tender

2005 August—Nedbank sells all but 1.5 m shares for R907m

2006 March—National Credit Act comes into force

– – – July—Net1 buys Prism, acquires Easypay (Transwitch)payment switch

2007 Tender churn begins for single national grants provider

2007 February—ad hoc extension of existing contracts

– – – May—Tender proposals submitted for national and provincial contracts

2008 October—Net1 relists on the JSE

– – – October—Net1 supplies 1 million smart cards to pay grants and pensions in Iraq

– – November—National tender process cancelled

2009—Net1 sells traditional micro-lending companies

2010 August—Net1 provincial contracts renewed

2012 February—SASSA announces that Net1 has won the single national contract for all grants; biometric re-registration and a new database of recipients.

– – September—High court declares Net1 tender invalid, but not cancelled

– – December US DoJ & SEC announce investigation of Net1 for alleged violations of Foreign Corrupt Practices Act; share price falls by 60%.

2013 February—Financial Services Board suspends Smart Life's insurance license

– – – June—SASSA regulations limit grant deductions to one payment for funeral insurance of less than 10% of the value of the grant

– – – November—Constitutional Court confirms that the 2012 tender was invalid

2014 January—Pomerantz announces US class action lawsuit in New York

– – – April—Constitutional court announces supervision of new SASSA tender; Net1 withdraws participation.

– – September—National Credit Regulator seeks cancellation of Moneyline's lending license

2015 March—Corruption Watch sues in the High Court for return of R300m paid to Net1 for the biometric re-registration

– – March—NCA Regulations—limit interest, fees; require credit history, affordability assessment

– – – May—National Consumer Tribunal clears Moneyline

– – June—First Easypay Anywhere (EPE) UEPS cards issued

– – September—Smart Life returns to selling life policies to grant recipients

– – September—US class action dismissed

– – October—Net1 retains SASSA contract by default

2016 January—800,000 EPE cards issued

– – – May—SASSA issues regulations under the Social Assistance Act prohibiting automated debits on grant recipients' bank accounts.

– – – July 1,500,000 EPE cards issued

– – – July 140,000 Smart Life policies sold

2017 February—SASSA fails to implement the Constitutional Court's new tender

– – – July—US DoJ closes investigation

– – – November Inter-ministerial Committee announces contract with the SA Post Office to deliver all grants using bank accounts; 3 million will continue to receive cash payments; Net1/CPS will cease to work on grants on 1 April 2018

2018 February—SASSA requests a further six month extension of the Net1/CPS contract. 'South Africans took to Twitter to vent their frustration'