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The Poverty of Fintech? Psychometrics, Credit Infrastructures, and the Limits of Financialization

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ABSTRACT

It is increasingly common to claim that innovative financial technologies ('fintech') will enable ever-wider access to credit. Previous critical accounts have often linked the development of fintech to processes of financialization. However, these arguments rarely take account of the uneven and highly limited character of 'financial inclusion' in practice. Drawing on engagements with science and technology studies and historical materialist political economy, this article advances an approach emphasizing processes of *abstraction* from productive activities, mediated through particular infrastructures, as core elements of financial accumulation. Seen in this light, psychometrics in particular and alternative credit data more broadly can be seen as flawed efforts to confront three sets of limits – (1) the necessarily reductive character of abstract framings, and the consequent challenges posed by their encounter with complex processes in practice, (2) the ways that systems for credit scoring interact with the infrastructures of existing financial systems, and (3) the difficulty of realizing financial profits in the context of widespread precarious livelihoods. Looking at alternative forms of credit data from this angle offers a way of grasping the truncated and uneven rollout of fintech, and hence of prompting more critical reflections about the limits to processes of financialization.

INTRODUCTION

We are increasingly awash in claims that innovative, disruptive new financial technologies (fintech) will enable wider access to financial services for the 'unbanked'. A particularly common claim here is that innovative uses of what are often called 'alternative' forms of data – ranging from algorithms scanning patterns of mobile phone use or internet browsing histories, to so-called 'psychometric' credit scores – offer means of increasing lending to borrowers in the global south lacking recorded credit histories, property titles, or pay slips and income tax records (see, for instance, Insight2Impact 2016; PwC 2016; Hoder *et al.* 2016).¹ This set of claims about

¹ To describe such forms of financial practice as 'alternative' is admittedly problematic insofar as such forms of finance are very much produced through their intersections with 'mainstream' financial capital (see Tooker and

fintech evidently aligns closely with the growing prominence of ‘financial inclusion’ (the wider use of formal financial services) as a policy objective. Broader access to financial services is increasingly seen as a necessary condition for sustainable growth, financial stability, and poverty reduction (e.g. AFI 2010). This agenda of financial inclusion has attracted a growing body of critical commentary in international political economy (IPE) -- in particular from authors who see the project as a key extension of wider processes of ‘financialization of daily life’ (e.g. Aitken 2013; Roy 2010; Mader 2018). The latter refers to ways in which financial techniques, and associated rationalities, shape an increasingly wide range of everyday economic practices – a process usefully described by Martin (2002) as an ‘invitation to live by finance’. It has been common for previous critical analyses of fintech applications in consumer finance to follow this broad line of argument (e.g. Gabor and Brooks 2017; Aitken 2017).

Such studies have provided valuable critiques. They have pointed to significant pathologies implicit in the ways in which new methods of credit scoring seek to make marginal livelihoods ‘legible’ to financial markets — particularly the coupling of disciplinary modes of surveillance and stratification with hyper-individualizing narratives framing the poor as risk-taking, entrepreneurial financial subjects (as noted in perceptive critiques from Gabor and Brooks 2017; Aitken 2017). However, in practice both financial inclusion in general and fintech applications in particular have made far more truncated and uneven progress than is often assumed either in critical accounts or in optimistic narratives. Fintech applications are being developed and diffused as explicit responses to palpable *limits* to financial accumulation, and (arguably) are likely to fail to transcend them. Situating these experiments in narratives of ‘financialization’ – implying the ever-more-pervasive spread of financial logics – can thus lead us to lose sight of these important dynamics.

Drawing together perspectives in Science and Technology Studies (STS) on ‘market devices’ and Marxian perspectives on money and credit, I argue that fintech applications for financial inclusion should be understood as efforts to navigate the fraught and failure prone dynamics of *abstraction* underlying capitalist social relations in general and financial accumulation in

Clarke 2018). The term ‘alternative’ thus needs to be used with some caution, but it does nonetheless designate a set of experiments with new forms of credit scoring.

particular. By ‘abstraction’, I refer to the processes through which concrete objects and activities are converted into standardized, calculable values that can be exchanged and rendered subject to speculation (see Bryan and Rafferty 2016; Christophers 2011; Leyshon and Thrift 2007). The systems through which such abstractions are carried out can helpfully be analyzed as ‘financial infrastructures’ in the sense developed by Bernards and Campbell-Verduyn (this issue). Emphasizing the ‘infrastructural’ character of credit information systems captures a number of their important features. They play a central, but obscure, role in facilitating flows of credit, mobilizing various forms of information to produce standardized, quantified, and *abstract* evaluations of credit risk. They are also composed of relatively durable material objects articulated across particular spaces, onto which new devices inevitably need to be mapped. Looking at efforts to develop alternative forms of credit data from this angle offers a way of grasping the truncated and uneven rollout of fintech, and hence of prompting more critical reflections on what efforts at producing alternative forms of credit data might tell us about processes of financialization.

I flesh out these arguments empirically by exploring the development of psychometric credit scoring, especially through the activities of the Entrepreneurial Finance Lab (EFL) – one of the longest-running actors developing psychometric credit scores. Psychometric tests originated in efforts to develop ‘scientific’ techniques for screening job applicants, primarily in the United States (see Schmidt and Hunter 1998); they aim to quantify cognitive attributes for the purpose of screening individuals’ suitability for specified tasks. Psychometrics are, admittedly, only one among a number of techniques through which various actors seek to accomplish similar objectives (see Gabor and Brooks 2017; Aitken 2017). Indeed, EFL merged with Big Data credit scorer Lenddo in late 2017 (on Lenddo, see Langevin, this issue). This is nonetheless a particularly informative case study for two reasons. First, psychometrics have been relatively widely adopted and actively supported by key development agencies. Second, psychometrics are explicitly aimed at rendering subjectivities legible to financial capital. In this sense they exemplify key tendencies identified in previous writing on alternative credit data. A closer exploration of their limits, and of the ways in which psychometrics are wrapped up with wider transformations of production and accumulation, is thus likely to be suggestive.

What follows is laid out in five steps. The first section below sets experiments with alternative credit data in the context of uneven progress towards ‘financial inclusion’. In light of this discussion, the next section develops the concept of *abstraction* in more detail. The final three sections explore the development of psychometrics as efforts of grappling with three sets of limits. First, abstractions are necessarily simplified and reductive, they selectively process some kinds of information and not others. As a result, they are continually subject to what Callon (1998) refers to as ‘overflows’ – namely, confrontations with forces which don’t fit this framing that they can’t account for. Second, there are distinct limits posed by the ways in which psychometrics must be integrated with existing infrastructures. Finally, psychometrics reflect a wider inability to overcome the fundamental contradictions of consumer finance in the context of increasingly precarious labour markets and livelihoods. The first two of these three sections proceed through close readings of EFL methodologies and activities, the final section explores two particular applications of psychometrics: in retail credit in Zimbabwe and urban microfinance in India. The latter are apposite cases both because the lenders in question were early adopters of psychometrics and because they are indicative examples of particularly common applications of the scores (retail lending and microcredit, respectively).

ALTERNATIVE CREDIT DATA AND FINANCIALIZATION

Emergent financial technologies have often been understood in critical IPE and related disciplines as governmental techniques producing particular kinds of market subjects amenable to participation in financialized models of accumulation. Here, recent critical contributions on fintech from IPE scholars (particularly Gabor and Brooks 2017) explicitly follow a longer tradition of research treating consumer credit scoring in as a technology of government (Leyshon and Thrift 1999; Jeacle and Walsh 2002; Marron 2007; Langley 2014). Previous assessments along these lines have tended to emphasize the disciplinary and stratifying tendencies implicit in new modes of credit scoring (Roderick 2014; Fourcade and Healy 2018). Generally speaking, these studies have focused on the contents of models and algorithms and the behavioural expectations they mobilize — references to James Scott’s (1998) concept of ‘legibility’ are very common (e.g. Gabor and Brooks 2017; Aitken 2017; Fourcade and Healy 2018). Gabor and Brooks, for instance, note that in a context where data about patterns of mobile phone use can increasingly be deployed in credit scoring through the activities of groups like startup Cignifi, ‘A

mobile phone... would become a new Panopticon for self-regulating behaviour in ways that preserve mobile-data based credit scores' (2017: 430). Other authors draw somewhat more optimistic assessments emphasizing the possibilities for new forms of resistance and agency implicit in emergent financial technologies (e.g. Kremers and Brassett 2017; Kear 2017; Maurer 2012; Langley 2014). In either case, though, credit scores and other fintech applications are often treated as forms of hyper-individualized and responsabilizing governmentality – as (neo)liberal modes of governing economic activity through the 'self-regulating capacities of subjects' (Miller and Rose 1990).

Assimilating these developments into wider narratives of 'financialization' (as both Aitken 2017 and Gabor and Brooks 2017 seek to do), however, can implicitly ascribe a unidirectional, even teleological nature to the development of fintech.² This is problematic in the first instance because it can lead us to overlook the very limited progress of financial inclusion in practice. In particular, despite a considerable number of global and national policy frameworks promoting 'financial inclusion', actual progress in terms of 'access' to credit for the poorest has been highly uneven. Borrowing from formal financial institutions continues to be heavily outweighed by borrowing from family and friends or informal lenders in most developing regions. And, as table 1 shows, the growth of formal credit has been slow, deeply uneven, and even prone to reversals in particular cases. Indeed, in the aggregate, the proportion of people in the lowest income quintiles borrowing from formal financial institutions fell between 2011 and 2014, and had yet to return to 2011 levels. In no small part this is because, as Mader (2018: 477) accurately notes, where private capital has gotten involved in financial inclusion, it has generally done so through high-interest loans targeted to the 'urban, employed, "less poor"'.

[TABLE 1 AROUND HERE]

This is a critical piece of context for making sense of emergent forms of credit data. The uneven progress of financial inclusion is often attributed in no small part to the limits of existing credit infrastructures. In the words of one groups of consultants, in contexts where formal credit histories, employment records, and tax documentation are often absent, lenders 'are unable to

² See Christophers (2015) for a similar argument about the concept of 'financialization' more broadly.

properly understand their consumers and assess their risk, either forcing them to charge high interest rates to protect against unforeseen risk or discouraging them from serving new markets' (Insight2Impact 2016: 4). The World Bank's *Doing Business* reports regularly point to a positive correlation between credit bureau coverage and private credit as a share of GDP (2017: 59). The Bank has also regularly published research on the role of credit information institutions in promoting access to credit for small and medium enterprises in particular (e.g. Martinez and Singh 2014). Advocates of financial inclusion, in short, are well aware that the infrastructures underlying everyday credit are highly uneven. Developing alternative means of credit scoring, including psychometrics, is presented as a relatively straightforward technical fix to the uneven progress of financial inclusion -- rendering precarious or informal incomes into calculable credit risks. For instance, one report commissioned by the Inter-American Development Bank (IADB) notes that 'alternative analytics... help develop more robust client risk profiles at a fraction of what it would cost to compile such information manually' (Hoder *et al.* 2016: 18). This is a problematic, depoliticizing diagnosis – but the kernel of truth here is that the limits of financial inclusion are in no small part down to the limits of existing credit infrastructures.

This matters because it suggests that, rather than representing the inexorable spread of the 'invitation to live by finance' (Martin 2002), innovations in credit data might better be read as efforts to overcome some critical limits to financial accumulation. What is needed, then, is an approach that can interrogate these limits and the ways in which fintech applications might help mitigate or reinforce them. I argue in what follows that one particularly useful way forward here comes from focusing on the ways in which alternative credit data seeks to *abstract* calculable credit risks from everyday economic activities, and how those systems plug into existing financial infrastructures.

INTERROGATING ABSTRACTIONS: STS AND MARXIAN APPROACHES

We can pick out a useful way forward by noting that a number of Marxian and STS-inspired approaches to global finance, interestingly, share two critical claims: (1) that this dynamic of abstraction is necessary to capitalist relations of production more broadly, but amplified in the case of speculative financial practices; and (2) that such abstractions are difficult and contradictory, and must be continually produced and re-produced (e.g. Callon 1998; Collectif

CSI 2017; Christophers 2011; Martin *et al.* 2008; Joseph 2014).³ In Bryan and Rafferty's (2016), helpful phrase, money and financial markets depend on the continual 'decomposition of things into their attributes'. Çaliskan and Callon, not dissimilarly, observe that markets are dependent on the fixing of boundaries between 'the "things" to be valued and the "agencies" capable of valuing them' (2010: 5) — a 'disentanglement' which is greatly facilitated when 'a commodity has undergone specific processes of standardization that transform it into an entity described in both abstract and precise terms, and guaranteed by a series of textual and material devices' (2010: 7-8). The implication here is that financial accumulation is dependent on the ongoing dialectic between everyday productive activities and the particular infrastructures through they can be standardized, decomposed, and reassembled in ways that render them amenable to financial speculation. The seemingly 'decoupled' character of financial profits (a central premise of much writing on financialization, e.g. Krippner 2011; Lapavitsas 2013) then, is created through particular practices and remains subject to significant material limits. This is both because 'abstract' values must be produced through particular devices arrayed into workable infrastructures, and in the sense that the concrete practices of production and accumulation out of through which 'abstracted' streams of value must be realized are fragile and prone to interruption.

STS-influenced perspectives have developed close analyses of the particular socio-technical devices involved in the production of such abstractions. This point is related to the argument made by a number of STS scholars, most notably MacKenzie (2006), that mechanisms for risk assessment and valuation in financial markets are 'performative' — that is, that they do not simply reflect markets, but in fact actively work to *produce* them. Where previous IPE scholars have engaged with STS-influenced discussions of finance, it has often been through engagements with this argument (e.g. Lockwood 2015; Braun 2016; Stellinga and Mügge 2017). But where such previous applications have tended to draw on these arguments to emphasize the 'reflexivity' of financial markets, a focus on abstraction implies greater attention to the processes by which objects and activities can become subject to financial speculation in the first place.

³ There is, of course, a good degree of variation within both broad bodies of literature. As Christophers (2014) notes, there is much less scope for engagement between 'stronger' versions of the claims made either by Marxists or STS scholars, but there remain interesting areas of overlap between more flexible ones.

Muniesa *et al.* note, helpfully, that the critical feature of market devices is that they *render* things ‘economic’ (2007: 3) — ‘Markets contain devices that aim at rendering things more “economic” or, more precisely, at enacting particular versions of what it is to be economic’ (2007: 4; *cf.* Collectif CSI 2017). Aitken’s (2017: 280) recent contribution on alternative credit data, notably, starts from a similar vantage point, emphasizing the ‘acts of configuration’ required to ‘make visible’ bodies ‘which are not legible in the language or forms of display common to mainstream finance’. Drawing in particular on Leyshon and Thrift (2007), Aitken (2017) (rightly) describes these activities as a kind of ‘prospecting’ for streams of income that can be assembled into financial assets. In linking these developments into a wider narrative of ‘financialization’ though, he takes the analysis in a different direction from what follows. Here I want to emphasize that STS-influenced perspectives are perhaps most useful in emphasizing the *fragility* of abstractions through explorations of the particular material devices and practices of standardization through which they are continually produced and reproduced.

This literature has highlighted two important features of such devices. First, they are assembled in a contingent manner, typically out of already existing materials. Financial innovation, as MacKenzie and Pardo-Guerra aptly note, is virtually always ‘the creative, ad-hoc re-use of existing resources’ (2014: 157; *cf.* Engelen *et al.* 2010; Erturk *et al.* 2013). New devices are developed through error-prone and contested processes of problem-solving and experimentation. They are not, in short, the straightforward, functional solutions to technical problems that the discussions of alternative credit data cited above would make them out to be. This *ad hoc*, experimental, character is, as Bernards and Campbell-Verduyn (this issue) note, reflective of broader patterns of technological change which we can usefully understand through the lens of ‘infrastructures’. Credit infrastructures are necessarily embedded in material objects which mediate relationships between situated activities, but also limited by that materiality. As Star (1999: 382) argues, technological change continually ‘wrestles with the inertia of the installed base and inherits strengths and limitations from that base’, and tends to require ‘time and negotiation, and adjustment with other aspects of the systems that are involved’ (Star 1999: 382).

Second, and following from the above, devices assembled through such means are inherently fragile. Devices in financial markets involve ‘multiple complex circuits between heterogenous

acts and instruments’ (Erturk *et al.* 2013: 345). Abstraction and standardization bring inevitable problems of their own. Abstract values, Callon (1998) argues, are inevitably a ‘fragile, artificial result based on considerable investments’ (251). They require means of making visible and measuring some selected, reductive aspects of the ‘thing’ in the world that they seek to render amenable to speculation. As a result, they remain continually vulnerable to ‘overflows’ – to forces or events not accounted for in the model. Abstraction, in short, is at once critical to the operation of financial markets and inherently difficult. It is carried out through infrastructures that can, inevitably, process some kinds of information and not others (see Bernards and Campbell-Verduyn, this issue).⁴ We can usefully take STS debates on ‘market devices’, and the concept of ‘infrastructures’ more broadly, as an injunction to pay close attention to the specific systems through which abstractions like credit risk are produced. This kind of analysis, as I argue further below, helps to explain significant features of the roll-out of psychometrics and alternative credit data more broadly. However, such approaches are less effective at grappling with questions of power and politics (Bernards and Campbell-Verduyn, this issue; *cf.* Erturk *et al.* 2013). In particular, while they highlight the material and spatial limits of financial infrastructures themselves, they give us little leverage for exploring how the dynamics of ‘real economies’ themselves might pose significant limits on practices of abstraction. In confining their view to financial devices in and of themselves, they can risk missing out on the ways in which abstractions feed back on dynamics of work and production. They can thus usefully be complemented by more explicitly political economy approaches, particularly, I argue, historical materialist perspectives.

The latter have generally pointed to the ways in which speculative financial activities remain dependent on particular configurations of productive activity, and the ways in which productive and reproductive economies themselves might throw up limits to the processes of standardization and decomposition necessary to enable the construction of financial assets. A number of recent analyses have started productively from the link Marx draws between money and the fetishization of social relations in the form of commodities (e.g. Christophers 2011; Joseph 2014; Soederberg 2014). Through its embodiment in circulating commodities, for Marx, ‘concrete

⁴ Campbell-Verduyn *et al.* (this issue) make a related claim about the crisis tendencies resulting from inherent ‘fault lines’ in the informational infrastructures underlying the global financial system.

labour becomes the form of the manifestation of its opposite, abstract human labour' (Marx 1990a: 150). Marx later observes that such abstraction reaches its logical conclusion in circulations of credit and interest in which 'all that we see is the giving out and the repayment' and 'everything that happens in between' — namely concrete productive activities that enable the repayment of debts and interest — is 'obliterated' (1990b: 471). Importantly, though, this 'obliteration' is only ever partially achieved. As Harvey argues, financial capital remains dependent on a 'process of realization within the continual flow of production and consumption' (2006: 95). Financial accumulation is in this sense dependent on a continual dialectic between concrete productive activities and circulations of abstract value embodied in money and credit.

It has been common for Marxian analysts to emphasize the coercive aspects of such processes of abstraction. A number of phenomena, including the project of financial inclusion (Soederberg 2014) and the growing use of digital credit scoring for consumer lending (Roderick 2014; this issue), have been interpreted as disciplinary mechanisms aimed at producing the particular configurations of labour and working class livelihoods necessary to enable ongoing financial accumulation. There has been, as Christophers (2014) notes, relatively little attention in these discussions to the specific socio-technical objects through which such processes are actually carried out. These accounts are, in this sense, usefully complemented by the STS-inflected discussions introduced above. Yet, Marxian perspectives also point to a significant limit that the relatively narrow focus of the latter on financial devices in and of themselves can lead us to miss. Namely, the actual ability of regulatory interventions to configure labour, incomes, and livelihoods in forms that enable the continued production of streams of payment income, however, is increasingly suspect. As a number of authors have recently noted, financial profits are increasingly threatened by the growing fragility of everyday incomes in the context of increasingly widespread precarity and structural change in labour markets (Montgomery and Tepe-Belfrage 2017; Lapavitsas and Mendieta-Muñoz 2018; Joseph 2014). These dynamics are also plainly visible in the discussions of India and Zimbabwe below.

While these literatures have often been seen as incompatible, especially by Marxists (e.g. Fine 2003), there have been notable previous calls for more fruitful engagements between them in more general terms (see Christophers 2014; Castree 2002). I argue here that these perspectives

offer usefully complementary insights. They start from a strikingly similar point in emphasizing the dynamics of abstraction necessary to financial accumulation; they offer different, but complementary insights about the fraught and tension-riddled nature of these processes themselves. STS-inspired perspectives usefully point to the troublesome (material, spatial) character of financial devices themselves, and the difficulties and compromises necessary to plug new devices into existing infrastructures, while Marxian perspectives highlight the fundamental contradictions and power relations that these devices need to navigate. If STS analyses point us to the fragility of abstractions, the material and spatial character of devices, and the inevitability of ‘overflows’ (per Callon 1998; Çaliskan and Callon 2010), Marx’s (1990b) injunction to focus on ‘all that happens in between’ to enable the realization of interest calls for a much more specific analysis of *that which is being abstracted*, rather than a focus solely on the troublesome nature of devices themselves. Both perspectives point to the proposition that abstractions are at once critical to the operations of financial markets and inevitably fraught and incomplete — because they must be carried out through particular devices with material and spatial limits, which must be worked in to existing infrastructures, and because they depend on the reconfiguration of concrete patterns of production and reproduction in ways that are often fundamentally contradictory. In the first instance, this set of insights can help us to situate experiments with alternative credit data in the context of the limited progress of financial inclusion described above -- as *ad hoc* efforts to grapple with the fundamental limits of financial accumulation, rather than extensions of any broad-based project of financialization or ‘ubercapitalization’ (per Fourcade and Healy 2017). Moreover, as I show in the remainder of this paper, this perspective helps us to explore the ways in which psychometric testing in particular continues to run up against these limits.

PSYCHOMETRIC TESTS AS DEVICES

On the surface, psychometric testing depends very much on mobilizing the figure of the informal worker as risk-taking ‘entrepreneur’. The latter can usefully be situated in what Breman and van der Linden (2014) have aptly described as a longer-run ‘project of informalization’, in which the World Bank and others have coupled pressures for the removal of protective institutions with efforts to develop training and credit facilities and formalize property rights in order to promote self-employment and entrepreneurial livelihoods. In this sense, psychometric credit scores are

very much devices which embody a ‘particular version of the economy’ (Muniesa *et al.* 2007). In the first instance, we can analyze their development as a series of efforts to grapple with the inevitable ‘overflows’ (Callon 1998) that this entails.

The extent to which psychometrics pick up and develop these kinds of ideas about entrepreneurship probably goes some way, in the first instance, towards explaining the extent to which the development of EFL’s methods has been supported by a number of different public and private regulatory agencies. EFL was developed out of a research initiative at the Harvard Kennedy School’s Centre for International Development, started in 2006. It was incorporated as a private company in 2010. It attracted funding from a number of different public development agencies in subsequent years. In 2013, the project was funded by the G20’s ‘SME Finance Challenge’, an initiative launched alongside the G20’s Principles for Innovative Financial Inclusion and managed by the World Bank’s International Finance Corporation, that included funding from the governments of Canada, the US, the UK, Korea, and the Netherlands (SME Finance Forum 2014). A number of subsequent studies sponsored by the Inter-American Development Bank (IADB) and World Bank have been carried out in Latin America. The IADB facilitated and published studies co-authored by EFL staff testing models developed in the project discussed above with SME borrowers in Argentina (Klinger *et al.* 2013b) and Peru (Klinger *et al.* 2013c). A similar pilot project was carried out by World Bank staff in Peru in 2012 (Arráiz *et al.* 2015a; 2015b).

Yet, to deploy these kinds of assumptions as a means of measuring credit risk is not straightforward, and has required that EFL grapple with some fundamental challenges of abstraction and resultant overflows. The model developed by EFL draws on a number of widely used tests of intelligence and personality traits drawn from a growing literature in applied psychology that has explored linkages between intelligence, personality traits, and ‘entrepreneurial success’ (e.g. Baum and Locke 2004). The basic premise, ostensibly, is that ‘entrepreneurs’ with greater aptitude will more likely be able to repay a loan. None of this literature, however, was directly concerned with default risk. The first problem in applying psychometrics to credit scoring was thus quite simply the need to figure out what factors might actually predict default. An early technical note from EFL suggested that: ‘unlike building a

model based on typical socio-demographic characteristics, psychometric questions have not been asked on past applications nor are client answers present in large bureaus, and therefore psychometric information represents new data that must be collected.’ (EFL 2012: 2). There is a critical slippage implicit here – despite the continual references to promoting ‘entrepreneurship’, in tailoring and testing the model to account for default risk in particular, EFL’s scoring methods in fact turn less on predicting the entrepreneurial success of borrowers than on predicting their likelihood of making loan re-payments. As Langevin (this issue) also argues, these are not exactly the same thing – and efforts to further develop and apply the EFL model have had to work through a continual series of engagements with overflows as a result.

The first iteration of the EFL model was tested in a research project conducted in Kenya, South Africa, Nigeria, and Peru. Tests were administered to existing clients of a number of banks, and psychometric scores were tested against default rates and self-reported profit levels (Klinger *et al.* 2013a). The tests were scored along three dimensions: personality type, intelligence, and honesty. Measures of personality drew on a series of publications in psychology about the relationships between the so-called ‘big five’ personality traits and entrepreneurship (see Zhao and Seibert 2006; Ciavarella *et al.* 2004). Intelligence was measured through ‘digit span recall’ tests (in which participants are shown a string of digits for five seconds, the digits are hidden for 5 seconds, and then the test taker is asked to enter the number) as well as Ravens Progressive Matrices (which present test-takers with a series of incomplete geometric patterns and ask them to choose from among eight possible options to complete the pattern) (Klinger *et al.* 2013a: 16-17). Both tests had previously been used in published studies on predictors of success in entrepreneurship (de Mel *et al.* 2008). They also incorporated an assessment of ‘honesty and integrity’ drawn from earlier work aimed at screening potential convenience store employees to prevent theft (Bernardin and Cooke 1993), based on an adapted version of the ‘Honesty’ subscale of the London House Personnel Selection Inventory (Klinger *et al.* 2013a: 17-18). Notably, the measure of honesty in particular was explicitly incorporated as a measure of *credit risk* rather than entrepreneurial aptitude. Indeed, it is noted that the impacts of ‘honesty and integrity’ on entrepreneurship are unstudied and likely ambiguous: ‘Are dishonest entrepreneurs more likely to fail at business because they cannot generate the trust needed for relationships? Or are honest entrepreneurs more likely to fail because they will be taken advantage of in the cut-

throat marketplace?’ (Klinger *et al.* 2013a: 18). Here already, the notion of ‘entrepreneurial’ aptitude has started to slip, and the model has been subject to a series of incremental adjustments seeking to grapple with the tendency of its abstract framing of creditworthiness to overflows.

There also remain notable limits to psychometric tests themselves as means of evaluating credit risk that the tests have continued to wrestle with. Persistent concerns about the potential for ‘gaming’ the test are notable – these are, perhaps, especially indicative of the potential for overflows inherent in applying abstracted framings to human actors with agency. One EFL pilot project notes, for instance, that in the context of a research project where the results would be tested against existing credit histories rather than used to allocate loans:

Clients may not manipulate their answers enough. The ultimate goal is to evaluate the potential for these types of tests to be used as screening devices to allocate finance and assistance to entrepreneurs. This means that when entrepreneurs complete the psychometric assessments, they would be under high incentives to give socially desirable answers and “game” the test. To determine if these types of psychometric questions can be implemented in such a high-stakes setting, it would be desirable to replicate that high-stakes situation as closely as possible (Klinger *et al.* 2013: 21)

Concerns about manipulation are, to some extent, baked into psychometric testing software. EFL also administers tests using computer software designed to track response times and even monitor mouse movements. As one sympathetic report notes, ‘The software monitors mouse movements for signs of indecision or distraction. When the unscrupulous lie to get a loan, they often do so in predictable ways’ (Economist 2016). This has not necessarily been enough to allay such concerns, which have also been expressed by a number of commentators. A UK media report notes that ‘such tests can be manipulated, as certain answers — like proficiency with technology and a propensity to save money — are obviously preferred by certain lenders’ (BI Intelligence 2017). A Bangladeshi bank manager interviewed by the *Financial Times* similarly notes ‘If you ask the same set of questions to people in the same business circle, after a while they will grow familiar with the test’ (qtd. Kynge 2014).

This broad set of concerns might usefully be thought of as a series of efforts to grapple with ‘overflows’, in Callon’s (1998) sense. Psychometric credit scores are necessarily reductive and static – they ‘fix’ in place an assessment of the credit risk attached to an actor with a capacity for reflexivity and agency that the tests struggle to grapple with. These challenges are only multiplied, as I show further in the final section below, when we start to take account of the ways in which the targeted populations are suspended in the contradictory political economies of neoliberalization.

PSYCHOMETRICS AND CREDIT INFRASTRUCTURES

A second set of limits stems from the ways in which psychometrics must be plugged into wider credit infrastructures in order to work. Psychometric tests, importantly, are devices that are explicitly designed to be cheap and portable. They are administered in roughly 30 minute-long computerized tests, mostly carried out on site in bank branches. Psychometric credit scores are often promoted by drawing a direct analogy to the use of statistical credit scoring techniques in the US in particular: ‘Unfortunately this rich-country solution cannot be directly applied to emerging markets, because the long and detailed personal credit histories that are available in the United States are not available for most small business owners around the world’ (Klinger *et al.* 2013a: 10). Psychometrics are thus explicitly framed as a cheap and quick second-best option means of approximating the modes of calculating credit risk available in the global north.

Because they are short tests administered in a particular time and place, they are relatively easy to slot in to existing credit infrastructures based primarily on face-to-face evaluation of credit applications in brick and mortar branches. This portability, though, has proved troublesome in particular ways. First, it has (ironically) profoundly limited the spatial scope of psychometric applications. Since 2012-2013 in particular, EFL has entered into commercial partnerships with banks, microfinance institutions, and retailers in Mexico, Guatemala, Ecuador, Peru, Ethiopia, Kenya, Zimbabwe, South Africa, India and Indonesia (see Table 2). EFL scores are primarily used to supplement existing historical data or screening processes. Indeed, EFL has also developed partnerships with including conventional credit scoring companies. It ran a pilot project with Equifax in Peru (EFL n.d. a) and licensed its model to the Fair Isaac Corporation in 2016 as part of a project be rolled out initially in Turkey, Russia, and Mexico (FICO 2016). Both projects aim to incorporate psychometric data as a supplement to ‘thin files’ in existing credit

bureau coverage. The specific application of the scores varies. In most applications, partner banks set a percentile threshold (i.e. loans are disbursed to applicants whose EFL tests score above a certain percentile rank) (e.g. EFL n.d. b) or classify potential borrowers into low, medium, and high risk, or reject, categories and use these ratings to make decisions about the type and extent of further screening (EFL n.d. c). EFL also entered into a heavily publicized partnership with MasterCard in 2013, in which EFL credit scoring would be used to screen applicants for small business MasterCards in developing countries (see MasterCard 2013).

[TABLE 2 AROUND HERE]

As a result, despite the self-justification of alternative credit data as a response to the unevenness of ‘access’ to finance in the global south, actual applications of psychometric credit scores in practice map fairly closely onto the uneven patterns of progress in ‘financial inclusion’ noted above. EFL operates in a handful of specific countries, through partnerships with local banks, microlenders, and retailers (and increasingly with mainstream credit scoring firms). The countries involved, notably, are primarily large countries which already have relatively deep financial sectors (South Africa, India, Mexico, Kenya, Indonesia, Russia) or otherwise major markets for microfinance. Peru, for instance, has regularly been rated at or near the top of the Economist Intelligence Unit’s *Global Microscope* reports on ‘enabling environments’ for microfinance and financial inclusion (e.g. EIU 2016). Moreover, these activities are virtually all focused on buttressing precisely the kinds of activities that Mader (2018: 477) aptly notes that financial institutions in the global south are already more likely to engage in (as noted above – high interest loans, often primarily (indeed, often explicitly) for consumption rather than for business applications, to predominantly urban, ‘less poor’ borrowers. It seems highly unlikely that psychometric credit scoring will be rolled out in places that remain remote from mainstream financial centres -- as in, say, rural Niger where slightly more than 1 percent of people in lower-income quintiles borrow from formal financial institutions (see Table 1).

Crucially, then, the development of psychometrics has been dependent on the ability of firms selling psychometric credit models to plug themselves in to the broader ‘installed base’ (Star 1999) of existing credit infrastructures. At the same time, psychometrics would seem in this

sense to be highly likely to ‘inherit the strengths and limitations’ of the ‘installed based’ of credit infrastructures into which they have been plugged (Star 1999: 382). The uneven geography of psychometrics noted above is one example, but some of the qualitative details of the scores themselves are also affected. One of the most crucial examples here stems from the spatial and temporal character of the branch infrastructures into which psychometrics are rolled out. Simply put, in order to plug into existing credit infrastructures, psychometrics have to inherit the often spatially-bound and temporally-limited character of credit evaluation systems used in the absence of comprehensive credit data systems – this, arguably, is likely to reinforce the tendency towards overflows identified in the previous section. Psychometric tests, in brief, inevitably produce a ‘snapshot’ of the character of borrowers. The extent to which this raises problems, can, perhaps be perversely illustrated in the extent to which advocates of psychometric tests emphasize the static character of the aspects of personality and intelligence they seek to measure. According to the EFL research project: ‘At a first approximation, the psychometric dimensions we seek to measure are stable over time among adults. This allows us to measure them and compare to historical and concurrent outcomes’ (Klinger *et al.* 2013a: 21). Or, put slightly differently, in order for psychometric tests to be administered in the way that they have to be to ‘plug in’ to existing credit infrastructures, they need to be measuring things that don’t change. This seems especially problematic, as I argue further in the following section, given that ‘all that happens in between’ (Marx 1990) to enable the repayment of loans is perhaps especially irregular and unpredictable in precisely the populations targeted by the project of financial inclusion.

PSYCHOMETRICS AND THE ANTI-NOMIES OF FINANCIALIZATION

In this final section, I want to turn to a brief inspection of the commercial roll-out of psychometrics. This turns out to reveal fraught efforts both by private businesses and by policymakers to navigate the broader contradictions of accumulation in the context of increasingly precarious livelihoods. Psychometrics have often been adopted by firms whose profits have been directly threatened by the increasingly precarious incomes of their clients. This, again, has arguably reinforced the tendency of psychometrics as abstract framings to overflow – inherently individualizing models of ‘entrepreneurial’ success are particularly troublesome in the context of widespread and structural precarity. As a result, psychometrics

have not generally succeeded in overcoming the more fundamental limits to the realization of abstract values through processes of production and consumption.

Precarity and Retail Lending in Zimbabwe

Psychometric credit scoring has in practice often (even primarily) been used in retail lending. Exact numbers are hard to come by, but even sympathetic observers note that ‘The biggest market for psychometrics is for... consumer loans’ (Economist 2016). Indeed, it is notable here that a number of significant applications of psychometrics have often come from *retailers* seeking means of maintaining sales revenues threatened by the increasingly precarious incomes potential consumers rather than financial institutions. This is visible in two of the largest and earliest applications of EFL scores: the Peruvian branch of Grupo Monge, a retailer specializing in low-cost appliances and electronics primarily in Central America (one of the first firms to adopt EFL’s credit scores) and the Zimbabwean clothing retailer Edgars. The latter is examined briefly here.

Here it is worth stepping back to consider the dynamics of precarity and labour market transformations in Zimbabwean urban spaces underlying the increased reliance on credit sales. After a disastrous experiment with structural adjustment in the 1990s, Zimbabwe’s government veered somewhat unpredictably between nationalist, outwardly anti-imperial development policy frameworks (which it has generally lacked the capacity to effectively implement) and efforts to promote the ‘normalization’ of relations with global capital (see Moyo and Yeros 2007) provoking a series of political and economic crises culminating in rates of inflation over 200 million percent by July of 2008. From 2009-2013, the country was governed by a ‘Government of National Unity’, which agreed a number of transitional stabilizing arrangements backed implicitly or explicitly by the World Bank and IMF, sought to stabilize prices by adopting the US dollar and South African Rand, and generally placed a heavy emphasis on enabling foreign investments in mining and prioritizing public debt repayments (Bond and Sharife 2012). These developments led to a well-documented stark deterioration of urban labour markets and living conditions from the late 1990s (see Potts 2006; Muchadenyika and Williams 2016).

As Table 3 shows, according to official labour force surveys, at least 80 percent of the country's population has consistently been engaged in vulnerable forms of work — unemployment, casual wage work, and own-account activities including subsistence and survivalist activities — for the past two decades. This figure is contested, with trade unions and opposition parties frequently citing figures closer to 95 percent. Official surveys have also found that nearly 85 percent of those classified as 'employed' earned incomes below the poverty line (LEDRIZ 2016: 5).⁵ For present purposes, the basic point is that for most of the last two decades, the incomes and livelihoods of the vast majority of Zimbabweans have become increasingly precarious and reliant on informal activities. While the proportion of workers engaged in informal livelihoods has probably remained relatively stable, these activities themselves are prone to periodic and systemic crises. A notable consequence of the multicurrency arrangements is that a considerable number (probably the majority) of Zimbabweans rely on cash incomes in the context of a multicurrency system reliant on unstable imports of foreign currencies, and hence to periodic liquidity crises. Frequent and recurrent cash shortages have regularly undercut incomes. This context has posed two significant problems for formal sector retailers: first, the increasingly precarious incomes of potential consumers presented an obvious threat to revenues; and second, the rapid expansion of informal and second-hand clothing markets — primarily driven by workers seeking to supplement insecure incomes — from the late 1990s presented a significant source of competition.

[TABLE 3 AROUND HERE]

Edgars started offering retail credit in 2009 in what was described as an effort to compete with increasingly pervasive informal and second-hand clothing markets which had 'rushed into the market with cheap goods' (Edgars 2010: 4) over the preceding decade. While the majority of the company's sales have been made on credit, it is notable here that Edgars has not actually profited much from interest charges. As Table 4 shows clearly, throughout the period in question, interest charges have consistently represented a very small fraction of company revenues overall -- indeed, costs of debt collection have normally exceeded revenues from lending. The role of

⁵ The poverty line in Zimbabwe is recalculated monthly, but has generally been in the vicinity of USD 100 per month for most of the last five years.

credit as an increasingly fraught means of buttressing retail sales is perhaps especially visible in the increasingly generous terms of lending. Initially, credit was offered on relatively strict terms – requiring a 25 percent deposit and repayable over three months. The deposit requirement was subsequently removed and loan period extended to six months in 2010 (Edgars 2011: 7), and maximum repayment periods were extended again to 390 days in 2014 (Edgars 2015: 63). It is in this context that we need to make sense of EFL’s role. Psychometric credit scores were also introduced in 2014, justified as a means of extending store credit to informal workers without income documentation. According to EFL: ‘Edgars realized a need to include this massive untapped market in their credit offering’ (EFL n.d. e: 3).

[TABLE 4 AROUND HERE]

Adopting psychometric credit scores has, in practice, done little to offset the more fundamental challenges posed by widespread precarity compounded by frequent cash shortages. On a number of occasions in 2016 and 2017, banks adopted limits on cash withdrawals. These had significant knock-on effects on a good deal of informal workers, and hence both on retail sales and the ability of a growing segment of existing borrowers at Edgars to repay. Outstanding credit has in fact declined considerably since 2014 -- from USD 33.8 million to 24.6 by 2017.

Simultaneously, a growing proportion of loans have been written off -- totalling 4 percent of outstanding loans in 2015 (Edgars 2016: 10), 7.9 percent in 2016 (Edgars 2017: 10), and 6.9 percent in 2017 (Edgars 2018: 10). The point here is that, rather than enabling increasingly financialized modes of accumulation, psychometric credit scoring has in some of the largest and most significant practical applications instead been used in increasingly fraught efforts to maintain or increase retail sales in the face of labour market changes leading to increasingly unstable consumer incomes – despite the adoption of psychometric credit scoring, the company’s credit portfolio shrank and default rates increased. While evidently this shouldn’t be attributed to the adoption of psychometrics, it does indicate that the impacts of the latter are limited in the face of more fundamental challenges thrown up by the concrete patterns of work and livelihoods they seek to abstract. Growing levels of precarity, in short, have tended to introduce important new sources of ‘overflows’.

Navigating Crises in Microcredit - India

A number of other significant applications of psychometric credit scores are intimately linked to patterns of crisis and regulatory change in microfinance markets -- including the partnership between EFL and microlender Janalakshmi Financial Services (JFS) in India. Commercial microfinance in India expanded rapidly in the early 2000s, focused primarily on high-interest loans to agrarian borrowers. The fragility of this system was thrown into sharp relief by a series of crises, culminating in the suicides of dozens of overly-indebted farmers in Andhra Pradesh in 2010.⁶ The crisis sparked an inquiry by the Reserve Bank of India that led to a round of regulatory reforms -- most notable here are interest rate caps and individual limits on total indebtedness for lower income borrowers (RBI 2011). These drove shifts by microlenders away from relatively low-risk, low-return group loans towards increased volumes of individual loans, especially larger loans for 'middle class' borrowers. In short, in the aftermath of the crisis and regulatory reforms, Indian MFIs dramatically re-oriented their focus towards the urban 'less poor'. These shifts also kicked off a round of consolidation in the microfinance sector, with the number of registered MFIs falling from more than 70 prior to the crisis to 56 by the end of 2016, while the gross loan portfolio of Indian MFIs grew from INR 111.8 billion in 2012 to 532.3 billion in 2015, alongside an increase in borrowers from 14.8 million to 32.5 million (EY 2016: 14).

As table 5 makes clear, JFS was well-positioned to capitalize on these shifts. Unlike most Indian MFIs in the 2000s, JFS had targeted urban informal sector (who make up a considerable proportion of the total population, see Agarwala 2013) and aimed to offer a wider range of financial services beyond group loans. After 2010, this population was explicitly targeted by the segments of financial capital that had rushed into Andhra Pradesh in the decade prior. The rapid expansion of JFS' loan portfolio was underwritten by several rounds of venture capital funding, as well as subsequent investments from a range of global institutional investors after 2013, and JFS was subsequently given regulatory permission to operate as a bank rather than an MFI in early 2017. The role of EFL here was as part of a wider bundle of 'innovative' technologies

⁶ See Taylor (2011; 2012); Young (2010) for excellent discussions of the crisis and the development of the microcredit sector in Andhra Pradesh. Bateman (2010) situates the crisis in the wider development of commercial microfinance.

deployed to manage credit risks and simplify interactions with borrowers in these settings, with psychometric tests incorporated into a set of systems, notably including biometric identification and a tiered system of loan provision in which borrowers who established reliable credit histories in group loans or with small sums were offered larger loans (EFL n.d. f: 2-3; JFS 2014). This is a useful illustration of the point raised in the section above about the tendency of psychometrics to reinforce existing patterns of uneven development implicit in the need to plug alternative forms of data into existing credit infrastructures. But more importantly for present purposes, the realization of financial accumulation through this emergent infrastructure shows signs of being undercut by shifts in the patterns of precarious economic activity through which interest and repayments needed to be realized.

[TABLE 5 AROUND HERE]

One of the most notable developments here was the Indian government's experiment with 'demonetization' in late 2016 (see Chandrasekhar and Ghosh 2018). With less than four hours-notice, notes with values from Rs 500 to Rs 1000 were withdrawn from circulation. Early analyses showed considerable job losses in the aftermath of demonetization, including a drop of decrease the 'economically active' population by roughly 1.5 million (Vyas 2017). These impacts were disproportionately felt by informal economies, where cash transactions have continued to predominate and the adoption of digital payment systems is liable to be costly (requiring, for instance, equipment purchases to enable point of sale payments) and slow (see Chandrasekhar and Ghosh 2018). Given that urban informal economies remain the main targets for JFS lending, this 'liquidity crunch' had an outsized impact. In this context, at JFS, measures of portfolio at risk – the proportion of credit accounts more than 30 days past due, a commonly used measurement of asset quality for MFIs – spiked from 0.95 percent in the 2015-2016 fiscal year to 35.31 percent in 2016-2017 (JFS 2017: 40). The impact of the demonetization push is perhaps primarily a short-term problem for lenders like JFS, but it does nonetheless show the fragility of the extension of financial accumulation through the abstraction of precarious livelihoods enabled (in part) by psychometrics.

Navigating the Limits of Financial Accumulation

The point of these brief discussions is to highlight the fact that practical applications of psychometrics often appear to be driven fundamentally by efforts to cope with the contradictions of capital accumulation in the context of growing precarity. In the case of Edgars in Zimbabwe, credit relations are less a source of profit in and of themselves and more a way of maintaining revenues from retail operations in the face of the increasingly precarious incomes of potential customers. In the case of JFS in India, we can point to the rapid expansion of the company's credit portfolio after 2010, into which EFL scoring was plugged after 2014. JFS was well-positioned here to capitalize on a wider movement of financial capital towards individual loans, increasingly to urban borrowers, in the aftermath of the Andhra Pradesh crisis and regulatory reforms in India's microcredit system. As informal livelihoods have increasingly come under strain, partly as a result of demonetization policies, however, there are signs of increasing distress.

In either case, narratives of 'financialization', with their attendant implications of increasingly pervasive financial logics, fail to capture the complex and contradictory landscapes of accumulation into which psychometric credit scores have been rolled out. Psychometrics seem, from this perspective, less like a further step towards the all-encompassing financialization of the global economy and more one means, amongst others, through which private companies and international regulatory agencies have sought (with limited success) to navigate the complex and contradictory landscape of increasingly precarious livelihoods. Equally, and critically, in both cases discussed here, there are signs of rising defaults and deteriorating returns on credit – an indication that abstracted predictions of default risk do not enable financial capital to escape the patterns of concrete activity needed to enable repayment. Seen from this angle, psychometrics look like an *ad hoc* effort to convert irregular, precarious incomes into predictable, calculable asset streams in the context of shifting patterns of livelihoods and regulatory change. They point us towards a reading of the turn to alternative credit data as a sign of the increasingly fragile nature of financial accumulation at the margins.

CONCLUSION

I have argued in the foregoing that the example of psychometric credit scoring shows that, if we look closely at efforts to assemble the sets of devices necessary to extend the 'invitation to live

by finance' (Martin 2002) to most of the world's 'unbanked', it becomes clear that such processes are subject to three important limits. All three stem fundamentally from the trouble processes of 'abstraction' implicit in the construction of financial markets. First, they are fragile achievements dependent on reductive understandings of complex phenomena – a dynamic which contributes to significant tendencies towards overflows. Second, the very things that make psychometric credit scores viable – namely their simplicity, portability, and compatibility with existing credit infrastructures – have profoundly shaped the geography of their diffusion and the spatio-temporal frame of their application. They can, in the end, only operate effectively at the sites where existing credit infrastructures are already established. Finally, actual applications of psychometric credit scores — as in the examples of Edgars in Zimbabwe and JFS in India — have often been driven by efforts by businesses to adapt to wider patterns of informalization, precarity, and crisis-prompted regulatory reforms rather than any sweeping drive towards 'financialization'.

This kind of analysis has important implications for studies of financialization. Two points in particular are worth noting: on one hand, this would seem to suggest that any 'decoupling' of financial profits is necessarily *produced* at much greater difficulty than is often assumed, and subject to a continual and fraught dialectic with the productive activities through which speculative incomes must be realized. IPE scholars, accordingly, should pay more attention to how assets and incomes are made into objects of financial speculation in the first place. There is a good deal of scope for engagement on this point with both STS and Marxian perspectives emphasizing the troublesome character of these abstractions. Second, in assimilating experiments with fintech into a wider narrative of 'financialization', existing analyses have often missed some of the key drivers of such developments, and fundamental contradictions and limits implicit therein. This suggests that some caution is probably in order around the ways in which the concept of 'financialization' is used in these debates. As Christophers (2015: 194) has aptly noted more broadly, 'narratives of financialization tend implicitly to become one-sided, even teleological scripts of linear, uninterrupted, ineluctable development'. Slotting experiments with fintech into such narratives without exploring the wider complex of underlying relations through and into which such devices are necessarily rolled out can lead to critiques that fail to engage with important political dynamics of such processes.

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Table 1 - Indicators of 'Financial Inclusion' in Selected Countries

<i>Country</i>	<i>Percent of Poorest Two Income Quintiles with a Bank Account</i>			<i>Percent of Poorest Two Income Quintiles Borrowing from a Formal Financial Institution</i>		
	<i>2011</i>	<i>2014</i>	<i>2017</i>	<i>2011</i>	<i>2014</i>	<i>2017</i>
Brazil	39.4	58.5	56.6	4.9	7.5	7.4
China	46.0	72.0	68.4	8.0	5.9	6.8
Colombia	13.3	23.4	35.0	8.3	6.4	9.0
El Salvador	6.1	21.6	19.3	3.6	13.5	6.6
India	27.3	43.8	77.1	7.4	4.9	5.6
Indonesia	10.0	21.9	36.6	8.5	11.3	12.4
Kenya	20.7	36.3	70.5	4.2	10.6	11.7
Malaysia	50.4	75.6	80.5	2.9	15.2	9.3
Mexico	11.9	28.6	25.8	5.3	6.5	4.0
Niger	0	3.7	10.5	0.2	1.3	2.8
Nigeria	12.8	33.8	24.5	1.8	6.5	2.8
Peru	5.2	18.4	27.0	8.6	7.4	7.3
Philippines	10.7	14.9	18.0	4.8	8.2	5.2
South Africa	38.8	56.5	62.6	4.7	4.2	7.1
Tanzania	7.5	11.3	37.3	2.7	4.0	3.1
Uganda	10.9	13.5	47.3	6.0	11.3	8.6
Zimbabwe	24.1	16.3	43.6	2.9	2.2	0.9
Low and Middle Income Countries Total	29.1	44.8	54.2	7.7	6.8	7.5

Source: World Bank Findex Data, available: <http://datatopics.worldbank.org/financialinclusion/home>

Table 2 - Example EFL Commercial Projects

<i>Country</i>	<i>Year</i>	<i>Partner Organization</i>	<i>Organization Type</i>	<i>Description</i>
Indonesia	2012	BTPN	Bank	Screening of new applications for SME lending with hybrid EFL scores and conventional credit scorecards, scores used to sort potential borrowers into categories for subsequent screening
South Africa	2012	Business Partners Ltd.	Investment Fund Specializing in SMEs	EFL scores incorporated into due diligence on SME borrowers, use of scores expanded to Kenya, Rwanda, Uganda, Zambia, Malawi, and Namibia by 2015
Guatemala	2012	Banco G&T Continental	Bank	Screening clients for new microcredit products targeting informal businesses, intended use in pricing risk and maintaining targeted default rates
Global	2013	MasterCard	Payment Services Provider	EFL scores used to screen clients for small business credit cards at participating banks
Peru	2013	Banco Financiero	Bank	New loan product targeting microenterprises created, administered based on EFL scores
Peru	2013	Equifax	Consumer Credit Rating Agency	Pilot study on EFL test as supplement to Equifax scores
Peru	2013	Grupo Monge	Retail Group	Screening ‘unbanked’ applicants for retail line of credit programme, practice extended to Guatemalan and Nicaraguan stores in 2014 and 2015
Ecuador	2013	Banco Pichincha	Bank	Screening of consumer and small business loans, top 70 percent of EFL scores selected for further screening; also used as basis for appeal of rejected business loan applications
India	2013	Janalakshmi Financial Services	Microfinance Institution	EFL model used as mechanism for ‘graduating’ microcredit borrowers from group borrowing to individual loans

Zimbabwe	2014	Edgars	Retail Group	Screening applications for retail lines of credit for customers without pay slips
Russia, Mexico, Turkey	2016	Fair Isaac Corporation	Consumer Credit Rating Agency	EFL model licensed to FICO for use in enhancing credit scores of 'thin file' borrowers
Guatemala	2016	FINCA	Microfinance Institution	EFL score cut-off used to select clients for further screening.

Table 3 – Precarious and Vulnerable Employment in Zimbabwe

<i>Year</i>	<i>Unemployment</i>	<i>Casual Employee</i>	<i>Own Account/Unpaid Family Worker</i>
2004	9.3	7.1	64.3
2011	10.7	8.4	66.6
2014	11.3	7.9	66.3

Source: ZimStat 2006; 2013; 2015

Table 4 - Edgars PLC. Sales Revenue and Credit

<i>Year</i>	<i>Revenue (USD)</i>	<i>Outstanding Credit (USD)</i>	<i>Late Payment Charges (USD)</i>
2009	11 129 670	2 534 475	19 445
2010	36 071 500	15 108 841	532 297
2011	52 966 011	18 286 758	1 721 504
2012	62 320 946	22 462 329	2 142 466
2013	64 762 000	23 637 261	2 730 575
2014	72 072 000	33 821 503	3 274 472
2015	62 272 000	33 032 667	5 088 358
2016	50 330 000	25 598 246	5 145 693
2017	62 882 000	24 678 180	3 733 148

Source: Edgars PLC. Annual Reports (various years)

Table 5: Janalakshmi Financial Services – Unsecured Credit Portfolio

<i>Year</i>	<i>Credit Outstanding (INR)</i>	<i>Overdue (INR)</i>
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2013	8 192 885 770	8 516 242
2014	18 636 385 622	69 571 173
2015	36 608 860 652	266 356 370
2016	90 660 844 896	180 137 266
2017	117 747 500 000	817 600 000

Source: JFS annual reports (various years)