Psychometrics:
A new tool for Small Business Lending

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Abstract

Small businesses are significant drivers of growth in developed markets, but often struggle in underdeveloped and emerging markets for a variety of reasons, one of which is often lack of access to finance. On the other side of the fence, potential financiers struggle to come up with sustainable-lending models to service micro–entrepreneurs and -enterprises ("MEs"); for-profit lenders avoid them due to their lack of collateral and credit histories, while sustainable microfinance institutions ("MFIs") rely upon a combination of intuitive assessments (often involving site visits), policy rules, appropriate pricing (cost-recovery plus a factor for growth), and concepts like group liability, individual development accounts, and community/village banks. Even then, MFIs penetration is extremely low, and many or most entrepreneurs rely upon savings, family and friends, and in worst case scenarios the local loan shark.

While many MFIs have developed credit scoring models, the accepted wisdom is that they are ill-suited for third-world microfinance, or cannot be done without further supplementary intuitive assessments and/or risk mitigation. Credit scoring developed in credit-hungry first-world countries, and over time a massive infrastructure has developed to feed it its data dependency, the usual fodder being application and behavioural data. The former is weak, but a starting point where little else exists. The latter is powerful, but elusive in data-deficient environments where either: a) the societies are largely cash based; b) prospective customers are credit virgins (first-time borrowers); and/or c) there is little or no infrastructure to assemble the credit histories that do exist.

Are there not other ways? Can we not assess a potential applicant based upon a test? This paper presents a novel means and preliminary results for scoring MEs, based upon a computer-based test that assesses business aptitude, intelligence, and entrepreneurial ability using psychometric principles. Such tests are already well used for employment assessments, so their use for credit risk assessments seems a logical next step.

An approach was developed by the Entrepreneurial Finance Lab ("EFL"), which originated at Harvard University with funding from Google.org. It is currently being piloted by The Standard Bank Group in selected African markets, and although not a panacea, it is a very promising tool for entering new markets *sans* data. Indeed, it may also provide a valuable alternative source of data in the first-world for assessing start-up entrepreneurs.

Author Biography

Ray Anderson is Head of Scoring at Standard Bank Africa, covering sub-Saharan Africa outside South Africa. After finishing his BComm at the University of Calgary, his wanderlust resulted in him braving 30 years in a changing South Africa. His first exposure to credit scoring was in 1982, when he programmed a vehicle loan scorecard into a calculator. He then spent 13 years in project finance doing computer programming and financial modeling, 15 years covering various aspects of credit scoring, and somewhere fit in an MBA at Wits Business School. His book, The Credit Scoring Toolkit, was published by Oxford University Press in 2007 after three years in the writing. Mr. Anderson is married, has a passion for travel, and enjoys writing, hiking, 4x4ing, scuba diving, share investing, the arts, and the occasional whisky.

Introduction

Credit scoring is an operations research technique used by lenders to harness data and make decision making easier, primarily in retail (high-volume low-value) credit where automation achieves its greatest benefits, especially for consumer credit.[1] Over the past 50 years it has supplanted the traditional judgmental 5C credit risk assessments (capital, capacity, character, conditions and collateral), and resulted in much greater availability and lower cost of credit. More recently it has been successfully used to assess small– and medium–sized enterprises (SMEs) in developed countries, mostly by focussing upon the credit histories of the principals.

The problem comes when we move further upstream into the "financially excluded" camp, which has little access not only to loans, but also savings and insurance products. In this context these are enterprises even smaller, especially in emerging economies where the requisite data is either non-existent or in its nascent stages (which implies poor quality and/or insufficient depth/breadth). Access to finance is restricted because they have neither collateral nor readily-accessible credit histories of any depth.[2] The common wisdom is that scoring cannot be used in such data poor environments, without costly human oversight. While this may be true of traditional data sources, i.e. application and behavioural data, there are other possibilities.

Rioux and Bernthal (1999) published survey results showing that already then about 65 percent of employers were making extensive use of "personality inventories" (such as MMPI®, Hogan, and Myers Briggs®), and 36 percent expected to increase their usage. At the same time, there is a growing body of research that identifies certain personality traits associated with successful entrepreneurs. It should then follow that such or similar tests could be used to assess entrepreneurs' ability and willingness to repay loans.

To this end, the Entrepreneurial Finance Lab has developed a tool—a computer-based questionnaire that takes on average 30 to 40 minutes to complete—to assess factors such as business aptitude, intelligence, motivation, locus of control, honesty and integrity, and so on. Initial indications are that it can reduce bad rates by 25 to 40 percent on existing books, and has the potential to open up totally new markets. The Standard Bank Group is piloting this tool in selected markets in Africa, the first being Kenya. According to Peter Wharton Hood, the Group Deputy CEO, the goal is not only to gain first-player advantage in these markets, but also to foster transformational change and make a substantial difference to the people in the countries where it operates.

The micro-ENTERPRISE environment

It is easy to think of emerging economies as just smaller versions of developed economies, but this is not the case; there are some notable differences. In developed markets the distribution of firms by

[1] As size increases the focus shifts to reviews of trade creditors, financial statement analysis, full fundamental analysis, and an analysis of traded securities (where traded on liquid markets).

[2] Credit bureaux in most first-world countries arose to serve retailers, whereas most African markets are still cash-based societies. Countries like Nigeria, Ghana, Uganda, and Kenya have credit bureaux that service their banks and some others, but enquiries usually return a no hit, multiple hit, or thin file.

the log of the number of employees is relatively normal but skewed towards the smaller end (about 4 or 5 employees). In contrast, the distribution in emerging markets is bimodal—split between the very small (1 or 2 employees) and large (50 plus).

The "missing middle" is seen to be a structural deficiency that inhibits the growth potential of emerging markets. According to Tybout (2000), besides differences in access to finance, it also results because larger firms are better able to operate in environments characterised by regulatory restrictions (pricing, labour laws, business licensing, foreign trade, foreign currency movements), environmental uncertainty (economic, regulatory, political), poor governance (lax legal system, uncertain property rights, corruption), poor infrastructure (road, rail, electricity, education, medical). He also notes that in emerging markets: a) domestic demand is limited and import barriers greater; b) the economies are more agrarian, where local markets are served by cottage industries that absorb the underemployed outside of the planting and harvest seasons; c) many smaller firms are loath to grow beyond a certain stage and instead fly under the radar to avoid regulation; d) the most successful entrepreneurs are attracted to larger firms; and e) capital intensity is discouraged by uncertainty, cheap labour, and lack of human capital.

There are also differences between the nature of the smaller enterprises. In developed markets a distinction has been made between three main types of entrepreneurs: a) craftsman, who have a trade that carry on for their own account; b) opportunists, who seek and capitalise upon opportunities as they arise; and c) inventors, a combination of the two that can take a concept and turn it into a business, focussing especially on product design and obtaining patents [Ciavarellaa (2004)]. To this should be added another dimension, which is insignificant in developed markets because of their social welfare networks (e.g. 'the dole' in the UK). This is the distinction between: i) 'subsistence' or 'necessity' entrepreneurs who are running a small, usually one-person or one-family business, because there are no alternatives; and ii) 'dynamic' or 'opportunity' entrepreneurs, who do it because they want to and are able to employ others beyond family.[3]

The micro-FINANCE environment

MFIs have as their mission "financial inclusion" for the betterment of the poor and growth of the economies within which they operate. Of late, however, these institutions have been suffering from some insecurity; while there may be benefits to some of the immediate recipients, it does not spread further. It seems that much of the problem results from a focus on the subsistence/necessity entrepreneurs,[4] whereas investments in dynamic/opportunity entrepreneurs would provide greater benefits. For that matter, the latter group has problems gaining access to finance generally—they are too affluent to get money from the MFIs, but too small to get money from formal lenders. At the same time, the pool of dynamic entrepreneurs tends to be small, whether because of poor education and/or skills levels (that inhibit them from recognising opportunities), problems opening

[3] The 'subsistence/dynamic' dichotomy was used by the International Labour Office in Geneva [ILO (2000)], whereas "necessity/opportunity" is used in the Global Entrepreneurship Monitor and is more widely accepted.
[4] Indeed, the term 'microenterprise' is sometimes associated solely with necessity-based enterprises, and 'microfinance' solely with lending based upon group liability.

and operating businesses (such as cultural taboos, legal restrictions, and demands for bribes), and other factors.

In South Africa, a distinction is made between "Microfinance" and "Microlending"; the former having a social end to better the lives of the poor, and the latter being purely commercial (and often predatory). In both cases, lenders are now required to share data via the credit bureau, which has required significant investments in infrastructure and risk assessment models, and improved access to lower-cost credit (at least for those who have avoided spending splurges gone wrong). Most of the borrowers are salaried employees, who can present payslips indicating they can afford a loan. Unfortunately, financial inclusion does not automatically translate into financial sophistication, and the recent economic rollercoaster has resulted in many having court judgments taken against them.

It is similar in countries to the north, where almost all personal lending by mainstream banks is to people in formal employment. The difference is that credit risk continues to be mitigated by a web of policy rules and high margins, as the lack of data infrastructure (own or bureau) inhibits greater sophistication. This includes the lack of unique nationally-accepted identification numbers. Where scorecards have been developed, the biggest contributors have been the strength of the existing banking relationship and delinquencies on current or past loans, and their use has been limited to identifying a few super-goods or super-bads. Little or nothing exists to assess new-to-bank customers, especially microenterprises.

Assessing micro-entreprises

Most MEs have either never borrowed before, or there is no data on past borrowings. Traditional credit risk scorecards rely upon application and behavioural data (own or bureau), which is significant in developed markets. The latter relies on infrastructure investments, whether by lenders or credit bureau, and even then the data quality may be poor (inaccuracies, problems matching, lack of depth or breadth). As a result, microfinance has developed using concepts like group liability, individual development accounts, and community/village banks,[5] while for-profit lenders have relied heavily upon price.

Beyond the lack of data, lending to microenterprises is complicated by a variety of other factors.

- ☞ Lenders are wary of their uncertain incomes and treat them like the poor cousins of their salaried counterparts, if treated at all. The people who have it easiest are those where at least one family member is in formal employment, and they can borrow against that salary.
- ☞ Micro-enterprises work from day-to-day and week-to-week (traders), or season-to-season (agriculture), while lenders tend to structure monthly repayments.
- ☞ The loans tend to be low-value and short-term, such that once the costs of making the loans are included the resulting interest rates seem usurious (APRs of 50%+), even though they are totally affordable to the target market (i.e. the entrepreneurs can earn even greater profits).

[5] MFIs also provide services other than credit, including savings and insurance products. Indeed, in some environments the need of the financially excluded for savings products and savings mobilisation is greater than the need for credit.

- ☞ The enterprise and the individual are usually one, and statistical analyses are distorted by extraneous factors for which no data is collected, such as the support of extended households and income from their other enterprises or formal employment.
- ☞ Lenders want to apply similar rules to those for larger businesses yet: i) the self-employed are too busy running their businesses or do not have the necessary knowledge to provide that information (e.g. financial statements); and ii) where available, the same ratios can take on much different meanings.
- ☞ Borrowers tend to be price insensitive, as their primary interest is in whether their net revenues can repay the loan and still give them a fair margin.
- ☞ Traditional 5C assessments could be done but are not very cost-effective, especially for banks that charge relatively thin margins.

As a result, microenterprise lending tends to be dominated by non-bank lenders who often specialise in this market, and rely upon a combination of intuitive 5C assessments (often involving site visits), policy rules, and interest rates at least sufficient to cover costs and provide a fair return. Even then, penetration by lenders is extremely low.

The Entrepreneurial Finance Lab

Questions have recently been asked by credit scoring practitioners regarding potential new advances in their domain. New statistical and mathematical techniques do not provide much hope, while new data sources seem limited. The use of attitudinal questionnaires hardly features, because they are perceived as prone to manipulation (gaming) and nobody has gotten their head around how to assess them.

This "EFL tool" is the brainchild of Bailey Klinger, CEO of the Entrepreneurial Finance Lab whose acronym prefixes in the name, and Asim Khwaja, a professor at Harvard University. They developed this idea while performing research on the barriers to small enterprise growth in South Africa, and subsequently launched a research initiative at Harvard University (the EFL Research Initiative www.cid.harvard.edu/eflri) spanning Africa and Latin America, as well as a private enterprise (EFL). Although still early days, they have already won the G-20 SME Finance Challenge in 2010 as one of the top innovations in the world to unlock scalable SME finance in developing countries.[6]

A primary premise was that if psychometric principles can be used successfully for employment assessments, it should be possible to extend it to credit assessments. Academic papers had already shown correlations between personality characteristics and entrepreneurship (e.g. entrepreneurs versus managers, successful versus failed entrepreneurs and their survival rates). The challenge was to: a) design a cost-effective, scalable, and game-resistant test;[7] b) gather data, both on the borrowers and their subsequent performance; c) develop an initial model; d) apply it in practice, and assess the results. Cost-effectiveness applies both to the lender and borrower, in terms of being

[6] The entry was titled "Automated, scalable, and proven psychometric risk measurement tool for SMEs."
[7] In this context, "gaming" refers to attempts to manipulate the results to achieve a desired end, similar to what would be achieved by embellishing an application of any sort to improve its chances of acceptance.

quick and easy to administer/complete, noting that the threshold varies with the potential payoffs for each.

Test design

The test design involved several steps, the first of which was to scour existing literature for personality and other traits known to differentiate between successful and unsuccessful entrepreneurs. Personality traits included factors like locus of control (internal versus external), ethics and honesty, conscientiousness (dependability, industriousness, efficiency), and optimism. Certain other factors were also included that in academic studies had been included as control variables, such as age, past business experience, and enterprise size. On the latter, the personality traits that define the successful entrepreneur vary between start-up, growth, and mature enterprises [Acharya et al.].

The next step was to design a questionnaire that could assess these factors. Much of this was borrowed from existing tests and purchased from leading employment screening companies, including psychometric, intelligence[8], and business aptitude tests. Part of the challenge was to come up with a generalised test that would be as broadly applicable as possible, given differences across national geographies, cultures, socioeconomic groups, etc. Thereafter they needed to develop a means of administering the questionnaire in the most cost-effective manner. The questionnaire was set up on a small portable computer or handheld device that could either be set up in a bank branch or be used by sales consultants during site visits. This provided the added benefits of: a) avoiding any data-capture exercise; and b) allowing the random selection of a larger set of questions to prevent gaming.

Next came data collection, which was obtained from various financial institutions that partnered EFL including: South Africa) an SME venture capital company and a commercial bank; Kenya) two commercial banks, one SME-focused and the other microfinance-focused; Colombia) one microfinance institution and one commercial bank; and Peru) two microfinance institutions, one urban and one rural.

Rather than applying the questionnaires and waiting months or years for performance data, the questionnaire was instead applied to existing accounts where the results were already known—a difficult feat if you want ask questions of delinquent account-holders, whose relationship with the lender may be less than amicable or hostile. The end result was that the development sample was comprised primarily of accounts that were either up-to-date or 30 days-past-due, with a small number at 60 days.

This then provided sufficient fodder for model development. Initial results were extremely positive, including Gini coefficients in the 50 percent plus region for the development sample, but it was

[8] Two types of intelligence noted in this context are short-term cognitive and abstract thought, which can at least partially be measured by a digitspan recall and Raven test respectively. It must be noted that their correlation with entrepreneurial success and credit behaviour is not always intuitive, e.g. smarter individuals can have a tendency to become distracted and not keep the necessary focus.

recognised that it was based upon a huge number of assumptions. Ultimately, they needed an innovative and forward-thinking pilot partner to try it out. It's one thing to provide data to develop a tool; it's another to put skin in the game by putting it into practice.

The Pilot!

In this instance, the guinea pig volunteered. The Standard Bank Group was looking for tool that allowed them entry into emerging markets where it had no experience, and was willing to put money at risk in the experiment. The country of choice was Kenya, and more specifically the Gikomba market in Nairobi, a large informal market covering four square kilometres, that was called the "supermarket of the poor" by the Nairobi Standard newspaper.

The pilot stared in October 2010. Thus far the total number of loans is still relatively small, but sufficient to conclude that the tool works and the segment can be lent to profitably. There were a lot of challenges along the way though, not all of which have been fully resolved. On the business front:

- determining the maximum loan size and pricing;
- determining appropriate repayment terms and frequencies;
- adjusting processes, loan sizes, and pricing for concerns of different sizes;
- accommodating the tool within existing structures (process, product, etc.);
- accommodation of weekly instead of monthly repayments;
- coming up with a sustainable collections model;
- customer and staff education;
- proper selection and incentivisation of sales staff;
- and addressing potential fraud or embellishment.

Although there is a bank branch at the market, salespeople were hired to go into the market to seek out prospects. Surveys had indicated that potential demand was high, yet this did not turn into sales—each salesperson averaged one per day. A couple of the problems identified were: a) a very heavy focus on ensuring payments were up to date instead of sales; and b) inappropriate incentives. On the latter, an issue was that the seemingly low basic salary was considered enough to live on by the salespeople.

As far as an experiment was concerned:

- the setting of fail-safe default-rate thresholds, beyond which the experiment would be terminated (in whole or in part);
- defining a control group against which to compare;
- developing means of matching test results with loan outcomes;

On the final point, embellishment of credit applications can occur anywhere, and this should be no exception here—applicants will probably tell us what they think we want to hear, to improve their chance of getting the loan.

From a purely technical point of view, there were also more minor issues relating to the use of the tool:

- avoiding confusion between predicted and actual default probabilities;
- developing a reporting framework to present results to the business;

When initially presented, EFL claimed that they were able to achieve Gini coefficients in the 50 plus percent range in their development sample. We realised that this was highly ambitious, yet the concept made logical sense. Our expectation was that we would not reach those lofty levels at the outset, but still reasonable predictive power. The issue, of course, was that the model was built on borrowed data. Some came from the Gikomba market itself, but much came from South America.

For the pilot, applicants were subjected both the EFL test and our normal lending criteria, and if they were accepted on either it was a pass. At the same time, the EFL cut-offs were initially set low to maximize learning (initial EFL decline rates were only 5%, though this has since been increased to 15%). This did not mean that every application resulted in a loan though, as people changed their minds, could not be found later, or did not pass fraud checks.

EFL had two models from which to choose—micro and not-so-micro. When the pilot first started the former was used, but it was soon realised that the latter worked better. This had little influence on the results, given that almost all applicants were being accepted anyway. After several months though, there was sufficient data to justify changing models and moving the cut-off upwards.

Early Results

The pilot has now been running since October 2010, and we were able to draw conclusions based on the first 400 taken up loans, with performance measured at April 2011. Although small in number, the results are indicative. The loan sizes had ranged from $12,000 down to starter loans of just US$300, with many of the former being granted in the early stages to larger importers. The ultimate goal, however, was to test the smaller loans and their volumes did increase. Overall, the portfolio 90 days-past-due rate at the moment is under 5%. This is much lower than initial projections, which implies that significant inroads could have been made into this market without the EFL tool, as long as appropriate processes were in place. On the downside, it limits the amount of data we have to assess the results of the experiment.

Figure 1 shows the volume of accounts and bad rates split out by loan size. It's not surprising that the default rate increases with loan size, but one must be aware that the smaller loans also had much more punitive interest rates to cover perceived higher risk (here borne out) and the originations costs. That said, many of these loans have been successfully repaid and the applicants have graduated to larger loan sizes at lower rates.

Figure 1: Volumes and bad rates by loan size

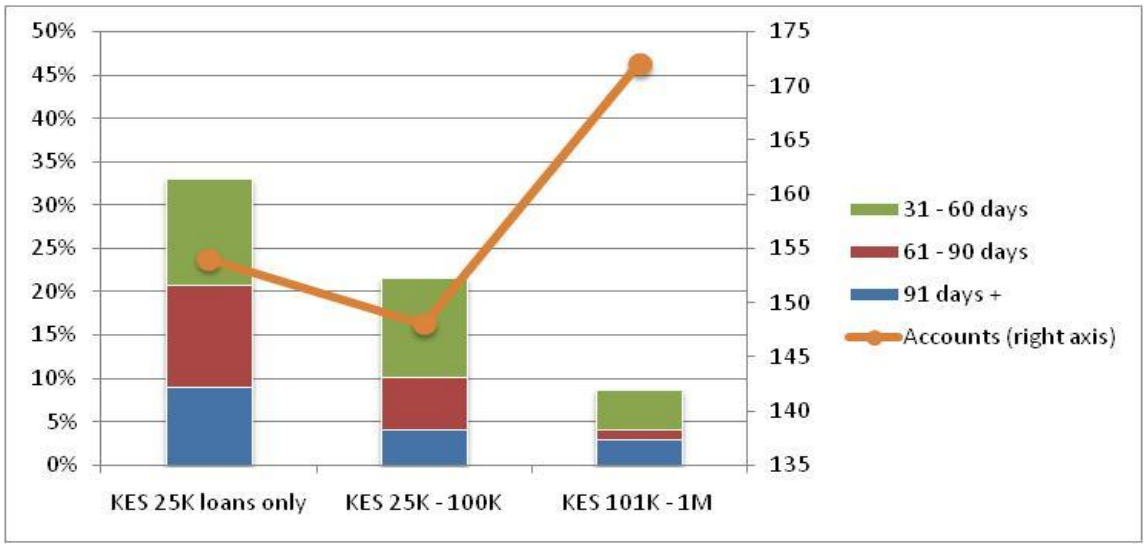


Table 1 shows the difference in results between the EFL test (rows) and the normal SB application process (columns). It's logical that the default rates are lower where the applicants passed both tests, but what's really notable is that: a) 70 percent of booked loans passed on EFL only; and b) they are lower risk than those who passed the SB process but were failed by EFL.

Table 1: EFL versus SB

	Approved		3+ past due	
	Yes	No	Yes	No
Yes	98	269	1.0%	4.8%
No	45		8.9%	

When the scorecard itself was assessed the results were not as high as those achieved on the development sample's global data, but are still promising—the Gini coefficients are better than what we typically achieve in data-deficient environments, and are expected to improve once tailoring has been done for specific environments.

Figure 2: Strategy Graph

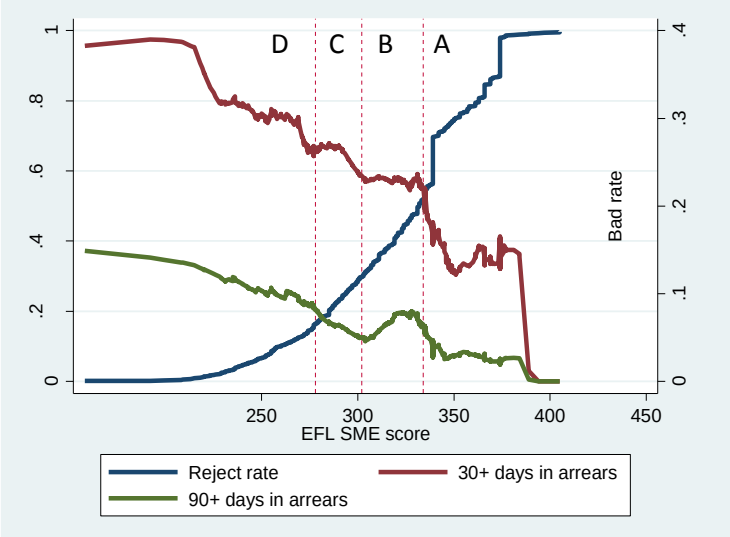
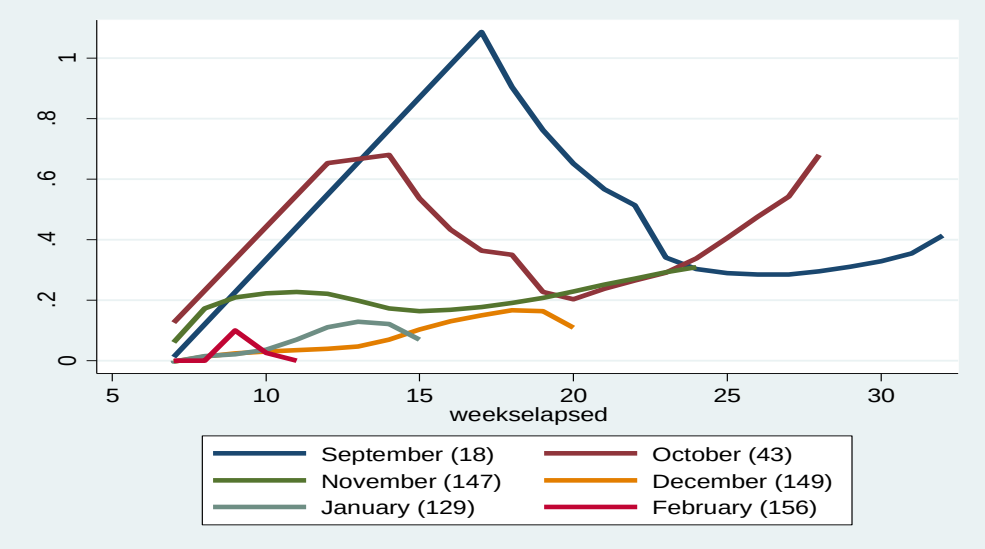


Figure 2 is a "strategy graph" showing the trade-off between the reject rate and bad rate across the score spectrum. The "A" to "D" labels indicate score ranges within the spectrum where different strategies (maximum loan amounts and interest rates) were applied. Granted, these do affect the risk and would need to be controlled for in future. What is notable is that the EFL score is especially

strong within the "D" range (worst 20%), does not strongly differentiate between "C" and "B" (middle 40%), and distinguishes the "A" group (best 40%) from the rest but provides little within that group. Ultimately, the power has been provided by its ability to identify the first ("D") group. Once again, this is preliminary and is likely to improve significantly once a bespoke model can be developed.

Finally, Figure 3 shows a vintage analysis showing the default rates as the different monthly cohorts evolve. In particular, it's showing how the default rates have been reducing as each month goes by. The results for the initial two months are distorted because of extremely low relative volumes and teething problems of getting appropriate collections processes in place. Indeed, heavy reliance is currently being put upon site visits to remind people to pay, which creates a heavy resource burden.

Figure 3: Vintage analysis



Conclusion

Although still relatively early, initial results indicate that the tool is providing results comparable to what traditional scoring techniques would provide with a combination of application data and negative bureau data (i.e. excluding payment profile data from other lenders). This is significant, given that these are borrowed models, developed based upon interviews with customers of other banks (even in other countries), where most "bads" were only 30 days-past-due. At the outset Standard Bank had sufficient confidence in the tool to initiate pilots in other countries, and once there is sufficient data will tailor one or more models for its through-the-door population of real-life microenterprise loan applicants.

There is also significant potential for this tool in other environments (modified to suit of course). Existing credit scoring focuses primarily upon what people have already done to predict what they will do; this tool achieves the same end by instead focussing on what they believe and their potential to achieve. Its value would be greatest in thin-data environments where customers lack credit histories, e.g. youth/students and low-income lending. Second, and no less important, would be to supplement thick data environments where the applicants are looking for credit outside of existing

parameters, such as entrepreneurs seeking significant capital injections without having already strong capital bases. The challenge will be the tailoring of questionnaires to allow adequate assessment of these individuals' potential for credit in those markets.

The Entrepreneurial Finance Lab is also looking at other supplementary tools that can potentially be used in the loan application process. First, the use of biometric identification, or more specifically fingerprinting. This really provides the greatest benefit where part of a national database (as is currently being done by the credit bureau in Uganda), but in a field-experiment in Malawi was shown to affect applicant behaviour positively even where the database is maintained by a single lender [Giné et al. (2010)]. Second, the use of voice analysis to detect potential fraud. While the psychometric test has elements that measure honesty and integrity, extra measures are required to detect potential misrepresentation of the enterprise.

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