



Microfinance Index of Market Outreach and Saturation

# MIMOSA 2.0: Mapping the (micro)credit cycle



responsAbility



BNP PARIBAS



# Acknowledgments

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Emmanuelle Javoy and Daniel Rozas



**Deutsche Bank**



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# Sponsor forward

There is an often-cited quote, “You can’t manage what you don’t measure,” variously – albeit incorrectly – attributed to management consultants Peter Drucker and W.E. Deming. No one knows who first formulated these words, but the sentiment certainly befits the notion of data-driven decisions. And few sectors are as data-intensive as finance, be it micro or the larger kind.

Yet when it comes to preventing overindebtedness, we are limited to monitoring highly qualitative measures – are policies in place to check borrower repayment capacity? Have the Board of Directors and management been trained in client protection? Is the market crowded? These are valuable inputs, but highly subjective.

At the other end of the spectrum, client overindebtedness surveys gather lots of quantitative data, yet they turn out to be almost as limited. First, they are difficult to cross-compare – there are nearly as many definitions of overindebtedness as there are overindebtedness surveys. Should one use debt-to-income ratio as the measure? If so, which income to use – household or individual, gross or net, with remittances or not? Or maybe ask borrowers if they are experiencing financial stress? But then how to separate debt-induced stress from the more common poverty-induced kind? Even when we can resolve these questions, such studies are too costly and impractical to use for ongoing management.

In short, the sector is left with limited means by which to measure, and thus, manage the risk of overindebtedness. The MIMOSA Project is meant to narrow this gap. The MIMOSA 1.0 prototype published in 2013 showed that such a metric was possible, but on its own it was insufficient. The new MIMOSA 2.0 has taken that promise and transformed it into a robust and actionable tool for decision-making.

It provides measures of credit outreach and saturation that are accurate and directly comparable between different countries as well as between their administrative regions. The accompanying MIMOSA country reports are a critical planning input for financial institutions, investors, and regulators. Providing year-by-year trends and a holistic review of key indicators that provide context to the country’s outreach and saturation, these reports can inform strategies in the near and more distant futures.

We welcome the new MIMOSA 2.0 and look forward to its expansion to more markets. This is a major contribution to financial sector development, building more stable markets and preventing overindebtedness. We are proud to have been able to participate in this project.

# Executive summary

The MIMOSA project is an effort to fill an important gap in the sector by establishing a standard framework for measuring credit saturation. In doing so, it gives market participants – MFIs, investors, and regulators – a tool that can guide important planning decisions that avoid excessive saturation and overindebtedness, while highlighting areas that remain underserved.

This publication represents a major milestone for the MIMOSA project. Aside from making important changes to the MIMOSA model, we conducted pilot studies in eight different markets around the world, and gathered local lending data from an additional 20 countries and regions. With MIMOSA 2.0, we have moved from the realm of prototyping into ongoing provision of up-to-date information on credit in a significant number of markets important to the microfinance and financial inclusion sectors. In addition to this whitepaper, during the month of November, we are publishing seven country reports.

A MIMOSA country report consists of four components:

- **Penetration** – a measure of credit utilization in the market (at both regional and national levels), expressed as the number of individual borrowers per adult population.
- **Capacity** – a model estimate of the number of active borrowers the market can be expected to sustainably support. It is derived by observing a large number of markets over a period of time.
- **The MIMOSA score** – an indicator of credit saturation based on how much observed penetration deviates from the capacity estimate. A separate provisional score for credit card saturation is also provided.
- Additional **risks/mitigants** provide context and meaning to the score (regulatory quality, competition, maturity, transparency and other factors relevant to measuring saturation).

All of these components are guided by the following rules: keep it simple without being simplistic, rely on data that is meaningful and accessible in most markets, and keep the output both understandable and actionable. If we can't explain it, we don't use it.

The heart of MIMOSA rests in our credit penetration metrics – the broadest set of microfinance borrowing data assembled to-date. For each of the country reports, we have collected penetration data from three tiers: the World Bank Global Findex survey, local supply-side data (credit bureaus, central banks, microfinance associations, MIX Market), and client data from our own field surveys of 100-150 potential borrowers in different parts of the country. By interpolating between these three tiers, we are able to create a more accurate and consistent measure of penetration than any single source can provide.

Meanwhile, the indicators used to calculate credit capacity provide the necessary context that supports this level of penetration, including regional differences within a country. The resulting MIMOSA score, whether at the national or subnational level, provides a straightforward measure of credit saturation that allows direct comparisons between countries and regions. Combined with the risks and mitigants for credit sustainability, a MIMOSA country report is an indispensable tool for informed decision-making. And for countries where we have not yet done a full assessment, we provide a set of provisional scores as a general guide.

Like any predictive tool, MIMOSA should not be used blindly, but rather, as an input for decision-making. Had MIMOSA existed in 2008, it would have scored both Nicaragua and Andhra Pradesh at the highest saturation level. Still, it cannot predict every crisis – Morocco in 2008 would have scored as a normal market, though many of the additional risks (growth, competition, regulation) would have been flagged as red.

This whitepaper is an introduction to MIMOSA, and includes an extract of scores, a review of the structure and underlying components of the framework, along with the rules and process used to generate penetration and capacity inputs. We explain the risks and mitigants included in the MIMOSA country reports, along with brief summaries of select examples. We end with a back-test of MIMOSA by exploring how the tool would have fared as a predictor of past crises. The appendices provide additional detail on the data and analysis that form the foundation of MIMOSA.

This publication marks the end of the MIMOSA 2.0 project phase. Combined with the publication of the first set of country reports, we have created an infrastructure for collecting and analyzing data that is ready to scale and can be regularly updated. Our goal is to provide current coverage for at least 20 countries, and thus significantly raise the depth of information in one of the key areas in microfinance and financial inclusion.

This is a work in progress. Check in with us at [MimosalIndex.org](http://MimosalIndex.org) for more updates!

# Contents

Acknowledgments	<b>2</b>
Sponsor Forward	<b>3</b>
Executive Summary	<b>4</b>
MIMOSA Scores 2014	<b>7</b>
1 Introduction	<b>8</b>
2 What is MIMOSA?	<b>9</b>
3 The MIMOSA country reports	<b>15</b>
4 MIMOSA in action	<b>21</b>
Appendix A: Finding the most accurate measure of penetration	<b>25</b>
Appendix B: MIMOSA model and calculations	<b>28</b>
Appendix C: MIMOSA for credit cards	<b>33</b>

# MIMOSA Scores 2014

Below table is an extract from the full list of MIMOSA scores, accessible through [MimosalIndex.org](http://MimosalIndex.org).

Underline: indicates countries with a current MIMOSA country report

**Bold**: scores based on validated data (see section 3.3.1 for more details)

All figures (except scores) expressed as % of adults, age 15+

Country name	Penetration		Capacity (% age 15+)		Mimosa score		Credit cards		
	Findex	Local	Mimosa Capacity	Penetration over capacity	2014	2011	Penetration	Capacity	Mimosa CC Score
<b>Pilot countries</b>									
<b><u>Cambodia</u></b>	<b><u>27.7</u></b>	<b><u>17.6</u></b>	<b><u>8.8</u></b>	<b><u>8.8</u></b>	<b>5</b>	<b>4</b>	<b><u>2.3</u></b>	<b><u>1.2</u></b>	<b><u>Neutral</u></b>
<b><u>Bolivia</u></b>	<b><u>19.7</u></b>	<b><u>19.9</u></b>	<b><u>11.2</u></b>	<b><u>8.7</u></b>	<b>5</b>	<b>4</b>	<b><u>4.6</u></b>	<b><u>5.5</u></b>	<b><u>Neutral</u></b>
Azerbaijan	18.9	7.2	12.0	6.8	4	4	8.1	4.5	Neutral
<b><u>Kyrgyzstan</u></b>	<b><u>13.5</u></b>	<b><u>14.0</u></b>	<b><u>9.7</u></b>	<b><u>4.3</u></b>	<b>4</b>	<b>3</b>	<b><u>1.7</u></b>	<b><u>2.1</u></b>	<b><u>Neutral</u></b>
Senegal	3.5		5.6	-2.1	2	2	0.9	0.8	Neutral
<b><u>Morocco*</u></b>	<b><u>4.4</u></b>	<b><u>3.6</u></b>	<b><u>9.0</u></b>	<b><u>-4.6</u></b>	<b>2</b>	<b>2</b>			
Peru**	11.2	30.2	16.8	n/a	n/a	n/a	10.0	23.5	n/a
<b>Other countries</b>									
Mongolia	35.7		10.6	25.1	6	6	0.8	5.0	Neutral
<b><u>Nicaragua</u></b>	<b><u>14.3</u></b>	<b><u>23.7</u></b>	<b><u>10.2</u></b>	<b><u>13.5</u></b>	<b>6</b>	<b>5</b>	<b><u>1.9</u></b>	<b><u>3.4</u></b>	<b><u>Neutral</u></b>
Montenegro	23.5		12.1	11.4	6	5	12.3	6.0	High
Myanmar	15.5		6.4	9.1	5	5	0.0	0.8	Neutral
Kenya	14.9	16.6	6.6	8.3	5	3	2.7	0.8	Neutral
Vietnam	18.4		11.7	6.7	4	4	1.2	2.2	Neutral
Jordan	13.6		10.5	3.1	3	1	1.8	5.5	Neutral
Dominican Rep	18.2		15.5	2.7	3	2	9.3	13.3	Neutral
Colombia	15.6		13.5	2.1	3	2	12.2	10.4	Neutral
Bosnia	14.0	6.3	12.4	1.6	3	2	6.2	4.0	Neutral
Indonesia	13.1		11.8	1.3	3	2	1.1	3.9	Neutral
Tanzania	6.5		5.6	0.9	3	3	0.4	0.7	Neutral
Philippines	11.8		10.9	0.8	3	3	2.2	2.1	Neutral
Georgia	13.7		13.5	0.2	3	2	13.2	6.6	High
Ghana	8.1		8.2	-0.1	2	2	0.6	1.7	Neutral
Ecuador	13.4		13.6	-0.2	2	2	4.9	8.3	Neutral
Brazil	11.9		12.7	-0.7	2	1	28.3	10.2	High
Nigeria	5.3		7.1	-1.8	2	1	1.9	1.0	Neutral
Bangladesh***	9.9		14.2	n/a	n/a	5	0.2	1.0	Neutral
India	6.4		10.7	-4.4	1	2	3.4	1.4	Neutral
Pakistan	1.5		7.7	-6.2	1	1	0.1	1.0	Neutral

\* 2014 Findex data for Morocco not published; using 2011, consistent given slow growth; local data represents only microfinance lenders

\*\*Data from Peru is still in the process of being validated, and will be made available by year-end 2015.

\*\*\* Bangladesh score for 2014 withheld due to inconsistency in penetration data

# 1 Introduction

In the 1970s, the American economist Hyman Minsky developed the Financial Instability Hypothesis – that financial markets, and debt in particular, are the major factor behind the never-ending alternation between boom and bust. Minsky termed this the Credit Cycle: success leading to excess leading to crisis leading to recovery. For much of his life, the theory remained on the fringes of economics, that is, until the financial crisis of 2008 brought his work back from the dusty shelves of university archives.

Like all debt markets, microcredit is susceptible to the credit cycle. During 2008-10, repayment crises in Bosnia, Nicaragua, Morocco and Andhra Pradesh underscored the point. But knowing that the sector follows the credit cycle is not enough. The bigger question is how to identify where along that cycle the markets are located.

The past several years have seen much work aiming to identify the warning signs: rapid growth, bonus-oriented compensation, high staff turnover, multiple borrowing, poor governance. The signs are indeed many, and the industry is getting better at recognizing them. But they still don't measure the thing itself – too many people borrowing too much. And even then, where to draw the line? How many is too many? How much is too much?

Answering those questions is the main objective of MIMOSA. A credit bubble is not a precise threshold, but we do know that the more such bubbles inflate, the more they become susceptible to a crisis and the greater their damage to overburdened borrowers and their lenders. The publication of MIMOSA 1.0 in 2013 demonstrated that benchmarks and reasonably accurate measures of credit saturation in diverse markets were indeed possible. With the help of a number of microfinance investors and donors, this proof of concept has been translated into a far larger – and more useful – effort.

This publication is a major milestone for the MIMOSA project. With the publication of the 2014 Global Findex data, we have substantially revised and strengthened our market capacity model. In addition, we conducted pilot studies in eight different markets – Azerbaijan, Bolivia, Cambodia, India (W. Bengal), Kyrgyzstan, Morocco, Peru, and Senegal – and gathered local lending data from an additional 20 countries and regions.

The purpose of this exercise was to get deeper and more accurate metrics to assess credit penetration and capacity. To do this, we collected data at three distinct levels: global data sources and local supply-side and demand-side data. In the pilot countries, we gathered this data not only at the national but also at regional levels. This multi-sourcing of data helps confirm the relevance and accuracy of figures for both capacity and penetration.

For example, the MIMOSA field surveys – interviews of 100-150 individuals in each country – are too small to supply significant samples on loan use. However, they are excellent for quickly and cheaply assessing gaps in other data sources, such as the presence of unregistered MFIs. Similarly, accurate supply-side data from central banks or credit bureaus can help confirm (and in some case adjust) findings from the Findex survey. Plus, by collecting regional data, we can calculate saturation scores not only for the country, but also for its top-level administrative regions – which we provide in the MIMOSA country reports.



Together with this whitepaper, we are publishing seven country reports<sup>1</sup> and plan to expand this to at least twenty countries by the end of 2016.

Data type	Sources	Number of countries	
		National data	Regional data
<b>Demographic / macro</b>	UNDP, World Bank, IMF, central banks, census bureaus	~140	9
<b>Supply-side</b>	Central banks, MF associations, MIX	28	8
	Credit bureaus	5	3
	MIMOSA MFI surveys	8	8
<b>Demand side</b>	Global Findex	~140	-
	MIMOSA field surveys	8 (samples of regions)	

<sup>1</sup> The pilot in West Bengal was terminated early, due to lack of necessary data.

## 2 What is MIMOSA?

The core of MIMOSA consists of four components: penetration, capacity, the MIMOSA score, and additional risks/mitigants:

- **Penetration** is simply a measure of credit available in the market, which in MIMOSA 2.0 is expressed as the number of individual borrowers as a share of the adult population.
- **Capacity** is a model estimate of how many active borrowers the market can be expected to sustainably support.
- The **MIMOSA score** is a function of penetration and capacity, rated based on how much penetration is higher or lower than the capacity estimate.
- Additional **risks/mitigants** provide context and meaning to the score (regulatory quality, competition, maturity, transparency and other factors relevant to measuring saturation).

All of these components are guided by the following rules: keep it simple without being simplistic, rely on data that is meaningful and accessible in most markets, and keep the output both understandable and actionable. If we can't explain it, we don't use it.

### 2.1 Penetration

It seems like a simple question – what is the level of credit penetration in a given market? Yet this proved to be one of the major challenges during the project. The resulting collection of data from multiple sources has formed the heart of what is now MIMOSA.

We explain the technical aspects of penetration measures in Appendix A. However, some of these concepts are fundamental to understanding and using MIMOSA, and we summarize them below.

#### 2.1.1 Microcredit market vs. Total retail credit market

MIMOSA is not limited strictly to measuring microfinance. With the exception of credit cards, all fixed-term, formal loans used by retail borrowers are included in our metrics.

This may seem contrary to our mission, embedded within the name – to measure microfinance outreach and saturation. However, drawing boundaries around this more specific segment can be a somewhat arbitrary exercise. Microfinance customers can and do borrow from other financial institutions, while banks can and do make microfinance loans, alongside loans to wealthier customers. Moreover, many MFIs seem to have limited knowledge of their client incomes, at least at the aggregate level. In nearly every country, when responding to our survey, MFIs provided such vastly varying estimates of client incomes that they were unusable. We eventually dropped this question from the survey altogether.<sup>2</sup>

<sup>2</sup> Institutions that consistently use poverty-tracking tools, such as the Progress Out of Poverty scorecard, provided very detailed responses regarding client incomes. However, such institutions are in the minority.

This broader scope also captures the objectives of those institutions focused on financial inclusion generally, and not just microfinance. Narrowing the penetration measures to more specifically reflect microfinance customers remains an important objective for us. In the MIMOSA country reports, we make special note of metrics that pertain specifically to the microfinance sector. We will continue to work on finding reliable methods of better defining more specific target segments and providing their penetration levels.

Notwithstanding the added value of looking at narrower customer segments, borrowing patterns of any one income group are closely linked to the borrowing patterns for all retail clients, as demonstrated by the MIMOSA 1.0 study.<sup>3</sup> Moreover, in most of the markets that MIMOSA targets, MFIs serving poor clients tend to have greater outreach than banks working with higher-income groups, and as a result, penetration of MFI target clients reasonably closely tracks the penetration levels in the overall population. In light of these factors, measuring penetration for all retail loans is equally relevant to both microfinance and financial inclusion sectors.

## 2.1.2 Loans and credit cards

Our penetration metrics focus on fixed-term loans, including microfinance. Credit cards are of course also loans and have an important impact on borrowing capacity. However, credit card debt is more heterogeneous – mere possession of one is not the same as carrying a large outstanding balance. Moreover, data on credit cards, and certainly, credit card usage, is not as broadly available as data on loans. Finally, though both loan and credit card usage is driven by largely the same indicators, the distribution pattern for credit cards greatly differs from fixed term loans. Because of this, we evaluate credit card penetration and capacity separately, and provide a separate credit card saturation score.

For more detail on the credit card model, please see Appendix C.

## 2.1.3 Formal and informal loans

A trend in overindebtedness research has been to look not just at formal loans, but at the overall indebtedness of a household, including loans from private moneylenders, stores, and friends and family.

When studying specific households, this is a valuable approach. However, when looking at aggregate data, informal loans are problematic in many respects.

First, aside from surveys, there is just no way to gather such data, and while Global Index sheds some light on informal borrowing, it's insufficient for assessing penetration. Second, informal loans are by definition non-systemic. Credit bubbles resulting from informal lending may be possible, but we are not aware of any. And finally, though informal credit can be a source of additional financial stress, it can likewise prove complementary to formal loans, filling in gaps in cashflow and providing flexibility that few formal lenders can offer. As such, assessing informal lending as part of credit penetration can be problematic. As a result, we limit our measure of penetration to formal loans only.

That said, our definition of formal lending is not limited to institutions that are supervised or even recognized by the country's financial authority. An important role of the MIMOSA field surveys is to assess the presence of "shadow" lending by organized institutions that are not included in the financial reporting system.

For more detail on the methodology for measuring penetration, please see Appendix A.

<sup>3</sup> MIMOSA Microfinance Index of Market Outreach and Saturation: Part 1 – Total Credit Market Capacity, Planet Rating, March 2013

## 2.2 Capacity

Unlike penetration, borrowing capacity cannot be measured directly. But it can be reasonably modeled. Three pillars guide the MIMOSA credit capacity model:

1. Retail markets have a limited capacity for credit. The more penetration exceeds capacity, the greater the risk of a credit bubble.
2. Credit capacity is not a fixed value applicable to all markets, but is instead dependent on a number of observable factors. The result is that different markets can have very different levels of capacity. While in one country or region, a given level of penetration could mean a credit bubble, in another area, the same penetration may be a sign of an underserved market.
3. One can reasonably estimate the credit capacity in a given place and time by referencing a data set covering many markets at multiple points in time.

To achieve the third pillar, MIMOSA relies on the Global Findex database, which currently provides a snapshot of credit usage in over 140 markets taken in 2011 and 2014. Although Findex is an imperfect proxy of borrowing penetration (see Appendix A), it remains the single best source for a reasonable regression analysis. As the MIMOSA database grows, we will supplement the Findex dataset with our own penetration metrics. Until then, it will remain the basis on which we model credit capacity.

After extensive evaluation of several dozen indicators, the MIMOSA 2.0 model was winnowed to just three: the Human Development Index, the Credit Bureau Score, and population density. These three indicators capture different elements of capacity, are accessible, and together can be used to estimate capacity at both the national and regional levels. As always, our emphasis is on simplicity and accessibility, rather than theoretical perfection. We review these in brief below, but for more detail, including the model formula, see Appendix B.

**Human Development Index (HDI):** an indicator produced by UNDP that combines both economic development (per capita GNI) and overall standard of living (life expectancy and education). Countries with higher HDI show higher borrowing from financial institutions. This is the most significant factor in the MIMOSA model.

**Credit Bureau Score:** a score that relies on detailed data from the World Bank Doing Business report, combining both the breadth of credit bureau coverage as well as the depth of information provided about borrower history and existing debts. It is one of the most important market-level features that can raise the level of credit capacity, irrespective of a country's level of overall development. It also tends to be a reasonable (though imperfect) proxy for financial sector development.

**Population density:** a metric that captures one of the contextual factors responsible for financial sector development. Simply put, it's easier to serve areas with high population densities than with low ones, and in such areas, one would expect to see higher levels of penetration. All else equal, higher density increases the level of credit capacity.

These three factors are combined to generate the expected level of penetration, which we define as credit capacity.

## 2.3 The MIMOSA score

The MIMOSA score rates markets as being under-served, healthy, or at various levels of saturation. The mechanics are straightforward. We take the difference between penetration and capacity and match it to one of the six tiers that are defined using the standard deviation in our capacity estimates (Figure 1). The two red tiers, MIMOSA scores of 5 and 6, denote markets at high risk of overheating, where penetration is at least two standard deviations above estimated capacity. For 2014, 9 countries receive these scores. Another 11 countries score 4, meaning they are moderately saturated, but probably do not present a high risk in the immediate future. The majority of countries (59%) are in the normal range (2-3). Finally, 18 countries scoring 1 are significantly underserved.

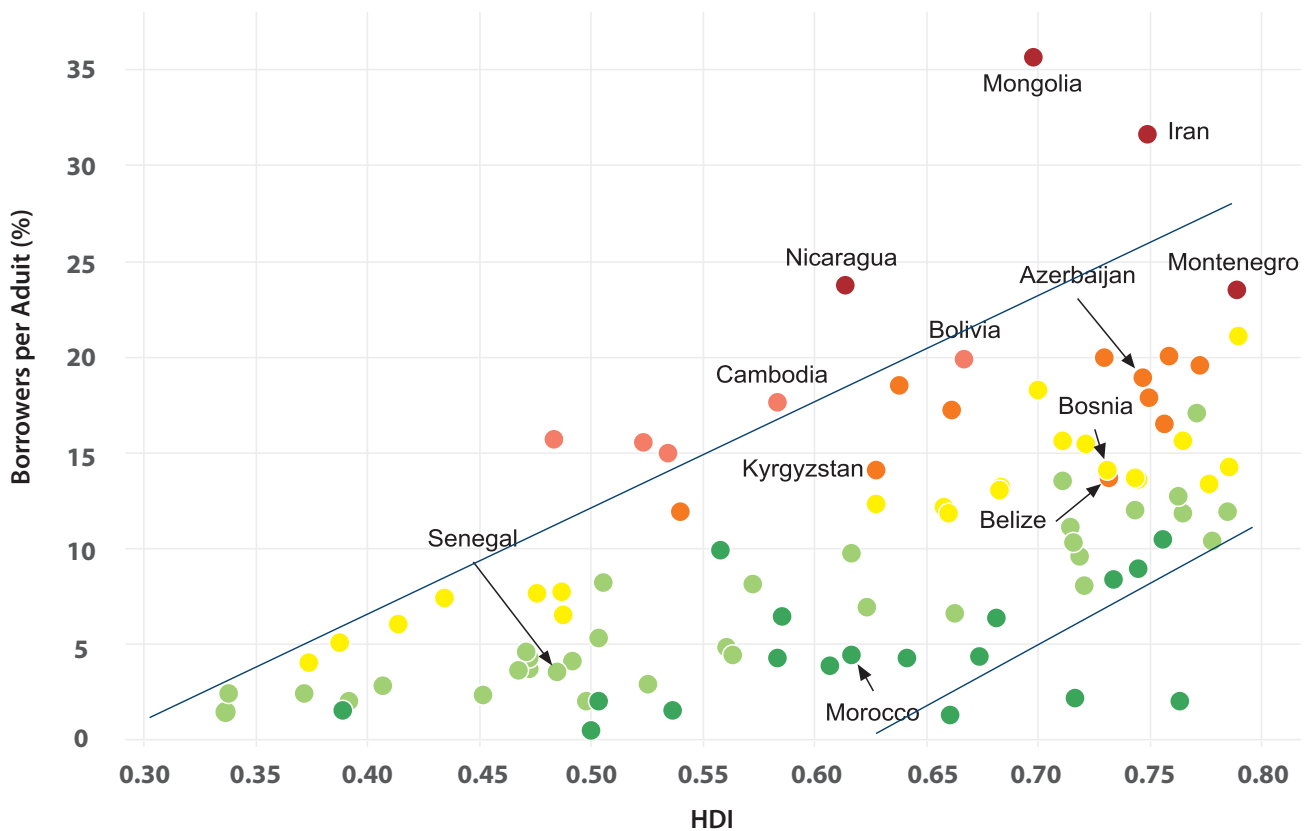
The resulting scores (Figure 2) clearly demonstrate the impact that economic development, as proxied by the HDI, has on credit capacity. The countries outside the upper HDI trendline nearly all score 4 or 5. Yet there are notable exceptions. Thus, Montenegro has a score of 6, despite a penetration level well below the upper bound suggested by HDI. However, Montenegro has a rather low credit bureau score of just 35, which puts its capacity at 12.1, well below that of its peers. A similar pattern can be seen between Bosnia and Belize, where despite identical HDI and penetration levels, Bosnia's higher credit bureau score (82.3) and higher population density (75 persons/km<sup>2</sup>) gives it a lower saturation score than Belize's non-existent credit bureau and sparse geography (10 persons/km<sup>2</sup>).

While the scoring model is driven entirely by data, not all scores are created equal. They fall into two categories: validated and provisional. In rare cases, we may manually adjust or withhold scores from publication, along with an explanation. In all cases, the calculation of the scores remains fully transparent.

**Figure 1: MIMOSA Score diagram**

MIMOSA Score	Penetration over/ under capacity		Number / percent of countries countries (2014)	Market Status
	Percentage points	Standard deviation		
6	>11.1%	3+	4 / 4%	Saturated
5	7.4-11.1%	2 to 3	5 / 5%	
4	3.7-7.4%	1 to 2	11 / 12%	
3	0-3.7%	0 to 1	22 / 24%	Normal
2	-3.7 - 0%	-1 to 0	33 / 35%	
1	< -3.7%	< -1	18 / 19%	Underserved

Figure 2: Penetration and MIMOSA scores by country, 2014



### 2.3.1 Validated versus provisional scores

Our ability to gather the data required to generate these penetration estimates is limited to countries where we have either conducted full MIMOSA reviews or have otherwise validated penetration figures. To-date, this covers five countries – a figure we expect to grow over time to 20 countries or more.<sup>4</sup> However, using Findex data, we can generate scores for 90+ countries. While in some cases, these figures may not reflect the precise level of penetration, most often they can still offer useful guidance. With MIMOSA 2.0, we are publishing two sets of scores designated as either validated or provisional, to reflect the level of accuracy they represent.

<sup>4</sup> Scores for Azerbaijan and Senegal are marked as provisional, but will be updated to validated once the country reports are completed, by end-2015.

## 2.3.2 Manual score adjustment

In rare cases we may manually adjust a score. In those circumstances, the decision is based on strong quantitative indicators that can be directly linked to credit capacity.

This was the case with Morocco, where in our field survey, 1/3rd of vendors who acknowledged being offered MFI loans, cited the Islamic prohibition against interest as the reason for declining the offers. By effectively removing a large segment of the population out of the loan market, such strong objections to borrowing reduce demand for credit, thus lowering credit capacity.

Because our model cannot capture this reduced demand, we adjusted capacity manually. In Morocco, a 30% reduction in capacity increases the MIMOSA score by a full point. We believe that a similar issue may apply to other MENA countries as well. However, we will consider adjusting their scores only after confirming the actual shift in demand through field surveys or other means. After all, the situation is not applicable to all Muslim countries – in field surveys in Azerbaijan, the religious prohibition against interest was cited just once, while in Senegal it did not come up at all.

## 2.3.3 Withholding scores

In some cases, we have found Findex penetration rates to be highly inconsistent with what we know about those markets. Until we can examine detailed country data, we will withhold their MIMOSA scores. In 2014, this situation applies to Mexico, Bangladesh, and temporarily Peru.

As with MIMOSA 1.0, in Mexico we continue to see a huge disparity between Findex penetration levels (10.4 in 2014) and the well-recognized competitive microfinance market in the country, which targets a small portion of the country's population, with substantial regional variation.

Findex also shows an enormous decline in penetration in Bangladesh during 2011-14, from 23.3 to 9.9, implying that the country is now underserved. Nothing in the local data supports this trend, and feedback from local market experts suggests that factors unrelated to market conditions may have affected the survey.

Finally, Peru shows a particularly wide discrepancy between Findex (11.2) and its regulator and credit bureau (30.2). We believe this may be due to a combination of factors, and we're in the process of collecting additional local data that will help resolve this discrepancy.

We will publish MIMOSA scores for all three markets as soon as we're able to validate their penetration figures.

## 3 The MIMOSA country reports

The new country reports provide a host of supplemental data and context to help evaluate the MIMOSA score. We review the main components below.

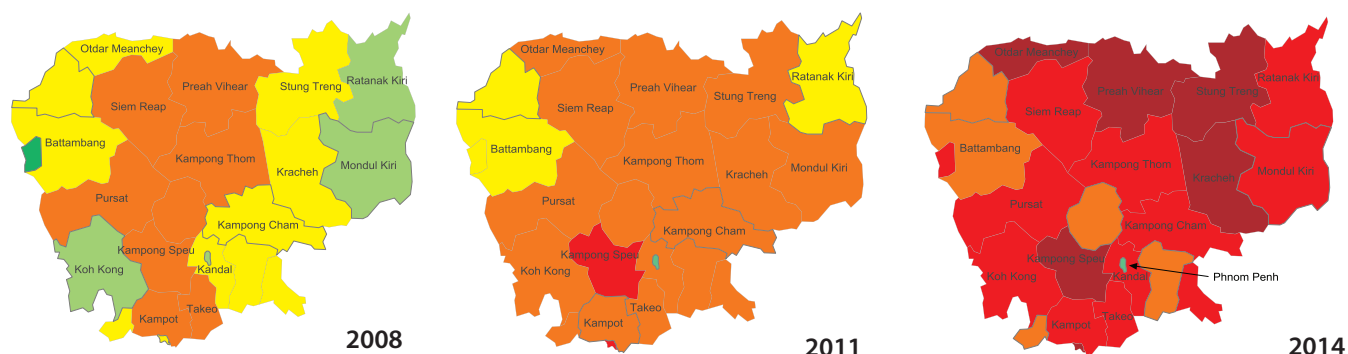
### 3.1 Regional scoring

The main approach to regional scores is similar to what we do at the national level. We calculate penetration using comprehensive regional reports from local bodies. Where we have only partial regional data, we make adjustments based on best available proxies. For example, in Azerbaijan, we have region-wise data for microfinance lending, but for bank loans, we only have data at the national level and number of bank branches in each of the regions. This allows us to blend more precise microfinance data with a reasonable approximation of bank lending to create a region-wise distribution map.

To calculate capacity, we seek out the regional level component data that make up HDI – life expectancy, education levels, and per capita GNI – which we use to calculate the regional HDI. In some cases, we cannot gather the full set of indicators or find an imperfect match. In those cases, we use this partial data to generate the HDI scores for the region and the national level, prorating these against the figures published by UNDP. For example in Senegal, the closest regional data for GNI per capita was a 2011 poverty survey by the government statistics department, which listed average monthly per capita income in each region. We then calculated regional income factors relative to the national figure and applied them to the GNI per capita figure used in the HDI score produced by UNDP.

Population density does not normally require any manipulation. However, deviations may still arise due to internal migration or old data (i.e. censuses conducted nearly a decade earlier). In some cases (such as in Kyrgyzstan), we rely on data that is adjusted for temporary migration, which counts individuals in the region where they reside, rather than where they are officially registered.

**Figure 3: MIMOSA Scores in Cambodia, 2008-14**





The credit bureau score is the only element that is not recalculated on a regional basis. Then again, credit bureaus are national bodies in all countries that we are aware of, so we would not expect to have any regional variation.

The resulting regional scores may have more data gaps than national scores, but even with these imperfections, having a regional perspective can be instructive and valuable. For example, the Cambodia report clearly highlights that Phnom Penh, the country's capital and largest city, is underserved, even as many parts of the country are highly saturated. Regional scores can also help better highlight the evolution of a country's saturation levels over a period of time (Figure 3).

## 3.2 Additional risks and mitigants

In addition to measuring saturation levels at the regional level, the MIMOSA country reports also provide a battery of indicators on factors that directly impact the country's credit capacity and its ability to manage high saturation levels. Each indicator is given three levels: green, beige, and red, representing a mitigant, neutral, or risk (Figure 4).

Most of these factors focus more on the microfinance and financial inclusion sectors and thus provide an assessment that more directly relates to MIMOSA's target audience. The categories covered consist of 1) regulation, 2) market competition, 3) sector maturity, 4) data availability, and 5) other risks.

### 3.2.1 Regulation

Markets with stronger regulatory capacity are better positioned to react to signs of market overheating, put in place controls to head off a possible crisis, as well as manage an actual crisis itself, should it prove unavoidable. For regulation, we look specifically to aspects directly affecting microfinance and other institutions serving MFI clients, relying on the EIU Microscope annual assessments on three areas we deem most critical to saturated markets: quality of client protection on overindebtedness and collections, as well as the level of coverage by the credit bureau – in this case, specifically with respect to MFIs and related organizations. In addition, we include Microscope's overall score for regulatory capacity.

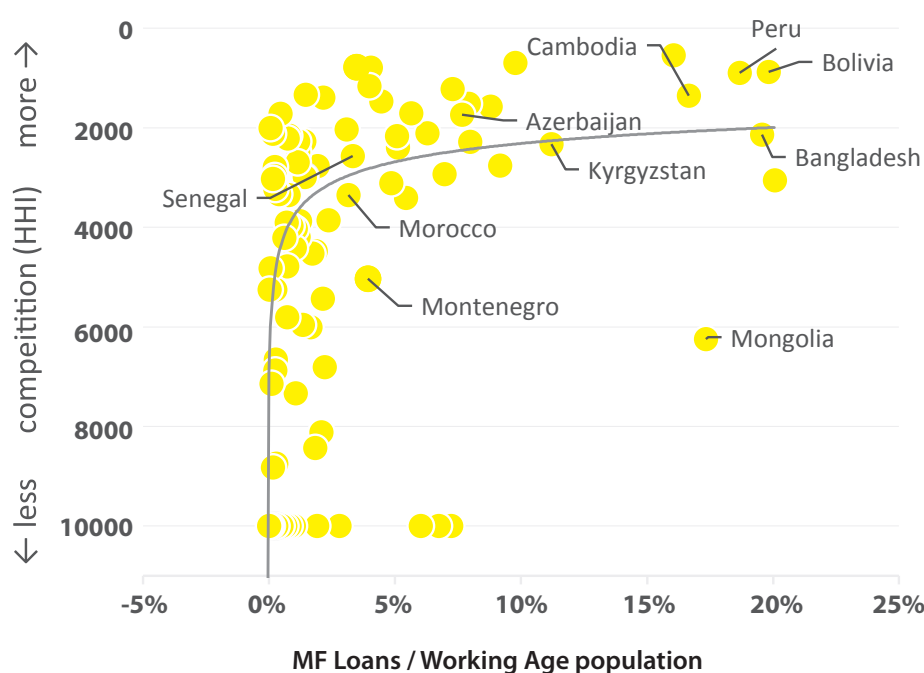
### 3.2.2 Competition / Overheating

Saturated markets are often the result of high competition. Meanwhile, more competitive or fragmented markets tend to be less amenable to voluntary, industry-level responses to increasing saturation, such as slowing or even reversing growth in cases where saturation becomes extreme. A good example of such a response was the reaction of the leading MFIs in Bangladesh in 2007-08. Facing strong signs of oversaturation, the leading four MFIs in the country, which together held a large majority of the market, each slowed or even reversed growth, and thus avoided a likely crisis.<sup>5</sup>

Competitive or fragmented markets, measured using the Herfindahl-Hirschman Index (HHI), also tend to be strongly correlated with high levels of penetration (Figure 5). Those that significantly exceed the trend (for example, Peru or Bolivia) may face greater obstacles to voluntary action by the institutions. Meanwhile, a saturated but highly consolidated market like Mongolia may suggest greater capacity by the lenders to implement a voluntary response.

However, these indicators should be viewed in context. In the case of Peru, while the market may be too competitive to implement a voluntary response, given the relatively high capacity of its regulator, there may be less need for such a voluntary response in the first place.

**Figure 5: Competition (HHI) and loan penetration**






<sup>5</sup>G. Chen, S. Rutherford. A Microcredit Crisis Averted: The Case of Bangladesh, CGAP, Jul 2013

In addition to measuring competition directly, we also add a separate measure of multiple borrowing, which is nearly always the result of high competition. While we have noted a very strong correlation between penetration and multiple borrowing (see 5.1), it is nevertheless useful to identify the factor separately, as in some countries the two may diverge.

Finally, we take a measure of market growth, both recent past and future expectations. The latter relies on the MIX Market barometer survey, an MFI survey conducted by the MIMOSA project itself, or both. We compare this to the overall economic trends in the country to gauge the sustainability of the microfinance sector growth relative to the overall economy. For this reason, unlike with penetration and capacity measures, we look at portfolio volumes, instead of number of customers. Thus, already saturated microfinance sectors that continue to substantially outpace economic growth should be seen as a higher risk than those that moderate their growth. On the other hand, low-penetration markets may benefit from rapid but still manageable growth.

Figure 4: Additional risks and mitigants

Category	Indicator	Indicator	Mitigant 	Neutral 	Risk 
Regulation	Overall quality of regulation	Overall microscope score (0-100)	$\geq 75$	50-75	$< 50$
	Consumer protection (OID)	Microscope score 4.2.1	3	2	0 or 1
	Consumer protection (Collections)	Microscope score 11.3.2	2	1	0
	Credit bureau, credit reporting	Microscope score 10	$\geq 75$	50-75	$< 50$
Competition / overheating	Level of competition	Herfindahl-Hirschman Index	$HHI > 3,000$	$1,500 < HHI < 3,000$	$HHI < 1,500$
	Multiple borrowing	% borrowers with 3+ loans	$< 5\%$	5-15%	$> 15\%$
	Prior growth	Loan portfolio 3-year CAGR	$< 2\times$ GDP growth	2-3x GDP growth	$\geq 3\times$ GDP growth
	Future growth	Loan portfolio 12-mth growth expectations	$< 2\times$ GDP growth forecast	2-3x GDP growth forecast	$\geq 3\times$ GDP growth forecast
Maturity of microfinance institutions	Age of FIs	% clients of MFIs $> 20y$ or $< 10y$ old	$> 65\%$ of the borrowers are clients of MFIs $> 20$ years old	Other	$> 65\%$ of the borrowers clients of MFIs $< 10$ years old
	Prior crisis experience	Date of previous crisis	Experienced crisis in past 15 years	no crisis experience	
Data availability/ Transparency	Composite score	See Transparency worksheet	$\geq 3$		$< 1.5$
	Ratings	% leading MFIs rated in past 2 years	$\geq 75$	50-75	$< 50$
Other risks	FX exposure	% of loans in foreign currency	$< 10$	10-25	$\geq 25$
	Interest rate level	Average Full APR, weighed by number of borrowers	$< 30\%$	30-60%	$> 60\%$

### 3.2.3 Maturity of microfinance institutions

Institutions with long histories, and especially that have experienced past crises, are arguably better positioned to react to warning signs of oversaturation. This again can be seen in the above example of Bangladesh, where at the time of the market pullback, the leading MFIs had already been operating for some 30 years and had already experienced a serious downturn in the early 2000s. On the other hand, in all prior crises – Bosnia, Nicaragua, Morocco, and Andhra Pradesh – the MFIs were relatively young, often with less than 10 years' experience at the time of the crisis, and had moreover never experienced a sector-level downturn.

### 3.2.4 Data availability / transparency

When relevant data is regularly reported and made available to others, it allows the regulator, participating institutions, investors, and market analysts to assess developing risks at an earlier stage, and thus take steps to head off a potential crisis. This metric incorporates multiple components. Is data regularly reported to a central authority (a central bank, an association, a credit bureau, etc.)? Is it done by all major lenders, or is a significant portion left to operate in the shadows? Is the data reported in sufficient frequency and at reasonable granularity? And finally, how broadly is this data made available – does it remain the sole preserve of the regulator, is it shared with market participants, is it made public?

For us, these are not theoretical questions. We have, for example, suspended our pilot in West Bengal after finding it impossible to collect microfinance penetration data at any level more granular than the state, which in West Bengal comprises over 90 million people. Useful analysis at this level of granularity is highly limited. On the other hand, we have found countries, such as Peru and Cambodia, where the broad scope of public or reasonably accessible private data allows answers to all sorts of critical questions.

### 3.2.5 Other risks

This is a grab-bag of indicators, for now comprising just two: the degree of foreign currency lending present in the country, and the level of interest rates prevalent in the market.

With foreign currency lending, we try to assess the level of impact that a currency depreciation could have on client indebtedness, and so specifically focus on foreign currency loans to end-clients, rather than measuring the unhedged exposure of financial institutions. While institutional stability is of course important, we feel that it is outside the scope of MIMOSA and is better addressed through traditional due diligence.

The second metric, interest rates, recognizes that, all else equal, high interest loans pose greater risk of over-indebtedness on clients than low interest ones. However, given limited data on the connection between interest rates and saturated markets, we only set a single level – 60% APR – to highlight markets with interest rates significantly higher than average. This should be seen as a more informational metric rather than an explicit warning flag.

## 4 MIMOSA in action

To better understand how MIMOSA works, it's useful to review a few example markets, including those with published country reports and those whose scores remain provisional.

### 4.1 Country examples

#### 4.1.1 Cambodia

Cambodia has long been on the list of countries seen as at risk of overindebtedness. Not surprisingly, its 2014 MIMOSA score is 5, i.e. highly saturated. What may be surprising is that the figure isn't higher – the Global Findex survey found the country's loan penetration to be 27.7% in 2014 (up from 19.5% in 2011). This places the country among the most penetrated credit markets of any developing country, far in excess of its calculated capacity of 8.8%.

However, this figure is far above the 17.6% penetration calculated from supply-side data, compiled from the central bank, the country's credit bureau, and the Cambodian microfinance association, whose members are responsible for nearly 95% of all formal loans in the country. After assessing the results from our field survey, we believe that the bulk of this discrepancy is most likely explained by the unusual wording of the Findex survey in the country, which appears to have captured a part of informal lending that is normally excluded in other countries. For more detail, see section 5.2.3.

The revised figures rank Cambodia as the 7th most saturated market among developing countries, though given its rapid growth, it will probably soon pass into the top 5. A number of its regions are already exceptionally saturated (a score of 6). We urge all actors in Cambodia – MFIs, investors, and regulators – to substantially slow growth, focus on diversifying the client base, and bring the market down to a more sustainable level.

### 4.1.2 Kyrgyzstan

A few years ago, Kyrgyzstan was seen as one of the more heated markets in the sector, prompting an over-indebtedness survey in 2011. At the time, multiple borrowing was significant, with 11% of borrowers holding three or more loans. This figure has declined greatly, to just 2.3% of clients in 2014. Currently, Kyrgyzstan has a MIMOSA score of 4, i.e. moderately saturated.

The decline in multiple borrowing is a result of multi-pronged efforts from several parties. With all major microfinance providers reporting to the credit bureau, the central bank had the required data to institute additional provisioning requirements for multiple loans. This has spurred growth in debt consolidation offers, and a number of MFIs implemented a policy of a per-client maximum of 2 multiple loans.

Kyrgyzstan is thus one of the premier examples of the strong gains in credit capacity that can come from an effective credit bureau, especially when it is paired with sensible regulations aimed at preventing overindebtedness.

### 4.1.3 Morocco

Morocco stands out in the field of microfinance as a market with the unusual mix of relatively high market development scores, yet very low levels of penetration. Part of this is due to dampened demand for credit stemming from religious restrictions. However, a factor that is at least as important is the persistent overhang of risk aversion on the part of the MFIs following the microfinance crisis in 2008.

Many of the systemic supports in place now were established as a response to the crisis. A risk-averse regulator, a market concentrated among the largest three MFIs that account for some 90% of market share, legal restrictions that keep all MFIs operating as NGOs, and a general conservatism within the microfinance sector – all of these factors have conspired to keep growth to a minimum for the past 5 years, with low penetration the inevitable result.

The MIMOSA score, paired with strong mitigants against overindebtedness, demonstrates that the market in Morocco has substantial room for growth. Rather than a sign of a healthy market, the substantial positive gap between Morocco's penetration and capacity should be seen as a sign of unmet demand.

### 4.1.4 Myanmar

There are other surprises in the new MIMOSA scores. Perhaps chief among them is Myanmar, which, between a Findex penetration level of 15.5% and low capacity (low HDI, no credit bureau) received a MIMOSA score of 5, edging out both Bolivia and Cambodia. However, we have validated that the penetration found by Findex is generally in line with the 19% formal credit penetration found by the FinScope 2013 survey. Contrary to common assumptions, Myanmar has a rather active financial sector, albeit dominated by the government agricultural bank, MADB. Given that the country's lending is largely limited to rural areas, Myanmar may well present opportunities for microfinance. However, the high MIMOSA score helps highlight that growth in the country should be guided by deeper understanding of the market and the risks of both over-indebting existing borrowers, as well as the political risk of unsettling a well-connected incumbent lender.

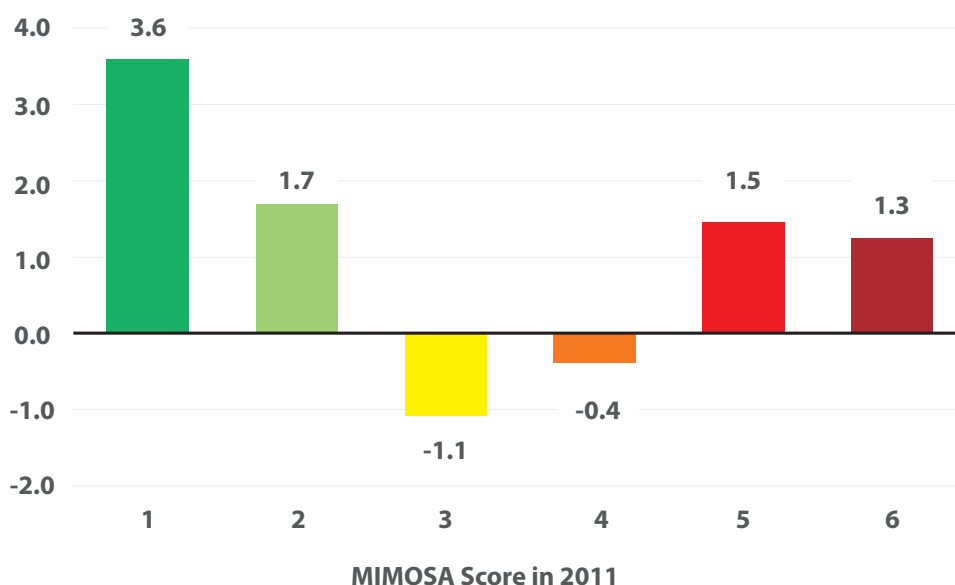
## 4.2 Trends in credit saturation

The world according to MIMOSA is seeing growing credit penetration, and in some cases, increasing saturation. To be sure, higher HDI levels and better credit bureau scores contributed to higher capacity levels across the board. However, between 2011-14, growth in penetration has exceeded the increase in capacity in all but one of the pilot markets we covered during this project phase. Ironically, the exception was Morocco, which was the sole pilot market to be underserved in 2011, and since then has further widened that gap.

On average, countries that were most underserved in 2011 have seen the most growth in penetration. Fully served markets, in categories 3 and 4, have declined somewhat (Figure 6).

Finally, of the seven most saturated markets that received scores of 5 or higher in 2011, four (Mongolia, Peru, Nicaragua, and Montenegro) have continued to grow well above capacity. Only Iran has registered a small decline. Of the remaining two, Laos was not included in the 2011 Findex survey, and thus is not scored. Meanwhile, Bangladesh is being withheld from publication due to concerns about data accuracy (see 2.3.3).

**Figure 6: Average change in Penetration-Capacity gap, 2011-14 (percentage points)**



## 4.3 Predicting past crises

What if MIMOSA had existed in 2008? Could it have predicted the crises that befell several markets in microfinance? We considered the four main crisis markets: Bosnia, Morocco, Nicaragua, and Andhra Pradesh, and were able to collect historical data on three of these.



### 4.3.1 Bosnia

For Bosnia, while we have good data for the number of MFI loans at the time, we have been unable to find reliable data for bank loans. And the large gap between Findex penetration and MFI lending data in both 2011 and 2014 suggests that bank lending is a significant factor in Bosnia. Thus, we have been unable to calculate penetration for Bosnia around the time of the crisis in 2008-09.

### 4.3.2 Nicaragua

A hypothetical MIMOSA report in 2008 would have placed Nicaragua in the highest-risk category, at 4.5 standard deviations above capacity. Currently, only two countries score at that level – Mongolia and Iran, with both receiving only provisional scores. Moreover, the supplemental indicators for Nicaragua in 2008 would have been mostly red – a market with limited regulatory capacity, an incipient use of the credit bureau by MFIs, relatively high competition, extremely rapid growth, dominated by young institutions, and with little transparency. A 2008 report on Nicaragua would have been damning.

### 4.3.3 Morocco

Morocco, on the other hand, would have been assessed as a normal market, though higher than its current low level of penetration. This raises important questions of whether MIMOSA would have proven inadequate at the time. There are three explanations.

First, the inclusion of Morocco in the pantheon of “crisis markets” is arguably incorrect. A recently published IFC study of microfinance in Morocco during 2008-13,<sup>6</sup> argues that the market crisis there was more modest than is commonly perceived, far below the levels of Bosnia or Nicaragua and more in line with other countries adjoining Europe and affected by the financial and economic crisis. The widely cited market figures in Morocco were weighed down by the failure of the 2nd largest MFI, Zakoura, which imploded from internal mismanagement and fraud, and likely would have struggled to survive under any circumstances.

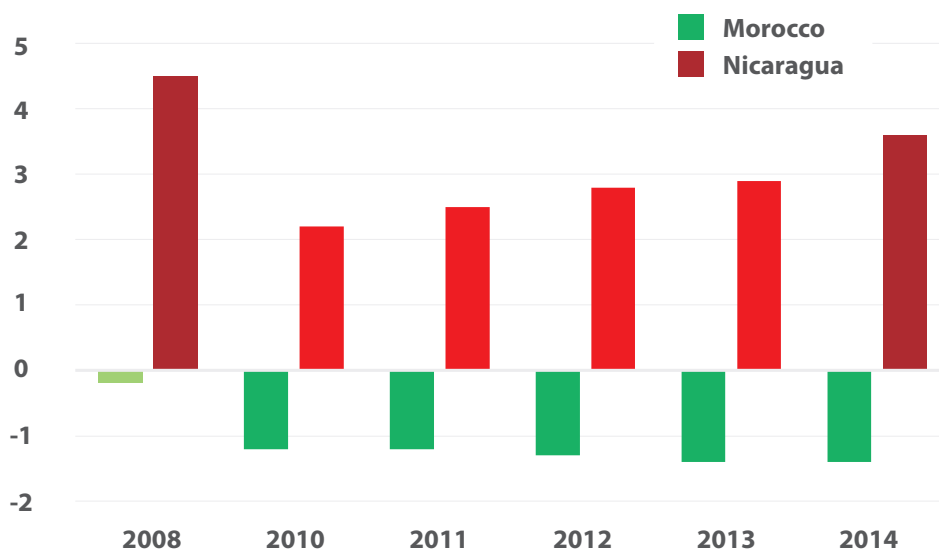
Second, the supplemental indicators for Morocco in 2008 would have highlighted a number of risks, including extremely rapid growth, minimal data availability and no credit bureau, a sector dominated by young MFIs, and a regulator that was new to the sector. That said, the sector would have been marked as only moderately competitive, with moderate levels of multiple borrowing.

Third, as mentioned earlier, given the large number of people unwilling to borrow due to religious reasons, credit capacity in Morocco is about 30% lower than the level estimated by our model. In 2008, this would have brought its score to 3, the upper range of normal.

In short, what MIMOSA shows is that while Morocco in 2008 was not primed for a major market-level crisis (nor was there one), it was approaching saturation, while exhibiting many attendant risks, which made it vulnerable to the combined effects of a major MFI collapse and the global economic downturn.

<sup>6</sup>D. Rozas et al, “Ending the Microfinance Crisis in Morocco: Acting early, acting right,” IFC 2014

**Figure 7: Standard deviations above capacity**



### 4.3.4 Andhra Pradesh

The crisis that befell Andhra Pradesh in 2010 is the single largest microfinance crisis to-date, both in terms of people affected and amount of losses sustained. As mentioned earlier, detailed data in India is difficult to come by, but as it happens, there was a market survey conducted in rural parts of the state that captured all types of lending, including banks, MFIs, and bank-linked Self-Help Groups (SHGs).<sup>7</sup> We rely on this study to draw a picture of the situation in rural areas, recognizing that penetration in urban areas was substantially greater, at least for microfinance loans.<sup>8</sup>

Based on HDI data at the state level, population data at the rural level, and a credit bureau score at the national level, we find that the market in the state had an estimated capacity of 10.0%. By comparison, the penetration level for bank and MFI loans stood at 16.6%, and at 29.0% when combined with SHG loans. The resulting MIMOSA scores are 4 and 6 respectively, with the latter figure representing 5.2 standard deviations above capacity – a level higher even than Nicaragua in 2008.

While SHG loans are commonly seen as semi-formal, they are nevertheless tied to the formal sector through bank lending, and would thus be included as part of the MIMOSA loan penetration measure.<sup>9</sup> SHGs also played a prominent role in motivating the state government (which administered the SHG program) to shut down the MFIs. The additional warning signals, including extremely rapid growth, high competition, and high multiple borrowing all point to what was a deeply saturated market.

<sup>7</sup> D. Johnson, S. Meka, Access to Finance in Andhra Pradesh, IFMR Centre for Micro Finance, Oct 2010

<sup>8</sup> Rozas D., Krishnaswamy, K., "Microfinance in Crisis: The case of the hidden city", Microfinance Focus, 25 Jan 2011

<sup>9</sup> SHG loans were explicitly included in Mr. Rozas' initial capacity model for Andhra Pradesh in 2009, which served as a foundation for MIMOSA. See Rozas, D. Is there a Microfinance Bubble in South India? Microfinance Focus, 17 Nov 2009

## Appendix A: Finding the most accurate measure of penetration

Penetration is ultimately a measure of two things: how many borrowers are there, and how much are they borrowing? For now, MIMOSA focuses mainly on the former. First, in markets with active microfinance sectors, the number of borrowers with small loans is large, whereas their cumulative balance is often only a fraction of total lending. Similarly, even within a single institution, average loan size estimates tend to be heavily weighted by large loans, skewing measures of debt held by the majority of borrowers. In time, we hope to develop better mechanisms to estimate loan sizes, but until then, we focus on the number of borrowers to assess penetration.

But even once we've settled on assessing the number of borrowers, the question of finding an accurate measure remains, for as we have found in the course of this project, different data sources can yield quite different estimates. We explore these issues below.

### A.1 Loans and borrowers

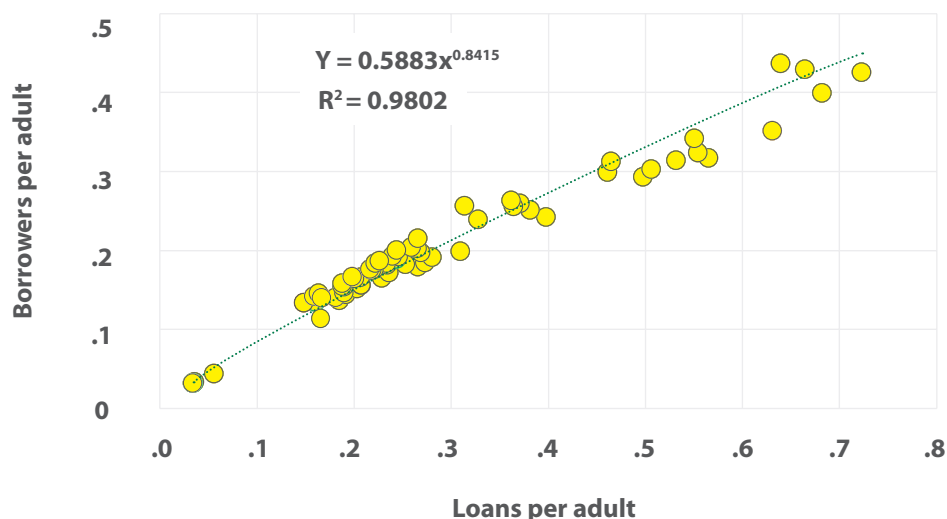
To evaluate the number of borrowers, we have sought out data from regulators, microfinance associations, and MIX Market. Unfortunately, these measures can be problematic. This type of data tends to measure the number of outstanding loans. But loans and borrowers aren't the same. The ratio between them is the rate of multiple borrowing – a critical metric for those seeking to understand overindebtedness and saturation.

While most (though still not all) markets have reasonably good data on the number of active loans, data on borrowers is normally available only from credit bureaus. From our pilots, we were able to collect both borrower and loan data in five markets (Bolivia, Cambodia, Kyrgyzstan, Morocco, and Peru), in three of which the data was further broken out by region. This led us to an unexpected discovery: the relationship between loans and borrowers can be almost perfectly described by a simple formula (Figure 8). This relationship is surprisingly strong, and the same formula holds true, despite the fact that these five countries represent very different markets at different points in time, with very different levels of both penetration and multiple borrowing.<sup>10</sup>

Based on this finding, we have applied the formula to estimate unique borrowers in markets where we only have access to loan data. The result allows us to approximate credit penetration in number of borrowers.

<sup>10</sup> The  $R^2$  of 0.98 is so high as to raise questions about the integrity of the finding. However, even a weak relationship here would show a high  $R^2$  – there can never be more borrowers than loans, and at low levels of penetration, high multiple-borrowing is rare. The data becomes more dispersed as level of penetration increases.

Figure 8: Borrowers per Adult vs. Loans per Adult



Observations: Bolivia (national, 2008-14, regional 2013), Cambodia (regional, 2014), Kyrgyzstan (national, 2011 & 2014), Morocco (national, 2008-13), Peru (regional, 2014)

## A.1.2 In search of perfect data

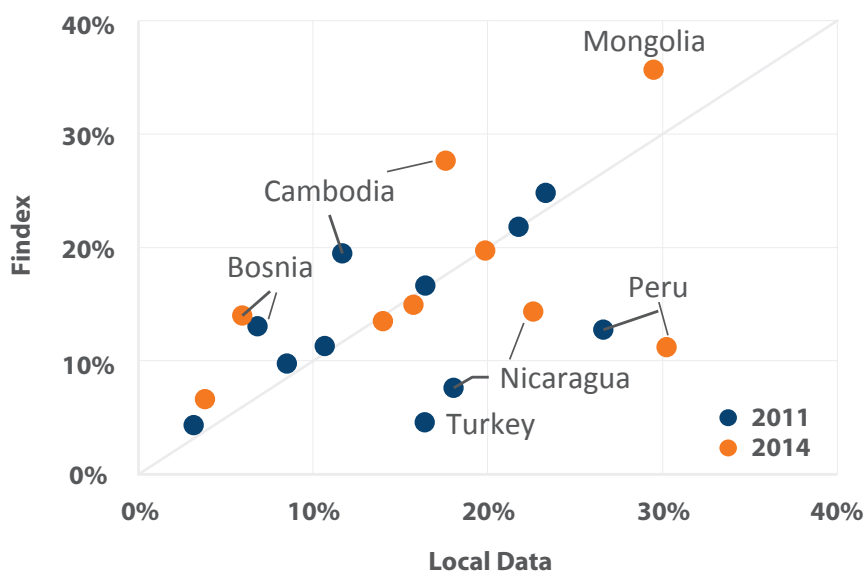
But we don't stop there. To insure that we have the best possible measure of credit penetration, we validate this figure with two additional inputs: the World Bank Global Findex and our own field surveys in the target market. On their own, these three sources – national figures, Findex, and field surveys – have significant drawbacks and blind spots. But when all three tell a consistent story, we can be confident that our measure of penetration is meaningful. In cases where there are gaps between the different metrics, we seek to understand the reasons behind them and select the source that best describes the state of the market.

To understand these differences, we used data from five pilot markets and seven additional ones – a total of 12 markets, in most cases with observations in both 2011 and 2014 – the two years covered by the Findex survey. In a slight majority of markets in our sample (58%), Findex almost perfectly aligns with the national penetration data, measured using reported borrowers or calculated using the above methodology (Figure 9).

For a number of deviations between Findex and the national data, the misalignment is indeed significant and also consistent, suggesting other factors at play. For Peru, Nicaragua, and Turkey, Findex significantly undercounts penetration compared to local data (in Peru 2014, almost by a factor of three). Meanwhile, in Bosnia and Cambodia, Findex is substantially overcounting. In nearly all cases, the pattern is consistent for both 2011 and 2014.<sup>11</sup> There are several plausible explanations for these differences.

<sup>11</sup> For Turkey, we only have national data for 2011-13, though extrapolating from the trend, it's likely that Findex is much closer to the national data in 2014.

Figure 9: Borrowers per Adult: Findex vs. National data



### A.1.2.1 Lying borrowers

First, respondents to the Findex survey may simply be untruthful, with some denying borrowing when asked – a practice that has been documented in other surveys.<sup>12</sup> And this tendency could well vary by country. We believe this may be a factor in Peru, though most likely not the only one.

### A.1.2.2 High/low frequency borrowing

A second possibility is the result of differences in borrowing frequency and actual outstanding loans at any one time, which may lead to over- or under-counting of actual number of borrowers. Consider a hypothetical country where every adult takes out a 2-week loan once a year, repays, then remains debt-free for the remaining 50 weeks. By the Findex methodology, this would be the most penetrated country in the world. Yet by no measure would we consider the market to be saturated, since most of the population is debt-free most of the time. Of course no such country exists, but the underlying issue can create substantial disconnects between the two metrics.

<sup>12</sup> D. Karlan, J. Zimmerman, Lying about borrowing. Journal of the European Economic Association, 2008

### A.1.2.3 Shadow lending

The third possibility may be due to “shadow” lending not captured in official reporting. We deploy a field survey in each of our pilot countries to test this. In Cambodia, for example, this seemed a reasonable hypothesis, with known unregistered lenders operating throughout the country. In our field survey, names of unregistered institutions were cited as active lenders with relative frequency, though none of the interviewees mentioned actually having borrowed from them. We conclude that, although they may be responsible for some share of lending, their activity is nowhere near the levels implied by the penetration gap between Findex (27.7%) and the national data (17.6%) in Cambodia.

Instead, we believe the bulk of the gap stems from the specific phrasing of the Khmer version of the Findex survey, which included both “pawnshops and payday lenders” in the list of financial institutions. While these may arguably be seen as at least semi-formal institutions, feedback from local experts suggest that the phrasing of the question is such that it may also include fully informal lenders as well. The combination could plausibly account for the gap.

### A.1.2.4 Inaccurate estimates

Finally, there is the possibility that our methodology for estimating the number of borrowers from loan reporting data may be incorrect. We believe this to be the likely factor in Mongolia, where penetration levels (by any measure) are so high that they reduce the accuracy of our formula. As penetration increases, the difference between number of loans and number of borrowers also begins to widen. Thus, it is natural for there to be more variation at higher levels. In Mongolia, the national data reports 46.1% loans per adult, which our formula extrapolates to 29.5% borrowers per adult, compared to 35.7% in Findex. The difference of 6.1% in the two borrower measures is a relatively small fraction of penetration. In less penetrated markets, the same fraction would be well within the Findex margin of error. In the end, the difference is academic – Mongolia is such a distant outlier that it scores at the highest risk level, no matter which penetration metric is used.

This multi-tiered approach – using Findex, national data, and field surveys – to interpolate the level of penetration is one of the core strengths of MIMOSA. And we have used this not only in cases where we see differences. For example, in Morocco we were able to get data on both loans and borrowers, but for MFIs only. Using the resulting gap with Findex, we were able to estimate the likely level of penetration by banks, which we believe to be roughly 25% of total penetration.

With just desk research and a small field survey, MIMOSA is able to yield a measure of penetration that is more precise than any single source, and one that would be difficult to replicate without a far more costly survey.

## Appendix B:

# MIMOSA model and calculations

The MIMOSA model is derived by using the credit penetration figure reported by Global Index (Borrowed from a financial institution, % age 15+) for 191 observations from 106 countries with HDI < .800 and reported data for 2011, 2014, or both. This figure is regressed against three indicators: Human Development Index, the Credit Bureau Score, and population density.

Here is the resulting model and regression output:

$$\text{Penetration} = -44.05 + 19.0 * \text{HDI} + 0.250 * \text{Credit bureau score} + .00637 * \text{Population density}$$

Source	SS	df	MS
Model	2587.68079	3	862.560262
Residual	5314.65716	187	28.4206265
Total	7902.33795	190	41.5912523

Number of obs	=	191
F( 3, 187)	=	30.35
Prob > F	=	0.0000
R-squared	=	0.3275
Adj R-squared	=	0.3167
Root MSE	=	5.3311

FinInst_Borrowed	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
HDI	18.997	3.831226	4.96	0.000	11.43902 26.55498
Population Density	.0249658	.0087413	2.86	0.005	.0077216 .0422101
Credit Bureau Score	.0063659	.0023897	2.66	0.008	.0016516 .0110802
_cons	-4.046506	2.158812	-1.87	0.062	-8.305262 .2122497

Note that the R<sup>2</sup> of .317 is not exceptionally high. Other factors indeed affect borrowing, including long term growth in per capita GDP and employment levels. However, neither of these variables is commonly available at regional level, despite having substantial regional variation. Even with these variables and a few others included, R<sup>2</sup> levels off at .400, that is to say, still with high heterogeneity remaining unexplained. Our preference is thus to maintain the simplest model that can be applied as broadly as possible, including at the regional level.

This absence of statistical explanation is by no means a problem. The very premise of MIMOSA is that countries have a broad band of credit penetration, and only those that fall well outside that range should be flagged as under- or over-saturated. By doing this we are making a critical assumption – that given certain conditions, there is such a thing as a “normal” level of credit penetration (i.e. capacity), and that it can be approximated by observing multiple countries over a period of time. This is a major departure from all other previous attempts to define market capacity in microfinance, which takes the bottom-up approach, relying on a complex combination of estimates and assumptions of who the target borrowers are and what their demand for loans may be.

Why would our selected model yield the “normal” level of penetration? The answer comes from the credit cycle itself – though the global economy is correlated, the place of different countries in the credit cycle remains varied. With multiple observations taken at different periods, the credit cycle and the propensity of markets to regress to the mean will help the credit capacity figure to settle.

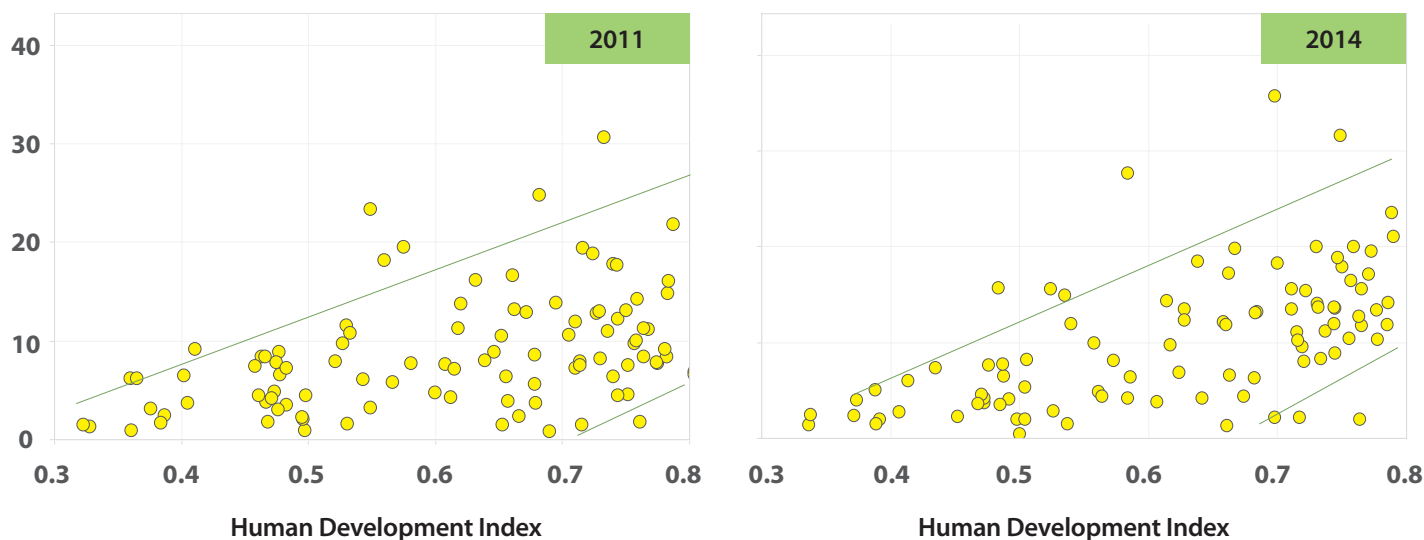
We can see this already in the two periods covered by Findex, which show an overall increase in borrowing levels of 1.6% worldwide during 2011-14. The effect is smaller on the MIMOSA model, where a model capacity level for a hypothetical average country would show 0.9% higher capacity in 2014 than in 2011, if the model were to be computed separately for each year. Combining the observations from both years reduces the shift further, so that a combined 2011 & 2014 model is only 0.5% higher than the 2011 model alone. The result is a relatively stable estimate of market capacity – in sharp contrast to the bottom-up models, whose capacity estimates can shift by a factor of two simply by changing the definition of poverty level from an international to a national standard.<sup>13</sup>

## B.1 Borrowing levels and human development index (HDI)

Among the large number of indicators we applied, the single strongest predictor of borrowing is a country's HDI. This metric is produced by UNDP to measure the level of development, combining both economic factors (per capita GNI) and overall standard living (life expectancy and education metrics).

Figure 10 shows that, while any given HDI level has a high variance in borrowing, one can easily recognize a pattern of clear upper- and lower-bounds, with just a handful of countries straying outside those lines. The relationship between HDI and borrowing penetration forms the heart of the MIMOSA model – the higher a country's HDI, the greater its capacity for credit.

**Figure 10: % Borrowed from a financial institution in past 12 months, age 15+ (Findex)**



One important critique of MIMOSA's reliance on HDI is that it directly undermines the objective of financial inclusion – to provide financial services to those currently excluded. After all, it is the very fact that less developed countries have smaller financial sectors, which motivates the financial inclusion agenda. We don't accept the criticism. There is no reason to expect countries with vastly different levels of development to have financial systems of equal depth. Moreover, for any level of HDI, there is broad variation in borrowing levels. So using HDI can help identify underserved markets as well as overserved ones. And finally, HDI is not the sole factor behind MIMOSA.

<sup>13</sup> See Guerin, et. al. The Crises of Microcredit, Ch. 2: Estimating Levels of Credit Market Saturation (Rozas & Javoy), Zed Books, Oct 2015



## B.2 Credit bureau score

A country can raise its credit capacity through better financial regulation and support for credit infrastructure. The first installment of MIMOSA relied on the penetration of formal savings as a proxy for overall market development. Unfortunately, we found that up-to-date data on savings outreach is unavailable in many markets, and even less so at subnational levels.

However, credit bureau development has proven an excellent proxy for measuring financial sector development, and one that is moreover directly related to credit capacity. Indeed, a strong credit bureau is a critical foundation for expanding credit outreach while avoiding over-indebtedness.

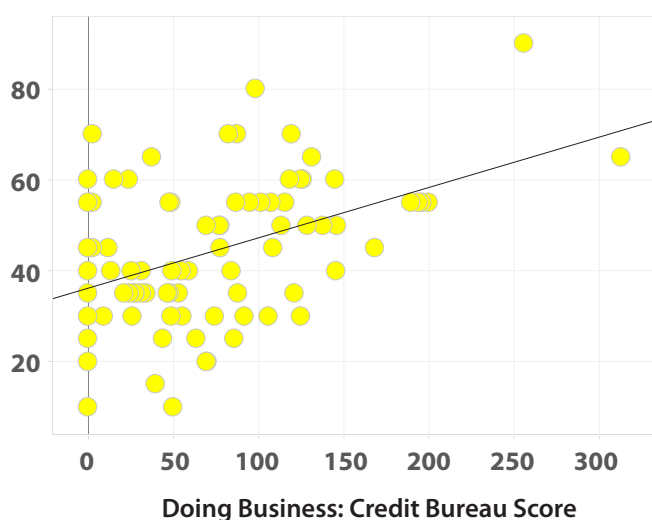
The World Bank's Doing Business Report assesses private credit bureaus and public credit registries annually in nearly all markets covered by Findex, reporting both degree of coverage (% of adults) and 8 different indicators measuring depth of coverage. We developed the Credit Bureau Score using the following methodology:

Categories	Indicators
Coverage	• Coverage (% of adults)
Info on borrower history	Average of: <ul style="list-style-type: none"><li>• Are data on loan amounts below 1% of income per capita distributed? (0/1)</li><li>• Are at least 2 years of historical data distributed? (0/1)</li><li>• Are data from retailers or utility companies distributed? (0/1)</li></ul>
Info on debt outstanding	Are both positive and negative credit data distributed? (0/1)
Calculation	Coverage * (Info on borrower history + Info on debt outstanding)

We perform the same calculation for both private credit bureaus and public registries and sum the results, creating an indicator with a theoretical range of 0-400.

The result is well correlated with the broader market development measure provided in the EIU Microscope report (Figure 11) and is also strongly correlated with credit usage (Figure 12).

**Figure 11: Microscope Institutional Supporting Framework\***



**Figure 12: Borrowers per Adult (%)**



\* Includes 5 indicators: Accounting transparency, Dispute resolution & Pricing transparency (client protection), Credit bureaus, Policy & practice of financial transactions through agents

The correlation between credit penetration and the strength of credit bureaus is no surprise. In budding markets, credit bureaus tend to be established and strengthened in response to concerns about overheating. Once established, credit bureaus can strongly affect lender behavior. In a few of our pilot studies (Kyrgyzstan, Cambodia) we have seen a significant decline in levels of multiple borrowing once MFIs were required to use credit bureaus to report and to verify client debts, especially when regulators encouraged them (implicitly or explicitly) to use this to reduce multiple lending. For example, in Kyrgyzstan, the number of clients holding three or more loans declined from 11% to 2% between 2011-14, even as the number of borrowers grew by 3% of the adult population.

Absent supporting regulations, one should not automatically assume that strong credit bureaus are a guaranty for good lending. Indeed, they could be misused, by identifying borrowers with good repayment histories and lending more, thus ignoring their repayment capacity. Such practices largely precipitated the mortgage market meltdowns in the US, Ireland, Spain, and elsewhere during the 2008 financial crisis. They are most effective when paired with strong regulation – which was the case in Kyrgyzstan, where the regulator added an additional provisioning requirement for parallel loans.

However, the presence of the credit bureau on its own still increases capacity, simply by providing more information to lenders. In the event there is runaway lending, it would be captured by the accompanying increase in penetration, over and above the increased capacity provided by the bureau. This is further supported by our separate reporting of risks and mitigants, such as scores for market practices on avoiding overindebtedness and prevalence of multiple borrowing. MIMOSA thus captures both the increased capacity as well as unsustainable practices enabled by a credit bureau.

## B.3 Population density

The final factor in the MIMOSA model is population density. The original model relied on semi-formal lending to serve as a proxy for the level of intrinsic demand. While effective, its underlying components have been removed from the Findex survey, and there are no other sources that can replace it. In searching for other factors that might represent a country's unique structure that encourages or discourages lending, we settled on population density.

The argument is straightforward. People in densely populated countries are easier to reach, including by MFIs and other lenders. The resulting lower transportation costs and increased staff productivity make loans cheaper and more broadly available. All else equal, countries with higher population density have higher credit capacity.

After accounting for HDI and the Credit Bureau Score, population density explains 2.2% of the variation in penetration levels in Findex. The indicator is imperfect. First, a number of areas, namely city regions, have density measures far beyond our modeling dataset, where the highest density is in Bangladesh, at 1203 persons/km<sup>2</sup>. To avoid unfounded extrapolation, we have set the model cutoff for high-density areas at 1200 persons/km<sup>2</sup>.

Moreover, some sparsely populated countries, such as Mongolia, can have a large proportion of the population living in urban areas where accessibility is not an issue. We were not successful in accounting for these variations using national-level data. However, the regional scores available in MIMOSA country reports correct much of this imbalance. As we gather more subnational data in more countries, we expect to be able to update the model to better reflect the complex nature of population distributions.

## B.4 Additional factors

As mentioned earlier, the three factors were selected from a large number of indicators that we explored in developing MIMOSA. A selection of these is included below. The results are calculated cumulatively, with HDI, Credit Bureau Score, and population density already included.

### Additional regression variables (run with above model)

Rank	varname	b	se	p	AdjR <sup>2</sup>	N
1	MIMOSA_1_Score	3.433	0.255	0.000	0.659	185
2	household_depositsToGDP (FAS)	-1.900	2.939	0.520	0.421	90
3	household_loansToGDP (FAS)	8.161	3.399	0.018	0.389	105
4	gdpGrowth15y	1.453	0.459	0.002	0.355	183
5	gdpGrowth10y	2.918	0.963	0.003	0.354	187
6	incomePerCapitaGrowth15y	1.580	0.727	0.031	0.354	160
7	incomePerCapitaGrowth10y	2.945	1.244	0.019	0.350	171
8	LogGDPperCapita	-2.380	0.815	0.004	0.345	179
9	PublicRegistryCoverage (Doing Business)	0.084	0.028	0.003	0.344	191
10	gdpGrowth5y	6.447	2.544	0.012	0.344	189
11	incomePerCapitaGrowth5y	6.486	3.287	0.050	0.343	173
12	GDPperCapita	0.000	0.000	0.006	0.342	179
13	SavedAtFinInstitution (Findex)	0.119	0.043	0.007	0.340	191
14	Population15to64Share	0.240	0.108	0.027	0.331	191
15	UrbanizationRatio	-0.060	0.027	0.028	0.331	191
16	PrivateBureauCoverage (Doing Business)	-0.050	0.024	0.040	0.328	191
17	GettingCreditScore (Doing Business)	0.224	0.135	0.099	0.323	191
18	UsedCreditCard (Findex)	-0.091	0.082	0.269	0.323	179
19	PoliticalStability (WGI)	0.681	0.443	0.126	0.322	191
20	Year2014Dummy	1.038	0.775	0.182	0.320	191
21	RuralPopulationDensity	0.016	0.012	0.199	0.319	191
22	logCreditBureauScore (Doing Business)	0.527	0.417	0.208	0.319	191
23	HasCreditCard (Findex)	-0.077	0.069	0.265	0.318	191
24	household&SME_depositsToGDP (FAS)	-3.348	2.295	0.146	0.314	186
25	AdultPopulationDensity	0.022	0.045	0.627	0.314	191
26	ControlOfCorruption (WGI)	-0.239	0.610	0.696	0.314	191
27	DepthOfCreditInformation (Doing Business)	0.085	0.285	0.765	0.313	191
28	household&SME_loansToGDP (FAS)	2.964	2.283	0.196	0.313	186
29	shadowEconPct (Buehn & Schneider)	-0.020	0.039	0.603	0.311	178
30	loansToGDP (FAS)	0.854	1.137	0.454	0.304	182
31	depositsToGDP (FAS)	-0.405	0.575	0.482	0.304	182
32	household&cmrcl_loansToGDP (FAS)	7.553	2.362	0.002	0.298	130
33	EmploymentRate_15+	0.067	0.044	0.127	0.264	97
34	household&cmrcl_depositsToGDP (FAS)	2.282	2.122	0.284	0.242	129
35	Microscope_Regulatory	0.088	0.042	0.037	0.231	101
36	Microscope_Institutional	0.032	0.043	0.450	0.200	101
37	Gini (WDI)	-0.123	0.102	0.237	0.191	37
38	Self_employment_ratio (WDI)	0.094	0.069	0.184	-0.020	39

## Appendix C:

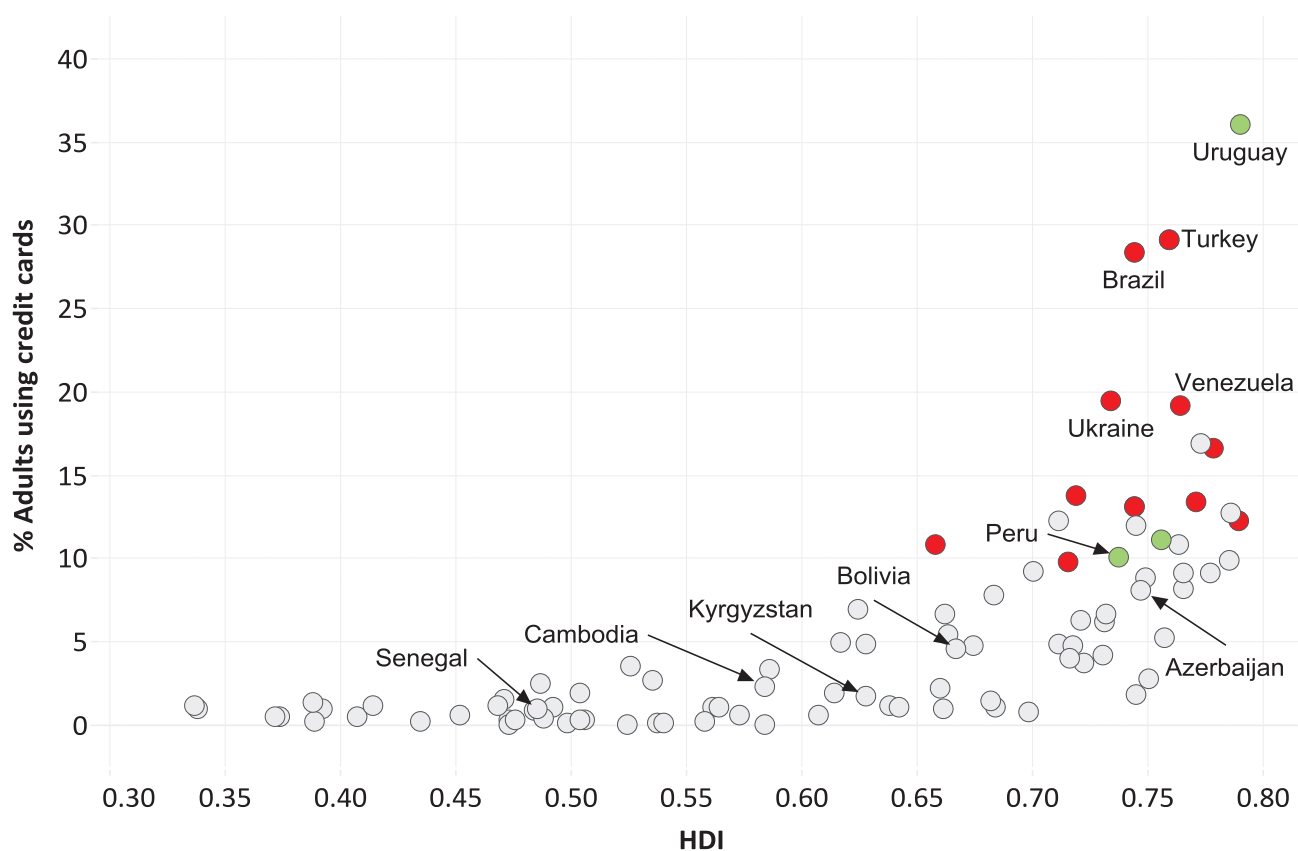
### MIMOSA for credit cards

Assessing credit card penetration and capacity follows a similar path to fixed-term loans. First, due to lower availability of data nearly all measures of penetration rely on Findex (Used credit card in the past 12 months, % age 15+).<sup>14</sup> This includes most pilot markets as well.

The absence of data is not surprising, especially given that credit card use is largely insignificant until countries hit middle-income level. However, the pattern of credit card use is also quite different from fixed-term borrowing, with a function that is more exponential than linear (Figure 13).

That has affected our model, which likewise incorporates this exponential function. The components are also slightly different, with population density replaced by urbanization rate (% of population considered urban). This is consistent with the observation that at least in developing economies, credit cards are largely prevalent in cities, and rarely circulate in the countryside.

**Figure 13: MIMOSA for credit card use**



<sup>14</sup> The measure is available only in Findex 2014. For 2011 data, we used interpolated the metric using Has Credit Card, % age 15+, which is present in both years.

Because we have less expertise in assessing credit card saturation, we use only three score levels: one standard deviation below capacity are scored 1 (underserved), those within one std dev are graded 2 (normal), and anything above one std dev are graded 3 (saturated). Due to the exponential function, all markets below HDI of .60 receive a grade of 2, since they would have to have negative penetration to fall more than one std dev below capacity.

Because of the lower variation in credit card penetration in most countries, the model also has a much higher  $R^2$  (.611) than the main MIMOSA model. That doesn't make it a more precise measure of capacity – this simply an artefact of low credit card usage in most developing markets.

Here is the regression output for credit card usage:

$$\log(\text{CC Penetration}) = -3.20 + 4.68 * \text{HDI} + 0.00586 * \text{Credit bureau score} + 0.0173 * \text{Urbanization ratio}$$

Source	SS	df	MS
Model	231.266073	3	77.0886911
Residual	144.612423	172	.840769901
Total	375.87849	175	2.14787712

Number of obs	=	176
F( 3, 172)	=	91.69
Prob > F	=	0.0000
R-squared	=	0.6153
Adj R-squared	=	0.6086
Root MSE	=	.91694

FinInst_Borrowed	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
HDI	4.681756	.8109349	5.77	0.000	3.081091 6.282422
Population Density	.0058572	.0015612	3.75	0.009	.0027757 .0089387
Credit Bureau Score	.0173373	.0049313	3.52	0.001	.0076037 .0270708
_cons	-3.200815	.3889251	-8.23	0.000	-3.968496 -2.433135



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