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## Article

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# The exposure of microfinance institutions to financial risk<sup>☆,☆☆</sup>

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## Abstract

This study examines the exposure of microfinance institutions to liquidity-, interest rate and foreign exchange (FX) risk. Using manually collected data from microfinance institutions' financial reporting, I find that the microfinance sector faces minimal liquidity risk, high interest rate risk and a lower than commonly assumed exposure to FX risk. Linking risk exposure to institutional characteristics, the data shows that legal status and regional affiliation are correlated with risk exposure while regulatory quality is not. Results suggest that the development community may not expect large benefits from expanding the plethora of current measures taken to mitigate liquidity or FX risk.

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## 1. Introduction

Modern microfinance that targets its activities to groups otherwise barred from formal financial services, has been widely accepted as a viable business model. After the very successful initial years, the microfinance community had even come to believe that microfinance is resilient to most traditional risks in banking thanks to its unique business model (Winkler and Wagner, 2012). However, a recent concourse of crises – for example in Bosnia and Herzegovina (2008), Pakistan (2008–09) and India (2010) – has brought down this level of optimism. In response, international donors and investors have made available large sums of money trying to mitigate the sector's exposure to financial risks. For example, in an attempt to reduce exposure to foreign currency fluctuations, development finance institu-

tions (DFIs) have created methods of local currency borrowing for microfinance institutions (MFIs). DFIs have also installed multi- million Dollar facilities that provide funds to MFIs in a liquidity crisis.<sup>1</sup>

Financial risks are of great concern in the standard banking literature but have gained little attention from the research community in microfinance up to now. From the commercial banking sector we know that a high exposure to financial risks depresses lending and reduces financial stability. High liquidity risk exposure of commercial banks led to a significant reduction in credit supply in the aftermath of the financial crisis in 2008 (Cornett et al., 2011) and the liquidity dry-up had to be met by massive public injections of liquidity into the financial markets. Similarly, a banking sector that is greatly exposed to foreign currency risk may exacerbate financial crises and risk exposure may be detrimental to credit supply in crisis times, as happened during the East-Asia crisis in the 90s (McKinnon

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<sup>1</sup> An example concerning FX risk is the TCX fund that provides instruments to hedge FX risk and spans 70 primarily small currencies ([www.txfund.com](http://www.txfund.com)). Another is the African Local Currency Bond Fund ([www.alcbfund.com](http://www.alcbfund.com)) that promotes local currency borrowing for African MFIs. Regarding liquidity risk, the donor community has for example established the Microfinance Enhancement Facility, which is a 500 million US Dollar facility aimed at supporting MFIs facing liquidity shortages in the wake of the 2008 financial crisis ([www.mef-fund.com](http://www.mef-fund.com)).

and Pill, 1998). Landier et al. (2013) show that credit supply of banks that are exposed to more interest rate risk reacts stronger to changes in the market interest rates, potentially increasing the volatility of lending. Therefore, DFIs hope that mitigating financial risks in the microfinance sector will enhance stability, help MFIs to increase lending activities or at least help them to maintain outreach in crisis times. Yet, up to now, no study exists that has quantified the exposure of the microfinance sector to financial risks.<sup>2</sup> Currently, much of the money used to mitigate financial risk in the sector is spent based on little more than anecdotal evidence.

This study seeks to fill this void and investigates to what extent the microfinance sector is exposed to financial risks and whether the money spent by DFIs on risk mitigation in the sector is being used efficiently. I use a new hand-collected data set on the maturity structure of assets and liabilities and FX positions from MFIs' financial reporting files and quantify the exposure of MFIs to three financial risks, liquidity risk, interest rate risk and foreign exchange (FX) risk. To do so, I construct simple measures of financial risk from publicly available and audited financial reporting data of MFIs and compare the risk exposure to similar measures from the commercial banking sector. My base sample consists of the 309 largest MFIs in 2011 (about half of which report details on their exposure to the risks I study).

The results show that MFIs, other than commercial banks, are only exposed to a minimal level of liquidity risk. MFIs' short-term assets ( $\leq 30$  days) surpass short-term liabilities threefold on average (a negative level of maturity transformation). That means that much of the sector's long-term funding is translated into short-term lending or investment in liquid assets like government bonds. Furthermore, even the MFIs with the lowest liquidity coverage are, compared to the commercial banking sector, in a comfortable liquidity position. At the same time, interest rate risk exposure of MFIs is substantial and larger than that of commercial banks. The average difference between interest repricing assets and liabilities over a one-year horizon is 27% of total assets. My results also show that average exposure to FX risk is lower than most market observers tend to believe. Low FX risk exposure is the result of counterbalancing asset and liability positions. MFIs fund a considerable share of their assets with FX liabilities (28%), but the average share of FX assets also stands at 28% and offsets a large amount of exposure to FX funding. Using a conservative measure of FX risk, MFIs are only exposed to an average total difference between their foreign currency assets and liabilities (Net Open Position) of 4.5% of total assets.

Overall, results on the total risk exposure of MFIs suggest that liquidity or FX risk do not constrain the microfinance sector. This means that, while an extension of risk mitigation measures targeted towards FX or liquidity risk may be useful to support a few single MFIs, they are unlikely going to result in significantly more loans or longer-term loans extended to microfinance borrowers. The results also suggest that the sector is not prone

to a sudden liquidity dry-up in crisis times. Furthermore, interest rate risk seems to be underrepresented in the microfinance risk mitigation strategy of the international community, as it is substantially larger than that of the commercial banking sector. This also shows that measures to strengthen the microfinance sector in developing countries should be more firmly based on quantitative evidence to target risks that actually constrain MFIs' lending or endanger the sector's stability.

Naturally, the international investor and donor community is also concerned about the interplay of risk exposure with an MFI's legal status and the regulatory environment, because those are two key policy variables. The evidence on whether the exposure of MFIs to financial risks is affected by regulation and an MFI's legal status is limited. Klomp and de Haan (2015), using a large sample of banks in 94 developing and emerging economies, show that stricter capital requirements and supervisory control mitigate risk taking of financial institutions (measured by the Z-Score). In terms of legal status, practitioners frequently advocate the transformation of non-private MFIs and NGOs into private shareholder-owned firms (Mersland and Strom, 2008). This is at least partly due to the belief that shareholder-owned firms feature a superior ability to manage risk. Another strand of literature studies the effects of regulation and legal status on outreach and performance of MFIs. These studies hint at a limited impact of both the regulatory framework and the legal status. Mersland and Strom (2009) (using a data set of MFI ratings) and Hartarska and Nadolnyak (2007) (using financial reporting data) both conclude that regulation does not affect outreach and financial performance. Mersland and Strom (2008) find only small differences between private, shareholder-owned firms and non-profit institutions in terms of social orientation and performance.

I link my results on financial risk exposure to the MFIs' legal statuses and quality of the local regulation to contribute to the discussion about which institutional features of MFIs are suitable to attain social outreach while at the same time containing risk. Results show that the strength of local regulation plays no role in determining exposure to financial risks. An MFI's legal status, however, does correlate with the exposure to liquidity and FX risk. Banks in the microfinance sector face higher liquidity risk than Non-Banking Financial Institutions (NBFIs) and the effect cannot be fully explained by their larger share of funding via deposits. NGOs, Credit Unions and Cooperatives are exposed to more FX risk, although their share of funding via FX liabilities is lower, which suggests an inferior ability to mitigate FX risk. An interesting side result is that regional affiliation is highly correlated with levels of risk exposure.

## 2. Theory and hypotheses on risk exposure

According to the Basel Committee on Bank Supervision (BCBS, 2008), liquidity risk is the risk that a financial institution (FI) is unable to meet its immediately outstanding obligations. For example, an FI is exposed to liquidity risk whenever it needs to raise more cash to repay its creditors than is inflowing from maturing loans or can be raised immediately by selling assets. Liquidity risk is inherent to banking because banks trans-

<sup>2</sup> Abrams and Prieur (2011) is one exception, being an analysis of FX risk from the practitioner community.

form short-term liabilities into long-term lending. Traditionally, deposits were at the center of liquidity risk concerns with banks in countries with weak depositor protection most affected (the classical reference is [Diamond and Dybvig, 1983](#)). In the recent financial crisis, wholesale funding played a more important role for larger FIs. When trust in the markets eroded, the liquidity of large banks that relied heavily on short-term funding from other institutional investors dried up quickly ([Shin, 2009](#)).

A first look at the standard MFI business model suggests that MFIs are exposed to low levels of liquidity risk. MFIs tend to lend out short-term loans of relatively small sizes ([Winkler and Wagner, 2012](#)). Unlike purely commercial banks, MFIs are able to receive long-term financing from DFIs at concessionary terms and usually do not borrow short-term in the interbank money market. Other than commercial banks, MFIs are usually not exposed to credit commitments that severely strained liquidity in the banking sector when they were increasingly drawn down by borrowers after the 2008 financial crisis ([Cornett et al., 2011](#)). However, liquidity risk exposure ultimately remains an empirical question because deposit-taking MFIs have recently increased their share of funding from deposits ([Litzenkirchen and Weistroffer, 2012](#)). Therefore, deposits may be an increasingly important source of liquidity risk for MFIs.

*H1: The liquidity risk exposure of MFIs is lower than that of commercial banks.*

Interest rate risk is the exposure of an FI to movements in the interest rate ([BCBS, 2004](#)). I focus on basic repricing risk which results from a mismatch in volume of so-called rate-sensitive assets and liabilities (RSA and RSL) for which interest rates are repriced within a certain time period. Whenever, for example, an FI's liabilities reprice their interest rate and assets do not, the FI may have to start paying higher interest rates to fund assets that still yield the former lower interest rates. Repricing occurs whenever fixed-rate positions mature, interim or partial payments are due and interest payments change on a contractual basis or for floating-rate instruments that adjust their interest rate continuously ([Koch and McDonald, 2009](#)). The exposure of a bank to interest rate risk depends both on the mismatch of its RSA and RSL but also on the volatility of monetary conditions. Unexpected changes in the level of interest rates affect the value of a mismatched bank's equity ([Flannery and James, 1984](#)). Hypothetically, many MFIs operate in volatile monetary conditions which should make them try to keep the maturity mismatch of RSA and RSL in check. This idea is supported by the fact that for larger banks, there is a plethora of more or less complex (and mostly off-balance sheet) financial instruments such as interest rate swaps that can be used to hedge exposure to interest rate risk. Those instruments will, however, usually not be available to MFIs ([Brom, 2009](#)).

*H2: MFIs are exposed to a smaller amount of interest rate risk from a maturity mismatch between rate-sensitive assets and liabilities than commercial banks.*

Basic FX risk arises when an FI holds a different amount of assets than liabilities of a foreign currency. From an economic value perspective, a depreciating foreign currency reduces the value of foreign currency A&L. For example, if an FI holds more assets in a particular foreign currency than it holds liabilities, a

decrease in the value of the foreign currency vis-à-vis the local currency lowers the FI's economic value, which is measured in local currency. The willingness of borrowers and banks to engage in FX lending depends on the volatility of domestic inflation and the volatility of the exchange rate ([Brown and De Haas, 2012](#)). Hypothetically, FIs facing more volatile exchange rates will be less likely to find a given FX risk exposure acceptable.

The usual narrative is that MFIs are exposed to a large amount of FX risk. Much of the long-term DFI funding that MFIs attain is indeed denominated in foreign currency, potentially creating a mismatch to local currency lending. In 2011, the amount of cross-border funding for the sector was between 15 to 25 billion US Dollars depending on the source of the estimates, was mostly public, and constituted about one fifth of the sector's total volume of assets ([Reille et al., 2011](#); [Lahaye et al., 2012](#)). The largest share of cross-border funding comes as debt-type instruments (55%) ([Lahaye et al., 2012](#)) and in 2004 more than 90% of all cross-border debt funding towards MFIs was denominated in Euro or US Dollar ([Ivatury and Abrams, 2005](#)). Whether this really means that MFIs are exposed to a lot of FX risk is, however, an empirical question. Many MFIs operate in widely euroized or dollarized economies in which large parts of all assets – and not only liabilities – are denominated in hard currency (examples include Bosnia and Herzegovina or Ecuador). Hard currency lending may balance the effect of hard currency borrowing. In addition, customers in economies like Serbia for the Euro or Cambodia for the US Dollar consign deposits in local but also hard currency. Increasing local currency deposits may also mitigate FX risk for MFIs, which is why the exposure to FX risk too, is ultimately an empirical question.

*H3: MFIs are exposed to a larger amount of FX risk than commercial banks.*

### 3. Methodology and data

#### 3.1. Measuring risk

Data restrictions make measuring financial risks in the micro-finance sector very difficult. There is no comprehensive database of to what extent MFIs maintain foreign currency positions or what the maturity structure of MFIs' assets and liabilities is. Empirical evidence is additionally hampered by accounting standards and quality of publications, which differ widely among MFIs globally. In the following, I use risk measures that are both standard in the literature but at the same time can be constructed from financial reporting files based on different accounting standards.<sup>3</sup>

##### 3.1.1. Liquidity risk

To measure liquidity risk and form an idea of future expected cash outflow (i.e. liquidity demand) and expected cash inflow (i.e. liquidity supply), regulators have increasingly been using maturity profiles instead of simple static measures of liquidity

<sup>3</sup> [Brom \(2009\)](#) is a non-quantitative guideline on how to measure risk exposure to the three financial risks in this study.

(Van Greuning and Brajovic-Bratanovic, 2009). Maturity profiles group A&L into different time bands to capture the timing of expected future cash in- and outflows.

For my risk measure, I focus on the contractual time to maturity and disregard the fact that the contractual due date may not always be equal to the actual date of cash in- and outflow. I also leave aside the idea that some assets may be turned into cash more easily than others. This is because in the microfinance sector, short-run liquidity supply on the asset side of the balance sheet is mainly the amount of loans that mature over the short-term, cash and balances with the central bank. Securitization in this sector is still underdeveloped, especially for the smaller MFIs (Brom, 2009). On the liability side, the crucial difference between expected and contractual maturity concerns deposits. Current banking regulation assumes that a share of demand deposits stays with the financial institution (FI) for longer than the earliest contractual draw-down date (core deposits). To employ an even more conservative risk measure, I use the contractual maturity for all liabilities, which means that the full amount of demand deposits is possibly due in the short-run. Finally, the Liquidity Coverage (*LC*) is the ratio of short-term (by remaining time to contractual maturity) assets and liabilities within a one month time band.

$$LC = \frac{\text{Short-Term Assets (One Month)}}{\text{Short-Term Liabilities (One Month)}} \quad (1)$$

Short-term assets notably include maturing loans, central bank reserves, cash and all other current financial assets, as well as short-term investments.<sup>4</sup> For the denominator, I do not exclude any liability classes from the measure of short-term liquidity. The ratio does not consider off-balance sheet exposure. A value of one indicates a perfect match for A&L maturities and higher values indicate lower liquidity risk.

### 3.1.2. Interest rate risk

To measure interest rate risk, I construct the Cumulative Interest Gap (*CIG*) as the absolute value of the gap between RSA and RSL over a one year horizon normalized by the total amount of assets. A higher gap between repricing A&L indicates a higher exposure to interest rate risk.

$$CIG = \frac{|(\text{RSA} \leq \text{OneYear}) - (\text{RSL} \leq \text{OneYear})|}{\text{Total Assets}} \quad (2)$$

Determining a repricing profile requires (1) defining RSA and RSL and (2) grouping RSA and RSL into repricing time bands.<sup>5</sup>

<sup>4</sup> If listed on the balance sheet, I exclude property and equipment, provisions, deferred tax assets, the residual category of other assets, restricted funds, intangible assets and goodwill, and investments in associates from the liquidity coverage measure, due to their largely unclear role in liquidity provision and varying accounting standards. In no case do these positions constitute a sizable share of the total asset volume.

<sup>5</sup> In the final sample for interest rate risk 75 MFIs do not report A&L according to their repricing date but with respect to contractual time to maturity only. For those MFIs, I use data on A&L grouped according to remaining time to contractual maturity because MFIs' balance sheets usually do not contain many assets that reprice before their contractual maturity date. The comparability of repricing and maturity profiles is supported by the fact that, for MFIs reporting

To determine the amount of RSA and RSL, the same asset classes as before remain excluded and I additionally exclude cash holdings, because cash does not yield an interest. All liabilities are considered to be rate-sensitive.

### 3.1.3. FX risk

To measure FX risk, I disregard the maturity structure of FX positions and I rely on the Net Open Position (*NOP*) that measures the difference between all on-balance sheet FX assets and FX forwards bought and all FX liabilities and FX forwards sold within single foreign currencies (Net Exposure). I employ the most conservative aggregation method by adding the absolute values of all net exposures, both positive and negative, over the various currencies and normalize the result by the total amount of assets. While on an individual level this is a fair and comparable measure of FX risk exposure, it likely overstates FX risk on an aggregate level, because in the aggregate at least some MFIs are likely to be exposed to offsetting FX positions.<sup>6</sup>

$$NOP = \frac{\sum_{n=1}^N |\text{Net Exposure}_n|}{\text{Total Assets}} \text{ with } n = 1, \dots, N \text{ single currencies} \quad (3)$$

A few countries in the sample (e.g. Kosovo, Ecuador) have adopted the Euro or the US Dollar as their primary currency without a separate legal tender. In these cases, a supposedly hard currency (Euro or US Dollar) is defined to be the local currency and is not included in the *NOP*. In all other cases, the local currency is the currency not included in the *NOP*, no matter the share of A&L held in any hard currency.

### 3.2. Base sample

In order to be able to construct measures of financial risk, I hand-collect a set of data from publicly available (either via the Microfinance Information Exchange (MIX) database or via any other online source) and independently audited financial reporting files of MFIs from fiscal year-end 2011. To cover a relevant fraction of the market, the base sample for which financial reporting files have been searched for, consists of the 309 largest MFIs by total assets in 2011 from the MIX database. In the base sample of the 309 MFIs, the average MFI has 260 Mio. USD in assets (excluding one outlier at the top) and is about 20 years old. Due to the fact that I only search for financial reporting files of large MFIs, the results of this study pertain only to larger and therefore relatively more professional MFIs. Importantly, the base sample covers more than 60% of the total asset volume of MFIs registered in the MIX database (even excluding one outlier at the top) and is therefore politically most relevant.

Table 1 summarizes the availability of financial reporting files for those 309 MFIs. About half of the MFIs in the base sample

both maturity and repricing profiles, the two generally do not differ significantly over the one year horizon.

<sup>6</sup> 34 MFIs in the sample report their various FX positions aggregated into a single currency. In particular, 32 Latin American MFIs report all FX positions translated and aggregated into US Dollars only. Aggregation among various currencies (i.e. netting out the differences) is likely to understate true FX exposure. However, the error from this type of aggregation for Latin American MFIs is

Table 1  
Availability of audited financial statements for the baseline sample.

Yes (and information on any of the risks available)	150 (49%)
Yes (and no information on any of the risks available)	89 (29%)
No	57 (18%)
Other language (other than English, Spanish, French, German)	13 (4%)

The table shows whether audited financial statements are publicly available – and whether they contain detailed information on liquidity, interest rate or FX risk – for the baseline sample of the 309 largest MFIs by total asset volume in MIX in 2011.

do not report on any of my financial risks or do not publish audited financial statements in a standard language. The 150 MFIs reporting on any risk consist of 117 MFIs reporting on liquidity risk, 132 on interest rate risk and 97 on FX risk with many MFIs reporting on more than one.

### 3.3. Institutional determinants

Besides estimating the microfinance sector's overall exposure to financial risk, this study also asks in what way the exposure is linked to the legal status of MFIs and the regulatory environments which they operate in. The main explanatory variables (also widely perceived to be the most relevant policy variables) are an MFI's legal status as provided in the MIX database and the quality of local regulation. To measure regulatory quality, I rely on the data provided by Barth et al. (2013). Their database on bank regulation and supervision covers 180 countries in four surveys between 2000 and 2011, whereby I always use the most recent data available. In particular, I use the database's sub-category Official Supervisory Power that aims to capture "whether the supervisory authorities have the authority to take specific actions to prevent and correct problems" (Barth et al., 2013).

The bank regulation database is naturally focused on institutions governed by banking laws. In order to avoid missing the effects of regulation on legal statuses other than banks by construction, I use an alternative broader measure of regulatory quality provided by the Worldwide Governance Indicators (WGI) Project (Kaufmann et al., 2010). Their governance indicator, which is available for all countries in the sample, covers six dimensions (Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption) that affect not only banks but all legal types of MFIs, whereby I use the Regulatory Quality sub-index from 2011. As a third alternative, I consider data from the 2011 Global Microscope on the business environment in microfinance in 55 countries (EIU, 2011), a joint initiative of the Economist Intelligence Unit (EIU) and other DFIs. It is important to note that the main results in this paper do not change for any of the three alternatives and, in what follows, only the results for the bank regulation database from

Barth et al. (2013) are reported (other results are available upon request).

### 3.4. Control variables

In the main regressions, I control for factors that can reasonably be expected to influence risk taking and/or to be correlated with an MFI's legal status or regulatory quality. Age and size are supposed to capture the effects of an MFI's maturing process and I expect larger and older MFIs to have more sound risk management and thus lower average exposure. The return on assets (ROA) is included as a control variable to proxy managerial quality, but also competition effects. Less competition will generally allow MFIs to generate a higher ROA. However – at least in the short-run – riskier business models might also be correlated with a higher ROA. I additionally include regional dummies to capture the effects of different MFI business models across regions. The different business models might correlate with MFIs' risk preferences and/or a different attitude of investors towards certain regions. Finally, different exchange rate volatilities suggest different levels of FX risk exposure that can still be considered prudent. In order to control for different exchange rate volatilities caused by exchange rate regimes, I include a dummy for non-free-floating currencies in the regressions concerned with FX risk exposure. The data on currency regimes, where a value of one is assigned to non-free-floating currencies, was taken from the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions in 2011 (available at [www.imf.org/external/pubs/ft/ar/2011/eng/pdf/a2.pdf](http://www.imf.org/external/pubs/ft/ar/2011/eng/pdf/a2.pdf)). All other control variables are obtained from the MIX database for fiscal year-end 2011.

Summary statistics that are not reported show that the level of deposits in the sample is related to an MFI's legal status, as Banks in my sample are almost always deposit-taking. On average, Banks fund 56% of their total assets via deposits, NBFIs 26% and NGOs, Credit Unions and Cooperatives 31%. Also, an MFI's profit status is almost perfectly correlated with its legal status. In particular, almost all Banks in the sample operate for-profit while NGOs, Credit Unions and Cooperatives in the sample never do. To avoid multi-collinearity, an MFI's profit status and whether an MFI accepts deposits or not are thus discarded as control variables. The correlation structure of the other control variables does not suggest multi-collinearity problems (Table A.1 in the appendix states all the pairwise correlations between the risk measures and MFI features.).

### 3.5. Selection bias

While the results of this study pertain only to the base sample that has been searched for financial reporting files, even the final samples of MFIs that report on the risk exposures (as opposed to MFIs in the base sample that do not) necessarily suffer from some selection bias. To discuss this possible selection bias, Table 2 (categorical variables) and Table 3 (continuous variables) summarize descriptive statistics separately for MFIs that report data on one of the three risk measures (the selection) and those that do not publish audited financial statements at all or do

presumably small as FX positions in Latin America consist primarily of US Dollars in the first place.

Table 2  
Reporting vs. non-reporting MFIs – summary of categorical variables.

<i>Legal status</i> <sup>***</sup>	Reporting <sup>a</sup>	Not reporting <sup>b</sup>	<i>Profit status</i> <sup>***</sup>	Reporting	Not reporting
Bank	55 (37%)	38 (24%)	For-Profit	110 (73%)	69 (47%)
NBFI	72 (48%)	47 (30%)	Non For-Profit	40 (27%)	78 (53%)
NGO/Credit Union/Cooperative	23 (15%)	71 (45%)			
<i>Regions</i> <sup>***</sup>	Reporting	Not reporting	<i>Deposit taking</i>	Reporting	Not reporting
Africa	11 (7%)	24 (15%)	Yes	107 (71%)	108 (68%)
East Asia and the Pacific	15 (10%)	24 (15%)	No	43 (29%)	51 (32%)
Eastern Europe and Central Asia	44 (29%)	11 (7%)			
Latin America and the Caribbean	59 (39%)	61 (38%)			
Middle East and North Africa	1 (1%)	16 (10%)			
South Asia	20 (13%)	23 (14%)			

<sup>a</sup> Reporting MFIs are the ones reporting in sufficient detail to construct at least one risk measure.

<sup>b</sup> Non-reporting MFIs are the ones not reporting in sufficient detail to construct any risk measure and are not included in any final sample. NBFIs are Non-Banking Financial Institutions. Asterisks indicate results of Fisher's Exact Tests for independence of the categorical variables.

\*  $p < 0.05$ .

\*\*  $p < 0.01$ .

\*\*\*  $p < 0.001$ .

Table 3  
Reporting vs. non-reporting MFIs – summary of continuous variables.

<i>Variable</i>	Reporting <sup>a</sup>					Not reporting <sup>b</sup>				
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Regulatory quality <sup>*</sup>	147	11.39	2.17	6	14	153	10.86	2.19	6	14
Total assets (in million USD)	150	286	433	27	3,160	159	436	2,590	27	31,900
Age (in years)	150	18.9	9.9	3.0	64.0	153	21.2	12.1	3.0	66.0
ROA (in %)	150	2.1	5.2	−45.9	14.3	151	2.4	6.6	−62.1	17.0
Deposits to total assets (in %)	150	36.7	32.0	0.0	88.2	159	36.5	33.4	0.0	90.3
Non-free-floating currency	150	0.57	0.50	0	1	158	0.53	0.50	0	1

<sup>a</sup> Reporting MFIs are the ones reporting in sufficient detail to construct at least one risk measure. <sup>b</sup> Non-reporting MFIs are the ones not reporting in sufficient detail to construct any risk measure and are not included in any final sample. Regulatory Quality is the Official Supervisory Power index from Barth et al. (2013). Asterisks indicate results of *t*-tests for an equal mean of the two groups assuming unequal variances.

\*  $p < 0.05$ .

\*\*  $p < 0.01$ .

\*\*\*  $p < 0.001$ .

not report in sufficient detail (but were still part of the base sample). Interestingly, reporting MFIs and non-reporting MFIs are similar with respect to most of their balance sheet characteristics, which suggests that selection bias in the final samples of reporting MFIs is limited. Using *t*-tests for the continuous variables, the hypothesis of an equal mean between the two groups is only rejected for the regulatory quality index taken from the Barth et al. (2013) database. For the categorical variables, I report the results of a two-sided Fisher's Exact Test that is used to check the association between categorical variables. I find significant differences between reporting and non-reporting MFIs with respect to their legal status, the profit status and the region they operate in. There is no difference to be found between deposit-taking and non-deposit taking MFIs. If we accredited a monitoring role to depositors, we would also expect deposit-taking MFIs to be more likely to report details on their risk exposure.

Table A.2 in the appendix presents results from a Probit model on the differences between MFIs reporting and MFIs not reporting in detail for any of the risk measures. Results show that being an Eastern European MFI increases and being an NGO, Credit Union or Cooperative decreases the likelihood of report-

ing, but that differences between the reporting and non-reporting groups of MFIs are uncorrelated with most basic MFI portfolio characteristics. To further support the notion that the sample of reporting MFIs is not much different from non-reporting MFIs, I estimate a Heckman selection correction model for the regressions of legal status and regulation on liquidity risk exposure. I use the MIX database's reporting quality index (the diamonds) that are a function of how much data an MFI has provided to the MIX database, as an instrument. Again, the bias-correction model does not suggest the presence of significant selection bias (results are available upon request). This raises confidence in the fact that the results for the sample of reporting MFIs can be transferred to the base sample of 309 MFIs.

### 3.6. Estimation method

My measures of interest rate risk (*CIG*) and FX risk (*NOP*) are normalized by total assets and thus fractions bounded by the unit interval. Therefore, the determinants of interest rate and FX risk exposure cannot be consistently estimated using a linear model. One method of modeling dependent variables defined on the

standard unit interval is the fractional-logit approach introduced by Papke and Wooldridge (1996). Their approach imposes the following assumption on the conditional mean and chooses  $G(\cdot)$  to be the logistic function:<sup>7</sup>

$$\mathbb{E}(Y|\mathbf{X}) = G(\mathbf{X}\beta)$$

For the *LC* regression, I use a simple linear model. I use dummy coding for the categorical variables and define Africa and Banks as the baseline categories for region and legal status and perform F-tests to test for the joint significance of the categorical variables on the mean of the outcome variables.

## 4. Results

### 4.1. Financial risk exposure of MFIs

Table 4 presents results on the risk measures for the sub-samples of MFIs that report sufficiently detailed data. Since *LC* is a ratio it has the tendency to generate outliers whenever the denominator approaches zero. To account for this, I censor the upper 5% of the observations that are about 10 times larger than the standard deviation of the censored sample.

Hypothesis 1: Results show that liquidity risk in the micro-finance sector is minimal. The average liquidity coverage is more than 300%, i.e. MFIs' short-term assets ( $\leq 30$  days) surpass short-term liabilities – both by contractual due date – threefold (distributions of all the risk measures can be found in Fig. A1 in the appendix). Hence, the sector engages in a negative level of maturity transformation. This is in contrast to the commercial banking sector. Bonfim and Kim (2014) show that the liquidity ratio for European and US banks between 2002 and 2009 (using a three months time window for their measure) moves between 13% and 20%. The difference between my and their sample is not solely driven by the fact that some MFIs are not deposit taking. The average liquidity coverage of deposit taking MFIs only is still 211% in my sample.

The total share of short-term assets and short-term liabilities compared to the total volume of an MFIs assets stands at 21% and 18% respectively. This means that, on average, MFIs have one fifth of their total assets invested a very short-term loan portfolio and/or other highly liquid asset classes. Even though data on the exact distribution of the asset classes by maturity is missing for most MFIs, a spot test of some MFIs with very detailed information shows that both factors seem to play a role. This should give rise to some concerns in the development community because it means that MFIs oftentimes do not translate long-term funding into long-term loans for their borrowers and invest much of it in liquid assets (e.g. government bonds) that are outside of the scope of the type of assets that DFIs seek to support. Long-term DFI funding has probably contributed to the minimal level of liquidity risk exposure in the sector. Yet, results suggest that expanding long-term funding for the sector is unlikely to result

in a significant increase in long-term lending by microfinance institutions, because MFI lending is not constrained by liquidity concerns.

DFI liquidity support is arguably not targeted at the average MFI but MFIs with particularly low liquidity coverage. However, not only is the average sector exposure to liquidity risk low, but also the MFIs exposed to the highest amount of liquidity risk in the sample maintain a decent liquidity position. Only one MFI in the whole sample features a marginally lower liquidity coverage (19%) than the maximum average liquidity coverage in the commercial banking sector of the Bonfim and Kim (2014) sample (20%). More than 92% of the MFIs in my sample have a more than twice the liquidity coverage than the maximum average coverage of the banking sector of 20%. This very comfortable funding liquidity position – even at the lower end of the liquidity coverage distribution – suggests that almost all MFIs keep a considerable liquidity buffer for crisis times and large scale emergency liquidity support may not be needed.

Hypothesis 2: With regard to interest rate risk, MFIs in the sample face an average mismatch of 27% of total assets in absolute value between RSA and RSL over the one year horizon. This is a substantial exposure towards interest rate risk. For the median sized MFI in the sample (85.3 million US Dollar in total assets) an unfavorable/favorable 100 basis points change in the interest rate, being exposed to a 27% *CIG*, translates into a loss/gain in net interest income (NII) of about 115,000 US Dollar.<sup>8</sup>

$$\begin{aligned} & (\text{Avg. CIG} \times \text{Median Total MFI Assets}) \times 100 \text{ Basis Points} \\ & \times 6/12 = \text{Change in NII} \end{aligned} \quad (4)$$

The direction of the change in NII depends on whether the actual *CIG* and the basis points change are negative or positive. The analysis also abstracts from potential offsetting effects in time windows shorter than the one year horizon.

Over the one year horizon, two-thirds of all MFIs have more rate sensitive assets than liabilities on their balance sheet, i.e. they profit from an increase in the interest rate and one-third of MFIs vice versa. The average exposure of MFIs with more rate sensitive assets is stronger (30%) than the exposure of MFIs with more rate sensitive liabilities (19%). Comparing this to the commercial banking sector, I find that the exposure of the microfinance sector is larger than that of commercial banks. Using the same measure of interest rate risk for a sample of commercial banks between 1986 and 2011 Landier et al. (2013) find that the average *CIG* is 13.4%. Landier et al. (2013) also find that relatively more banks (78%) are exposed to more rate sensitive assets than liabilities. Despite the fact that the exposure to interest rate risk is substantial in the microfinance sector, it has not received much attention both in the academic and practical sphere. This might be due to the fact that interest rate risk is often

<sup>7</sup> As an alternative to the fractional-logit approach, I employ beta regressions and the main results are not sensitive to this choice. A good introduction into both methods can be found in Ramalho et al. (2011) and the sources within.

<sup>8</sup> This is under the assumption that all assets and all liabilities reprice instantaneously after half a year by the same rate, are reinvested at the new rate and there is no other change in the composition of the balance sheet. Similar to Brom (2009), I use the following formula to compute the change in NII at the median:

Table 4  
Results – risk measures.

Variable	Obs	Mean	Std. Dev.	Min	Max	25%	50%	75%
Liquidity Coverage (LC) <sup>a</sup>	117	3.10	4.64	0.19	25.09	0.73	1.44	2.69
Cumulative Interest Gap (CIG)	132	0.27	0.20	0.00	0.80	0.11	0.21	0.38
Net Open FX Position (NOP)	97	0.049	0.08	0.00	0.42	0.002	0.017	0.043
Net Open FX Position incl. OBS positions	95	0.051	0.08	0.00	0.42	0.003	0.019	0.054
Share of FX Assets to Total Assets	93	0.28	0.25	0.00	0.91	0.05	0.17	0.48
Share of FX Liabilities to Total Assets	93	0.28	0.24	0.00	0.80	0.08	0.20	0.49

<sup>a</sup> For the LC measure values above the upper 95th percentile are censored. OBS are off-balance sheet positions. The final three columns present the 25%, 50% and 75% quantiles. Liquidity Coverage is the amount of short-term assets divided by the amount of short-term liabilities. The Cumulative Interest Gap is the absolute value of rate sensitive assets over one year minus rate sensitive liabilities over one year, normalized by the total amount of assets. The Net Open FX Position is the sum of the absolute value of an MFI's open positions in different currencies, normalized by the total amount of assets.

perceived as potentially cutting into profits but that mitigation of the risk is not vital to the operation of an MFI.

Hypothesis 3: Looking at FX risk, MFIs are, on average, exposed to a Net Open Position of about 5% of their total assets. The distribution of the *NOP* is highly skewed and the average *NOP* is driven by some MFIs' exposure to large amounts of FX risk and by most MFIs facing only a small *NOP*. Off-balance sheet FX positions (in many cases credit commitments) are not always reported. Including off-balance sheet positions whenever reported, however, does not change the result. I find that netting out negative and positive positions between different currencies for a single MFI (instead of summing the absolute value of all single exposures), reduces the average *NOP* further to less than 1% of total assets.

Normalizing by the total amount of equity instead of total assets, average exposure in my sample is 25%. Brom (2009) suggests that 25% *NOP* with respect to total equity is still a prudent level when considering only net negative positions. Given that I aggregate both positive and negative positions (maximum exposure would thus double), most MFIs pass this prudence test easily, although about 15% of all MFIs feature a non-prudent exposure according to Brom (2009). Still, non-prudent exposure in my sample is often merely a result of very low levels of equity.

While the average *NOP* is low, the average total share of FX A&L is sizeable and stands at about 28% for both assets and liabilities. The usual narrative that MFIs are to a considerable extent indebted in foreign currency is true, but counterbalancing FX asset positions largely offset the exposure to FX liabilities. Comparing total FX assets and FX liabilities, the number of MFIs that are more strongly exposed to FX assets is almost the same as the number of MFIs that are exposed to more FX liabilities (46% vs. 54% of all MFIs). Furthermore, the use of foreign currency varies considerably between regions. Eastern European and Central Asian MFIs maintain the most, while African MFIs keep the least FX A&L in their portfolios (Fig. A2 in the appendix contains the distribution of FX risk among different regions). The fact that some MFIs are exposed to a large amount of FX risk indicates that sometimes – despite low average exposure – MFIs may be in need of measures against FX risk.

Comparing FX risk exposure in microfinance to the commercial banking sector is difficult because data for the commercial

banking sector is not easy to come by with. Using aggregate banking level data for Eastern Europe (a usual suspect for FX risk exposure), Ranciere et al. (2010) find that the commercial banking sectors in Eastern Europe are exposed to a *NOP* of 20% on average, while most of them maintain a larger total volume of FX assets than FX liabilities. In many of these countries the share of foreign currency loans of total loans is well above 50% (Ranciere et al., 2010), i.e. for the Eastern European Banking sector FX lending rather than FX borrowing drives FX risk exposure. One of the main reasons the microfinance sector is exposed to less FX risk than the commercial banking sector in Eastern Europe is that, although it maintains a lot of FX assets (about 40%, see Fig. A2 in the appendix), that share of lending in foreign currency is actually more moderate than in the commercial banking sector and matches the funding structure more closely. Generally, the findings show that oftentimes FX risk exposure of MFIs is caused by holding a lot of FX assets in the books and not necessarily by borrowing in foreign currency. This is in contrast to the common narrative that MFIs are exposed to FX risk because they borrow too much in foreign currency.

Lending in foreign currency by MFIs can be both supply- and demand side driven (Brown et al., 2014). Nevertheless, some authors suggest that FX loans are indicative of MFIs passing FX risk on to their clients (Crabb, 2004), exposing themselves to higher credit risk whenever borrowers are pushed into default by currency fluctuations. The belief is based on the idea that borrowers of microfinance institutions are unlikely to have sources of foreign currency income. On the bank balance sheet level, it is not obvious to which extent microfinance clients who obtain FX loans actually receive income or have expenses in foreign currencies and are thus exposed to FX risk themselves. Brown et al. (2011) suggest that retail clients borrowing in foreign currency are generally better equipped to deal with FX risk than is widely believed. If FX lending increases the risk of borrowers' default, that matters from a developmental point of view, it does, however, not alter the FX risk exposure of the sector in general.

Fig. 1 contains scatterplots that demonstrate the correlation between the three risk measures. The correlation structure is an indicator of whether MFIs might be trading off one risk for another. In particular, we might expect MFIs to trade off liquidity risk for FX risk by either relying on long-term hard currency financing or local currency deposits for funding. However, I find only weak support for this hypothesis in the data. The correlation

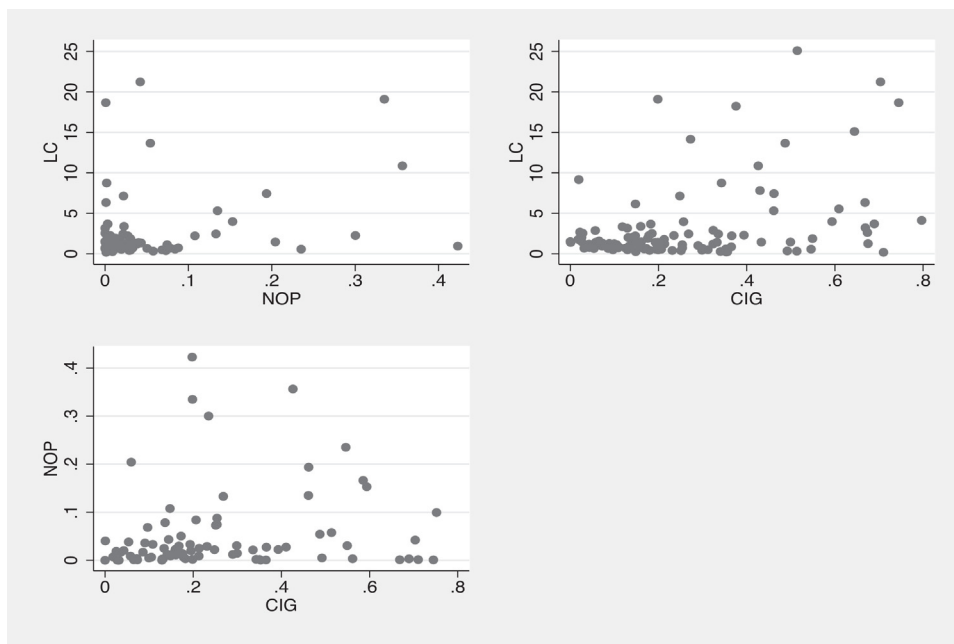


Fig. 1. Scatterplots for the measures for liquidity, interest rate and FX risk.

between NOP and LC is 0.262 (using logs of the variables does not change this result). This further supports the idea that risk exposure of MFIs cannot always be inferred from the standard funding structure story, because for example FX assets also play an important role in determining FX risk exposure.

#### 4.2. Institutional determinants of risk exposure

Table 5 states the summary statistics for the risk measures by legal status. *T*-tests show that Banks in microfinance are exposed to significantly more liquidity risk (the lowest *LC*) than Non-Banking Financial Institutions (NBFIs) and NGOs, Credit Unions and Cooperatives. At the same time, *t*-tests suggest that NGOs, Credit Unions and Cooperatives feature the highest interest rate risk and are exposed to more FX risk. Interestingly, Banks feature the lowest level of FX risk as they are the group that keeps both the highest share of FX assets and FX liabilities in their portfolio.

Table 6 reports estimation results on the determinants of risk exposure for the three different risk measures. I apply a log-transformation to the *LC* measure to achieve more efficient estimates. Therefore, results in columns (1)–(3) report exponentiated coefficients. Values smaller than one indicate a negative, values larger than one a positive influence. Results show that the group of NBFIs features lower liquidity risk than Banks do (even in the full specification results suggest that the liquidity coverage of NBFIs is 160% that of Banks). The difference between Banks and NGOs, Credit Unions and Cooperatives is not significant. The difference between NBFIs and Banks does not seem to be fully explained by the fact that Banks in the sample rely much more on deposits than NBFIs do. Repeating the same regression for the sub-sample of only deposit-taking institutions, NBFIs still feature significantly less liquidity risk than Banks (results

are reported in Table A.3 in the appendix). The coefficient on regulatory quality is insignificant in all specifications.

Baseline results on interest rate risk suggest that NGOs, Credit Unions and Cooperatives feature significantly higher levels of interest rate risk, but again there is no effect of regulatory quality on risk exposure. However, including the full set of controls, significant effects of the legal status on *CIG* disappear.

The *NOP* specifications show that alternative legal statuses are exposed to a higher level of FX risk than Banks in the sector (about 7–13 percentage points depending on the model specification), despite the fact that NGOs, Credit Unions and Cooperatives maintain less FX liabilities (see Table 5). This suggests that NGOs, Credit Unions and Cooperatives are not as well equipped to offset exposure with matching FX asset positions. The difference of about 7–13 percentage points is also meaningful economically, as it constitutes a difference of at least one standard deviation in the average *NOP*. Regional dummies are highly correlated with currency regimes and pick up that effect in the full specification. There is no significant difference between Banks and NBFIs and regulatory quality is again unrelated to risk exposure.

A few salient results on the influence of institutional features on risk exposure emerge across the three risk classes. On the one hand, results suggest no significant link between the quality of local regulation and risk exposure. Nonetheless, given the seemingly low level of liquidity risk for the sector in total, it might well be that regulators simply do not see sufficient necessity for intervention (which would be somewhat contradictory to the plethora of measures taken by DFIs). On the other hand, results confirm that an MFI's legal status can matter. Banks in the microfinance sector are exposed to a higher level of liquidity risk than NBFIs, which is likely the composite effect of Banks relying more on deposits for funding but also of other institutional features, and also more long-term lending. The observation that

Table 5  
Summary statistics – risk measures by legal status.

Variable	Obs	Mean	Std. Dev.	Min	Max	T-tests
<b>LC<sup>a</sup></b>						
Bank	51	1.34	0.97	0.19	4.13	Bank vs. NGO/CU/Coop*
NBFI	47	5.01	6.42	0.27	25.09	Bank vs. NBFI***
NGO/CU/Coop	19	3.12	3.53	0.23	13.65	NBFI vs. NGO/CU/Coop
<b>CIG</b>						
Bank	54	0.21	0.18	0.00	0.80	Bank vs. NGO/CU/Coop**
NBFI	57	0.28	0.20	0.00	0.74	Bank vs. NBFI
NGO/CU/Coop	21	0.37	0.19	0.09	0.75	NBFI vs. NGO/CU/Coop
<b>NOP</b>						
Bank	36	0.03	0.04	0.00	0.20	Bank vs. NGO/CU/Coop*
NBFI	49	0.04	0.08	0.00	0.36	Bank vs. NBFI
NGO/CU/Coop	12	0.13	0.13	0.00	0.42	NBFI vs. NGO/CU/Coop*
<b>FX Assets (share)</b>						
Bank	35	0.35	0.25	0.00	0.79	Bank vs. NGO/CU/Coop
NBFI	46	0.21	0.22	0.00	0.73	Bank vs. NBFI**
NGO/CU/Coop	12	0.29	0.33	0.00	0.91	NBFI vs. NGO/CU/Coop
<b>FX Liabil. (share)</b>						
Bank	35	0.35	0.25	0.00	0.80	Bank vs. NGO/CU/Coop
NBFI	46	0.22	0.21	0.00	0.72	Bank vs. NBFI*
NGO/CU/Coop	12	0.33	0.24	0.00	0.67	NBFI vs. NGO/CU/Coop

<sup>a</sup> For the LC measure values above the 95th percentile are censored. NBFIs are Non-Banking Financial Institutions. NGO/CU/Coop are NGOs, Credit Unions and Cooperatives.

Banks fund a higher share of assets via FX liabilities but are still exposed to less FX risk suggests that Banks might have access to better management tools to mitigate FX risk, also by granting more FX loans. Digging deeper into the mechanisms that translate the legal status into risk exposure requires more detailed data about asset and liabilities classes (e.g. for most MFIs, I only observe the total volume of assets and liabilities that are due within one month but not the exact composition). Therefore, from the present data, it is difficult to tell the underlying reasons for the differences in the risk exposure of Banks, NBFIs and NGOs/Credit Unions/Cooperatives. However, we know that as MFIs become more commercialized they tend to grant larger loans (Cull et al., 2016; Jia et al., 2016). Those loans are also likely to be more long-term which may be part of the explanation why microfinance Banks are exposed to more liquidity risk. At the same time, the funding structure of MFIs changes as they become more commercial. Yet, by no means are mature Banks in my sample totally like commercial banks, because even as MFIs mature many of them tend to keep on receiving subsidized funding (Cull et al., 2016). More standardized and detailed reporting of different asset and liability classes would certainly help to uncover more of the underlying mechanisms. Interestingly, regional affiliation has a significant impact on all measures of risk exposure. It seems that, despite the standardization in microfinance over the last years, banking traditions in different parts of the world still shape MFIs' business models up to now.

## 5. Conclusion

This study offers novel evidence on the exposure of the microfinance sector to liquidity, interest rate and FX risk. I first present evidence on the sector's overall risk exposure and then estimate which institutional features correlate with higher

levels of risk. The microfinance sector in total engages in negative maturity transformation and the world's largest MFIs, on average, face minimal liquidity risk. This is good news from a financial stability point of view. However, from a developmental rather than from a risk management perspective, the outstandingly high liquidity coverage might not always be desirable. Long-term lending by MFIs often constitutes an explicit goal DFIs pursue. Currently, MFIs are not translating long-term funding into long-term lending towards their borrowers. This pattern is similar to Garmaise and Natividad (2013) who show that subsidized funding towards MFIs does not immediately translate into cheaper loans for microfinance borrowers. The maturity mismatch between MFIs' borrowings and their lending is either because microfinance borrowers do not demand long-term loans, because MFIs use short loan tenors to manage credit risk and/or because MFIs are able to generate larger returns investing the funds in other short term asset classes (e.g. government bonds). In any case, it is clear that the microfinance sector is not constrained by funding liquidity risk to engage in longer-term lending. At the same time, the imbalanced maturity structure (borrow long and lend short) exposes the sector to a considerable amount of interest rate risk. This risk has not been given much attention by the development community, yet the exposure still needs to be managed and calls for sound risk management practices at the MFI level. Exposure to FX risk is – due to offsetting FX asset positions – lower than most market observers tend to believe. In particular, Banks in the microfinance sector are well equipped to counterbalance the large share of FX liabilities within their portfolios. Whether granting FX loans means that MFIs are exposed to an additional amount of credit risk because their borrowers may not be able to withstand currency fluctuations is unclear. More micro-level studies on

Table 6  
Results.

	(1) ln(LC)	(2) ln(LC) OLS	(3) ln(LC)	(4) CIG Fractional Logit	(5) CIG	(6) CIG	(7) NOP	(8) NOP Fractional Logit	(9) NOP
NBFI	2.537*** (4.60)	1.943*** (3.47)	1.674* (2.26)	0.067 (1.80)	0.008 (0.17)	0.006 (0.12)	0.006 (0.46)	0.008 (0.45)	0.024 (1.22)
NGO/CreditUnion/Cooperative	1.483 (1.25)	1.115 (0.33)	0.937 (−0.21)	0.153** (3.14)	0.063 (1.05)	0.067 (1.01)	0.067* (2.31)	0.083 (1.95)	0.132** (2.58)
Regulatory Quality	0.936 (−1.33)	0.947 (−1.13)	0.986 (−0.30)	−0.003 (−0.32)	0.001 (0.24)	0.003 (0.50)	0.004 (0.91)	0.004 (1.05)	0.004 (1.08)
ln(Assets)		0.752*** (−3.58)	0.763** (−3.35)		−0.050* (−2.33)	−0.044 (−1.89)		−0.007 (−0.66)	−0.002 (−0.20)
AGE (in years)		0.979* (−2.31)	0.984 (−1.37)		−0.002 (−1.18)	−0.000 (−0.09)		−0.004** (−3.30)	−0.002 (−1.67)
ROA		1.024 (0.67)	1.063 (1.60)		0.012 (1.56)	0.016* (2.44)		−0.003 (−1.32)	−0.005 (−1.55)
East Asia and the Pacific			2.222* (2.17)			0.016 (0.21)			0.058 (1.54)
Eastern Europe and Central Asia			2.071* (2.08)			0.013 (0.19)			0.043 (1.76)
Latin America and the Caribbean			2.480** (2.97)			−0.023 (−0.31)			−0.005 (−0.31)
South Asia			4.692*** (3.40)			0.159 (1.86)			–
Middle East and North Africa			–			−0.032 (−0.46)			–
Non-Free-Floating Dummy							0.040 (1.85)	0.047** (2.47)	0.021 (1.28)
Observations	114	113	113	129	128	128	94	94	94
R <sup>2</sup> (1–3) - BIC (4–9)	0.159	0.278	0.366	−582.3	−565.0	−547.2	−396.7	−384.6	−371.8

Columns (1)–(3) report results for OLS estimations. Coefficients are exponentiated. Values smaller than one indicate negative effects. For the LC measure values above the 95th percentile are censored. Columns (4)–(9) report results for fractional logit estimations. Reported coefficients are marginal effects. NBFIs are Non-Banking Financial Institutions. Regulatory Quality is the Official Supervisory Power index from Barth et al. (2013). Baseline categories are Bank for legal status and Africa for regional dummies. The model was estimated including a constant term. Regressions are exclusive of one outlier with regard to ROA. Main results are not sensitive to this outlier.

\*  $p < 0.05$ ,  $t$ -statistics in parentheses.

\*\*  $p < 0.01$ ,  $t$ -statistics in parentheses.

\*\*\*  $p < 0.001$ ,  $t$ -statistics in parentheses.

the cash flows of MFI borrowers would help to find out whether MFIs pass FX risk on to their borrowers.

Findings on the institutional determinants of risk exposure suggest that there is no effect of the quality of local regulation on exposure to financial risks. However, risk exposure varies among different legal statuses. Microfinance Banks maintain a more balanced asset and liability structure than NGOs, Credit Unions and Cooperatives do, exposing them to a lesser amount of interest rate and FX risk. This fact may be of importance for the practitioner community in thinking about which institutional features of MFIs are most suitable to attain social outreach while at the same time containing risk.

I conclude that, despite the exposure of single institutions to noteworthy FX risk or in a few cases liquidity risk, calls for

an expansion of systemic actions against these risks in micro-finance are lacking foundation in the actual data. The data at hand is obviously silent about whether low levels of risk exposure are merely the success of effective measures taken against financial risk in the past. Still, on an aggregate level, there is not much reason to expect MFIs to expand their lending activities – both in volume and towards longer-term credit – due to policies geared towards FX and particularly liquidity risk. Instead, the development community should expect larger benefits from policy measures that are targeted towards risks that effectively constrain MFIs' lending, for example interest rate risk.

## Appendix.

Table A.1

Pairwise correlations between main variables and controls.

	LC*	CIG	NOP	Regul	Peg	Assets	Age	De/As	ROA
<b>LC*</b>	1								
<b>CIG</b>	0.402	1							
<b>NOP</b>	0.262	0.148	1						
<b>Regul</b>	−0.126	−0.029	0.046	1					
<b>Peg</b>	−0.105	0.047	0.264	−0.176	1				
<b>Assets</b>	−0.213	−0.204	−0.181	0.030	0.026	1			
<b>Age</b>	−0.188	−0.052	−0.178	0.024	−0.026	−0.019	1		
<b>De/As</b>	−0.487	−0.442	−0.395	0.203	0.032	0.126	0.274	1	
<b>ROA</b>	0.100	0.234	−0.029	−0.006	0.083	−0.016	0.014	−0.056	1

\*For all correlations involving LC values above the 95th percentile are censored. Abbreviations are: Regul = Regulatory Quality, the Official Supervisory Power index from Barth et al. (2013), Peg = Dummy for Non-Free-Floating Currencies, Dep/As = Deposits to Assets Ratio.

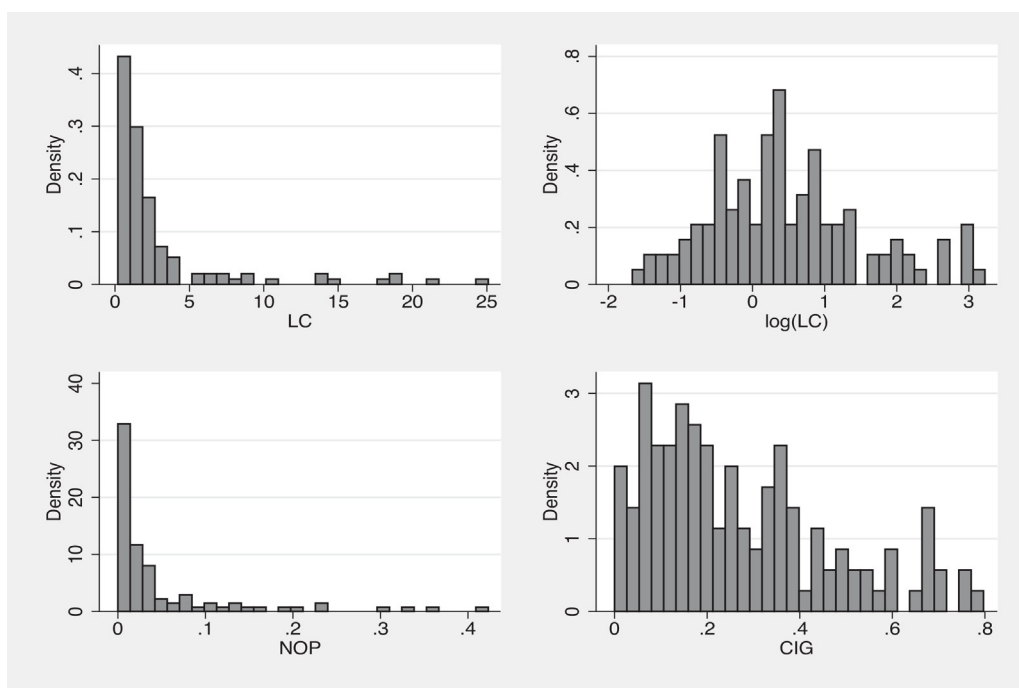


Fig. A1. Densities of the risk measures (LC measure censored).

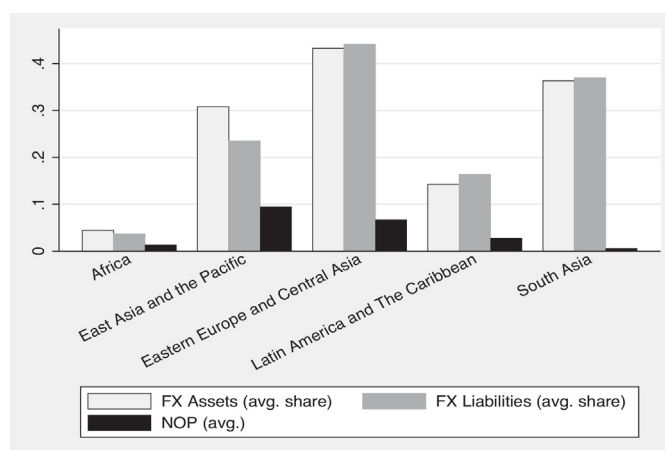


Fig. A2. FX exposure by region.

Table A.2  
Selection model.

	(1) Selection Dummy
NBFI	0.025 (0.35)
NGO/CreditUnion/Cooperative	−0.211* (−2.52)
Regulatory Quality	0.018 (1.32)
External Audit Strength	0.132** (2.75)
ln(Assets)	0.030 (1.22)
AGE (in years)	−0.001 (−0.27)
ROA	0.001 (0.28)
East Asia and the Pacific	0.023 (0.19)
Eastern Europe and Central Asia	0.442*** (4.59)
Latin America and the Caribbean	0.047 (0.48)
Middle East and North Africa	−0.305* (−2.50)
South Asia	0.008 (0.07)
Observations	287
Pseudo R <sup>2</sup>	0.188

The table reports results from a Probit model on which MFIs report in sufficient detail to construct any of the single risk measures. The model includes the Strength of External Audit category from the Barth et al. (2013) bank regulation database, which is the sum of affirmative answers to seven questions on the effectiveness of external audits of banks. NBFIs are Non-Banking Financial Institutions. Regulatory Quality is the Official Supervisory Power index from Barth et al. (2013). Baseline categories are Bank for legal status and Africa for regional dummies. Results are marginal effects.

\*  $p < 0.05$ ,  $t$ -statistics in parentheses.

\*\*  $p < 0.01$ ,  $t$ -statistics in parentheses.

\*\*\*  $p < 0.001$ ,  $t$ -statistics in parentheses.

Table A.3  
Results – deposit-taking only.

	(1) ln(LC)	(2) ln(LC)	(3) ln(LC)
NBFI	2.119*** (3.56)	1.628* (2.57)	1.544* (1.99)
NGO/CreditUnion/Cooperative	0.889 (−0.28)	0.652 (−1.02)	0.577 (−1.57)
Regulatory Quality	0.941 (−1.40)	0.946 (−1.33)	0.983 (−0.43)
ln(Assets)		0.742*** (−3.62)	0.781** (−3.06)
AGE (in years)		0.988 (−1.37)	0.997 (−0.27)
ROA		1.097 (1.80)	1.130* (2.62)
East Asia and the Pacific			2.528* (2.64)

Table A.3 (Continued)

	(1) ln(LC)	(2) ln(LC)	(3) ln(LC)
Eastern Europe and Central Asia			2.414* (2.91)
Latin America and the Caribbean			2.293** (2.96)
South Asia			5.576*** (3.65)
Constant	2.019 (1.48)	673.7*** (3.84)	53.16* (2.34)
Observations	89	89	89
R <sup>2</sup>	0.145	0.272	0.423

Columns (1)–(3) report results for OLS estimations. Coefficients are exponentiated. Values smaller than one indicate negative effects. For the LC measure values above the 95th percentile are censored. NBFIs are Non-Banking Financial Institutions. Regulatory Quality is the Official Supervisory Power index from Barth et al. (2013). Baseline categories are Bank for legal status and Africa for regional dummies.

\*  $p < 0.05$ ,  $t$ -statistics in parentheses.

\*\*  $p < 0.01$ ,  $t$ -statistics in parentheses.

\*\*\*  $p < 0.001$ ,  $t$ -statistics in parentheses.

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