Power to the people: what's driving the supply of green microfinance?

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Abstract

This paper explores some of the possible drivers of the supply of a relatively new form of microfinance: microloans for distributed clean energy systems. The number of microfinance institutions offering this 'green microfinance' varies considerably across developing economies. Drawing from a sample of countries in Latin America, we consider whether the green microfinance market is attractive for firms to enter without the need for market interventions. That is, we test the hypothesis that entry will occur provided there is high demand for green microfinance and an absence of barriers to entry. We also test an alternative hypothesis that these conditions are insufficient and that direct support from governments or development organisations is required to promote market entry. Regression analysis using data sourced from development organisations, government databases and industry publications confirms our hypothesis and leads us to reject our alternative hypothesis.

1. Introduction and hypothesis

Access to electricity is essential for social and economic development. An estimated 1.26 billion people living in developing economies do not have access to electricity and 80 per cent of these people live in rural communities (IEA 2014).

Government electrification programs through grid connection are often costly and slow. Distributed clean energy systems can provide alternatives to grid electricity and, in certain circumstances, can increase household and business productivity, reduce fuel costs and increase energy independence.

Common examples of these systems include solar lanterns, efficient cook stoves, solar hot water systems, solar photovoltaic (PV) systems and micro-hydro generators. Access to these technologies has traditionally been through government or development organisation programs. While these parties are expected to maintain an important role in providing energy access, the private sector also has a part to play. The International Energy Agency estimates $15 billion from the private sector is required each year to provide global access to modern energy by 2030 (IEA 2011).

One private finance vehicle that may have considerable potential is ‘green microfinance’. This is a relatively new branch of microfinance that primarily involves small loans to households, communities or microenterprises for clean energy and energy efficient technologies.

The proliferation of green microfinance providers varies considerably across countries. For example, in 2012 Nicaragua had eight providers with over US$1.2 million in green microloans disbursed. To its south, in Costa Rica, there was one provider with approximately US$250,000 in loans. To its north, in El Salvador, there were no green microfinance providers (BNEF & MIF 2013).

This paper explores some of the possible differences between countries that could be driving the supply of green microfinance.

Our hypothesis is: high demand for distributed clean energy systems and low barriers to market entry will promote entry into the green microfinance market.

Our alternative hypothesis is: firms will not enter the green microfinance market without interventions in the market from governments or development organisations.

This study focuses on 17 countries in Latin America where the proliferation of green microfinance firms varies considerably.

To test our hypothesis, we draw from publicly available data on drivers of demand for distributed clean energy systems. As a proxy for barriers to entry, we use a score developed by The Economist Intelligence Unit. This score measures the overall strength of the business environment for microfinance, which includes an assessment of barriers to entry and expansion. We use regression analysis to assess the strength of the relationship between our independent variables and the number of firms in a country offering green microfinance.

To test our alternative hypothesis, we consider quantitative and qualitative information on government and development organisation interventions in the market. This includes regression analysis of the relationship between the number of green microfinance firms and existence of policies supporting clean energy in a country, such as clean energy targets and feed-in tariffs. Due to the limited data available to investigate this alternative hypothesis, we also use qualitative information on government and non-government programs providing targeted support to green microfinance in the sample countries.

2. Theory and literature review

Much has been written on the demand for microfinance in developing economies. There is also considerable literature on the demand for distributed clean energy systems within communities with poor access to electricity, some of which is discussed below.

Far less has been written on the intersecting issue of green microfinance and, in particular, what is driving its demand and supply. Green microfinance generally includes small loans for clean energy, energy efficiency and climate change adaptation technologies. Clean energy systems are the most commonly discussed technologies for green microfinance in the literature reviewed and the focus of this paper.

Research suggests there is considerable demand for these systems in developing economies as they offer a range of health and economic benefits in communities where alternatives are costly, polluting, unreliable or simply unavailable (Allderdice, Winiecki & Morris 2007; IEA 2014; Morris & Kirubi 2009). Where grid electricity is unavailable, there is high use of diesel for small generators, biomass for cooking, and kerosene for lighting. These fuels can be costly to purchase or time consuming to collect. Their use can also have health and safety risks (Morris & Kirubi 2009). For example, an estimated 3.5 million premature deaths occur each year due to indoor smoke exposure (IEA 2014).

Demand for clean energy systems is not isolated to areas where electricity is unavailable. It can also be driven by price signals for customers who want to reduce their exposure to high electricity prices or where electricity supply is unreliable and blackouts are costly to individuals or businesses (Ndzibah [no date]).

The literature highlights the significant potential for green microfinance to help meet the demand for these systems (Allderdice, Winiecki & Morris 2007; Allet 2011; Morris & Kirubi 2009; IEA 2011). To promote the growth of green microfinance, some authors assert that support is required from governments and development organisations.

Morris and Kirubi (2009) recommended key actions for governments, including the provision of financial support to microfinance institutions (MFIs) such as loan guarantees and establishing capacity building programs for energy entrepreneurs and financial institutions. The IEA (2011) recommended concentrating multilateral and bilateral funding on end-user finance, operating through local banks and microfinance arrangements. Allderdice, Winiecki and Morris (2007) similarly recommend finance from governments and development organisations for technical and credit risk guarantee funds and loans to MFIs to on-lend for energy purposes.

A number of MFIs have demonstrated that green microfinance can be commercially viable without the direct support of government or development organisations (Allderdice, Winiecki & Morris 2007). Market interventions may therefore not be required, provided there is strong demand for the product and minimal barriers to entry. This is the theory being considered in this paper in the context of the proliferation of green MFIs in certain Latin American countries.

3. Analysis of our hypothesis

3.1 Data description

To test our hypothesis we used regression analysis involving the latest available data for the variables set out in Table 1, which are further explained below.

This study is primarily focused on market entrants and we consider the number of firms a suitable indicator of supply in this context. However, the supply indicator confounds demand and supply, since observed supply is a function of both demand and supply factors.

The X1 score has been developed through studies over six consecutive years using quantitative and qualitative data. High scores (close to 100) represent strong business environments for microfinance, which includes consideration of the regulatory framework and practices (regulatory and market-entry conditions) and supporting institutional framework (business practices and client interaction).

Variables X2-X5 are a series of potential drivers of demand for distributed clean energy systems. Demand should be higher where fewer people have access to the electricity grid (X2), access to grid electricity is unreliable and blackouts are costly (X5), or where alternatives to clean energy systems are expensive. That is, where the price of grid electricity is high (X3) or the price of diesel for small onsite generators is high (X4).

Table 1 – Variables

Variable	Unit	Data source	Year for data used
Y – supply of green microfinance	Number of green microfinance providers	Climatescope 2013	2012
X1 – Microfinance business environment	Score out of 100	Global microscope on the microfinance business environment 2013	2013
X2 – Electrification level	Population with electricity	Climatescope 2013	2012
X3 - Electricity price	US$/kWh	US Energy Information Administration	2010
X4 - Diesel Price	US$/Litre	The World Bank	2012
X5 - Value lost due to electrical outages	% of sales	The World Bank	2009 or 2010 (depending on availability)

The sample countries were chosen due to data availability and the diversity in their Y values. The values for the above indicators for our sample are set out in Table 2.

3.2 Regression results

Appendix A.1 contains the results of the regression analysis testing our hypothesis.

The R Square of the regression analysis shows that the model explains 60 percent of the variation however the high p-values for some variables suggests the model contains some useless predictors. Relative to the other independent variables, X1 (business environment) and X5 (value lost due to electrical outages) have the most significant relationship to Y (number of green MFIs), as the calculated p-values for each of these variables are less than five percent

(0.4 percent and 3.2 percent respectively). The coefficients in the regression model show that the supply of green microfinance increases by 0.17 with a unit increase in the business environment (X1) and 0.37 with a unit increase in the value lost from electrical outages.

Table 2 – Variables and values for sample countries

Country (Latin America)	**Y (number of green MFIs)**	**X1 (microfinance business environment score)**	**X2 (population with electricity)**	**X3 (electricity prices in USD)**	**X4 (Diesel Prices in USD/L)**	**X5 (% of sales lost due to electrical outages)**
Peru	10	82.5	30,500,000	0.134	1.41	3.2
Nicaragua	8	52.9	6,000,000	0.172	1.19	18.2
Mexico	6	51.1	114,900,000	0.096	0.85	3.4
Bolivia	5	69.8	10,800,000	n/a	0.54	2.5
Dominican Republic	5	53.6	10,200,000	0.136	1.35	4.4
Ecuador	5	48.3	15,200,000	0.094	0.29	3.9
Guatemala	3	41.4	15,100,000	n/a	1.04	2.8
Paraguay	2	53.5	6,700,000	0.072	1.31	1.4
Argentina	1	28.8	41,000,000	0.023	1.33	3.5
Brazil	1	49.1	198,400,000	0.171	1.02	3
Chile	1	49.9	17,400,000	0.195	1.24	1.3
Costa Rica	1	42.1	4,700,000	0.097	1.36	1.7
Panama	1	53.5	3,700,000	0.165	1.02	2.1
Uruguay	1	51.5	3,400,000	0.174	1.88	0.3
Colombia	0	58.5	46,600,000	0.135	1.18	1.8
El Salvador	0	53.8	6,200,000	0.142	1.17	7
Venezuela	0	26.1	29,500,000	n/a	0.01	8.3

To account for a possible time lag between a market being considered attractive for microfinance (X1) and the supply of green microfinance (Y), we also ran the regression analysis for the 2007 and 2009 values for X1. The results are presented in Appendix A.2.

The R-square statistic dropped to 0.43 and 0.50 respectively, showing a lesser fit to the regression line than the original model using 2013 data for X1. Another change was that the X1 variable became the only significant independent variable, but with decreasing statistical significance with a progressively increasing p-value of 0.4 per cent for 2013, 1.6 per cent for 2009 and 3.8 per cent for 2007. The coefficient of the X1 variable also decreased thus having a smaller effect on the dependent variable (from 0.17 per unit change in X1 for 2013 to 0.14 for 2009 and 0.07 for 2007).

4. Analysis of our alternative hypothesis

To test the relationship between government and development organisation interventions in the market and the number of green MFIs, we considered government policies supporting clean energy and other initiatives directly targeting green MFIs.

Table 3 shows which of the sample countries have clean energy targets or feed-in tariffs. These government policies are market interventions that typically provide subsidies to distributors or owners of small-scale clean energy. This form of support can reduce the cost of distributed clean energy systems and could, in theory, make green microfinance more commercially viable.

Table 3 – Clean energy policies

Country	**Number of green microfinance providers in 2012**	**Country had clean energy target in 2012**[1]	**Country had feed-in tariff in 2012**
Peru	10	✓	X
Nicaragua	8	X	X
Mexico	6	✓	X
Bolivia	5	X	X
Dominican Republic	5	✓	✓
Ecuador	5	X	✓
Guatemala	3	X	X
Paraguay	2	X	X
Argentina	1	✓	✓
Brazil	1	X	X
Chile	1	✓	X
Costa Rica	1	X	X
Panama	1	X	✓
Uruguay	1	✓	✓
Colombia	0	✓	X
El Salvador	0	X	X
Venezuela	0	X	X

[1] Information on the presence of clean energy target and feed-in tariffs sourced from Climatescope 2013.

4.1 Regression results

Regression analysis was undertaken using the information in Table 3, using a value of 1 if a country has a clean energy target (independent variable X6) or has a feed-in tariff for clean energy systems (independent variable X7). The results are presented in Appendix A.3.

The R-square showed a poor fit at 17.9 per cent and neither independent variable had significant p-values (less than five per cent). The independent variable with the most influence on the number of green microfinance providers was whether a country had clean energy target with a coefficient of 0.56.

4.2 Anecdotal evidence

Based on our literature review, it is likely that more tailored assistance could be impacting supply. Governments and development organisations have provided financial assistance to MFIs to promote green microfinance through subsidised loans or technologies. They also provide technical assistance by promoting partnerships between MFIs and energy companies or through training MFI staff on clean energy technologies (Allderdice, Winiecki, Morris 2007; Allet 2011; Morris & Kirubi 2009; IEA 2011). We were unable to obtain data on the level of this assistance in each of the sample countries and have instead considered anecdotal evidence.

From a search of publicly available information we have identified a number of relevant programs that were in place before or during 2012. Some examples are listed in Table 4 below relating to green microfinance in Peru and Nicaragua where green MFI entry has been the highest (GNSED 2014; IDB 2014; Micro Energy International 2014). Due to the limited information collected, we cannot draw conclusions on the impact of market interventions in promoting green microfinance market entry. More extensive research would be required to further explore the correlation.

Table 4 – Targeted programs for green microfinance

Program	**Organisation(s)**	**Scope**	**Likelihood of impact on Y**
Ecomicro	Inter-American Development Bank (IDB)	USD$7 million, 3 year program MFI training to pilot green microfinance products	Low – early stage of project implementation and limited reach by 2012. MFI in Bolivia, Mexico, Nicaragua and Peru selected to start program at end 2012
Peru Energy Inclusion Initiative	MicroEnegy International & Appui au Developpement Autonome	Promoting partnerships between MFI and clean energy suppliers	Low – project was yet to reach large scale by 2012
Nicaragua Offgrid Rural Electrification (PERZA)	Government of Nicaragua with World Bank and UNDP assistance	US$19m, part of which was dedicated to promote MFI loans for distributed clean energy technologies	Medium to high – program closed in 2011 and outcomes included accrediting two PV companies, creating national marketing systems, and at least 5 MFIs offering these loans by project end

5. Key limitations of the study

5.1 Data limitations

Our analysis relies on secondary data of unknown quality and we were unable to obtain data for all variables for the same time period. This may reduce the accuracy of our results.

We were unable to obtain data to include the price of kerosene and biomass as possible drivers of demand for microfinance for distributed clean energy systems.

We were also unable to obtain sufficient data to test our alternative hypothesis.

5.2 Methodology

There may be a range of other issues deterring market entry in some countries that were not considered as part of this study.

This includes difficulties obtaining technology suppliers, technology not meeting legal requirements around 'productive' uses for loans, and the requirement for marketing and training to raise awareness of clean energy systems among customers and suppliers (Allderdice, Winiecki & Morris 2007). We have excluded these potential issues in this study due to difficulty in obtaining relevant data.

For similar reasons, we did not assess the impact of competition from commercial or development banks to determine if this is a possible deterrent for MFIs to enter the green microfinance market in some countries.

6. Conclusion

Our findings suggest that government interventions may not be required to encourage firms to enter the green microfinance market, provided there is a strong business environment for microfinance with low barriers to entry. These conditions may be sufficient to encourage green

MFIs to enter a market without the need for market interventions from governments or development organisations.

There also appears to be more green MFIs in countries where unreliable electricity supply has a high cost for businesses. Green MFIs may be more focused on providing loans to businesses for the purchase of clean energy systems rather than providing loans to individuals or households. This makes sense from a commercial perspective, where loans to businesses may be lower risk than loans to individuals.

Green MFIs in Latin America do not appear to be targeting countries where there is likely to be high demand from individuals for distributed clean energy systems due to low electrification rates or high costs of substitutes (such as high electricity prices or high diesel prices).

While our analysis suggests that green MFIs may enter countries without the need for financial or technical support from governments or development organisations, we are not concluding that this type of support is unnecessary. Our analysis has not taken a detailed look at the impact of these types of market interventions and it is possible that targeted programs supporting green MFIs could help to address market externalities and promote the growth of this nascent financial market. For example, programs could be beneficial that support green MFIs who offer their services in remote areas off the electricity grid where the social benefits are likely to be high, but the costs of doing business in these areas may be higher than servicing urban areas.

This topic could benefit from further research to address the limitations discussed above. Additionally, consideration could be given to expanding the sample to other regions.

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Appendix A – Regression results

<u>A.1 – Regression analysis to test the hypothesis</u>

Regression Statistics	
Multiple R	0.777023618
R Square	0.603765704
Adjusted R Square	0.423659205
Standard Error	2.300654723
Observations	17

	Coefficients	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-6.674011888	0.041191858	-13.02901192	-0.319011859
X1 - Microfinance business environment	0.173157115	0.004161546	0.067325267	0.278988963
X2 – electrification rate	6.65203E-09	0.593942949	-2.00142E-08	3.33183E-08
X3 – electricity price	-15.01806224	0.21355465	-40.05408457	10.01796009
X4 – diesel prices	0.632974711	0.708429382	-2.996798862	4.262748285
X5 – value due to electrical outages	0.367973207	0.032165088	0.037590823	0.698355592

A.2 – Regression analysis to test the hypothesis (using different years for X1 to test possible time lag)

Table A.2 - Values for X1 for different years

Country	(Y)	Microfinance business environment (X1) 2007	Microfinance business environment (X1) 2009
Peru	10	74.1	73.8
Nicaragua	8	53.8	58.7
Mexico	6	48.3	47.3
Bolivia	5	79.4	71.7
Dominican Republic	5	57.5	47
Ecuador	5	68.3	59.7
Guatemala	3	44	51.8
Paraguay	2	52.9	49.5
Argentina	1	26.8	30.8
Brazil	1	43.3	44
Chile	1	48.3	48
Costa Rica	1	0	42.5
Panama	1	0	50.9
Uruguay	1	35.8	28.4
Colombia	0	46.1	58.6
El Salvador	0	61.5	57.5
Venezuela	0	27.4	24.1

X1-2009

Regression Statistics	
Multiple R	0.708401473
R Square	0.501832647
Adjusted R Square	0.275392941
Standard Error	2.579663419
Observations	17

	Coefficients	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-6.077853368	0.09478341	-13.39609165	1.240384918
X1 - Microfinance business environment	0.139061921	0.016090085	0.031278827	0.246845016
X2 – electrification rate	8.0102E-09	0.570327084	-2.21251E-08	3.81455E-08
X3 – electricity price	-9.071040991	0.478242126	-36.26780002	18.12571804
X4 – diesel prices	1.569390068	0.420290844	-2.556451067	5.695231203
X5 – value due to electrical outages	0.279949197	0.120315734	-0.085948762	0.645847157

X1-2007

Regression Statistics	
Multiple R	0.652477819
R Square	0.425727305
Adjusted R Square	0.164694262
Standard Error	2.769711265
Observations	17

	Coefficients	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-2.317433128	0.411176044	-8.288214826	3.653348569
X1 - Microfinance business environment	0.074487259	0.038270833	0.004818021	0.144156498
X2 – electrification rate	6.01224E-10	0.967602574	-3.12473E-08	3.24498E-08
X3 – electricity price	-2.430044575	0.855323907	-31.08343849	26.22334934
X4 – diesel prices	1.117814873	0.58620502	-3.269651451	5.505281197
X5 – value due to electrical outages	0.2317752	0.22389139	-0.164026048	0.627576447

A.3 – Regression analysis to test the alternative hypothesis

Country	Number of green microfinance providers in 2012	Country had clean energy target in 2012	Country had feed-in tariff in 2012
	Y	X6	X7
Peru	10	1	0
Nicaragua	8	0	0
Mexico	6	1	0
Bolivia	5	0	0
Dominican Republic	5	1	1
Ecuador	5	0	1
Guatemala	3	0	0
Paraguay	2	0	0
Argentina	1	1	1
Brazil	1	0	0
Chile	1	1	0
Costa Rica	1	0	0
Panama	1	0	1
Uruguay	1	1	1
Colombia	0	1	0
El Salvador	0	0	0
Venezuela	0	0	0

Regression Statistics	
Multiple R	0.178677196
R Square	0.03192554
Adjusted R Square	-0.106370811
Standard Error	3.187587534
Observations	17

	Coefficients	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	2.75	0.021933505	0.461299805	5.038700195
X6 - Clean energy target	1	0.547210499	-2.476785181	4.476785181
X7 - Feed-in tariff	-0.75	0.674916442	-4.505357204	3.005357204