MALMQUIST INDEX IN EVALUATING THE
MICROFINANCE SECTOR OF VIETNAM

Quynh Anh Mai Nguyen ✉

Graduate School of Global Studies, Doshisha University, Kyoto, Japan

quynhanhkttc@gmail.com

Nam Hoai Trinh

Graduate School of Global Studies, Doshisha University, Kyoto, Japan

ntrinh@mail.doshisha.ac.jp

Abstract

The sustainability of microfinance institutions (MFIs) is not only about the profitability but also about the ability to sustain the long-term operation. This study applied the Malmquist productivity index to measure the running efficiency of sampled MFIs in Vietnam in a certain period as well as explore the factors associated with the development to bring forward suggestions. The empirical findings reveal that MFIs have overall productivity regress during 2013-2015. Over the years, the number of MFIs dropping productivity increased. Many MFIs become worse in avoiding waste and using the advantage of scale. Moreover, an improvement in technology can help MFIs to meet the dual objective of reaching poor people for poverty reduction and financial sustainability. The study also pointed out that few MFIs have influenced the process as there were no MFIs obtained considerable achievements all the time.

Keywords: Data Envelopment Analysis, Malmquist Index, Microfinance, Vietnam, Productivity measurement

INTRODUCTION

Despite the remarkable achievement of the microfinance sector in Vietnam, challenges remain. According to the National Microfinance Strategy up to 2020, product development, financial sustainability, and outreach expansion are three high prioritized objectives to promote microfinance.

Moreover, assessing institutions' efficiency is a critical measure of relative performance toward benchmark microfinance institutions (MFIs) in overall performance, financial sustainability, and outreach. Balkenhol (2007), Nieto et al. (2007), Haq et al. (2010), Widiarto et al. (2015), and Emrouznejad et al. (2017) proposed efficiency concept to assess actual resources utilizing by an organization in producing a given quality of outputs relative to optimal use of these resources. Efficiency is not how MFIs must gain, instead of how well they manage their resources.

By now, a good number of reports and papers have attributed the success of outreach and the impact on alleviating poverty by MFIs in Vietnam. The methodologies, however, were limited to traditional financial ratio analysis and descriptive analysis. These most common methodologies and issues are hitherto not fit at capturing microfinance performance. Furthermore, the sustainability of MFIs is not only about the profitability but also about the ability to sustain the long-term operation. Hence, extensive research studying the efficiency of MFIs on the microfinance sector of Vietnam is significant.

In this paper, the Malmquist productivity index is used to measure the running efficiency of sampled MFIs in a certain period as well as explore the factors associated with the development to bring forward suggestions.

MALMQUIST PRODUCTIVITY INDEX AND ITS DECOMPOSITION

The measurement of productivity change is another significant aspect to consider when dealing with efficiency and performance of the financial sector. As such, the other aspect of Data Envelopment Analysis (DEA) is the Malmquist productivity index (MPI) that assesses the productivity change of Decision Making Units (DMUs) within a specified period. The application of MPI supplies not only the proportion of the productivity gains of each MFI from year to year but also the components that are the source of gains.

Compared to other indices such as Fisher and Tornqvist, the MPI based on DEA model is currently the most popular index due to the ability to handle panel data, desirable characteristics, and properties. It can be useful in the situation in which the objectives of managers are not specific, or are challenging to achieve since it does not require any presumption of profit minimization or cost minimization. Moreover, an assumption associated with the application of MPI is the existence of a competitive market, which encourages businesses to conduct effective strategies. Furthermore, this approach enables decomposition of productivity change.

Moreover, MPI is one of the prominent and useful indices for comparing the relative productivity of DMUs between two consecutive periods. In other words, DEA-based MPI was

used to analyze the performance of each MFI regarding productivity change and its components over time. The calculation of MPI requires measurements of two different time periods and two grouped periods. From the combination of the inputs and outputs of a DMU in periods t and t+1, it is possible to determine whether the variation in the performance of this DMU is due to technical efficiency change (EC) of each DMU and technological change (TC). This decomposition helps in further modeling and innovation of efficiency analysis.

Mathematically, Fare et al. (1994) specify an output-based MPI calculated for two consecutive time frames, t and t+1, as follows:

$$MPI\ (y^t, x^t, y^{t+1}, x^{t+1}) = \left[\frac{D_0^t(x_0^{t+1}, y_0^{t+1})}{D_0^t(x_0^t, y_0^t)} x \frac{D_0^{t+1}(x_0^{t+1}, y_0^{t+1})}{D_0^{t+1}(x_0^t, y_0^t)}\right]^{1/2}$$

The above measure is the geometric mean of two Malmquist index at the period t and t + 1. x^t and y^t and (t) stands present the input and output vector of a production unit for the period.

Where:

MPI: the Malmquist productivity index between the two periods.

Subscript (t, t + 1): time periods.

Subscript (0): the orientation.

D: distance functioned by taking the DMU in the assessment to the desired frontier. While the input vector constant for the period t, the distance function explains the major changes until the period t + 1.

The first ratio expresses the concept of "Catch-Up," or the Malmquist output index at time t. It measures changes in the output during (t, t+1) by using period t frontier as the benchmark. The second ratio denotes "Frontier Shift" of the DMU from time t to t+1. It measures changes in the output during (t, t+1) by using period (t+1) frontier as the benchmark.

The equation represents the productivity of production points (x_0^{t+1}, y_0^{t+1}) relative to the production point (x_0^t, y_0^t). When $MPI > 1$, it implies productive growth/progress; when $MPI < 1$, it signifies productivity deterioration/regress; and $MPI = 1$ means the efficiency remains equal compared to period t in t+1.

By rearranging the above equation, MPI includes two components: technical efficiency change (EC), and the shift in the frontier or the technological change (TC) between period t and t+1.

$$MPI = \frac{D_0^{t+1}(x_0^{t+1}, y_0^{t+1})}{D_0^t(x_0^t, y_0^t)} x \left[\frac{D_0^t(x_0^t, y_0^t)}{D_0^{t+1}(x_0^t, y_0^t)} \cdot \frac{D_0^t(x_0^{t+1}, y_0^{t+1})}{D_0^{t+1}(x_0^{t+1}, y_0^{t+1})}\right]^{1/2}$$

MPI = EC x TC

The ratio outside the brackets, EC, indicates the magnitude of the efficiency change between two time periods; that is, it is also a measure of how close the DMU is to the frontier in period t + 1 compared with period t. If EC = 1, the DMU has the same distance in the period t + 1 and t from the respective efficient frontiers. If EC > 1, the DMU has moved closer to the period t + 1 frontier than it was to the period t frontier, and if EC < 1, the converse occurs. Then, the production technology of DMUs can be improved when the value of EC is > 1, and vice versa. The bracketed term, TC, is the index of technological progress between two periods. If TC = 1, there is no shift in the technology frontier; a value of TC < 1 indicates technological setbacks; TC > 1 indicates technological progress and is considered to be evidence of innovation.

Concerning the return to scale assumption, MPI must be calculated in the first step from constant return to the scale (CRS), since, if measured according to variable returns to the scale (VRS), the result is inexact. The EC and TC indices are under the assumption that the DMU operated regarding CRS. It assumes that a DMU is operating in an optimal scale. For more realistic cases with VRS, therefore, the calculation of under the assumption of CRS technology can further decompose into pure technical efficiency change (PEC) and scale efficiency change (SEC). This decomposition could help to realize the reason for productivity in a particular term.

SEC indicates the productivity gain or loss associated with a production unit. This value shows that whether movements inside the frontier are in the right direction to achieve the CRS point, where changes in outputs result in proportional changes in inputs. Specifically, SEC refers to the ability to work at the most advantageous scale. PEC is the efficiency change calculated under VRS and refers to the capacity of optimizing waste by producing maximum outputs from inputs. In this case, MPI would comprise three components.

$$MPI = PEC x SEC x TC$$

According to Grosskopf (2003), a PEC is:

$$PEC = \frac{D_{0VRS}^{t+1}(x_0^{t+1}, y_0^{t+1})}{D_{0VRS}^{t}(x_0^{t}, y_0^{t})}$$

D_{VRS} is the output distance function for variable return to scale.

SEC presents the following formulation:

$$SEC = \frac{D_{0CRS}^{t+1}(x_0^{t+1}, y_0^{t+1})/D_{0VRS}^{t+1}(x_0^{t+1}, y_0^{t+1})}{D_{0CRS}^{t}(x_0^{t}, y_0^{t})/D_{0VRS}^{t}(x_0^{t}, y_0^{t})}$$

While the EC refers to the changes in technical efficiency calculated under CRS, the PEC corresponds to real changes in technical efficiency about VRS and represents the changes resulting from efficiency improvement in operations and management activities. This decomposition allows us to think about contexts that a DMU is technically effective, since the volume of production uses the least amount of resources, but not operating at the optimal scale

production. On the other hand, SEC points out the movements inside the boundary that is appropriate to obtain the CRS point at which the output changes result in proportional changes in inputs. In other words, it indicates that the change in effect due to the economics of scale when SEC > 1.

VARIABLE SELECTION AND DATA

The process of selecting indicators applied the following considerations. First, the variable must reflect the evaluation content in an objective manner. Second, the strong linear relationship between the internal variables of inputs and outputs should prevent. Third, data is available. Last, the selections of variables for the efficiency resulted from the experts' opinions and previous studies.

Since reporting to the global and national database is not obligatory for MFIs, the selection of variables also did purposively based on data availability. Data for this study were from the database of the Vietnam Microfinance Working Group, the Microfinance Information Exchange (MIX)- a global web-based microfinance information platform that captures MFI activities around the world, and the author's fieldworks. Though the database has the limitation of not capturing all MFIs, it is worth noting that this is hitherto the best available and updated data on the microfinance sector in Vietnam.

The MPI analysis in this paper then evaluates the efficiency changes in major 24 MFIs between 2013 and 2015 when the necessary data is available. There are five variables, including three inputs and two outputs. Table 1 depicts descriptive statistics of indicator values, including their mean, minimum, and maximum. The input measures included total assets, operating cost, and the number of loan officers. Furthermore, the output measures included gross loan portfolio and the number of active borrowers.

Table 1: Descriptive Statistics for the Variable in MPI Analysis (2013-2015)

Year		2013	2014	2015
Inputs				
Total Asset (USD)	Max	6,129,734,396	6,379,050,000	6,612,232,646
	Min	159,840.03	225,756.88	252,117.83
	Average	290,198,326	312,692,489.4	325,373,374.8
Operating Cost (USD)	Max	138,531,997	249,421,301.8	247,958,724.2
	Min	17,240.175	37,723.97	40,649.42
	Average	7,500,049.7	12,160,437.45	12,270,499.63
Loan Officers (Number)	Max	1,316	1,316	3,481
	Min	2	2	5
	Average	101	117	210

Outputs				
Gross Loan Portfolio (USD)	Max	5,773,396,452	6,001,490,599	6,434,685,129
	Min	153,600.02	200,070.73	228,714
	Average	258,735,620	286,932,641.3	306,339,787.1
Active Borrowers (Number)	Max	7,100,000	7,100,000	6,863,035
	Min	755	775	757
	Average	317,973	321,387	314,110

Source: Author's calculation

ANALYSIS AND EMPIRICAL RESULTS

Efficiency changes among major MFIs in Vietnam are summarized in Table 2. MPI method is appropriate for evaluating the dynamic change of the efficiency of MFIs. The productivity change can analyze factors that influence the development of productive forces, which relies on either technological progressing or management-level improving. Then, MPI is the result of technical efficiency change and technological change explaining the total gain.

The evolution of the performance of selected MFIs between the year 2013 and 2014 shows an increase of 5.2% in the mean of productivity (MPI = 1.052). Data suggest that 13 MFIs decreased their productivity since they have the value lower than 1 for this index. Except for Women Development Fund Lao Cai (WDF) with MPI = 1, the remaining MFIs increased their productivity between 2013 and 2014 with MPI > 1. The main contribution of MPI is the increase of 7.8% in EC. The results explain that eight (out of 24) MFIs have shown improvement in EC, especially Cooperative Bank of Vietnam (Co.B). As such, Co.B showed decreases of technological efficiency (TC = 0.849), managed to overcome this situation with very positive changes in its technical frontiers, which contributes actively to the productivity gains recorded (MPI = 1.784). Likewise, the improvements of 6.5% in PEC over the period, that is, operations and management activities, are the source for the achievements in EC. The contribution of EC in MPI and that of PEC in EC suggested that all MFIs were good at transforming as much as outputs from inputs.

According to the five components analyzed in Table 2 for the period 2013-2014, only the TC component has an average value below 1. Notably, 10 MFIs were having a poor value lower than 1 (TC < 1), that means technological regression. Other MFIs, except WDF, have TC values greater than 1, and therefore, they had positive technological progress. It means that, for a given level of input, these MFIs can obtain a higher level of output in 2014 than in 2013.

Analyzing EC data, 10 out of 24 MFIs decreased their technical efficiency. It signifies that this group in 2014 had fewer abilities to work at its optimal scale. On the other hand,

Anh Chi Em (ACE), An Phu Development Fund (A.P), Capital Aid Fund for Employment of the Poor (CEP), Co.B, the Center of Small Enterprise Development Assistance (SEDA), ThanhHoa Fund for Poor Women (T.HOA), World Vision Vietnam (WV), and Capital Aid Fund for Women in Economic Development Ho Chi Minh city (CWED) showed an increase in their technical efficiency, with particular emphasis on Co.B (EC = 2.102). Technically, these MFIs are closer to the frontier in 2014 when compared to that of 2013. The remaining MFIs show the values of EC that are equal to 1 so that there were no changes in technical efficiency. Focusing on PEC, only ACE, Co.B, SEDA, WV, and CWED presented management improvements that translate into increased productivity from 2013 to 2014. For SEC, the analysis finds that 12 MFIs slightly increased their scale (size) in this period since they have values higher than 1. Eight MFIs do not have scale issues (SEC = 1) and are operating on the frontier of CRS (optimal scale).

For the period 2014-2015, there was a decrease in the average productivity of the 24 sampled MFIs (MPI = 0.996). As such, the improvements are negative. It also notices that most of MFIs are not able to use their input for the best output production during this period is higher than that in the previous period. While Co.B, Microfinance Funds for Community Development (M7CDI), and WV suffered a considerable decrease in productivity compared to 2014, only CWED had a substantial productivity gain in which TC component mostly contributes to the gain. 15 out of the 24 MFIs in the analysis dropped their productivity in 2015 due to the deterioration of both technical and scale efficiency. The highest average efficiency is scored for CWED by 69.7%, and NinhPhuoc Women Development Fund (M7NP) and SEDA score the lowest positive change with 0.1%.

Since, for many MFIs, TC > EC, the productivity improvements during this period were strongly dependent on changes in technology. Overall, many MFIs had an excellent strategy to chase for technological improvement. These changes show that investments in new technologies, which may include new methodologies, procedures, or techniques to improve results. The technological expansion could also mean that institutions have improved their productivity by the technical experience of staffs as well as taking advantage of modern facilities and equipment.

Except for TC, four remaining components registered a negative average change. However, their values are very close to 1, so that, on average, all MFIs are operating very close to their optimal level. Moreover, PEC values show that the relationship between inputs and outputs worsened between 2014 and 2015; that is, most of MFIs in 2015 were farther away from the VRS frontier formed by the reference MFIs compared to the frontiers of 2014.

Table 2: Malmquist Index and Its Components for Period 2013-2015

No.	MFIs	2013-2014					2014-2015				
		EC	PEC	SEC	TC	MPI	EC	PEC	SEC	TC	MPI
1	ACE	1.124	1.119	1.005	1.001	1.125	0.981	1	0.982	1.019	1
2	A.P	1.018	1	1.018	1.01	1.028	0.992	1	0.992	1.013	1.005
3	BTV	0.951	0.853	1.115	0.937	0.891	1.026	1.021	1.006	1.002	1.028
4	BTWU	0.963	0.963	1.029	1.002	0.965	1.008	1.023	0.986	1.01	1.018
5	CAFPE	1	1	1	0.948	0.948	0.96	1	0.96	0.972	0.933
6	CEP	1.024	1	1.024	1.021	1.045	0.99	1	0.99	0.997	0.987
7	CWCD	0.959	0.976	0.982	0.99	0.949	0.863	1.025	0.842	1.014	0.875
8	Co.B	2.102	2.101	1	0.849	1.784	1	1	1	1.014	1.014
9	Dariu	0.963	0.939	1.026	1.009	0.972	0.933	0.937	0.996	1.007	0.94
10	FWD	0.973	1	0.973	0.986	0.959	1.027	1	1.027	1.025	1.053
11	DBP	0.915	0.916	0.999	1.011	0.925	0.908	0.908	0.999	1.011	0.918
12	M7NP	1	1	1	0.971	0.971	1	1	1	1.001	1.001
13	M7STU	0.969	0.968	1	0.994	0.963	0.961	0.982	0.978	1.026	0.986
14	M7MFI	0.926	0.9	1.028	1.011	0.936	0.993	0.999	0.994	1.008	1.002
15	M7CDI	1	1	1	1.036	1.036	0.924	0.991	0.932	0.897	0.829
16	MOM	1	1	1	0.881	0.881	1	1	1	0.998	0.998
17	PPC	0.999	1	0.999	1.006	1.005	0.985	0.989	0.996	1.012	0.997
18	SEDA	1.031	1.012	1.018	0.999	1.029	0.984	1	0.984	1.018	1.001
19	TYM	0.878	0.855	1.026	1.016	0.892	1.011	1.018	0.993	1.002	1.013
20	T.HOA	1.012	0.985	1.027	1.008	1.019	0.941	0.943	0.998	1.012	0.952
21	VBSP	1	1	1	0.783	0.783	1	1	1	0.621	0.621
22	WDF	1	1	1	1	1	0.998	1	0.998	1.015	1.013
23	WV	1.744	1.732	1.007	1.011	1.763	1.005	1.012	0.994	1.011	1.016
24	CWED	1.32	1.25	1.056	1.046	1.381	1	1	1	1.697	1.697
	MEAN	1.078	1.065	1.014	0.980	1.052	0.979	0.994	0.985	1.017	0.996
	Summary	>1: 8	>1: 5	>1: 12	>1: 13	>1: 10	>1: 5	>1: 5	>1: 2	>1: 19	>1: 12

Source: Author's calculation

CONCLUSION

This paper contributes to scare research in developing economies, financial stability, and economic welfare. Based on the comparisons and analyses, both across MFIs and over a period, it is possible for institutions with more specific sources on how to address improvement regarding management and sustainability. The empirical findings of this paper reveal that MFIs have overall productivity regress during 2013-2015. Over the years, the number of MFIs dropping productivity increased. Many MFIs become worse in avoiding waste and using the advantage of scale. Moreover, an improvement in technology can help MFIs to meet the dual objective of reaching poor people for poverty reduction and financial sustainability.

In this study, it is evident from the empirical results that few MFIs have influenced the process as there were no MFIs obtained considerable achievements all the time. In-depth study

of using the super efficiency score should be employed to see the best performers in the microfinance industry that will help to draw benchmark accordingly. An in-depth study of working on other indicators of sustainability such as productivity, profitability, and portfolio quality in more MFIs can be taken for further analysis. Additionally, an in-depth study of other parameters of the economic model in a more extended period can also be taken for further research.

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