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Productivity change of microfinance institutions in Kenya: A bootstrap Malmquist approach

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ABSTRACT

This paper uses a DEA (Data Envelopment Analysis) based Malmquist approach to investigate the changes in productivity of 20 Kenyan microfinance institutions (MFIs) over the period 2009–2012. A bootstrap procedure is employed to determine whether the changes in Malmquist index and its components are statistically significant. Results show that MFIs have experienced about 7% annual productivity progress on average, which is mainly attributable to technological advances. A second-stage bootstrapped regression analysis is employed to examine the impact of several environmental variables on productivity change measures. Results show that matured MFIs tend to have a lower productivity compared to their younger counterparts. Results also reveal that higher return-on-assets associates with the productivity gain and technological improvements.

1. Introduction

Over the past few years, Microfinance Institutions (MFIs) have gone through sweeping changes, mainly driven by rapid innovations in technology and introduction of supportive policy reforms, which have considerably altered the environment in which they operate. The advances in technology and implementation of new policy instruments that ensure the systemic stability and client protection (Arun, 2005) have spurred the competition among MFIs that operate in different niche markets. The growing competition has resulted in pushing the production possibility frontier outward, increasing the outreach and sustainability that can be achieved (Manos and Yaron, 2009). There has been considerable research effort into measuring MFI efficiency (e.g., Nghiem et al., 2006; Paxton, 2007; Gutiérrez-Nieto et al., 2007; Gutiérrez-Nieto et al., 2009; Hermes et al., 2011; Servin et al., 2012: Piot-Lepetit and Nzongang, 2014; Wijesiri et al., 2015), but very few empirical studies explore productivity dynamics (e.g., Bassem, 2014). This may indicate the greater difficulty of finding time series data for individual MFI.

This study aims to quantify the Malmquist index (MI) and its components of 20 MFIs operating in Kenya over four year period from 2009 to 2012 (80 observations). Microfinance industry in Kenya is of particular interest to investigate the productivity progress as it goes through strong regulatory changes and technological advances in recent years. In an effort to streamline the microfinance industry in Kenya, the Microfinance Act was enacted in 2006 and became operational in 2008. The Act provides directions for MFIs to strengthen the corporate governance principles, safeguard the depositors, adherence to core capital requirements, promote competition to enhance efficiency and conduct the business in a prudent and professional manner (DPFB, 2013). Moreover, recent regulatory changes in Kenyan microfinance industry, facilitate several credit-only microfinance institutions to successfully transform into regulated deposit-taking-microfinance institutions (DTMs), to achieve their full potential, by offering a range of products and services. The Banking and Microfinance Act is further amended to allow DTMs to use agents to conduct deposit taking business in view of improving financial inclusion in frontiers in rural areas (Central Bank of Kenya, 2011). On the other hand, Kenya has demonstrated the best use of technology for improving financial inclusion (Gwalani and Parkhi, 2014). The recent development in mobile phone technology has enabled a large number of people who are otherwise excluded from formal financial institutions to access a range of financial services (i.e., mobile money, mobile savings, mobile insurance and mobile credit) at an affordable price. For example, according to Demombynes and Thegeya (2012), 93% of people in Kenya are mobile phone users and 73% are mobile money customers by 2012. Thus, mobile money seems to be ubiquitous in

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Kenya (Vaughan et al. 2013). Especially, the introduction of M-PESA[1] money-transaction service in 2007 has made a dramatic impact on Kenyan financial landscape over the years (Johnson and Arnold, 2012; Assunção, 2013). Apart from deep market penetration, M-PESA money-transfer program has enhanced the agency and well-being of people (Graham and Nikolova, 2013). IMF (2011) reveals that M-PESA provides mobile banking services to more than 70% of Kenyan population, and it processes more transactions within Kenya than Western Union does globally. It is, therefore, interesting to investigate how Kenyan MFIs react in response to these recent changes in regulatory and technological environment in order to secure their survival.

In the present paper, we use Data Envelopment Analysis (DEA) based Malmquist productivity index (Färe et al., 1994) to measure the productivity of MFIs. Since this method requires neither any price data nor any specific behavioral assumption such as cost minimization or profit maximization (Coelli et al. 2005), it becomes a suitable method towards measuring the changes in productivity in the context of microfinance industry. For example, in some cases, price data of MFIs may be distorted due to states interventions or due to bad accounting practices. Behavioral assumption of MFIs may also be difficult owing to duel maximization problem (Rhyne, 1998). An additional advantage of MI is that decomposition of it into efficiency change ("catching-up") and technological change ("innovation") sheds light on the sources of productivity movements of MFIs.

Although DEA based MI is flexible and attractive to researchers, it has been criticized for not accounting for the measurement errors in the estimation of Malmquist indices, with possible consequence for erroneous policy conclusions. Based on the bootstrap concept (Efron, 1979), Simar and Wilson (1998, 2000) attempt to solve this inherent limitation. They propose a DEA bootstrap method that analyses the sensitivity of measured efficiency scores to the sampling variation of the estimated frontier. Simar and Wilson (1999) modify the bootstrap method by introducing bivariate smoothing procedure to preserve any temporal correlation present in the panel data. In the present paper we employ the bootstrap Malmquist approach proposed by Simar and Wilson (1999) to obtain confidence intervals for the MI and its components to determine whether the productivity movements of MFIs are statistically significant. Additionally, in line with Odeck (2009) and Assaf (2011), we employ the second-stage truncated bootstrap regression (Simar and Wilson, 2007) to explain the variations in MI and technological changes (TEC) of MFIs in terms of several environmental variables.

From methodological points of view, the main contribution of the present paper lies in the use of bootstrap DEA Malmquist approach proposed by Simar and Wilson (1999) and subsequent truncated regression with bootstrap approach proposed by Simar and Wilson (2007). As for an additional contribution, in contrast to the earlier studies based on self-reported and incomplete data available on MixMarket database (www.mixmarket.org), we use subsidy-adjusted high quality balance panel dataset executed from rating reports. Since the rating reports make an impressive effort to capture the subsidies obtained from MFIs, they are one of the most trustworthy data sources (Hudon and Traca, 2011). To the best of the author's knowledge, this is the first attempt to investigate the productivity changes of MFIs using a bootstrap method.

Our results suggest that Kenyan MFIs have experienced about 7% annual productivity progress on average, which is mainly attributable to technological improvements over the period 2009–2012. Moreover, the second-stage regression results reveal that matured MFIs tend to have lower productivity compared to their younger counterparts. We also find that higher return-on-assets (ROA) associates with both productivity progress and technological advances over the considered period. Since efficiency and productivity are affected by the policy decisions (Mukherjee et al. 2002), the empirical results in this paper shed light on the influences of recent policy reforms in Kenyan microfinance industry over the productivity dynamics of Kenyan MFIs. Findings of the present paper can, therefore, be used by policy makers to reassess the success and failures of the current policy choices. Moreover, statistically significant results yielded in the present study, may help managers to make more efforts to improve the performance of the MFIs that are desperately needed the improvements.

The rest of the paper unfolds as follows. The next section provides a brief literature review. Section three discusses the methodology and data specification of input and output variables. Section four presents the empirical results. Section five concludes.

2. Literature review

Parametric methods like Stochastic Frontier Analysis (SFA) and non-parametric methods like Data Envelopment Analysis (DEA) are the widely used frontier methods in prior studies on efficiency and productivity changes of MFIs. Appendix (A) presents a survey of previous research conducted to investigate efficiency and productivity dynamics of MFIs using frontier techniques.

Paxton (2007) uses SFA to investigate the efficiency of 190 semi-formal financial intermediaries in Mexico. She finds that differences in technical efficiency scores are associated with differences in technology, average loan size, poverty outreach and institutional age. Heremes et al. (2011) employ SFA to examine the trade-off between poverty outreach and efficiency of MFIs. They find that outreach and efficiency are negatively correlated. Servin et al. (2012) use SFA to investigate the technical efficiency of different types of MFIs in Latin America. Using data for 315 institutions from the period 2003-2009, they find that differences in efficiency are associated with the differences in ownership types. Gutiérrez-Nieto et al. (2007) use DEA to examine the efficiency of 30 Latin American MFIs. They also use the principal component analysis method to explain the efficiency scores by means of four principal components. Results show that variations of efficiency scores are associated with institutional type and geographical location. Gutiérrez-Nieto et al. (2009) use DEA to examine the relationship between financial and social efficiency, and the relationship between efficiency and other indicators like age, profitability and institutional type. They find that efficiency in supporting women and efficiency in fighting poverty are positively correlated. They also find that Non-Governmental Organizations (NGOs) are more socially efficient. Piot-Lepetit and Nzongang (2014) use DEA to investigate the trade-off between outreach and sustainability of 52 MFIs in Cameroon. They find mix results: there is no trade-off between financial and social sustainability for almost half of MFIs; trade-off exits for 15% of MFIs. Nghiem et al. (2006) use DEA and second-stage Tobit regression for a sample of 44 MFI in Vietnam. Regression of the efficiency measures over several environmental variables reveals that age and location of MFIs are significant determinants of efficiency. In contrast to the earlier studies that involve constructing deterministic frontier, Wijesiri et al. (2015) examine the efficiency and its determinants by employing a double bootstrap DEA method. Results show that age and degree of capitalization are significant determinants on financial efficiency. Results also indicate that age, institutional type and profitability are the crucial determinants of social efficiency.

Empirical studies on productivity movements of MFIs are still in its infancy. Among the handful of studies attempting to evaluate productivity change of MFIs, Bassem (2014) examines productivity changes in 33 MFIs operating in Middle East and North African

[1] M-PESA is a mobile phone based money transaction service in Kenya.