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*The impact of subsidies on the sustainability  
of microfinance institutions*

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## List of Abbreviations

ASEAN	Association of Southeast Asian Nations
BCC	Banker, Charnes, and Cooper
BDO	Binder Dijker Otte
CCR	Charnes, Cooper, and Rhodes
CRS	constant returns to scale
DEA	data envelopment analysis
DMU	decision making unit
EAP	East Asia and the Pacific
EG	equity grants
EVA	economic value added
E&Y	Ernst & Young Global Limited
FSS	financial self sufficiency index
IAS	International Accounting Standard
KfW	Kreditanstalt fuer Wiederaufbau
KPMG	Klynveld Peat Marwick Goerdeler
MDGs	Millennium Development Goals
MENA	Middle East and North Africa
MFI	microfinance institution
MNT	Mongolian tögrög
NBFI	non-banking financial institutions
NGO	non-governmental organization
NPC	net present cost
OLS	ordinary least squares
OPEX	operational expenditure
OSS	operational self-sufficiency
PCA	principal component analysis
pcGNI	gross national income per capita
PG	profit grant
PKF	Pannell Kerr Forster
PPP	private public partnerships
PTE	pure technical efficiency
PwC	PricewaterhouseCoopers
RBV	resource-based view of the firm
ROA	return on assets
ROE	return on equity
RTS	returns-to-scale
S	annual subsidy received
SA	South Asia
SAROA	subsidy-adjusted return on assets
SAROE	subsidy-adjusted return on equity
SCA	sustained competitive advantage
SDI	subsidy dependence index
SDR	subsidy dependence ratio
s.t.	subject to
UN	United Nations
UNDP	United Nations Development Programme
UN SDGs	United Nations Sustainable Development Goals

USAID	United States Agency for International Development
USD	United States dollar
V.A.T.	value-added tax
VRS	variable returns to scale
WAEMU	West African Economic and Monetary Union



## Abstract

Measuring the influence of subsidies on the sustainability of microfinance institutions is a major challenge. This dissertation shows that the Subsidy Dependence Index remains the most promising ratio to calculate the subsidy received and measure microfinance institutions' dependence on subsidies to conduct further research on the institutions' ability to become socially and financially sustainable. By comparing the Subsidy Dependence Index to alternative measurements, a detailed discussion, and an exemplary calculation, its applicability to addressing the research gap of microfinance institutions' reliance on subsidies to improve their efficiency can be shown. A calculation for 224 microfinance institutions serving 23.5 million active borrowers shows its applicability for large-scale data sets. Focusing on the microfinance institution (MFI), this research project takes an institutionalist approach.

Since efficiency is the prerequisite to sustainability, the hypothesis that subsidies have a conflicting influence on microfinance institutions' financial and social efficiency has been tested using a reduced panel of 216 microfinance institutions. A multi-input/multi-output data envelopment analysis (DEA) is applied to determine financial and social efficiency beyond ratios. The efficiency scores that serve as a proxy for sustainability are then used as dependent variables in panel data regressions. The main finding is that subsidies have a negative but only marginal effect on efficiency. However, the effect is only strongly significant regarding social efficiency.

To the best of the author's knowledge, there is no research done to evaluate the influence of subsidies on financial and social efficiency based on a DEA.

Keywords: Data envelopment analysis · Efficiency · Microfinance · Subsidies · Subsidy Dependence Index · Sustainability · Principal component analysis

## 1. Introduction

Since the early 1970s<sup>1</sup> (Callaghan, Gonzalez, Maurice, & Novak, 2007), microfinance has become an institutional tool to fill the gap between supply and demand for credit by the poor by responding to the failure of subsidized credits (Shetty, 2008).

Microfinance includes all actions undertaken by financial institutions to enable relatively poor people in terms of their personal living conditions to undertake an entrepreneurial activity or receive small-scale financial services such as loans, savings, insurance, and remittances. However, microcredits, i.e., loans to individual entrepreneurs to boost business income, are often at the center of attention due to data access and calculability.

Thereby microfinance institutions (MFIs) act in the same overall market as common banks, whose primary function is to collect deposits from different sources and invest them with prospective borrowers for profit. MFIs offer access to microcredit for the poor and encourage economic activity. Nevertheless, two different approaches exist. While some MFIs primarily focus on maximizing profits, others have an explicit social mission. The latter intends to maximize credit access for the poor to support income-generating activities in the rural non-formal sectors through self-employment, particularly for special interest groups, such as micro-entrepreneurs, women, and the relatively poor (Pearl & Phillips, 2001). While traditional banks preferably serve larger enterprises and comparably wealthy individuals who meet their collateral requirements (Sen, 2008), MFIs serve micro-entrepreneurs, small enterprises, and poor individuals in rural and informal sectors (Ledgerwood, 1999) who have little access to conventional banking facilities due to their lack of collateral (De Aghion & Morduch, 2005). By supplying financial products, MFIs aim to solve unemployment in general and micro-enterprise development in particular by addressing a growing number of borrowers. In 2009 MFIs served 98 million borrowers and 139.9 million in 2018, with a credit portfolio of approximately USD 124 billion (Convergences, 2019). The latest economic challenges resulting from the SARS-Cov-2 pandemic, with up to 70 percent of borrowers reporting that they cannot repay their loans (Malik et al., 2020), indicate a continuous need for microfinance and likely subsidies.

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<sup>1</sup> Muhammad Yunus' early experiments at the Grameen Bank in 1976 are a prominent example.

Based on its social impact and the substitution of informal lenders, the microfinance model even expanded to Northern countries, such as the United States of America (Carr & Tong, 2002) and Germany (Glaubitt, Hagen, & Schütte, 2007) after it became popular in emerging and developing economies. Although microfinance has a long history and has become influential on the public agenda, the literature shows that a lack of theoretical foundation concerning the supply side exists, i.e., valid benefit-cost, statistical studies of impact, and academically well-grounded motives (Dichter & Harper, 2007). Cull and Murdoch claim that research still fails to show that microfinance can fulfill its promise to “reduce poverty, improve living conditions, and fuel micro-businesses” (Cull & Morduch, 2017), although they remain optimistic. In their systematic review of 169 peer-reviewed academic papers since 1990 on the performance of MFIs, Hermes and Hudon (2018) support the impression of ongoing controversy about measuring MFI performance and state a strong research gap. They specifically claim that subsidies as a funding source are among the main drivers of MFIs’ financial and social performance. Since MFIs are not immune to market requirements, refunding is a crucial point and has shifted the discussion toward for-profit, financially self-sustaining institutions (Robinson, 2001) for almost two decades. Gutiérrez-Nieto and Serrano-Cinca see an increasing debate on the mission drift of MFIs in their literature review of 1.874 papers published from 1997 to 2017 (Gutiérrez-Nieto & Serrano-Cinca, 2019), which requires a reliable measure of subsidy dependence to understand the influence of subsidies on the MFIs’ capability to fulfill their mission. An important reason for the ongoing research gap is that Muhammad Yunus and other early promoters of microfinance have failed to develop an analytical superstructure since it was not their focus. The shift toward profitability has led some researchers to claim that microfinance has even lost its moral compass (Hulme & Maitrot, 2014). Despite its overwhelming potential, financing is a bottleneck. Therefore MFIs should be financially viable since unviable institutions cannot meet their social obligations for long (Gutiérrez-Nieto, Serrano-Cinca, & Molinero, 2009), making corporate and social sustainability a heavily interwoven issue for MFIs. By focusing on the MFI and not the client, this dissertation takes the institutionalist approach in contrast to the welfarist approach.

Consequently, some MFIs have turned to international private capital markets for refinancing. To do so, they must adapt to internationally recognized rating standards. Thereby they increase their transaction costs even further, which are relatively high

compared to other asset classes but improve their financial statements for research. Because their loan pricing is generally critically related to continuing reliance on subsidies (Karlan & Zinman, 2008), they face increasing pressure from policymakers, donors, and investors. Consequently, since support by subsidies is only justifiable if the social benefit exceeds its cost, a shift in the direction of for-profit, financially self-sustaining institutions with individual credit has been an ongoing development (Robinson, 2001). While some researchers assumed that roughly half of all MFIs could become self-sustaining (Caudill, Gropper, & Hartarska, 2009), and only one to three percent were financially self-sufficient and held positive income a decade and a half ago (Callaghan et al., 2007), some recent research claims that microcredit became largely financially self-sustaining (Cull, Demirgüç-Kunt, & Morduch, 2018). Since, research shows improved self-sustainability, but most MFIs receive subsidies, only 20-25% of MFIs reported not using subsidies (D'Espallier, Guerin, & Mersland, 2013; D'Espallier, Hudon, & Szafarz, 2013), financial self-sustainability and using subsidies might not be as strongly correlated as could be expected. Therefore subsidies should be measured in both financially self-sustaining and not self-sustaining MFIs. The continuous need for microfinance seems all too apparent within the latest economic challenges based on the SARS-Cov-2 pandemic. Consequently, the financial self-sustainability of MFIs as lenders to the poorest is highly relevant.

Historically subsidies play an essential role in the industry, while the efficient allocation of subsidies is a constant struggle (Cull & Morduch, 2017). Understanding the dependence of MFIs on subsidies and their influence on the MFIs' efficiency is a prerequisite to conducting research on the industry's sustainability, growth potential, and MFIs' loan pricing. Reliably measuring subsidies is warranted because of their relevance for economic and political decision-making regarding the most efficient approach to address poverty by supporting MFIs. Improving the application of existing approaches to understanding the relevance of subsidies on financial development institutions like MFIs, such as the Subsidy Dependence Index (SDI), is a prerequisite for further research. Although the SDI, strictly speaking, quantifies subsidy dependence rather than self-sustainability (Schreiner & Yaron, 2001), it is accepted as a well-suited measure for sustainability (von Pischke, 1996). It is currently the most efficient approach to understanding the role of subsidies in the MFIs' urge to become efficient and self-sustaining in the long run, particularly since subsidy dependence is simply the inverse of self-sustainability (Yaron, 1994).

Financial self-sustainability is achieved when the return on equity, net of any subsidy received, equals or exceeds the opportunity cost of funds.

Since Yaron's earliest approach to grade development finance institutions by their subsidy dependence to enable more detailed research, various iterations and improvements have been conducted on the resulting Subsidy Dependence Index (SDI) to apply it to the microfinance industry. Though well accepted by principal, all improvements require increasing access to data, which is hardly accessible in large-scale data sets on MFIs. Latest developments have sharpened the edges of various equation components, but their application is still challenging.

As the Subsidy Dependence Index (SDI) (Yaron, 1992) demonstrates a lender's requirement for subsidies "to earn a return equal to the opportunity cost of capital", it is a well-suited measure for sustainability (von Pischke, 1996) for analyzing MFIs, since MFIs are heavily subsidized<sup>2</sup>. A common approach to define an MFI's sustainability has been profitability analysis, sometimes combined with cost and profit functions to understand their efficiency (Khalily, Imam, & Khan, 2000). Since these approaches tend to misrepresent sustainability and efficiency due to their lack of adequately addressing subsidies, the SDI can help overcome this problem. Khalily et al. even infer that the extent of subsidy intensity is an inverse function of the degree of efficiency. Compared to other ratios or levels of operational self-sufficiency (OSS)<sup>3</sup>, the SDI is constricted regarding the time frame of analysis but is a more reliable measure of sustainability based on its high data quality. Particularly in calculating the annual subsidy received, the SDI's numerator guarantees high-quality data for analysis.

A fundamental prerequisite for sustainability is efficiency (Nyamsogoro, 2012) since unsustainable and subsidized MFIs are bound to create inefficiency and distortion (Khalily et al., 2000). Therefore, it is of utmost importance to understand the possible influence of subsidies on efficiency.

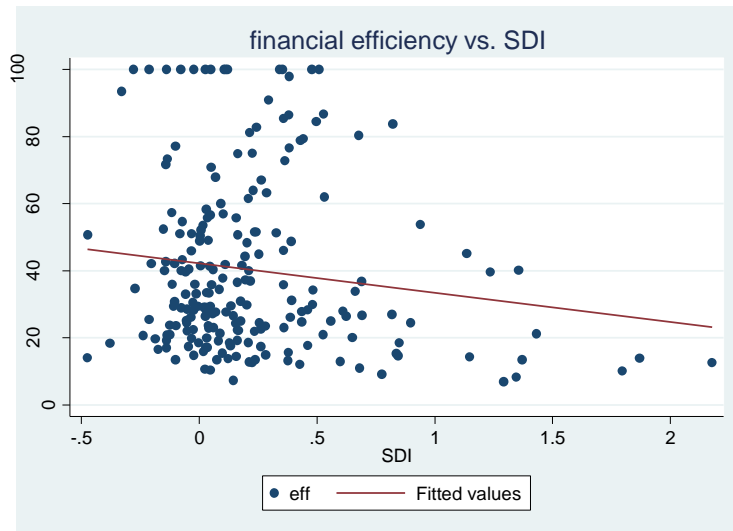
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<sup>2</sup> See [appendix 1](#) for an overview of the 130 most relevant public donors for MFIs from the sample

<sup>3</sup> Operational self-sufficiency (OSS) is defined as total financial revenue / (financial expense + operating expenditure + loan loss provision expense). If applied as a proxy for sustainability, operational self-sufficiency rates above 100 % are often referred to as operationally sustainable, and operational self-sufficiency rates above 110 % as financially sustainable.

In a scatter plot<sup>4</sup> (Fig. 1) for the variables *financial efficiency* (see [chapter 11](#)) and the *SDI* as a proxy for sustainability (see [chapter 5](#)), efficient MFIs show lower SDI values, meaning efficient MFIs tend to be less subsidy dependent than less efficient MFIs.

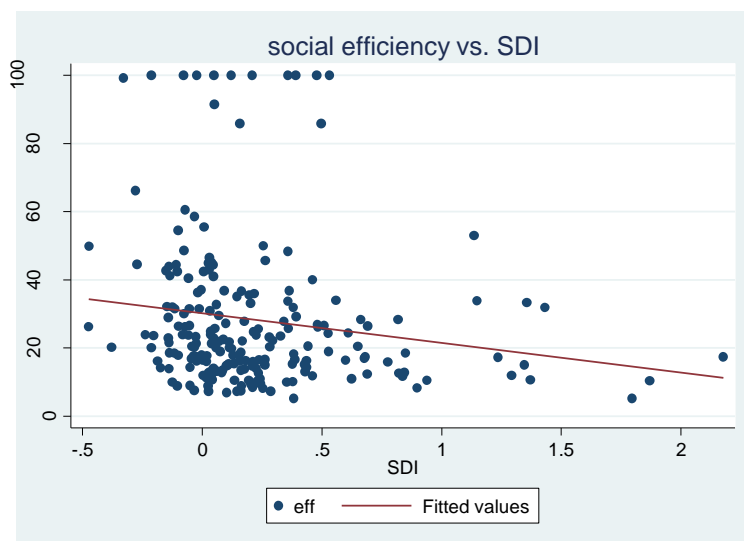
**Fig.1 - Scatter plot for MFIs' financial efficiency vs. MFIs' SDI**



Source: author's own compilation

A scatter plot<sup>5</sup> (Fig. 2) for the variables *social efficiency* and the *SDI* shows similar results.

**Fig. 2 - Scatter plot for MFIs' social efficiency vs. MFIs' SDI**



Source: author's own compilation

<sup>4</sup> To better highlight the fitted values, SDI values above six have been cut off as rare outliers. The STATA code for both scatter plots can be found on the data drive in the STATA file "effSDI.do".

<sup>5</sup> For a better highlighting of the fitted values, SDI values above six have been cut off as rare outliers

In the interest of reaching for operational or financial sustainability and outreach, this dissertation addresses financial and social efficiency separately after defining and calculating subsidies. A regression analysis was conducted to understand the influence of subsidies on the MFIs' efficiency. To calculate the required efficiency scores, variables were applied that capture the MFIs' dual objectives of financial sustainability and outreach. The latter objective has specifically been mentioned as an indicator of social sustainability in the UN SDGs<sup>6</sup>. It is particularly suitable as it indicates the MFIs' services to a large number of borrowers (breadth of outreach), particularly in the lower-income strata (depth of outreach).

Although efficiency is crucial for MFIs to fulfill their mission in the long and medium run, it can hardly be measured like in regular banks due to their double mission, also referred to as the microfinance promise (Morduch, 1999a) and the potential role of subsidies. While there have been many attempts to define MFIs by their efficiency, the impact of subsidies on the overall efficiency is still open to discussion (D'Espallier et al., 2013). This dissertation assesses efficiency based on the microeconomic theory of production function with a Data Envelopment Analysis (DEA), a non-parametric linear programming technique that helps overcome ranking by simple financial ratios (Margaritis & Psillaki, 2007).

While the impact of subsidies on the MFIs' sustainability has been an ongoing discussion in research, this dissertation focuses exclusively on efficiency as a proxy for sustainability. Margaritis and Psillaki (2007), e.g. measure MFIs' Pareto-efficiency by defining it as the distance from the industry's best practice, i.e., the discrepancy between maximum potential output and an MFI's actual output. There are plenty of studies within microfinance and DEA literature to support the search for valid inputs and outputs to measure MFI efficiency, including both social and commercial aspects. Since most studies that explore the efficiency of MFIs are predominantly case studies or include samples smaller than 100<sup>7</sup>, they describe the experience and performance of a limited amount of MFIs operating in a single country or similar markets (Caudill et al., 2009). To overcome this limitation, an international industry efficiency ranking of MFIs, as it exists for other industries (Harris & Raviv, 1991; Rajan & Zingales, 1995), will be built by measuring efficiency scores with a DEA. The

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<sup>6</sup> United Nations Sustainable Development Goals: <https://sdgs.un.org/> (accessed 9/19/2021)

<sup>7</sup> For details, see [table 12 - Overview of 18 peer-reviewed publications addressing DEA in MFIs](#)



DEA offers the possibility to link social efficiency assessment – a research field with relatively rare publications compared to financial efficiency – with financial efficiency calculation.

[Chapter 1](#) gives a detailed introduction to the research topic, followed by a definition of sustainability and subsidies in the scope of the following research ([chapter 2](#)). The following [chapter 3](#) explains the relevant theories and the applied research framework. The predominant approaches from the literature to assess sustainability in MFIs are presented in [chapter 4](#), including Yaron's SDI and its advantages over competing approaches. This is followed by a detailed derivation of the SDI, including a discussion on negative subsidies and the opportunity cost of subsidized capital ([chapter 5](#)). Chapters [6](#), and [7](#) apply the SDI to a well-accepted database, showing the dramatic effect of increased restrictions on sample size, including an exemplary calculation. [Chapter 8](#) contains a descriptive sample analysis to improve the understanding of the necessity of addressing subsidy dependence before conducting research on sustainability. It is complemented by a hierarchical overview of all microfinance institutions (MFIs) by their subsidy dependence. [Chapter 9](#) gives an interim conclusion on the particular relevance of the SDI formula to reliably calculate subsidies for further research and an outlook on the second part of the thesis. [Chapter 10](#) gives a theoretical introduction to the data envelopment analysis (DEA) Efficiency scores for all MFIs are calculated in [chapter 11](#) after a thorough literature review to define the inputs and outputs for the DEA from previous research. Hypotheses are derived from the literature, and the model specifications for the regression analysis are explained. [Chapter 12](#) shows the specific results of the DEA, makes a case for the selected model through a principal component analysis (PCA) and regresses subsidies on the MFIs' financial and social efficiency scores as proxies for their respective sustainability. The results are explained in [chapter 13](#), followed by a summary and implications derived from the research in the final [chapter 14](#).

## **2. Sustainability and subsidies – Definition of terms**

Sustainability is a competitive advantage derived from organizational and managerial processes (Teece, Pisano, & Shuen, 1997), and its outcomes in many cases depend on the existence of antecedents specific to institutions rather than external



parameters. While sustainability has become an omnipresent term, common understanding refers to institutions' pursuit to fulfill the United Nations Sustainable Development Goals (UN SDGs), or more commonly, the broadest possible number of them.

The 17 UN SDGs (see [table 1](#)) were proclaimed in 2015 and are included in the United Nations General Assembly Resolution, although referred to as the Agenda 2030. Although the microfinance approach can be assumed to positively impact achieving these goals either for individuals or entire regions, the industry's effect on most goals is minuscule or indirect.

**Table 1 - Overview of the United Nations Sustainable Development Goals**

SDG 1	No poverty - End poverty in all its forms everywhere
SDG 2	Zero hunger - End hunger, achieve food security and improved nutrition and promote sustainable agriculture
SDG 3	Good health and well-being - Ensure healthy lives and promote well-being for all at all ages
SDG 4	Quality education - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
SDG 5	Gender equality - Achieve gender equality and empower all women and girls
SDG 6	Clean water and sanitation - Ensure availability and sustainable management of water and sanitation for all
SDG 7	Affordable and clean energy - Ensure access to affordable, reliable, sustainable and modern energy for all
SDG 8	Decent work and economic growth - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
SDG 9	Industry, innovation and infrastructure - Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
SDG 10	Reduced inequalities - Reduce inequality within and among countries
SDG 11	Sustainable cities and communities - Make cities and human settlements inclusive, safe, resilient and sustainable
SDG 12	Responsible consumption and production - Ensure sustainable consumption and production patterns
SDG 13	Climate action - Take urgent action to combat climate change and its impacts
SDG 14	Life below water - Conserve and sustainably use the oceans, seas and marine resources for sustainable development
SDG 15	Life on land - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
SDG 16	Peace, justice and strong institutions - Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
SDG 17	Partnerships for the goals - Strengthen the means of implementation and revitalize the global partnership for sustainable development

Source: author's own compilation based on the [Sustainable Development Goals \(https://sdgs.un.org/goals\)](https://sdgs.un.org/goals)

The most promising SDGs to be addressed by the MFIs' promise to "reduce poverty, improve living conditions, and fuel micro-businesses" (Cull & Morduch, 2017) are the promise to end poverty in all its forms everywhere (SDG 1) and the promise to promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all (SDG 8). While the fulfillment of these two SDGs can be facilitated by easier access to credit for the poor, questions of equality can

also be addressed insight the MFIs. The achievement of gender equality and empowerment of women (SDG 5) can be addressed by preferred access to credit and by employment through the MFIs directly. A common measure is gender-diverse boards inside the MFIs. A broader and promising impact of MFIs in the scope of the SDGs is the reduction of inequality within and among countries (SDG 10). This can be achieved by the success of the industry as a whole. A more indirect effect can be expected regarding hunger (SDG 2) and health (SDG 3) through specific loans and the ability to start one's own business.

The SDGs were predated by the Millennium Development Goals (MDGs), which were proclaimed by the UN in 2000 to be achieved in 2015. The eight goals show substantial overlap with the latter SDGs. Therefore, regarding sustainability, one can argue that both goals can be applied to measure MFIs' influence. This is crucial since policymakers often apply the goals as an argument for comprehensive subsidies.

**Table 2 - Overview of the Millennium Development Goals**

Goal 1	Eradicate extreme poverty and hunger
Goal 2	Achieve universal primary education
Goal 3	Promote gender equality and empower women
Goal 4	Reduce child mortality
Goal 5	Improve maternal health
Goal 6	Combat HIV/AIDS, malaria and other diseases
Goal 7	Ensure environmental sustainability
Goal 8	Develop a global partnership for development

*Source: author's own compilation based on [The Millennium Development Goals Report by the United Nations \(2015\)](#)*

However, the approach to measuring the fulfillment of the SDGs or MDGs by MFIs remains unsatisfying for sustainability research and the role of MFIs, since SDGs address somewhat contradicting goals and consequently are unlikely to be satisfied without conflicts in resource allocation. Furthermore, the SDGs and MDGs alike take a holistic approach to sustainability that cannot be achieved by one industry or institution alone. A more severe problem for research is the lack of an overall definition of sustainability in the SDGs and MDGs.

The thesis takes a more conservative approach based on existing research in microfinance with a focus restricted on the financial and social sustainability of MFIs. It is necessary to narrow the question of sustainability in the industry and address the institutions themselves instead of a highly indirect influence that remains intangible if one wants to make a case for the allocation of subsidies to achieve the greater good in the long run. Therefore, the thesis addresses the efficiency of MFIs and the role of subsidies on their path to efficiency as a proxy for sustainability.

## 2.1. Financial and social sustainability

In general, consequently likewise financial and social sustainability, sustainability refers to an MFI's capacity to operate resources efficiently over time while achieving its goals.

In the endeavor to understand the dynamics of MFIs as a research topic, it is crucial to understand that some MFIs primarily focus on maximizing profits, and others have an explicit social mission. The MFIs' double mission of economic profit and a social mission, addressing two intuitively conflicting goals, is referred to as the Yaron (Yaron, 1994) framework of sustainability and outreach (Gutiérrez-Nieto et al., 2009), wherein financial sustainability focuses on financial performance, and outreach evaluates the social performance. While some researchers find evidence for a conflict between financial efficiency and outreach (Hermes, Lensink, & Meesters, 2011; von Pischke, 1996), other researchers find evidence that MFIs that do well on outreach tend to be financially efficient (Gutiérrez-Nieto et al., 2009; Quayes, 2012). In both prioritization scenarios, the MFIs' main objectives are operational sustainability (cost-covering) and outreach (Hartarska & Nadolnyak, 2007) (social sustainability). High operational sustainability is commonly referred to as financial sustainability.

## 2.2. Subsidies

A challenge on the path to sustainability is understanding the role of subsidies. Ideally, MFIs should be able to operate without subsidies in order to be considered sustainable. Consequently, subsidies should not be a required resource.

In the scope of this thesis, subsidies can only be provided by public donors, such as national or regional governments, or by their agents, such as ministries, governmental aid programs, and international government-funded institutions or institutions dependent on or controlled by a government, such as the European Commission or the United Nations and its organs. Therefore Private Public Partnerships (PPP) can be considered public donors, depending on an overwhelming share of public funding or a strong dependence on the national or regional government. Although officially independent in most countries within the sample, central banks play a central role in some countries and are therefore not excluded as

public funds. As far as they are not primarily controlled or financed by public funds, international foundations and religious institutions cannot provide public funds themselves and are therefore excluded.

For an overview of the most relevant public donors for MFIs from the Data Catalog in 2009 and 2008, see [appendix 1](#).

Since subsidies can only be calculated for well-defined periods to include opportunity costs, focusing on subsidies is a constraint to the long-term perspective of sustainability. Therefore efficiency in a well-defined timeframe will serve as a proxy for sustainability in the scope of the dissertation.

### **3. Theory and research framework**

#### **3.1. The resource-based view as a theoretical framework**

Within the last 20 years, the resource-based view of the firm (RBV) has become widely accepted within the strategic management literature ([Newbert, 2007](#); [Powell, 2001](#); [Priem & Butler, 2001](#)). It can be seen as a backlash to the environmental models such as the market-based view that focused on the external analysis ([Porter, 1980](#)) since the (sustained) competitive advantage of an institution can be better explained by its resources than by its product side ([Peteraf, 1993](#); [Wernerfelt, 1984](#)). While MFIs offer more and more products instead of mere micro-credits, their ability to serve the market is increasingly restricted by their resources. The RBV approach was developed by Wernerfelt and is based on earlier work by Caves ([Caves, 1980](#)). It only became famous with Barney's paper ([Barney, 1991](#)), "Firm resources and sustained competitive advantage", in which he provides a broad theoretical framework.

The RBV is particularly suitable for MFIs because it focuses on institutions' internal dynamics and their transformation into valuable resources that can lead to a sustainable competitive advantage if applied efficiently. Wernerfelt ([1984](#)) and Cavusgil et al. ([2007](#)) even propose a proactive development of new resources. In terms of competition, this means that (1) a single superior resource owned by an

institution can explain its competitive advantage. Even (2) if the competitor can discern these resources, he will be unable to acquire them easily. This consideration is especially interesting in refinancing for MFIs in different market environments that compete for the same scarce international financial resources that have to be combined in the most efficient manner.

Hence, the RBV examines the link between an MFI's internal characteristics and performance (Barney, 1991), and the resources a MFI possesses should best guide its strategy. Although Schindehutte & Morris (2009) criticize its usability for entrepreneurship research, it fits well for the microfinance market since MFIs, while fostering micro-entrepreneurship themselves, are well-established financial institutions and not entrepreneurial ventures themselves. Besides that, the RBV belongs to the well-established theoretical approaches to determining the strategic resources available to a firm.

To fully understand the approach's capability, one must look at the definition of resources within the RBV. In the original RBV, resources can commonly be considered "tangible or intangible semi-fixed assets or skills" tied semi-permanently to the firm (Caves, 1980). In a narrower sense, a resource, in the context of the RBV, includes "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (Daft, 1983) with the aim of efficiency being crucial for this thesis. These valuable resources include firm-specific assets which are difficult to imitate (e.g., trade secrets), that are neither perfectly imitable nor substitutable without great effort, resulting in resource position barriers (Wernerfelt, 1984), but address short-term balance effects as well as the resources' long term capacity (Caves, 1980).

Contemporary literature distinguishes five classes of resources: financial, physical, human, technological, and reputational resources. While the first two are tangible, the others must be considered intangible (Grant, 2002). Over time, the classification of resources has been further developed. Makadok distinguishes resources and capabilities (2001). In his argumentation, a resource is an observable and marketable asset. Barney defines a resource as valuable, rare, imperfectly imitable, and non-substitutable (Barney, 1991). On the other hand, a capability is a type of resource that helps improve the productivity of other resources held by the institution. It is firm-

specific, intangible, organizationally embedded, and nontransferable. While resources can be acquired, capabilities must be built (Teece et al., 1997). He further suggests distinguishing between ordinary and dynamic capabilities. While an ordinary (core) capability "permit[s] a firm to 'make a living' in the short term" (Winter, 2003), a dynamic capability can be defined as the firm's capability to integrate, build and reconfigure internal and external competences to address changing environments (Teece et al., 1997) by renewing its competences based on required innovative responses and when the nature of future competition is and markets are difficult to determine (Teece et al., 1997). Dynamic capabilities are management capabilities and difficult-to-imitate combinations of organizational, functional, and technological skills. Therefore, internal and external firm-specific capabilities have to be exploited and developed. Although resources and capabilities are considered sticky, the approach's ability to consider developing new capabilities (Wernerfelt, 1984) is especially compelling for the microfinance industry, considering the increasing amount of microfinance products compared to pure microcredits in the past. While ordinary capabilities are well defined in sustainability research, there is no generally agreed-on pool of dynamic capabilities. Nevertheless, Teece et al. (1997) offer three categories that can be addressed. These are organizational and managerial processes, positions (e.g., complementary assets, customer base, and external relations), and paths (i.e., strategic alternatives).

The RBV explicitly looks for internal sources of sustained competitive advantage (SCA) and aims to explain why firms within the same industry differ in performance (Kraaijenbrink, Spender, & Groen, 2010). Thereby the RBV sees institutions with superior systems and structures being profitable based on markedly lower costs, higher quality, or market performance (Teece et al., 1997). The lower costs can, e.g., be represented by lower operational expenditure (OPEX) or a better ratio regarding the MFI's number of qualified and trained employees, which are regionally scarce. The higher quality can be measured by the size of an MFI's gross loan portfolio, the number of active borrowers, or the average loan balance. However, the number of borrowers is limited due to competition and must be secured by binding contracts. Due to the specific social mission of MFIs, borrowers can not be easily substituted by other sources of income and can therefore even be considered imperfectly imitable. The financial revenue of an MFI can serve as a proxy for market performance.

The RBV is particularly interesting for a geographically spread industry working across regions and legal systems since it assumes that firms within the same industry may be heterogeneous concerning the strategic resources they control and that these resources may not be perfectly mobile across institutions (Barney, 1991) and that heterogeneity may therefore be lasting. Mobile refers to the fact that resources can be bought and sold in factor markets (Barney, 1986).

Although external parameters, i.e., the macroeconomic and legal environment, might protect individual MFIs or MFIs in specific countries against the competition, the RBV suggests that firm-specific factors are more important than industry effects. However, the geographical region of operation and its legal status should be considered as potentially influencing an MFI's performance.

The application of these resources and capabilities finds its synthesis in the efficiency of each MFI. In order to pick the resources and capabilities for further analysis that improve an MFI's efficiency, one needs to define the required attributes. Barney (1991) lists four attributes that not only improve efficiency and effectiveness but potentially create a competitive advantage and can therefore inspire the selection:

A resource or capability must be (a) valuable in the sense that it exploits opportunities and/or neutralizes threats that occur in a firm's environment. Furthermore, it must be (b) rare among the competition. In order to also hold the possibility of sustainable competitive advantage, it must also be (c) imperfectly imitable and (d) there cannot be strategically equivalent substitutes that are valuable but neither rare or imperfectly imitable.

The RBV, which belongs to the most influential theoretical approaches in business research today, has been subject to many meta-analyses; its explanatory value can therefore be considered proven (Barney & Arkan, 2001). Its applicability for microfinance seems especially compelling hence it is considered to be valuable for analyzing corporate social responsibility (Barney, Wright, & Ketchen Jr., 2001; Branco & Rodrigues, 2006), since the RBV recognizes the importance of intangible concepts, in this particular research environment the organizational culture of MFIs. While there is consensus about its usability for corporate social responsibility, it is also of particular interest to the research project that "a uniquely ethical culture does not necessarily translate into financial success" (Barney et al., 2001) but can also



deal with social aspects. Addressing the market of emerging economies, where many MFIs are positioned, the RBV is proven to be applicable (Chan, 2005). The international orientation of the research project is backed by the demand for large-scale quantitative studies of the RBV in homogeneous environments (Lockett & Thompson, 2001), i.e., the industry, hence the question of the role of subsidies is subject to the regulation of the industry.

### 3.2. The Contingency theory

The contingency theory (Kieser & Ebers, 2019), although referred to as contingency or situational approach, widens the perspective of the RBV to address sustainability by including the external situation of the MFI. The theory claims that there is no best way to organize an institution and that the optimal course of action is instead contingent (dependent) upon the internal and external situation. While former business research tried to formulate common rules for effective management, like system theory (von Bertalanffy, 1972) trying to create universal models with a non-situational approach, contingency theory focuses on company performance (Donaldson, 2001). Researchers of contingency theory argue that the appropriateness of managerial decisions and the institution's strategy should depend upon the institution's requirements and adequate environmental factors (Burns & Stalker, 1961; Dill, 1958; Venkatraman & Camillus, 1984; Zeithaml, Varadarajan, & Zeithaml, 1988) through a "concept of fit" (Venkatraman & Camillus, 1984) rather than solely external parameters. By widening the RBV's perspective with a combination of the MFI's status quo and external influence factors, sustainability can be achieved through company-specific actions that result in differently efficient MFIs. An efficiency ranking enables benchmarking of MFIs while addressing a more extensive set of performance influencing decisions on the MFIs' path to sustainability and addresses performance, which is the core principle of the contingency theory (Donaldson, 2001). The thesis, therefore, applies the contingency theory with a focus on the joint internal activities of the MFIs on their path to efficiency and, consequently their ability to become sustainable.

To fulfill these requirements, the research framework needs to study the efficiency of MFIs as a proxy for sustainability in combination with different internal settings, e.g., age, size, and legal status in different situational factor setups, i.e., regional settings.



### 3.3. Research framework

In reference to [chapter 3.1](#) and the literature review ([chapter 11.2](#)), the following research frameworks for a financial and a social perspective will guide the dissertation. In the first step, the annual subsidies received will be calculated based on Yaron's SDI. In the second step, the financial and social efficiency scores will be calculated through a DEA, with reference to inputs and outputs derived from the literature review (see [Fig. 3](#) and [Fig. 4](#)).

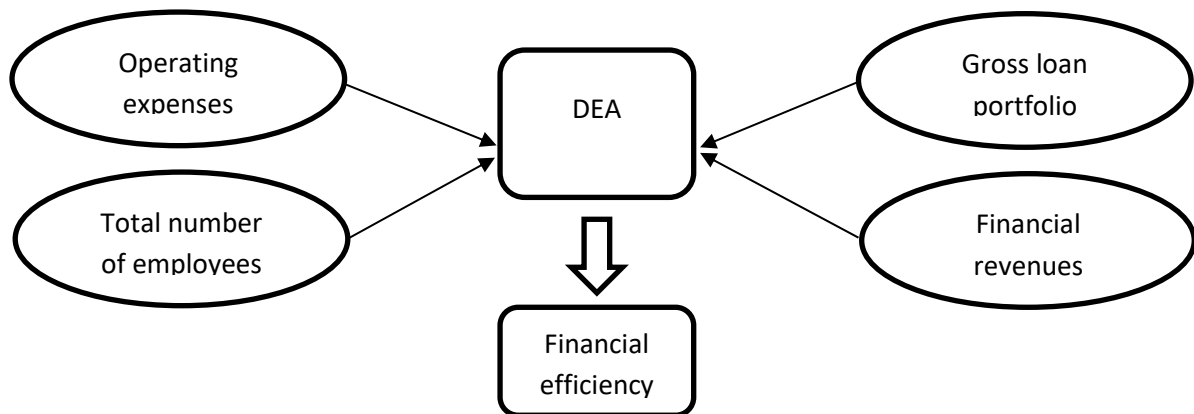


Fig. 3 - DEA model for financial efficiency scores

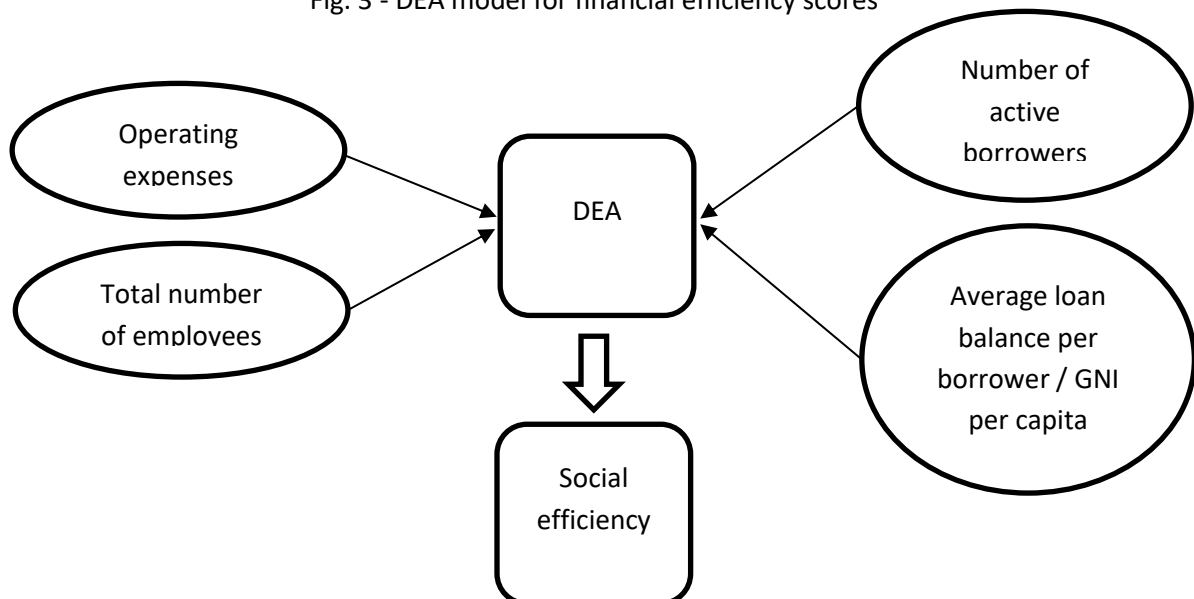


Fig. 4 - DEA model for social efficiency scores

In the final step, MFI age, MFI size, and annual subsidy received (S) are regressed on the MFI financial and social efficiency scores (see [Fig. 5](#)).

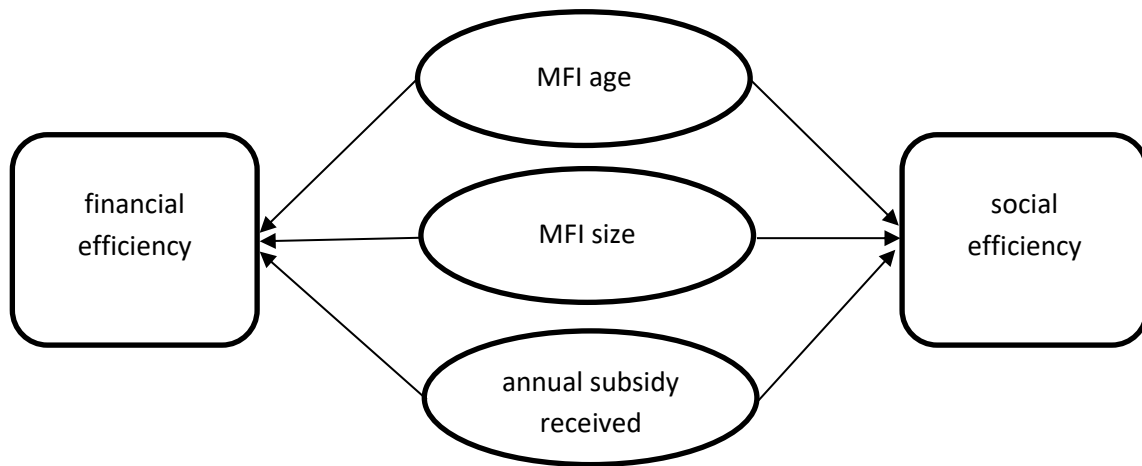


Fig. 5 - Core independent variables for the OLS regressions

#### 4. Competing approaches for the calculation of sustainability

Any approach to evaluate an MFI's development regarding its sustainability must be associated with financial data analysis in order not to fall for a superficial and ill-defined approach to sustainability. This holds particularly true for the present thesis, focusing on financial sustainability and an extension on social sustainability.

While this thesis can generally draw from a vast amount of research on financial data analysis, the narrower research topic is less developed. The sustainability of MFIs “depends upon the capacity [...] to persistently keep up its activities and services to meet its mission” (Kar, 2020) and generally relates to social and financial sustainability. In order to define if an MFI has indeed the capacity to fulfill its mission, financial data can be drawn from the financial reports directly or through databases. By referring to the underlying financial reports, some ratios can be accessed easily and can be cross-checked with the underlying data directly. This also enables the researcher to ensure data quality by developing a profound understanding of the applied accounting standards, e.g., IAS, and its underlying legal differences and accounting choices in international data sets. Through this financial due diligence, one can understand the MFIs' accounting choices and generate a set of generally accepted ratios for comparison among MFIs.

Various conservative financial profitability ratios, such as return on equity, return on assets and economic value added, help to understand the performance of financial institutions. Although they are generally accepted and widely applied in financial data analysis, they are limited regarding their ability to tackle the question of financial sustainability in the presence of subsidies. Since received subsidized funds<sup>8</sup> are often not accounted for in income statements due to the very nature of the funds, applying financial profitability ratios can therefore lead to an unrealistic estimation of the dependence on subsidies. Although this thesis focuses primarily on financial sustainability and the ability to measure social sustainability is not at the core of this thesis, it will help to shift the discussion from an accounting to an economic perspective by applying the Subsidy Dependence Index (SDI) and thereby taking into account the real cost of the subsidy to society. The aforementioned conservative ratios cannot address the cost to society and, in many scenarios, is not relevant for financial data analysis due to a lack of focus on sustainability from a macro perspective of the underlying business model. The SDI offers a realistic approach to calculating the real costs to society by measuring the social cost of microfinance and helps to overcome this blind spot of traditional analysis by ratios.

Conservative financial profitability ratios include the return on equity (ROE) and the return on assets (ROA). Traditionally an MFI is considered financially self-sustainable when its ROE, net of all subsidy received, equals or exceeds the opportunity cost of funds (Aveh, 2011). A shortcoming of the ROE and ROA is that they are unreliable for subsidized MFIs since profit grants can severely impact the accounting profit by being subject to accounting choices (Schreiner & Yaron, 2001) a challenge that can hardly be solved by reassessing merely the financial report. In contrast to the ROE, the ROA measures how effectively an MFI uses its assets to generate profits. Both ratios address the ability of an MFI to improve over the long term and are traditionally widely accepted.

In order to overcome the therefore common limitation of accounting choices regarding equity and profit grants, subsidy-adjusted ROE (SAROE) and subsidy-adjusted ROA (SAROA) were implemented in the field of financial profitability ratios, including true profit instead of accounting profit to average equity or accordingly

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<sup>8</sup> In the context of some research papers on the microfinance industry, the term “subsidized funds” summarizes grants, subsidies, and technical aid from public sources and is used interchangeably to subsidies.

average assets. However, Schreiner and Yaron (2001) show that the SAROE, even after adjusting the financial statements, still lacks relevant features that the SDI can compensate for. First, the SAROE can be positive but still below the opportunity cost of subsidized capital ( $m$ ), particularly in countries with high inflation rates, which can be a severe obstacle in traditional markets of MFIs. Secondly, in contrast to the SAROE, the SDI allows comparing the grants provided to the MFI's customers with grants through other channels. The grant provided by society for each dollar of interest paid by the clients can be measured. Third, the SAROE will not necessarily worsen if the MFI favors investments over lending, resulting in a pivot of an MFI's business model. This severe shift is commonly referred to as a mission shift in microfinance research.

While there are more complex measures of profitability, such as net present cost (NPC) to society<sup>9</sup>, similar to net present value and suited for long time frames, it is crucial to apply user-friendly approaches by reducing the complexity of the calculation without reducing the informative value of the result and enabling the analysis of large-scale international data sets. Some standard accounting measures of profitability are simply inadequate for assessing MFIs' performance in the presence of received subsidies due to shortcomings in the financial statements. Another example is operational self-sufficiency (OSS) which reflects the ability to compensate for operating expenses in the income statement with the operating income for a given period. Thereby it includes only financial cost but excludes the cost of capital. It is the unadjusted version of the following Financial Self Sufficiency Index.

Two interesting approaches are the Financial Self Sufficiency Index (FSS) and the Subsidy Dependence Index (SDI). Adjusting the data from the financial statements as if the MFI would not have received any subsidies, the FSS and the SDI take a more advanced approach<sup>10</sup>.

Financial self-sufficiency is a requirement for scaling microfinance and meeting the consistently high demand. It is a measure of financial sustainability first applied by Peck et al. (1995). In order to become financially self-sufficient, an MFI must at least

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<sup>9</sup> For a detailed discussion, see Schreiner, M., & Yaron, J. 2001. *Development Finance Institutions : Measuring Their Subsidy*. Washington, D.C.: World Bank Publications.

<sup>10</sup> For a more detailed discussion, see [Opportunity cost of subsidized capital](#)

cover its operating costs, including loan loss reserves, the cost of funds, and inflation through its fees (von Pischke, 1996). The Financial Self Sufficiency Index (FSS) can be calculated as

$$FSS = \frac{\text{Adjusted Financial Revenue}}{\text{Adjusted(Financial Expense + Net Loan Loss Provision Expense + Operating Expense)}} \quad (1)$$

Manos and Yaron (2008) suggest adjusting revenues and costs for inflation, subsidies, loan loss provisions, and write-offs. Nevertheless, they conclude that the FSS will likely overstate an MFI's financial self-sufficiency. Particularly its likelihood of not fully accounting for the MFI's opportunity costs is a limitation of the FSS, which is a consequence of taking the national market deposit rate as the opportunity cost of capital. However, it is not feasible for most data sets to come up with reliable individual opportunity costs for each MFI without implementing a new margin of error.

A financial profitability ratio that is particularly interesting to prepare research on MFIs regarding their financial self-sustainability and the impact of subsidized funds on it is the Subsidy Dependence Index (SDI). The SDI is similar to the wider known concept of economic value added (EVA), calculating the profit after tax minus the economic cost of the funds used, which is quite common in for-profit institutions to take into account the opportunity costs to investors. Both the EVA and the SDI help to better understand what is happening. The SDI was first suggested by Yaron (1992) and has been frequently updated.

The SDI's main difference towards the FSS is that it uses a market rate instead of inflation when adjusting the cost of equity (Ledgerwood, 1998). A general advantage of the SDI is that the calculation of the subsidy received does not depend on the accounting measures, which is a severe advantage in international studies. The SDI recognizes that "a dollar treated as a profit grant has the same effect on business performance as a dollar treated as an equity grant" (Schreiner & Yaron, 2001). A second advantage is that, in contrast to traditional profitability ratios, it takes into account unreported subsidies and replaces the subsidized interest rate paid with an adequate shadow price to concessionary borrowed funds (Manos & Yaron, 2008) by including the opportunity cost of subsidized capital, sometimes also called opportunity costs to society or social opportunity cost. The selection of the opportunity costs ( $m$ ) is essential. Hence it can easily lead to overestimating or underestimating the cost of publicly subsidized debt (Manos & Yaron, 2008) (see

[Opportunity cost of subsidized capital](#) ). A third advantage is that it is calculated using unadjusted data from the financial statements, reducing the complexity and margin for error based on interpretation. A fourth advantage, particularly in comparison to the SAROA, is the prominent influence of revenue from lending as its denominator since a shift from the MFI's core mission of lending would negatively impact the SDI. In consequence of its advantages, the SDI opens a potential path to overcome the ex-ante prevalent reliance on financial profitability ratios when addressing MFIs dependent on subsidies.

Some suggested adaptations to the SDI are considered competing approaches, such as the subsidy dependence ratio (SDR) ([Khandker & Khalily, 1996](#)). Khandker and Khalily argue that an MFI could decrease its dependence on subsidies through revenues from loans as well as investments, such as treasury bills, and therefore suggest modifying the denominator from the revenue from lending ( $LP^*i$ ) to the revenue from lending and investment ( $LP^*i + I^*j$ ) to address this issue. In this case,  $i$  is the average investment, and  $j$  is the yield on investment. Indeed, the SDI worsens if the MFI invests in government bonds. While this is generally true, lending to the poor is the core concept of microfinance, and it seems well justified to pick revenue from lending as the denominator. Yaron and Schreiner ([1999](#)) reject the SDR, claiming that it ignores the MFIs' mission and their role as price-takers on non-loan investments alike. Since the calculation of the annual subsidy received ( $S$ ) in the nominator also includes the true profit (8), the argument for including investments is inconsistent since revenue from investment has already been accounted for.

[Table 3](#) gives an overview of the most common ratios on financial profitability in research and financial due diligence and hierarchically orders them by their informative value regarding the impact of subsidies in ascending order.

**Table 3 - Overview of financial profitability ratios**

Ratios	Calculation	Limitations
Return on equity (ROE)	$\frac{\text{Accounting profit}}{\text{Avg. Equity}}$	<ul style="list-style-type: none"> <li>• Unreliable for subsidized MFIs due to accounting choices on grants</li> <li>• Ignores the opportunity cost of subsidized capital</li> <li>• Positive SAROE/SAROA can still be lower than the opportunity cost of subsidized capital</li> <li>• Not impacted by a mission shift from lending to bonds</li> </ul>
Return on assets (ROA)	$\frac{\text{Accounting profit}}{\text{Avg. Assets}}$	
Subsidy-adjusted return on equity (SAROE)	$\frac{\text{True profit}}{\text{Avg. Equity}}$	
Subsidy-adjusted return on assets (SAROA)	$\frac{\text{True profit}}{\text{Avg. Assets}}$	

Operational self-sufficiency (OSS)	$\frac{\text{Total Operating Revenue}}{\text{Expenses (Fin. Exp. + Operational Costs + loss on loan expenses)}}$	<ul style="list-style-type: none"> <li>• Only covers operating income and operating expenses along with the provision of loan loss</li> </ul>
Financial self-sufficiency (FSS)	$\frac{\text{Adj. Financial Revenue}}{\text{Adj. (Fin. Exp. + Net Loan Loss Prov. Exp. + Operating Exp.)}}$	<ul style="list-style-type: none"> <li>• Does not fully account for the opportunity costs</li> <li>• Likely to underestimate subsidy dependence</li> <li>• Error margin through adjustments</li> </ul>
Subsidy dependence ratio (SDR)	$\frac{\text{Subsidy}}{\text{Revenue from lending + Revenue from investments}}$	<ul style="list-style-type: none"> <li>• Ignores the MFI's mission</li> <li>• Ignores that MFI is a price-taker on non-loan investments</li> <li>• Makes MFI appear closer to subsidy independence</li> </ul>
Subsidy Dependence Index (SDI)	$\frac{\text{Subsidy}}{\text{Revenue from lending}}$	<ul style="list-style-type: none"> <li>• Financial statements required for at least two consecutive years</li> <li>• Only applicable for short timeframes, since it measures the percentage increase in revenue from lending all else unchanged</li> </ul>

Source: author's own compilation

By principle, each improvement in a ratio seems to require increasing access to data, which is hardly accessible in large-scale data sets on MFIs. The calculation of the SDI, which remains the most favorable ratio, still requires an in-depth analysis of financial statements to improve the required data. However, even the SDI or the SDR cannot indicate how far subsidies are justified and if the potential benefits outweigh the costs. This will be dealt with in the second part of the thesis by investigating the potential influence of subsidies on the MFIs' performance.

## 5. Application of the SDI

### 5.1. Calculation of the SDI and transformation of the SDI equation

The Subsidy Dependence Index measures subsidy dependence by measuring the degree to which an MFI relies on subsidies for its continued operations ([Ledgerwood, 1998](#)). The calculation of the SDI has been a well-described method evaluating development finance institutions ([Hasan, Hassan, & Uddin, 2009](#); [Hermes & Lensink, 2007](#); [Hudon & Traça, 2011](#); [Schreiner & Yaron, 2001](#); [von Pischke, 1996](#); [Yaron,](#)

1992), such as MFIs, regarding their attempts to become self-sustainable by measuring their financial costs in microfinance operations and their dependence on subsidies and has been frequently updated (Manos & Yaron, 2008; Schreiner & Yaron, 1999). However, in most publications, it has been only applied as a theoretical concept (Hermes & Lensink, 2007; von Pischke, 1996) or a case study (Morduch, 1999b), and it has rarely been applied to a data set (Nawaz, 2010), requiring a time-consuming thorough analysis of financial statements, as it has been conducted for this thesis. Although it cannot provide a complete cost-benefit analysis of the MFI's performance, which would require special access to the financial information beyond the financial statements, it has been proven to be more reliable than the other approaches, which attempt to measure self-sufficiency, such as financial self-sufficiency (FSS) (Yaron & Manos, 2007).

Subsidies to MFIs are received from subsidized funds, and subsidized funds are public funds (Schreiner & Yaron, 2001). Hence the term subsidized funds is used interchangeably. However, the generally accepted terms subsidy dependence and SDI will not be altered but will be continued as established technical terms.

Schreiner and Yaron state that “by definition, only public funds can be subsidized, and private funds, regardless of their price, are not subsidized” (Schreiner & Yaron, 2001). The type of subsidized fund, including, e.g., outright gifts and payments in-kind (see [table 4](#)), is irrelevant to this differentiation. However, exemptions for private funds with a public character are tax-exempt contributions or liabilities whose market prices are affected by a state guarantee. In the interest of data access and comparability, the author excluded funds from private sources, with the exemption of obviously publicly controlled private donors. Consequently, when the financial statements are unclear on whether the source of a fund is public, publicly controlled, or private, the source is excluded, resulting in a tendency towards an underestimation rather than an overestimation when calculating received subsidies.

The calculation of the SDI is a two-step process. Its complexity lies in the first step, calculating the annual subsidy received ( $S$ ) (4.1), the SDI's numerator. The SDI does not depend on the type of subsidy received (Schreiner & Yaron, 2001) since it addresses equity grants and profit grants alike. In the second step, the subsidy will be compared with revenue from loans ( $LP \cdot i$ ) (2), derived from the financial statements, as the denominator.



The SDI equation is

$$\text{SDI} = \frac{\text{subsidy}}{\text{revenue from lending}} \quad (2)$$

where

$$\text{SDI} = \frac{\text{subsidy}}{\text{revenue from lending}} = \frac{S}{LP * i} \quad (2)$$

In order to compare MFIs, the SDI measures the percentage increase in the MFI's revenue from lending that would be required to reduce the subsidy (S) to zero, all else unchanged. Some authors refer to the unlikelihood that all else will be unchanged in the following financial year as a restriction of the SDI (De Aghion & Morduch, 2005), showing that Yaron's approach to measuring progress by decreasing dependence on subsidies over time (Yaron, 1994) is limited. However, the SDI serves well to compare MFIs' social cost in a short time frame (Schreiner & Yaron, 2001), i.e., a specific financial year, as done in this thesis.

The SDI can be positive, negative, or zero (Schreiner & Yaron, 1999, 2001). A positive SDI, e.g., of 1.0 means, that the MFI is subsidy dependent and that an increase in revenue from lending of 100 percent is required to compensate for all subsidies and make the SDI zero. In the opposite case of a negative SDI, the MFI would be defined as subsidy independent and, if the MFI receives subsidies, it would be able to compensate society for its opportunity cost.

An SDI of zero would mean that an MFI has achieved subsidy independence.

- $\text{SDI} > 0 \Rightarrow$  MFI is subsidy dependent
- $\text{SDI} \leq 0 \Rightarrow$  MFI is subsidy independent

Although technically incorrect, a MFI with a SDI above zero is sometimes referred to as not self-sustainable, and a MFI with a SDI of zero or below is referred to as self-sustainable. These claims need to be addressed carefully since the SDI, as stated above, does not measure sustainability directly, although it is considered a well-suited measure for sustainability (von Pischke, 1996).

## 5.2. Numerator (S)

The subsidy (S) of each MFI includes all annual subsidies received (Yaron, 1992). Schreiner and Yaron (2001) list six types of subsidies, which are equally distributed to three equity grants (EG) and three profit grants (PG). Arguing that equity grants (EG) have a direct impact on the MFI's net worth without changing the reported accounting profit in the reporting period directly, and profit grants (PG) have a direct impact on the accounting profit by either or both inflating revenues and deflating expenses, they argue to include all six types of subsidies, in order to not underestimate the MFI's dependence on subsidies.

**Table 4 - Types of subsidized funds**

Type of subsidized funds	Notation	Type of grant
Direct grant	DG	Equity grant
Paid-in capital	PC	Equity grant
Revenue grant	RG	Profit grant
Discount on public debt	$A^*(m-c)$	Profit grant
Discount on expenses	DX	Profit grant
True profit	TP	Equity grant

Source: (Schreiner & Yaron, 2001)

Direct grants (DG) are cash gifts and gifts in kind and, implying proper accounting, are easy to measure. Paid-in capital (PC) includes shares sold to public donors, such as governments, central banks, and public funds. Technically gifts in kind are not subsidies but are relevant to understanding the overall social costs of MFIs' subsidy dependence. True profit (TP) is a different form of equity grant (EG) since it is defined as accounting profit (P) minus the sum of all profit grants (PG) in order to retrieve "the change in retained earnings that would obtain in the absence of profit grants" (Schreiner & Yaron, 2001) and is often forgotten.

Profit grants (PG) do not depend on the MFI's performance and can easily influence traditional financial profitability ratios such as the return on equity (ROE), but the SDI ignores this challenge by assuming the same effect of profit grants and equity grants on MFI performance. Revenue grants (RG) are cash gifts like direct grants (DG) but with an accounting choice to record them as revenue.

Discount on public debt ( $A^*(m-c)$ ) is public debt times the opportunity cost of public debt minus the rate actually paid by the MFI, where  $m$  is the opportunity cost of subsidized capital or public debt and  $c$  is the rate actually paid by the MFI. The average rate paid for public debt can be calculated as the average expense for

interest for public debt divided by average public debt. It is not strictly a subsidy by itself but a discount on subsidized debt.

$$c = \frac{\text{expense for interest for public debt}}{\text{average public debt}} \quad (3)$$

Discounts on expenses (DX) are paid by public donors as a third party. They include mainly technical help, free deposit insurance, coverage of organization costs, feasibility studies, debt guarantees, consultant fees, and travel and education expenses for employees and are often difficult to track (Schreiner & Yaron, 2001). Hence, they will be defined as zero if not explicitly stated as discounts on expenses (DX) in the financial statements. As direct grants (DG), they are technically not subsidies but are relevant to understanding the overall social cost of MFIs.

Grants, including non-monetary grants, such as office equipment and small inventory, are recognized by most MFIs from the sample only when there is reasonable assurance that the MFI will comply with all conditions attached to the grant and the grant will be received.

Yaron combines all aforementioned subsidies in the Subsidy Dependence Index numerator (5), where K is revenue grants (RG) and discounts on expenses (DX) combined.

$$S = A * (m - c) + [(E * m) - P] + K \quad (4.1)$$

This can also be rewritten as

$$S = m * E + A(m - c) + K - P \quad (4.2)$$

Where

- S := Annual subsidy received<sup>11</sup>
- m := Opportunity cost of subsidized capital
- E := Average equity
- A := Average public debt
- c := Rate paid for public debt
- K := Revenue grants and discounts on expenses
- P := Accounting profit

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<sup>11</sup> The numerator of the SDI includes various forms of subsidized funds entrusted to the MFI, which technically are not subsidies but are relevant to define the MFIs' overall social cost, e.g., by discounts on public funds or payments in kind. In line with Yaron's publications on the SDI, the term subsidy is generally used in this publication to stick with the accepted terminology.

Considering that

$$K = RG + DX \quad (5)$$

K can be omitted, and subsidy (S) "can be seen as the sum of the opportunity cost of the net worth [...] and of profit grants, less the accounting profit available to compensate for this cost" (Schreiner & Yaron, 1999).

Taking further into account that equity (E) equals the average of the sum of the equity start stock ( $E_0$ ) and the end stock ( $E_1$ ), (E) can be rewritten as  $E_0 + \frac{\Delta E}{2}$ . Since  $\Delta E$  can be defined as the sum of equity grants and profit grants (4.2) has been rewritten as

$$S = m * E_0 + \left(\frac{m}{2}\right)[DG + PC + A(m - c) + RG + DX + TP] - TP \quad (4.3)$$

In this formula, subsidy equals the unpaid social opportunity cost less profit generated from the MFI's operations. For a systematic derivation see (Schreiner & Yaron, 1999).

Subsidy is broken down into three terms (Schreiner & Yaron, 2001), which are the opportunity cost of the subsidies used by the MFI throughout the year (6), the opportunity cost of the fresh subsidies which the MFI received throughout the year (7), and the true profit which the MFI would record without having received subsidies (8).

The opportunity cost of the subsidies used throughout the year:

$$m * E_0 \quad (6)$$

The opportunity cost of the fresh subsidies received throughout the year:

$$\left(\frac{m}{2}\right)[DG + PC + A(m - c) + RG + DX + TP] \quad (7)$$

True profit that would have been recorded without subsidies:

$$TP = P - (RG + A * (m - c) + DX) \quad (8)$$

Plugging (8) into (4.3), the subsidy can be calculated for an MFI in any given financial year.

### 5.3. Negative and positive subsidies

A positive annual subsidy received is just as likely as a negative one. However, equation 4.3 covers extreme scenarios. Theoretically, it would be possible for an MFI to not receive any subsidized funds during the previous or current financial year but still show a positive annual subsidy received due to (8) taking into account accounting loss. One could argue that an accounting loss in a financial year with no equity start stock would lead to bankruptcy, and therefore the MFI is supported by society. In these extreme scenarios, the informative value of the calculation should be evaluated critically. Of course, the annual subsidy received can be negative, which would be the case if an MFI did not receive any subsidized funds and made an accounting profit, making it an extreme but highly likely scenario.

### 5.4. Limitations

#### Reduced tax/ tax exemption:

Although the accounting profit is included in the calculation of the subsidy, the issue of favorable or even unfavorable tax regulations remains a challenge in the discussions of the SDI. In order to account for granted tax exemptions, even profound knowledge of the applicable tax code and the stated purpose of the MFIs would not be enough since the issue of pending lawsuits and inconsistent or flawed application of the applicable tax code, willingly or unwillingly, cannot be accounted for, mainly since some MFIs conduct business in challenging legal environments. While some MFIs are partially or entirely exempt from payment of income and other taxes under a country's tax code, others might not be exempt due to their registration. For example, an MFI can be registered as an NGO in Uganda, which is involved in charitable activities and therefore falls within the definition of exempt organizations for tax purposes as described in the national income tax act. In some countries, special arrangements exist based on the origin of the public debt. In Palestine, for example, USAID Projects can be awarded a zero V.A.T. status by authorization of the Minister of Finance, as is the case for the MFI "VITAS PSE".

Average public debt:

Average public debt (A), also referred to as public debt, is the average of all concessionary borrowed funds from public donors, i.e., funds with favorable interest rates and repayment terms, from the previous and the current financial year. These funds can be received from the government, government agencies, and similar bodies, whether local, national, or international, so far as they use public sources (see [appendix 1](#) for a list of the most prominent public donors for the sample for the financial years 2008 and 2009). Although negative public funds based on interest rates above market rates or even bribes and kickbacks are generally possible, they would be against the definition of favorable interest rates and conditions. Public debt is always calculated as an average over all borrowed funds within the financial year, based on the value at the end of the previous financial year ( $A_{t-1}$ ) and the current year ( $A_t$ ). No negative values have been reported within the underlying sample for this thesis.

Mandatory deposits:

Most countries by law require mandatory deposits at the central bank from banks, including MFIs, to meet legal reserve requirements. Based on the associated interest rate, one could define these deposits as negative or positive subsidies since countries with high inflation rates require deposits in local currencies. A reason to define the reserve amounts as subsidies for the microfinance industry could be that the amount is often determined by defined percentages of minimum share capital and customers' deposits, e.g., in Cambodia and Laos, which differ from regular banks. However, the SDI does not take an interest in these deposits.

Inflation:

Since “the SDI does not discount flows of funds” ([Schreiner & Yaron, 2001](#)), it is likely to be incorrect for countries with high inflation over long timeframes, which supports the author’s argument to apply it for a well-defined timeframe of one financial year, mainly since the SDI measures the increase in revenue from lending that would be required to reduce the subsidy to zero, all else unchanged.

### Lending rates:

Increasing lending rates above a certain threshold can lead to lower profits in case of adverse selection and moral hazard (Cull, Demirgüç-Kunt, & Morduch, 2007), leading to reduced applicability of the SDI in extreme scenarios.

### Opportunity cost of subsidized funds:

While the subsidies from the current financial year have average opportunity costs of  $m/2$ , the average opportunity costs for the sum of all previous financial years is  $m$ . Since the specific share of equity derived from subsidies remains unclear, an error margin cannot be overcome by the SDI's estimation without access to the complete previous data of an MFI and leaves room for improvement.

## 5.5. Opportunity cost of subsidized capital (m)

The opportunity cost of subsidized capital (m) is the interest rate the MFI would have to pay if it had no access to concessionary borrowed funds. It is the bank rate that usually meets the short- and medium-term financing needs of the private sector in the MFI's country of operation.

Selecting the opportunity cost of subsidized capital (m) is a crucial component of enabling reliably comparable subsidy dependence indices (SDI) in an international data set with different economic frameworks and legal systems. Different types of MFIs, such as banks, rural banks, credit unions and cooperatives, non-banking financial institutions (NBFIs), and non-governmental organizations (NGOs), setting different priorities on profitability and possessing heterogeneous capital structures are a challenge. [Table 5](#) gives an overview of the distribution of the types of MFIs within the underlying sample for this thesis.

**Table 5 - Types of MFIs**

Current Legal Status	Freq.	Percent	Cum.
Bank	19	8.48	8.48
Credit Union / Cooperative	7	3.13	11.61
NBFI	98	43.75	55.36
NGO	86	38.39	93.75
Other	1	0.45	94.20
Rural Bank	13	5.80	100.00
Total	224	100.00	

Source: author's own compilation

Manos and Yaron, for example, see arguments against “applying a ‘one size fits all’ rule in selecting the opportunity cost” (Manos & Yaron, 2008), in particular deposit interest rates, based on the different likelihood of subsidized and unsubsidized MFIs to obtain funds based on deposit interest rates at all. Taking this argument into account would result in an increasing amount of sub-samples with decreasing possibilities for research, but the authors make the case themselves that the impact of using, for example, the deposit rate would only be relevant in the extreme cases of highly profitable MFIs. Considering the general difficulty of finding a proxy for the opportunity costs, the deposit rate is still well accepted and frequently applied.

In order to reduce the risk of applying a ‘one size fits all’ proxy in the whole sample for the opportunity cost of subsidized capital, which is most likely inappropriate for at least some MFIs, this thesis applies the lending interest rate from the World Development Indicators<sup>12</sup>. The World Bank Group (Group, 2020a) defines the lending interest rate as the bank rate that usually meets the private sector's short- and medium-term financing needs. This rate is usually differentiated according to the creditworthiness of borrowers and the objectives of financing. Hence the lending interest rate on a national level is only the most likely approximation to each MFI's real interest rate, which remains unknown. The terms and conditions attached to these rates also differ by country. However, applying it to MFIs representing an industry with similar objectives of financing improves their comparability.

However, Manos and Yaron rightly address the possibility that “poorly performing and highly levered MFIs are likely to face an even higher rate to compensate for their high risk” (Manos & Yaron, 2008) than the lending interest rate, which is an argument that can be addressed to improve the quality of research further.

## 5.6. Denominator (LP*\*i*)

The common denominator is revenue from loans (LP*\*i*). While in principal many other items from the financial statement relating units of dollars per unit of time could be

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<sup>12</sup> Lending interest rate data has been downloaded from the World Bank's "World Development Indicators" as of May 17<sup>th</sup>, 2020, at <https://data.worldbank.org/indicator/FR.INR.LEND?locations=BD&view=map&year=2006>. World Bank defines the lending interest rate as “the bank rate that usually meets the short- and medium-term financing needs of the private sector. This rate is normally differentiated according to creditworthiness of borrowers and objectives of financing. The terms and conditions attached to these rates differ by country, however, limiting their comparability.”

Due to insufficient data, lending rates (foreign currency) have been added for the year 2009 for Cambodia, Poland, and El Salvador from the International Monetary Fund's (IMF) as of May 19<sup>th</sup>, 2020 at <https://data.imf.org/regular.aspx?key=61545855>, based on the Fund's principal statistical data set “International Financial Statistics”. For Palestine, the lending rate had to be derived from IMF. 2012. *International Financial Statistics CD-ROM (IFS CD-ROM)*. In I. M. F. S. Dept. (Ed.), Ver. 1.2.130 ed.



applied, such as average equity or average assets, Schreiner and Yaron argue (2001) for revenue from loans based on four assumptions:

- 1) Interest rates are often set by the MFI, donors, or the government. Since demand for loans outstrips supply, interest rate hikes do not have a negative impact on demand to small lenders. Efficient MFI are also not affected by changes if they charge sufficiently to cover their long-term costs.
- 2) Chances of survival increase if public funds are cut in the long term since revenues from loans can cover the cost of private funds more efficiently.
- 3) “Revenue from loans is the biggest item in the income statement and usually exceeds all other operational sources of income combined” since lending is the prime activity. Most MFIs “cannot reduce expenses or increase” non-loan “income enough to compensate for subsidies, so higher prices for loans may be the best option, at least in the short term.”
- 4) Applying revenue from loans as the denominator places the subsidy in the context of the MFI’s size.

Assumption 1 is particularly relevant since it applies particularly to small borrowers, which are the main customer group of MFIs and have little bargaining power or alternatives for funding. However, it contradicts MFIs’ double mission so far, as maximizing profits can hinder the social mission of maximizing credit access for the poor, in particular for special interest groups such as micro-entrepreneurs, women, and the relatively poor (Pearl & Phillips, 2001), in order to support income-generating activities in the rural non-formal sectors through self-employment. While MFIs have a double mission, the consequences of debt and equity holders’ incentives within capital structure theories must be analyzed for social and financial goals. Of particular interest is the fundamental conflict of social incentives and value-increasing financing choices, which seems to contradict the assumption of capital structure theory that firms act to maximize the present value of current and future benefits to insiders (i.e., cash, wages, stocks, and options in the firm, and personal benefits such as perquisites). This is particularly interesting since Mersland and Strøm find no difference between non-profit organizations and shareholder firms in financial performance and outreach (Mersland & Strøm, 2009). Therefore, one must clarify if all investors and managers have the same incentives.

Assumption 2 seems to be a circular argument since only profitable MFIs can obtain private funding in the long run, which consequently should have a higher survival rate. However, over time cutting public funds, i.e., subsidized funds, could incentivize MFIs to aspire subsidy independence and thereby increase their chance of survival.

Assumption 3 is straightforward and accepted without restriction, particularly since the all else equal assumption supports the short-term view.

Assumption 4 is directly derived from the necessity to measure the subsidy to an MFI against its volume of business while accepting its explicit mission of lending to the poor. Applying other denominators, such as loan recuperation, deposit mobilization, or administrative costs, would contradict the intention of the SDI.

The fact that most research regarding the institutionalist approach only considers microcredit when conducting research on microfinance allows applying revenue from loans. If an MFI would, e.g., focus on insurance instead of loans, the SDI's informative value would be obliterated by applying revenue from loans as the denominator.

## 6. Sample and sample reduction

In order to gain relevant results, it is indispensable to apply profound and internationally comparable data across MFIs of different scales, regional focus, legal structure, financing sources, and mission statements based on established databases generally accepted in microfinance research. Thereby the author responds to the request to use qualified data to analyze microfinance questions ([Hartarska, 2005](#); [Hartarska & Nadolnyak, 2007](#); [Morduch, 1999a](#)). A well-established large-scale database for microfinance research ([Hartarska & Nadolnyak, 2007](#)), including high-quality longitudinal cross-country financial panel data of 3,039<sup>13</sup> MFIs

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<sup>13</sup> The following adjustments to the original data set have been conducted in the following order beforehand:

- 1) For 30 MFIs, the data set did not include the variables "Country", "Region", and "MFI Full Name" and had to be added manually. MFI ID: 100461, 101448, 101600, 101616, 102346, 104110, 104504, 116157, 116338, 122392, 126954, 132928, 132930, 133505, 141587, 143482, 143483, 149264, 150434, 152525, 152727, 152745, 152746, 152747, 165405, 166515, 167080, 167881, 169683, 176789. For 13 further MFIs, reliable data could not be found.
- 2) Quarterly reports have been omitted.
- 3) For three MFIs, the data for one fiscal year had to be combined from two separate entries: MFI ID: 100461, 114832, 169054.
- 4) For four MFIs, the fiscal year has been corrected, twice for two of them, due to obvious mistakes. None for or from the fiscal year 2009: MFI ID: 102661, 100184, 104306, 169054.

worldwide covering the years 1999 to 2019, used to be offered by MIX Market ([www.mixmarket.org](http://www.mixmarket.org)). MIX Market is a non-profit company that works to support the growth and development of the microfinance sector by providing detailed financial and social performance information from MFIs, and business information facilitators, donor organizations, and investors in microfinance. Although the database is well accepted, the self-reported data bears the risk of a self-selection bias with a likely tendency towards more developed MFIs. The original data set was transitioned from its source MIX Market to the World Bank's Data Catalog<sup>14</sup> in September 2019. It was downloaded from the World Bank's Data Catalog on February 12<sup>th</sup>, 2020 (<https://databank.worldbank.org/source/mix-market/>). The Data Catalog initially consists of four separate data sets<sup>15</sup>, including company metadata, social performance data, and financial performance data. All three, excluding financial performance data in local currencies, have been combined by the author based on the MFIs' identification numbers, names, and fiscal years.

To define the most promising financial year regarding the most extensive sample for this thesis rather than just the most recent data, the distribution of fiscal years with entries in the data set<sup>16</sup> was analyzed, resulting in the fiscal years 2011 (1,662 MFIs), 2010 (1,606 MFIs), 2014 (1,567 MFIs), 2009 (1,548 MFIs) and 2012 (1,529 MFIs) as the most promising ones.

Since the financial measurement is only as accurate as the data used and the MFIs in the database apply different methods for their calculation of "donations" and "donated equity", it was considered inadequate to rely on MIX Market's definitions to derive the subsidized funds and calculate the annual subsidy received (S). While some MFIs in the database include all donations as donated equity, others include only in-kind donations and donations for financing the gross loan portfolio or fixed

5) For 20 MFIs, annual report intervals changed during the year, resulting in doubles/triples in the original data. These MFIs have been reduced to the most complete annual reports. Only three of the affected MFIs' reported data for 2009. The 20 MFIs have been identified based on the variables "MFI ID" and "MFI Name": MFI ID: 100075, 100124, 100184, 100241, 100294, 100301, 100305, 100492, 100725, 100853, 101072, 101083, 101446, 102661, 102700, 104021, 104134, 137508, 176759, 169054.

<sup>14</sup> The term Data Catalog is sometimes preferred over the terms database and data set, particularly when referring to the World Bank Data Catalog as the original source; also, they can be used interchangeably.

<sup>15</sup> Original titles of the data sets: MIX Market MFI Company Metadata / MIX Market Social Performance Data set / MIX Market Financial Performance Data set in USD / MIX Market Financial Performance Data set in Local Currencies. All aforementioned Excel files can be found on the data drive in the folder "raw data".

<sup>16</sup> The complete distribution of financial years and residual MFIs is:

1999:	157	2000:	232	2001:	352	2002:	543	2003:	817	2004:	997	2005:	1,202
2006:	1,288	2007:	1,422	2008:	1,468	<b>2009:</b>	<b>1,548</b>	<b>2010:</b>	<b>1,606</b>	<b>2011:</b>	<b>1,662</b>	2012:	1,529
2013:	1,472	<b>2014:</b>	<b>1,567</b>	2015:	1,055	2016:	833	2017:	837	2018:	759	2019:	3

assets. It remains unclear in the database whether donations are restricted to a specific use or unrestricted revenue. However, it is imperative for the calculation of subsidies to have a consistent definition of the applied variables and reject flawed data.

Consequently, it became necessary to gather more detailed data than available in the underlying database and find the individual financial statements for the MFIs included in the reduced data set to gather enough data to calculate the annual subsidy received.

Since the variables equity (start stock) ( $E_0$ ), accounting profit (loss) ( $P$ ), and revenue from lending ( $LP^*i$ ) can be accepted from the data set without referring to the financial statements, and the variable opportunity cost of subsidized capital ( $m$ ) has been added from an external source (see [chapter 5.5](#)), the data set can be further reduced to the most promising financial years based on the data availability of equity (start stock) ( $E_0$ ), accounting profit (loss) ( $P$ ), revenue from lending ( $LP^*i$ ) and opportunity cost of subsidized capital ( $m$ ). Hence the most promising financial years are 2011 (980 MFIs), 2010 (978 MFIs), 2008 (963 MFIs), and 2009 (954 MFIs)<sup>17</sup>. Considering the availability of financial statements in English, the sample is reduced drastically, resulting in the financial year 2009 with the highest likelihood of enough data for 388 MFIs, including 224 MFIs with enough relevant data in their financial statements to calculate the annual subsidy received.

The financial statements for the financial year 2009 have been transferred from an older download of the MIX Market database by the author, followed by manual downloads of accessible financial statements from the MIX Market website over the time from June 22<sup>nd</sup> to October 13<sup>th</sup>, 2011<sup>18</sup>. The current version of the Data Catalog as of September 2019, no longer includes financial statements. The corresponding financial statements have been identified by combining the metadata for both databases and checking for the identical identification number of each MFI.

<sup>17</sup> The complete distribution of financial years and residual MFIs is:

1999:	0	2000:	1	2001:	1	2002:	1	2003:	132	2004:	269	2005:	1433
2006:	626	2007:	782	<b>2008:</b>	<b>963</b>	<b>2009:</b>	<b>954</b>	<b>2010:</b>	<b>978</b>	<b>2011:</b>	<b>980</b>	2012:	775
2013:	650	2014:	676	2015:	720	2016:	607	2017:	473	2018:	383	2019:	0

<sup>18</sup> The financial statements downloaded for each MFI from the sample, organized by country of operation and financial year, are on the data drive in the folder "financial statements by country and year".

The Data Catalog, as of February 12<sup>th</sup>, 2020, has been downloaded in USD and the local currencies, respectively<sup>19</sup>, to enable a calculation of an individual exchange rate for each MFI when adding data from the financial statements and in order to avoid deviations based on applying general exchange rates. To develop an exchange rate as adequate as possible, assets have been applied for the calculations as they are large entities from the financial statements. For MFIs that report their financial statements in USD and their local currency, the local currency is applied to calculate an exchange rate to avoid deviations from the exchange rate in the data set.

To confirm proper accounting, the financial statements of the MFIs have been checked for their auditors. 57.21 percent of the audited MFIs have been checked by internationally well-established firms or their regional representatives, with KPMG as the most strongly represented auditor (KPMG 17.91%, PwC 10.45%, Deloitte 7.96%, E&Y 7.46%, Grant Thornton 3.48%, BDO 3,48%, PKF Int. 1,99%, RSM 1.49%).

## 7. Exemplary calculation of the SDI

Subsidy (S) has been calculated based on data derived from the financial statements for the financial years 2008 and 2009 and the World Bank's Data Catalog<sup>20</sup> in order to calculate (4.3) for each MFI.

The direct grants (DG) have been derived directly from the financial statements and include all cash gifts and gifts in kind from public donors as included in the balance sheet. In contrast to direct grants (DG), revenue grants (RG) include only cash gifts from public donors and an accounting choice to record them as revenue, so they were mainly found in the income statement. Paid-in capital (PC) has been derived from public donors' nominal increase in share capital as captured in the financial statements. No distinction between preference and ordinary shares has been made. Discounts on expenses (DX) by public donors are rare in the examined MFIs. Assuming they were included correctly in the financial statements, a more extensive

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<sup>19</sup> To calculate the exchange rates, the following two versions of the same datasheet have been matched: USD: "mix-market-financial-performance-data set-in-usd" / Local currency: "mix-market-financial-performance-data set-in-local-currencies" (both downloaded as of as of February 12th 2020 at <https://databank.worldbank.org/source/mix-market/>).

<sup>20</sup> For a complete list of all MFIs, see [appendix 2](#)

scope of covering organization costs and specific expenses, such as consultant fees and travel costs, would be expected.

Equity (start stock) ( $E_0$ ) has been derived directly from the data set and is defined as equity at the end of the previous year, i.e., the residual interest in the assets of the MFI after deducting all its liabilities. The opportunity cost of subsidized capital ( $m$ ), the lending interest rate, has been applied as the bank rate that usually meets the short- and medium-term financing needs of the private sector in the MFI's country of operation (For a more detailed discussion see [Opportunity cost of subsidized capital](#) ). The opportunity cost of the subsidies used throughout the year can be calculated with (6).

In order to calculate the discount on the public debt ( $A*(m-c)$ ), public debt ( $A$ ) has been calculated as an average over the reporting period, i.e., a fiscal year based on the financial statements, by adding up borrowings from public funds at the end of the reporting period plus borrowings from public funds at the beginning of the reporting period ( $\frac{A_{t-1}+A_t}{2}$ ). The average rate paid for public debt ( $c$ ) (3) has been calculated as the interest expense on public debt divided by the average public debt ( $A$ ). The interest expense on public debt has been derived directly from the financial statements as the sum of all interest payments on public debt in the current financial year. In the rare cases where only a range for the interest rate on debt has been presented due to the combination of various loans, the higher interest rate has been applied, so the resulting interest rates for public debt favor underestimating the subsidies. In consequence, the discount on public debt can be calculated directly as  $A*(m-c)$  by inserting average public debt ( $A$ ), the opportunity cost of subsidized capital ( $m$ ), and the average rate paid for public debt ( $c$ ) into the equation.

To calculate the MFI'S true profit (TP), which would have been reported without subsidies, the accounting profit (loss) ( $P$ ) has been derived directly from the data set. The accounting profit (loss) ( $P$ ) is defined as the total of income less expenses, excluding the components of other comprehensive income. The data can now be inserted into (8) to retrieve the change in retained earnings that the MFI would obtain in the absence of profit grants.

Now we can calculate the opportunity cost of the new subsidies received throughout the year by applying (7) for each MFI and combining the formulas (6), (7), and (8) to

solve (4.3) and calculate each MFI's annual subsidy received (S) over the financial year 2009.

$$S = m * E_0 + \left(\frac{m}{2}\right)[DG + PC + A(m - c) + RG + DX + TP] - TP \quad (4.3)$$

Taking the financial revenue from loans as reported in the data set as revenue from lending (LP\*i), the Subsidy Dependence Index (SDI) (2) can be calculated. The financial revenues from loans are defined as “interest and non-interest income generated by the provision of credit services to the clients. Fees and commissions for late payment are also included” (Group, 2020b).

$$SDI = \frac{\text{subsidy}}{\text{revenue from lending}} = \frac{S}{LP * i} \quad (2)$$

Table 6 gives an overview of all variables used in the equations, including summary statistics for the sample.

**Table 6 - Variable descriptions and summary statistics**

Variable	Abbr.	Definition	Unit	Mean	Median	Min	Max
Opportunity cost of subsidized capital**	m	Bank rate that usually meets the short- and medium-term financing needs of the private sector in the MFI's country of operation. <sup>21</sup>	%	13.98977	13.32667	3.985	26.653
Equity (start stock)**	E <sub>0</sub>	Equity at the end of the previous year, i.e. the residual interest in the assets of the MFI after deducting all its liabilities (IAS 1)	USD	8,186,700	1,748,014	-784,609	251,715,749
Direct grant**	DG	Cash gifts and gifts in kind by public donors	USD	260,175.5	0	0	16,152,264
Paid-in capital**	PC	Shares sold to public donors	USD	124,552.8	0	0	10,446,645
Average public debt**	A	Average of all concessionary borrowed funds from public donors from the previous and the current financial year	USD	6,627,226	578,034.4	0	222,395,871
Discount on public debt**	A*(m-c)	A*(m-c)	USD	467,597.7	9,033.119	-688,313	13,009,504
Revenue grant**	RG	Cash gifts by public donors, like direct grants (DG), but with an accounting choice to record them as revenue	USD	43,579.68	0	0	2,754,815
Discount on expenses**	DX	Discount on expenses by public donors, such as technical help, free deposit insurance, coverage of organization costs, feasibility studies, debt guarantees, consultant fees, and travel and education expenses for employees	USD	737.6461	0	0	165,232
Sum of all other subsidies received**	K	Sum of revenue grants (RG) and discounts on expenses (DX)	USD	44,317.33	0	0	2,754,815

<sup>21</sup> <https://data.worldbank.org/indicator/FR.INR.LEND?locations=BD&view=map&year=2006>

		combined as calculated in the original SDI equation					
Accounting profit (loss)**	P	The total of income less expenses, excluding the components of other comprehensive income*	USD	510,267.6	92,162.5	- 10,100,00 0	59,144,524
True profit**	TP	$P - (RG + A^*(m - c) + DX)$	USD	- 1,647.375	19,323.28	- 15,800,00 0	58,887,167
Average rate paid for public debt**	c	Expense for interest for public debt in the current financial year / Average public debt (A)	%	4.8140	3.7971	0	46.4916
Revenue from lending***	LP*i	Interest and non-interest income generated by the provision of credit services to the clients. Fees and commissions for late payment are also included*	USD	7,646,002	1,860,512	4,878.07	171,812,129
Average loan portfolio (net)***	LP	Value of loan portfolio net of impairment loss allowance and unearned income and discount*	USD	32,400,00 0	6,698,349	0	789,294,661
Yield on loans***	i	$(LP*i)/LP$	%	34.99311	28.23466	2.23873	454.0189
Annual subsidy received**	S	$m * E_0 + \left(\frac{m}{2}\right)[DG + PC + A(m - c) + RG + DX + TP] - TP$	USD	1,222,683	192,341.6	- 17,200,00 0	24,509,013
Subsidy Dependence Index**	SDI	$\frac{S}{LP * i}$	N/A	0.56458	0.14525	-0.47558	20.39706

\* as defined in "mix-market-financial-performance-field-definitions" / \*\* N=224 / \*\*\* N=223 / \*\*\*\* N=222

Source: author's own calculations<sup>22</sup>

As revenue from lending is defined as financial revenue from loans, we can also calculate the yield on loans (i) by dividing revenue from lending (LP\*i) by the average loan portfolio (net) (LP), which is included in the data set as the net loan portfolio, the value of loan portfolio net of impairment loss allowance and unearned income and discount.

An exemplary calculation will be shown based on data from the Mongolian MFI "Credit Mongol".

The MFI is in the data set, and the data is available both in USD and the local currency for the financial years 2009 and 2008, and a calculation of the exchange rates, which aligns with the data set, was therefore possible. The assets in 2009 amounted to USD 4,623,342 (MNT 6,622,936,788) and USD 4,954,930 (MNT 6,315,058,821) in 2008, resulting in an exchange rate of 1: 1,432.4998, or 1: 1,274.5001, which is consistent with other MFI from Mongolia within the sample. Data on equity (start stock) ( $E_0$ ) for 2009 (USD 1,728,682) exists, and data on the lending

<sup>22</sup> Excel files with the combined data, based on the original data files, can be found on the data drive. The file "Final Excel data" includes the final Excel data, the file "Combined data including SDI calculations.xlsx" includes the intermediary calculations of the SDI, and the required data.



interest rate as a proxy for the opportunity cost of subsidized capital ( $m$ ) exists in the World Bank's "World Development Indicators" as for Mongolia in 2009 and is 0.21667. An audited financial statement for the financial year 2009, including relevant data on 2008, was confirmed. The end of the financial year in the data set is equivalent to the financial statement, December 31<sup>st</sup>, for both 2009 and 2008. The auditing company is Dalaivan Audit, a Baker Tilly International member company. Consequently, it was possible to calculate the required data missing in the data set.

The Opportunity cost of subsidized funds ( $m \cdot E_0$ ) throughout the year (6) has been calculated as 374,553 USD. Direct grants (DG) are USD 616,043, derived from the balance sheet, including donated capital in the local currency, including MNT 838,586,000 from the European Union's TACIS<sup>23</sup> program and MNT 43,895,800 from Germany's "Kreditanstalt fuer Wiederaufbau" (KfW). The Paid-in capital (PC) was zero since no shift in the shareholder structure has been reported, and overall share capital is reported as MNT 501,000,000, equal to the previous financial year. Revenue grants (RG) are USD 31,273 from the United Nations Development Programme (UNDP) to compensate expenses for the "Project of Financial services in remote rural areas", implemented by funds of the British Government. Since these expenses are more likely to be based on revenue-generating business activities, they are defined as revenue grants instead of discounts on expenses. No direct Discounts on expenses by public donors (DX) have been reported. Average public debt (A) of USD 736,450 has been calculated as an average over public debt at the end of the previous and the current fiscal year. The data has been derived from the balance sheet, applying the exchange rate for the previous and the current year's data. Public debt for both years includes only long-term loans, MNT 70,000,000 from the World Bank and MNT 843,408,600 from KfW (2009) and MNT 158,372,500 and MNT 906,176,400 (2008) from the same donors. In order to calculate the average rate paid for public debt (c), the interest expense on public debt for each relevant loan has been calculated based on the related interest rate or payment stated in the financial statement. The loan from the World Bank bears annual interest of 8.1 percent. For the loan from KfW, MNT 62,786,300 were settled for the reporting period. In total, USD 47,788 was paid as interest expense on public debt in 2009 on the average public debt (A) of USD 736,450, equal to an average rate paid for public debt (c) of

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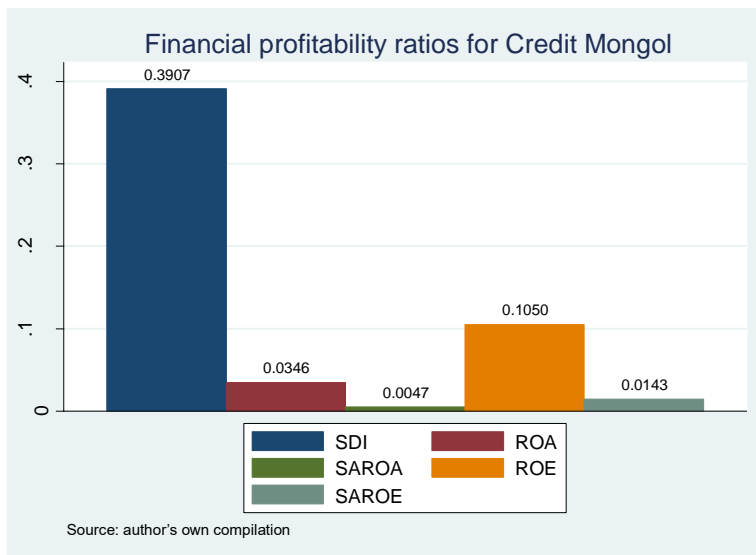
<sup>23</sup> "Technical Assistance to the Commonwealth of Independent States" program, as well as Mongolia, by the European Commission

6.489 percent. Consequently, the discount on public debt ( $A*(m-c)$ ) could be calculated as USD 111,778. Before calculating the opportunity cost of the new subsidies received throughout the current year, the true profit (TP) that would have been recorded without subsidies was calculated by plugging the reported accounting profit (P) (USD 165,695) from the data set and the calculated data into (8), resulting in a total profit of USD 22,644 for 2009. We can now plug all the data into (4.3) to calculate the annual subsidy received (S) as USD 436,598. In order to derive the SDI, we only need to take the annual subsidy received (S) as the numerator and revenue from lending ( $LP*i$ ) as the denominator and calculate (3), resulting in 0.391 as the SDI. Revenue from lending is financial revenue from loans, i.e., USD 1,117,457, as taken directly from the data set and defined as interest and non-interest income in 2009 generated by providing credit services to the clients, including fees and commissions for late payment. The resulting SDI of 0.391 means that the MFI “Credit Mongol” is subsidy dependent and currently not self-sustainable. All else constant, it would require an increase in the revenue from lending of 39.07 percent in order to compensate for all subsidy received.

All data plugged in (2) shows the detailed exemplary calculation of the annual subsidy received (S) and the subsidy dependence index (SDI) for the financial year 2009:

$$\begin{aligned}
 SDI &= \frac{S}{LP * i} = \frac{m * E_0 + \left(\frac{m}{2}\right)[DG + PC + A(m - c) + RG + DX + TP] - TP}{LP * i} \\
 &= \frac{0.21667 * 1,728,682 + \left(\frac{0.21667}{2}\right)[616,043 + 0 + 111,778 + 31,273 + 0 + 22,644] - 22,644}{1,117,457} \\
 &= \frac{436,599}{1,117,457} = 0,390707507
 \end{aligned}$$

[Fig. 6](#) shows the SDI compared to the conservative financial profitability ratios ROA and ROE, including their subsidy-adjusted versions. The SAROA and the SAROE indicate that the subsidies severely impact the MFI’s financial sustainability. An equal picture can be seen for the entire sample. The SDI confirms subsidy dependence, indicating a likely lack of financial self-sustainability.

**Fig. 6 - Financial profitability ratios for the MFI Credit Mongol**

Source: author's own compilation

## 8. Descriptive sample analysis regarding the MFIs' SDI status

To get an overview over the MFIs' subsidy dependence [table 7](#) shows a complete list of all 223 MFIs by their respective subsidy dependence indices (SDI) in descending order, indicating a clear tendency in the sample. SDI values are considered a proxy for the sustainability status of the respective MFI. While SDI values above zero are defined as subsidy dependent, SDI values at zero or below are considered subsidy independent. The underlying sample includes some extreme cases of subsidy dependence with SDI values between 5.405 and up to 20.397, which are clear outliers. Such high dependences generally depend on an MFI's unfavorable ratio of the annual subsidy received ( $S$ ) and its revenue from lending ( $LP^*i$ ). However, it does not say anything per se about an MFI's intentionality regarding its sustainability efforts. Subsidy independence is not as extreme, with SDI values not lower than -0.476. To better understand the sample, the ten most extreme cases of subsidy independence with SDI values of -0.205 and below will be compared to the outliers of subsidy dependence.

Calculations have been conducted as in the exemplary calculation in [chapter 7](#), based on the original data from the World Bank's Data Catalog. The results of all interim calculations are shown in detail in [appendix 3](#), including all results of annual subsidies received ( $S$ ) and the resulting SDIs.

**Table 7 - Overview of all MFIs' SDI values**

#	MFI	SDI	#	MFI	SDI	#	MFI	SDI	
1	SRSP	20.397	70	ABS-CBN	0.305	149	RB Pagbilao	0.032	
2	SV Creditline	14.38	71	EKI	0.294	150	Indur MACS	0.031	
3	KOPSA	11.949	72	ProCredit Bank - MKD	0.286	151	Sonata	0.031	
4	Nidan	9.577	73	HEED	0.282	152	CreditAccess Grameen	0.029	
5	U Micro-finance	9.227	74	FINCA - JOR	0.28	153	SEWA MACTS	0.027	
6	Farm Credit Armenia	6.324	75	IDYDC	0.275	154	Finance Trust	0.027	
7	FINCA - AFG	5.405	77	VisionFund Kenya	0.262	155	PAWDEP	0.026	
8	WWI - AFG	2.176	78	Opportunity Uganda	0.261	156	ProCredit Bank Serbia	0.026	
9	Pak Oman	1.87	79	Orangi	0.255	157	OXUS - AFG	0.024	
10	FINCA Pakistan	1.795	80	FINCA - Russia	0.254	158	TSPI	0.021	
11	T-O-M	1.432	81	XacBank	0.243	159	JFSL	0.018	
12	Fonkoze Financial Services, S.A. (SFF)	1.37	82	KEP	0.24	160	Fundusz Mikro	0.016	
13	Letshego KEN	1.355	83	SDC	0.236	161	SVSDF	0.008	
14	MADRAC	1.346	84	LIDER	0.235	162	Nav Bharat	0.005	
15	Swadhaar	1.293	85	MCO OXUS - TJK	0.235	163	HKL	0.003	
16	MIKRA	1.235	86	KredAqro NBCO	0.229	164	FINCA - AZE	0.002	
17	CUMO	1.149	87	MI-BOSPO	0.225	165	ASHI	-0.002	
18	FinAgro	1.135	88	PPSS	0.224	166	MCF Borshud	-0.005	
19	Aiyl Bank	0.939	89	Partner	0.215	167	Arohan	-0.013	
20	FMFB	0.898	90	IPR	0.215	168	TMSS Micro Credit	-0.019	
21	Reliance	0.849	91	Wave	0.213	169	Milamdec	-0.022	
22	CSC	0.844	92	FMFB - AFG	0.211	170	BRAC Bangladesh	-0.023	
23	Telenor Microfinance	0.836	93	BESA	0.209	171	New RB of Victorias	-0.023	
24	Patria Credit	0.822	94	ICNW	0.208	172	RB Talisayan	-0.025	
25	Arthacharya	0.818	95	PRASAC	0.204	173	RB Camalig	-0.026	
26	BEES	0.775	96	BASTOB	0.201	174	NWTF	-0.031	
27	BIMAS	0.69	97	KIF	0.195	175	Letshego RWA	-0.032	
38	ProCredit Bank - ARM	0.689	98	WMN (Russia)	0.194	176	Sathapana Bank	-0.034	
39	Lak Jaya	0.681	99	KAMURJ	0.181	177	NongHyup Finance Plc	-0.036	
30	OMRO	0.677	100	Faulu MFB	0.176	178	FINCA - MEX	-0.043	
31	Khushhali Bank	0.663	101	CDBD Cooperative	0.175	179	KCCDFI	-0.046	
32	VisionFund Uganda	0.65	102	Sajida	0.168	180	FAIR Bank	-0.051	
33	BRAC - AFG	0.624	103	NOA - ALB	0.165	181	Bangko Luzon	-0.051	
34	ASALA	0.611	104	Mikrofond	0.163	182	RGVN	-0.054	
35	RRF	0.599	105	Thardeep	0.162	183	Serviamus	-0.054	
36	RDRS	0.559	106	FINCA - UGA	0.161	184	Vitas s.a.l.	-0.058	
37	BTA Bank	0.531	107	JSC Bank Constanta	0.161	185	Star Microfin	-0.059	
38	Sunrise	0.528	108	Agrocredit Plus	0.157	186	Alwatani (National Microfinance Bank)	-0.071	
39	CFA	0.526	109	FMF-E	0.157	187	RB Guinobatan	-0.072	
40	Agroinvestbank	0.512	110	ECLOF - PHL	0.155	188	GLOW	-0.072	
41	Microinvest	0.509	111	BRAC Pakistan	0.146	189	Nano	-0.077	
42	Sungi	0.496	112	CBIRD	0.145	190	Uttrayan Financial	-0.078	
43	Nor Horizon	0.483	113	SEF-ZAF	0.134	191	PATRA Yanbian	-0.079	
44	SEWA Finance	0.482	114	UNRWA\Palestine	0.134	192	Lazika Capital	-0.082	
45	TuranBank	0.477	115	BRAC - UGA	0.132	193	ASA Philippines	-0.098	
46	Apna Microfinance	0.462	116	Safco Support	0.128	194	BRAC - LKA	-0.101	
47	Berendina Micro Investment	0.461	117	IDF	0.123	195	RASS	-0.101	
48	VITAS IFN SA	0.442	118	Grameen Bank	0.121	196	RORES	-0.104	
49	FINCA - SLV	0.435	119	WB Finance	0.113	197	KixiCredito	-0.105	
50	First MicroFinance Company	0.435	120	MIKROFIN	0.112	198	CEOSS	-0.108	
51	Vision Fund TZA	0.431	121	Kompanion	0.109	199	MFW	-0.114	
52	OBS	0.43	122	Khan Bank	0.107	200	Vitas JOR	-0.116	
			123	ProCredit Bank - ALB	0.101	201	Adhikar	-0.125	
			124	Society for Social Services	0.1	202	Cantilan Bank	-0.126	
			125	Growing Opportunity Finance	0.099				
			126	National Rural	0.092				

53	ASA Pakistan	0.427	127	Chamroeun	0.087	203	VITAS PSE	-0.135
54	Credit Mongol	0.391	128	Crystal	0.085	204	FINCA - TZA	-0.137
55	Phoenix +	0.39	129	FINCA - ZMB	0.081	205	Kasagana-Ka	-0.138
56	FINCA - GEO	0.386	130	CEVI	0.074	206	Paglaum Cooperative	-0.139
57	ProCredit Bank - ROM	0.383	131	Elet-Capital	0.068	207	Equity Bank KEN	-0.139
58	LOK Microcredit Foundation	0.382	132	PRIZMA	0.068	208	RB Lebak	-0.141
59	KRK Ltd	0.38	133	Seilanithih	0.062	209	AgroInvest - Serbia	-0.142
60	WDFH	0.378	134	Jagorani Chakra	0.059	210	RB Solano	-0.147
61	RIC	0.376	135	AfricaWorks	0.058	211	BWDA	-0.152
62	Mikro ALDI	0.363	136	Azeri Star	0.051	212	RAFI Micro-finance	-0.174
63	JWS	0.36	137	RB Bagac	0.05	213	Moris Rasik	-0.187
64	VSSU	0.359	138	Mol Bulak Azerbaijan	0.048	214	Al Majmoua	-0.205
65	MUL	0.358	139	FinDev	0.047	215	Pustikar	-0.214
66	GGEM Microfinance Services Ltd.	0.358	140	Maxima	0.047	216	CBMO	-0.214
67	DemirBank	0.353	141	BRAC - TZA	0.046	217	TYM	-0.237
68	SINERGIJA	0.341	142	NCS	0.044	218	Sarala	-0.274
69	Women for Women	0.326	143	KREDIT	0.043	219	Future Financial	-0.278
			144	Mol Bulak Finance	0.042	220	PATRA Hunchun	-0.329
			145	BURO Bangladesh	0.04	221	Kotalipara	-0.379
			146	ECLOF - KEN	0.039	222	SPBD Samoa	-0.474
			147	AFK	0.035	223	Microloan Foundation Malawi	-0.476
			148	Mimo Finance	0.035			

Source: author's own compilation

Based on the calculation of the annual subsidy received (S) to derive the SDI, we can see that most MFIs from the sample are subsidy dependent (see [table 7](#) and [table 8](#)) with a mean SDI of 0.5645831. All else constant on average, an increase in the revenue from lending of 56.46 percent would be necessary to compensate for all subsidy received.

**Table 8 - SDI distribution**

Subsidy dependence index (SDI)				
	Percentiles	Smallest		
1%	-.3792326	-.4755836		
5%	-.1739858	-.4736665		
10%	--.1247461	-.3792326	Obs	223
25%	-.0191032	-.3293627	Sum of Wgt.	223
50%	.1452516		Mean	.5645831
		Largest	Std. Dev.	2.106618
75%	.3857745	9.576683		
90%	.8357167	11.94897	Variance	4.43784
95%	1.370471	14.3805	Skewness	6.559015
99%	11.94897	20.39706	Kurtosis	50.96986

Source: author's own compilation

A median of 0.1452516 indicates that the distribution is skewed to the right. Since we can see similar data for the annual subsidy received (S) with a mean of 1,222,683 and a median of 192,341.6, the MFIs were looked at separately by their legal status regarding their SDI indices, annual subsidy received, and number of active borrowers (see [table 9](#)). After dropping four observations for lack of data on active borrowers and one observation for missing data on the revenue from lending (LP\*i), the sample

shows substantially different SDI indices by legal status, with only rural banks being subsidy independent on average.

**Table 9 - MFI by their legal status**

Legal status	SDI	Annual subsidy received	Active borrowers	
Bank		114,351,223	7,965,030	<i>sum</i>
	<b>0.3696</b>	6,352,846	442,502	<i>mean</i>
	18	18	18	<i>n</i>
Credit Union / Cooperative		-208,049	381,334	<i>sum</i>
	<b>0.0503</b>	-29,721	54,476	<i>mean</i>
	7	7	7	<i>n</i>
NBFI		119,251,207	3,353,409	<i>sum</i>
	<b>0.8754</b>	1,216,849	34,218	<i>mean</i>
	98	98	98.00	<i>n</i>
NGO		16,449,007	11,554,497	<i>sum</i>
	<b>0.3921</b>	198,181	139,211	<i>mean</i>
	83	83	83.00	<i>n</i>
Other		527,576	9,813	<i>sum</i>
	<b>0.1340</b>	527,576	9,813	<i>mean</i>
	1	1	1.00	<i>n</i>
Rural Bank		-2,712,669	276,947	<i>sum</i>
	<b>-0.0663</b>	-208,667	21,304	<i>mean</i>
	12	13	13.00	<i>n</i>
Total		247,658,296	23,541,030	<i>sum</i>
	0.5693	1,125,720	107,005	<i>mean</i>
	219	220	220.00	<i>N</i>

Source: author's own compilation

Regarding the outliers for subsidy dependence with SDI values of 5.405 and above, we can see that six<sup>24</sup> out of seven are NBFI, receiving on average the second-highest amount of annual subsidy with 1,216,849 USD and, regarding the specific subsample of six MFIS, on average 1,268,488.20 USD. With the seventh outlier being an NGO, a not-for-profit legal structure is among the lowest performers. This seemingly obvious result is disturbed by the fact that among the ten most subsidy independent MFIs are six NGOs<sup>25</sup>, two NBFI<sup>26</sup>, one Rural Bank<sup>27</sup>, and one Credit Union<sup>28</sup> indicating that a not for -profit legal structure is not per se an indicator of an MFI's potential to achieve subsidy independence.

Separating the sample by region (see [table 10](#)) shows severe differences in SDI indices. Only the East Asia and the Pacific region are subsidy independent on average, which can be expected due to its long-standing existence in a comprehensive market.

<sup>24</sup> MFI ID: 100154, 100633, 101198, 102464, 102860, 115218

<sup>25</sup> MFI ID: 100024, 100205, 100724, 101723, 101917, 102203

<sup>26</sup> MFI ID: 100691, 114764

<sup>27</sup> MFI ID: 100545

<sup>28</sup> MFI ID: 100015

**Table 10 MFI by region**

Region	SDI	Annual subsidy received	Active borrowers	
Africa		-8,758,290	1,318,894	<i>sum</i>
	0.2591	-364,929	54,954	<i>mean</i>
	24	24	24	<i>n</i>
East Asia and the Pacific		-59,044	1,339,860	<i>sum</i>
	-0.0369	-1,406	31,901	<i>mean</i>
	41	42	42	<i>n</i>
Eastern Europe and Central Asia		194,069,434	1,522,924	<i>sum</i>
	0.4014	3,130,152	24,563	<i>mean</i>
	62	62	62	<i>n</i>
Latin America and The Caribbean		4,072,282	159,185	<i>sum</i>
	0.5875	1,357,427	53,062	<i>mean</i>
	3	3	3	<i>n</i>
Middle East and North Africa		-1,515,374	195,640	<i>sum</i>
	0.0343	-137,761	17,785	<i>mean</i>
	11	11	11	<i>n</i>
South Asia		59,849,288	19,004,527	<i>sum</i>
	1.1916	767,299	243,648	<i>mean</i>
	78	78	78	<i>n</i>
Total		247,658,296	23,541,030	<i>sum</i>
	0.5693	1,125,720	107,005	<i>mean</i>
	219	220	220	<i>N</i>

Source: author's own compilation

Consequently, four out of the ten best performing MFIs are from the East Asia and the Pacific region. This is on a par with the South Asia region, which is, on average, the worst regarding SDI performance and an indicator that South Asia shows clear outperformers, with four mainly mature MFIs from India among the best performers. Nevertheless, South Asia also offers six out of the seven most subsidy dependent MFIs, including three from India<sup>29</sup>, two from Pakistan<sup>30</sup>, and one from Afghanistan<sup>31</sup>, which is in conformity with the average results by region.

In order to interpret the results, a differentiation based on the average annual subsidy received (S) per active borrower is required (see [Fig. 7](#)). Differentiating MFIs again by their legal status, we can now see that, on average, non-banking financial institutions (NBFIs) receive 35.56 USD per customer, followed by banks (14.36) and non-governmental organizations (1.42). Credit unions and cooperatives (-0.55) and rural banks (-9.79) even receive negative subsidies. Other institutions can be neglected (n=1).

Distribution by region (see [Fig. 7](#)) shows high average subsidies per borrower for Eastern Europe and Central Asia (127.43), followed by Latin America and The Caribbean (25.58), and South Asia (3.15). All other regions show on average

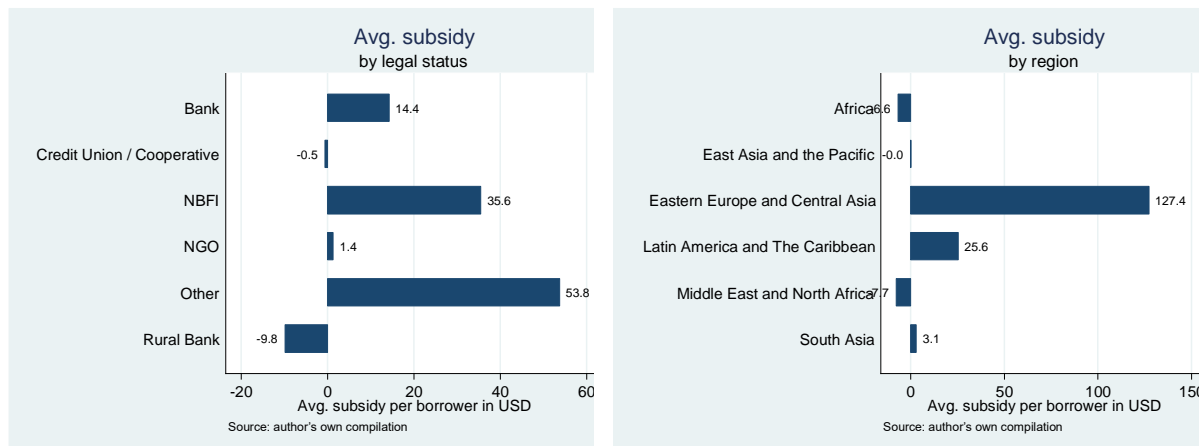
<sup>29</sup> MFI ID: 101198, 102464, 115218

<sup>30</sup> MFI ID: 100121, 100633

<sup>31</sup> MFI ID: 100154

negative subsidies, with East Asia and the Pacific being the most moderate (-0.04) and strong negative average subsidies per borrower in Africa (-6.64) and the Middle East and North Africa (-7.75).

**Fig. 7 - Average subsidy per active borrower by legal status and region**



Source: author's own compilation

Regarding the SDI, rural banks, which were shown to be, on average, the only subsidy independent MFIs, even receive on average negative subsidies per active borrower and therefore are fulfilling their double mission reliably. At the same time, non-banking financial institutions are not only more subsidy dependent on average than any other legal form of MFI but also receive the highest average amount of subsidies per active borrower.

Regarding the regional distribution, East Asia and the Pacific was, on average, the only subsidy independent region. Likewise, to the legal status, the only subsidy independent region also receives negative subsidies, however only to a minimal extent of -0.04 USD. With 43 MFIs out of 223, the results for the regional distribution are more robust than for the legal status, with 13 rural banks out of 223 MFIs.

## 9. Interim conclusion on the applicability of the SDI

The SDI is a potent tool to calculate the annual subsidy received for a restricted timeframe and answer the narrowly defined question of subsidy dependence for MFIs. Being the inverse of self-sustainability, the SDI quantifies subsidy dependence in a reliable manner, which is a prerequisite to conducting research on MFIs' sustainability and is often considered a proxy for sustainability itself.



The calculation of the annual subsidy received as the SDI's numerator is the most complex part of the SDI's application for research. However, the integration of three types of equity grants and three types of profit grants, covering all types of subsidized funds, helps to improve the understanding of the underlying data and is advantageous to the other ratios discussed.

Since subsidies as a funding source are among the main drivers of MFIs' financial and social performance, the consideration of the SDI as a mere measurement of financial self-sustainability should be reconsidered. The choice of revenue from lending as the equation's denominator takes the specific social mission of MFIs into account by penalizing any deviation from lending to customers.

Although financial and social sustainability is not mutually exclusive, one should not succumb to the preference to devise a holistic approach to measure the sustainability of MFIs but instead focus on separate steps to conduct research on financial and social sustainability, considering the SDI as a well-equilibrated ratio to verify that financial sustainability is not underweighted.

The consistent usage of the SDI is a reliable approach to help overcome the research gap of reliably measuring MFI performance and simultaneously does not contradict attempts to give more weight to social sustainability measures. It helps overcome traditional concerns about a mission drift from an explicit social mission to more profit-oriented MFIs.

It is a valuable measure for any further investigation, with proven applicability, and has so far disproven the necessity to improve it any further. However, since the SDI is calculated based on data from the financial statement, the relationships among its components and with other data from the financial statements are well known, and it would not make sense to regress the SDI against most data from the financial statement (Schreiner & Yaron, 2001). Instead, it should be regressed to age, legal status, regulation status, size, or social sustainability measures, limiting its applicability in some scenarios.

Like all other financial sustainability ratios and proxies thereof, the SDI itself cannot indicate how far subsidies are justified and if the potential benefits outweigh the costs. In the second half of the thesis, after an overview of the MFIs by their SDI

hierarchy, the annual subsidy from the SDI formula will therefore be linked to the efficiency of the MFI.

## 10. Methodology – Application of the Data Envelopment Analysis

The consecutive second part of the thesis applies a two-step approach to address the influence of the hitherto calculated subsidies on MFIs' efficiency. A DEA is applied to benchmark MFIs regarding their financial and social efficiency separately in the first step. Efficiency scores for all possible model specifications are treated as a multivariate data set to apply a principal component analysis (PCA) as a data reduction technique to select the optimal model. In the second step, efficiency is regressed on MFI age and MFI size, based on the literature research, and extended by subsidies.

The DEA is a non-parametric linear programming technique developed (1978) and improved (1981) by Charnes, Cooper, and Rhodes and is based on Farrell's article "The Measurement of Productive Efficiency" (1957). It is a common technique in operations research and production economics to address efficiency, e.g., welfare efficiency (also "Pareto-Koopmans efficiency"), and is specifically suitable for evaluating MFIs relative to their peers. This technique is particularly successful when "conventional cost and profit functions" within parametric approaches "cannot be justified."

In contrast to statistical regression analysis, reflecting the observations' average or central tendency behavior, DEA deals with best performers by defining an efficient frontier on which all Pareto-optimal decision making units (DMU) are located (Lehmann, Warning, & Weigand, 2004). The efficient frontier envelops all other DMUs' observations, i.e., inputs and outputs, and defines all DMUs' performance by their deviation from the previously defined frontier. DMUs below the frontier are consequently labeled inefficient. Every DMU consumes inputs to produce outputs. Furthermore, conventional regression-based methods deal with single output and multiple input cases, while DEA models simultaneously analyze multiple inputs and outputs. In contrast to partial productivity measures (output/input), DEA accounts for all outputs and inputs in one single ratio, leading to total factor productivity, and the

measures of efficiency become units invariant. DEA allows for handling vast amounts of variables and relations, making it easy to address complex problems. An advantage of the DEA is that weights do not need to be attached to the inputs and outputs in advance, but variable weights are derived directly from the data. Consequently, minimal a priori assumptions are required. Neither does one need to prescribe the functional form. It, therefore, offers objectively determined efficiency scores (Berger & Humphrey, 1997). The efficiency scores are between 1 and 0 because the ratio is formed relative to the Euclidean distance from the origin over the possibility set. However, the DEA's limitation is the efficiency frontier's sensitivity to outliers and measurement errors.

The most widely applied DEA models are the CCR model, named after Charnes, Cooper, and Rhodes (Charnes et al., 1978), and the BCC model, named after Banker, Charnes, and Cooper (1984). There are several other DEA models with different assumptions in DEA research. The CCR and the BCC model differ regarding the treatment of returns to scale for the inputs and outputs. While the CCR model assumes that each DMU operates only with constant returns to scale (CRS), the BCC model assumes variable returns to scale (VRS) for both the inputs and outputs. The BCC model only differs from the CCR model in that the former includes a convexity condition in its constraints. Therefore, the CCR model is only appropriate if all DMUs operate on an optimal scale.

In consequence, the CCR model delivers a single value, the "overall technical efficiency" for both pure technical and scale efficiency, while the BCC model only delivers "pure technical efficiency" (PTE). As in most DEA models, both the CCR and BCC models can be designed as either input-oriented or output-oriented. If the model aims to minimize inputs while satisfying at least the given output levels, it is defined as an input-oriented model. The efficiency is therefore measured as a proportional reduction in input usage. An output-oriented model, in contrast, attempts to maximize outputs without requiring more of the inputs observed (Cooper, Seiford, & Tone, 2007). The decision to apply an input-oriented or an output-oriented model should be based on the research goal and the mechanisms behind the market data. The applied input-oriented BCC models measure the efficiency scores with two constant outputs and a proportional reduction of two inputs.

Efficiency in DEA is based on an extended ratio definition of outputs divided by inputs. There are different types of inefficiencies in DEA. The “technical inefficiency” term is taken from the literature of economics (“economic efficiency”) and defines an inefficiency that can be eliminated without changing proportions, i.e., all sources of waste which can be eliminated without worsening any other input or output. In [Fig. 8](#), DMU A shows technical inefficiency regarding DMU B. “Mix inefficiency” occurs when only some inputs (outputs) are identified as exhibiting inefficient behavior. Its elimination will alter proportions inputs (outputs) are utilized (produced) and can be seen in [Fig. 8](#) in DMU C regarding DMU D. Both technical and mix inefficiencies represent waste which can justifiably be eliminated without requiring any additional data. In some literature, *technical inefficiency* is defined as *pure technical inefficiency* to summarize both *pure technical inefficiency* and *mix inefficiency* under the broader term technical inefficiency.

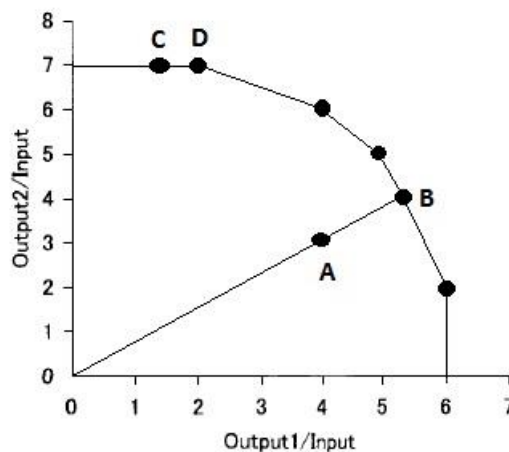


Fig. 8 - Adjusted description of the DEA model based on Cooper et al. (2007)

Source: author's own compilation

Input excesses  $s^-$  and output shortfalls  $s^+$  in DMUs are identified as slack vectors. An optimal solution would therefore have zero slack. If a DMU is radial-efficient ( $\theta=0$ ) and all slacks are zero, it is considered fully efficient or BCC-efficient. A DMU is only fully efficient if it is impossible to improve any input or output without worsening some other input or output. Full efficiency is also known as Pareto-Koopmans Efficiency. If  $\theta$  is unequal to zero, it is defined as technically inefficient; if any slack is unequal to zero, it is defined as mix inefficient.

This thesis takes an input-oriented BCC model approach. Although the CCR with CRS has been prominent ([Basharat, Hudon, & Nawaz, 2015](#); [Gutiérrez-Nieto,](#)

(Serrano-Cinca, & Molinero, 2006), it should be rejected because it cannot be guaranteed that MFIs adjust input and output levels to optimal levels in the short run (Hidenobu & Daiju, 2020). The BCC model is favored for this thesis over the CCR model because it is unlikely that all MFIs from the sample operate at their optimal scale, which would be a necessary assumption for the CCR model (Banker et al., 1984). Imperfect regional competition, different age, and constraints in fund availability are strong arguments against optimal efficiency; hence the CRS assumption is rejected. The input orientation aligns with the approach since MFI managers can be considered to have less control over the output levels (Van Damme, Wijesiri, & Meoli, 2016). Variables that cannot be varied at the discretion of management are called non-discretionary. The calculation of the input-oriented efficiency scores ( $\theta$ ) can be performed by solving the following linear programming problem:

$\text{Min}_{(\theta, \lambda)} \theta$	s.t.:	$\begin{aligned} \theta X_0 + \sum_j \lambda_j X_j &\geq 0 \\ -Y_0 + \sum_j \lambda_j Y_j &\geq 0 \\ \sum_j \lambda_j &= 1 \\ \lambda_j &\geq 0 \end{aligned}$	(1)
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subject to

$\theta$	Scalar variable representing the technical efficiency score
$X_0$	Quantities observed of inputs of the DMU of which one measures efficiency
$Y_0$	Quantities observed of outputs of the DMU of which one measures efficiency
$Y_j$	Quantities observed of outputs for the DMU j
$X_j$	Quantities observed of inputs for the DMU j
$\lambda_j$	Coefficients of weighting

For a detailed explanation of DEA models, see Cooper et al. (2007).

## 11. Data, variables, and formulation of hypotheses

Data was obtained on February 12, 2020, from World Bank's Data Catalog, a well-established large-scale database for microfinance research (Hartarska & Nadolnyak,

2007), initially offered by MIX Market ([www.mixmarket.org](http://www.mixmarket.org)), which was incorporated in 2002 and is also known as the MIX Market database (<https://databank.worldbank.org/source/mix-market/>). The Data Catalog includes high-quality longitudinal cross-country financial panel data of 3,039<sup>32</sup> MFIs worldwide, covering 1999 to 2019. Four data sets have been combined, and the most comprehensive year regarding data integrity has been selected. Subsidies have been calculated based on Yaron (Yaron, 1992) (*for a detailed description of the sample and sample reduction, see [chapter 6](#)*).

### 11.1. Data Envelopment Analysis (DEA)

To guarantee a reliable calculation of efficiency scores, DEA requires homogeneous data. The data set for 224 MFIs for the financial year 2009 has consequently been further reduced by eight MFIs with missing inputs data to 216<sup>33</sup> MFIs (see [appendix 2](#) for a detailed list of all 216 MFIs). No MFIs with missing data on outputs remained. No outliers were excluded since they did not affect the ranking within the DEA results (see [chapter 12](#)). The remaining sample represents 23.376.871 active borrowers, representing a market share of roughly 12.29% out of 190,135,080 clients reached worldwide as of December 31, 2009, based on the State of the Microcredit Summit Campaign Report 2011 (Reed, 2011).

The amount of DMUs, i.e., MFIs, exceeds the general rule for the DEA that its amount needs to be higher than the sum of inputs and outputs times three (Cooper et al., 2001) and is therefore considered sufficient. If the number of DMUs is less than the combined number of inputs and outputs, the share of DMUs identified as efficient

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<sup>32</sup> The following adjustments to the original data set have been conducted in the following order beforehand:

- 6) For 30 MFIs, the data set did not include the variables "Country", "Region", and "MFI Full Name" and had to be added manually. MFI ID: 100461, 101448, 101600, 101616, 102346, 104110, 104504, 116157, 116338, 122392, 126954, 132928, 132930, 133505, 141587, 143482, 143483, 149264, 150434, 152525, 152727, 152745, 152746, 152747, 165405, 166515, 167080, 167881, 169683, 176789. For 13 further MFIs, reliable data could not be found.
- 7) Quarterly reports have been omitted.
- 8) For three MFIs, the data for one fiscal year had to be combined from two separate entries: MFI ID: 100461, 114832, 169054.
- 9) For four MFIs, the fiscal year has been corrected, twice for two of them due to obvious mistakes. None for or from the fiscal year 2009: MFI ID: 102661, 100184, 104306, 169054.
- 10) For 20 MFIs, annual report intervals changed during the year, resulting in doubles/triples in the original data. These MFIs have been reduced to the most extensive annual reports. Only three of the affected MFIs' reported data for 2009. The 20 MFIs have been identified based on the variables "MFI ID" and "MFI Name": MFI ID: 100075, 100124, 100184, 100241, 100294, 100301, 100305, 100492, 100725, 100853, 101072, 101083, 101446, 102661, 102700, 104021, 104134, 137508, 176759, 169054.

<sup>33</sup> The following MFIs have been dropped due to the lack of data on input or output variables: 100096, 100311, 100427, 100875, 101109, 102623.

increases, and efficiency discrimination becomes “questionable due to an inadequate number of degrees of freedom” (Cooper et al., 2007).

Although a bigger sample size for the subsequent regression analysis would be preferable, the data is based on the most extensive existing data catalog on microfinance institutions and the most promising financial year. It has been reduced only by data availability to guarantee the best data quality and enable comparison to existing research.

The sample consists of 18 banks, seven credit unions/cooperatives, 97 NBFIs, 82 NGOs, eleven rural banks, and one others based on the criteria.

## 11.2. Literature Review

Literature on potential inputs and outputs is extensive enough to exclude a bias from arbitrary choices. Nevertheless, the selection of variables remains challenging in order to avoid meaningless measurements. For example, a simple approach by screening common ratios in microfinance (CGAP, 2003)<sup>34</sup> is impracticable since this course of action could include variables measuring the same overall aspect and neglect the need to define the unique character of MFIs as specialized financial institutions. Instead, the selection should be addressed by evaluating the role and capabilities of MFIs, which can be dealt with by a value-added, operating, and intermediation approach.

The literature on financial institutions holds conflicting views on whether an MFI should be evaluated with an intermediation or a production approach, which fundamentally influences the selection of inputs and outputs (Sealey & Lindley, 1977) and their relationships. According to Gutiérrez-Nieto et al. (2006), under the intermediation approach, MFIs make a profit by collecting deposits and making loans (Kipsha, 2013; Sedzro & Keita, 2009), while under the production approach, MFIs use physical resources, e.g., labor and money, in order to process transactions, take deposits, lend funds, and collect revenues. These resources can be directly derived from the resource-based view of the firm (Barney, 1991). According to Qayyum & Ahmad (2006), MFIs would be responsible for transferring assets from the savors to the investors under the intermediation approach, and inputs would be labor, capital

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<sup>34</sup> Microfinance consensus guidelines. Definitions of selected financial terms, ratios, and adjustments for microfinance



cost, and interest payable on deposits. The outputs would be loans and financial investments. Under the production approach, they are producers of deposits and loans, and the number of employees and capital expenditures are considered inputs. A third approach, although uncommon, would be the assets approach (Qayyum & Ahmad, 2006) which assumes that the function of an MFI is the creation of loans. The latter approach has not been found in the literature review. The value of assets would, in this case, act as output. The definition of an MFI under the intermediation or production approach profoundly influences what to consider an input or an output in the DEA.

Since DEA requires homogeneous data and not all MFIs from the sample collect deposits, they were not included in the applied DEA. Otherwise, one would have to consider whether they are inputs (intermediation approach) or outputs (production approach). Another variable of particular interest to MFIs is subsidies. However, prominent literature (Gutiérrez-Nieto et al., 2006; Wijesiri, Yaron, & Meoli, 2017) does not include subsidies or subsidy dependence in DEA models. Some authors argue that, strictly speaking, “subsidy dependence does not necessarily link with [a] high efficiency level” (Wijesiri et al., 2017), but considering efficiency as a proxy for sustainability, the role of subsidies needs to be clarified to improve research. Since Yaron himself (Wijesiri et al., 2017) does not argue for including subsidies in a DEA, they will be dealt with in the subsequent regression analysis. After all, this thesis applies a production approach (Gutiérrez-Nieto et al., 2009), with inputs and outputs based on the following literature review.

Based on the RBV, these resources or capabilities derived from the literature must at least be (a) valuable and (b) rare. In order for them to hold the possibility of sustainable competitive advantage, they must also be (c) imperfectly imitable, and (d) there cannot be strategically equivalent substitutes that are valuable but neither rare or imperfectly imitable.

The selection of these resources as inputs and outputs further needs to be guided by financial and social sustainability aspects and has been addressed by a comprehensive literature review regarding specifically publications applying a DEA on MFIs. When searching for papers in databases, the keywords were DEA and microfinance restricted to full-text access in English using the EBSCO database. The intention is not to exhaust literature research but to follow the developments in the



implementation of the DEA in microfinance research, isolate the research streams and lead other researchers to enable the calculation of realistic efficiency scores for further analysis. [Table 11](#) provides a brief review of the literature on DEA in microfinance research, including 18 relevant peer-reviewed publications. The literature review addresses the applied approach, the publication's objective regarding the addressed efficiency, the orientation of the DEA model, applied inputs and outputs, and background information on the sample regarding the type, size, geographical distribution, and focus.

The average sample size includes 107 MFIs with a minimum of seven and a maximum of 420 MFIs. Only four publications address an international sample. While both the production and the intermediation approach can be found in the literature, 14 publications take a production approach comprising 17 separate models, and four of the publications additionally include an intermediation approach; one of the latter also includes a combined approach. Interestingly none of the publications solely considers an intermediation approach. 13 publications address financial efficiency, 14 publications address social efficiency, including 13 publications addressing financial and social efficiency. Regarding the orientation of the DEA models applied, three papers include both input- and output-oriented models. Input-orientation overwhelms output-orientation 13 to 6. Eleven publications apply both constant and variable returns to scale, with a minor majority of 15 applying CRS and an almost equal amount of 13 applying VRS, indicating an ongoing discussion in the literature over the preferability of CCR and BCC models. However, a positive tendency over time towards BCC models exists in the addressed literature.

In total, 28 models are included in the publications. Regarding input and output variables, production approaches show on average 2.94 inputs and 2.18 outputs. On the other hand, intermediation approaches show fewer variables with an average of two inputs and two outputs, consistent with the more straightforward definition of collecting deposits and making loans.

The literature review shows the strong influence of the MIX Market database for the field among peer-reviewed papers and indicates high-quality data for this thesis.

**Table 11 - Overview of 18 peer-reviewed publications addressing DEA in MFIs**

Author(s) / Year:	Approach:	Objective:	DEA orientation:	RTS:	Specification (Approach / Objective):	Inputs:	Outputs:	Data:	Regional focus:
(Gutiérrez-Nieto et al., 2006)	Combined approach (intermediation & production)	Financial & social efficiency	N/A	CRS	Financial & social efficiency	Number of credit officers, OPEX	2 Number of loans outstanding, GLP, Interest and fee income	3 Cross-sectional, 30 MFIs, 2003	Latin America
(Bassem, 2008)	Production approach	Financial & social efficiency	Input	CRS & VRS	Production model	Number of personnel, Total assets	2 Female borrowers, ROA	2 Panel data, 35 MFIs, 2004-2005	Mediterranean
(Gutiérrez-Nieto et al., 2009)	Production approach	Social efficiency	N/A	CRS	Social efficiency	Total assets, OPEX, Number of employees	3 GLP, Financial revenue, Number of active women borrowers Indicator of benefit to the poorest	4 Cross-sectional, 89 MFIs, 2003	International
(Sedzro & Keita, 2009)	Intermediation & production approach	Financial & social efficiency	Output	CRS & VRS	Intermediation model	Total deposits, Labor, Physical capital	3 Loans, Interest income, Investments	3 Panel data, 7 MFIs, 2000-2002	WAEMU
					Production model	Labor, Physical capital, Financial capital	3 Number of savers, Number of borrowers, Investments		
(Annim, 2012)	Production approach	Financial & social efficiency	Input	CRS & VRS	Production model	Financial expense, OPEX, Number of personnel	3 Financial revenue, Net operating income, GLP, Number of women clients	4 Panel data, 164 MFIs, 2004-2008	International
(Kipasha, 2013)	Intermediation & production approach	Overall efficiency	Input	CRS & VRS	Intermediation model	Total funds mobilized	1 GLP	1 Panel data, 29 MFIs, 2009-2011	Tanzania
					Production model	Total assets, Personnel, OPEX	3 GLP, Financial revenues		
(Kemonou & Anjugam, 2013)	Intermediation & production approach	Overall efficiency	Input & output	CRS & VRS	Intermediation model	Credit officers Cost per borrower	2 GLP	1 Panel data, 70 MFIs, 2008-2010	SSA (25 countries)
					Production model	Employees Personnel expenses	2 Outstanding loans		
(Tahir & Che Tahrim, 2013)	Production approach	Overall efficiency	Input & output	CRS & VRS	Production model	Total assets OPEX	2 GLP, Number of active borrowers	2 Panel data, 2008-2011	ASEAN (5 countries)

(Abdelkader, Hathroubi, & Jemaa, 2014)	N/A	N/A	Input	CRS & VRS	N/A	Total assets, OPEX, Number of employees	3	Indicator of benefit to the poorest, Financial revenue	2	Cross-sectional, 61 MFIs, 2006-2009	MENA
(Kablan, 2014)	Production approach	Financial & social efficiency	Input	CRS & VRS	Production model & financial efficiency	Financial expenditure, Capital, Personnel	3	GLP	1	Panel data 104 MFIs, 2000-2002	WAEMU
					Production model & social efficiency	Financial expenditure, Capital, Personnel	3	Number of active borrowers, Poverty index, Percentage of women borrowers	3		
(Basharat et al., 2015)	Production approach	Financial & social efficiency	Output	VRS	Financial efficiency	Total assets, OPEX, Number of staff	3	GLP, Financial revenue	2	Panel data, 291 MFIs, 2005-2008	International (67 countries)
					Social efficiency	Total assets, OPEX, Number of staff	3	Number of women borrowers, Indicator of benefit to the poorest	2		
(Widiarto & Emrouznejad, 2015)	Production approach	Overall & financial & social efficiency	Input & output	CRS & VRS	Overall efficiency	Assets, OPEX, Portfolio at risk 30 days, Employees	4	Financial revenue, Avg. loan balance per borrower over GNI per capita (inverse), Number of borrowers	3	Panel data, 231 MFIs, 2009-2010	MENA/EAP/SA
					Financial efficiency	Assets, OPEX, Portfolio at risk 30 days, Employees	4	Financial revenue	1		
					Social efficiency	Assets, OPEX, Portfolio at risk 30 days, Employees	4	Average loan balance per borrower over GNI per capita (inverse), Number of borrowers	2		
(Wijesiri & Meoli, 2015)	Malmquist productivity index	Financial sustainability & poverty outreach	Output-oriented	N/A	Financial sustainability & poverty outreach	Total assets, OPEX, Labor	3	Financial revenue, Total number of active borrowers	2	Panel data, 20 MFIs, 2009-2012	Kenya
(Wijesiri, Viganò, & Meoli, 2015)	two-stage double bootstrap	Financial & social efficiency	Input-oriented	CRS	Financial efficiency	Total assets, Number of credit officers, Cost per borrower	3	Financial revenue	1	Cross-sectional, 36 MFIs, 2010	Sri Lanka

					Social efficiency	Total assets, Number of credit officers, Cost per borrower	3	Total number of female borrowers	1		
(Van Damme et al., 2016)	Production approach	Financial & outreach efficiency	Input-oriented	VRS	Production model	OPEX, Total number of employees	2	GLP, Total number of woman borrowers	2	Cross-sectional, 36 MFIs, 2011	Sri Lanka
(Lebovics, Hermes, & Hudon, 2016)	Production approach	Financial & social efficiency	Input-oriented	CRS	Production, financial efficiency	Total liabilities, OPEX, Total number of staff	3	GLP, Financial revenue	2	Cross-sectional, 28 MFIs, 2011	Vietnam
					Production, social efficiency	Total liabilities, OPEX, Total number of staff	3	Poverty outreach measure	1		
(Akram, Shan, Shaikh, & Yashkun, 2016)	N/A	N/A	N/A	CRS & VRS	N/A	Assets, Personnel, OPEX	3	Number of women borrowers, GLP, Number of loans outstanding, ROA	4	Panel data, 170 MFIs, 2008-2009	SA
(Wijesiri et al., 2017)	N/A (metafrontier model)	Financial & social efficiency	Input-oriented	CRS & VRS	Financial efficiency	OPEX, Total number of employees	2	GLP, Financial revenue	2	420 MFIs	International
					Social efficiency	OPEX, Total number of employees	2	Standardized average loan balance per borrower (inverse), Number of active borrowers	2		

Source: author's own compilation

The literature on efficiency in microfinance is small compared to the literature on financial institutions in general, although the market size had long outgrown its infancy, with around 190 million clients in 2009 (Reed, 2011). Nevertheless, there is ongoing research applying non-parametric analysis with DEA models to tackle efficiency, which can be built upon to reduce the likelihood of bias from arbitrary choices.

Gutiérrez-Nieto et al. (2006) addressed the efficiency of 30 Latin American MFIs in 2003, downloading data from the Microrate web page. A combined intermediation and production approach measures financial and social efficiency with constant returns to scale (CCR model). The selected model out of different specifications identifies 4 MFIs to be efficient. The model applies the *number of credit officers* and *operating expenses* as inputs, while outputs are *number of loans outstanding*, *gross loan portfolio*, and *interest and fee income*. While number of loans outstanding is associated with a production orientation, the two latter outputs are associated with an intermediation orientation. Gutiérrez-Nieto et al. identify the specification of the DEA model as relevant for the efficiency scores.

The financial and social efficiency of 35 MFIs from the Mediterranean has been analyzed by Bassem (2008) for the period 2004 to 2005 based on a production approach. Panel data has been downloaded from the MIX Market database. Input-oriented DEA models have been applied both with constant (CCR model) and variable returns to scale since input orientation can better illustrate the share of variables management can effectively control. Inputs for both returns-to-scale (RTS) have been the *number of personnel* and *total assets*; the outputs have been *female borrowers* and *ROA*. Five MFIs were efficient in the CCR model but up to nine for the BBC model.

Gutiérrez-Nieto et al. (2009) apply a larger and more international sample of 89 MFIs for 2003 from the MIX Market database in their subsequent paper. While applying a larger sample than in 2006, the authors narrow the focus by applying a production model measuring solely social efficiency under the assumption of constant returns to scale (CCR model). A production model is best suited since MFIs' focus is on granting loans. The amount of both inputs and outputs is increased; inputs are *total assets*, *operating costs*, and *number of employees*. The latter includes all individuals actively employed, including contract employees or advisors dedicating most of their time to the MFI, even if they are not legally employed, leaving some margin for error

in the DEA. Outputs are *gross loan portfolio*, *financial revenue*, the *number of active women borrowers*, and an *indicator of benefit to the poorest*, defined as the average loan balance per borrower divided by per capita gross national income (pcGNI). The number of active women borrowers is based on the assumption that microfinance can address the social component not merely through economic effects but specifically through female empowerment. This assumption should only be considered for homogeneous data sets based on different legal systems, e.g., in Islamic cultures. The indicator of benefit to the poorest is rooted in the assumption that poverty “should be measured in relation to the general wealth of the population”.

Financial and social efficiency has also been measured by Sedzro and Keita (2009) for seven MFIs in the West African Economic and Monetary Union (WAEMU) for the period 2000 to 2002, with data from the directorate of the Decentralized Financial Systems of the Central Bank of West African States, downloaded from the “Monograph of the Decentralized Financial Systems” data bank. The comprised countries are Benin, Burkina-Faso, Ivory-Coast, Mali, Niger, Senegal, and Togo. Differentiating between an intermediation approach and a production approach, they construct output-oriented DEA models with CRS (CCR model) and VRS (BCC model), with three inputs and outputs for each model. The production model considers *labor*, *physical capital*, and *financial capital* as inputs to generate *number of savers*, *number of borrowers*, and *investments* as outputs. In the intermediation model, Sedzro and Keita change the input financial capital to *total deposits* and, maintaining *investments* as an output, consider *loans* and *interest income* as outputs. Financial and social efficiency has been measured with input-oriented DEA models with CRS (CCR model) and VRS (BCC model) based on a production approach by Annim (2012). Based on international panel data on 164 MFIs for 2004-2008 from the MIX Market database, Annim considers three inputs and four outputs, showing that financially efficient MFIs tend to fail to reach out to the poorer customers. Inputs are *financial expense*, *operating expense*, and *number of personnel*. Outputs are *financial revenue*, *net operating income*, *gross loan portfolio*, and *number of women clients*.

A study on differences in technical efficiency among 29 MFIs in Tanzania from 2009 to 2011 was conducted by Kipesha (2013). Applying input-oriented DEA models with CRS (CCR model) and VRS (BCC model), Kipesha considers *total assets*, *personnel*, and *operating costs* as inputs, and *gross loan portfolio* and *financial revenues* as

outputs for the production model. *Total funds mobilized* is the only input for the intermediation model, and *gross loan portfolio* is the only output. Higher production efficiency scores for both CRS and VRS show high inefficiency on MFIs intermediation role.

Another study on Sub-Sahara African MFIs was conducted by Kemonou and Anjugam (2013) in the same year on 70 MFIs for a comparable period from 2008 to 2010. Similarly addressing overall efficiency with input-, but additionally, output-oriented DEA models with CRS (CCR model) and VRS (BCC model), the inputs and outputs, however, differ. The authors consider *employees* and *personnel expenses* inputs and *outstanding loans* the sole output in the production model. For the intermediation model, inputs are *credit officers* and *cost per borrower*, and the only output is *gross loan portfolio*. Data was derived from the MIX Market database, income statements and balance sheet data from the reporting MFIs directly.

Tahir & Che Tahir (2013) again take a mere production approach considering overall efficiency with CRS (CCR model) and VRS (BCC model) in input-, as well as output-oriented DEA models. They apply their models to panel data from Cambodia, Indonesia, Laos, Philippines, and Vietnam as five representatives of the Association of Southeast Asian Nations (ASEAN) from 2008 to 2011. Gathering their data from the MIX Market database, the authors choose *total assets* and *operating expenses* as inputs; outputs are *gross loan portfolio* and *number of active borrowers*.

Taking a DEA-bootstrapping methodology, Abdelkader et al. (2014) analyzed cross-sectional data regarding the efficiency of 61 MFIs from the Middle East and North Africa (MENA) for the period 2006 to 2009. The data source is the MIX Market database. Under the assumption of an input orientation and CRS as well as VRS, they consider three inputs, i.e., *total assets*, *operating expenses*, and *number of employees*. Outputs are *financial revenue* and an *indicator of benefit to the poorest* (POV). Based on the indicator of benefit to the poorest from Gutiérrez-Nieto et al. (2009) the latter output is defined as  $POV = pov_i \times \text{number of active borrowers}$ .

They find differences by legal status in their sample.

Sticking to an input-oriented orientation and a production approach, Kablan (2014) evaluates financial and social efficiency under the assumptions of CRS (CCR model) and VRS (BCC model) for a panel of 104 MFIs from the West African Economic and Monetary Union (WAEMU) for the period 2000 to 2002. Data was downloaded from the MIX Market database. Kablan differentiates the production approach based

model for financial and social efficiency. Regarding their financial efficiency, three inputs, i.e., *financial expenditure*, *capital*, and *personnel*, face the single output *gross loan portfolio* as a proxy for credit distribution. Concerning social efficiency, the inputs are identical, but the outputs are three times as many. The outputs are *number of active borrowers*, *percentage of women borrowers*, and a *poverty index* identical to Abdelkader et al. (2014). They conclude that financial efficiency increases at the expense of social efficiency and vice versa.

As in most DEA approaches on MFIs, Basharat et al. (2015) base their research on a production approach but interestingly choose output-oriented DEA models under VRS assumption to measure financial and social efficiency scores, in contrast to most papers, where input-orientation combined with both CRS and VRS can be seen in most scenarios. They address an above-average sized panel data set of 291 MFIs from all over the world from 2005 to 2008. The data is derived from the MIX Market database. Using *total assets*, *operating cost*, and *number of staff* as inputs in both their financial and social efficiency model, the outputs differ. In the efficiency model, the outputs are *gross loan portfolio* and *financial revenue*; in the social efficiency model, the outputs are *number of women borrowers* and an *indicator of benefit to the poorest*. Addressing the influence of efficiency on MFIs' interest rates, the authors see a significant positive relationship of financial efficiency with interest rates, while social efficiency has a positive but insignificant impact on interest rates. However, the explanatory power is restricted due to the limitation of the data to two years.

Widiarto and Emrouznejad (2015) equally take a production approach but return to input- and output-orientation under CRS (CCR model) and VRS (BCC model) assumptions. The authors also obtain their data from the MIX Market database addressing a sample of 231 MFIs over the period 2009 to 2010, but slightly limit their international focus to the three regions Middle East and North Africa (MENA), East Asia and the Pacific (EAP), and South Asia (SA) since their focus is on Islamic MFIs. In contrast to other publications from the literature review, they construct a joint DEA model for overall efficiency in addition to the separate models for financial and social efficiency. All three models include the same three inputs, i.e., *assets*, *operating expenses*, and *portfolio at risk 30 days*. It remains the only paper considering portfolio at risk as a variable. Whereas the financial model considers *financial revenue* as the sole output, the social model considers the two outputs *average loan balance per borrower over pcGNI* (in inverse form) and *number of borrowers*. The latter differs



from number of women borrowers as an input in other social efficiency studies on MFIs, based on religious implications on legal systems in the addressed markets, showing the impracticability of focusing on female borrowers as an output in international studies without further restrictions on the sample. The overall efficiency model combines all three inputs and outputs.

Another approach considered by Wijesiri and Meoli (2015) is a DEA-based Malmquist productivity index to address financial sustainability and poverty outreach in an output-oriented model. For 20 MFIs in Kenya from 2009 to 2012, they measure financial sustainability and poverty outreach with the inputs *total assets*, *operating expenses* and *labor*, and the outputs *financial revenue* and *total number of active borrowers*. They can show for their sample that matured MFIs show, on average lower productivity. Data is derived from rating reports.

A second paper for the same year by Wijesiri et al. (2015) applies a two-stage double bootstrap approach to measure financial and social efficiency with input-oriented models under the CRS assumption. In contrast to the previous paper, they used cross-sectional data on 36 MFIs from Sri Lanka in 2010. Applying the same three inputs in both models, *total assets*, *number of credit officers* and *cost per borrower*, the model on financial efficiency applies *financial revenue* as the sole output. The model on social efficiency applies *total number of female borrowers* as the sole output. Data is obtained from the Microfinance Review (LMFPA, 2012).

An input-oriented approach for the same sample but with a production approach (Van Damme et al., 2016) applies different inputs and outputs to measure financial and outreach efficiency under the assumption of VRS. Taking *operating expenses* and *total number of employees* as inputs, *gross loan portfolio*, and *total number of woman borrowers* are outputs. The publication addressed the effect of governance on efficiency, showing a positive impact of small and gender-diverse boards on the MFIs' financial efficiency for the sample.

DEA models with mere CRS assumption (CCR model) are scarce. Lebovics et al. (2016) consider an input-oriented model with CRS based on a production approach measuring the financial and social efficiency of 28 MFIs from Vietnam for 2011. Data was obtained from the MIX Market database. The authors argue for an input-oriented model due to a general focus on cost-minimization similar to the broader banking industry and a lack of influence on outputs. Like most authors, Lebovics et al. use the same inputs to measure both financial and social efficiency, i.e., *total liabilities*,

*operating costs*, and *total number of staff*. The outputs *gross loan portfolio* and *financial revenue* are applied to measure financial efficiency; a constructed *poverty outreach measure* is considered an output for social efficiency. The poverty outreach measure is identical to the poverty index from Abdelkader et al. (2014). The authors can confirm that financial and social efficiency are not related in their sample. A sample for the South Asian region can be found at Akram et al. (2016) with panel data for 170 MFIs from 2008 to 2009. The authors measure the efficiency of DEA under CRS and VRS assumptions, considering the input *assets*, *personnel*, and *operating expense*. The outputs are *number of women borrowers*, *gross loan portfolio*, and *number of loans outstanding*.

The most extensive sample among all publications from the literature review is Wijesiri et al.'s latest paper (2017) on 420 MFIs operating worldwide, with data obtained from the MIX Market database. The authors measure financial and social efficiency based on a metafrontier model under CRS and VRS assumptions. Both models are input-oriented and consider the same inputs, i.e., *operating expenses* and *total number of employees*. In order to measure financial efficiency, the outputs are *gross loan portfolio* and *financial revenue*, while the outputs for the social efficiency are *standardized average loan balance per borrower* (inverse value) and *number of active borrowers*. The earlier is defined as the average loan balance per borrower divided by pcGNI. The authors find that for both financial and social efficiency, most MFIs are inefficient, particularly regarding achieving their outreach objectives, and that larger MFIs from the sample have, on average higher efficiency scores for both models.

Based on the previous literature review, this thesis applies inputs and outputs that have been used in earlier studies on MFIs' efficiency.

The applied specification of inputs and outputs (see [table 12](#)) is supported by Wijesiri et al. (2017), who are equally influenced by Yaron's framework, based on the dual concepts of outreach and sustainability to measure performance.

The selected inputs are *operating expenses*<sup>35</sup> (Abdelkader et al., 2014; Akram et al., 2016; Annim, 2012; Basharat et al., 2015; Gutiérrez-Nieto et al., 2006, 2009; Kipsha, 2013; Lebovics et al., 2016; Tahir & Che Tahir, 2013; Van Damme et al.,

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<sup>35</sup> Operating expenses include expenses not related to financial and credit loss impairment, such as personnel expenses, depreciation, amortization, and administrative expenses.

2016; Widiarto & Emrouznejad, 2015; Wijesiri & Meoli, 2015; Wijesiri et al., 2017) and the *total number of employees*<sup>36</sup> (Abdelkader et al., 2014; Akram et al., 2016; Annim, 2012; Basharat et al., 2015; Bassem, 2008; Gutiérrez-Nieto et al., 2009; Kablan, 2014; Kemonou & Anjugam, 2013; Lebovics et al., 2016; Van Damme et al., 2016; Widiarto & Emrouznejad, 2015; Wijesiri et al., 2017) for both models. Since two different DEA models are constructed, one for financial efficiency and one for social efficiency, the outputs differ for both models, confirmed as adequate by the literature research. For the financial model, outputs are *gross loan portfolio*<sup>37</sup> (Akram et al., 2016; Annim, 2012; Basharat et al., 2015; Gutiérrez-Nieto et al., 2006, 2009; Kablan, 2014; Kemonou & Anjugam, 2013; Kipesha, 2013; Lebovics et al., 2016; Tahir & Che Tahir, 2013; Van Damme et al., 2016; Wijesiri et al., 2017) and *financial revenue*<sup>38</sup> (Abdelkader et al., 2014; Annim, 2012; Basharat et al., 2015; Gutiérrez-Nieto et al., 2009; Kipesha, 2013; Lebovics et al., 2016; Widiarto & Emrouznejad, 2015; Wijesiri & Meoli, 2015; Wijesiri et al., 2015; Wijesiri et al., 2017), for the social model, the first output is the *number of active borrowers*<sup>39</sup> (Kablan, 2014; Sedzro & Keita, 2009; Tahir & Che Tahir, 2013; Widiarto & Emrouznejad, 2015; Wijesiri & Meoli, 2015; Wijesiri et al., 2017). Some authors merely focus on the total number of woman borrowers instead of the number of active borrowers as a proxy for the breadth of poverty outreach. However, the international sample includes countries that either favor or restrict women from access to credit. While many MFIs favor female lenders or even exclusively focus on female lenders, especially in Sub-Sahara Africa, the sample also includes Islamic and Muslim countries, which tend to restrict women from access to funding. Islamic and Muslim countries include Afghanistan, Azerbaijan, Egypt, Jordan, Kyrgyzstan, Lebanon, Pakistan, Palestine, and Tajikistan. The second output is *average loan balance per borrower / gross national income per capita*<sup>40</sup>, a proxy for the poverty level of customers. Based on Gutiérrez-Nieto et al.

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<sup>36</sup> The total number of employees is the number of individuals who are actively employed by an entity. This number includes contract employees or advisors who dedicate a substantial portion of their time to the entity, even if they are not on the entity's employees' roster (<https://datacatalog.worldbank.org/dataset/mix-market#tab2> accessed 3/19/2020).

<sup>37</sup> All outstanding principals due for all outstanding client loans. This includes current, delinquent, and renegotiated loans, but not loans that have been written off (<https://datacatalog.worldbank.org/dataset/mix-market#tab2> accessed 3/19/2020).

<sup>38</sup> Includes all financial income and other operating revenue which is generated from non-financial services. Operating income also includes net gains (losses) from holding financial assets (changes in their values during the period and foreign exchange differences). Donations or any revenue not related to a financial institution's core business of making loans and providing financial services are not considered under this category (<https://datacatalog.worldbank.org/dataset/mix-market#tab2> accessed 3/19/2020).

<sup>39</sup> The number of individuals who currently have an outstanding loan balance with the financial institution or are primarily responsible for repaying any portion of the gross loan portfolio. Individuals who have multiple loans with a financial institution should be counted as a single borrower (<https://datacatalog.worldbank.org/dataset/mix-market#tab2> accessed 3/19/2020).

<sup>40</sup> Average loan balance per borrower / GNI per capita --- Average outstanding loan balance compared to local GNI per capita to estimate the outreach of loans relative to the low-income population in the country (<https://datacatalog.worldbank.org/dataset/mix-market#tab2> accessed 3/19/2020).

(2009), most authors argue that the average loan balance per borrower is only a rough measure and needs to be weighted by country depending on the average per capita income. A common approach is to standardize the output by constructing a poverty index that takes the extent of lending to the poor into account by dividing the average loan balance per borrower by the per capita gross national income (Abdelkader et al., 2014; Basharat et al., 2015; Gutiérrez-Nieto et al., 2009; Kablan, 2014; Lebovics et al., 2016; Widiarto & Emrouznejad, 2015; Wijesiri et al., 2017).

*Table 12 - Specification of inputs and outputs*

Model	Inputs	Outputs
Financial Model	Operating Expenses	Gross Loan Portfolio
	Total Number of Employees	Financial Revenue
Social Model	Operating Expenses	Number of Active Borrowers
	Total Number of Employees	Average Loan Balance per Borrower / GNI per Capita

Source: author's own compilation

An extensive list of all MFIs' input and output values of the DEA can be found in [appendix 4](#).

### 11.3. Formulation of hypotheses

This chapter introduces a series of hypotheses pertaining to MFI efficiency scores.

The defined research gap of reliably measuring the performance of MFIs that almost comprehensively rely on subsidies to improve their efficiency while not neglecting the MFIs' double mission of social and profit-oriented performance alike requires combining an internal and external perspective. This has been prepared by considering the RBV and the contingency theory for the theoretical framework.

The calculated efficiency scores derived from the literature review, representing different internal resource and capability settings in the MFIs, need to be evaluated in different internal settings, e.g., age and size, and, as postulated by the [contingency theory](#), in different situational setups, such as legal status or in different situational factor setups, i.e., regional settings.

The literature recognizes that the variable age (AGE) has a positive impact on either financial efficiency (Wijesiri et al., 2017) or financial and social efficiency (Gutiérrez-Nieto et al., 2009). This is in line with the life cycle theory of MFI development, expecting younger MFIs to be less efficient. Over time, the learning process makes a

positive impact of age on mature MFIs likely. Rejecting the null hypothesis that age has no significant impact on efficiency, we can conclude the first hypothesis.

**Hypothesis 1** – Age (AGE) has a positive impact on both financial and social efficiency.

The variable size (SIZE) has been found to positively impact financial and social efficiency (Bogan, 2008; Wijesiri et al., 2017) in the literature. Likewise, MFIs are unlikely to scale without being efficient in the first place. This indicates that a feared mission drift might indeed occur when MFIs grow and control more assets, neglecting their promise to support the poor. Therefore, we expect the null hypothesis that size is not significantly related to efficiency to be rejected and conclude the second hypothesis.

**Hypothesis 2** – Size (SIZE) is positively related to efficiency.

The variable annual subsidy received (S) is of particular interest since its influence has been shown as contradicting in research. The double mission makes it imperative to differentiate the influence on the financial and the social efficiency.

Early research suggests a significant negative influence of subsidies (Bogan, 2008), consistent with the interpretation that MFIs should rely less on subsidies. However, a positive influence of annual subsidy received (S) on social efficiency is expected in order to justify their widespread dispersion throughout the entire industry to reach a large number of borrowers (breadth of outreach), particularly in the lower-income strata (depth of outreach). Rejecting the null hypothesis that annual subsidy received (S) has no significant influence on social efficiency, we can conclude the third hypothesis.

**Hypothesis 3a** – Annual subsidy received (S) positively influences social efficiency.

Some later research suggests at least a marginal but significant positive influence of subsidies on financial efficiency (Hudon & Traça, 2011) since MFIs that receive subsidies were shown to be more efficient than their competitors. However, Hudon and Traça underestimate subsidies by considering only donated equity, making a comparison for small effect sizes difficult. Furthermore, they draw attention to a reverse effect of over-subsidization, leading MFIs to become less efficient above a

threshold. In the case of low or no subsidization, they state that precautionary MFIs tend to serve wealthier clients, which could severely influence the overall influence of subsidies in the sample. Therefore, we can conclude consistently with (Bogan, 2008) that a negative influence of annual subsidy received on financial efficiency exists since it is consistent with the view that MFIs should rely less on subsidies. We reject the null hypothesis that the annual subsidy received ( $S$ ) has no significant influence on financial efficiency and conclude the fourth hypothesis.

**Hypothesis 3b** – Annual subsidy received ( $S$ ) negatively influences financial efficiency.

The variable geographical region (RGN) can be expected to have a significant impact on an MFI's efficiency, based on the distribution over the applied regions. While some regions are saturated and mature, some lack microfinance distribution, as shown in the sample of the SDI values by region (see [table 10](#)). Rejecting the null hypothesis that geographical region has no significant impact on efficiency, we can conclude the fifth hypothesis.

**Hypothesis 4** – The geographical region (RGN) has a significant impact on efficiency.

#### 11.4. PCA

Although the inputs and outputs are based on existing research, verifying optimal model specifications for the specific data set remains crucial. The number of inputs and outputs needs to be reduced to a parsimonious amount since correlations between inputs and outputs are likely to make results unreliable (Pedraja-Chaparro, Salinas-Jiménez, & Smith, 1999), and studies with a large number of variables produce higher mean technical efficiency scores in DEA (Fall, Akim, & Wassongma, 2018). However, there are no statistical frameworks to test on significance in a DEA model (Gutiérrez-Nieto et al., 2006). The model specification methodology (Serrano Cinca & Mar Molinero, 2004) seems the most promising approach. In the model specification approach, the efficiency scores for all possible combinations of inputs and outputs (see [table13](#)), i.e., model specifications, are calculated in this thesis with

an input-oriented BCC model. Each DMU has a specific efficiency score under each model specification and can be compared for further analysis.

To enable readability, the inputs (I) and outputs (O) will be coded according to [table 13](#).

**Table 13 - Coding and model specifications**

Financial Model		Possible model specifications
<b>Input</b>	<b>Code</b>	FM.I1.I2.O1.O2
Operating Expenses	I1	FM.I1.I2.O1
Total Number of Employees	I2	FM.I1.I2.O2
<b>Output</b>	<b>Code</b>	FM.I1.O1.O2
Gross Loan Portfolio	O1	FM.I1.O1
Financial Revenue	O2	FM.I1.O2
		FM.I2.O1.O2
		FM.I2.O1
		FM.I2.O2
Social Model		Possible model specifications
<b>Input</b>	<b>Code</b>	SM.I1.I2.O1.O2
Operating Expenses	I1	SM.I1.I2.O1
Total Number of Employees	I2	SM.I1.I2.O2
<b>Output</b>	<b>Code</b>	SM.I1.O1.O2
Number of Active Borrowers	O1	SM.I1.O1
Average Loan Balance per Borrower / GNI per Capita	O2	SM.I1.O2
		SM.I2.O1.O2
		SM.I2.O1
		SM.I2.O2

*Source: author's own compilation*

Thus, the resulting nine specifications respectively for the financial and social model will be the columns in the model-specific two-way tables, while the DMUs will be presented in the rows (see [appendix 6](#) and [appendix 7](#)). A subsequent principal component analysis (PCA) rejects insufficient model specifications and prioritizes the remaining models by their efficiency. The model specifications are treated as variables in the PCA, and the DMUs (MFIs) are treated as cases.

## 11.5. Model specification

In the final step, using regression analysis, the effect of MFI age, MFI size, and subsidies on the MFI efficiency scores from the DEA is measured through an OLS regression (see [Fig. 9](#)). The dependent variable is the financial efficiency score for the financial model and the social efficiency score for the social model. The independent variables assumed to determine financial and social efficiency are age (AGE), size (SIZE), and annual subsidy received (S).



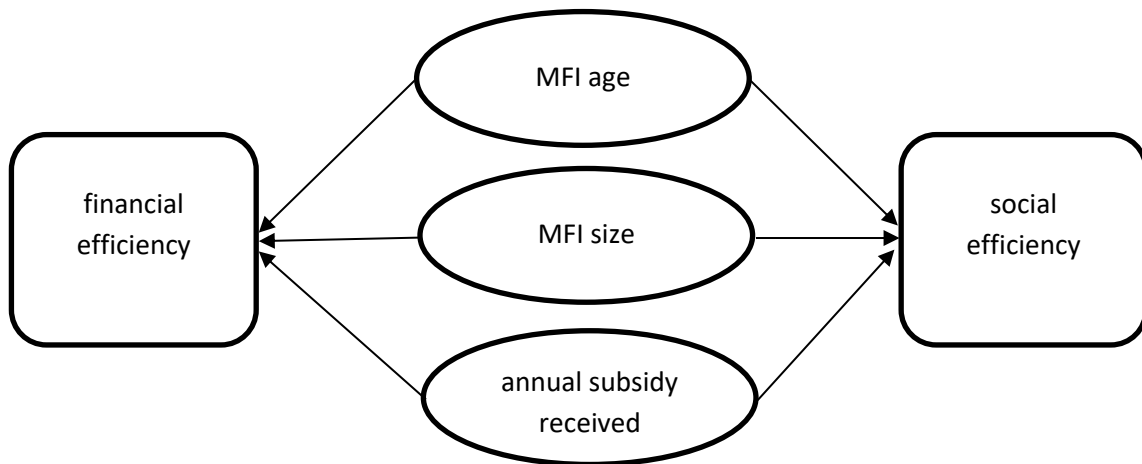


Fig. 9 - Core independent variables for the OLS regressions

The annual subsidy received (S) has been calculated based on Yaron (1992) (see [appendix 5](#)). Subsidy is broken down into three terms (Schreiner & Yaron, 2001), which are the opportunity cost of the subsidies used by the MFI throughout the year, the opportunity cost of the fresh subsidies which the MFI received throughout the year, and the true profit which the MFI would record without having received subsidies.

It had to be corrected based on the original variable “date established” from the data catalog before being implemented into the regressions as a dummy variable.

Regarding their age, three groups are defined based on the life cycle theory of MFI development (de Sousa-Shields & Frankiewicz, 2004), which claims that the funding sources are linked to the MFI’s stage of development. MFIs four years or younger are defined as new, MFIs between five and eight years of age are defined as young, and MFIs above eight years of age are defined as mature.

The dummy variable size (SIZE) is the same variable applied in the DEA (see [chapter 12.1](#)).

Additional environmental variables likely to influence efficiency scores are debt to equity ratio (DER), geographical region of operation (RGN), and legal status (LEGSTAT).

The dummy variable debt to equity ratio (DER) is a proxy for the MFIs’ leverage intensity to differentiate profit-oriented and social MFIs. The variable geographical



region (RGN) differentiates the four regions of operation generally applied in literature on MFIs, i.e., Africa & Middle East, Asia, Eastern Europe & Central Asia, and Latin America, and is a dummy variable to control for regional effects. The legal status (LEGSTAT) is the same dummy variable LEGSTAT applied in the DEA (see [chapter 12.1](#)).

Since the specification of outputs differs for the financial DEA and social DEA models, resulting in different efficiency scores, two separate regression analyses are required. Based on the dependent and independent variables, the two regressions have the following form:

$$\log(\theta_i) = \beta_0 + \beta_1 S_i + \beta_2 AGE_i + \beta_3 SIZE_i + \beta_4 DER_i + \beta_5 RGN_i + \beta_6 LEGSTAT_i + \varepsilon_i$$

## 12. Descriptive sample analysis preparing the regression analysis

### 12.1. Data Envelopment Analysis (DEA)

The computations of the DEA were conducted with the constantly improved commercial application DEA-Solver-Pro, version 15.1 from SAITECH, Inc.<sup>41</sup> due to its strong technical capabilities ([Barr, 2004](#)) and constantly high acceptance in research.

Since DEA is sensitive to outliers, both models (FM.I1.I2.O1.O2 and SM.I1.I2.O1.O2; see [table 13](#)) have been calculated with and without outliers to identify a possible effect. Outliers regarding assets were identical to outliers regarding the input OPEX and ranked among the MFIs with the most extensive staff, i.e., input Personnel. Since the outliers for the outputs, Gross Loan Portfolio and Financial Revenue are also identical to the outliers regarding assets, the five MFIs with the highest assets<sup>42</sup> were temporarily suppressed, and the DEA was rerun without outliers. However, there is no change in the MFIs' efficiency scores based on excluding the specific outliers for both the financial and social model, so the particular DEAs cannot be considered sensitive to outliers, and the outliers were not excluded.

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<sup>41</sup> <http://www.saitech-inc.com/>

<sup>42</sup> 100363, 100456, 100579, 100615, 100636

Efficiency scores for the input-oriented BCC model for financial efficiency include 15 efficient DMUs and 216 inefficient DMUs with an average efficiency score of 0.4003. Social efficiency scores include 12 efficient DMUs and 216 inefficient DMUs, with a lower average efficiency score of 0.2867 (see [table 14](#)). See [appendix 6](#)<sup>43</sup> and [appendix 7](#) for detailed efficiency scores of the DEA for all 18 possible model specifications<sup>44</sup>.

**Table 14 - Results of the BCC models**

	Financial model (FM.I1.I2.O1.O2)	Social model (SM.I1.I2.O1.O2)
Number of DMUs	216	216
Number of efficient DMUs	15	12
Average efficiency score	0.4003	0.2867
Percentage of efficient DMUs	6.94%	5.56 %

Source: author's own compilation

Four regions<sup>45</sup>, Africa & Middle East, Asia, Eastern Europe & Central Asia, and Latin America, are defined regarding the geographical distribution. Based on the literature, the four regions represent different economic, cultural, and legal areas.

As to MFI size, three groups are defined. MFIs with Assets below USD 5,000,000 are defined as small, MFIs with assets above USD 5,000,000 and below USD 50,000,000 are defined as medium, and MFIs with assets above USD 50,000,000 are defined as large.

With respect to profit status, for-profit institutions include 66.67% of all financially efficient MFIs while only representing 43.32% of all MFIs, with a ratio of 1.54.

Regarding social efficiency scores, non-profit and for-profit MFIs are equally distributed, representing 50% each. While non-profit MFIS represent 56.02% of the sample, they are underrepresented in relation to their efficiency with a ratio of 0.89, in contrast to for-profit MFIs representing 43.52% with a ratio of 1.15.

<sup>43</sup> Efficiency Scores from all DEA models can be found on the data drive in the Excel file "All Efficiency Scores.xlsx"

<sup>44</sup> All detailed DEA calculations can be found on the data drive in the folder "DEA tests and efficiency scores". A mere overview of the results can also be found in [appendix 6](#) for all financial models and [appendix 7](#) for all social models.

<sup>45</sup> Within the sample of 216 MFIs, [Region 1](#) (Africa & Middle East) represents Angola (1), Egypt (2), The Gambia (1), Jordan (4), Kenya (7), Lebanon (2), Malawi (2), Mozambique (1), Palestine (3), Rwanda (1), Sierra Leone (1), Tanzania (2), Uganda (6), and Zambia (1). [Region 2](#) (Asia) represents Afghanistan (8), Bangladesh (17), Cambodia (11), People's Republic of China (2), East Timor (2), India (29), Pakistan (16), Philippines (23), Samoa (1), Sri Lanka (7), and Vietnam (1). [Region 3](#) (Eastern Europe & Central Asia) represents Albania (3), Armenia (4), Azerbaijan (7), Bosnia and Herzegovina (12), Bulgaria (1), Georgia (5), Kosovo (3), Kyrgyzstan (7), Macedonia (2), Moldova (1), Mongolia (3), Poland (1), Romania (4), Russia (2), Serbia (3), and Tajikistan (4). [Region 4](#) (Latin America) represents El Salvador (1), Haiti (1), and Mexico (1)

Regarding their legal status, six widespread legal forms are defined in the data catalog, i.e., banks, credit unions and cooperatives, NBFIs, NGOs, rural banks, and others.

In each possible model specification, each DMU has a specific efficiency score (see [appendix 6](#) and [appendix 7](#)).

Based on the model specification FM.I1.I2.O1.O2 (See [appendix 6](#)), the input-oriented BCC model results will be explained.

15 DMUs are fully efficient with an efficiency score of 1 and zero slack. All other 201 DMUs are technically inefficient. For example, MFI “LOK Microcredit Foundation” (100525) from Bosnia and Herzegovina has three preferred references (Lambda) to become fully efficient itself. It follows the fully efficient MFIs “Pustikar Sakh Sahakari Samiti Ltd.” (100015), “PATRA Yanbian” (101801), and “Mol Bulak NBCO LLC” (102061), which, by definition, do not have to follow any other DMUs themselves. For the technically inefficient MFI “LOK Microcredit Foundation” to become proportionally efficient, it would have to change inputs and outputs to specific target values based on its reference DMUs. Personnel would have to be reduced by 2.1 % from currently 306 employees to 299.53, and OPEX should be reduced by 4.99 % from USD 10,740,196 to USD 10,204,361. Regarding its outputs, the MFI needs to increase its Gross Loan Portfolio by 105.67 % from USD 68,206,950 to 140,283,224. There is, however, no need to improve or decrease its Financial Revenue of USD 27,329,084 to become fully efficient. Having interpreted the predicted values, slacks differ in so far as they show discrepancies.

Similar interpretations are possible for all DMUs across all performance models.

Returns to scale (RTS): The number of DMUs with increasing RTS is 152, 14 DMUs show constant RTS, and 50 DMUs show decreasing RTS.

The model specifications are treated as variables in the following PCA, and the DMUs (MFIs) are treated as cases. The PCA favors the models FMI1I2O1O2 and SMI1I2O1O2.

## 12.2. PCA

The PCA has been conducted with STATA/IC 13.1. The Kaiser-Meyer-Olkin measure of sampling adequacy had to be at least 0.5 in order not to be rejected. Principal components that account for variance in the data due to random error or noise have been selected with Horn's Parallel Analysis. Unexplained values above 0.5 have been dropped, and loadings had to be at least 0.7. Homoscedasticity was tested for with Bartlett's test, and the p-value had to be below 0.05. Model specifications not meeting these requirements were dropped, and the PCA was rerun.

PCA was conducted separately for the financial and social models, applying the resulting financial or social efficiency scores from all possible DEA models. The total number of possible combinations from two inputs and two outputs is nine for the financial and the social model, neglecting redundancies due to mere deviating sequences.

### PCA – Financial Model

The first principal component of the financial model, accounting for 77.23% of the variance, has an associated eigenvalue of 6.95. Only one more eigenvalue is greater than 1, at 1.42, accounting for 15.79 of the variance. In total, the first two principal components account for 93.02% of the variance. This suggests that only two numbers (components) are required to explain why a particular MFI achieves a specific efficiency level under all specifications. The Kaiser-Meyer-Olkin measure of sampling adequacy shows values above 0.7061 with an average of 0.7652. Horn's Parallel Analysis for principal components confirms after 270 iterations that Horn's adjusted Eigenvalue criterion is met, and indeed only two principal components are required. Rerunning the PCA and forcing the PCA to divide the (remaining) variables into two components shows that all unexplained components do not exceed 0.141 and stay way below 0.5. Orthogonal rotation confirms the results. Both principal components included loadings of 0.8003 or above for all financial models. The factor test showed a p-value of 0.000. The analysis confirms that model specification FM.I1.I2.O1.O2, which includes both input and output variables, is the most reliable specification, as the literature research suggests.

### PCA – Social Model

The first principal component of the social model, accounting for 67.95% of the variance, has an associated eigenvalue of 5.44. Only one more eigenvalue is greater than 1, at 1.63, accounting for 20.42 of the variance. In total, the first two principal components account for 88.36% of the variance. This suggests that only two numbers (components) are required to explain why a particular MFI achieves a specific efficiency level under all specifications. However, one iteration was necessary, and one model specification had to be rejected. The rejected specification is SM.I1.O1. The Kaiser-Meyer-Olkin measure of sampling adequacy shows values above 0.5449 with an average of 0.6198. Horn's Parallel Analysis for principal components confirms after 240 iterations that Horn's adjusted Eigenvalue criterion is met, and indeed only two principal components are required. Rerunning the PCA and forcing the PCA to divide the (remaining) variables into two components shows that all unexplained components do not exceed 0.2583 and stay way below 0.5. Orthogonal rotation confirms the results. The principal component included loadings of 0.714 or above for all social models. The factor test showed a p-value of 0.000. The analysis confirms that model specification SM.I1.I2.O1.O2, which includes both input and output variables, is the most reliable specification, as the literature research suggests.

Both PCAs confirm that the model specifications, including both inputs and outputs suggested by the literature, report the most reliable results. DEA component correlations are shown in table 15<sup>46</sup>. Due to the sheer amount of DMUs, this thesis refrains from a graphical approach.

A high and positive correlation of the first principal component (Comp1) with efficiency can be seen under all remaining model specifications in both cases. However, one model specification was dropped for the social model. The second principal component (Comp2) for the financial model is mainly weakly negatively correlated, except for the model specifications FM.I1.O1.O2, FM.I1.O1, and FM.I1.O2, where it is strongly positively correlated.

Further analysis will be conducted with the most extensive model in both the financial and social models, including two inputs and two outputs.

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<sup>46</sup> The STATA code for both PCA models can be found on the data drive in the file "STATA DEA PCA.do". The code refers to the tabs "FMx100" AND "SMx100"

**Table 15 - DEA component loadings matrices**

Financial model			Social model		
	Comp1	Comp2		Comp1	Comp2
FMI1I2O1O2	.9685	-.05152	SMI1I2O1O2	.9813	.1097
FMI1I2O1	.9268	-.001896	SMI1I2O1	.7368	.5879
FMI1I2O2	.9632	-.04539	SMI1I2O2	.8548	-.4087
FMI1O1O2	.8381	.5066	SMI1O1O2	.8558	-.09618
FMI1O1	.8003	.5209	SMI1O2	.7615	-.5855
FMI1O2	.83	.5123	SMI2O1O2	.8999	.2283
FMI2O1O2	.8613	-.4627	SMI2O1	.6724	.714
FMI2O1	.851	-.4341	SMI2O2	.7906	-.4413
FMI2O2	.8534	-.4725			

Source: author's own compilation

Source: author's own compilation

## 12.3. Preparation of the regression analysis

### Dependent variables

The dependent variables financial efficiency score and social efficiency score have been logged to achieve normality.

### Independent variables

AGE – Mature MFIs include 66.67% of all financially efficient MFIs while representing only 62.96% of all MFIs with a ratio of 1.06, while new and young MFIs are underrepresented. Regarding social efficiency scores, mature MFIs include 83.33% of all efficient MFIs while representing only 62.96% of all MFIs with a ratio of 1.32, while new and young MFIs are again underrepresented.

**Table 16 - Frequency by age**

variable	age	frequency
AGE1	Mature	136
AGE2	New	38
AGE3	Young	42
	Total	216

Source: author's own compilation

SIZE – MFIs are either small, medium, or large based on their total assets. Large MFIs include 60.00% of all financially efficient MFIs but represent only 16.13% of all MFIs, equivalent to a ratio of 3.72; all other regions are underrepresented. Regarding social efficiency scores, large MFIs include 33.33% of all efficient MFIs while representing only 16.20% of all MFIs with a ratio of 2.06, small MFIs include 58.33% of all efficient MFIs but represent only 31.94% of all MFIs with a ratio of 1.83, while large MFIs include 33.33% of all efficient MFIs but represent 16.20% of all MFIs.

Medium size MFIs include 8.33% of all efficient MFIs while representing 51.85% of all MFIs with the lowest ratio of 0.16.

**Table 17 - Frequency by size**

variable	size	frequency
SIZE1	Large	35
SIZE2	Medium	112
SIZE3	Small	69
	Total	216

Source: author's own compilation

S – Subsidies historically play an essential role in the industry (Cull & Morduch, 2017), e.g., MFIs' loan pricing is critically related to continuing reliance on subsidies (Karlan & Zinman, 2008). They remain among the main drivers as a funding source of MFIs' financial and social performance (Hermes & Hudon, 2018).

RGN – Regarding financial efficiency scores, Eastern Europe & Central Asia include 53.33% of all efficient MFIs while representing only 28.57% of all MFIs with a ratio of 1.87. All other regions are underrepresented in proportion to their share within the sample or, in the case of Latin America, do not include efficient MFIs. Regarding social efficiency scores, Eastern Europe & Central Asia includes 41.67% of all efficient MFIs while representing only 28.70% of all MFIs with a ratio of 1.45. All other regions are underrepresented in proportion to their share within the sample or, in the case of Latin America, do not include efficient MFIs. Asia has a ratio of 0.92, and Africa & Middle East has a ratio of 0.53.

**Table 18 - Frequency by geographical region**

variable	region	frequency
RGN1	Africa & Middle East	34
RGN2	Asia	117
RGN 3	Eastern Europe & Central Asia	62
RGN 4	Latin America	3
	Total	216

Source: author's own compilation

LEGSTAT – Banks and NBFIs include 40.00% of all financially efficient MFIs each, while banks only represent 8.29% with a ratio of 4.82 and NBFIs 44.70% of all MFIs with a ratio of 2.07. NBFIs are slightly underrepresented with a ratio of 0.89, and NGOs are strongly underrepresented with a ratio of 0.35. Rural Banks are inefficient. Regarding social efficiency scores, Credit Unions include 16.67% of all efficient MFIs while representing only 3.24% of all MFIs with a ratio of 5.14. Banks surprisingly include 25.00% of all efficient MFIs while representing 8.33% of all MFIs with a ratio of 3.00. NBFIs are underrepresented, including 41.67% of all efficient MFIs while

representing 37.96% of all MFIs with a ratio of 0.93. NBFIs are also underrepresented, with a ratio of 0.44. Rural banks and Others are inefficient.

**Table 19 - Frequency by legal status**

variable	legal status	frequency
LEGSTAT1	Bank	18
LEGSTAT2	Credit Union / Cooperative	7
LEGSTAT3	NBFI	97
LEGSTAT4	NGO	82
LEGSTAT5	Other	1
LEGSTAT6	Rural Bank	11
	Total	216

Source: author's own compilation

### 13. Results

For all models, the independent and control variables have been checked for multicollinearity to ensure the reliability of coefficients and standard errors. No variables have shown a variance inflation factor of 10 or above, indicating no multicollinearity. Normality of residuals has been checked; linearity has been confirmed. Shapiro-Wilk W tests for normality have shown no severe outliers.

Atypically low and high data values that disturb the normal distribution for the residuals of the financial model were not expected due to the moderate skewness of the efficiency scores underlying the logged dependent variable with a mean of 0.2929 and a median of 0.2079. A similar assumption can be made for the social model with a mean of 0.2867 and a median of 0.214.

Taking a closer look at the DEA does not indicate an isolated input or output relevant for possible outliers, which is due to the nature of the DEA. An alternative search for extreme annual subsidy received (S) or debt to equity ratios (DER) did not indicate any relevance for the presence of outliers. However, the log transformation of the efficiency scores forced the response variable "Score" to become closer to a normal distribution and helped suppress potential outliers. Since no outliers exist, none had to be removed.

Checks for homoscedasticity of residuals show some inconsistent spreads in the patterns of the residuals. Robust regression (model 2) using iteratively reweighted least squares has therefore been additionally conducted to overcome



heteroscedasticity for both financial and social models. The robust regression has been rerun (model 3) without the insignificant variables but had no impact on the significant variables in the financial efficiency regression. The variable LEGSTAT5 has been omitted in the robust model in the social efficiency regression. However, the lack of change in the direction of the significant variables throughout all models indicates that the levels of heteroscedasticity have been a minor problem and that the findings are robust.

**Table 20 - Regression results<sup>47</sup>**

Variables	FE			SE		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
S	-6.98e-09 (-1.26)	-4.85e-09 (-0.93)		-3.83e-08* (-2.41)	-5.85e-08*** (-3.87)	-6.05e-08*** (-4.32)
AGE1	-0.0146 (-0.37)	-0.0239 (-0.63)		0.149 (1.25)	0.137 (1.20)	
AGE2	-0.0832 (-1.67)	-0.0971* (-2.07)	-0.0943** (-2.60)			
AGE3				0.0748 (0.52)	0.171 (1.25)	
SIZE1	0.305*** (5.43)	0.272*** (5.15)	0.261*** (5.96)			
SIZE2	0.126*** (3.68)	0.103** (3.20)	0.125*** (4.03)	-0.374** (-2.64)	-0.311* (-2.30)	-0.428*** (-5.42)
SIZE3				0.109 (0.67)	0.152 (0.99)	
DER	0.00105 (1.08)	0.000934 (1.02)		-0.00146 (-0.53)	-0.00158 (-0.60)	
RGN2	-0.178*** (-4.17)	-0.157*** (-3.92)	-0.146*** (-3.90)	-0.0772 (-0.63)	-0.0579 (-0.50)	
RGN3	0.243*** (4.85)	0.244*** (5.17)	0.240*** (5.61)	0.00904 (0.06)	0.0618 (0.45)	
RGN4	-0.00595 (-0.05)	0.0150 (0.13)		-0.466 (-1.28)	-0.443 (-1.28)	
LEGSTAT1	-0.188 (-1.81)	-0.0677 (-0.69)		-1.010*** (-3.37)	-1.285*** (-4.51)	-1.287*** (-4.79)
LEGSTAT3	-0.171* (-2.05)	-0.0299 (-0.38)		-0.740** (-3.09)	-0.712** (-3.13)	-0.710** (-3.20)
LEGSTAT4	-0.164* (-1.98)	-0.0651 (-0.83)		-0.550* (-2.31)	-0.532* (-2.34)	-0.602** (-2.70)
LEGSTAT5	-0.106 (-0.47)	0.0283 (0.13)		-1.342* (-2.06)	-1.286* (-2.08)	0 (.)
LEGSTAT6	0.0198 (0.20)	0.123 (1.29)		-0.664* (-2.29)	-0.682* (-2.47)	-0.703* (-2.58)
_cons	-0.546*** (-5.42)	-0.649*** (-6.85)	-0.716*** (-18.28)	-0.676* (-2.21)	-0.773** (-2.65)	-0.543* (-2.46)
N	215	215	215	216	216	215
R-sq	0.559	0.583	0.559	0.250	0.343	0.315

t statistics in parentheses

\* p<0.05, \*\* p<0.01, \*\*\* p<0.001

FE:= financial efficiency, SE:= social efficiency, S:= annual subsidy received, AGE1:= Mature, AGE2:= New, AGE3:= Young, SIZE1:= Large, SIZE2:= Medium, SIZE3:= Small, DER:= Debt to equity ratio, RGN2:= Asia, RGN3:= Eastern Europe & Central Asia, RGN4:= Latin America, LEGSTAT1:= Bank, LEGSTAT3:= NBF, LEGSTAT4:= NGO, LEGSTAT5:= Other, LEGSTAT6:= Rural Bank

<sup>47</sup> The STATA code for all regression models can be found on the data drive in the folder "Regression analysis (STATA)" in the file "STATApaper2\_01.07 condensed.do"

Source: author's own compilation

Two regression models have been applied, one with the financial efficiency scores and one with the social efficiency scores from the DEA (see [appendix 6](#) and [appendix 7](#)), as Pareto-optimal decision making units (DMU) within the sample, based on inputs and outputs derived from the literature (see [table 12](#)).

$$\log(\theta_i) = \beta_0 + \beta_1 S_i + \beta_2 AGE_i + \beta_3 SIZE_i + \beta_4 DER_i + \beta_5 RGN_i + \beta_5 LEGSTAT_i + \varepsilon_i$$

The respective efficiency scores have been implemented in the OLS regression as the logged response variable. The response variable  $\theta$  denotes the DMUs' efficiency with respect to the efficiency frontier only within the sample and is always within a range of 0 and 1, indicating the highest possible output by each DMU given the inputs of each model. The efficiency score is a continuous variable with a maximum of 100% efficiency. To interpret the results of the logged response variable, one needs to be aware that the starting value of  $\theta$  differs for both models and that a one-unit increase or decrease in the coefficient has consequently a different influence on efficiency in both models depending on their individual starting value.

In the financial model, 15 MFIs (6.94%) are at the 100% efficiency level; the starting value, i.e., the lowest efficiency score, is 0,04707 ([appendix 6](#)), or 4.707 %.

Regarding the social model 12 MFIs (5.56%) reach maximum efficiency with a starting value of 0,05236 ([appendix 7](#)), or 5.236%, which is the lowest efficiency within the sample.

An increase of one unit in  $S$  is associated with an increase of  $\beta_1$  in  $\log \theta_i$ . Based on the logarithmic form of the dependent variable and unlogged explanatory variables, the substantive interpretation of respective estimation results gets more complicated, and the coefficients should be exponentiated to interpret their influence since one is interested in the results of the original scale of the response variable instead of the logged efficiency. For positive coefficients, the conversion is  $\exp(\text{coef.})-1$ ; for negative coefficients, the conversion is  $-(1-\exp(\text{coef.}))$ <sup>48</sup>.

When, as in both models, the response variable is logged, and the predictor variables are not, a one-unit change in the predictor variable is associated with a 100x the

<sup>48</sup> See [appendix 8](#) for a complete list of exponentiated coefficients from [table 20](#)

coefficient percent change in the response variable's percentual increase or decrease.

However, this approximation only works well if the coefficient is close to zero since the difference between non-exponentiating and exponentiating gets wider the higher the coefficient is. The coefficients for the annual subsidy received (S) are close to zero in all models, and indeed, no difference can be confirmed between exponentiated and non-exponentiated coefficients comparing regression results (see [table 20](#) and [appendix 8](#)). The continuous predictor variable debt to equity ratio (DER) is not significant in all models and can be ignored. The dummy variables age, size, region, and legal status are binary categorical predictor variables.

Regarding the interpretation of the predictor variables' coefficients, their direction (positive/negative) and their statistical significance have been addressed, as well as their increase or decrease. A negative value for the constant (cons) is no point of concern, since it is consistent within the microfinance industry that the expected value of the response variable will be negative when all predictors are set to zero.

After rejecting the null hypothesis, the hypothesis of a positive impact of age on financial and social efficiency ([hypothesis 1](#)) has been partly confirmed for financial efficiency. Regarding the influence of age of an MFI on its financial efficiency, the exponentiated coefficient for MFIs of four years or younger (AGE2) is negative (-0.09) and highly significant, indicating a negative relationship for new MFIs. This means that, based on  $\beta_2$  being -0.0943 and  $-(1-\exp(-0.0943))$  being -0.0900, any MFI of four years or younger is, on average, 9% less efficient than MFIs from any other age group within the data set. However, the results are insignificant for older MFIs. While the coefficients for young and mature MFIs are positive regarding social efficiency, they remain insignificant. Therefore, the hypothesis has to be rejected for social efficiency at any age of a MFI for the sample.

The hypothesis of a positive impact of size on financial and social efficiency ([hypothesis 2](#)) has been confirmed for financial efficiency. Concerning the influence of the MFIs' size on financial efficiency, a positive and highly significant influence can be found for large and medium-sized MFIs. The exponentiated coefficient for large MFIs (SIZE1) is 0.2982. This means that, based on  $\beta_3$  being 0.261 and  $\exp(0.261)-1$  being 0.2982, any MFI with assets above USD 50,000,000 are, on average, 29.82%

more efficient than MFIs of any other size within the data set. Medium-sized MFIs, i.e., MFIs with assets above USD 5,000,000 and below USD 50,000,000, show a  $\beta_3$  of 0.125, and  $\exp(0.125)-1$  being 0,1331 are on average 13.31% more efficient than MFIs of any other size. This indicates that MFIs tend to be financially more efficient with growing size.

Regarding social efficiency, small MFIs show a positive coefficient but remain insignificant. Interestingly, medium-sized MFIs show a negative exponentiated coefficient of -0.3482, indicating that size negatively influences social efficiency in contrast to financial efficiency, where it has been confirmed. This means that, based on  $\beta_3$  being -0.428 and  $-(1-\exp(-0.428))$  being -0.3482, any medium-sized MFI is, on average, 34.82% less efficient than MFIs of any other size within the data set.

Therefore, the joint hypothesis of a positive impact of size on both forms of efficiency, financial and social, strictly speaking, has to be rejected. However, we can separate the relationships for financial and social efficiency and conclude a confirmation for financial efficiency, indicating towards the severe conflict of interest from the MFIs' double mission on their path to sustainability.

The unit for the continuous predictor variable annual subsidy received (S) is US dollar [USD], reaching from USD -17,243,767.09 to USD 24,509,012.59. The relationship between annual subsidy received and efficiency differs substantially for both models. While both models show negative coefficients, the influence is not significant regarding financial efficiency. However, the effect is strongly significant for social efficiency, indicating that subsidies have a negative impact on the social efficiency of MFIs. The exponentiated coefficient of -6.05e-08 shows a minor but highly significant negative influence of subsidies on social efficiency. Based on the  $\beta_1$  being -6.05e-08, each additional USD in S is associated with a decrease in efficiency of -0,000000605 percent on social efficiency since  $-(1-\exp(\text{coef.})) = -6.04999981224097\text{e-}08 \approx -0.000000605\%$ . An increase of S based on the sample's median of USD 192,341.60 would result in a decrease in efficiency of 1.1569%, while an increase of S based on the sample's arithmetic mean of USD 1,222,683.00 would result in a decrease in efficiency of 7.1303 percent. Since the coefficient is close to zero, the difference between being exponentiated or not does not lead to different results. Therefore, after rejecting the null hypothesis that the annual subsidy received has no significant influence on social efficiency, we have to reject the hypothesis of a positive impact of

the annual subsidy received on social efficiency ([hypothesis 3a](#)). Regarding the influence of subsidies on social efficiency, a relatively small but significant negative effect can be seen, which seems counterintuitive to the implicit intention to subsidize MFIs to improve their efficiency over time to enable their sustainability. This indicates that subsidies might be hindering the social efficiency of MFIs.

For the hypothesis of a positive impact of annual subsidy received on financial efficiency ([hypothesis 3b](#)), the null hypothesis of no significant influence of annual subsidy received on financial efficiency could not be rejected. The hypothesis itself could also not be confirmed. Again, this seems counterintuitive and addresses the question of an even more detailed differentiation of subsidies. A possible solution can be found with Armendáriz and Jonathan (2004), who suggest that subsidies should be smart, i.e., transparent, rule-bound, and limited in time, which has not been this thesis' perspective due to the nature of the SDI approach. Since the applied data cannot provide these details, a conclusion regarding a potential mission drift of individual MFIs cannot be excluded.

The hypothesis of a significant impact of the geographical region on financial efficiency ([hypothesis 4](#)) has been confirmed but must be rejected for social efficiency. The regional influence is mixed. Highly significant coefficients for financial efficiency can be seen in the two most saturated markets in the sample, Asia (RGN2) and Eastern Europe & Central Asia (RGN3). Based on  $\beta_5$  being -0.146 and  $-(1-\exp(-0.146))$  being -1358, MFIs in the biggest market, Asia (RGN2), are, on average, 13.58% less efficient than MFIs from any other region within the sample. A contrary influence can be seen for Eastern Europe & Central Asia (RGN3). With  $\beta_5$  being 0.24, and  $\exp(0.24)-1$  being 0.2712, MFIs in Eastern Europe & Central Asia are, on average, 27.12% more efficient than MFIs from any other region within the sample. Surprisingly, no influence of the region can be seen on social efficiency.

A reverse effect can be seen for the influence of the legal status. While an influence of the legal status of the MFIs cannot be confirmed for financial efficiency, the coefficients for social efficiency are as expected and support the findings regarding the MFIs' size. Regarding Banks (LEGSTAT1), the chronologically lowest negative and significant exponentiated coefficient of -1.287 can be seen among the various legal forms. Based on  $\beta_6$  being -1.287 and  $-(1-\exp(-1.287))$  being -0.7239, any bank MFI is, on average, 72.39% less efficient than MFIs of other legal status. This is

followed by NBFIs (LEGSTAT3) with  $\beta_6$  being -0.71 resulting in a decrease in efficiency of 50.84%, rural banks (LEGSTAT6) with  $\beta_6$  being -0.703 resulting in a decrease in efficiency of 50.49%, and NGOs (LEGSTAT4) with  $\beta_6$  being -0.602 resulting in a decrease in efficiency of 45.23%. The decline of the coefficients follows the expected pattern according to the social focus of the MFIs' legal status, with traditional banks being the least efficient regarding social efficiency.

## 14. Conclusion and implications

The thesis was motivated by the goal of understanding the need for and influence of subsidies on the sustainability efforts of MFIs as a tool to enable the very poor through access to credit. To achieve this goal, a two-step approach was required. After defining the basic terms of subsidies and sustainability based on the existing research, a theoretical framework was built based on the resource-based view of the firm and the contingency theory. A systematic derivation to reliably calculate subsidies was achieved through the application of the SDI, which additionally allowed to sort MFIs by their degree of subsidy dependence.

The calculation of the SDI for a sample of MFIs from a well-established data base allowed to answer the first research question.

*First research question: To which degree are MFIs subsidy dependent?*

The SDI has shown that the majority of all MFIs from the sample are still subsidy-dependent and that, taking the SDI as a proxy for sustainability, the microfinance market is still far from producing sustainable MFIs. Since the SDI addresses both the institution and the social cost to society, a case to continue subsidizing a growing market to enable the very poor through microfinance tools can easily be made by forming an argument to improve MFIs in the future and is quite common. Since access to the established banking system is blocked for the very poor, it seems worthwhile to continue one of the very few tools of credit access at hand. Considering the social costs of inefficient subsidization, it, however, becomes a less compelling argument, and its negative impact should not be easily rejected by politicians trying to improve the living conditions since, in some cases, subsidies might be distributed

better through other means. However, the high subsidy dependence of the MFIs also raises the question of whether the recipients of the subsidies should at all become sustainable over time or if their need to subsidize should merely be accepted as a cost to society to support the very poor through credit. This decision can only be made by taking into account other measures to fight poverty and enable the very poor.

The second part of the thesis addresses the question of which efforts MFIs undertake to become more efficient in order to achieve sustainability. This had to be done through a DEA with inputs and outputs based on a profound literature review in order to structure the MFIs by their efficiency. Only afterward was it possible to conduct research on the influence of subsidies on the MFIs' efficiency as a proxy for their sustainability efforts through regression analysis. This approach allowed to differentiate financial and social aspects of efficiency, taking into account the double mission of MFIs and answering the second research question.

*Second research question: Which relationship exists between subsidies and MFIs' sustainability efforts, i.e., their efficiency?*

In the interest of understanding the influence of subsidies on the financial and social efficiency of MFIs as a prerequisite for sustainability, the lack of a significant positive influence seems counterintuitive at first glance. However, the findings of a negative and marginal influence of subsidies on efficiency, in the case of financial efficiency, even insignificant, are backed by Morduch's findings ([Morduch, 1999a](#)) that efficient MFIs are less dependent on subsidies. This is in line with the finding that, on the one hand, MFIs in the sample are more likely to be financially than socially efficient, with 15 to 12 out of a total of 216, but the influence of subsidies is only significant for the later. Financially efficient MFIs are not only more likely, but they also show higher efficiency scores on average, with 0.4003 in contrast to only 0.2867 for socially efficient MFIs. Therefore, regarding the double mission, it is less likely to become financially efficient. Different efficiency findings corroborate an often assumed trade-off between financial and social sustainability.

An interesting case can be made for MFIs simply not needing subsidies received or neglecting them by deliberately choosing outreach over financial efficiency by serving clients with higher delivery costs, such as rural or poorer clients ([Bogan, 2012](#); [De](#)

[Aghion & Morduch, 2005](#)). After all, the small but insignificant negative effect of subsidies on financial efficiency is in line with the literature and should be addressed with even more detailed and large data sets to differentiate subsidies by their requirements and the legal status of the MFIs.

This opens a discussion if MFIs should try to fulfill a double mission or if it would be acceptable to allow a mission drift and focus subsidies on only specifically socially efficient MFIs that address the poorest of the poor. The findings seem to contradict this possibility since subsidies seem to significantly reduce an MFI's incentive to become socially efficient, which opens the discussion of moral hazard in subsidized MFIs and the consequences for their clients. MFIs' motivation to become efficient instead of potentially using their long journey towards efficiency to help the poor as an argument to collect subsidies over time should be critically controlled. A rigorous unbundling between the interest of subsidy providers and subsidy receivers, i.e., MFIs and clients alike, is crucial and questions the role of decision-makers from politics on the route of enabling socially efficient MFIs. However, the negative effect of subsidies is minimal in the sample, so further research should focus on the different roles of specific forms of subsidies to better understand how to reduce inefficiencies and enable sustainability.

The regression analysis has shown that subsidies are unlikely to help MFIs become efficient and consequently sustainable in the long run when addressed by employing established measures of efficiency from the microfinance literature. Nevertheless, MFIs do not seem to follow the current understanding of social efficiency, postulating the need for a more accessible approach to measuring their social impact. One approach could be to address the influence of subsidies on lending rates for the clients, which would not necessarily impact the MFIs' efficiency, but serve the overall mission by enabling credit for clients that would otherwise not be reached, maybe even through MFIs that would otherwise go out of business due to not being able to cover their cost.

Fortunately, even a negative influence of subsidies does not necessarily mean that the overall mission of helping the poor cannot be met, but that providers of subsidies would need to adapt their checks and balances by fulfilling the call for smart subsidies to be rule-bound.



Another approach would be to question the measurement of social efficiency itself. While the literature review and the resulting DEA are well-backed by research, it remains a challenge to argue why specific measures, such as the number of female borrowers or outreach, are, besides being included in the UN SDGs, in and of itself, sufficient to contribute to the overall goal of reaching sustainability of the industry through efficiency.

The findings of the thesis are not in conflict with existing research but bring a new perspective due to its approach of shedding light on the influence of subsidies on MFIs' efficiency as a proxy for their sustainability efforts. Thereby the thesis strengthens the appeal of the perspective that subsidies for MFIs can have a negative influence on the cost to society in the long run if not applied carefully.

A takeaway from the regression analysis is that older MFIs tend to be more efficient regarding financial efficiency, making a case for regulation towards supporting bigger market players in the interest of reducing subsidies and reallocating the subsidies towards other social causes if the policymakers want to optimize the cost to society.

While the approach of calculating subsidies through the SDI formula is compelling to address the full influence of subsidies in all its manifestations, it cannot address aspects such as terms for smart subsidies and comparison of MFIs over longer timeframes. Although the SDI is probably the most reliable measure to calculate subsidies, future research should find a formula to reliably include all forms of subsidies while analyzing the development of MFIs over longer time frames than one financial year while working around the need to gain access to financial data beyond the financial statements.

The thesis implications for further research include proof of the applicability of the SDI for the calculation of subsidies in well-defined time frames with data accessible through publicly accessible financial reports. However, it also shows the need to address legal aspects in calculating of subsidies to cover smart subsidies that depend on achieving milestones in an MFI's development over time. From a theoretical perspective, the thesis has shown the applicability of the RBV as a tool to address international data sets and the RBV's suitability to include social aspects of financial institutions' business goals.

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## Appendices

### Appendix 1

#### Overview of the 130 most relevant public donors for MFIs from the Data Catalog in 2009 and 2008

Abbreviation – Full Name – Website	Country of origin/ primary activity
ACPC - Agricultural Credit Policy Council - <a href="http://acpc.gov.ph">acpc.gov.ph</a>	Philippines
ADB - Asian Development Bank - <a href="http://www.adb.org">www.adb.org</a>	Philippines
AECID - Agencia Espanola de Cooperación Internacional para el Desarrollo - <a href="http://aecid.es">aecid.es</a>	Spain
AFD - Agence Française de Développement - <a href="http://www.afd.fr">www.afd.fr</a>	France
AKAM - Aga Khan Agency for Microfinance - <a href="http://www.akdn.org">www.akdn.org</a>	Switzerland
AKSRP - Aga Khan Rural Support Programme - <a href="http://akrsp.org.pk">akrsp.org.pk</a>	Pakistan
ARDB - Agricultural and Rural Development Bank - <a href="http://www.ardb.com.kh">www.ardb.com.kh</a>	Cambodia
AusAID - Australian Agency for International Development - <a href="http://dfat.gov.au/development/australias-development-program">dfat.gov.au/development/australias-development-program</a>	Australia
Bank of Uganda - Bank of Uganda - <a href="http://www.bou.or.ug">www.bou.or.ug</a>	Uganda
BAS - EBRD's Business Advisory Services - <a href="http://www.ebrd.com">www.ebrd.com</a>	Tajikistan
BGVB - Bangiya Gramin Vikash Bank - <a href="http://bgvb.in">bgvb.in</a>	India
BID - Inter-American Development Bank - <a href="http://www.iadb.org">www.iadb.org</a>	USA
BiH - Razvojna Banka Federacije - <a href="http://rbfbih.ba">rbfbih.ba</a>	Bosnia and Herzegovina
BIO - Belgian Investment Company for Developing Countries - <a href="http://www.bio-invest.be">www.bio-invest.be</a>	Belgium
BOC - Bank of Ceylon - <a href="http://boc.lk">boc.lk</a>	Sri Lanka
BSP - Bangko Sentral NG Pilipinas - <a href="http://www.bsp.gov.ph">www.bsp.gov.ph</a>	Philippines
BSTDB - Black Sea Trade and Development Bank - <a href="http://www.bstdb.org">www.bstdb.org</a>	Greece
CBI - Central Bank of India - <a href="http://www.centralbankofindia.co.in">www.centralbankofindia.co.in</a>	India
CBRA - Central Bank of the Republic of Azerbaijan - <a href="http://www.cbar.az">www.cbar.az</a>	Azerbaijan
CDA - Cooperative Development Authority - <a href="http://www.cda.gov.ph">www.cda.gov.ph</a>	Philippines
CDB - China Development Bank - <a href="http://www.cdb.com.cn">www.cdb.com.cn</a>	China
CDP - Community Development Programme - <a href="http://www.india.gov.in">www.india.gov.in</a>	India
CDR - Council for Development and Reconstruction - <a href="http://www.cdr.gov.lb">www.cdr.gov.lb</a>	Lebanon
CESSD - Communication for Effective Social Service Delivery - <a href="http://www.dfat.gov.au">www.dfat.gov.au</a>	Australia/Pakistan
CFLI - Canada Fund - <a href="http://www.canadainternational.gc.ca">www.canadainternational.gc.ca</a>	Canada
Chexim - The Export-Import Bank of China - <a href="http://www.eximbank.gov.cn">www.eximbank.gov.cn</a>	China
CIDA - Canadian International Development Agency - <a href="http://www.international.gc.ca">www.international.gc.ca</a>	Canada
CMP II - Crops Maximization Project-II - <a href="http://www.fao.org">www.fao.org</a>	United Nations/Pakistan
DACAAR - Danish Committee for Aid to Afghan Refugees - <a href="http://dacaar.org">dacaar.org</a>	Afghanistan
DANIDA - Danish International Development Agency - <a href="http://um.dk/da">um.dk/da</a>	Denmark
Danish Embassy - Danish Embassy - <a href="http://tanzania.um.dk/en/danida-en">tanzania.um.dk/en/danida-en</a>	Tanzania
DBP - Development Bank of the Philippines - <a href="http://www.dbp.ph">www.dbp.ph</a>	Philippines
DEF - Development and Employment Fund - <a href="http://www.unescwa.org/development-and-employment-fund">www.unescwa.org/development-and-employment-fund</a>	United Nations/Jordan
DEG - Deutsche Investitions- und Entwicklungsgesellschaft mbH - <a href="http://www.deginvest.de">www.deginvest.de</a>	Germany
DFID - Department for International Development - <a href="http://www.dfid.gov.uk">www.dfid.gov.uk</a>	United Kingdom
DTI - Department of Trade and Industries - <a href="http://www.dti.gov.ph">www.dti.gov.ph</a>	Philippines
DW - Development Workshop - <a href="http://www.dw.angonet.org">www.dw.angonet.org</a>	Angola
EBRD - European Bank for Reconstruction and Development - <a href="http://www.ebrd.com">www.ebrd.com</a>	European Union (UK)
EC - European Commission - <a href="http://ec.europa.eu">ec.europa.eu</a>	European Union (Belgium)
ECOSORN - Economic and Social Re-launch of Northwest Provinces - N/A	Cambodia
EFSE - European Fund for Southeast Europe (KfW) - <a href="http://www.efse.lu">www.efse.lu</a>	Germany
FAO - Food and Agriculture Organization of the United Nations - <a href="http://www.fao.org">www.fao.org</a>	United Nations
FBiH - Ministry of Finance (LIP) - <a href="http://www.mft.gov.ba">www.mft.gov.ba</a>	Bosnia and Herzegovina
FMO - Nederlandse Financierings-Maatschappij voor Ontwikkelingslanden N.V. - <a href="http://www.fmo.nl">www.fmo.nl</a>	Netherlands
FSSP - Financial Sector Strengthening Program - <a href="http://www.worldbank.org">www.worldbank.org</a>	Switzerland
FTB - Foreign Trade Bank of Cambodia - <a href="http://ftbiplc.com">ftbiplc.com</a>	Cambodia
Gillès Stichting - UNESCO/ Stichting Gillès - <a href="http://inezkort.wixsite.com/gilles">inezkort.wixsite.com/gilles</a>	Belgium

GTZ - Deutsche Gesellschaft fuer Technische Zusammenarbeit GmbH - <a href="http://www.giz.de">www.giz.de</a>	Germany
HBInt - Hypo Alpe Adria Bank - <a href="http://www.hypo-alpe-adria.com">www.hypo-alpe-adria.com</a>	Austria
IB - Indian Bank - <a href="http://www.indianbank.in">www.indianbank.in</a>	India
IBRD - International Bank for Reconstruction and Development - <a href="http://www.worldbank.org">www.worldbank.org</a>	USA
ICO - Instituto de Crédito Oficial - <a href="http://www.mineco.gob.es">www.mineco.gob.es</a>	Spain
IDA - International Development Association - <a href="http://ida.worldbank.org">ida.worldbank.org</a>	USA
IDB - Islamic Development Bank - <a href="http://www.isdb.org">www.isdb.org</a>	Saudi-Arabia
IDBI - Industrial Development Bank of India - <a href="http://www.idbibank.in">www.idbibank.in</a>	India
IFAD - International Fund for Agricultural Development - <a href="http://ifad.org">ifad.org</a>	United Nations
IFC - International Finance Corporation - <a href="http://www.ifc.org">www.ifc.org</a>	USA
IFCI - Industrial Finance Corporation of India - <a href="http://www.ifcilt.com">www.ifcilt.com</a>	India
ILO - International Labour Office - <a href="http://www.ilo.org">www.ilo.org</a>	Switzerland/Albania
INFUSE - Inclusive Finance for the Under-Served Economy - <a href="http://www.unCDF.org/timor-leste">www.unCDF.org/timor-leste</a>	United Nations
IOB - Indian Overseas Bank - <a href="http://www.iob.in">www.iob.in</a>	India
JBIC - Japan Bank for International Cooperation - <a href="http://www.jbic.go.jp">www.jbic.go.jp</a>	Japan
JICA - Japanese International Cooperation Agency - <a href="http://www.jica.go.jp">www.jica.go.jp</a>	Japan
JSDF - Japan Social Development Fund - <a href="http://www.worldbank.org">www.worldbank.org</a>	Japan
KfW - Kreditanstalt fuer Wiederaufbau - <a href="http://www.kfw.de">www.kfw.de</a>	Germany
KPF - Khushhal Pakistan Fund - N/A	Pakistan
LBP - Land Bank of the Philippines - <a href="http://www.landbank.com">www.landbank.com</a>	Philippines
MAEP - Mymensingh Aquaculture Extension Project (follow up to the DANIDA's, Denmark's development cooperation, AES/FARS program) - <a href="http://um.dk/en/danida-en/">um.dk/en/danida-en/</a>	Bangladesh
MESPT - Micro Enterprises Support Programme Trust - <a href="http://mespt.org">mespt.org</a>	Kenya
Ministry of Finance - Ministry of Finance (Afghanistan) - <a href="http://mof.gov.af">mof.gov.af</a>	Afghanistan
MISFA - Microfinance Investment Support Facility for Afghanistan Limited - <a href="http://misfa.org.af">misfa.org.af</a>	Afghanistan
msc - The Microfinance Support Centre Limited - <a href="http://www.msc.co.ug">www.msc.co.ug</a>	Uganda
N/A - City Government of Palawan - <a href="http://www.palawan.gov.ph">www.palawan.gov.ph</a>	Philippines
N/A - Danish Ministry of foreign affairs - <a href="http://um.dk">um.dk</a>	Denmark
N/A - Dutch Grant Loan - <a href="http://business.gov.nl">business.gov.nl</a>	Netherlands
N/A - Emergency Livelihood Restoration Programme - <a href="http://www.fao.org">www.fao.org</a>	United Nations/Pakistan
N/A - German-Azerbaijan Fund (KfW) - <a href="http://www.kfw-entwicklungsbank.de">www.kfw-entwicklungsbank.de</a>	Germany
N/A - Ministry of Labor - <a href="http://timor-leste.gov.tl">timor-leste.gov.tl</a>	East Timor
NABARD - National Bank for Agriculture and Rural Development - <a href="http://www.nabard.org">www.nabard.org</a>	India
National Bank of Pakistan - National Bank of Pakistan - <a href="http://www.nbp.com.pk">www.nbp.com.pk</a>	Pakistan
NBC - National Bank of Cambodia - <a href="http://www.nbc.org.kh">www.nbc.org.kh</a>	Cambodia
NBM - National Bank of Malawi - <a href="http://natbank.co.mw">natbank.co.mw</a>	Malawi
NFA - National Food Authority - <a href="http://www.nfa.gov.ph">www.nfa.gov.ph</a>	Philippines
NFSE - National Fund for Support of Entrepreneurship - <a href="http://agrarkredit.az">agrarkredit.az</a>	Azerbaijan
NLSF - National Livelihood Support Fund - <a href="http://www.landbank.com">www.landbank.com</a>	Philippines
NORAD - Norwegian Agency for Development Cooperation - <a href="http://www.norad.no">www.norad.no</a>	Norway
NORFUND - Norwegian Investment Fund for Developing Countries - <a href="http://www.norfund.no">www.norfund.no</a>	Norway
OBC - Oriental Bank of Commerce - <a href="http://www.obcindia.co.in">www.obcindia.co.in</a>	India
OFID - OPEC Fund for International Development - <a href="http://opecfund.org">opecfund.org</a>	Austria
PAEF - Polish-American Enterprise Fund - N/A	USA
PCDF - Philippines-Canada Development Fund - N/A	Canada
People's Bank - People's Bank - <a href="http://www.peoplesbank.lk">www.peoplesbank.lk</a>	Sri Lanka
PKSF - Palli Karma-Sahayak Foundation - <a href="http://pkfs-bd.org">pkfs-bd.org</a>	Bangladesh
PMSIL - Prime Minister Special Initiative for Livestock - <a href="http://www.mnfsr.gov.pk">www.mnfsr.gov.pk</a>	Pakistan
PNB - Philippine National Bank - <a href="http://www.pnb.com.ph">www.pnb.com.ph</a>	Philippines
PNB - Punjab National Bank - <a href="http://pnbanking.in">pnbanking.in</a>	India
PPAF - Pakistan Poverty Alleviation Fund - <a href="http://ppaf.org.pk">ppaf.org.pk</a>	Pakistan
PRM - Bureau of Population, Refugees, and Migration - <a href="http://www.state.gov/bureaus-offices/under-secretary-for-civilian-security-democracy-and-human-rights/bureau-of-population-refugees-and-migration">www.state.gov/bureaus-offices/under-secretary-for-civilian-security-democracy-and-human-rights/bureau-of-population-refugees-and-migration</a>	USA
PRONAFIN - Programa Nacional de Financiamiento al Microempresario - <a href="http://www.gob.mx/pronafim">www.gob.mx/pronafim</a>	Mexico
QUEDANCOR - Quedan and Rural Credit Guarantee Corporation - <a href="http://quedancor-home.blogspot.com">quedancor-home.blogspot.com</a>	Philippines
RAEF - Romanian American Enterprise Fund - <a href="http://www.raef.ro">www.raef.ro</a>	USA/Romania
RFBBIH - Development Bank of the Federation of Bosnia and Herzegovina - <a href="http://rbfbih.ba">rbfbih.ba</a>	Bosnia and Herzegovina
RGVN - Rashtriya Gramin Vikash Nidhi (sponsors: IFCI, IDBI, NABARD) - <a href="http://www.rgvn.org">www.rgvn.org</a>	India
RMK - Rashtriya Mahila Kosh - <a href="http://www.rmknic.in">www.rmknic.in</a>	India



RS DEF - Development and Employment Foundation of Republic of Srpska - N/A	Bosnia and Herzegovina
RSPN - Rural Support Programme Network - Phase II - <a href="http://www.rspn.org">www.rspn.org</a>	Pakistan
SBC / SBGFC - Small Business Corporation / Small Business Guarantee and Finance Corporation - <a href="http://www.sbgfc.org.ph">www.sbgfc.org.ph</a>	Philippines
SBI - State Bank of India - <a href="http://bank.sbi">bank.sbi</a>	India
SBP - State Bank of Pakistan - <a href="http://www.sbp.org.pk">www.sbp.org.pk</a>	Pakistan
SDC - Swiss Agency for Development and Cooperation - <a href="http://www.deza.admin.ch">www.deza.admin.ch</a>	Switzerland
sefa - Small Enterprise Finance Agency (incl. Khula Enterprise Finance Limited) - <a href="http://www.sefa.org.za">www.sefa.org.za</a>	South Africa
SEFOPE - The Secretariat of State for Employment and Training - <a href="http://sefope.gov.tl">sefope.gov.tl</a>	East Timor
SEIP - Skills for Employment Investment Program - <a href="http://www.adb.org">www.adb.org</a>	Philippines/Bangladesh
SHB - National Housing Bank - <a href="http://nhb.org.in">nhb.org.in</a>	India
Sida - Swedish International Development Cooperation Agency - <a href="http://www.sida.se">www.sida.se</a>	Sweden
SIDBI - Small Industries Development Bank of India - <a href="http://www.sidbi.in">www.sidbi.in</a>	India
SNS - SNS Institutional Microfinance Fund - <a href="http://www.srh.nl">www.srh.nl</a>	Netherlands
Spanish Government - Spanish Government - <a href="http://www.lamoncloa.gob.es">www.lamoncloa.gob.es</a>	Spain
SPEED - Support Programme for Enterprise Empowerment and Development - <a href="http://www.speedghana.org">www.speedghana.org</a>	Ghana
Swedfund - Swedish Development Finance Institution - <a href="http://www.swedfund.se">www.swedfund.se</a>	Sweden
SZOPAD - Special Zone for Peace and Development Social Fund Project - <a href="http://www.worldbank.org">www.worldbank.org</a>	USA/Philippines
UNCDF - United Nations Capital Development Fund - <a href="http://www.uncdf.org">www.uncdf.org</a>	United Nations
UNDP - United Nations Development Programme - <a href="http://www.undp.org">www.undp.org</a>	United Nations
UNHCR - United Nations High Commissioner for Refugees - <a href="http://www.unhcr.org">www.unhcr.org</a>	United Nations
UNICEF - United Nations Children's Fund - <a href="http://www.unicef.org">www.unicef.org</a>	United Nations
UNWG - United Nations Women's Guild - <a href="http://www.unwg.org">www.unwg.org</a>	USA
USAID - United States Agency for International Development - <a href="http://usa.gov">usa.gov</a>	USA
WBMDFC - West Bengal Minorities Development & Finance Corporation - <a href="http://www.wbmdfc.net">www.wbmdfc.net</a>	India
WFP - World Food Programme - <a href="http://www.wfp.org">www.wfp.org</a>	USA
ACPC - Agricultural Credit Policy Council - <a href="http://acpc.gov.ph">acpc.gov.ph</a>	Philippines

Source: author's own compilation

## Appendix 2

### Overview of all MFIs

MFI Abbreviation	Full Name – Country of operation
ABS-CBN	ABS-CBN Bayan Foundation, Inc. - Philippines
Adhikar	Adhikar Microfinance Pvt Ltd - India
AFK	Agency for Finance in Kosovo - Kosovo
AfricaWorks	AfricaWorks - Mozambique
Agrocredit Plus	MCA "Agrocredit Plus" - Kyrgyzstan
AgroInvest - Serbia	AgroInvest - Serbia - Serbia
Agroinvestbank	OJSC Agroinvestbank - Tajikistan
Aiyl Bank	Aiyl Bank (formerly: KAFC) - Kyrgyzstan
Al Majmoua	Lebanese Association for Development -- Al Majmoua - Lebanon
Alwatani (National Microfinance Bank)	National Microfinance Bank Jordan - Jordan
Apna Microfinance	Apna Microfinance Bank (formerly: NMFB) - Pakistan
Arohan	Arohan Financial Services Pvt Ltd - India
Arthacharya	Arthacharya Foundation - Sri Lanka
ASA Pakistan	ASA Pakistan Limited - Pakistan
ASA Philippines	ASA Philippines - Philippines
ASALA	ASALA for Credit and Development Company - Palestine
ASHI	Ahon Sa Hirap Inc. - Philippines
Azeri Star	Azeri Star Microfinance - Azerbaijan
Bangko Luzon	Bangko Luzon - Philippines

BASTOB	BASTOB - Initiative for People's Self-Development - Bangladesh
BEES	Bangladesh Extension Education Services - Bangladesh
Berendina Micro Investment	Berendina Micro Investment company Ltd - Sri Lanka
BESA	Fondi BESA - Albania
BIMAS	Business Initiative and Management Assistance Services - Kenya
BRAC - AFG	BRAC Afghanistan - Afghanistan
BRAC - LKA	BRAC Lanka (Guarantee) Limited - Sri Lanka
BRAC - TZA	BRAC Tanzania - Tanzania
BRAC - UGA	BRAC Uganda - Uganda
BRAC Bangladesh	BRAC - Bangladesh
BRAC Pakistan	BRAC - PAKISTAN - Pakistan
BTA Bank	BTA Bank ( <i>formerly: Ineximbank</i> ) - Kyrgyzstan
BURO Bangladesh	BURO Bangladesh ( <i>formerly: BURO Tangail</i> ) - Bangladesh
BWDA ( <i>also: BFL</i> )	BWDA Finance Ltd - India
Cantilan Bank	Cantilan Bank, Inc. - Philippines
CARD Bank	CARD Bank, Inc. - Philippines
CBIRD	Cambodia Business Integrated in Rural Development - Cambodia
CBMO	Cooperative Bank of Misamis Oriental Inc. - Philippines
CDBD Cooperative	Colombo District Business Development Cooperative Society Ltd. - Sri Lanka
CEOSS	Coptic Evangelical Organization for Social Services - Egypt
CEVI	Community Economic Ventures, Inc. - Philippines
CFA	Child Fund Afghanistan - Afghanistan
Chamroeun	Chamroeun Microfinance - Entrepreneurs du Monde - Cambodia
Credit Mongol	Credit Mongol - Mongolia
CreditAccess Grameen	CreditAccess Grameen Limited - India
Crystal	JSC MFO Crystal ( <i>formerly: Crystal Fund</i> ) - Georgia
CSC	Community Support Concern - Pakistan
CUMO	CUMO Microfinance Limited - Malawi
DemirBank	DemirBank OJSC - Azerbaijan
ECLOF - KEN	Kenya Ecumenical Church Loan Fund - Kenya
ECLOF - PHL	ECLOF Philippines Foundation, Inc. - Philippines
EKI	EKI -Bosnia and Herzegovina
Elet-Capital	MCC Elet-Capital - Kyrgyzstan
Equity Bank KEN	Equity Bank Kenya - Kenya
FAIR Bank	First Agro-Industrial Rural Bank - Philippines
Farm Credit Armenia	Farm Credit Armenia UCO CC - Armenia
Faulu MFB	Faulu Microfinance Bank Limited - Kenya
FinAgro	FinAgro - Georgia
Finance Trust	Uganda Finance Trust Limited ( <i>formerly: Uganda Women's Finance Trust</i> ) - Uganda
FINCA - AFG	FINCA Afghanistan - Afghanistan
FINCA - AZE	FINCA Azerbaijan - Azerbaijan
FINCA - GEO	FINCA Georgia - Georgia
FINCA - JOR	FINCA Jordan - Jordan
FINCA - MEX	Financiera Finca, S.A. de C.V. SOFOM, ENR - Mexico
FINCA - Russia	FINCA - Russia - Russia
FINCA - SLV	Fundación Internacional para la Asistencia Comunitaria - El Salvador
FINCA - TZA	FINCA Tanzania - Tanzania
FINCA - UGA	FINCA Uganda - Uganda
FINCA - ZMB	FINCA Zambia - Zambia
FINCA Pakistan	FINCA Microfinance Bank Limited, Pakistan - Pakistan
FinDev	Finance for Development LLC - Azerbaijan
First MicroFinance Company	First MicroFinance Company (FMFC) - Kyrgyzstan
FMFB	The First MicroFinanceBank - Tajikistan - Tajikistan
FMFB - AFG	The First MicroFinanceBank - Afghanistan - Afghanistan
FMF-E	First Microfinance Foundation - Aga Khan Egypt - Egypt
Fonkoze Financial Services, S.A. (SFF)	Sèvis Finansye Fonkoze S.A. - Haiti
FULM	Saving House FULM - Macedonia
Fundusz Mikro	Fundusz Mikro - Poland
Future Financial	Future Financial Services Pvt Ltd - India
GGEM Microfinance Services Ltd.	Grassroots Gender Empowerment Movement Microfinance Services Ltd. - Sierra Leone

GLOW	Guidance Society For labour Orphans & Women - India
Grameen Bank	Grameen Bank - Bangladesh
Growing Opportunity Finance	Growing Opportunity Finance India Ltd. - India
HEED	HEED Bangladesh - Bangladesh
HKL	Hattha Kaksekar Ltd. - Cambodia
ICNW	Indian Cooperative Network for Women - India
IDF	Integrated Development Foundation - Bangladesh
IDYDC	Iringa Development of Youth, Disabled and Children Care - Tanzania
Indur MACS	Indur Intideepam Mutually Aided Thrift & Credit Cooperatives' Federation Limited - India
IPR	Intean Poalroath RongRoeurng LTD - Cambodia
Jagorani Chakra ( <i>also: JCF</i> )	Jagorani Chakra Foundation - Bangladesh
JFSL	Jagannath Financial Services Limited ( <i>formerly: KAS Foundation</i> ) - India
JSC Bank Constanta	JSC Bank Constanta - Georgia
JWS	JWS Pakistan - Pakistan
KAMURJ	KAMURJ UCO CJSC - Armenia
Kasagana-Ka	Kasagana-Ka Development Center, Inc. - Philippines
KCCDFI	Kasanyangan-Mindanao Foundation, Inc. - Philippines
KEP	KEP Trust - Kosovo
Khan Bank	Khan Bank LLC - Mongolia
Khushhali Bank	Khushhali Bank - Pakistan
KIF	Kaebauk Investimentu no Finansas, SA (ODTI of Tuba Rai Metin) - East Timor
KixiCredito	KixiCredito - Angola
Kompanion	Kompanion Financial Group Microfinance Closed Joint Stock Company - Kyrgyzstan
KOPSA	KOPSA - India
Kotalipara	KOTALIPARA DEVELOPMENT SOCIETY - India
KredAqro NBCO	KredAqro Non-Banking Credit Institution - Azerbaijan
KREDIT	KREDIT MFI - Cambodia
KRK Ltd	Kreditimi Rural i Kosoves LLC ( <i>formerly: Rural Finance Project of Kosovo</i> ) - Kosovo
Lak Jaya	Lak Jaya Micro Finance Ltd. - Sri Lanka
Lazika Capital	JSC Lazika Capital - Georgia
Letshego KEN	Letshego Kenya Limited - Kenya
Letshego RWA	Letshego Rwanda Limited - Rwanda
LIDER	LIDER - Bosnia and Herzegovina
LOK Microcredit Foundation	LOK Microcredit Foundation - Bosnia and Herzegovina
MADRAC	Microfinance Agency for Development and Rehabilitation of Afghan Communities - Afghanistan
Maxima	Maxima Microfinance Plc - Cambodia
MCF Borshud	MCF Borshud - Tajikistan
MCO OXUS - TJK	Micro-Lending Fund 'OXUS' - Tajikistan
MFW	Microfund for Women - Jordan
MI-BOSPO	MI-BOSPO Tuzla - Bosnia and Herzegovina
Microinvest	JV MFO Microinvest LLC - Moldova
Microloan Foundation Malawi	Microloan Foundation Malawi - Malawi
MIKRA	MIKRA - Bosnia and Herzegovina
Mikro ALDI	Mikro ALDI - Bosnia and Herzegovina
MIKROFIN	MIKROFIN Banja Luka - Bosnia and Herzegovina
Mikrofond	Mikrofond - Bulgaria
Milamdec	Milamdec Foundation Inc. - Philippines
Mimo Finance	Mimoza Enterprises Finance Pvt. Ltd. - India
Mol Bulak Azerbaijan	Mol Bulak NBCO LLC - Azerbaijan
Mol Bulak Finance	MCC Mol-Bulak - Kyrgyzstan
Moris Rasik	Moris Rasik - East Timor
MUL	Micro Uganda Ltd - Uganda
Nano	NANO FINANCIAL SERVICES INDIA PVT LTD - India
National Rural	National Rural Support Programme - Pakistan
Nav Bharat	Nav Bharat Jagriti Kendra - India
NCS	NIRANANTARA COMMUNITY SERVICES - India
New RB of Victorias	New Rural Bank of Victorias Inc. - Philippines
Nidan	Nidan Micro Finance Foundation - India

NOA - ALB	NOA -Albania ( <i>formerly: Opportunity Albania</i> ) - Albania
NongHyup Finance Plc	NongHyup Finance (Cambodia) Plc - Cambodia
Nor Horizon	Nor Horizon UCO LLC - Armenia
NWTF	Negros Women for Tomorrow Foundation, Inc. - Philippines
OBS	Opportunity Bank Serbia - Serbia
OMRO	Opportunity Microfinance Romania - Romania
Opportunity Uganda	Opportunity Bank - Uganda
Orangi	Orangi Charitable Trust - Pakistan
OXUS - AFG	OXUS Afghanistan - Afghanistan
Paglaum Cooperative	Paglaum Multi-Purpose Cooperative - Philippines
Pak Oman	Pak Oman Micro Finance Bank Ltd - Pakistan
Partner	Partner mikrokreditna fondacija - Bosnia and Herzegovina
PATRA Hunchun	PATRA Hunchun - China, People's Republic of
PATRA Yanbian	PATRA Yanbian - China, People's Republic of
Patria Credit	Patria Credit IFN S.A. ( <i>formerly: CAPA Finance</i> ) - Romania
PAWDEP	PAMOJA WOMEN DEVELOPMENT PROGRAMME - Kenya
Phoenix +	Phoenix + - Tajikistan
PPSS	Palli Progoti Shahayak Samity - Bangladesh
PRASAC	PRASAC MFI Ltd - Cambodia
PRIZMA	PRIZMA - Bosnia and Herzegovina
ProCredit Bank - ALB	ProCredit Bank Albania ( <i>formerly: FEFAD Bank</i> ) - Albania
ProCredit Bank - ARM	ProCredit Bank Armenia - Armenia
ProCredit Bank - MKD	ProCredit Bank Macedonia - Macedonia
ProCredit Bank - ROM	ProCredit Bank Romania ( <i>formerly: Miro Bank</i> ) - Romania
ProCredit Bank Serbia	ProCredit Bank Serbia - Serbia
Pustikar	Pustikar Sakh Sahakari Samiti Ltd. - India
RAFI Micro-finance	RAFI Microfinance, Inc - Philippines
RASS	Rashtriya Seva Samithi - India
RB Bagac	Rural Bank of Bagac - Philippines
RB Camalig	CAMALIG BANK, INC. (A RURAL BANK) - Philippines
RB Guinobatan	Rural Bank of Guinobatan, Inc. - Philippines
RB Lebak	Rural Bank of Lebak (Sultan Kudarat), Inc. - Philippines
RB Pagbilao	Rural Bank of Pagbilao, Inc. - Philippines
RB Solano	Rural Bank of Solano Inc. - Philippines
RB Talisayan	Rural Bank of Talisayan - Misamis Oriental Inc. - Philippines
RDRS	RDRS Bangladesh - Bangladesh
Reliance	Reliance Financial Services Company Limited - Gambia, The
RGVN	RGVN (North East) Microfinance Ltd - India
RIC	Resource Integration Centre - Bangladesh
RORES	Rores MED Trust - India
RRF	Rural Reconstruction Foundation Jessore - Bangladesh
Safco Support	Safco Support Foundation - Pakistan
Sajida	Sajida Foundation - Bangladesh
Sarala	Sarala Women Welfare Society - India
Sathapana Bank	Sathapana Bank Plc - Cambodia
SDC	Society Development Committee - Bangladesh
SEF-ZAF	Small Enterprise Foundation (South Africa) - South Africa
Seilanithih	Seilanithih - Cambodia
Serviamus	Serviamus Foundation Inc - Philippines
SEWA Finance	SEWA Finance - Sri Lanka
SEWA MACTS	SEWA MACTS Federation Limited - India
SINERGIJA	SINERGIJAplus - Bosnia and Herzegovina
Society for Social Services	Society for Social Services - Bangladesh
Sonata	Sonata Finance Pvt Ltd - India
SPBD Samoa	South Pacific Business Development - Samoa
SRSP	Sarhad Rural Support Programme - Pakistan
Star Microfin	Star Microfin Service Society - India
Sungi	Sungi Development Foundation - Pakistan
Sunrise	Microcredit Foundation Sunrise - Bosnia and Herzegovina
SV Creditline	SV Creditline Pvt Ltd - India
SVSDF	Srivardan Sociodevelopment Foundation - India
Swadhaar	Swadhaar FinServe Pvt Ltd - India

Telenor Microfinance	Telenor Microfinance Bank Ltd - Pakistan
Thardeep	Thardeep Microfinance Foundation - Pakistan
TMSS Micro Credit	Thengamara Mohila Sabuj Sangha - Bangladesh
T-O-M	Tikkun Olam Microfinance - Afghanistan
TSPI	TSPI Development Corporation - Philippines
TuranBank	TuranBank OJSC - Azerbaijan
TYM	TYM FUND - Vietnam
U Microfinance	U Microfinance Bank Limited ( <i>formerly: Rozgar MF Bank</i> ) - Pakistan
UNRWA\Palestine	UNRWA Microfinance and Microenterprise Department - Palestine
Uttrayan Financial	Uttrayan Financial Services Pvt Ltd - India
Vision Fund TZA	VisionFund Tanzania (VFT) - Tanzania
VisionFund Kenya	VisionFund Kenya - Kenya
VisionFund Uganda	VisionFund Uganda - Uganda
VITAS IFN SA	VITAS IFN SA ( <i>formerly: Express Finance IFN SA</i> ) - Romania
Vitas JOR	Vitas Jordan (Ex MEMCC) - Jordan
VITAS PSE	VITAS Palestine (ex Ryada - CHF International) - Palestine
Vitas s.a.l.	Vitas Lebanon s.a.l - Lebanon
VSSU	Vivekananda Sevakendra O Sishu Uddyan - India
Wave	Wave Foundation - Bangladesh
WB Finance	WB Finance - Cambodia
WDFH	Women Development Federation Hambantota - Sri Lanka
WMN (Russia)	ZAO NDCO Women's Microfinance Network - Russia
Women for Women	MCO Women for Women International - Bosnia and Herzegovina
WWI - AFG	Women for Women International Afghanistan Microfinance - Afghanistan
XacBank	XacBank - Mongolia

Source: author's own compilation

## Appendix 3

### Overview of all MFIs' SDI calculations

<i>Variable / MFI</i>	KredAqro NBCO	RGVN	Arthacharya	Pustikar	Kotalipara
Opportunity cost of subsidized capital (m)	20.03	12.19	15.67	12.19	12.19
Equity (start stock) (E <sub>0</sub> )	11,131,693	409,263	671,896	1,941,913	420,507
Direct grant (DG)	0	0	148,878	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	11,516,086	1,566,462	30,872	866,229	1,570,044
Discount on public debt (A*(m-c))	1,615,132	190,913	4,838	-1,122	-20,465
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	529,720	382,268	-46,111	761,507	607,565
True profit (TP)	-1,085,412	191,355	-50,949	762,629	628,030
Average rate paid for public debt (c)	6.00	0.00	0.00	12.32	13.49
Revenue from lending (LP*i)	14,727,764	2,175,564	200,817	2,243,285	1,423,289
Average loan portfolio (net) (LP)	42,495,304	11,961,876	1,086,598	15,630,038	5,038,326
Yield on loans (i)	34.66	18.19	18.48	14.35	28.25
Annual subsidy received (S)	3,368,047	-118,182	164,299	-479,554	-539,758
Subsidy dependence index (SDI)	0.229	-0.054	0.818	-0.214	-0.379
<i>Variable / MFI</i>	CreditAccess Grameen	Lak Jaya	WWI - AFG	VSSU	Star Microfin
Opportunity cost of subsidized capital (m)	12.19	15.67	15.00	12.19	12.19
Equity (start stock) (E <sub>0</sub> )	4,285,752	1,118,604	583,686	42,621	546,016
Direct grant (DG)	0	0	554,705	0	0

Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	3,055,352	0	4,540,318	675,526	1,139,343
Discount on public debt (A*(m-c))	-50,133	0	506,938	32,041	-22,140
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	200,391	-435,535	-484,315	-52,878	124,778
True profit (TP)	250,524	-435,535	-991,253	-84,919	146,918
Average rate paid for public debt (c)	13.83	0.00	3.83	7.44	14.13
Revenue from lending (LP*i )	9,671,251	846,299	498,134	242,198	1,239,604
Average loan portfolio (net) (LP)	51,434,282	2,715,492	2,326,640	1,139,544	4,713,064
Yield on loans (i)	18.80	31.17	21.41	21.25	26.30
Annual subsidy received (S)	284,014	576,711	1,084,085	86,891	-72,769
Subsidy dependence index (SDI)	0.029	0.681	2.176	0.359	-0.059
<b>Variable / MFI</b>	<b>HEED</b>	<b>IDF</b>	<b>SDC</b>	<b>RIC</b>	<b>Jagorani Chakra</b>
Opportunity cost of subsidized capital (m)	13.33	13.33	13.33	13.33	13.33
Equity (start stock) (E <sub>0</sub> )	1,521,217	1,892,990	1,091,392	742,498	3,516,141
Direct grant (DG)	0	0	0	125,112	1,435
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	6,208,612	1,344,812	3,113,977	8,673,562	21,873,892
Discount on public debt (A*(m-c))	507,632	139,751	316,279	862,514	1,731,030
Revenue grant (RG)	9,748	0	0	38,309	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	9,748	0	0	38,309	0
Accounting profit (loss) (P)	174,620	225,107	215,626	179,594	1,924,610
True profit (TP)	-342,759	85,356	-100,653	-721,229	193,580
Average rate paid for public debt (c)	5.15	2.93	3.17	3.38	5.41
Revenue from lending (LP*i )	1,977,203	1,484,875	1,101,783	2,235,724	6,853,301
Average loan portfolio (net) (LP)	8,687,276	6,698,349	5,229,313	10,325,624	37,865,161
Yield on loans (i)	22.76	22.17	21.07	21.65	18.10
Annual subsidy received (S)	557,123	181,916	260,467	840,482	403,343
Subsidy dependence index (SDI)	0.282	0.123	0.236	0.376	0.059
<b>Variable / MFI</b>	<b>SEF-ZAF</b>	<b>Orangi</b>	<b>National Rural</b>	<b>TMSS Micro Credit</b>	<b>Wave</b>
Opportunity cost of subsidized capital (m)	11.71	14.54	14.54	13.33	13.33
Equity (start stock) (E <sub>0</sub> )	3,229,004	2,769,081	10,260,119	12,106,343	642,708
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	1,880,999	2,973,667	42,286,843	0	5,256,252
Discount on public debt (A*(m-c))	63,868	229,849	1,860,189	0	402,159
Revenue grant (RG)	0	346,835	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	346,835	0	0	0
Accounting profit (loss) (P)	-584,452	762,247	1,787,405	1,979,623	172,135
True profit (TP)	-648,320	185,563	-72,784	1,979,623	-230,024
Average rate paid for public debt (c)	8.31	6.81	10.14	0.00	5.68
Revenue from lending (LP*i )	7,382,118	1,066,863	18,491,100	12,267,153	1,533,928
Average loan portfolio (net) (LP)	13,114,619	5,724,311	62,323,813	57,917,947	6,917,379
Yield on loans (i)	56.29	18.64	29.67	21.18	22.17
Annual subsidy received (S)	992,168	272,398	1,694,271	-234,342	327,146
Subsidy dependence index (SDI)	0.134	0.255	0.092	-0.019	0.213
<b>Variable / MFI</b>	<b>PPSS</b>	<b>SRSP</b>	<b>TSPI</b>	<b>RRF</b>	<b>Society for Social Services</b>
Opportunity cost of subsidized capital (m)	13.33	14.54	8.57	13.33	13.33
Equity (start stock) (E <sub>0</sub> )	924,410	-94,720	10,153,046	1,253,585	5,157,228
Direct grant (DG)	0	16,152,264	0	867	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	3,653,943	823,357	3,573,377	11,991,358	26,642,825
Discount on public debt (A*(m-c))	318,246	80,790	-149,149	1,079,130	1,986,404
Revenue grant (RG)	8,375	0	0	5,968	330,797

Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	8,375	0	0	5,968	330,797
Accounting profit (loss) (P)	185,472	-237,476	460,621	-387,544	2,190,380
True profit (TP)	-141,149	-318,266	609,770	-1,472,642	-126,821
Average rate paid for public debt (c)	4.62	4.73	12.74	4.33	5.87
Revenue from lending (LP*i)	1,233,031	71,643	13,574,803	2,694,230	9,625,353
Average loan portfolio (net) (LP)	5,048,592	71,225	28,689,669	12,796,397	37,177,452
Yield on loans (i)	24.42	100.59	47.32	21.05	25.89
Annual subsidy received (S)	276,701	1,461,302	279,686	1,613,938	960,060
Subsidy dependence index (SDI)	0.224	20.397	0.021	0.599	0.100
<b>Variable / MFI</b>	<b>Thardeep</b>	<b>BEES</b>	<b>FINCA - UGA</b>	<b>FINCA - AFG</b>	<b>FINCA - GEO</b>
Opportunity cost of subsidized capital (m)	14.54	13.33	20.96	15.00	17.87
Equity (start stock) (E <sub>0</sub> )	750,708	937,170	7,618,740	10,995,028	7,687,062
Direct grant (DG)	115,191	0	0	11,880,993	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	5,117,791	5,688,166	0	6,563,008	0
Discount on public debt (A*(m-c))	404,424	555,056	0	713,905	0
Revenue grant (RG)	0	101,872	0	467,783	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	101,872	0	467,783	0
Accounting profit (loss) (P)	408,182	-564,663	570,871	-1,724,658	-1,089,324
True profit (TP)	3,758	-1,221,590	570,871	-2,906,346	-1,089,324
Average rate paid for public debt (c)	6.64	3.57	0.00	4.12	0.00
Revenue from lending (LP*i)	886,058	1,689,547	6,726,358	983,763	6,131,582
Average loan portfolio (net) (LP)	3,143,408	7,790,877	12,521,598	1,449,728	16,368,716
Yield on loans (i)	28.19	21.69	53.72	67.86	37.46
Annual subsidy received (S)	143,419	1,308,859	1,085,462	5,317,326	2,365,408
Subsidy dependence index (SDI)	0.162	0.775	0.161	5.405	0.386
<b>Variable / MFI</b>	<b>FINCA - Russia</b>	<b>FINCA - AZE</b>	<b>FINCA - TZA</b>	<b>FINCA - ZMB</b>	<b>Vitas s.a.l.</b>
Opportunity cost of subsidized capital (m)	15.31	20.03	15.03	22.06	9.57
Equity (start stock) (E <sub>0</sub> )	5,411,465	12,056,608	226,644	1,023,772	2,794,680
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	181,515	0	0
Average public debt (A)	0	4,000,000	0	0	0
Discount on public debt (A*(m-c))	0	486,539	0	0	0
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	-1,329,999	3,168,637	763,008	89,714	434,243
True profit (TP)	-1,329,999	2,682,098	763,008	89,714	434,243
Average rate paid for public debt (c)	0.00	7.87	0.00	0.00	0.00
Revenue from lending (LP*i)	8,110,584	27,602,120	4,787,711	1,796,818	2,512,395
Average loan portfolio (net) (LP)	18,084,760	65,853,088	7,082,368	1,980,431	14,406,716
Yield on loans (i)	44.85	41.91	67.60	90.73	17.44
Annual subsidy received (S)	2,056,604	50,066	-657,959	146,052	-146,064
Subsidy dependence index (SDI)	0.254	0.002	-0.137	0.081	-0.058
<b>Variable / MFI</b>	<b>VisionFund Kenya</b>	<b>Vitas JOR</b>	<b>Fundusz Mikro</b>	<b>VisionFund Uganda</b>	<b>LIDER</b>
Opportunity cost of subsidized capital (m)	14.80	9.25	3.99	20.96	7.93
Equity (start stock) (E <sub>0</sub> )	2,980,915	7,960,524	16,400,733	506,186	7,066,626
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	385,708	511,298	4,109,630	0	0
Discount on public debt (A*(m-c))	34,659	19,639	-364,563	0	0
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	76,466	1,269,741	174,646	-501,511	127,956
True profit (TP)	41,807	1,250,102	539,209	-501,511	127,956
Average rate paid for public debt (c)	5.82	5.41	12.86	0.00	0.00

Revenue from lending (LP*i )	1,546,945	3,935,597	7,252,277	853,894	1,860,512
Average loan portfolio (net) (LP)	5,620,128	17,044,177	38,989,813	1,527,574	5,709,678
Yield on loans (i)	27.53	23.09	18.60	55.90	32.59
Annual subsidy received (S)	405,164	-455,315	117,840	555,037	437,679
Subsidy dependence index (SDI)	0.262	-0.116	0.016	0.650	0.235
<b>Variable / MFI</b>	<b>BRAC - AFG</b>	<b>Nor Horizon</b>	<b>WDFH</b>	<b>Al Majmoua</b>	<b>FinDev</b>
Opportunity cost of subsidized capital (m)	15.00	18.76	15.67	9.57	20.03
Equity (start stock) (E <sub>0</sub> )	-20,637	992,176	2,742,291	9,967,589	2,242,953
Direct grant (DG)	2,830,106	0	102,413	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	38,095,909	0	1,240,631	143,265	898,648
Discount on public debt (A*(m-c))	3,931,289	0	194,428	13,708	171,236
Revenue grant (RG)	1,575,416	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	1,575,416	0	0	0	0
Accounting profit (loss) (P)	982	-79,534	362,252	1,886,578	543,108
True profit (TP)	-5,505,723	-79,534	167,824	1,872,870	371,872
Average rate paid for public debt (c)	4.68	0.00	0.00	0.00	0.97
Revenue from lending (LP*i )	9,161,827	534,395	789,243	4,052,248	2,813,891
Average loan portfolio (net) (LP)	33,622,162	2,456,601	3,205,182	14,293,564	7,652,733
Yield on loans (i)	27.25	21.75	24.62	28.35	36.77
Annual subsidy received (S)	5,714,959	258,249	298,349	-828,881	131,762
Subsidy dependence index (SDI)	0.624	0.483	0.378	-0.205	0.047
<b>Variable / MFI</b>	<b>FMFB</b>	<b>Faulu MFB</b>	<b>BASTOB</b>	<b>OMRO</b>	<b>Sungi</b>
Opportunity cost of subsidized capital (m)	22.62	14.80	13.33	17.28	14.54
Equity (start stock) (E <sub>0</sub> )	6,284,248	6,731,754	163,396	2,640,517	372,091
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	5,496,940	3,156,607	420,860	5,172,448	0
Discount on public debt (A*(m-c))	918,330	180,571	42,915	575,520	0
Revenue grant (RG)	0	289,202	16,477	0	0
Discount on expenses (DX)	165,233	0	0	0	0
Sum of all other subsidies received (K)	165,233	289,202	16,477	0	0
Accounting profit (loss) (P)	-2,650,096	-637,122	24,995	-3,387,344	29,596
True profit (TP)	-3,733,659	-1,106,895	-34,397	-3,962,864	29,596
Average rate paid for public debt (c)	5.91	9.08	3.13	6.15	0.00
Revenue from lending (LP*i )	5,403,874	11,701,478	288,367	6,091,592	53,689
Average loan portfolio (net) (LP)	19,432,820	38,544,443	1,326,597	12,911,579	243,858
Yield on loans (i)	27.81	30.36	21.74	47.18	22.02
Annual subsidy received (S)	4,855,223	2,056,339	57,838	4,126,431	26,648
Subsidy dependence index (SDI)	0.898	0.176	0.201	0.677	0.496
<b>Variable / MFI</b>	<b>Lazika Capital</b>	<b>Kompanion</b>	<b>Mikrofond</b>	<b>FINCA - MEX</b>	<b>FULM</b>
Opportunity cost of subsidized capital (m)	17.87	26.65	11.34	7.07	11.17
Equity (start stock) (E <sub>0</sub> )	2,203,890	9,358,447	1,780,000	8,490,910	2,020,416
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	484,240	3,219,000	0	876,007	355,561
Discount on public debt (A*(m-c))	65,129	669,428	0	-4,750	35,450
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	677,525	1,723,250	11,429	1,597,411	30,130
True profit (TP)	612,396	1,053,822	11,429	1,602,161	-5,320
Average rate paid for public debt (c)	4.42	5.86	0.00	7.62	1.20
Revenue from lending (LP*i )	1,934,455	15,325,474	1,170,000	22,075,177	882,595
Average loan portfolio (net) (LP)	5,431,388	28,588,337	4,606,618	27,587,510	3,783,456
Yield on loans (i)	35.62	53.61	25.40	80.02	23.33
Annual subsidy received (S)	-158,117	1,670,134	190,982	-944,998	232,679
Subsidy dependence index (SDI)	-0.082	0.109	0.163	-0.043	0.264
<b>Variable / MFI</b>	<b>BURO Bangladesh</b>	<b>Sunrise</b>	<b>MI-BOSPO</b>	<b>Cantilan Bank</b>	<b>Vision Fund TZA</b>



Opportunity cost of subsidized capital (m)	13.33	7.93	7.93	8.57	15.03
Equity (start stock) (E <sub>0</sub> )	10,201,933	13,849,598	12,974,928	2,239,665	413,785
Direct grant (DG)	2,452,341	0	1,048,821	19,295	0
Paid-in capital (PC)	0	0	0	0	651,306
Average public debt (A)	0	28,468,453	19,994,820	1,768,213	0
Discount on public debt (A*(m-c))	0	421,263	-18,833	-136,772	0
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	953,951	-7,577,761	-1,226,701	422,448	-572,833
True profit (TP)	953,951	-7,999,024	-1,207,868	559,220	-572,833
Average rate paid for public debt (c)	0.00	6.45	8.03	16.30	0.00
Revenue from lending (LP*i)	15,907,518	16,646,924	9,905,349	2,766,696	1,486,873
Average loan portfolio (net) (LP)	57,690,733	47,705,438	35,784,203	12,807,266	1,477,833
Yield on loans (i)	27.57	34.90	27.68	21.60	100.61
Annual subsidy received (S)	632,599	8,797,090	2,230,049	-348,446	640,924
Subsidy dependence index (SDI)	0.040	0.528	0.225	-0.126	0.431
<b>Variable / MFI</b>	<b>NWTF</b>	<b>KAMURJ</b>	<b>PRASAC</b>	<b>HKL</b>	<b>ProCredit Bank - ALB</b>
Opportunity cost of subsidized capital (m)	8.57	18.76	15.81	15.81	12.66
Equity (start stock) (E <sub>0</sub> )	2,320,762	10,219,115	19,797,975	6,796,571	31,907,254
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	3,079,206	0	18,650,918	750,000	13,419,245
Discount on public debt (A*(m-c))	-18,062	0	2,407,542	51,082	1,182,636
Revenue grant (RG)	0	0	277,938	17,992	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	277,938	17,992	0
Accounting profit (loss) (P)	300,411	1,237,582	2,694,281	1,215,616	2,079,178
True profit (TP)	318,473	1,237,582	8,801	1,146,542	896,542
Average rate paid for public debt (c)	9.15	0.00	2.90	9.00	3.85
Revenue from lending (LP*i)	3,398,342	4,392,913	16,352,696	8,240,556	32,270,568
Average loan portfolio (net) (LP)	8,583,590	8,481,137	63,063,692	30,303,544	215,511,210
Yield on loans (i)	39.59	51.80	25.93	27.19	14.97
Annual subsidy received (S)	-106,805	796,094	3,334,440	24,160	3,274,837
Subsidy dependence index (SDI)	-0.031	0.181	0.204	0.003	0.101
<b>Variable / MFI</b>	<b>BRAC Bangladesh</b>	<b>Partner</b>	<b>Women for Women</b>	<b>Khushhali Bank</b>	<b>Opportunity Uganda</b>
Opportunity cost of subsidized capital (m)	13.33	7.93	7.93	14.54	20.96
Equity (start stock) (E <sub>0</sub> )	141,290,586	30,561,162	3,736,223	23,761,556	3,675,134
Direct grant (DG)	0	0	1,154,124	4,146,494	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	13,895,937	35,441,740	1,242,205	51,415,473	0
Discount on public debt (A*(m-c))	641,452	760,326	19,865	4,470,210	0
Revenue grant (RG)	0	0	0	2,754,815	56,979
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	2,754,815	56,979
Accounting profit (loss) (P)	25,154,232	-1,547,249	-635,222	3,005,632	-142,115
True profit (TP)	24,512,780	-2,307,575	-655,087	-4,219,393	-199,094
Average rate paid for public debt (c)	8.71	5.79	6.33	5.84	0.00
Revenue from lending (LP*i)	170,812,129	21,706,335	2,985,171	12,360,836	3,662,533
Average loan portfolio (net) (LP)	571,456,810	93,527,155	8,399,112	42,132,079	7,856,491
Yield on loans (i)	29.89	23.21	35.54	29.34	46.62
Annual subsidy received (S)	-4,007,344	4,670,471	972,044	8,193,600	954,334
Subsidy dependence index (SDI)	-0.023	0.215	0.326	0.663	0.261
<b>Variable / MFI</b>	<b>ProCredit Bank - MKD</b>	<b>RDRS</b>	<b>MFW</b>	<b>Equity Bank KEN</b>	<b>RB Solano</b>
Opportunity cost of subsidized capital (m)	11.17	13.33	9.25	14.80	8.57
Equity (start stock) (E <sub>0</sub> )	21,825,497	8,718,889	8,014,552	251,715,749	1,652,548
Direct grant (DG)	0	28,935	0	0	0
Paid-in capital (PC)	0	0	0	0	0

Average public debt (A)	74,563,787	7,367,555	4,828,913	2,145,340	0
Discount on public debt (A*(m-c))	7,969,249	682,727	70,813	257,357	0
Revenue grant (RG)	0	540,594	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	540,594	0	0	0
Accounting profit (loss) (P)	1,280,436	636,616	1,555,230	59,144,524	231,467
True profit (TP)	-6,688,813	-586,705	1,484,417	58,887,167	231,467
Average rate paid for public debt (c)	0.48	4.06	7.78	2.81	0.00
Revenue from lending (LP*i)	32,181,527	3,208,373	5,890,835	123,642,255	542,589
Average loan portfolio (net) (LP)	193,713,586	14,348,297	16,581,494	789,294,661	2,601,877
Yield on loans (i)	16.61	22.36	35.53	15.66	20.85
Annual subsidy received (S)	9,198,191	1,792,990	-671,434	-17,243,767	-79,993
Subsidy dependence index (SDI)	0.286	0.559	-0.114	-0.139	-0.147
<b>Variable / MFI</b>	<b>RB Talisayan</b>	<b>OBS</b>	<b>EKI</b>	<b>JSC Bank Constanta</b>	<b>ProCredit Bank - ROM</b>
Opportunity cost of subsidized capital (m)	8.57	6.87	7.93	17.87	17.28
Equity (start stock) (E <sub>0</sub> )	830,071	17,756,134	27,282,270	6,946,386	34,362,913
Direct grant (DG)	0	0	39,706	0	0
Paid-in capital (PC)	0	0	0	0	4,102,377
Average public debt (A)	579,619	3,802,235	48,104,472	2,718,377	83,841,365
Discount on public debt (A*(m-c))	4,888	-232,044	600,062	355,481	8,615,460
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	119,237	-3,098,200	-4,909,880	94,611	-7,212,411
True profit (TP)	114,349	-2,866,156	-5,509,942	-260,870	-15,827,871
Average rate paid for public debt (c)	7.72	12.97	6.69	4.79	7.00
Revenue from lending (LP*i)	1,512,303	9,258,191	25,456,966	9,372,455	56,150,188
Average loan portfolio (net) (LP)	3,379,802	40,010,957	103,677,088	30,615,385	249,152,739
Yield on loans (i)	44.75	23.14	24.55	30.61	22.54
Annual subsidy received (S)	-38,137	3,979,675	7,480,944	1,510,385	21,495,435
Subsidy dependence index (SDI)	-0.025	0.430	0.294	0.161	0.383
<b>Variable / MFI</b>	<b>MIKROFIN</b>	<b>NOA - ALB</b>	<b>Aiyi Bank</b>	<b>MIKRA</b>	<b>SINERGIJA</b>
Opportunity cost of subsidized capital (m)	7.93	12.66	26.65	7.93	7.93
Equity (start stock) (E <sub>0</sub> )	36,102,837	10,198,014	24,018,366	8,002,743	5,119,505
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	1,815,294	0	0
Average public debt (A)	64,356,068	12,907,713	29,826,824	6,436,542	6,657,804
Discount on public debt (A*(m-c))	771,115	631,616	5,860,510	81,822	528,130
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	355,000	11,885	1,081,550	-3,569,779	-1,387,429
True profit (TP)	-416,115	-619,731	-4,778,960	-3,651,601	-1,915,559
Average rate paid for public debt (c)	6.73	7.77	7.00	6.66	0.00
Revenue from lending (LP*i)	29,431,429	11,612,705	12,322,797	3,356,133	6,644,520
Average loan portfolio (net) (LP)	148,097,059	40,735,393	53,717,495	8,930,093	36,218,410
Yield on loans (i)	19.87	28.51	22.94	37.58	18.35
Annual subsidy received (S)	3,294,053	1,911,647	11,566,622	4,144,832	2,266,635
Subsidy dependence index (SDI)	0.112	0.165	0.939	1.235	0.341
<b>Variable / MFI</b>	<b>KEP</b>	<b>LOK Microcredit Foundation</b>	<b>RAFI Micro- finance</b>	<b>CBMO</b>	<b>Milamdec</b>
Opportunity cost of subsidized capital (m)	14.39	7.93	8.57	8.57	8.57
Equity (start stock) (E <sub>0</sub> )	20,631,072	11,804,531	265,486	2,536,484	422,775
Direct grant (DG)	0	0	0	0	250,757
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	26,319,964	31,056,618	0	3,720,650	965,317
Discount on public debt (A*(m-c))	1,583,262	736,599	0	-53,315	-27,819
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0

Accounting profit (loss) (P)	1,562,303	-7,992,936	146,363	687,088	40,346
True profit (TP)	-20,959	-8,729,535	146,363	740,403	68,165
Average rate paid for public debt (c)	8.37	5.56	0.00	10.00	11.45
Revenue from lending (LP*i)	12,907,315	24,486,941	674,493	2,307,489	887,716
Average loan portfolio (net) (LP)	58,203,829	61,414,748	886,547	9,720,391	1,893,403
Yield on loans (i)	22.18	39.87	76.08	23.74	46.88
Annual subsidy received (S)	3,102,128	9,348,909	-117,352	-493,695	-19,481
Subsidy dependence index (SDI)	0.240	0.382	-0.174	-0.214	-0.022
<b>Variable / MFI</b>	<b>Mikro ALDI</b>	<b>Apna Microfinance</b>	<b>ProCredit Bank Serbia</b>	<b>AFK</b>	<b>PRIZMA</b>
Opportunity cost of subsidized capital (m)	7.93	14.54	6.87	14.39	7.93
Equity (start stock) (E <sub>0</sub> )	2,314,134	1,121,902	125,992,639	705,843	14,024,823
Direct grant (DG)	0	0	0	0	6,900,735
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	703,756	0	222,395,871	0	17,196,608
Discount on public debt (A*(m-c))	-5,474	0	5,553,414	0	273,680
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	-301,763	3,060	12,014,864	24,107	769,286
True profit (TP)	-296,289	3,060	6,461,450	24,107	495,606
Average rate paid for public debt (c)	8.71	0.00	4.37	0.00	6.34
Revenue from lending (LP*i)	1,287,567	347,157	101,442,375	2,245,789	13,503,571
Average loan portfolio (net) (LP)	3,689,988	1,041,377	594,878,656	9,829,236	60,758,088
Yield on loans (i)	34.89	33.34	17.05	22.85	22.23
Annual subsidy received (S)	467,889	160,259	2,607,738	79,197	921,125
Subsidy dependence index (SDI)	0.363	0.462	0.026	0.035	0.068
<b>Variable / MFI</b>	<b>KRK Ltd</b>	<b>FMFB - AFG</b>	<b>KREDIT</b>	<b>Khan Bank</b>	<b>Safco Support</b>
Opportunity cost of subsidized capital (m)	14.39	15.00	15.81	21.67	14.54
Equity (start stock) (E <sub>0</sub> )	6,717,264	10,109,095	4,689,812	62,871,848	720,166
Direct grant (DG)	0	0	0	616,646	138,785
Paid-in capital (PC)	0	6,027,920	0	0	0
Average public debt (A)	5,208,718	20,315,482	0	10,941,001	2,287,550
Discount on public debt (A*(m-c))	382,885	473,528	0	2,014,873	149,549
Revenue grant (RG)	0	167,132	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	167,132	0	0	0
Accounting profit (loss) (P)	105,740	184,735	533,215	7,335,723	169,568
True profit (TP)	-277,145	-455,925	533,215	5,320,850	20,019
Average rate paid for public debt (c)	7.04	12.67	0.00	3.25	8.00
Revenue from lending (LP*i)	3,294,046	11,560,054	5,795,331	85,808,292	835,993
Average loan portfolio (net) (LP)	17,278,323	43,631,481	21,667,573	397,469,983	2,592,220
Yield on loans (i)	19.06	26.49	26.75	21.59	32.25
Annual subsidy received (S)	1,251,351	2,438,238	250,441	9,163,089	107,088
Subsidy dependence index (SDI)	0.380	0.211	0.043	0.107	0.128
<b>Variable / MFI</b>	<b>UNRWA\ Palestine</b>	<b>Microinvest</b>	<b>U Micro-finance</b>	<b>Grameen Bank</b>	<b>WB Finance</b>
Opportunity cost of subsidized capital (m)	6.19	20.54	14.54	13.33	15.81
Equity (start stock) (E <sub>0</sub> )	16,232,331	8,135,751	632,950	145,044,280	4,619,380
Direct grant (DG)	0	0	28,507	0	0
Paid-in capital (PC)	0	0	0	4,350,979	0
Average public debt (A)	7,875,000	9,443,161	0	24,360,219	0
Discount on public debt (A*(m-c))	487,463	1,786,928	0	2,762,379	0
Revenue grant (RG)	153,779	43,892	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	153,779	43,892	0	0	0
Accounting profit (loss) (P)	1,154,168	-1,227,177	-161,377	5,403,911	68,202
True profit (TP)	512,927	-3,057,997	-161,377	2,641,532	68,202
Average rate paid for public debt (c)	0.00	1.62	0.00	1.99	0.00
Revenue from lending (LP*i)	3,938,446	9,044,118	26,415	142,879,245	5,891,866
Average loan portfolio (net) (LP)	10,658,908	16,551,652	5,818	734,840,544	21,067,758

Yield on loans (i)	36.95	54.64	454.02	19.44	27.97
Annual subsidy received (S)	527,576	4,603,363	243,734	17,338,037	667,557
Subsidy dependence index (SDI)	0.134	0.509	9.227	0.121	0.113
<b>Variable / MFI</b>	<b>Finance Trust</b>	<b>New RB of Victorias</b>	<b>XacBank</b>	<b>Sathapana Bank</b>	<b>MCO OXUS - TJK</b>
Opportunity cost of subsidized capital (m)	20.96	8.57	21.67	15.81	22.62
Equity (start stock) (E <sub>0</sub> )	3,241,608	552,919	17,180,181	6,002,532	1,325,242
Direct grant (DG)	35,877	0	17,182	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	0	0	29,464,777	5,900,478	0
Discount on public debt (A*(m-c))	0	0	4,436,260	283,868	0
Revenue grant (RG)	0	0	1,856	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	1,856	0	0
Accounting profit (loss) (P)	571,797	67,759	1,786,428	1,717,124	-176,289
True profit (TP)	571,797	67,759	-2,651,688	1,433,256	-176,289
Average rate paid for public debt (c)	0.00	0.00	6.61	11.00	0.00
Revenue from lending (LP*i)	6,424,589	773,812	27,068,650	10,351,648	1,938,458
Average loan portfolio (net) (LP)	14,496,562	1,877,119	134,875,131	39,170,773	4,874,721
Yield on loans (i)	44.32	41.22	20.07	26.43	39.77
Annual subsidy received (S)	171,157	-17,493	6,569,505	-348,453	456,069
Subsidy dependence index (SDI)	0.027	-0.023	0.243	-0.034	0.235
<b>Variable / MFI</b>	<b>AgroInvest - Serbia</b>	<b>TYM</b>	<b>BESA</b>	<b>SPBD Samoa</b>	<b>KixiCredito</b>
Opportunity cost of subsidized capital (m)	6.87	10.07	12.66	12.08	15.68
Equity (start stock) (E <sub>0</sub> )	6,649,726	3,219,040	23,139,937	-784,609	1,282,333
Direct grant (DG)	0	0	3,747	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	0	0	6,686,859	0	3,653,115
Discount on public debt (A*(m-c))	0	0	344,824	0	135,257
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	1,593,424	876,682	1,170,526	185,593	1,109,580
True profit (TP)	1,593,424	876,682	825,702	185,593	974,323
Average rate paid for public debt (c)	0.00	0.00	7.50	0.00	11.98
Revenue from lending (LP*i)	7,619,944	2,144,426	10,435,601	568,293	6,527,387
Average loan portfolio (net) (LP)	17,596,341	9,760,463	40,621,626	1,410,080	8,998,693
Yield on loans (i)	43.30	21.97	25.69	40.30	72.54
Annual subsidy received (S)	-1,081,810	-508,420	2,178,367	-269,181	-686,224
Subsidy dependence index (SDI)	-0.142	-0.237	0.209	-0.474	-0.105
<b>Variable / MFI</b>	<b>Azeri Star</b>	<b>Crystal</b>	<b>Kasagana-Ka</b>	<b>ECLOF - PHL</b>	<b>VITAS IFN SA</b>
Opportunity cost of subsidized capital (m)	20.03	17.87	8.57	8.57	17.28
Equity (start stock) (E <sub>0</sub> )	1,321,474	1,225,729	360,456	1,558,910	1,745,825
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	0	683,969	367,144	0	5,800,676
Discount on public debt (A*(m-c))	0	116,745	-8,346	0	798,678
Revenue grant (RG)	0	137,432	0	0	269,278
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	137,432	0	0	269,278
Accounting profit (loss) (P)	215,136	326,028	153,382	48,705	-100,878
True profit (TP)	215,136	71,852	161,728	48,705	-1,168,834
Average rate paid for public debt (c)	0.00	0.80	10.84	0.00	3.51
Revenue from lending (LP*i)	1,388,788	2,062,984	899,222	561,786	3,304,379
Average loan portfolio (net) (LP)	2,584,679	4,103,747	1,436,637	2,011,459	9,978,305
Yield on loans (i)	53.73	50.27	62.59	27.93	33.12
Annual subsidy received (S)	71,089	176,266	-124,281	86,920	1,461,712
Subsidy dependence index (SDI)	0.051	0.085	-0.138	0.155	0.442
<b>Variable / MFI</b>	<b>CEVI</b>	<b>ASALA</b>	<b>RASS</b>	<b>ICNW</b>	<b>Patria Credit</b>
Opportunity cost of subsidized capital (m)	8.57	6.19	12.19	12.19	17.28

Equity (start stock) (E <sub>0</sub> )	1,153,362	2,349,043	1,502,914	1,249,416	19,507,201
Direct grant (DG)	0	0	0	0	4,314,490
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	0	833,334	6,630,058	0	22,070,808
Discount on public debt (A*(m-c))	0	30,250	165,129	0	2,391,338
Revenue grant (RG)	0	346,979	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	346,979	0	0	0
Accounting profit (loss) (P)	18,485	173,384	583,226	55,630	-2,148,238
True profit (TP)	18,485	-203,845	418,097	55,630	-4,539,576
Average rate paid for public debt (c)	0.00	2.56	9.70	0.00	6.44
Revenue from lending (LP*i)	1,096,996	580,272	1,967,488	480,574	9,848,251
Average loan portfolio (net) (LP)	2,405,838	2,777,555	14,937,760	2,258,198	42,821,946
Yield on loans (i)	45.60	20.89	13.17	21.28	23.00
Annual subsidy received (S)	81,106	354,617	-199,389	100,033	8,096,555
Subsidy dependence index (SDI)	0.074	0.611	-0.101	0.208	0.822
<b>Variable / MFI</b>	<b>Letshego KEN</b>	<b>ASHI</b>	<b>Agroinvestbank</b>	<b>Letshego RWA</b>	<b>CEOSS</b>
Opportunity cost of subsidized capital (m)	14.80	8.57	22.62	16.72	11.98
Equity (start stock) (E <sub>0</sub> )	4,393,931	1,787,104	44,909,275	664,045	5,462,580
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	10,446,645	0	0
Average public debt (A)	141,510	746,592	36,252,014	0	0
Discount on public debt (A*(m-c))	-4,025	22,385	4,177,645	0	0
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	-61,581	185,750	-10,140,097	152,895	888,978
True profit (TP)	-57,556	163,365	-14,317,742	152,895	888,978
Average rate paid for public debt (c)	17.65	5.57	11.09	0.00	0.00
Revenue from lending (LP*i)	519,196	1,446,322	47,914,734	896,658	1,677,639
Average loan portfolio (net) (LP)	2,013,698	3,702,386	155,810,069	1,392,862	7,117,753
Yield on loans (i)	25.78	39.06	30.75	64.38	23.57
Annual subsidy received (S)	703,499	-2,323	24,509,013	-29,060	-181,606
Subsidy dependence index (SDI)	1.355	-0.002	0.512	-0.032	-0.108
<b>Variable / MFI</b>	<b>Fonkoze Financial Services, S.A. (SFF)</b>	<b>RB Lebak</b>	<b>ABS-CBN</b>	<b>Nidan</b>	<b>Alwatani (National Microfinance Bank)</b>
Opportunity cost of subsidized capital (m)	17.33	8.57	8.57	12.19	9.25
Equity (start stock) (E <sub>0</sub> )	-687,537	938,299	3,389,777	96,833	5,826,210
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	0	130,201	173,395	235,978	5,907,582
Discount on public debt (A*(m-c))	0	7,422	-15,668	28,631	197,199
Revenue grant (RG)	454,000	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	454,000	0	0	0	0
Accounting profit (loss) (P)	-4,079,393	209,539	-443,148	-6,691	1,138,145
True profit (TP)	-4,533,393	202,117	-427,480	-35,322	940,946
Average rate paid for public debt (c)	0.00	2.87	17.60	0.05	5.91
Revenue from lending (LP*i)	2,963,058	797,430	2,291,346	4,878	4,958,766
Average loan portfolio (net) (LP)	7,071,231	2,603,579	1,714,392	217,895	13,413,058
Yield on loans (i)	41.90	30.63	133.65	2.24	36.97
Annual subsidy received (S)	4,060,786	-112,766	698,873	46,716	-349,596
Subsidy dependence index (SDI)	1.370	-0.141	0.305	9.577	-0.071
<b>Variable / MFI</b>	<b>VITAS PSE</b>	<b>Pak Oman</b>	<b>CSC</b>	<b>Telenor Microfinance</b>	<b>CFA</b>
Opportunity cost of subsidized capital (m)	6.19	14.54	14.54	14.54	15.00
Equity (start stock) (E <sub>0</sub> )	10,036,785	5,332,195	373,955	15,169,968	314,537
Direct grant (DG)	0	58,547	0	1,267,062	0
Paid-in capital (PC)	0	0	0	0	0

Average public debt (A)	0	0	2,788,192	3,694,934	3,560,809
Discount on public debt (A*(m-c))	0	0	182,278	368,699	362,021
Revenue grant (RG)	0	0	165,750	0	20,062
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	165,750	0	20,062
Accounting profit (loss) (P)	915,205	-83,150	-226,023	-1,492,463	81,009
True profit (TP)	915,205	-83,150	-574,051	-1,861,162	-301,074
Average rate paid for public debt (c)	0.00	0.00	8.00	4.56	4.83
Revenue from lending (LP*i)	1,970,823	458,128	725,297	4,846,274	673,379
Average loan portfolio (net) (LP)	11,398,622	1,144,678	1,780,371	17,929,467	1,474,851
Yield on loans (i)	17.29	40.02	40.74	27.03	45.66
Annual subsidy received (S)	-265,602	856,530	611,986	4,050,112	354,331
Subsidy dependence index (SDI)	-0.135	1.870	0.844	0.836	0.526
<b>Variable / MFI</b>	<b>Arohan</b>	<b>Sonata</b>	<b>Swadhaar</b>	<b>Credit Mongol</b>	<b>CUMO</b>
Opportunity cost of subsidized capital (m)	12.19	12.19	12.19	21.67	25.25
Equity (start stock) (E <sub>0</sub> )	1,781,381	1,624,393	1,829,242	1,728,682	3,270,603
Direct grant (DG)	0	0	0	616,043	134,256
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	3,326,511	0	333,556	736,450	0
Discount on public debt (A*(m-c))	42,417	0	17,503	111,778	0
Revenue grant (RG)	0	0	0	31,273	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	31,273	0
Accounting profit (loss) (P)	335,180	112,405	-870,177	165,695	-62,400
True profit (TP)	292,763	112,405	-887,680	22,644	-62,400
Average rate paid for public debt (c)	10.91	0.00	6.94	6.49	0.00
Revenue from lending (LP*i)	4,198,945	2,956,640	818,234	1,117,457	780,998
Average loan portfolio (net) (LP)	20,728,041	11,096,203	4,338,804	3,919,070	1,284,311
Yield on loans (i)	20.26	26.65	18.86	28.51	60.81
Annual subsidy received (S)	-55,232	92,418	1,057,593	436,598	897,299
Subsidy dependence index (SDI)	-0.013	0.031	1.293	0.391	1.149
<b>Variable / MFI</b>	<b>BWDA</b>	<b>Maxima</b>	<b>Seilanithih</b>	<b>KCCDFI</b>	<b>Mimo Finance</b>
Opportunity cost of subsidized capital (m)	12.19	15.81	15.81	8.57	12.19
Equity (start stock) (E <sub>0</sub> )	3,528,813	333,394	946,902	460,224	854,264
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	6,584,097	250,000	646,279	790,186	555,926
Discount on public debt (A*(m-c))	-688,313	21,527	75,213	-29,029	67,754
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	349,067	57,858	106,034	81,436	107,117
True profit (TP)	1,037,380	36,331	30,821	110,465	39,363
Average rate paid for public debt (c)	22.64	7.20	4.17	12.24	0.00
Revenue from lending (LP*i)	3,867,074	448,800	2,067,358	1,480,931	2,047,802
Average loan portfolio (net) (LP)	25,769,229	1,684,057	6,165,774	2,242,639	7,548,778
Yield on loans (i)	15.01	26.65	33.53	66.04	27.13
Annual subsidy received (S)	-586,035	20,956	127,276	-67,554	71,277
Subsidy dependence index (SDI)	-0.152	0.047	0.062	-0.046	0.035
<b>Variable / MFI</b>	<b>JFSL</b>	<b>IPR</b>	<b>NongHyup Finance Plc</b>	<b>CBIRD</b>	<b>SEWA Finance</b>
Opportunity cost of subsidized capital (m)	12.19	15.81	15.81	15.81	15.67
Equity (start stock) (E <sub>0</sub> )	567,307	1,287,646	923,736	217,396	367,170
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	0	825,000	1,284,794	673,332	0
Discount on public debt (A*(m-c))	0	56,190	17,273	45,860	0
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0

Accounting profit (loss) (P)	44,850	21,231	242,357	18,911	-37,479
True profit (TP)	44,850	-34,959	225,084	-26,949	-37,479
Average rate paid for public debt (c)	0.00	9.00	14.47	9.00	0.00
Revenue from lending (LP*i)	1,532,200	1,114,832	1,662,913	432,467	191,142
Average loan portfolio (net) (LP)	7,763,893	3,616,414	5,397,199	1,223,229	702,139
Yield on loans (i)	19.73	30.83	30.81	35.35	27.22
Annual subsidy received (S)	27,024	240,226	-59,873	62,817	92,084
Subsidy dependence index (SDI)	0.018	0.215	-0.036	0.145	0.482
<b>Variable / MFI</b>	<b>Moris Rasik</b>	<b>Nav Bharat</b>	<b>PATRA Hunchun</b>	<b>FMF-E</b>	<b>Elet-Capital</b>
Opportunity cost of subsidized capital (m)	11.17	12.19	5.31	11.98	26.65
Equity (start stock) (E <sub>0</sub> )	1,750,202	692,161	-18,882	-345,472	307,610
Direct grant (DG)	0	0	0	825,000	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	162,500	266,814	0	0	0
Discount on public debt (A*(m-c))	10,644	18,971	0	0	0
Revenue grant (RG)	245,000	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	245,000	0	0	0	0
Accounting profit (loss) (P)	695,290	108,472	23,461	-199,264	54,015
True profit (TP)	439,646	89,501	23,461	-199,264	54,015
Average rate paid for public debt (c)	4.62	5.08	0.00	0.00	0.00
Revenue from lending (LP*i)	1,096,592	290,232	72,384	1,241,495	518,146
Average loan portfolio (net) (LP)	3,776,901	1,243,306	517,072	4,399,332	1,077,105
Yield on loans (i)	29.03	23.34	14.00	28.22	48.11
Annual subsidy received (S)	-205,403	1,466	-23,841	195,360	35,171
Subsidy dependence index (SDI)	-0.187	0.005	-0.329	0.157	0.068
<b>Variable / MFI</b>	<b>PATRA Yanbian</b>	<b>Serviamus</b>	<b>DemirBank</b>	<b>OXUS - AFG</b>	<b>ASA Philippines</b>
Opportunity cost of subsidized capital (m)	5.31	8.57	20.03	15.00	8.57
Equity (start stock) (E <sub>0</sub> )	-81,793	804,316	41,500,000	679,634	1,712,181
Direct grant (DG)	0	2,152	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	0	0	79,961,096	4,840,195	301,044
Discount on public debt (A*(m-c))	0	0	13,009,504	493,279	-17,982
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	-1,568	96,127	6,378,750	617,721	680,742
True profit (TP)	-1,568	96,127	-6,630,754	124,442	698,724
Average rate paid for public debt (c)	0.00	0.00	3.76	4.81	14.54
Revenue from lending (LP*i)	35,507	430,095	44,168,750	1,011,055	5,310,694
Average loan portfolio (net) (LP)	317,791	797,589	242,832,500	2,357,682	10,794,159
Yield on loans (i)	11.17	53.92	18.19	42.88	49.20
Annual subsidy received (S)	-2,817	-23,019	15,581,663	23,832	-522,899
Subsidy dependence index (SDI)	-0.079	-0.054	0.353	0.024	-0.098
<b>Variable / MFI</b>	<b>BIMAS</b>	<b>MADRAC</b>	<b>Adhikar</b>	<b>RB Camalig</b>	<b>BRAC - TZA</b>
Opportunity cost of subsidized capital (m)	14.80	15.00	12.19	8.57	15.03
Equity (start stock) (E <sub>0</sub> )	2,119,093	-462,455	454,627	1,724,321	7,213,107
Direct grant (DG)	0	903,603	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	651,599	3,840,007	0	166,896	0
Discount on public debt (A*(m-c))	88,814	381,388	0	4,314	0
Revenue grant (RG)	0	38,037	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	38,037	0	0	0
Accounting profit (loss) (P)	-124,641	-256,001	293,304	201,919	952,525
True profit (TP)	-213,455	-675,427	293,304	197,605	952,525
Average rate paid for public debt (c)	1.17	5.07	0.00	5.98	0.00
Revenue from lending (LP*i)	750,866	486,458	1,763,767	1,595,863	4,437,964
Average loan portfolio (net) (LP)	2,178,670	2,134,406	7,007,014	5,917,931	9,165,595
Yield on loans (i)	34.46	22.79	25.17	26.97	48.42

Annual subsidy received (S)	517,950	654,628	-220,023	-41,248	203,224
Subsidy dependence index (SDI)	0.690	1.346	-0.125	-0.026	0.046
<b>Variable / MFI</b>	<b>BRAC - UGA</b>	<b>BRAC - LKA</b>	<b>WMN (Russia)</b>	<b>T-O-M</b>	<b>Microloan Foundation Malawi</b>
Opportunity cost of subsidized capital (m)	20.96	15.67	15.31	15.00	25.25
Equity (start stock) (E <sub>0</sub> )	2,331,637	-595,973	1,511,241	687,975	870,632
Direct grant (DG)	377,455	0	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	0	54,093	0	0	0
Discount on public debt (A*(m-c))	0	-2,313	0	0	0
Revenue grant (RG)	0	0	0	2,174	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	2,174	0
Accounting profit (loss) (P)	-4,215	174,688	-457,567	-167,427	681,948
True profit (TP)	-4,215	177,001	-457,567	-169,601	681,948
Average rate paid for public debt (c)	0.00	19.95	0.00	0.00	0.00
Revenue from lending (LP*i )	4,040,746	2,552,086	3,373,776	181,778	790,644
Average loan portfolio (net) (LP)	11,960,269	7,132,271	7,904,883	492,442	1,272,325
Yield on loans (i)	33.78	35.78	42.68	36.91	62.14
Annual subsidy received (S)	531,920	-256,712	653,890	260,240	-376,017
Subsidy dependence index (SDI)	0.132	-0.101	0.194	1.432	-0.476
<b>Variable / MFI</b>	<b>NCS</b>	<b>First MicroFinance Company</b>	<b>FINCA - JOR</b>	<b>FAIR Bank</b>	<b>Agrocredit Plus</b>
Opportunity cost of subsidized capital (m)	12.19	26.65	9.25	8.57	26.65
Equity (start stock) (E <sub>0</sub> )	15,210	4,376,339	375,527	1,924,489	379,917
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	251,164	0	0	7,290,117	0
Discount on public debt (A*(m-c))	30,611	0	0	-266,369	0
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	21,172	109,166	-283,977	87,967	67,853
True profit (TP)	-9,439	109,166	-283,977	354,336	67,853
Average rate paid for public debt (c)	0.00	0.00	0.00	12.22	0.00
Revenue from lending (LP*i )	286,237	2,463,730	1,089,579	3,609,132	269,562
Average loan portfolio (net) (LP)	1,237,612	8,310,143	3,441,497	8,777,532	819,832
Yield on loans (i)	23.13	29.65	31.66	41.12	32.88
Annual subsidy received (S)	12,583	1,071,807	305,572	-185,713	42,449
Subsidy dependence index (SDI)	0.044	0.435	0.280	-0.051	0.157
<b>Variable / MFI</b>	<b>Mol Bulak Finance</b>	<b>Sajida</b>	<b>BTA Bank</b>	<b>Mol Bulak Azerbaijan</b>	<b>MCF Borshud</b>
Opportunity cost of subsidized capital (m)	26.65	13.33	26.65	20.03	22.62
Equity (start stock) (E <sub>0</sub> )	1,021,872	2,068,612	35,076,002	29,719	134,626
Direct grant (DG)	0	0	0	0	14,645
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	525,045	9,143,492	1,771,046	0	31,150
Discount on public debt (A*(m-c))	131,926	951,782	415,272	0	6,135
Revenue grant (RG)	0	37,277	0	0	29,291
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	37,277	0	0	29,291
Accounting profit (loss) (P)	298,080	790,953	1,698,853	1,441	78,619
True profit (TP)	166,154	-198,107	1,283,581	1,441	43,193
Average rate paid for public debt (c)	1.53	2.92	3.21	0.00	2.92
Revenue from lending (LP*i )	3,506,415	3,129,028	15,602,318	97,758	448,030
Average loan portfolio (net) (LP)	10,682,119	13,703,854	42,161,470	509,998	1,114,790
Yield on loans (i)	32.83	22.83	37.01	19.17	40.19
Annual subsidy received (S)	145,929	526,488	8,291,622	4,656	-2,200
Subsidy dependence index (SDI)	0.042	0.168	0.531	0.048	-0.005



<i>Variable / MFI</i>	FINCA - SLV	Growing Opportunity Finance	Sarala	Reliance	Chamroeun
Opportunity cost of subsidized capital (m)	9.32	12.19	12.19	27.00	15.81
Equity (start stock) (E <sub>0</sub> )	2,626,096	1,823,249	182,101	654,501	145,049
Direct grant (DG)	0	0	7,246	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	0	555,926	2,862,280	4,463	0
Discount on public debt (A*(m-c))	0	24,787	96,380	1,088	0
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	-746,649	55,967	519,390	-837,139	0
True profit (TP)	-746,649	31,180	423,010	-838,227	0
Average rate paid for public debt (c)	0.00	7.73	8.82	2.61	0.00
Revenue from lending (LP*i)	2,200,410	1,962,320	1,347,356	1,062,633	264,436
Average loan portfolio (net) (LP)	3,210,995	5,951,597	7,597,024	2,538,291	675,206
Yield on loans (i)	68.53	32.97	17.74	41.86	39.16
Annual subsidy received (S)	956,495	194,439	-368,725	901,929	22,934
Subsidy dependence index (SDI)	0.435	0.099	-0.274	0.849	0.087
<i>Variable / MFI</i>	RB Pagbilao	PAWDEP	MUL	KIF	KOPSA
Opportunity cost of subsidized capital (m)	8.57	14.80	20.96	11.17	12.19
Equity (start stock) (E <sub>0</sub> )	291,534	193,411	275,382	413,584	598,110
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	0	151,628	0
Average public debt (A)	15,840	519,760	0	62,500	229,089
Discount on public debt (A*(m-c))	986	24,212	0	6,979	27,920
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	19,613	18,026	-245,380	20,257	-271,857
True profit (TP)	18,627	-6,186	-245,380	13,278	-299,777
Average rate paid for public debt (c)	2.34	10.15	0.00	0.00	0.00
Revenue from lending (LP*i)	224,088	1,416,015	774,710	217,579	29,802
Average loan portfolio (net) (LP)	772,844	8,002,640	941,441	368,067	0
Yield on loans (i)	29.00	17.69	82.29	59.11	0
Annual subsidy received (S)	7,186	36,154	277,377	42,498	356,106
Subsidy dependence index (SDI)	0.032	0.026	0.358	0.195	11.949
<i>Variable / MFI</i>	Indur MACS	SVSDF	Paglaum Cooperative	IDYDC	Berendina Micro Investment
Opportunity cost of subsidized capital (m)	12.19	12.19	8.57	15.03	15.67
Equity (start stock) (E <sub>0</sub> )	582,629	29,850	1,151,388	194,970	847,452
Direct grant (DG)	0	38,799	18,232	2,972	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	393,228	0	544,407	0	0
Discount on public debt (A*(m-c))	41,756	0	-40,470	0	0
Revenue grant (RG)	10,330	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	10,330	0	0	0	0
Accounting profit (loss) (P)	111,337	5,088	255,574	7,451	898
True profit (TP)	59,252	5,088	296,044	7,451	898
Average rate paid for public debt (c)	1.57	0.00	16.00	0.00	0.00
Revenue from lending (LP*i)	598,650	159,808	1,334,781	82,461	286,537
Average loan portfolio (net) (LP)	4,388,805	1,413,970	3,209,904	215,390	2,250,462
Yield on loans (i)	13.64	11.30	41.58	38.28	12.73
Annual subsidy received (S)	18,541	1,224	-185,687	22,637	131,982
Subsidy dependence index (SDI)	0.031	0.008	-0.139	0.275	0.461
<i>Variable / MFI</i>	FinAgro	Farm Credit Armenia	TuranBank	GGEM Microfinance Services Ltd.	Bangko Luzon
Opportunity cost of subsidized capital (m)	17.87	18.76	20.03	22.17	8.57

Equity (start stock) (E <sub>0</sub> )	2,433,541	554,229	24,666,667	244,473	1,349,793
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	0	0	172,154
Average public debt (A)	0	576,449	20,414,043	0	1,153,396
Discount on public debt (A*(m-c))	0	85,110	3,457,488	0	-39,606
Revenue grant (RG)	287,040	482,167	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	287,040	482,167	0	0	0
Accounting profit (loss) (P)	19,915	87,880	2,518,750	-819	169,842
True profit (TP)	-267,125	-479,396	-938,738	-819	209,448
Average rate paid for public debt (c)	0.00	4.00	3.09	0.00	12.00
Revenue from lending (LP*i)	619,736	93,551	12,848,750	153,271	1,563,776
Average loan portfolio (net) (LP)	1,970,850	1,245,447	95,632,500	241,524	7,417,163
Yield on loans (i)	31.45	7.51	13.44	63.46	21.08
Annual subsidy received (S)	703,688	591,640	6,131,508	54,920	-79,174
Subsidy dependence index (SDI)	1.135	6.324	0.477	0.358	-0.051
<b>Variable / MFI</b>	<b>RB Guinobatan</b>	<b>RB Bagac</b>	<b>FINCA Pakistan</b>	<b>CDBD Cooperative</b>	<b>ECLOF - KEN</b>
Opportunity cost of subsidized capital (m)	8.57	8.57	14.54	15.67	14.80
Equity (start stock) (E <sub>0</sub> )	358,875	293,134	9,038,133	322,235	1,796,602
Direct grant (DG)	0	0	0	0	0
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	508,116	20,131	0	766,157	467,179
Discount on public debt (A*(m-c))	7,420	-894	0	52,600	29,334
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	88,330	12,407	-	5,428	265,116
True profit (TP)	80,910	13,301	-	-47,172	235,782
Average rate paid for public debt (c)	7.11	13.01	0.00	8.81	8.53
Revenue from lending (LP*i)	642,385	248,731	1,913,391	559,298	1,273,459
Average loan portfolio (net) (LP)	2,622,111	1,012,628	4,843,502	2,357,832	4,043,346
Yield on loans (i)	24.50	24.56	39.50	23.72	31.50
Annual subsidy received (S)	-46,385	12,341	3,435,296	98,097	49,822
Subsidy dependence index (SDI)	-0.072	0.050	1.795	0.175	0.039
<b>Variable / MFI</b>	<b>AfricaWorks</b>	<b>ASA Pakistan</b>	<b>ProCredit Bank - ARM</b>	<b>Phoenix +</b>	<b>BRAC Pakistan</b>
Opportunity cost of subsidized capital (m)	15.68	14.54	18.76	22.62	14.54
Equity (start stock) (E <sub>0</sub> )	895,689	235,285	17,883,063	410,921	-144,532
Direct grant (DG)	0	0	0	1,684	809,817
Paid-in capital (PC)	0	0	0	0	0
Average public debt (A)	0	0	0	0	5,635,469
Discount on public debt (A*(m-c))	0	0	0	0	-330,201
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	102,246	-111,001	-206,856	22,270	-524,149
True profit (TP)	102,246	-111,001	-206,856	22,270	-193,948
Average rate paid for public debt (c)	0.00	0.00	0.00	0.00	20.40
Revenue from lending (LP*i)	798,623	321,194	5,140,614	188,078	1,329,512
Average loan portfolio (net) (LP)	941,163	1,425,182	32,682,521	537,943	4,138,987
Yield on loans (i)	84.85	22.54	15.73	34.96	32.12
Annual subsidy received (S)	46,173	137,137	3,543,110	73,372	193,702
Subsidy dependence index (SDI)	0.058	0.427	0.689	0.390	0.146
<b>Variable / MFI</b>	<b>Uttrayan Financial</b>	<b>SEWA MACTS</b>	<b>RORES</b>	<b>Future Financial</b>	<b>Nano</b>
Opportunity cost of subsidized capital (m)	12.19	12.19	12.19	12.19	12.19
Equity (start stock) (E <sub>0</sub> )	101,618	267,849	427,151	5,612,252	64,123
Direct grant (DG)	0	93,396	0	0	0
Paid-in capital (PC)	0	0	0	0	0

Average public debt (A)	0	158,850	362,427	9,251,678	0
Discount on public debt (A*(m-c))	0	-20,509	-124,328	43,492	0
Revenue grant (RG)	0	0	0	0	0
Discount on expenses (DX)	0	0	0	0	0
Sum of all other subsidies received (K)	0	0	0	0	0
Accounting profit (loss) (P)	36,044	10,630	52,581	3,226,790	55,807
True profit (TP)	36,044	31,139	176,909	3,183,298	55,807
Average rate paid for public debt (c)	0.00	25.10	46.49	11.72	0.00
Revenue from lending (LP*i)	275,901	289,300	1,166,269	8,269,187	575,573
Average loan portfolio (net) (LP)	1,385,582	2,474,332	3,378,157	41,451,851	1,326,692
Yield on loans (i)	19.91	11.69	34.52	19.95	43.38
Annual subsidy received (S)	-21,463	7,844	-121,645	-2,302,672	-44,591
Subsidy dependence index (SDI)	-0.078	0.027	-0.104	-0.278	-0.077
<b>Variable / MFI</b>	<b>SV Creditline</b>	<b>JWS</b>	<b>GLOW</b>		
Opportunity cost of subsidized capital (m)	12.19	14.54	12.19		
Equity (start stock) (E <sub>0</sub> )	199,324	342,004	27,328		
Direct grant (DG)	0	0	0		
Paid-in capital (PC)	0	0	0		
Average public debt (A)	0	3,006,489	205,693		
Discount on public debt (A*(m-c))	0	196,549	16,721		
Revenue grant (RG)	0	0	0		
Discount on expenses (DX)	0	0	0		
Sum of all other subsidies received (K)	0	0	0		
Accounting profit (loss) (P)	-1,098,027	47,464	34,912		
True profit (TP)	-1,098,027	-149,085	18,191		
Average rate paid for public debt (c)	0.00	8.00	4.06		
Revenue from lending (LP*i)	73,392	561,237	176,933		
Average loan portfolio (net) (LP)	1,977,607	1,872,071	1,025,808		
Yield on loans (i)	3.71	29.98	17.25		
Annual subsidy received (S)	1,055,409	202,254	-12,733		
Subsidy dependence index (SDI)	14.380	0.360	-0.072		

Source: author's own compilation

## Appendix 4

### Overview of all MFIs' input and output variables of the DEA

MFI	Operating Expenses [USD] (I)	Total Number of Employees (I)	Gross Loan Portfolio [USD] (O)	Financial Revenue [USD] (O)	Number of Active Borrowers (O)	Average Loan Balance per Borrower / GNI per Capita (O)
100001	6,723,643	304	43,950,894	16,433,420	20,145	0.4486
100012	764,273	414	12,460,604	2,282,214	101,389	0.1007
100013	169,220	90	1,247,345	252,439	10,339	0.0591
100015	217,489	55	16,726,882	2,592,908	9,407	1.7218
100024	678,655	453	5,126,256	1,474,736	70,021	0.0709
100036	5,203,736	1,380	73,420,428	11,375,918	352,648	0.1707
100042	938,075	248	3,018,983	918,430	30,513	0.0485
100047	947,455	120	2,401,533	636,390	11,855	0.4395
100052	132,462	63	1,164,851	250,282	6,601	0.1446
100055	423,602	104	4,758,007	1,415,133	29,746	0.1549
100074	1,224,779	507	9,288,637	2,170,800	79,335	0.2019
100080	953,834	488	7,329,709	1,555,493	73,802	0.1712
100081	719,513	400	5,521,305	1,135,631	49,137	0.1937
100094	1,472,879	679	11,080,306	2,321,981	80,181	0.2471

100095	3,386,282	1,869	40,864,900	7,347,548	317,068	0.2304
100098	551,742	132	5,901,352	1,328,272	49,155	0.1201
100104	9,001,371	2,396	65,862,911	19,751,748	431,027	0.1503
100109	8,048,606	4,112	60,924,675	12,392,841	486,127	0.2161
100110	1,062,792	654	7,284,221	1,606,530	80,285	0.1564
100115	893,877	432	5,251,746	1,322,603	44,712	0.2025
100121	262,551	30	98,435	94,473	1,121	0.0864
100122	11,396,819	2,036	30,198,615	13,626,103	264,089	0.0665
100123	2,207,352	1,148	13,959,243	2,870,790	148,737	0.1678
100126	6,164,152	2,573	39,640,497	10,750,455	265,353	0.2576
100127	491,766	237	3,326,817	1,081,862	31,647	0.1034
100129	1,592,666	765	8,361,299	1,716,652	93,995	0.1534
100153	6,730,691	466	12,737,847	7,593,360	45,135	0.5983
100154	3,365,777	239	1,737,351	572,612	10,697	0.3523
100155	4,857,082	322	16,758,554	6,674,520	38,952	0.1724
100156	5,654,195	198	18,590,732	8,285,136	8,560	0.2325
100158	16,511,005	712	69,235,272	27,507,601	90,558	0.158
100161	4,471,922	303	7,220,782	4,903,815	41,253	0.3202
100162	1,796,733	159	2,040,318	1,899,447	12,000	0.1771
100168	2,026,770	92	14,420,986	2,627,976	13,230	0.1352
100170	2,859,257	167	6,288,097	2,182,409	17,358	0.4767
100171	1,623,818	94	17,311,961	3,928,596	8,853	0.4913
100175	6,196,421	213	43,295,615	10,246,117	15,259	0.2314
100180	1,276,346	78	1,642,717	1,029,992	7,833	0.4446
100187	1,142,412	47	6,184,848	1,881,963	5,217	0.2522
100191	7,238,664	1,751	35,687,797	9,516,224	150,638	0.5139
100194	382,923	34	2,490,590	477,316	2,216	0.4228
100196	584,234	321	3,398,719	1,067,288	17,489	0.0952
100205	2,448,585	118	14,446,416	4,074,031	18,066	0.0992
100218	1,288,851	60	7,882,568	2,813,191	6,633	0.2455
100224	5,081,347	417	20,541,969	6,563,141	11,546	2.5252
100240	11,695,995	964	39,643,494	12,431,951	102,371	0.4599
100241	184,337	65	1,364,789	291,330	7,869	0.299
100242	3,061,358	70	17,804,895	4,997,554	2,526	0.9395
100247	30,313	33	252,761	76,461	3,653	0.0692
100252	755,472	65	5,584,360	2,128,258	8,041	0.2745
100261	9,379,279	835	30,179,260	15,360,314	99,385	0.349
100263	659,286	25	5,094,853	1,337,143	1,168	0.7373
100274	15,952,937	738	29,318,099	22,788,823	118,419	0.0276
100277	579,527	23	4,231,740	1,011,656	3,989	0.2411
100301	8,588,538	5,322	58,761,526	16,264,039	577,057	0.1756
100302	7,241,818	212	56,131,851	16,961,789	27,425	0.4832
100307	4,468,879	148	37,650,699	10,219,009	23,799	0.3366
100308	2,583,485	333	13,663,362	4,139,550	22,161	0.3444
100325	3,066,635	502	8,957,004	4,137,527	78,025	0.0641
100329	1,309,897	129	8,584,763	3,429,167	12,493	0.2217
100345	8,905,045	1,246	64,428,018	16,546,509	87,945	0.9369
100357	3,366,207	510	31,180,474	8,503,344	41,110	1.1669
100359	24,326,600	867	220,937,376	43,132,305	39,443	1.5219
100363	64,833,551	18,850	636,398,086	178,363,874	6,241,328	0.1758
100375	9,063,301	296	97,914,742	21,893,716	54,572	0.3818
100390	1,657,160	71	9,654,585	3,027,599	8,979	0.2288
100391	12,043,570	2,002	43,011,904	15,827,283	329,421	0.1284
100404	3,304,838	218	8,096,455	3,813,388	19,761	0.8686
100426	18,787,571	689	198,270,320	35,214,769	31,999	1.4082
100433	1,987,063	1,543	17,886,150	3,750,116	285,336	0.1081
100442	3,590,017	206	17,100,338	6,144,697	48,160	0.0892
100456	101,399,870	4,291	818,101,516	204,069,994	715,969	1.5035
100458	407,286	37	2,859,520	739,661	5,146	0.3104
100460	1,013,825	133	3,917,011	1,556,577	18,599	0.1224
100464	5,939,399	137	42,423,194	9,857,819	7,004	1.0549
100469	9,695,559	316	113,594,203	25,972,974	51,618	0.4682

100477	6,096,407	317	31,466,272	9,712,575	11,353	1.0955
100479	35,064,492	1,006	258,424,110	64,606,706	35,533	0.9693
100489	11,270,714	325	156,275,000	29,608,571	51,146	0.7214
100497	5,987,724	307	43,357,186	12,283,710	16,135	0.6718
100511	5,788,551	516	55,933,175	12,515,594	31,405	2.0472
100515	3,227,484	101	9,806,621	3,430,746	9,692	0.2389
100521	2,979,139	75	37,645,393	6,684,188	9,987	0.8899
100523	7,126,754	297	59,664,129	12,976,929	19,336	0.9524
100525	10,740,196	306	68,206,950	27,329,084	40,312	0.3995
100529	600,283	108	1,103,195	674,493	7,895	0.0781
100545	1,357,776	175	10,501,265	2,501,452	24,029	0.254
100546	700,671	176	1,993,963	900,582	20,462	0.0544
100551	622,803	25	4,340,705	1,291,350	2,641	0.388
100572	552,405	94	1,090,923	636,640	4,000	0.2727
100579	64,505,937	1,864	632,451,051	144,387,413	103,363	1.0656
100581	1,214,201	54	10,127,251	2,245,789	3,785	0.8258
100587	6,880,714	226	62,554,412	13,866,579	49,816	0.2672
100600	1,219,738	52	18,470,877	3,383,431	6,619	0.8613
100608	10,336,349	907	45,536,905	15,962,798	43,432	2.8196
100611	2,920,201	524	22,372,833	5,626,441	39,358	0.727
100615	37,765,340	3,815	416,552,376	102,493,817	311,196	0.8212
100626	468,791	191	2,702,345	855,741	23,123	0.1169
100630	2,637,629	179	11,202,985	4,031,845	9,813	0.5039
100632	2,146,087	107	19,435,662	10,103,327	16,681	0.7788
100633	164,106	27	10,469	99,408	52	0.2013
100636	81,866,903	23,283	817,389,833	205,943,135	6,430,000	0.2192
100638	4,036,939	637	21,314,258	6,178,958	98,777	0.332
100658	5,044,989	289	14,752,722	6,578,557	20,175	1.5502
100664	514,588	60	1,987,736	781,524	2,529	0.4391
100670	9,979,137	1,052	137,080,303	28,080,814	73,121	1.1501
100681	4,883,633	747	39,686,438	10,445,392	36,228	1.401
100683	1,345,102	167	5,350,511	2,018,833	6,581	1.1615
100684	3,586,425	104	18,870,594	6,834,244	14,928	0.2201
100691	1,006,425	231	9,836,185	2,252,853	40,282	0.2321
100720	5,022,692	177	43,556,028	9,521,445	14,909	0.7304
100724	383,005	23	1,423,037	661,743	4,795	0.1045
100725	4,906,633	183	9,324,262	7,138,122	8,582	0.2698
100748	931,553	53	2,600,519	1,380,901	6,536	0.0822
100772	1,247,410	85	4,259,051	2,087,839	4,534	0.3713
100781	739,812	115	1,489,166	992,489	15,537	0.0557
100795	710,848	65	2,158,201	809,694	4,996	0.2413
100804	1,541,016	51	11,713,045	3,459,381	1,942	0.8039
100807	1,030,124	193	2,500,816	1,150,101	25,321	0.0552
100819	882,523	40	2,995,817	580,347	2,339	0.5653
100822	253,431	117	15,012,824	2,055,958	47,265	0.3076
100830	227,472	313	2,289,882	483,698	250,834	0.0088
100840	5,587,666	140	46,246,435	10,716,032	7,800	0.7902
100853	854,439	36	2,146,539	938,004	3,225	0.7905
100872	1,109,587	162	3,816,893	1,489,124	19,129	0.1115
101040	638,055	28	1,481,958	921,909	1,723	1.7553
101053	733,789	120	7,331,742	1,751,694	38,873	0.0911
101072	3,682,589	430	7,502,143	3,487,596	32,409	0.3462
101086	495,063	40	2,761,613	974,389	4,875	0.3165
101198	2,426	42	217,895	4,878	1,660	0.1076
101244	2,772,086	132	13,646,082	4,989,432	23,687	0.1447
101249	1,030,518	38	11,998,550	1,970,730	5,397	0.9812
101362	1,039,102	150	1,191,595	949,186	8,092	0.1473
101363	702,210	158	1,991,431	830,534	11,975	0.1636
101365	6,779,909	791	18,244,562	5,808,002	70,671	0.2582
101366	620,153	86	2,134,918	785,103	11,662	0.4923
101367	1,836,539	751	21,746,801	4,207,375	187,754	0.0949
101372	1,679,027	856	12,568,446	3,074,091	85,897	0.1199

101373	1,525,189	328	4,350,462	851,820	27,391	0.1302
101400	655,154	70	3,981,755	1,152,555	1,608	1.5192
101441	1,054,901	148	1,473,398	969,892	36,261	0.1401
101488	1,257,683	647	25,837,861	4,424,395	220,645	0.096
101499	279,838	50	1,717,806	450,553	2,373	0.9258
101500	1,251,218	170	6,291,573	2,111,562	10,433	0.9278
101523	1,182,132	170	2,286,411	1,489,881	18,750	0.0681
101642	1,070,428	281	7,666,650	2,111,830	52,345	0.1418
101644	854,035	748	7,792,279	1,604,889	93,036	0.0687
101667	523,763	61	3,998,599	1,154,189	4,219	1.4581
101668	728,198	131	5,551,096	1,637,065	10,987	0.7773
101669	290,017	67	1,255,580	471,579	2,308	0.8369
101673	162,816	59	788,888	198,653	2,675	0.0632
101681	883,652	115	3,809,869	1,102,837	10,487	0.136
101692	124,467	55	1,277,460	298,366	9,908	0.1248
101723	48,924	14	517,072	72,384	592	0.245
101749	1,383,921	175	4,578,856	1,282,840	18,390	0.1203
101755	391,829	47	1,111,936	516,319	3,662	0.3483
101801	37,197	15	317,791	35,628	638	0.1397
101802	325,682	67	937,758	467,863	9,993	0.0524
101815	16,075,000	583	259,200,000	50,973,750	37,953	1.4111
101822	1,560,348	210	2,832,404	1,061,123	8,594	0.715
101825	3,922,012	858	13,861,339	5,463,459	179,626	0.0431
101834	493,029	69	2,631,820	809,710	10,353	0.3019
101842	1,459,637	155	2,818,208	508,446	13,853	0.4413
101858	722,913	254	9,041,134	1,793,169	61,742	0.1397
101868	1,095,408	87	6,197,095	1,662,290	12,011	0.2882
101873	7,324,232	827	10,067,847	4,690,496	89,818	0.2242
101874	4,213,027	859	12,967,983	4,691,652	103,489	0.2724
101892	1,655,017	474	7,277,828	2,615,256	63,977	0.0572
101895	2,061,327	92	9,012,207	3,524,803	3,327	0.29
101905	342,718	36	501,442	193,490	1,927	0.6998
101917	1,183,110	113	1,339,363	791,807	19,626	0.1937
101930	145,370	41	1,248,654	291,668	8,906	0.1358
101954	1,518,485	164	8,852,190	2,414,406	11,987	0.8471
101994	1,393,524	71	3,626,058	1,117,207	8,832	0.1032
102004	2,649,475	359	9,184,053	4,026,200	21,775	0.2451
102014	130,930	18	844,497	267,361	1,110	0.8728
102015	2,053,594	329	10,870,456	3,587,169	27,644	0.4511
102041	1,826,283	607	14,117,491	3,360,515	104,113	0.2338
102047	8,004,730	743	46,035,829	18,450,620	3,848	13.7512
102061	64,588	6	520,438	102,010	340	0.3163
102087	280,923	49	1,147,628	451,163	2,028	0.8032
102099	2,371,406	98	3,523,282	2,200,410	8,357	0.1251
102181	1,112,748	323	6,025,239	2,001,965	67,310	0.0734
102203	408,054	236	7,673,761	1,680,042	81,121	0.0916
102226	1,855,632	111	2,959,146	1,478,919	3,453	1.9734
102244	305,283	64	679,182	267,422	7,158	0.1214
102271	189,333	41	817,624	251,741	705	0.6479
102337	1,265,008	89	8,207,836	1,521,339	27,624	0.391
102392	620,135	16	1,391,609	859,302	1,515	1.9969
102422	166,724	34	437,162	218,064	2,838	0.2794
102465	263,379	116	4,433,279	624,324	24,668	0.174
102509	79,490	46	1,413,970	163,654	6,950	0.197
102548	1,012,445	204	3,407,106	1,605,324	18,562	0.1025
102626	232,543	61	2,281,088	333,218	15,350	0.0747
102652	421,096	26	2,182,180	633,699	623	1.4035
102860	569,487	28	1,259,621	192,111	128	3.7023
103694	4,636,250	197	99,398,750	15,070,000	3,347	6.1359
104013	139,664	19	255,193	156,542	2,936	0.2543
104214	1,048,681	127	7,918,003	2,025,910	9,610	0.4603
104224	219,055	11	1,041,571	277,281	622	0.9355

104311	3,572,555	443	5,025,174	2,555,465	14,192	0.3541
104312	266,970	69	2,357,832	598,293	11,099	0.1041
104401	1,129,932	124	4,353,162	1,634,525	16,902	0.3389
104531	645,867	58	964,583	820,472	3,542	0.597
111777	346,848	233	1,425,359	259,156	18,283	0.078
112061	4,961,208	239	33,514,298	6,897,707	3,847	3.2775
112503	154,955	17	549,807	228,200	594	1.3137
113688	1,530,762	826	4,303,119	1,310,707	45,011	0.0956
114030	144,711	43	1,389,055	275,955	11,988	0.095
114756	389,443	192	2,474,332	605,414	62,775	0.0382
114758	505,517	89	3,378,157	1,256,352	26,238	0.1247
114764	1,858,242	532	54,332,892	9,385,775	257,991	0.2039
114998	241,728	97	3,719,619	575,693	6,970	0.5168
115218	1,152,883	327	1,997,582	86,259	9,729	0.1683
115501	393,270	84	1,929,970	628,862	13,019	0.1482
122418	92,258	31	1,027,864	201,077	7,331	0.1149

Source: author's own compilation

## Appendix 5

### Annual subsidy received based on Yaron

The annual subsidy received has been calculated based on Yaron (1992)

$$S = m * E + A(m - c) + K - P$$

where

- S := Annual subsidy received
- m := Opportunity cost of subsidized capital
- E := Average equity
- A := Average public debt
- c := Rate paid for public debt
- K := Revenue grants and discounts on expenses
- P := Accounting profit

## Appendix 6

### DEA efficiency scores for all nine possible FM model specifications

DMU	FM models								
	I1I2O1O2	I1I2O1	I1I2O2	I1O1O2	I1O1	I1O2	I2O1O2	I2O1	I2O2
100001	63.984	30.068	63.984	63.47	20.9	63.47	58.47	28.769	58.47
100012	25.079	21.185	25.079	25.079	21.185	25.079	6.961	6.81	6.767
100013	26.921	24.514	26.921	13.591	9.359	13.591	8.405	8.168	8.355
100015	100	100	100	100	100	100	65.675	65.675	56.645
100024	18.355	9.935	18.355	18.355	9.779	18.355	4.43	3.214	4.385
100036	58.321	58.321	48.784	58.321	58.321	48.784	10.556	10.556	8.784
100042	10.98	7.778	10.98	8.351	4.148	8.351	5.783	4.292	5.744

100047	12.577	9.54	12.577	5.795	3.258	5.795	9.571	7.913	9.497
100052	35.766	32.138	35.766	17.227	11.144	17.227	11.96	11.425	11.901
100055	32.966	22.085	32.966	28.238	14.535	28.238	18.693	13.342	18.52
100074	14.893	9.846	14.893	14.893	9.846	14.893	5.402	4.398	5.304
100080	13.763	9.967	13.763	13.763	9.967	13.763	4.323	3.823	4.237
100081	13.397	10.593	13.397	13.397	9.939	13.397	4.188	3.824	4.11
100094	13.238	9.772	13.238	13.238	9.772	13.238	4.281	3.774	4.185
100095	40.337	37.523	40.337	40.337	37.523	40.337	4.398	4.353	4.236
100098	24.461	19.341	24.461	20.372	13.859	20.372	14.165	12.122	13.927
100104	60.011	28.54	60.011	60.011	28.54	60.011	8.966	5.457	8.966
100109	35.86	28.136	35.86	35.86	28.136	35.86	3.315	2.942	3.224
100110	12.751	8.89	12.751	12.751	8.89	12.751	3.302	2.84	3.241
100115	12.522	8.741	12.522	12.522	7.608	12.522	4.3	3.424	4.242
100121	23.414	23.413	23.414	3.76	0.924	3.76	20	20	20
100122	29.024	7.621	29.024	29.024	7.066	29.024	7.189	3.004	7.189
100123	12.894	8.22	12.894	12.894	8.22	12.894	3.031	2.698	2.958
100126	37.714	19.747	37.714	37.714	19.747	37.714	4.529	3.068	4.44
100127	19.17	12.472	19.17	18.692	8.729	18.692	6.748	4.732	6.707
100129	9.084	6.813	9.084	9.084	6.813	9.084	2.98	2.689	2.916
100153	22.259	7.252	22.259	21.176	2.459	21.176	17.522	6.16	17.522
100154	4.707	3.522	4.657	1.474	0.66	1.474	4.513	3.457	4.499
100155	26.054	13.207	26.054	24.775	4.506	24.775	22.597	11.236	22.476
100156	44.901	20.372	44.767	28.163	5.285	28.163	44.901	19.993	44.767
100158	48.899	19.545	48.899	48.774	16.818	48.774	42.348	19.299	42.348
100161	20.833	6.897	20.833	17.345	2.094	17.345	17.984	6.09	17.984
100162	19.105	6.094	19.105	8.897	1.456	8.897	15.19	5.55	15.19
100168	39.515	35.669	34.249	11.149	9.249	11.149	35.265	34.604	34.249
100170	17.431	10.709	16.822	6.413	2.85	6.413	16.286	10.012	16.173
100171	57.196	44.582	50.423	33.262	14.966	33.262	48.535	39.584	47.493
100175	53.511	41.075	50.984	34.735	22.217	34.735	52.564	40.452	50.984
100180	19.957	10.424	19.957	6.864	1.644	6.864	19.707	10.366	19.707
100187	51.512	35.657	51.011	13.866	7.017	13.866	51.512	35.166	51.011
100191	26.384	14.868	26.384	26.287	14.433	26.287	5.907	4.075	5.772
100194	34.112	31.799	32.382	10.886	8.365	10.886	29.174	28.417	28.794
100196	15.527	10.079	15.527	15.527	7.508	15.527	4.94	3.536	4.906
100205	42.071	28.282	39.078	23.493	7.669	23.493	39.635	27.019	39.078
100218	56.627	33.596	55.632	21.003	7.935	21.003	56.014	32.805	55.632
100224	24.504	13.044	24.256	23.153	7.556	23.153	17.278	10.363	17.086
100240	25.043	12.157	25.043	24.791	10.408	24.791	13.858	8.19	13.799
100241	29.744	26.702	29.744	14.229	9.421	14.229	12.249	11.645	12.172
100242	80.373	54.464	79.198	26.077	8.641	26.077	80.373	54.464	79.198
100247	84.403	77.618	84.403	27.627	9.502	27.627	18.182	18.182	18.182
100252	50.914	28.193	50.914	23.678	9.575	23.678	40.906	23.71	40.711
100261	41.79	9.938	41.79	41.588	8.577	41.588	19.851	7.32	19.851
100263	74.81	58.361	73.893	17.16	10.004	17.16	74.81	58.008	73.893
100274	40.525	8.507	40.525	40.369	4.807	40.369	33.71	8.065	33.71
100277	66.914	56.366	66.027	14.855	9.441	14.855	66.914	56.077	66.027
100301	49.014	24.815	49.014	49.014	24.815	49.014	3.304	2.193	3.304
100302	86.629	52.605	86.629	61.422	27.191	61.422	86.629	52.605	86.629
100307	74.903	51.706	73.171	47.956	25.295	47.956	74.903	50.683	73.171
100308	23.669	12.531	23.669	22.879	6.874	22.879	14.216	9.137	14.046
100325	19.763	6.035	19.763	19.258	3.791	19.258	9.33	4.319	9.313
100329	41.495	20.586	41.495	32.024	8.506	32.024	30.838	16.27	30.698
100345	48.356	28.837	48.356	48.356	27.855	48.356	14.367	10.266	14.367
100357	50.396	27.767	50.396	48.871	25.195	48.871	18.137	12.35	17.812
100359	56.866	56.419	56.558	55.134	54.821	55.061	56.322	56.181	56.322
100363	100	93.368	100	100	93.368	100	17.218	10.162	17.218
100375	81.061	65.564	81.061	67.68	50.145	67.68	80.667	65.564	80.667
100390	51.231	33.105	50.063	19.46	7.565	19.46	50.583	32.361	50.063
100391	33.713	12.374	33.713	33.713	11.328	33.713	8.54	4.276	8.54
100404	22.621	10.423	22.621	15.501	3.179	15.501	19.971	9.211	19.945
100426	63.172	63.172	57.885	62.348	62.348	56.888	62.448	62.448	56.995



100433	25.012	13.491	25.012	25.012	13.491	25.012	2.846	2.481	2.776
100442	35.9	20.059	34.82	29.955	6.512	29.955	32.792	17.871	32.535
100456	100	100	100	100	100	79.596	100	100	100
100458	39.882	31.87	39.815	15.588	9.045	15.588	33.934	27.966	33.62
100460	22.423	11.734	22.423	12.958	4.992	12.958	15.606	9.258	15.556
100464	78.755	61.634	76.292	34.004	22.538	34.004	78.755	61.634	76.292
100469	90.878	72.452	90.878	77.649	58.299	77.649	89.989	72.452	89.989
100477	36.572	22.123	33.548	32.313	14.116	32.313	33.062	20.036	32.509
100479	76.536	57.759	76.536	60.725	45.686	60.725	76.536	57.759	76.536
100489	100	100	100	78.832	77.258	77.824	100	100	100
100497	50.72	30.831	48.226	47.579	23.037	47.579	43.205	28.106	42.791
100511	53.762	38.758	51.056	50.585	33.806	50.585	26.52	21.537	25.961
100515	39.527	23.134	39.224	13.009	3.945	13.009	39.527	23.029	39.224
100521	100	100	96.628	40.471	37.936	40.471	100	100	96.628
100523	51.461	40.424	47.015	43.3	30.685	43.3	47.836	39.899	46.841
100525	97.883	44.241	97.883	74.413	25.265	74.413	97.883	44.241	97.883
100529	16.431	10.226	16.431	9.674	2.325	9.674	10.909	6.558	10.909
100545	25.428	18.992	25.428	15.458	10.045	15.458	17.594	14.029	17.275
100546	14.808	9.099	14.808	10.969	3.648	10.969	7.991	4.965	7.991
100551	72.687	52.728	72.043	17.555	9.013	17.555	72.687	52.401	72.043
100572	17.616	11.284	17.616	9.943	2.498	9.943	12.127	7.511	12.127
100579	100	100	100	93.121	93.121	80.348	100	100	100
100581	55.707	45.303	51.202	15.536	10.831	15.536	52.256	44.176	51.202
100587	67.889	54.96	65.956	49.268	34.372	49.268	67.045	54.96	65.956
100600	86.344	77.974	75.265	33.485	24.069	33.485	77.58	75.697	75.265
100608	39.902	16.602	39.902	39.73	14.265	39.73	19.017	9.988	19.017
100611	33.31	17.029	33.31	32.539	15.883	32.539	12.015	8.896	11.792
100615	100	94.529	100	95.61	91.676	94.781	33.801	29.437	33.801
100626	18.411	12.644	18.411	15.6	7.421	15.6	7.167	5.265	7.127
100630	29.412	16.795	29.412	21.423	5.517	21.423	25.709	14.444	25.523
100632	100	41.249	100	98.017	15.641	98.017	100	38.463	100
100633	34.587	33.64	34.587	6.265	1.478	6.265	22.222	22.222	22.222
100636	100	100	100	100	100	100	100	18.39	100
100638	27.625	11.264	27.625	26.844	10.345	26.844	10.726	7.009	10.576
100658	26.46	12.522	26.46	23.393	3.801	23.393	24.778	11.229	24.707
100664	28.109	16.957	28.109	13.013	4.952	13.013	21.468	14.545	21.437
100670	82.663	73.489	82.663	82.663	73.489	82.663	29.27	26.787	29.27
100681	45.858	27.541	45.858	45.468	24.965	45.468	15.188	10.58	14.836
100683	21.824	11.537	21.824	12.622	5.151	12.622	15.258	8.968	15.184
100684	71.695	38.81	71.141	34.629	8.672	34.629	71.695	38.563	71.141
100691	20.609	15.014	20.609	18.802	12.691	18.802	12.233	10.093	12
100720	61.408	49.785	57.132	37.92	27.636	37.92	59.124	48.97	57.132
100724	50.663	33.453	50.663	14.885	4.732	14.885	50.663	33.381	50.663
100725	42.107	12.402	42.107	26.807	2.467	26.807	42.107	12.22	42.107
100748	35.689	18.839	35.689	12.535	3.592	12.535	35.689	18.615	35.689
100772	34.398	16.611	34.398	14.071	4.415	14.071	30.652	15.234	30.652
100781	19.169	9.323	19.169	11.421	2.566	11.421	13.037	6.783	13.037
100795	24.215	15.48	24.215	9.75	3.897	9.75	20.273	13.914	20.226
100804	79.218	53.108	78.245	27.695	9.875	27.695	79.218	52.554	78.245
100807	13.462	7.462	13.462	9.474	3.123	9.474	8.593	5.016	8.593
100819	27.855	26.637	27.076	5.694	4.375	5.694	27.479	26.502	27.076
100822	77.007	77.007	68.211	77.007	77.007	68.211	28.15	28.15	21.993
100830	18.559	13.567	18.559	18.559	12.933	18.559	3.183	2.968	3.148
100840	83.688	65.709	81.32	41.395	26.942	41.395	83.688	65.709	81.32
100853	40.131	25.062	40.118	9.359	3.224	9.359	40.131	25.062	40.118
100872	18.369	9.648	18.369	11.334	4.444	11.334	12.393	7.486	12.351
101040	51	27.811	51	12.323	2.961	12.323	51	27.811	51
101053	29.351	21.455	29.351	20.113	12.96	20.113	19.198	15.55	18.883
101072	13.483	5.745	13.483	11.774	2.643	11.774	9.36	4.413	9.346
101086	42.696	28.013	42.696	16.764	7.184	16.764	37.176	25.414	37.025
101198	100	100	100	100	100	100	14.286	14.286	14.286
101244	43.22	23.933	41.937	28.727	6.398	28.727	42.238	23.027	41.937

101249	73.262	73.189	65.452	16.088	15.128	16.088	71.929	71.929	65.452
101362	13.899	6.418	13.899	7.785	1.454	7.785	9.704	4.832	9.704
101363	14.656	9.47	14.656	10.116	3.636	10.116	8.46	5.528	8.454
101365	15.231	6.699	15.231	14.662	4.185	14.662	8.133	4.923	8.043
101366	20.866	12.812	20.866	10.846	4.418	10.846	15.036	10.466	14.998
101367	33.076	23.768	33.076	33.076	23.768	33.076	6.503	6.052	6.319
101372	19.875	9.727	19.875	19.875	9.727	19.875	4.284	3.317	4.207
101373	6.949	6.152	6.949	4.774	3.689	4.774	4.213	4	4.138
101400	31.121	21.636	31.121	14.927	7.854	14.927	23.943	17.762	23.727
101441	14.188	6.711	14.188	7.832	1.78	7.832	9.976	5.251	9.976
101488	52.467	48.9	52.467	52.467	48.9	52.467	8.2	8.2	7.674
101499	29.283	24.586	29.283	14.101	7.849	14.101	19.15	16.451	19.04
101500	22.967	13.026	22.967	14.185	6.517	14.185	15.586	9.839	15.467
101523	17.43	6.817	17.43	10.644	2.485	10.644	11.774	5.46	11.774
101642	17.089	11.303	17.089	16.583	9.292	16.583	9.48	6.862	9.358
101644	15.852	11.838	15.852	15.852	11.838	15.852	2.892	2.609	2.831
101667	36.908	25.354	36.908	18.698	9.867	18.698	27.505	20.434	27.255
101668	26.082	16.077	26.082	18.959	9.874	18.959	16.58	11.717	16.414
101669	26.562	19.957	26.562	14.209	5.498	14.209	14.531	10.995	14.526
101673	29.857	26.684	29.857	11.38	6.059	11.38	11.839	11.015	11.824
101681	19.641	13.301	19.641	10.6	5.57	10.6	14.131	10.534	14.006
101692	41.32	35.944	41.32	21.544	13.039	21.544	14.586	13.467	14.514
101723	93.492	93.492	93.086	16.425	12.925	16.425	42.857	42.857	42.857
101749	14.389	9.869	14.389	7.849	4.28	7.849	10.35	7.739	10.243
101755	27.594	17.585	27.594	11.466	3.592	11.466	21.668	15.105	21.668
101801	100	100	100	13.392	10.021	13.392	40	40	40
101802	24.494	17.441	24.494	12.558	3.624	12.558	14.47	10.113	14.47
101815	100	100	100	100	100	100	100	100	100
101822	10.559	6.069	10.559	5.781	2.338	5.781	7.494	4.903	7.469
101825	23.558	5.335	23.558	23.224	4.594	23.224	7.048	3.589	7.01
101834	26.659	17.806	26.659	14.057	6.87	14.057	19.168	14.383	19.053
101842	8.208	7.82	7.927	3.033	2.487	3.033	6.626	6.626	6.519
101858	20.892	17.154	20.892	20.892	16.235	20.892	9.301	8.597	9.086
101868	30.475	22.317	29.758	12.795	7.332	12.795	25.329	19.024	25.008
101873	10.273	3.778	10.273	9.887	1.785	9.887	6.339	2.871	6.329
101874	17.493	4.983	17.493	17.195	4	17.195	6.139	3.392	6.094
101892	13.467	6.836	13.467	13.467	5.704	13.467	6.664	3.915	6.62
101895	44.318	24.247	44.093	21.471	5.675	21.471	44.318	23.677	44.093
101905	21.213	18.318	21.213	5.281	1.786	5.281	19.233	16.667	19.233
101917	13.958	7.172	13.958	5.732	1.44	5.732	11.474	6.657	11.474
101930	41.257	36.686	41.257	18.063	10.906	18.063	19.398	17.935	19.306
101954	24.695	16.952	24.695	13.346	7.567	13.346	18.145	13.101	17.898
101994	23.388	16.817	22.89	6.807	3.36	6.807	23.061	16.58	22.89
102004	21.973	8.349	21.973	21.275	4.5	21.275	12.746	6.157	12.71
102014	55.735	48.223	55.735	18.512	8.087	18.512	42.617	36.679	42.61
102015	22.867	10.799	22.867	22.285	6.876	22.285	12.638	7.671	12.521
102041	22.061	10.048	22.061	22.061	10.048	22.061	6.535	5.152	6.41
102047	62.029	21.665	62.029	61.926	18.692	61.926	26.957	12.325	26.957
102061	100	100	100	16.253	9.858	16.253	100	100	100
102087	29.387	22.258	29.387	14.065	5.175	14.065	19.441	14.624	19.441
102099	27.746	11.861	27.746	7.796	1.918	7.796	27.746	11.817	27.746
102181	15.382	8.971	15.382	15.132	7.017	15.132	7.858	5.025	7.798
102203	34.709	24.397	34.709	34.709	24.397	34.709	9.476	8.176	9.295
102226	18.45	9.646	18.45	6.732	2.055	6.732	17.932	9.489	17.932
102244	21.258	17.532	21.258	7.941	2.763	7.941	11.985	9.836	11.985
102271	33.329	28.75	33.329	12.116	5.408	12.116	18.326	15.981	18.322
102337	29.098	26.326	25.546	10.153	8.42	10.153	23.423	22.795	22.846
102392	85.298	47.62	85.298	11.841	2.857	11.841	85.298	47.62	85.298
102422	37.124	30.773	37.124	12.081	3.168	12.081	21.094	17.647	21.094
102465	27.868	27.868	26.788	21.771	21.771	20.465	11.442	11.442	9.72
102509	52.135	52.135	49.525	22.654	22.654	19.65	16.654	16.654	14.397
102548	16.962	8.425	16.962	13.376	4.343	13.376	10.385	5.571	10.383

102626	28.21	28.21	27.701	12.776	12.601	12.776	15.201	15.201	13.664
102652	45.095	35.358	43.728	12.985	6.653	12.985	43.987	34.956	43.728
102860	26.335	26.335	24.678	3.158	2.809	3.158	26.335	26.335	24.678
103694	100	100	83.607	100	100	81.993	100	100	82.492
104013	45.955	41.951	45.955	10.761	2.085	10.761	34.477	31.579	34.477
104214	28.536	20.462	28.536	16.246	9.797	16.246	20.326	15.55	20.023
104224	70.813	63.351	70.636	11.441	6.006	11.441	70.813	63.351	70.636
104311	10.103	4.153	10.103	6.001	1.821	6.001	6.947	3.244	6.947
104312	30.896	25.019	30.896	19.38	11.351	19.38	16.093	13.645	15.959
104401	23.518	13.063	23.518	12.2	4.982	12.2	17.397	10.583	17.32
104531	27.187	12.161	27.187	10.869	1.882	10.869	22.854	11.768	22.854
111777	12.017	11.222	12.017	6.792	5.234	6.792	3.297	3.297	3.256
112061	36.808	30.272	31.225	25.342	19.147	25.342	32.089	28.168	31.225
112503	48.697	40.499	48.697	13.542	4.356	13.542	42.79	35.615	42.79
113688	7.247	4.371	7.247	7.247	3.635	7.247	2.223	1.578	2.204
114030	39.91	36.974	39.91	17.243	12.219	17.243	18.167	17.708	18.039
114756	17.131	13.71	17.131	13.437	8.171	13.437	5.826	5.016	5.773
114758	30.779	17.582	30.779	21.052	8.624	21.052	19.917	12.709	19.84
114764	100	100	100	100	100	100	20.483	20.295	18.751
114998	28.892	28.583	28.892	20.627	19.875	20.627	12.315	12.315	11.117
115218	5.262	5.262	4.042	2.221	2.221	0.797	2.674	2.674	1.835
115501	22.964	17.062	22.964	13.802	6.288	13.802	13.527	10.262	13.477
122418	54.591	51.223	54.591	20.302	14.067	20.302	22.688	22.397	22.582

Source: author's own compilation

## Appendix 7

### DEA efficiency scores for all nine possible SM model specifications

DMU	SM models								
	I1I2O1O2	I1I2O1	I1I2O2	I1O1O2	I1O1	I1O2	I2O1O2	I2O1	I2O2
100001	10.22	9.958	2.233	0.944	0.284	0.677	10.22	9.958	2.233
100012	31.363	31.363	4.356	12.647	12.103	0.317	31.363	31.363	1.449
100013	28.333	28.333	19.821	6.066	6.066	1.434	20.283	20.283	6.667
100015	100	31.829	100	100	4.333	100	44.221	31.113	26.115
100024	20.176	20.176	4.478	9.455	9.455	0.357	20.176	20.176	1.325
100036	46.512	45.511	0.881	27.794	25.472	0.2	46.512	45.511	0.435
100042	17.33	17.33	4.894	3.037	3.037	0.259	17.33	17.33	2.419
100047	17.343	16.76	7.762	5.742	1.228	4.686	17.343	16.76	5.611
100052	33.663	33.663	26.776	8.945	5.2	5.364	21.704	21.704	9.524
100055	40.422	40.422	11.194	8.317	6.561	1.985	40.422	40.422	5.769
100074	20.279	20.279	3.337	7.226	5.926	1.172	20.279	20.279	1.183
100080	19.679	19.679	3.786	8.316	7.085	1.098	19.679	19.679	1.23
100081	16.451	16.451	5.041	8.153	6.297	1.851	16.451	16.451	1.5
100094	15.316	15.295	2.868	6.454	4.98	1.362	15.316	15.295	0.884
100095	32.74	27.812	1.137	32.74	27.812	0.53	28.734	27.713	0.321
100098	49.869	49.869	8.689	8.937	8.214	0.726	49.869	49.869	4.545
100104	36.83	36.335	0.508	25.268	24.116	0.087	36.83	36.335	0.25
100109	36.248	34.354	0.482	36.248	34.354	0.201	25.742	25.318	0.146
100110	15.899	15.899	3.081	7.868	6.91	0.809	15.899	15.899	0.917
100115	13.977	13.977	4.339	6.216	4.621	1.614	13.977	13.977	1.389
100121	24.365	24.365	23.413	0.924	0.924	0.924	23.191	23.191	20
100122	17.632	17.388	0.471	3.632	3.25	0.021	17.632	17.388	0.295
100123	16.38	16.365	1.617	6.811	6.128	0.455	16.38	16.365	0.523
100126	14.749	13.911	0.72	9.291	6.23	0.347	14.749	13.911	0.233
100127	18.721	18.721	7.091	6.2	6.001	0.493	18.721	18.721	2.532
100129	15.788	15.788	2.253	6.047	5.388	0.516	15.788	15.788	0.784

100153	13.437	13.069	1.677	1.58	0.619	0.958	13.437	13.069	1.648
100154	7.925	7.821	2.6	1.254	0.315	0.992	7.925	7.821	2.6
100155	16.56	16.56	1.863	0.952	0.743	0.219	16.56	16.56	1.863
100156	8.118	8.118	3.03	0.441	0.153	0.322	8.118	8.118	3.03
100158	16.372	16.372	0.843	0.567	0.501	0.053	16.372	16.372	0.843
100161	18.62	18.529	1.988	1.504	0.854	0.655	18.62	18.529	1.988
100162	12.761	12.761	3.774	1.176	0.655	0.624	12.761	12.761	3.774
100168	23.693	23.693	6.522	0.837	0.635	0.292	23.693	23.693	6.522
100170	16.634	16.082	4.164	2.252	0.581	1.717	16.634	16.082	4.164
100171	18.486	17.482	7.493	3.58	0.549	3.138	18.486	17.482	7.491
100175	11.401	11.401	2.817	0.503	0.237	0.292	11.401	11.401	2.817
100180	20.363	19.466	8.671	4.013	0.627	3.529	20.363	19.466	8.671
100187	25.483	25.483	12.766	2.121	0.494	1.813	25.483	25.483	12.766
100191	10.974	10.862	0.995	2.711	1.892	0.743	10.974	10.862	0.41
100194	26.082	24.409	20.303	11.251	0.765	11.043	26.038	24.409	19.511
100196	10.067	10.067	5.665	2.862	2.862	0.415	8.417	8.417	1.869
100205	23.495	23.495	5.085	0.704	0.704	0.099	23.495	23.495	5.085
100218	22.854	22.854	10	1.918	0.537	1.541	22.854	22.854	10
100224	8.21	4.732	7.154	7.247	0.223	7.09	7.878	4.732	4.728
100240	13.736	13.594	0.727	1.225	0.798	0.402	13.736	13.594	0.711
100241	33.11	30.136	26.996	17.747	4.358	14.447	23.427	23.427	9.231
100242	16.949	12.399	13.869	3.566	0.105	3.516	16.949	12.399	13.869
100247	85.9	85.9	77.618	13.941	13.941	8.003	30.486	30.486	18.182
100252	23.751	23.751	9.231	3.939	1.084	3.115	23.751	23.751	9.231
100261	15.35	15.256	0.744	1.347	0.967	0.351	15.35	15.256	0.742
100263	36.65	28.059	34.02	12.456	0.368	12.447	36.65	28.059	34.02
100274	20.422	20.422	0.813	0.676	0.676	0.015	20.422	20.422	0.813
100277	45.531	45.531	26.087	3.735	0.782	3.332	45.531	45.531	26.087
100301	45.007	43.613	0.392	45.007	43.613	0.128	25.106	24.849	0.113
100302	18.969	18.488	3.299	1.033	0.355	0.689	18.969	18.488	3.299
100307	23.649	23.48	4.136	1.179	0.502	0.702	23.649	23.48	4.136
100308	9.917	9.833	2.509	2.018	0.811	1.253	9.917	9.833	1.852
100325	20.161	20.161	1.803	2.328	2.328	0.079	20.161	20.161	1.195
100329	16.197	16.197	4.866	2.083	0.932	1.287	16.197	16.197	4.651
100345	9.396	9.098	1.312	2.141	0.902	1.205	9.396	9.098	0.778
100357	11.873	10.974	4.052	5.205	1.131	4.052	11.873	10.974	2.169
100359	6.955	6.22	1.549	0.909	0.15	0.768	6.955	6.22	1.519
100363	100	100	0.068	100	100	0.017	100	100	0.032
100375	24.709	24.482	2.159	0.969	0.554	0.409	24.709	24.482	2.159
100390	23.363	23.363	8.451	1.499	0.545	1.071	23.363	23.363	8.451
100391	28.291	27.781	0.457	9.666	8.926	0.042	28.291	27.781	0.3
100404	15.016	13.671	4.424	3.527	0.568	2.985	15.016	13.671	4.26
100426	7.337	6.502	1.848	1.055	0.159	0.902	7.337	6.502	1.814
100433	33.932	30.174	1.422	33.932	30.174	0.125	27.758	27.204	0.389
100442	31.363	31.363	2.913	1.238	1.237	0.068	31.363	31.363	2.913
100456	43.836	40.837	0.314	6.281	5.171	0.181	43.836	40.837	0.304
100458	32.135	32.135	16.216	7.751	1.369	6.893	32.135	32.135	16.216
100460	21.337	21.337	5.84	2.018	1.748	0.424	21.337	21.337	4.511
100464	13.115	10.341	7.587	2.157	0.122	2.058	13.115	10.341	7.587
100469	22.132	21.786	2.185	0.99	0.49	0.495	22.132	21.786	2.185
100477	7.423	6.151	3.461	2.254	0.183	2.089	7.423	6.151	3.355
100479	5.236	4.884	0.983	0.412	0.094	0.318	5.236	4.884	0.983
100489	21.737	21.005	2.588	1.134	0.418	0.71	21.737	21.005	2.588
100497	8.881	8.26	2.666	1.471	0.259	1.232	8.881	8.26	2.643
100511	10.452	8.541	4.857	5.304	0.506	4.756	10.452	8.541	3.169
100515	17.289	17.289	5.941	0.83	0.3	0.59	17.289	17.289	5.941
100521	27.737	23.764	12.551	3.691	0.334	3.402	27.737	23.764	12.551
100523	10.989	9.859	3.333	1.78	0.258	1.533	10.989	9.859	3.295
100525	18.19	17.97	2.123	0.712	0.348	0.366	18.19	17.97	2.123
100529	14.129	14.129	8.918	1.342	1.342	0.404	14.129	14.129	5.556
100545	20.019	20.019	4.383	3.122	1.667	1.542	20.019	20.019	3.429
100546	17.421	17.421	6.701	2.77	2.77	0.346	17.421	17.421	3.409

100551	36.797	35.28	25.707	6.271	0.532	6.083	36.797	35.28	25.707
100572	11.782	11.782	10.181	4.648	0.822	4.219	11.155	11.155	6.383
100579	7.335	7.096	0.561	0.346	0.146	0.192	7.335	7.096	0.561
100581	23.771	18.93	16.882	7.897	0.358	7.68	23.771	18.93	16.725
100587	29.511	29.485	2.655	0.998	0.667	0.329	29.511	29.485	2.655
100600	31.746	26.337	17.926	8.453	0.566	8.013	31.746	26.337	17.775
100608	8.297	6.484	4	4.502	0.388	3.992	8.297	6.484	2.402
100611	10.716	10.271	3.237	4.014	1.249	2.766	10.716	10.271	1.611
100615	14.946	13.101	0.298	3.956	2.326	0.245	14.946	13.101	0.236
100626	17.76	17.76	7.907	5.136	4.653	0.768	17.76	17.76	3.141
100630	10.404	9.838	4.011	2.3	0.371	1.992	10.404	9.838	3.976
100632	26.62	24.324	8.291	4.762	0.745	4.068	26.62	24.324	8.179
100633	33.64	33.64	33.64	8.699	1.478	8.699	22.222	22.222	22.222
100636	100	100	0.057	100	100	0.02	100	100	0.026
100638	19.99	19.881	1.534	3.062	2.233	0.763	19.99	19.881	0.957
100658	12.703	10.488	4.894	4.071	0.38	3.79	12.703	10.488	4.617
100664	16.08	14.471	14.428	8.834	0.624	8.618	15.536	14.471	11.218
100670	9.496	9.049	1.427	2.047	0.671	1.345	9.496	9.049	1.042
100681	7.56	6.691	3.447	4.123	0.689	3.447	7.46	6.691	1.667
100683	12.628	8.173	10.332	10.504	0.511	10.089	10.772	8.173	6.604
100684	22.96	22.96	5.769	0.82	0.402	0.464	22.96	22.96	5.769
100691	23.789	23.789	4.979	5.476	3.707	1.805	23.789	23.789	2.597
100720	14.72	13.478	4.782	1.878	0.287	1.616	14.72	13.478	4.782
100724	49.826	49.826	26.087	1.373	1.373	0.633	49.826	49.826	26.087
100725	8.798	8.798	3.279	0.605	0.177	0.468	8.798	8.798	3.279
100748	25.648	25.648	11.321	0.733	0.733	0.26	25.648	25.648	11.321
100772	13.466	13.106	7.444	3.105	0.403	2.868	13.466	13.106	7.444
100781	21.413	21.413	7.602	2.022	2.022	0.328	21.413	21.413	5.217
100795	18.01	18.01	9.231	3.183	0.765	2.72	18.01	18.01	9.231
100804	20.5	15.614	17.454	5.927	0.174	5.872	20.5	15.614	17.454
100807	18.972	18.972	5.122	2.31	2.31	0.236	18.972	18.972	3.109
100819	24.324	21.125	18.704	6.951	0.344	6.834	24.324	21.125	18.704
100822	54.495	54.282	18.277	28.165	17.21	10.937	54.495	54.282	5.128
100830	100	100	8.963	100	100	1.067	100	100	1.917
100840	12.572	10.816	6.3	1.703	0.143	1.588	12.572	10.816	6.3
100853	33.242	26.488	24.598	10.633	0.449	10.391	33.242	26.488	24.504
100872	17.918	17.918	5.17	1.765	1.641	0.263	17.918	17.918	3.704
101040	58.57	27.482	54.109	35.019	0.389	35.019	53.667	27.482	52.009
101053	44.354	44.354	7.539	4.911	4.911	0.331	44.354	44.354	5
101072	10.618	10.536	1.786	1.687	0.82	0.885	10.618	10.536	1.437
101086	28.968	28.895	15.003	6.481	1.077	5.826	28.968	28.895	15.003
101198	100	100	100	100	100	100	18.138	18.138	14.286
101244	26.222	26.222	4.545	1.016	0.805	0.257	26.222	26.222	4.545
101249	41.087	32.099	26.306	11.373	0.563	10.956	41.087	32.099	26.201
101362	10.334	10.334	5.539	1.31	0.793	0.717	10.334	10.334	4
101363	12.823	12.823	7.003	2.762	1.672	1.354	12.823	12.823	3.797
101365	11.674	11.656	0.902	1.289	0.955	0.317	11.674	11.656	0.759
101366	24.235	23.112	12.478	9.827	1.848	8.236	24.235	23.112	8.194
101367	31.389	31.384	2.016	9.707	9.284	0.132	31.389	31.384	0.799
101372	12.951	12.951	2.032	5.022	4.676	0.237	12.951	12.951	0.701
101373	11.937	11.937	3.283	1.957	1.683	0.346	11.937	11.937	1.829
101400	29.153	10.791	29.012	28.458	0.37	28.458	19.548	10.791	18.797
101441	33.8	33.8	5.504	3.75	3.192	0.62	33.8	33.8	4.054
101488	42.698	42.659	2.703	16.68	15.919	0.193	42.698	42.659	0.927
101499	40.973	21.166	39.898	38.333	1.097	37.843	23.212	16.983	19.253
101500	13.213	10.806	9.311	9.208	0.827	8.484	12.673	10.806	5.67
101523	16.802	16.802	4.875	1.511	1.511	0.205	16.802	16.802	3.529
101642	24.817	24.817	4.302	5.149	4.503	0.631	24.817	24.817	2.135
101644	15.99	15.99	3.11	9.947	9.947	0.284	15.99	15.99	0.802
101667	35.821	17.63	34.229	33.904	0.904	33.81	27.195	17.63	20.974
101668	17.655	14.541	13.568	13.263	1.49	11.964	16.383	14.541	6.674
101669	35.061	18.399	34.187	33.063	1.038	32.638	16.528	12.555	13.579

101673	26.876	26.876	24.198	2.053	2.053	1.49	15.02	15.02	10.169
101681	16.031	16.031	6.716	1.636	1.177	0.681	16.031	16.031	5.217
101692	42.455	42.455	28.938	10.028	7.934	3.697	32.23	32.23	10.909
101723	99.199	90.665	99.199	40.476	4.959	40.476	45.063	45.063	42.857
101749	16.07	16.07	4.323	1.445	1.267	0.291	16.07	16.07	3.429
101755	21.819	21.428	16.781	8.927	1.081	8.388	21.819	21.428	13.171
101801	100	100	100	17.436	6.522	17.436	42.435	42.435	40
101802	26.613	26.613	15.644	3.056	3.056	0.745	26.613	26.613	8.955
101815	9.932	8.936	2.185	1.271	0.219	1.057	9.932	8.936	2.147
101822	8.922	7.674	6.256	5.535	0.557	5.078	8.665	7.674	3.987
101825	26.309	26.309	1.268	4.18	4.16	0.062	26.309	26.309	0.699
101834	26.481	26.481	12.24	7.191	2.085	5.476	26.481	26.481	8.696
101842	15.021	14.556	5.154	3.873	0.921	3.057	15.021	14.556	4.351
101858	31.989	31.989	5.538	8.827	7.842	0.897	31.989	31.989	2.362
101868	23.338	23.338	6.897	3.222	1.075	2.306	23.338	23.338	6.897
101873	13.997	13.986	0.842	1.384	1.12	0.234	13.997	13.986	0.726
101874	15.464	15.415	1.292	2.861	2.241	0.552	15.464	15.415	0.698
101892	17.72	17.72	2.675	3.547	3.547	0.147	17.72	17.72	1.266
101895	10.501	10.501	6.522	1.321	0.191	1.237	10.501	10.501	6.522
101905	31.844	22.069	28.924	22.78	0.778	22.56	27.518	22.069	23.005
101917	26.227	26.227	5.426	2.58	1.577	1.125	26.227	26.227	5.31
101930	44.46	44.46	30.668	8.892	6.171	4.122	40.24	40.24	14.634
101954	14.233	12.362	7.4	7.008	0.774	6.319	14.054	12.362	5.584
101994	23.109	23.109	8.451	0.639	0.639	0.174	23.109	23.109	8.451
102004	8.989	8.989	2.214	1.476	0.777	0.748	8.989	8.989	1.671
102014	85.858	46.314	85.097	75.855	1.853	75.763	54.336	38.576	51.73
102015	12.255	11.995	3.516	3.454	1.261	2.233	12.255	11.995	2.068
102041	21.979	21.941	2.512	6.362	5.2	1.007	21.979	21.941	0.988
102047	100	1.386	100	100	0.055	100	100	1.386	100
102061	100	100	100	44.62	3.756	44.62	100	100	100
102087	37.034	20.908	36.146	32.511	0.982	32.178	21.545	16.467	18.158
102099	16.148	16.148	6.122	0.466	0.357	0.196	16.148	16.148	6.122
102181	27.268	27.268	3.953	5.547	5.547	0.218	27.268	27.268	1.858
102203	44.493	44.493	7.938	18.666	18.182	0.595	44.493	44.493	2.542
102226	18.47	8.843	16.06	14.13	0.218	14.13	16.457	8.843	14.288
102244	22.538	22.538	16.568	3.088	2.421	1.366	22.431	22.431	9.375
102271	44.789	26.668	44.789	37.371	1.281	37.371	19.847	15.725	19.447
102337	44.932	44.313	7.241	5.001	2.046	3.025	44.932	44.313	7.241
102392	100	46.5	100	42.956	0.391	42.956	100	46.5	100
102422	35.511	34.561	32.963	15.247	2.093	14.487	26.651	26.651	17.647
102465	30.876	30.876	14.534	12.461	8.811	4.109	30.876	30.876	5.172
102509	55.364	51.111	45.141	23.716	9.062	17.275	30.655	30.655	13.043
102548	13.888	13.888	5.072	1.768	1.747	0.24	13.888	13.888	2.941
102626	39.993	39.993	19.811	6.36	6.36	1.043	39.993	39.993	9.836
102652	52.974	24.411	52.244	40.066	0.576	40.066	47.958	24.411	47.958
102860	100	21.429	100	100	0.426	100	100	21.429	100
103694	100	4.916	100	51.596	0.085	51.122	100	4.916	100
104013	48.324	48.324	41.951	15.98	2.562	15.021	48.324	48.324	31.579
104214	14.293	13.67	7.231	5.236	0.916	4.485	14.293	13.67	5.399
104224	91.486	57.687	90.016	48.904	1.107	48.904	88.04	57.687	88.04
104311	5.25	5.187	1.848	1.281	0.385	0.94	5.25	5.187	1.405
104312	27.806	27.806	17.37	4.114	4.102	0.909	27.806	27.806	8.696
104401	21.384	21.208	5.803	4.107	1.433	2.803	21.384	21.208	4.947
104531	20.049	17.111	14.875	10.3	0.639	9.958	19.608	17.111	13.225
111777	15.183	15.183	8.736	5.028	5.028	0.699	12.013	12.013	2.575
112061	12.237	4.309	10.54	10.004	0.089	9.957	12.237	4.309	10.465
112503	100	40.578	100	100	1.566	100	70.205	37.125	70.205
113688	7.354	7.354	2.178	2.759	2.716	0.158	7.354	7.354	0.726
114030	48.545	48.545	30.063	8.122	8.122	1.676	47.152	47.152	13.953
114756	42.979	42.979	8.876	14.796	14.796	0.623	42.979	42.979	3.125
114758	42.405	42.405	10.671	5.547	4.871	0.908	42.405	42.405	6.742
114764	66.18	62.997	2.454	24.36	16.395	0.786	66.18	62.997	1.128

<b>114998</b>	29.951	20.671	26.198	24.649	2.988	22.412	15.657	14.562	7.415
<b>115218</b>	5.762	5.762	3.857	1.548	0.843	0.876	5.354	5.354	1.835
<b>115501</b>	25.642	25.642	12.767	4.686	3.226	1.922	25.642	25.642	7.143
<b>122418</b>	60.47	60.47	44.398	9.499	8.181	3.63	46.994	46.994	19.355

Source: author's own compilation

## Appendix 8

### List of exponentiated logged coefficients from [table 20](#)

Variables	FE			SE		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
S	-6.98E-09	-4.85E-09		-3.83e-08*	-5.85e-08***	-6.05e-08***
exp(coef.)	-6.98E-09	-4.85E-09		-3.83E-08	-5.85E-08	-6.05E-08
AGE1	-0.0146	-0.0239		0.149	0.137	
exp(coef.)	-0.0145	-0.0236		0.1607	0.1468	
AGE2	-0.0832	-0.0971*	-0.0943**			
exp(coef.)	-0.0798	-0.0925	-0.0900			
AGE3				0.0748	0.171	
exp(coef.)				0.0777	0.1865	
SIZE1	0.305***	0.272***	0.261***			
exp(coef.)	0.3566	0.3126	0.2982			
SIZE2	0.126***	0.103**	0.125***	-0.374**	-0.311*	-0.428***
exp(coef.)	0.1343	0.1085	0.1331	-0.3120	-0.2673	-0.3482
SIZE3				0.109	0.152	
exp(coef.)				0.1152	0.1642	
DER	0.00105	0.000934		-0.00146	-0.00158	
exp(coef.)	0.0011	0.0009		-0.0015	-0.0016	
RGN2	-0.178***	-0.157***	-0.146***	-0.0772	-0.0579	
exp(coef.)	-0.1631	-0.1453	-0.1358	-0.0743	-0.0716	
RGN3	0.243***	0.244***	0.240***	0.00904	0.0618	
exp(coef.)	0.2751	0.2763	0.2712	0.0091	0.0637	
RGN4	-0.00595	0.015		-0.466	-0.443	
exp(coef.)	-0.0059	0.0151		-0.3725	-0.3579	
LEGSTAT1	-0.188	-0.0677		-1.010***	-1.285***	-1.287***
exp(coef.)	-0.1714	-0.0655		-0.6358	-0.7233	-0.7239
LEGSTAT3	-0.171*	-0.0299		-0.740**	-0.712**	-0.710**
exp(coef.)	-0.1572	-0.0295		-0.5229	-0.5093	-0.5084
LEGSTAT4	-0.164*	-0.0651		-0.550*	-0.532*	-0.602**
exp(coef.)	-0.1513	-0.0630		0.7333	-0.4126	-0.4523
LEGSTAT5	-0.106	0.0283		-1.342*	-1.286*	0
exp(coef.)	-0.1006	0.0287		-0.7387	-0.7236	
LEGSTAT6	0.0198	0.123		-0.664*	-0.682*	-0.703*
exp(coef.)	0.0200	0.1309		-0.4852	-0.4944	-0.5049
_cons	-0.546***	-0.649***	-0.716***	-0.676*	-0.773**	-0.543*
exp(coef.)	-0.4207	-0.4774	-0.5113	-0.4914	-0.5384	-0.4190

Source: author's own compilation