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Comparing Microfinance and Education for Poverty Reduction – A Macro Perspective

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Abstract: Better access to finance and higher education levels in a country are two major policy areas of governments and international development cooperation organisations for the goal of reducing poverty. Microfinance has become a popular instrument to facilitate access to finance, but comparative evidence on a macro scale is scarce. This thesis examines the relative importance of the two policy areas using an unbalanced panel of 42 countries over the period of 1999 to 2013. As an indicator for microfinance, gross loan portfolio is used and for education, government expenditure on education. As measures of poverty, the poverty headcount ratio, the poverty gap and the squared poverty gap are used. Taking into account education, the effect of microfinance becomes smaller in comparison to previous empirical studies. Generally, the thesis finds a similar effect of the two determinants in absolute terms and on the three of the poverty measures. Education is more robust to different regression strategies. From a simulation exercise of the expected effects on poverty headcount ratio, the finding is that, on average, a relative increase by the factor 2 in microfinance gross loan portfolio compares to an increase of the factor 1.15 for government expenditure on education.

Key words: microfinance, poverty, education, country panel, comparison

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TABLE OF ABBREVIATIONS

Abbreviation	Meaning
\$US	US Dollar
2SLS	Two-Stage-Least-Squares
ECA	Europe and Central Asia
EDU	Government Expenditure on Education as a share of GDP
FE	Fixed Effects
GDP	Gross Domestic Product
GDPPC	Gross Domestic Product Per Capita
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GLP	Gross Loan Portfolio
GLPPC	Gross Loan Portfolio Per Capita
GMM	Generalised Method of Moments
IV	Instrumental Variable
LAC	Latin America and Caribbean
MDG	Millennium Development Goal
MFI	Microfinance Institution
MIX	Microfinance Information Exchange
MSME	Micro, Small and Medium-Sized Enterprises
PPP	Purchasing Power Parity
RE	Random Effects
SA	South Asia
SDG	Sustainable Development Goal
SEA	South-East Asia
SSA	Sub-Saharan Africa
UN	United Nations
UNDP	United Nations Development Program
WDI	World Development Indicator

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1 INTRODUCTION

Numerous projects of international development cooperation and of governments have deployed financial and personnel resources to the launch and the development of microfinance and microfinance institutions around the globe. One of the most prominent examples of such an initiative is that of Mohammed Yunus, who found the Grameen Bank in Bangladesh in 1976 (Pitt & Khandker, 1998). The Grameen Bank is based on group lending and is praised for its success in providing financial access to the poor and its expansion into about 40 countries.¹ Another example of an initiative that aims to foster microfinance is the programme *Pro-poor Growth and Employment Promotion in Nigeria (SEDIN)* implemented by the *Deutsche Gesellschaft für Zusammenarbeit (GIZ)* on behalf of the German government (SEDIN, 2016). One major objective of the programme is to facilitate access to microfinance by improving the legal framework for microfinance institutions (MFI) and increase the lending activities of MFIs in Nigeria. The overall goal of the project is to promote pro-poor growth. Besides microfinance initiatives like the two examples mentioned, there is a number of other tools that are seen to be efficient for the reduction of poverty and hence compete with the concept of microfinance. Moreover, not only tools compete, but entire domains of policy areas for poverty reduction. Besides improving access to finance as done by the microfinance initiatives and through the promotion of MFIs, the major policy areas for poverty reduction are education, infrastructure and health, to name only a few.

1.1 RESEARCH PROBLEM AND MOTIVATION

Improving the lives of millions of poor individuals and decreasing the number of people in poverty globally was the first goal of the Millennium Development Goals (MDG) of the United Nations (UN, 2015). The formulated target was to reduce by 2015 the ratio of people with incomes of less than one US-Dollar (\$US) a day compared to 1990 and the threshold value was reached five years in advance. According to the most recent Human Development Report (UNDP, 2015), more than a billion people were able to leave extreme poverty as defined by the poverty line of \$US 1.25 a day. Poverty remains a chief interest on the global policy agenda, as it is included as Goal 1 of the Sustainable Development Goals (SDG), the successors of the MDGs (UN, 2016). The ambition of the first of the seven targets under Goal 1 of the SDGs is to eradicate extreme poverty as measured by the poverty headcount ratio of people living on less than \$US 1.25 a day. There are currently still about 836 million individuals falling under this poverty line, predominantly in South Asia and Sub-Saharan Africa. Increasing their incomes and lifting them above the poverty line is thus an objective of numerous programmes and initiatives of different actors in human and economic development.

¹ Poor refers to individuals living under a certain poverty line. The definition of poverty lines has changed over time and will be briefly discussed in the thesis. The most recent line sets the threshold for extreme poverty at \$US 1.90 a day.

This thesis considers the tool of microfinance as one instrument of achieving the goal set by the SDGs and compares the allocation of resources in this policy domain to the policy domain of education. Under the term microfinance, the provision of a variety of *micro* financial services is commonly understood. These services include loans, savings and insurance services as well as money transfers, all at a micro scale, which usually refers to amounts of about \$US 50 – \$US 1000 (Robinson, 2001; Van Rooyen, Stewart & de Wet, 2012). The typical target groups are individuals

“who farm or fish or herd; who operate small enterprises or microenterprises where goods are produced, recycled, repaired, or sold; who provide services; who work for wages or commissions; who gain income from renting out small amounts of land, vehicles, draft animals, or machinery and tools; and to other individuals and groups at the local levels of developing countries, both rural and urban”(Robinson, 2001, p.9)

Thus, microfinance is commonly used by individuals who have volatile incomes from various sources and who often live from their incomes on a day-to-day basis. This thesis refers to these individuals as the *poor* and means thereby individuals living under a certain poverty line. There are several definitions of the poverty line, both at national levels as well as in international data sources. From the World Bank Development Indicators (WDI), poverty measures using the poverty line at \$US 1.90 a day are retrieved and used in this thesis (World Bank & International Monetary Fund, 2016). The revision of the former \$US 1.25 a day poverty line, that is based on a sample of the national poverty lines of the 15 poorest economies in the world, converted the poverty line from local currency into \$US of 2011 at PPP.² It should be noted, that still poverty is a multidimensional problem and by looking on income poverty, large parts, but not the entire problem is captured.

Access to microfinance services is provided under various regimes. A common scheme is the group-based lending scheme, which is employed by MFIs that operate on a commercial basis and by not-for-profit MFIs such as village banks (Robinson, 2001). As the introductory example of the GIZ project illustrates, international development cooperation organisations are involved in the promotion of MFIs. Many of these institutions also received at some point funding or other kinds of support by governments or donor organisations. The typical aim thereby is to enable and build self-sufficient MFIs, since donor organisation and governments cannot finance the institutions on a global scale. One important assessment that governments and donor organisations have to make concerns the question of how efficient MFIs can be implemented and of what lending policies work best. Prior to this, however, is the question if microfinance represents an efficient instrument for the goal of poverty reduction. Governments and donor organisations need to justify the allocation of resources and the engagement they take for microfinance. For this prior question, two objections are to be considered. The first of which has to demonstrate that microfinance leads to lower poverty and the second is that microfinance is an efficient instrument in comparison to other policy fields such as education. Only then, the allocation of resources from governments and donor organisation is ensured to be efficient and aligned with the goal set: To reduce poverty.

² For a discussion of this measure and its challenges see World Bank and International Monetary Fund (2016).

1.2 AIM AND SCOPE

The aim of this thesis is to explore the relative importance of microfinance and education for poverty reduction and how the use of funds in the two policy fields compare to each other in terms of the effect on poverty measures. In the scope of the thesis are three different poverty measures commonly used in the economic science: The headcount poverty ratio, the poverty gap and the squared poverty gap. These three measures enable to capture not only incidence, but also depth and severity of poverty in the sample countries. The focus of the thesis is to answer the question: What is the relative importance of microfinance and education for poverty reduction as measured by these three indicators? When taking both into consideration simultaneously, it could be that one is as dominant that the effect of the other determinant on the poverty measures diminishes. A prior question to the first question is thus: Are education and microfinance simultaneously relevant for poverty reduction? Previous research at an aggregate level emphasises the reducing effect of microfinance on poverty (Imai et al., 2012; Inoue & Hamori, 2013), but does not take other relevant determinants of poverty into account. To the knowledge of the author, no study has so far undertaken such a comparison. In a similar way as these studies, the present thesis uses an unbalanced panel of developing countries covering the years of 1999 to 2013 and applies Random Effects and Fixed Effects models.

There are some limitations of the scope of the thesis and of the method applied that should not be overlooked. The thesis uses education rather than other determinants such as infrastructure or health promotion as an alternative policy field to oppose to microfinance mainly due to two reasons: Firstly, data availability and secondly due to the well-established theoretical link of education, human capital, productivity, employment and hence poverty. In terms of the scope, the present thesis is furthermore limited since it does not take into account the quality but the quantitative provision of the two determinants. Other approaches are more appropriate to assess this aspect, such as qualitative methods or an examination at the micro level. Moreover, it has to be noted that there is a great diversity in the forms of microfinance, be it commercial and not-for profit MFIs. The thesis uses data from the Microfinance Information Exchange (MIX) and hence follows the definition of MFIs of this data source. Although the thesis includes to some extent the discussion of potential endogeneity between microfinance and poverty, the reverse relationships are not assessed (e.g. the effect of poverty levels on microfinance or on education in a country). Finally, the interaction of the two fields is not explored since this represents also a topic in its own.

1.3 DISPOSITION

Section 2 describes previous research in microfinance and education as determinants of poverty alleviation with a focus on studies at an aggregate level. Section 3 outlines the theory used for this thesis. The first part of section 4 describes the data used for the empirical part and the second part explains the empirical methodology. A focus is laid on the discussion of the endogeneity issue and how the issue was dealt with in previous works. Section 5 contains on the one hand the main results with the three different measures of poverty. On the other hand, four different sets of robustness checks are conducted. Section 6 concludes with a discussion of the methods, the findings and its implications as well as points out pathways of future research.

2 PREVIOUS RESEARCH ON DETERMINANTS FOR POVERTY REDUCTION

There is a broad consensus in economic research, that poverty has to be seen from a multidimensional perspective, which means that not only income poverty is relevant, but also the poverty in terms of health, education and security (Agénor, 2004). Many of these factors go hand in hand and it is therefore difficult to determine which factor dominates other factors or in which direction the causal linkage runs. Income poverty however is seen as a key factor enabling a reduction of poverty in all the other dimensions by which poverty can be understood (Agénor, 2005). Research has been conducted from a variety of strands. Both micro- and macroeconomic, as well as theoretical and empirical work has helped to understand better income poverty. Policy-oriented research has focussed on certain fields of the economy that are seen as possible channels for the reduction of poverty, such as the labour market or the support of the poor through welfare systems of the state. The following chapter summarises mainly empirical studies with a focus on the macroeconomic level and through the channel of the labour market. Since the present thesis looks on the determinants of education and microfinance as factors of poverty reduction, studies dealing with these two aspects in the context of poverty are primarily considered. In literature reviews of the effect of microfinance on poverty, some authors argue, that the field of microfinance research is biased towards the micro perspective and studies at the micro level dominate research on microfinance as a tool for providing access to finance to the poor (Agénor, 2005; Imai et al., 2012). A reason for this is that available and comparable data on a macro level are scarce. In this literature review however, the focus is on macro studies, since the empirical analysis will deal with microfinance, education and poverty at this level.

2.1 MICROFINANCE

Many scholars and development practitioners see microfinance as a success story for poverty alleviation. For instance, Robinson (2001) provides a variety of examples where microfinance borrowers in developing countries around the world improved their income levels. Although there are some literature reviews (e.g. Brau & Woller, 2004) that help to understand the vast field of microfinance research, it is impossible to say if these success stories are cherry-picked evidence or reflect a common understanding of the beneficial effect of microfinance. It is worth to note that there is also some criticism towards microfinance that questions the popularity of microfinance as a tool for poverty reduction. Table 1 gives an as far as possible balanced but certainly non-extensive overview of empirical research dealing with microfinance and its linkage to poverty or to a few other related economic outcomes, such as inequality or household consumption levels. From the table, it can be seen that only three studies on the country level could be identified, which reflects the scarcity of macro studies in the field and the aforementioned dominance of micro studies. As the macro studies are more of relevance, these studies are described in more detail.

TABLE 1: PREVIOUS EMPIRICAL LITERATURE ON MICROFINANCE AND POVERTY REDUCTION

Author(s)	Coverage	Main findings
Amin, Rai, and Topa (2003)	Household level in Bangladesh, monthly 1991 - 1992	Microfinance successfully reaches the poor but fails to help the vulnerable, that is, the households that are the most in need of financial access.
Coleman (1999)	Household level in Northeast Thailand, 1995 - 1996	By addressing selection bias, Coleman (1999) shows that there are no relevant effects from microfinance programmes.
Cuong (2007)	Household level in Vietnam, 2002 and 2004	Microfinance has an inequality reducing effect. However, the effect is statistically not significant.
Diagne and Zeller (2001)	Household level in Malawi, three waves in 1995	Borrowing from a microfinance institution increases poverty of a household in comparison to households that have not taken microcredits.
Imai et al. (2012)	Country level, 2003 and 2007	Microfinance gross portfolio has a significant negative effect on the poverty headcount ratio, the poverty gap and the squared poverty gap and the results remain robust after addressing endogeneity by an IV strategy.
Inoue and Hamori (2013)	Country level, 1995 - 2008	The result from an IV panel estimation strategy is that microfinance has a statistically significant negative effect on the poverty headcount ratio.
Kai and Hamori (2009)	Country level, 2003 - 2007	Microfinance has a lowering effect on inequality and thus represents an effective tool for redistribution.
Khandker (2005)	Household level in Bangladesh, 1991/92 and 1998/99	Microfinance helps to alleviate poverty both at an individual level and at a community level, since it is also beneficial to nonparticipants. The impact on extreme poverty is larger than the impact on moderate poverty. Furthermore, it has a positive effect on consumption levels.
Khandker and Faruquee (2003)	Household level in Pakistan, 1996	Microcredits have a positive effect on household welfare.
Morduch (1998)	Household level in Bangladesh, 1991 - 1992	Microfinance has no statistically significant impact on household consumption.
Mosley (2001)	Borrowers of four MFIs in Bolivia, 1999 and 2000	Assessing different institutional designs of microfinance, the author demonstrates the efficiency of microfinance and compares it to other measures, such as investment in health, education and infrastructure. The results corroborate microfinance as the least cost extensive measure.
Mosley and Hulme (1998)	Borrowers of 13 MFIs in seven countries, 1992	Microfinance loans are effectively increasing incomes of the participants but are not targeted to the poorest of the poor but to those close to the poverty line.
Pitt and Khandker (1998)	Household level in Bangladesh, 1991 - 1992	The authors show that microfinance loans enable households to increase consumption. Furthermore, there are larger effects from loans provided to women in comparison to loans provided to men.
Roodman and Morduch (2014)	Household level in Bangladesh, 1991 - 1992	In a replication study of the work by Pitt and Khandker (1998), the authors show that the results obtained are misleading and the positive effect of microfinance on consumption levels of households found in the original analysis does not withstand the replication assessment.
Van Rooyen, Stewart and De Wet (2012)	Meta study of 15 micro level studies in sub-Saharan Africa	Microfinance can have both a positive and negative effect on different economic outcomes. The sign of the effect depends on the programme design of the MFI.
Zaman (1999)	Household level in Bangladesh, 1995	Microfinance helps household to smooth consumption. It reduces poverty when combined with insurance and savings services.

For the purpose of the thesis, it is worth to have a closer look on some of the studies that take a similar approach to the one that will be followed in the thesis. Imai, Gaiha, Thapa and Ananim (2012) provide one of the few studies of the impact of microfinance at the macro level. Examining a cross-section data set of about 50 countries in the developing world and a panel data set over two years, the authors find a significant negative impact of microfinance in terms of gross loan portfolio per capita (GLPPC) on the so-called FTG class of poverty measures³. These measures comprise headcount poverty ratio, poverty gap and squared poverty gap. Furthermore, Imai et al. check for endogeneity by applying an IV strategy and instrumenting GLPPC with the instruments of costs of contract enforcement and the lag of a weighted five-year average of gross loan portfolio. The conclusion in this thesis from the cross section OLS, the IV and the panel Random and Fixed effects estimations is that microfinance GLPPC reduces the incidence of poverty as given by the headcount ratio of people living below the poverty line of US\$ 1.25 (based on 2005 constant prices PPP - at Purchasing Power Parity). The negative effect on poverty gap and squared poverty gap indicates that microfinance helps to reduce the severity and depth of poverty.

A very similar study to the previous one is presented by Inoue and Hamori (2013). Their proposition is that microfinance represents a mean of *financial permeation*, which stands for the expansion of the financial sector towards the poor. The core argument of this concept is that the usage of financial services among the poor spreads among individuals with low incomes and thereby enhances their pool of opportunities formerly restricted by the limitations of financial access. In order to assess the effect of microfinance, Inoue and Hamori (2013) construct an unbalanced panel containing poverty headcount ratio as dependent variable and apply a Generalised Method of Moments (GMM) approach. In terms of the explanatory variables, three different ratios are used: the number of microfinance institutions, the number of active borrowers and the gross loan portfolio all expressed in terms of per capita. The study corroborates the effect found by Imai et al. (2012) and supports the hypothesis of the authors that financial permeation as represented by the three microfinance measures is associated with a reduced poverty headcount ratio.

Another cross-country study is provided by Kai and Hamori (2009), who investigate the relationship of microfinance and inequality in a cross-sectional set of 61 developing countries. Their focus is on the *equalizing effect* of microfinance, which improves the incomes of the poor and therefore reduces the inequality gap between rich and poor population strata. As inequality measures, Kai and Hamori (2009) use the Gini coefficient of the country. For the pooled OLS regressions, the authors use the number of MFIs as the independent variable of interest and the number of active borrowers in a country. Their overall finding is that microfinance is important for inequality in a country and they corroborate empirically the existence of a Kuznets' Inverted-U curve for the relationship between access to finance and inequality.

There is a vast amount of studies at the micro level that focuses on different aspects of microfinance. Gender topics are a major field researcher have looked at. For instance, researchers assessed the gender pay gap, poverty of women and the effect of microfinance (e.g. Khandker, 2005). There are many examples of microfinance programmes where microfinance services are predominantly used by women and thus micro loans help to alleviate the income gap in developing countries (Pitt & Khandker, 1998). Another field of research in the category of studies using micro data concerns specific country contexts, poverty settings (e. g. rural or urban) and microfinance institutions or programmes. There is so far no common clear understanding among researchers of the effect of microfinance at the individual or the household level. This is partly due to the diversity of the microfinance supply, of its targets and mechanisms. Another part of the explanation is that there are various methods and approaches of microfinance research at the micro level, which makes it hard to compare results.

³ FTG class of poverty measures according to Foster, Greer & Thorbecke (1984). For further discussion, see section 4.1.

On the one hand, several authors conducting micro-level studies suggest that there is a positive effect of microfinance services (Khandker, 2005; Pitt & Khandker, 1998; Zaman, 1999). On the other hand, there are also some authors that find no significant or relevant effect (Coleman, 1999; Cuong, 2007; Morduch, 1998) or even a poverty increasing effect of microfinance (Diagne & Zeller, 2001). The replication study on the work by Pitt and Khandker does not support the results found, that microfinance helps to raise the consumption level of households in Bangladesh and alleviates poverty especially when the borrowers are women (Roodman & Morduch, 2014). The caveats that these authors point out in the original study is that some econometric issues are not addressed and that the non-randomised research design hinders the possibility of tracing causality. Another work reflecting the indecisiveness of scholars around the world on microfinance is illustrated by the meta-study by Van Rooyen, Stewart and De Wet (2012), who systematically collect the findings of studies dealing with the impact of microfinance in Sub-Saharan Africa. According to these authors, microfinance can both be beneficial and harmful for the goals of reducing poverty and increasing the income of the poor. Crucial for this is a thorough programme design and a cautious lending policy of the MFIs.

A further study of relevance that should be pointed out is the study by Mosley (2001), who compares the cost effectiveness of microfinance to other ways that attempt poverty alleviation. One finding is that microfinance helps to reduce poverty but fails to tackle extreme poverty. The author states that in the Bolivian country setting, the cost for lifting one individual over the poverty line is on average between US\$ 300 and US\$ 600 when spent on microfinance. Other expenditures, such as investment in primary health, education or in infrastructure measures such as roadbuilding are not able to reach such a low value. However, these estimates stem from case studies in Bolivia and are hence hardly generalizable or applicable to other countries.

2.2 EDUCATION

This section will give a brief summary of literature on the linkage of education and poverty. Tilak (2002) provides an overview of literature and demonstrates the importance of the policy field for poverty alleviation strategies. According to this author, education represents a long-term instrument to reduce poverty in contrast to the poverty alleviation concepts that focus on the provision of employment or on income redistribution. This is in line with what further research has found. For instance, Agénor (2004, 2005) points out to the relevance of human capital accumulation as a determinant of poverty reduction in the long term. In order to build this, the suggestion for developing countries is to focus on education and to facilitate the access to it for poor individuals. Table 2 gives an overview of empirical works on the linkage and the remainder of this section presents the relevant studies at the macro level further in detail.

TABLE 2: PREVIOUS EMPIRICAL LITERATURE ON EDUCATION AND POVERTY REDUCTION

Author(s)	Coverage	Main findings
Afzal, Malik, Begum, Sarwar and Fatima (2012)	Case study of Pakistan, 1971-2010	Using enrolment and expenditure on education, the authors show that education effectively reduces poverty in Pakistan.
Awan, Malik, Sarwar and Waqas (2011)	Household level in Pakistan, 1998 – 1999 and 2001 - 2002	Educational attainment significantly reduces the incidence of poverty. Persons with higher educational attainment are less likely to be poor.
Bils and Klenow (2000)	Country level, 1960 - 1990	Only a limited effect was found running from schooling to economic growth.
Breton (2004)	Country level, 1985	Comparing the effects of human and physical capital for economic output, the author finds that both factors are approximately equally important.
Checchi (2003)	Country level, 1960 - 1995	Using enrolment rates as an indicator of education, the author shows that there is a negative effect on inequality. Enrolment in secondary education is most relevant, in comparison to primary and higher education.
De Silva and Sumarto (2015)	Region level in Indonesia, 2002-2012	Comparing the effect of health and education human capital against physical capital on poverty, the authors demonstrate that the effect of education human capital reducing poverty as measured by the headcount ratio is larger than the effect from physical capital.
Janjua and Kamal (2011)	Country level, 1999-2007	Income growth and education are both important for poverty reduction with education being the most significant factor.
Njong (2010)	Household level in Cameroon, 2001	Higher educational levels have a significant lowering effect on the probability of an individual being poor.

Several studies compare the effect of human and physical capital on economic measures. Breton (2004) suggests that the importance of the two production factors is comparable for economic output. Another result is the indication of human capital being less important for lower income countries relative to its importance in higher income countries. Another approach is taken by Bils and Klenow (2000), who focus on the effects of schooling on economic growth and thereby show that the linkage impact is marginal.

Considering the effect of poverty, De Silva and Sumarto (2015) compare education human capital and human capital derived from health to physical capital. They are using an augmented neoclassical growth model that includes health and education in the form of a human capital term as a theoretical basis. In this model, investment in physical and human capital increases the output per worker. In the empirical part the authors use gross secondary school enrolment, share of population with secondary education and years of schooling as indicators for education as well as the poverty headcount index as an indicator for poverty. Applying a Fixed Effects and a GMM estimation strategy on a panel data set of regions in Indonesia, De Silva and Sumarto demonstrate that investment into human capital by better education has a larger negative effect on poverty than investment in physical capital. Another study conducted by Checchi (2003) finds that among enrolment variables, secondary education is most relevant for reducing inequality in terms of incomes. Similarly, Janjua and Kamal (2011) use enrolment rate in secondary education as a measure for education and poverty headcount ratio for poverty. When estimating the impact of education on poverty and contrasting it to the impact of income growth by means of a Fixed Effects and a Generalised Least Squares model, they find education to be the most relevant determinant. Finally, considering only one country and by taking a time series approach, Afzal et al (2012) examine the country case of Pakistan by looking on the linkages between education, economic growth and poverty and by using an auto-regressive distributed lag model. They find a reducing effect of education in terms of enrolment and expenses of education.

This section gave a brief overview of relevant literature dealing with the effects of microfinance and education on various economic outcomes and poverty in particular. Mixed findings on the impacts have been observed in empirical studies, although there is the tendency for the support of the argument that there is a poverty reducing effect from the two determinants. No study has however been found that has undertaken a comparison of the two policy areas using a cross-country approach. There is hence space for a study with the aim to compare the importance of microfinance and education at a country level.

3 THEORY ON THE DETERMINANTS OF POVERTY REDUCTION

Before discussing the theoretical basis for the two determinants of poverty reduction, it is worth to point out the multidimensionality of the problem. Economic growth and poverty reduction are mutually dependent and factors of economic growth and determinants of poverty are to a large extent identical. Therefore, it is a consensus among researchers that economic growth generally reduces poverty (Zhuang et al., 2009). Theoretical research on the nexus of economic growth and poverty has added further ties to this nexus, such as employment and inequality (Islam, 2004; Thorbecke, 2013). Economic growth is needed in order to alleviate poverty, but economic growth alone is not sufficient. At this point another dimension steps into the causal linkages chain, which concerns the question of how this income is distributed. Many of the theoretical advancements in the relationship between inequality and growth have their origins in Kuznets' inverted-U shaped curve of the relationship (1955). High incomes in an economy with high inequality mean no better outcome for the population strata living in poverty. Since this represents a research field in its own, the inequality dimension of the linkage will be left aside.

Due to the multidimensionality of the problem, the debate on the elements of an efficient economic policy and on the question of how to prioritize the different arenas for policy action are discussed controversially. Kanbur (2001) maps the fields of agreement and disagreement for the goals of reducing poverty and smoothen income distributions. There is, for instance, a common understanding among researchers that education and health are equally crucial to poverty reduction as income increase. There are a number of further determinants that are seen to represent crucial policy areas on the way to a poverty-free world. Research on poverty and on alleviation strategy has been conducted concerning the policy areas of infrastructure, security from violence, interest rates, trade, the legal institutions, the business climate and more. Furthermore, different instruments in various policy areas have been identified that help to reduce poverty. The following two sections describe the theoretical considerations for microfinance and education as two policy arenas and determinants for reducing poverty.

3.1 MICROFINANCE

The theoretical linkages of microfinance and poverty can be divided into a direct and an indirect effect. Before describing the indirect effect, an explanation of the direct effect is provided. The direct effect concerns the increase in the income of individuals that result from the use of microfinance services. Increases in the income derive from the expansion and diversification of economic activities through the help of these services⁴. Robinson (2001) shows how microfinance opens up the possibility for poor individuals to get access to finance, that the poor otherwise not have. The access to the credit market is constrained for the poor since they lack collaterals (such as land or deposits) and the borrowing costs are too high (Agénor, 2005). Microfinance provides a possible remedy to this problem, as it is able to overcome problems of adverse selection and moral hazard and create an offer of lending, savings and other financial

⁴ In the short term, there is clearly an increase from the provision of the loan itself. This is however not the increase that is of importance here and in regard to poverty.

services. Robinson gives examples of how microfinance is used by the poor and how it affects the incomes and the economic opportunities of poor individuals. Microfinance loans, or also called microcredits, can be used to start a business, to invest in new or maintain existing machinery, to employ workers for the expansion of the business or to finance education of various forms. Hence, microfinance helps to reduce poverty via the support of micro, small and medium-sized enterprises (MSME), which represent key actors in developing countries and with regard to the goal of poverty reduction (Green, Kirkpatrick & Murinde, 2006). Moreover, microfinance can help in a more general way to improve the lives of the poor, as it can open up new opportunities, for instance when families are enabled to send their children to school and jobs are created. Furthermore, for the direct effect of microfinance on individual or household income levels, a number of side mechanisms are at work.

The income situation is not only positively affected through this opening up of economic opportunities derived from borrowing, but also from depositing savings in a MFI or from using microinsurances. Some side mechanisms can be identified, such as the consumption-smoothing, the confidence-building and the entrepreneurship-spurring mechanism. Concerning consumption smoothing, the income volatility can be decreased by depositing savings and using the savings when needed for larger expenditures. Also, certain insurances products lead to consumption smoothing. This function alleviates thereby situations where individuals fall into extreme poverty due to unforeseen events that cause a heavy burden on income (such as the loss of an income source in the family or health expenditures). Savings can be used for the purchase of land or other large investments, which will help to improve the income situation further. The mechanism of confidence building makes clients of MFI more secure in their business since it enables them to achieve their goals and backs them financially. In particular, women and young small-business owners are empowered.

Moreover, microfinance might not only have a positive effect on already-entrepreneurs, but spur entrepreneurship, which leads to the indirect effect of microfinance. The indirect effect comprises the the spillover effect of microfinance, which concerns not only the clients of microfinance but also other actors in the surrounding of microfinance borrowers (Khandker, 2005). The mechanism of the multiplier effect is that microfinance loans induce investment and consumption. Investment rises when a microfinance borrower purchases machinery and consumption rises when a borrower employs workers who can then increase their consumption levels. Spillovers are created when other entrepreneurs and not-yet-entrepreneurs follow the example of microfinance borrowers (Lahimer, Dash & Zaiter, 2013). Moreover, spillovers can foster innovation output among microfinance clients.

Taking the two effects to the macro level is straightforward: If many individuals or household can benefit from access to finance and increase their incomes, the overall number of individuals living under the poverty line decreases. In order to help these individuals, a crucial condition is that microfinance loans are directed to individuals living under the poverty line and that these individuals are able to use the loans in a way that increases their incomes sustainably. For the case that individuals use the loans for consumption purposes, the effect will not be sustainable and they will not be able to lift themselves out of poverty. The rationale is then that more microfinance available per capita in a developing country allows more individuals of the poor population strata to benefit from the provision of microfinance services. Robinson (2001) describes how the scale of activities of microfinance institutions affects poverty in a country. The so-called outreach of microfinance describes the number of individuals reached by MFIs and the provision of financial services to the population. The better the outreach of microfinance, the better the demand for microfinance in a country is met and the larger is the effect on poverty. Figure 1 provides an overview of the effects between poverty and microfinance at work.

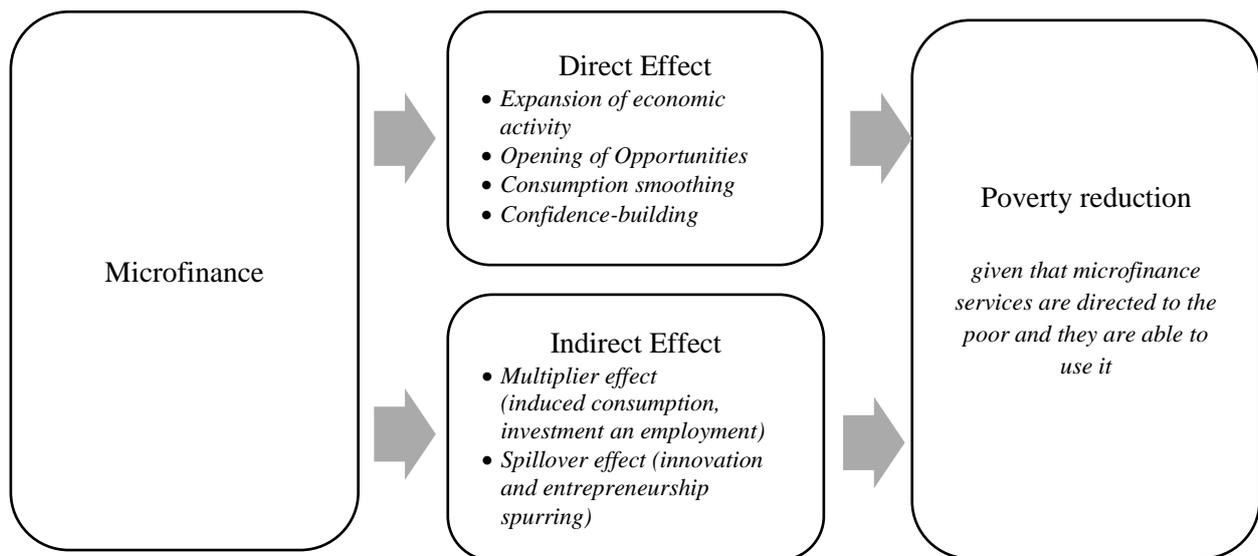


FIGURE 1: LINKAGE BETWEEN MICROFINANCE AND POVERTY (OWN ILLUSTRATION)

There is also opposition to the theory that microfinance alleviates poverty at an individual level or at an aggregate level (Diagne & Zeller, 2001; Morduch, 1998; Roodman & Morduch, 2014). Researchers advocating for a negative or no effect of microfinance on poverty assert that in order to benefit from microfinance a certain level of education is needed. Also, the quality of microfinance matters crucially, such as, for instance via the guidance in business projects. Moreover, a criticism is that microfinance is not able to reach the poorest of the poor (Amin, Rai & Topa, 2003). Another assertion is that microfinance is harmful because it leads to indebtedness and there is the risk of abuse of the loans for short-term expenditure or consumption. Assuming well implemented programmes that address these issues with their lending policy, these cases should be ruled out. Also the argument that a certain level of education is needed should not constrain the positive effect too much. The expectation is thus that microfinance outreach reduces poverty at a macro level.

3.2 EDUCATION

The theory distinguishes several linkages through which education has a reducing effect on poverty. Tilak (2002) provides an overview of theoretical concepts of the relationship between poverty and education. According to him, prominent examples of approaches of the literature to the explanation of the linkage are the human capital, the basic needs and the human development approach. The human capital theory sees human capital explicitly as an own production factor that is distinguished from the production factors of labour and physical capital (Goode, 1959; Schultz, 1961). In this framework, education enhances skills and knowledge and thereby the human capital stock since education is a determinant of human capital. The skills of higher educated individuals increase the employment and the productivity of the individuals and hence the incomes of those individuals. This can also be seen in a macro perspective: A higher human capital stock of a country goes hand in hand with a higher productivity of its economy and thus the income to be distributed is larger. Figure 2 illustrates in a simplistic way the relation chain of education and poverty.

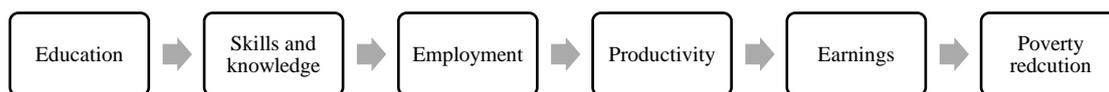


FIGURE 2: RELATIONSHIP BETWEEN EDUCATION AND POVERTY IN THE HUMAN CAPITAL FRAMEWORK (ADAPTED FROM TILAK, 2002)

Employment and earnings are hereby the decisive components for the reduction of poverty. An individual leaves poverty by means of education via the employment link (the individual gets employed due to education and therefore leaves the status of poverty) or via the earnings link (the individual increases its income due to higher education and therefore leaves the status of poverty). Besides the income level, more education affects other dimensions, which are ultimately also related with poverty reduction. This implies the basic needs approach. Education translates in a better standard of living, as for instance in terms of nutrition and health, which is relevant for the development of a country and for poverty alleviation. However, these dimensions should also not be discussed further for the purpose of this thesis. The reverse linkage should be mentioned here as well and runs from poverty to education. Poverty represents an impediment for education. This can both be seen from a micro and macro perspective. Poor countries often do not have the financial and practical resources to provide schooling to all individuals and education investment may suffer from low government budgets. At a household or an individual level, poverty withholds parents to send their children to school since they are needed to earn the household income. Thus, there is a mutual causality and the endogeneity of the relation of poverty and education for the micro and macro level becomes evident.

Turning to the more practical and applied side of theoretical research on the relation of education and poverty, a vast number of authors and empirical researchers see education as a key policy field for poverty alleviation (Afzal et al., 2012; Agénor, 2005; Janjua & Kamal, 2011; Olaniyan & Okemakinde, 2008). In order to reduce poverty, many researchers claim that long term determinants of income are more relevant than short term policy intervention (Tilak, 2002). Education is seen to be such a long-term policy area. The relative importance of education in comparison to other factors for poverty reduction has thus been emphasised and different approaches to improve education in developing countries have been suggested. The expectation is thus that education level reduces poverty at a macro level.

The aim of the present thesis is to contrast the effect of microfinance to the effect of poverty. Previous studies have found a lowering effect of microfinance on poverty (Imai et al., 2012; Inoue & Hamori, 2013). Since these studies have not taken into account education, the expectation is that the effect for microfinance on poverty will be smaller than the effect presented in these studies. Concerning the question of how the two effects relate to each other, it is tricky to argue for a certain expectation from a theoretical perspective which effect will dominate. However, this aspect is very much of interest for governments and international development cooperation, since financial and personnel resources are scarce. Moreover, developing countries cannot focus on many policy targets at once. Identifying the most binding constraints as suggested for policies to promote economic growth should then also be applied to the policy arena of poverty reduction (Hausmann, Rodrik & Velasco, 2008). Prioritizing the policy areas and concentrating on the most effective tool is hence of great relevance and a convincing maxim. The description of the empirical methods that allow an assessment of the effect and for the purpose of a weighting of the relevance of the policy areas is the topic of the next section.

4 EMPIRICAL APPROACH

This part outlines the data used and the empirical strategy applied. Concerning the data, the choice of the variables is explained. The empirical method is based on previous research when looking at the relationship of poverty, microfinance and education.

4.1 DATA

For the empirical analysis, World Development Indicators (WDI) from the World Bank Data Base are used. The data is merged with aggregate country statistics from the Microfinance Information Exchange (MIX), which provides country estimates on microfinance. Using these variables, a panel was constructed containing 42 countries in the period of 1999 to 2013. For certain years, data was not available and hence the panel is unbalanced. Table 3 gives a brief overview of the variables used and reports some descriptive statistics of the sample. A more detailed overview of the panel data and on availability of the data is given on a country level by Table 13 in appendix A.1.

TABLE 3: OVERVIEW OF USED DATA

Variable	Source	Observations	Mean	Std. Dev.
Poverty headcount ratio at US\$ 1.90 a day (2011 PPP, % of population)	WDI	225	12.69471	14.0422
Poverty gap at US\$ 1.90 a day (2011 PPP, %)	WDI	225	4.3456	5.5793
Squared poverty gap at US\$ 1.90 a day (2011 PPP, %)	WDI ⁵	225	1.726732	1.170507
Gross loan portfolio, adjusted (US\$), per capita	MIX	225	47.24791	81.1303
Number of active borrowers, adjusted, per capita	MIX	225	0.269386	0.3231937
Government expenditure on education as % of GDP (%)	WDI	225	4.006419	1.499007
Lower secondary completion rate, both sexes (%)	WDI	187	75.79036	21.71273
GDP per capita (2011 PPP international \$)	WDI	225	7762.822	4584.474
Domestic credit to private sector (% of GDP)	WDI	225	32.06291	23.09843
Time required to enforce a contract (days)	WDI	159	582.2138	306.1388

One of the most commonly used measures for poverty is the incidence of poverty as given by the poverty headcount ratio (Tilak, 2002). The measure is calculated by the ratio of individuals in the population earning less than a certain income threshold, which represents the poverty line (Agénor, 2004). Another common measure used is poverty gap. The poverty gap measure gives the percentage average shortfall of the population from the poverty line in terms of income and is to be interpreted as the intensity or the depth of poverty in a country. For this thesis, the selection of poverty measures examined in the study by Imai et al. (2012) is followed in order to be able to compare the results. In order to measure the severity of poverty, Imai et al. suggest squaring poverty gap, since the squaring will amplify extreme values of poverty. This strategy helps to assess if the argument that microfinance is not able to reach the poorest of the poor is valid. These three measures are commonly known as the Foster-Greer-Thorbecke indices. A general definition of these indices is given by Foster et al. (1984) and can be written as

$$FGT_{\alpha} = \frac{1}{N} \sum_{i=1}^H \left(\frac{z - y_i}{z} \right)^{\alpha}$$

⁵ Own calculation from WDI data.

In this equation, z represents the poverty line, y_i the incomes of the individual i , H the number of the poor and N the total population in a country. When $\alpha = 0$, we get the first measure, the poverty headcount ratio, and with $\alpha = 1$ and $\alpha = 2$, we get poverty gap and squared poverty gap respectively. The poverty line, or poverty threshold, is thus subject to the definition of a certain income that defines the state of poverty. It should be noted that the international poverty line was subject to changes over the last years and there are a number of limitations for the measures based on poverty lines.⁶ The most recent revision of the poverty line as used by international institutions such as the World Bank or the International Monetary Fund, set the threshold at \$US 1.90 Purchasing Power Parity (PPP) and 2011 prices. One criticism is that, notwithstanding the adjustment according to PPP, the poverty line can lead to the situation of somebody not being able to cover his or her cost of living and hence being de facto poor. Furthermore, poverty lines can only measure poverty in terms of income poverty and neglect other dimensions of poverty. The poverty headcount ratio and the poverty gap at a certain poverty line are still the dominant concepts of measurement. This thesis uses hence the poverty headcount ratio and the poverty gap with a poverty line at US\$ 1.90 a day (2011 PPP) as provided by WDI.

For the determinant of access to finance, the variable gross loan portfolio from the Microfinance Information Exchange (MIX) is used. Gross loan portfolio (GLP) is adjusted by MIX for inflation and write-offs. The definition of gross loan portfolio is, according to the World Bank,

“the outstanding principal balance of all of an MFI’s outstanding loans, including current, delinquent, and restructured loans, but not loans that have been written off. It does not include interest receivable.” (ed. CGAP/World Bank, 2003, p.6)

Further variables used for robustness checks retrieved from the MIX data base are number of active borrowers and the number of microfinance institutions in a country.⁷ In order to use GLP in this thesis, the values are divided by the total population and then the log of the per capita GLP amounts is taken. The number of active borrowers is divided through inhabitants and the resulting variable gives hence the ratio of active microfinance borrowers in a country per capita. Both variables represent hence the outreach of microfinance in a country.

For the determinant of education, the variable of government expenditure on education as provided by the WDI is used. This variable reflects the education level and efforts of policymakers in the policy field of education. The measure includes local, regional and national expenditures for the education system. Two major shortcomings of this variable have to be noted here. Firstly, the funding of the education system differs across countries and some countries might have a low percentage in terms of this figure because schooling is funded from private sources. This may disturb the estimation of the correct effect. Secondly, the variable is, just as microfinance, an input variable and might not adequately reflect educational attainments in a country. Lower secondary completion rate, which is defined as the total number of entrants in the final grade of lower secondary schooling, addresses partly these issues and is applied in the robustness checks. The usage of these variable as education indicator is suggested by previous empirical studies, as for instance, by Checchi (2003) and by Afzal et al. (2012).

Further variables obtained from WDI comprise two control variables and further variables used for the robustness checks. The control variables are Gross Domestic Product (GDP) per capita and the share of the domestic credit directed to the private sector as a share of GDP. GDP per capita is transformed to its log. The motivation for GDP per capita is that the overall level of economic development influences

⁶ For a more details on the methods of the poverty line and a more detailed discussion, consult the Global Monitoring Report 2016 (World Bank & International Monetary Fund, 2016).

⁷ Number of microfinance is used in the robustness checks to weight the other two microfinance variables.

poverty. The rationale for domestic credit share is to capture the accessibility of financial markets in a country. A higher general credit volume relative to GDP may make it easier for the poor to get access to financial source and lessen the relevance of microfinance. Another variable retrieved and included in the panel is the variable of time needed to enforce a contract in a country. The relevance of this variable is discussed separately in the next section.

After constructing the panel, countries with only one observation in terms of the variables used for the main estimation strategy were deleted from the panel. The resulting number of observations is hence 225. As it can be seen from Table 3, for most variables, 225 data points are available. The variables with less data points will only be used in the control strategies. The restriction on 225 observations is predominantly caused by availability of data for the poverty measures.

4.2 EMPIRICAL STRATEGY

The empirical model follows the model suggested by Imai et al. (2012), which is specified as follows.

$$Pov_i = \beta_0 + \beta_1 GLP_i + \beta_2 GDPPC_i + \beta_3 Domcred_i + \beta_4 Reg_i + u_i$$

Pov is the measure of poverty. As such is used headcount ratio of people living under the poverty line, poverty gap and squared poverty gap with all of the measures using the same poverty line. *GLP* represents the gross loan portfolio per capita and thus reflects microfinance lending activity in a country. The control variables *GDPPC* and *Domcred* represent GDP per capita and domestic credits of banks as a proportion of GDP. Furthermore, country dummies are included by the *Reg* variable. Using IV and OLS these authors conduct cross section regressions. For the IV estimation, cost of contract enforcement as well as a five-year lag of the GLP per capita average are used. Furthermore, using a panel of two years, Imai et al. (2012) run pooled OLS, Fixed Effects and Random Effects models.

For this analysis, the education variable is added to the equation above and country panel data are used for the regressions. Hence the model looks as follows:

$$Pov_{it} = \beta_0 + \beta_1 GLP_{it} + \beta_2 EDU_{it} + \beta_3 GDPPC_{it} + \beta_4 Domcred_{it} + u_i$$

Analogously to Imai et al. (2012), the three different measures of poverty are used, in order to estimate the effect on the incidence, the depth and the severity of poverty. For each of these independent variables a set of six regressions is conducted. The models used comprise Random Effects (RE), Fixed Effects (FE) and Tway Fixed Effects. Since the equivalent of a FE model is to add dummies, we can present the Oneway and Tway FE models by adding country dummy variables or both country and year dummy variables to the above expression of the model. The advantage of Fixed Effects models are that time invariant unobserved determinants of the left hand side are cancelled out (Wooldridge, 2012). The Fixed Effects Estimator, or so-called Within-Estimator, gives then the variation of the poverty headcount ratio differing from the mean across the countries to all relevant variables that vary over time. In order to decide between Random and Fixed Effects, Hausman tests are conducted (Wooldridge, 2012). Furthermore, the significance of the year dummies is tested with a Wald test with the null hypothesis that all year dummies are jointly significant.⁸

⁸ The Stata package provides the command *testparm* which allows testing the joint significance of the year dummies with a Wald test. The null-hypothesis is that all the year dummy variables are jointly zero. If this is rejected, year dummies should be included in the models.

For the robustness checks, the above model is further modified. Due to space limitations and since the three dependent variables behave similarly the robustness checks are conducted only using poverty headcount ratio. Four sets of robustness checks are conducted. Firstly, the variables of interest, GLP and education are replaced. Instead of GLP per capita, the number of active borrowers of microfinance loans is used and instead of government expenditure on education the lower secondary completion rate is used. As a second robustness check, the sample is divided into three subgroups of countries according to world regions. Thereby, regional effects can be compared and the robustness of the main results to different regional settings is assessed. Thirdly, since there is a potential bias from endogeneity, a Two-Stage-Least-Squares (2SLS) strategy is chosen in order to investigate the linkage of microfinance and poverty. As a final robustness check the time dimension is eliminated by using averaged values of the variables and estimation of a cross-section version of the model.

Generally, an IV strategy (or 2SLS strategy as the computational equivalent) is capable to address three potential issues, that is, omitted variable bias, simultaneity and measurement errors. The motivation for a quasi-experimental approach such as a 2SLS strategy is that the FE and RE regressions conducted could suffer from omitted variables. FE regressions cancel out time-invariant effects but cannot address certain endogeneity issues, such as variables that change for the different countries over time and that affect the outcome (Wooldridge, 2012). Furthermore, there could be determinants that simultaneously affect poverty and microfinance and that introduce an upwards bias. A possible mechanism representing endogeneity could be that a high poverty measure attracts investors and increases the amount of microfinance directed to a country. Hence, the standard regression set described above is biased. In order to check for this, an IV strategy using two instruments is considered. In the study of Imai et al. (2012), the authors use cost of contract enforcement. As an instrument for the level of microfinance and the number of active borrowers we use time to enforce a contract, which is a very similar instrument since time can also be seen as a cost factor for enforcing a contract. For a valid IV estimation approach, two conditions have to be met, that is, the so-called *independence assumption* or significance of the first stage and the exclusion restriction (Angrist & Pischke, 2009).

While the first one of the two assumptions is testable, the second one can generally not be tested using econometrics and represents thereby an identifying assumption. The rationale of the instrument is that the amount of the microfinance gross loan portfolio in a country may depend on the rule of law and the efficiency of the legal systems. The faster a contract can be enforced the more security finance creditors have in lending operations, which should in turn positively impact the amount of microfinance. This is the motivation for a strong first stage. Concerning the exclusion restriction, the assumption is that time to enforce a contract does not affect the poverty headcount ratio other than via the instrumented variable. This is a very strong assumption and unlikely to hold entirely. However, it can be argued that there is no direct linkage running from time to enforce a contract to poverty, which justifies the instrument as a second-best solution. In their study, Imai et al. (2012) suggest to use a complementary instrument since the cost of contract enforcement turns out to be a weak instrument. The reason for the weakness of the instrument might be that contractual agreements are less relevant for MFIs. The advantage of many microfinance programmes is that it does not require a strong legal framework and enforced by the state. Instead, MFIs rely on lending groups and the social peer pressure in such groups. Instrumenting GLP with time or cost to enforce a contract is then not sufficient in order to achieve a viable estimation of the GLP per capita in a country. Exploiting the panel structure, the authors use a weighted 5-year lag of average GLP per capita in order to augment the predictive power for gross loan portfolio in the first stage. The weights are according to the number of MFIs in a country. Following the proposition by Imai et al. (2012), we use hence a log of the weighted 5-year lag of average of GLP per capita as well as the weighted 5-year lag of average ratio of active borrowers. While there is a very strong first stage for the case of this instrument expected, the exclusion restriction is almost certainly not fulfilled since past rounds of microfinance

investment probably have a long term effect on poverty. Since this approach has already been applied by Imai et al. (2012) and a better instrument is lacking, the 2SLS strategy suggested is best practicable approach to address endogeneity.

Before turning to the application of the empirical strategy, potential issues from the unbalanced panel should be alluded to. Generally, issues from unbalanced panels arise when the data points are missing not at a random and hence cause a bias of the estimation results. Typically, in such cases, the panel suffers from attrition or self-selection. As mentioned in the previous section, the restriction of data is mostly due to the availability of the poverty measures. The sources for the calculation of these measures are typically household surveys at a national level, which are usually conducted independently from each other among the countries. We therefore assume that the data points are missing randomly, which would not lead to the introduction of a bias in the estimation results and which allows hence the usage of such an unbalanced panel.

5 RESULTS

This chapter presents the regression results applying the empirical strategy described before. For the regressions, an unbalanced panel of 42 countries and 15 years with about 225 observations are used. For some of the countries up to 15 years of observations are available, whereas for some other countries only a few years are included in the data set. Table 13 in appendix A.2 gives an overview of data availability. The data availability is constrained similar as in the study by Inoue and Hamori (2013), who employ an unbalanced panel in the same context. As discussed above, the fact that certain data are missing for estimation could introduce a bias when the reason for the missing of the data is non-random. Although the assumption is that this is not the case, several methods, such as the further restriction of the data set in terms of years have been used in order to check the robustness of the results. The coefficients were not found to be affected substantially. Moreover, the part on robustness checks presents several checks that address issues that could potentially disturb the main results by introducing a bias or misleading the interpretation.

5.1 MAIN RESULTS

The following section presents the main results from the consideration of three different measures of poverty: Poverty headcount ratio, poverty gap, and squared poverty gap. The statistical and economic significance are discussed and interpretations of the coefficients are given. The coefficients are translated into monetary values but should not be taken as a granted factor that will affect the dependent variable immediately and unconditionally. One has to be aware that these calculations stem from aggregated data and are not supposed to be applied on a specific context or for a certain country. However, the purpose of these computational exercises is to enable comparisons of the two determinants of interest in the thesis: microfinance and education. The amounts given should be understood as an indicator of the relative impact of the effects and can hence indicate the comparative importance of investment in the two policy areas of microfinance and education with regard to poverty alleviation.

5.1.1 Poverty headcount ratio

To begin with, Table 4 gives the estimates of the regressions of poverty headcount ratio from the Random Effects model (RE) in column (i) and (ii), from the Fixed Effects model (FE) in column (iii) and (iv) and from the Fixed Effects model with year dummy variables in column (v) and (vi). Column (i), (iii) and (v) show the estimates of the regressions only with the microfinance variable *log of GLP per capita*

(henceforth GLPPC) and the education variable *government expenditure on education as a share of GDP* (henceforth EDU). These are the two independent variables of interest. In column (ii), (iv) and (vi), the control variables *log of GDP per capita* and *domestic credit to private sector as a share of GDP* are added to the models. Starting with the RE model, both the GLPPC and EDU are significant and have a negative impact on the poverty headcount ratio. This is what theory proposes, as microfinance and education are expected to have a negative effect on any measures of poverty. Adding controls does not change much for EDU, but halves the estimate of GLPPC. This is due to the strong impact of GDP per capita on the model. Both control variables are significant. While log of GDP per capita has a pronounced negative effect on the poverty headcount ratio, the coefficient of domestic credit has a positive sign. Since the domestic credit variable serves rather as a control reflecting the amount of lending from financial institutions and the accessibility of financial markets in a country, the meaning of this variable will not be discussed further.

The assumption of the RE model is that all unobserved factors are fixed over time and independent of the variables on the right hand side, that is GLPPC, EDU and the control variables for all time periods. For a set of developing countries, it is not very likely that the time-invariant effect is random among these countries. Using the Hausman test and given that there is homoscedasticity, it can be tested if the RE model or the FE model is more appropriate. Conducting this test despite the problem of potential heteroskedasticity, the result suggests that the FE model should be used. The results from these tests are also reported in Table 4. Striking for the decision between RE and FE is the rationale of the assumptions of the model used. Since it is rather likely that the time-invariant effect is dependent on the country, a FE model is more convincing. This is also suggested by the common practice when using aggregate or country level data (Wooldridge, 2012). The next two columns, (iii) and (iv), report the estimates from a Oneway FE regression. Introducing a country Fixed Effect gives similar results as in the RE model. Column (iii) shows that the coefficients change slightly, but behave very similar to the two previous regression exercises. This tells us that there is no huge difference in using a RE and FE model for this simple case. In the case of column (iv) with the controls of GDP per capita and domestic credit, the coefficient of microfinance is however not significant anymore. This indicates that there are time-invariant unobserved factors that strongly influence the model while accounting for the two controls.

For the case of the FE model, there is the option of including time dummies, in order to take into account a year effect that affects all the countries identically. The option of including time dummy variables can be tested by a Wald-test with the null-hypothesis that all the year dummies are jointly equal to zero. Since this null hypothesis is rejected, year dummies are included. When using a Twoway FE model and adding year dummies as presented in column (v) and (vi), the microfinance coefficients are quite different from the other four regression models as the sign of GLPPC changes. Remarkably, the EDU coefficient remains very similar throughout all the models, both in its significance and in its magnitude. At the one percent significance level, EDU is significant in four cases and in the other two cases the coefficient is significant at the five percent level. The coefficient for GLPPC is significant for three out of six regressions and it is negative in four cases of the six regression exercises. In two cases the coefficient is significant at a one percent significance level. A preliminary finding is thus that the variable EDU is robust to different model specifications while the GLPPC variable is much more sensitive to different specifications of the model.

TABLE 4: MAIN RESULTS FOR POVERTY HEADCOUNT RATIO

Explanatory variables	Random effects		Fixed effects		Tway Fixed effects	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of GLP per cap.	-1.762*** (0.34)	-0.702** (0.28)	-1.602*** (0.35)	-0.305 (0.28)	0.578 (0.36)	0.611 (0.41)
Gov. exp. education	-3.938*** (1.35)	-3.698*** (1.17)	-4.327*** (1.47)	-4.208*** (1.35)	-3.130** (1.35)	-3.498** (1.39)
Log of GDP per cap.		-19.348*** (2.21)		-21.587*** (4.92)		-13.660* (7.65)
Domestic credit		0.135*** (0.04)		0.130*** (0.05)		0.125** (0.05)
Constant	36.122*** (6.06)	193.785*** (19.83)	34.192*** (5.82)	215.036*** (43.01)	29.752*** (5.34)	143.661** (67.05)
Obs.	225	225	225	225	225	225
R-squared			0.457	0.550	0.589	0.615
Number of countries	42	42	42	42	42	42
Country FE	NO	NO	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	YES	YES
Hausman	9.11 (0.01)	10.08 (0.04)				

Table 4 reports the estimates from the RE, FE and Tway FE regressions. The dependent variable is the poverty headcount ratio with a poverty line at \$US 1.90 a day (2011 PPP, measured in percentage of the population). The independent variables of interest are log of GLP per capita and government expenditure on education (as % of GDP). The control variables are log of GDP per capita and domestic credit to private sector (as % of GDP). For the regressions, countries in the regions of Sub-Saharan Africa, Latin America and the Caribbean, South-East Asia, South Asia, Europe and Central Asia are used and the years from 1999 to 2013 are considered. The standard errors are reported in parentheses and are heteroskedasticity adjusted.

* significance at the 10 % level, ** significance at the 5 % level, *** significance at the 1 % level

A first possible interpretation of the estimates in column (ii) is that with an increase of the gross loan portfolio of microfinance in a country of ten percent, a decrease of the poverty headcount ratio by 0.07 percentage points is expected.⁹ For the coefficient of education, the interpretation is that an increase of ten percentage points of government expenditure as a share of GDP is associated with a decrease of the poverty headcount ratio by 0.35 percentage points. These estimates are much smaller than the ones found by Imai et al. (2012), although the same units of measurement are used (unlike some of the results presented by Inoue and Hamori (2013)). The reason for this is that their study only takes into account the year 2007 in the cross-section regression and the years 2003 and 2007 for panel regressions. When running a cross-section regression by restraining the panel to the year 2007, the estimates found for microfinance are comparably high as in the study by Imai et al. (2012). Another aspect is that the present thesis accounts for education. This also seems to reduce the estimates found for microfinance.

In order to investigate the relative importance of the different variables, transformations of the coefficients have to be made since they are given in different units and thus cannot be compared immediately. The estimates are converted into comparable units and then interpreted. To approximate the relative importance of the two determinants a simple transformation of the effect into \$US is helpful. Therefore, we take the mean of the sample for GLP per capita, which is at \$US 47.45 (see Table 3). Taking again the example of column (ii) and assuming a doubling of the microfinance gross loan portfolio, the effect of microfinance corresponds to a decrease of the poverty headcount ratio of 0.49 percentage points. According to Table 3, the sample mean of the expenditures governments spend on education in terms of the share of total GDP is about 4.00 %. Multiplied by the sample mean of GDP per capita, this percentage corresponds to an average of \$US 311 for the sample. Adding the per capita amount of \$US 47.45 to government expenditure on education (as previously from a doubling of the microfinance figure), the percentage change refers to an increase by only 15.2 % percent. This amount invested through government expenditure on education instead of microfinance GLPPC leads to a decrease of the poverty headcount by 0.53 percentage points.

Consequently, this leads to two indications. Firstly, that education is, compared to microfinance, a very important determinant of the poverty headcount ratio of a country. And secondly, in absolute terms, an increase of the investment in one of the two determinants corresponds to almost the same effect for the

⁹ For the interpretation of log transformed variables on one side of the model equation the simple formula $coefficient * \ln 1.1 = expected\ change$ is used (University of California, 2016).

poverty headcount ratio. However, in relative terms, it is more efficient to increase investment on education rather than microfinance, since the same effect on poverty headcount ratio requires a much smaller relative increase of investment in education expenditure compared to microfinance gross loan portfolio. This finding has to be understood as an approximation of the relative effect and it is interesting from a computational perspective. Clearly, it takes much more than investment for a better education to effectively decrease poverty. Moreover, other effects, such as quality of education, interfere here. Further caveats to the application of such figures are the aggregation and the heterogeneity of the countries in the sample. As a final limitation to the calculation exercise, it has to be noted that there could be a non-linear relationship between poverty and the two determinants. When reaching a certain level in the variables of GLPPC or EDU, poverty headcount could behave differently than in a linear way.

5.1.2 Poverty gap

The same set of regressions as conducted with poverty headcount ratio is calculated for poverty gap and the estimates are reported in Table 5. Poverty gap represents the depth of poverty in a country and it is of interest for this section if the effects of microfinance and education behave similarly or differ from their effect on the poverty headcount ratio. As can be seen from a comparison of Table 4 and Table 5, the overall pattern of the results is quite comparable to the results obtained previously. Column (i) and (ii) show the RE model estimates for microfinance and education. Both are negative and significant at a one percent significance level in the RE model. The Hausman test indicates that the RE model is preferred over the FE model when controlling with the two additional variables. However, there is potential heteroskedasticity and this indication might be misleading. Following the rationale explained above that it is preferable to rely on FE models for aggregate data, FE models are conducted to check if the coefficients change. The estimates of the FE model as presented by column (iii) and (iv) are negative and significant at a one and a five percent level respectively. Although they are not changing for the Oneway FE model, the sign of the GLPPC coefficient changes in the Twoway specification of the FE model. As already seen in the case of the poverty headcount ratio, the coefficients become positive and they are even statistically significant for the case of the poverty gap. Another similar point to the previous regression set with the poverty headcount ratio is that the GLPPC coefficient drops quite extensively in column (ii) versus (i) and (iv) versus (iii). EDU however remains relatively stable in its magnitude. This means that GLPPC turns out to have a smaller impact on poverty measures (as of poverty headcount ratio or poverty gap) when including further controls. Another remarkable aspect is, that GLPPC remains significant in column (iv) contrary to what was previously observed. A possible implication is that GLPPC rather affects depth of poverty than poverty in terms of the headcount ratio. Generally, throughout all models regressing poverty gap, government expenditure on education has a clearly negative and significant effect on poverty gap, as it was already the case for the regressions on the headcount ratio. The positive coefficients for GLPPC observed in columns (v) and (vi) in both regression sets are unexpected and somewhat puzzling, since the other models indicate a clear negative relationship. This issue should be investigated further.

TABLE 5: MAIN RESULTS FOR POVERTY GAP

Explanatory variables	Random effects		Fixed effects		Twoway Fixed effects	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of GLP per cap.	-0.725*** (0.13)	-0.373*** (0.13)	-0.657*** (0.14)	-0.259** (0.13)	0.397** (0.18)	0.328* (0.17)
Gov. exp. education	-1.230*** (0.36)	-1.245*** (0.30)	-1.409*** (0.40)	-1.427*** (0.35)	-0.798** (0.30)	-0.882*** (0.32)
Log of GDP per cap.		-7.028*** (1.17)		-8.047*** (2.36)		-2.336 (2.69)
Domestic credit		0.070*** (0.03)		0.079** (0.03)		0.065** (0.03)
Constant	12.064*** (1.90)	69.143*** (10.18)	11.698*** (1.68)	78.611*** (20.12)	10.717*** (1.93)	28.673 (23.07)
Obs.	225	225	225	225	225	225
R-squared			0.369	0.458	0.558	0.588
Number of countries	42	42	42	42	42	42
Country FE	NO	NO	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	YES	YES
Hausman	7.69 (0.02)	6.70 (0.15)				

Table 5 reports the estimates from the RE, FE and Twoway FE regressions. The dependent variable is the poverty gap with a poverty line at \$US 1.90 a day (2011 PPP, measured in percentage of the population). The independent variables of interest are log of GLP per capita and government expenditure on education (as % of GDP). The control variables are log of GDP per capita and domestic credit to private sector (as % of GDP). For the regressions, countries in the regions of Sub-Saharan Africa, Latin America and the Caribbean, South-East Asia, South Asia, Europe and Central Asia are used and the years from 1999 to 2013 are considered. The standard errors are reported in parentheses and are heteroskedasticity adjusted.

* significance at the 10 % level, ** significance at the 5 % level, *** significance at the 1 % level

To give an interpretation of the results, the same logic of the exercise presented above is repeated for poverty gap. Again, a doubling of the microfinance amount is assumed. The coefficients in column (iv) for GLP and education are -0.259 and -1.427 respectively. A doubling of microfinance would translate into a decrease of the poverty gap by 0.18 percentage points. A similar amount as this dispersed to the education expenditures (or equivalently an increase of government expenditures by 15.2 %) however would show a decrease of the poverty gap by 0.20 percentage points. It can be seen from this example that the difference of the effect on poverty gap between microfinance and education is not as large as in the calculation example from the poverty headcount measure. This means that education is relatively more important for the incidence of poverty, while similar absolute increases in disbursement directed to education and microfinance seem not to cause a substantially different impact on the depth of poverty as represented by the measure of poverty gap.

5.1.3 Squared poverty gap

Following the methodology of Imai et al. (2012), poverty gap was squared. Table 6 provides the estimates for squared poverty gap which reflects the severity of poverty. Again, the overall pattern is very similar to the two cases of poverty measures presented before. GLPPC significantly reduces squared poverty gap for the RE model in column (i) and (ii) and the FE model in (iii) and (iv) at a one percent level of significance for three out of the four regressions. The estimation using squared poverty gap hence follows the pattern seen for poverty gap. However, coefficients for squared poverty gap change the sign and are not significant in the Twoway FE model in (v) and (vi), as already seen in the regression set with poverty headcount ratio. Moreover, the drops in the GLPPC coefficients can once again be observed when adding the controls to the RE and Oneway FE model (column (i) – (iv)). The coefficient of government expenditure on education is, once again, significant and negative for all models. In four out of the six cases, EDU is significant at a one percent level.

TABLE 6: MAIN RESULTS FOR SQUARED POVERTY GAP

Explanatory variables	Random effects		Fixed effects		Twoway Fixed effects	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of GLP per cap.	-0.191*** (0.03)	-0.106*** (0.03)	-0.178*** (0.03)	-0.053* (0.03)	0.048 (0.03)	0.045 (0.04)
Gov. exp. education	-0.279*** (0.09)	-0.275*** (0.09)	-0.319*** (0.11)	-0.308*** (0.09)	-0.181* (0.09)	-0.207** (0.09)
Log of GDP per cap.		-1.460*** (0.20)		-2.079*** (0.53)		-0.918 (0.67)
Domestic credit		0.011*** (0.00)		0.013** (0.00)		0.011** (0.00)
Constant	3.456*** (0.43)	15.376*** (1.72)	3.467*** (0.40)	20.881*** (4.50)	3.144*** (0.39)	10.698* (5.85)
Obs.	225	225	225	225	225	225
R-squared			0.451	0.557	0.621	0.642
Number of countries	42	42	42	42	42	42
Country FE	NO	NO	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	YES	YES
Hausman	6.10 (0.05)	10.43 (0.04)				

Table 6 reports the estimates from the RE, FE and Twoway FE regressions. The dependent variable is the squared poverty gap with a poverty line at \$US 1.90 a day (2011 PPP, measured in percentage of the population). The independent variables of interest are log of GLP per capita and government expenditure on education (as % of GDP). The control variables are log of GDP per capita and domestic credit to private sector (as % of GDP). For the regressions, countries in the regions of Sub-Saharan Africa, Latin America and the Caribbean, South-East Asia, South Asia, Europe and Central Asia are used and the years from 1999 to 2013 are considered. The standard errors are reported in parentheses and are heteroskedasticity adjusted.

* significance at the 10 % level, ** significance at the 5 % level, *** significance at the 1 % level

Taking column (iv) as an example for the interpretation of the results, a ten percent increase of GLPPC is associated with a decrease of the squared poverty gap by 0.005 percentage points, whereas a ten percent increase of government expenditure by education is associated with a decrease of the squared poverty gap by 0.03 percentage points. Repeating the calculation example from before (with a doubling of the microfinance gross portfolio), the effect on squared poverty gap from microfinance is -0.037 while the effect from education is -0.044. This is once again very similar in absolute terms. In terms of relative increases, the increase needed for microfinance to trigger this effect is much larger than the relative increase needed in education expenditures. As mentioned before, the increase by the factor 2 for microfinance gross loan portfolio approximately corresponds to a raise of the expenditures on education by the government by the factor 1.15.

In summary, government expenditure on education appears to be highly influential to all the poverty measures and robust to different model specifications. The finding is hence that EDU has an impact on incidence, depth and severity of poverty. The pattern of GLPPC is also quite similar when using the three measures reflecting incidence, depth and severity of poverty. GLPPC however is quite sensitive to the model specification. The coefficients of this variable are in all RE model regressions significant and mostly significant and negative in the Oneway FE model. For the Twoway FE model, the signs change to positive in each of the three regression sets with the different poverty variables. The change of coefficients in sign and magnitude after introducing a time fixed effect indicates that there might be a certain trend or a break in the microfinance variable. Another possible reason for this result is the unbalanced panel that is used, as for some countries more than ten years are covered whereas for others only a few years are available. Figure 3 shows the overall development of microfinance over time. The graph plots GLPPC and an alternative measure of microfinance, the ratio of active borrowers per capita.

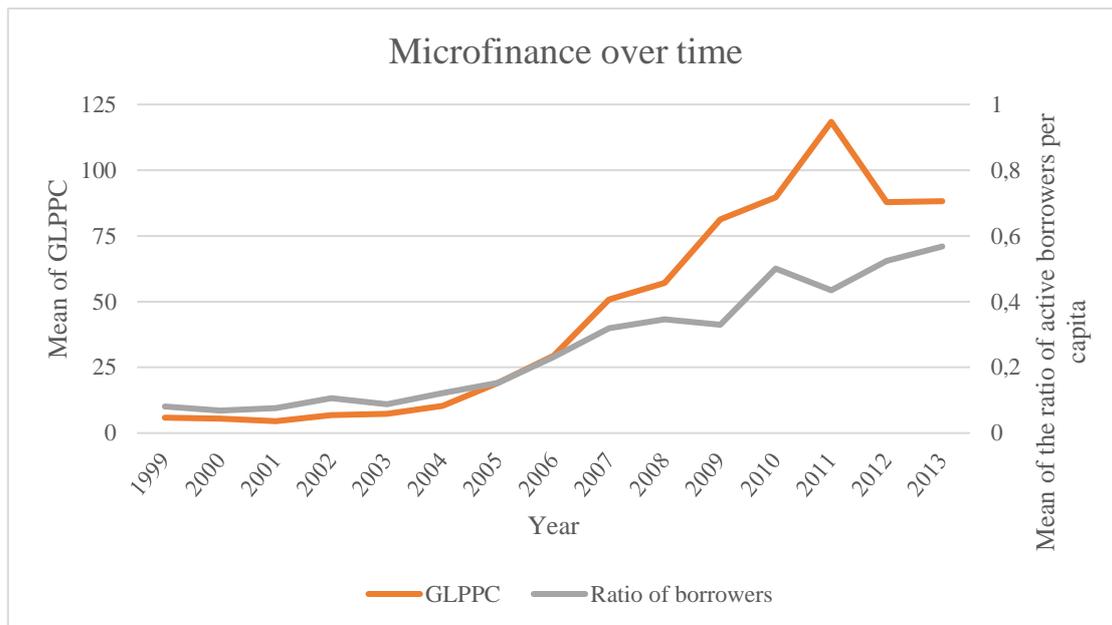


FIGURE 3: MICROFINANCE GLPPC AND RATIO OF ACTIVE BORROWERS OVER TIME, 1999 - 2013, MEANS

A clear upward trend is visible from this graph for both variables. After the year 2004, the popularity of microfinance rises. A first drop is recorded in the ratio of borrowers in 2009 and a second one in 2011, while the gross loan portfolio keeps increasing still. However, GLPPC decreases significantly in 2012, while the ratio of borrowers increases further. Figure 4 shows the development of the poverty headcount ratio and poverty gap over the same period. It can be observed from this graph, that after 2011, the two measures of poverty continue to decrease. Comparing the two graphs might hence indicate that until 2011 a decrease of poverty went hand in hand with increasing levels of microfinance provision. There is a break for this pattern observed in 2012. Since there are no more data available that go beyond 2013, it remains unclear if this is a temporary phenomenon of microfinance provision.

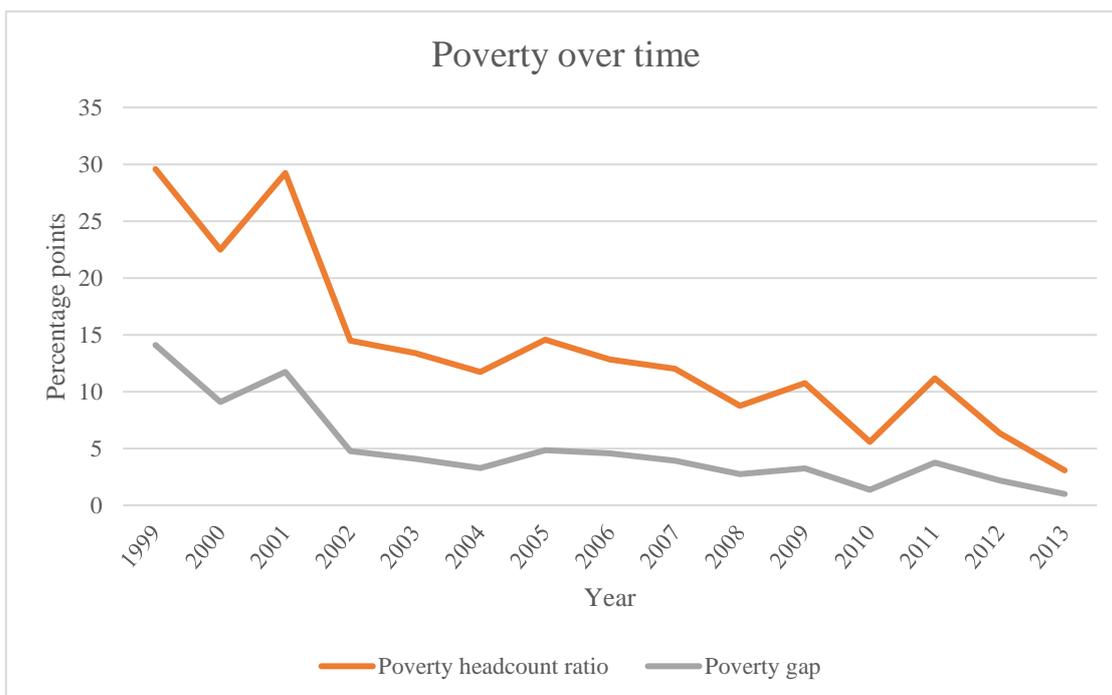


FIGURE 4: POVERTY HEADCOUNT RATIO AND POVERTY GAP OVER TIME, 1999 - 2013, MEANS

These graphs hence offer a possible explanation for the change of the coefficient when including time dummy variables in the FE models. Looking at the similar regression sets by using the alternative variable of the ratio of active borrowers per capita helps to determine the role of microfinance for poverty. The following section will apply this strategy. Moreover, the issue will be addressed by using a 2SLS strategy, by examining subgroups of countries and by using averaged values for a regression of cross-section version of the model.

5.2 ROBUSTNESS CHECKS

Due to limitations of space, the following section reports the robustness checks only considering the variable of poverty headcount ratio. The main results part showed that there is quite some similarity in the behaviour between the three poverty variables and the variables for microfinance and education. Therefore, the robustness checks will focus on the poverty headcount ratio as the most popular indicator for poverty among the three measures. Conducting the robustness checks with the two poverty gap measures shows that the findings are very similar to the findings on the poverty headcount ratio presented in this section. Furthermore, robustness checks have been conducted with the exclusion of extreme values and outliers in any of the variables considered here. These checks do not interfere on the results obtained above in a substantial way.

5.2.1 *Alternative variables for microfinance and education*

The first robustness check replaces the two independent variables of interest. In the case of the microfinance variable, instead of the log of GLPPC the ratio of active borrowers of microfinance loans per capita is used. This strategy has also been applied by other comparable studies of microfinance (Imai et al., 2012; Inoue & Hamori, 2013). For the education variable, the alternative measure to government expenditure on education is the lower secondary completion rate. There are reasons to believe that the two alternative measures represent equally valid indicators of the determinants of microfinance intensity and education level. The ratio of active borrowers per capita reflects the so-called outreach, which is the prevalence and usage of microfinance, in a country. Stronger outreach of microfinance is assumed to have a larger impact on the reduction of the poverty headcount. The lower secondary completion rate however is quite different from government expenditure on education. The latter is more of an input variable, whereas the former represents clearly an output variable since it gives the ratio of individuals completing lower secondary education in a country. Both variables have with the original variables in common that they do not say anything about the quality of the determinant of microfinance or education provision. Having completed lower secondary education in a country might qualify for different things in different countries. Nevertheless, the variable is a proxy of the education and the schooling level in a country. The rationale for employing lower secondary education completion instead of, for instance, the primary education completion rate, is that this might be a more appropriate measure for a comparison to microfinance measures. Individuals taking a microcredit are likely to have their peers in the group of individuals that have completed at least lower secondary education because for economic activities pursued by such individuals, typically more is needed than just literacy as obtained from primary education. This allows hence again comparing the importance of the policy fields of microfinance to education for the goal of alleviating poverty.

The estimates from the RE, Oneway and Twoway FE models are reported in Table 7, which is accordingly constructed as Table 4 in the main results section. The columns (i), (iii) and (v) give the estimates with a replacement of GDPPC by the ratio of active borrowers. In column (ii), (iv) and (vi) the education variable is represented by lower secondary completion rate. A first finding from the table is that the ratio of active borrowers is negative and significant at least at a five percent significance level for all three cases. Thus,

it provides support for the effect of GLPPC on poverty as demonstrated before. Furthermore, the number of active borrowers is also significant and negative for the Twoway FE model. The time dimension seems to matter for GLPPC, but not for the alternative measure of the ratio of active borrowers. This corroborates to some extent the finding of the graphical analysis of Figure 3 and Figure 4, where GLPPC dropped while the ratio of active borrowers increased further. A possible implication is that outreach (as measured by the ratio of active borrowers) might be more important than the amount of microfinance supplied as in the gross loan portfolio. In any case, the lesson from this robustness check emphasises the role of microfinance for poverty and shows that both education and microfinance are important simultaneously.

TABLE 7: RESULTS FOR ROBUSTNESS CHECK WITH ALTERNATIVE VARIABLES

Explanatory variables	Random effects		Fixed effects		Twoway Fixed effects	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of GLP per cap.		-0.955* (0.51)		-0.776 (0.46)		0.174 (0.40)
Ratio. of borrowers	-7.457*** (2.01)		-8.817*** (2.78)		-6.809** (3.04)	
Gov. exp. education	-3.637*** (1.00)		-4.068*** (1.11)		-3.635*** (1.25)	
Low. sec. completion		-0.178*** (0.03)		-0.145*** (0.04)		-0.079* (0.04)
Log of GDP per cap.	-17.869*** (2.17)	-15.663*** (2.37)	-12.869** (5.03)	-18.146*** (5.73)	-9.005 (7.58)	-6.331 (7.26)
Domestic credit	0.124*** (0.04)	0.064 (0.06)	0.084* (0.04)	0.058 (0.08)	0.100** (0.05)	0.052 (0.07)
Constant	181.372*** (19.03)	163.366*** (19.25)	141.260*** (42.72)	182.550*** (49.28)	104.373** (65.81)	79.293 (62.65)
Obs.	225	249	225	249	225	249
R-squared			0.590	0.416	0.632	0.493
Number of countries	42	41	42	41	42	41
Country FE	NO	NO	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	YES	YES
Hausman	6.93 (0.14)	4.17 (0.38)				

Table 7 reports the estimates from the RE, FE and Twoway FE regressions. The dependent variable is the poverty headcount ratio with a poverty line at \$US 1.90 a day (2011 PPP, measured in percentage of the population). The independent variables of interest are this time number of active microfinance borrowers per capita inhabitants and lower secondary completion rate. The control variables are log of GDP per capita and domestic credit to private sector (as % of GDP). For the regressions, countries in the regions of Sub-Saharan Africa, Latin America and the Caribbean, South-East Asia, South Asia, Europe and Central Asia are used and the years from 1999 to 2013 are considered. The standard errors are reported in parentheses and are heteroskedasticity adjusted.

* significance at the 10 % level, ** significance at the 5 % level, *** significance at the 1 % level

5.2.2 Subgroup of countries

The next robustness check divides the sample into three regional country groups. As there is a large number of observations from countries of Latin-America and the Caribbean (LAC) and countries in Europe and Central Asia (ECA), these two country groups are investigated separately (column (i) and (ii) for LAC and column (iii) and (iv) for ECA). Each of these two country groups consist of 12 countries. The remainder of the 50 observations consists of countries in South-East Asia, South Asia and Sub-Saharan Africa, which are taken as one group including 18 different countries. Table 14 in appendix A.1 presents the regional classification of the countries and the number of observations by country. As can be seen from this appendix, all countries are represented with at least two observations. For this set of robustness checks, only the estimations from FE models are presented. Since the sample is divided into regional subgroups, the subsamples are less randomised in terms of the countries than the original sample. Hence the assumption of the RE model is very likely not to be accurate and using a FE model is more appropriate.

TABLE 8: RESULTS FOR ROBUSTNESS CHECK WITH SUBGROUPS OF COUNTRIES

Explanatory variables	Only LAC		Only ECA		Rest of countries	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of GLP per capita	-0.340* (0.17)	-0.314 (0.34)	-0.528 (1.16)	0.472 (0.91)	1.409 (1.25)	0.424 (1.42)
Gov. exp. education	-3.312*** (0.37)	-2.716*** (0.50)	-6.023** (2.51)	-1.696 (1.79)	-4.322*** (1.02)	-2.605 (1.67)
Log of GDP per capita	-25.732*** (2.74)	-18.772*** (4.40)	-10.791 (6.11)	23.126* (11.68)	-43.085*** (12.46)	-22.725 (20.46)
Domestic credit	0.171*** (0.03)	0.187*** (0.03)	0.145* (0.07)	0.325** (0.12)	-0.189 (0.12)	-0.251 (0.16)
Constant	252.564*** (23.73)	187.472*** (40.93)	123.881** (52.98)	-165.996 (103.74)	398.665*** (98.46)	222.172 (163.90)
Obs.	88	88	87	87	50	50
R-squared	0.822	0.852	0.573	0.779	0.608	0.799
Number of countries	12	12	12	12	18	18
Country FE	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	NO	YES	NO	YES

Table 8 reports the estimates from the FE and Two-way FE regressions. The dependent variable is the poverty headcount ratio with the poverty line at \$US 1.90 a day (2011 PPP, measured in percentage of the population). The independent variables of interest are log of GLP per capita and government expenditure on education (as % of GDP). The control variables are log of GDP per capita and domestic credit to private sector (as % of GDP). For the regressions, countries in the regions of Sub-Saharan Africa, Latin America and the Caribbean (LAC), South-East Asia, South Asia, Europe and Central Asia (ECA) are used and the years from 1999 to 2013 are considered. The standard errors are reported in parentheses and are heteroskedasticity adjusted.

* significance at the 10 % level, ** significance at the 5 % level, *** significance at the 1 % level

Comparing the estimations with the regional subsamples reveals that the two variables of interest behave quite differently. While the EDU coefficient is for all estimation negative and for all but one significant, the GLPPC coefficient changes and has a negative sign for half of the regressions and a positive sign for the other half. Only in the case of the Oneway FE regression on the LAC countries, the coefficient of GLPPC is negative and significant at a 10 percent level of significance. In two other cases, the coefficient is negative but not significant. In the Two-way FE regression of the ECA observations and in the two regressions run with the rest of the countries, the coefficient has a positive sign. The finding from the check is hence that EDU is robust to the different subgroups. GLPPC reacts to the restriction of the sample to regional contexts and is not statistically significant when applied to these subgroups in all except one case. Consequently, this finding implies that the importance of microfinance varies according to the regional context. Education as a determinant for poverty however is more or less equally important, especially when considering the Two-way FE regressions in the three subgroups of countries.

5.2.3 Addressing endogeneity

This section presents an attempt to address endogeneity. As in section 4.2 explained, there are several potential sources for endogeneity when examining the linkage of poverty and microfinance. A 2SLS approach can address these issues, when there are valid and strong instruments applied. For the reason given in the empirical part, the instruments chosen for the 2SLS strategy are rather weak. This is also reflected by the correlation matrix, as given by Table 15 in appendix A.2. In order to apply this strategy, the correlation of the variables should be checked. It can be seen from the results from the diagnostics that the linkages are not as optimal as in the reference study. Furthermore, Table 16 in appendix A.3 provides the first stages of the 2SLS estimations. From this table, the weakness of the first instrument can be seen, as it is only significant for microfinance in one out of four cases. The lag of the weighted average of the two microfinance variables is however significant in three out of four cases. This means that the condition of a strong first stage is fulfilled. However, whether the exclusion restriction holds is questionable. For the purpose of the analysis, it is still useful to consider the estimates from such an approach in order to get an idea of the effects. Table 9 reports the estimates from the 2SLS strategy. For column (i), the instrument of time to enforce a contract was found to be significant. Remarkably, in this case the GLPPC coefficient is significant at a one percent level. In two more cases, microfinance is a significant determinant of poverty headcount ratio, while EDU is significant for two of the cases. Another point that can be noted is that the coefficients are much larger in the case of the microfinance coefficient than the estimates found in part 5.1.1. This finding is similar to what Imai et al. (2012) found and is possibly caused by the weak

instrumentation. In summary, the 2SLS estimations point to the fact that microfinance plays a relevant role. In order to make a firm statement based on results from a 2SLS approach, the caveats of such an approach need to be assessed thoroughly and a stronger instrumentation strategy that fulfils the requirements by the two conditions for 2SLS is needed.

TABLE 9: RESULTS FOR ROBUSTNESS CHECK USING A 2SLS STRATEGY

Explanatory variables	(i)	(ii)	(iii)	(iv)
Log of GLP per capita	-7.713*** (1.78)	-7.856* (4.73)		
Ratio of borrowers			-19.265*** (4.34)	-6.946 (4.40)
Gov. exp. education	-0.371 (0.83)	-0.999 (1.76)	-1.577* (0.88)	-2.520*** (0.74)
Log of GDP per capita		-9.670 (6.23)		-17.587*** (2.30)
Domestic credit		-0.030 (0.09)		0.017 (0.04)
Constant	41.144*** (6.85)	129.086** (42.98)	29.255*** (4.13)	177.860*** (19.62)
Obs.	114	114	114	114
Number of countries	35	35	35	35

Table 9 reports the estimates from the 2SLS panel regressions with random effects. The dependent variable is the poverty headcount ratio with the poverty line at \$US 1.90 a day (2011 PPP, measured in percentage of the population). The independent variables of interest are log of GLP per capita, number of active microfinance borrowers per capita and government expenditure on education (as % of GDP). The control variables are log of GDP per capita and domestic credit to private sector (as % of GDP). The instruments are time to enforce a contract and a weighted 3-year lag of average GLPPC or ratio of active borrowers respectively. For the regressions, countries in the regions of Sub-Saharan Africa, Latin America and the Caribbean, South-East Asia, South Asia, Europe and Central Asia are used and the years from 1999 to 2013 are considered. The standard errors are reported in parentheses and are heteroskedasticity adjusted.

* significance at the 10 % level, ** significance at the 5 % level, *** significance at the 1 % level

5.2.4 Cross-section estimation with averaged values

As a final check for robustness, cross-section regressions of 5-year averaged values are proposed. Similarly, to the regression with the subgroup of countries, where regional patterns were addressed, the purpose of this is to cancel out the effect of time. Furthermore, the regional effect can be elaborated upon by including region dummies. This was not possible in the FE model, since these models already contained country dummy variables. Column (i) and (ii) of Table 10 indicate the estimates of the cross-section estimation for the time span of 2002 – 2007 and column (iii) and (iv) for the period of 2008 – 2013. (ii) and (iv) include a regional dummy for each of the regions in the sample. From the table, it can be seen, that time does not affect the significance of averaged GLPPC unless the region dummies are included as in column (iv) for the period of 2008 - 2013. The averaged EDU variables behave differently, since it is only significant with the inclusion of region dummies. Another remark should be made on the large value of the coefficient for the SSA dummy, the dummy for Sub-Saharan Africa. The large values for the two coefficients reflect the high poverty rates in Sub-Saharan Africa. Other regional dummy variables turn out not to be significant. When attributing more relevance to the models with region dummies, the key finding of this check could be that microfinance relative to education has become less relevant in the more recent period of 2008 – 2013 versus 2002 – 2007. This finding might however be resulting from the global downswing in the gross loan portfolio as already shown in Figure 3. Generally, both variables seem to matter at a different degree for the measure of the poverty headcount ratio.

TABLE 10: RESULTS FOR ROBUSTNESS CHECK WITH AVERAGES

Explanatory variables	Average of 2002-2007		Average of 2008-2012	
	(i)	(ii)	(iii)	(iv)
Log of GLP per capita	-4.035*** (1.09)	-2.173** (0.87)	-3.915** (1.47)	-1.861 (1.12)
Gov. exp. education	-1.826 (1.22)	-2.524*** (0.92)	-1.487 (1.37)	-2.525** (1.04)
Log of GDP per capita	-20.613*** (2.26)	-16.664*** (2.77)	-16.522*** (2.50)	-10.486*** (2.44)
Domestic credit	0.103* (0.06)	0.050 (0.05)	0.032 (0.09)	0.015 (0.05)
SSA		11.356** (5.26)		24.735*** (6.57)
LAC		1.480 (5.33)		5.510 (5.21)
ECA		-6.814 (5.64)		-0.394 (6.02)
SEA		-3.036 (6.09)		2.850 (6.26)
Constant	208.569*** (17.78)	173.927*** (22.26)	177.131*** (19.87)	115.314*** (22.65)
Obs.	55	55	49	49
R-squared	0.841	0.882	0.731	0.837
Region dummy	No	Yes	No	Yes

Table 10 reports the estimates from the cross section OLS and FE regressions. The dependent variable is the poverty headcount ratio with a poverty line at \$US 1.90 a day (2011 PPP, measured in percentage of the population). The independent variables of interest are log of GLP per capita, government expenditure on education (as % of GDP). The control variables are log of GDP per capita, domestic credit to private sector (as % of GDP) and region dummies. For the regressions, countries in the region of Sub-Saharan Africa (SSA), Latin America and the Caribbean (LAC), South-East Asia (SEA), South Asia (SA), Europe and Central Asia (ECA) are used and the years from 1999 to 2013 are considered. The standard errors are reported in parentheses and are heteroskedasticity adjusted.

* significance at the 10 % level, ** significance at the 5 % level, *** significance at the 1 % level

There are several lessons that can be learned from the robustness checks conducted. Firstly, the replacement by alternative independent variables for microfinance and education supports the findings derived in the main part. The FE model including ratio of active borrowers suggests that GLPPC is disturbed by a year effect probably stemming from a downturn of gross loan portfolio after 2011 (compare Figure 3). Secondly, the outcome of restricting the sample to regional subgroups showed that GLPPC, but not EDU, is sensitive to specific regional contexts. Thirdly, from the section addressing endogeneity with 2SLS estimations, a weak indication can be drawn that microfinance is a causal determinant of the poverty headcount ratio. The fourth robustness check has used averages to cancel out the time effect on two subsequent time periods. From these final four regressions to check robustness, the finding is that GLPPC is also robust to this case while EDU is only significant when controlling with regional dummy variables. The general conclusion from the section of robustness checks is that the checks support the results found in the main results part with the restriction that regional affects make a difference in the GLPPC coefficients and the suggestion that the positive coefficients in the Twoway FE models of part 5.1 stem from the decrease of GLPPC after 2011.

6 CONCLUDING REMARKS

The objective of the present thesis is to examine the importance of microfinance for poverty reduction while taking into account the education level in a country. Past research studying microfinance on an aggregate level has not yet undertaken an attempt to explicitly compare the relative effect of investment into the two policy fields of poverty reduction. The concept of microfinance as a tool for poverty reduction has gained in popularity among researchers and in the community of international development cooperation latest since the success stories of the Grameen Bank in Bangladesh and the spread of microfinance in various countries. On the one hand, the concept of microfinance and its functioning as an instrument for poverty reduction seems thereby as simple as convincing: Give the poor access to finance. The typical microfinance services address an immediate need of the poor to be able to take loans, deposit savings and get insurance, all at a micro level. Different theories suggested why this may be an important

channel in economic development to alleviate poverty. The direct linkage argues that microfinance helps in reducing poverty by smoothing the consumption of the poor and making their incomes less volatile. The induced effect comes via the induced consumption and employment opportunities that root in the spillover and multiplier effects between microfinance borrowers, their clients and their suppliers. Although there are a number of critical voices, the merit attributed to microfinance is that it effectively alleviates poverty when properly implemented.

On the other hand, the question is if this is more efficient than focusing on other policy areas of poverty reduction. Empirical evidence suggests that there are effects from advancing the institutional and legal conditions in a country, improving infrastructure and making health and education systems better. In contrast to these policy fields, the aim of poverty alleviation via microfinance represents rather a way of fighting the symptoms than tackling the problem of poverty at the roots. This can be reasonable from a short term perspective. In particular, when the aim is to help from outside of the political system and if there are obstacles of political or practical nature that do not allow a change in these essential factors of economic development. In the long term, the more sustainable way of alleviating poverty might be to focus on the fundamental causes of high poverty rates. A complementary way for the interpretation of the results of this thesis is thus the comparison of two policy paradigms: Approaching poverty with policy fields from its roots or from its symptoms. Clearly, a number of aspects are left out and there are limitations of the approach taken. However, the aim was to provide directions in how policymakers and development practitioners should weight the two action fields in the policy mix and in the setup of their agenda. Clarification of the comparative relevance of different approaches and tools for the reduction of poverty are relevant since financial and personnel resources are scarce and donor organisations as well as governments in developing countries have a great interest in using the money in the most efficient way for poverty reduction.

Are education and microfinance simultaneously relevant for poverty reduction?

The overall finding in this thesis using data on poverty, microfinance and education in 42 countries for the years of 1999 - 2013 suggests that both determinants are relevant for poverty alleviation. Table 11 presents an overview of the main results for the effects of microfinance and education on poverty headcount ratio, poverty gap and squared poverty gap. The general patterns of the results for microfinance and education using different models is very similar across the three different measures for poverty incidence (poverty headcount ratio), depth (poverty gap) and severity (squared poverty gap). Education has clearly a negative effect on the poverty measures and microfinance has in most cases a negative effect. The positive effect on poverty from microfinance found in the Twoway FE models is not significant in most of the cases. This tells us, that microfinance as measured by GLPPC is sensitive to the specification of the models. Generally, the two coefficients of the two variables are not heavily affected when adding the controls of GDP per capita and domestic credit. The linkage of the poverty measures and government expenditure on education is more robust to the application of different models. This might indicate a higher general relevance of education than microfinance for poverty independently from different country contexts. At this point, it has to be noted once again, that the non-significance of some of the microfinance estimates might also be an effect of the unbalanced panel or a too small sample size. Furthermore, the robustness checks have shown that the outcomes and the conclusion concerning the relevance of microfinance when taking into account education on the regional context and are influenced by effects occurring at certain points in time. Both a design with alternative variables for microfinance and education and a 2SLS strategy addressing endogeneity underlines however that the two determinants are relevant simultaneously. The finding of a higher general relevance of education in comparison to microfinance requires thus approval by future research.

TABLE 11: SUMMARY OF THE MAIN RESULTS

Model	Poverty headcount ratio		Poverty gap		Squared poverty gap	
	GLPPC	EDU	GLPPC	EDU	GLPPC	EDU
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
RE	-1.762***	-3.938***	-0.725***	-1.230***	-0.191***	-0.279***
RE with controls	-0.702**	-3.698***	-0.373***	-1.245***	-0.106***	-0.275***
Oneway FE	-1.602***	-4.327***	-0.657***	-1.409***	-0.178***	-0.319***
Oneway FE with controls	-0.305	-4.208***	-0.259**	-1.427***	-0.053*	-0.308***
Twoway FE	0.578	-3.130**	0.397**	-0.798**	0.048	-0.181*
Twoway FE with controls	0.611	-3.498**	0.328*	-0.882***	0.045	-0.207**

Table 11 provides an overview of the results from the different estimation approaches. The reported figures are the coefficients for GLPPC and EDU presented in the main results part in Table 4, Table 5, and Table 6.

* significance at the 10 % level, ** significance at the 5 % level, *** significance at the 1 % level

When comparing the results to previous studies on microfinance at an aggregate level, it can be noticed that the estimates found in this thesis are generally lower than the coefficients found by Imai et al. (2012) and by Inoue and Hamori (2013). The effect of microfinance on the poverty headcount ratio ranges in the first of these two studies between -0.37 to -3.80. Inoue and Hamori found the effect to be between -1.986 to -4.753 (only considering the comparable models). The present thesis finds an effect of -0.305 to -1.762.¹⁰ One reason for this is the inclusion of education in the model. Furthermore, for the former of the two studies, the time period differs and for the latter the differences in the model and the control strategy explain the differences in the coefficients. The findings in the present thesis support the suggestion that microfinance contributes in a relevant way to poverty alleviation when taking into account incidence, depth and severity of poverty (with the different measures of poverty used here).

What is the relative importance of microfinance and education for poverty reduction?

The table above allows no direct comparison of the magnitude of the coefficients, since the units of the measurements differ. For the purpose of such a comparison, a simulation exercise was performed. Taking the means of GLPPC and EDU across all observations and assuming an increase by the factor 2 of microfinance gross loan portfolio, the equivalent percent increase of the government expenditure share on education can be calculated. This increase amounts then to a percentage change of +15.2 %. Applying these increases equivalently to the coefficient gives us the expected average change in the dependent variable. It has to be noted that this exercise has the only purpose of making the two determinants comparable in order to estimate their relative importance. The figures obtained have no practical usability due to the aggregation level and the ignorance of further determinants. Moreover, the strong assumption of a linear relationship is not likely to hold. Table 12 reports the outcomes of such a simulation exercise.

¹⁰ Since Twoway FE effects using a yearly panel have not been conducted by these authors, these findings cannot be compared.

TABLE 12: EXAMPLES OF A COMPUTATIONAL SIMULATION
ASSUMING AN INCREASE BY \$US 47.45 OF THE EXPENDITURES DISBURSED TO THE TWO DETERMINANTS

Model	Poverty headcount ratio		Poverty gap		Squared poverty gap	
	GLPPC	EDU	GLPPC	EDU	GLPPC	EDU
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
RE	-1.22***	-0.56***	-0.50***	-0.17***	-0.13***	-0.04***
RE with controls	-0.49**	-0.53***	-0.26***	-0.18***	-0.07***	-0.04***
Oneway FE	-1.11***	-0.61***	-0.46***	-0.20***	-0.12***	-0.05***
Oneway FE with controls	-0.21	-0.60***	-0.18**	-0.20***	-0.04*	-0.04***
Twoway FE	0.40	-0.44**	0.28**	-0.11**	0.03	-0.03*
Twoway FE with controls	0.42	-0.50**	0.23*	-0.13***	0.03	-0.03**

Table 12 summarises examples obtained from computational exercises assuming an increase of \$US 47.45 per capita disbursed to the two action fields of policy via microfinance gross loan portfolio and government expenditures on education from the different estimation approaches. The figures stem from using the coefficients presented in the main results part in Table 4, Table 5, and Table 6. An increase of \$US 47.45 corresponds in average to a doubling of GLPPC and to an increase of about +15.2 % for EDU. The methodology used to obtain the figures is also described in part 5.1.1. The interpretation is as follows: Column (i) and (ii) give the expected average decrease in percentage points for poverty headcount ratio and column (iii) and (iv) the expected average decrease in percentage points for the poverty gap when the respective determinant experiences an increase of \$US 47.45. Column (v) and (vi) show how squared poverty gap changes accordingly.

The respective results were significant with * significance at the 10 % level, ** significance at the 5 % level, *** significance at the 1 % level.

Generally, the results for the effects from the two determinants are within the same range. With a closer look on the magnitudes, the answer to the question whether there is a greater impact from the one or the other is not unequivocal. When disregarding the results from the Twoway FE model, the effect of GLPPC on the poverty measure is larger in eight out of twelve cases. Microfinance seems to matter especially for poverty gap. However, when controlling with GDP and domestic credit, education exhibits in half of the cases the larger impact on the poverty measures. Based on these findings and considering the limitations pointed out, advocating for the one or the other policy area as the more relevant field for poverty reduction is hence not appropriate. Two suggestive findings can nevertheless be drawn from it: Firstly, the importance of the two fields are comparable and secondly, to achieve a similar effect on poverty, the relative increase needed for gross loan portfolio (factor 2) is much larger than the relative increase needed in terms of government expenditure on education (factor 1.15).

In light of these findings, it is worth to note the shortcomings of this thesis. First of all, the quality of each of the two determinants has not been considered. Secondly, the unbalanced panel might have an effect on the results. And thirdly, the assessment of potential endogeneity between poverty and microfinance might not be sufficient to rule out simultaneity bias. The advantage of the present thesis is that it takes into account education as a determinant of poverty, which has to the best of the author's knowledge not been considered in studies assessing the linkage of microfinance to poverty reduction. Another asset of the thesis is that it uses the new measures of poverty with a poverty line at \$US 1.90 instead of the former line at \$US 1.25 a day. The findings of the thesis point out that governments and international development cooperation organisations, such as GIZ, should not neglect the one or the other policy fields. The popularity gains microfinance has experienced in recent years might have side-tracked efforts towards microfinance and away from efforts that are fundamental to poverty alleviation in a long term and in a sustainable way. Long term effort in policy areas such as education should not suffer from the attention given to instruments battling the symptoms. This does not implicate that these two fields are not complementary. Aligning the two policy areas could then even be more fruitful than a competition for the goal of poverty alleviation. To what extent and how this can be made is left for further investigation.

For future research on microfinance, interesting starting points can be to take into consideration further possible determinants of poverty, such as efforts to improve and expenditures on infrastructure or the health system. Regional contexts and effects over time should thereby be accounted for. This would allow a weighting of the importance of different policy fields and help to direct financial resources to the most effective domains relevant for poverty reduction. A further pathway for future research is to come up with a strategy that is able to address the issue of endogeneity between microfinance provision and poverty levels. Finally, two interesting ideas could be to look at interaction effects and to assess temporally lagged effects between education and microfinance for the purpose of poverty alleviation. The logic here would

be that the poor can only benefit from microfinance when a certain education level is assured and microfinance might poverty more through a long-term relationship.

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APPENDIX

A.1 OVERVIEW OF DATA BY COUNTRY AND DATA AVAILABILITY

TABLE 13: OVERVIEW OF DATA BY COUNTRY AND DATA AVAILABILITY, 1999 - 2013

Country	Regional country group	Observations	Mean of pov. headcount r.	Mean of poverty gap	Mean of GLPPC	Mean of EDU
Albania	ECA	2	1.67	0.28	33.76	3.10
Armenia	ECA	12	4.85	0.96	146.79	2.89
Azerbaijan	ECA	4	0.00	0.00	7.84	3.22
Bolivia	LAC	9	18.04	10.22	133.62	6.45
Brazil	LAC	10	8.46	3.71	3.03	4.83
Bulgaria	ECA	9	1.91	0.70	53.75	3.90
Cambodia	SEA	3	23.77	5.51	40.75	1.97
Cameroon	SSA	2	26.20	7.20	4.12	2.99
Colombia	LAC	15	12.76	5.79	40.08	4.23
Costa Rica	LAC	2	5.85	3.09	3.51	4.98
Côte d'Ivoire	SSA	2	26.03	8.68	2.14	4.27
Dominican Republic	LAC	3	5.53	1.77	10.09	1.95
Ecuador	LAC	5	13.75	5.86	62.69	3.05
El Salvador	LAC	9	8.26	3.04	41.47	3.23
Georgia	ECA	10	16.18	5.35	76.44	2.62
Guatemala	LAC	2	11.52	3.97	10.53	2.95
India	SA	3	30.36	6.85	2.30	3.41
Indonesia	SEA	4	20.56	3.97	17.18	2.81
Kazakhstan	ECA	7	0.66	0.12	8.88	2.64
Kyrgyz Republic	ECA	13	16.28	4.00	30.79	5.38
Madagascar	SSA	3	68.96	31.26	0.56	3.29
Mali	SSA	2	53.59	19.05	4.30	3.95
Mexico	LAC	7	6.31	2.02	10.65	4.75
Moldova	ECA	9	3.19	0.69	19.81	8.02
Mongolia	SEA	4	3.31	0.70	268.64	5.29
Nepal	SA	2	31.02	8.91	3.67	3.92
Niger	SSA	2	61.18	21.33	1.00	4.11
Pakistan	SA	4	14.02	2.37	1.33	2.28
Panama	LAC	3	6.74	2.37	23.64	3.54
Paraguay	LAC	8	7.71	2.79	48.01	4.09
Peru	LAC	15	10.60	3.60	103.78	2.96
Philippines	SEA	4	15.92	3.65	3.06	2.87
Romania	ECA	9	2.23	0.52	11.02	3.53
Senegal	SSA	2	43.08	14.27	7.07	4.22
Serbia	ECA	4	0.16	0.03	91.70	4.64
South Africa	SSA	4	22.49	7.39	15.62	5.34
Sri Lanka	SA	2	2.06	0.34	23.38	1.89
Tajikistan	ECA	4	15.35	4.11	22.04	3.18
Togo	SSA	2	54.87	22.13	16.17	4.05
Uganda	SSA	2	37.35	11.65	7.68	2.99
Ukraine	ECA	4	0.40	0.07	3.40	5.79
Vietnam	SEA	3	8.06	1.88	51.73	5.83

TABLE 14: REGIONAL COUNTRY GROUPS

ECA	LAC	SEA	SSA	SA
Albania	Bolivia	Cambodia	Cameroon	India
Armenia	Brazil	Indonesia	Côte d'Ivoire	Nepal
Azerbaijan	Colombia	Mongolia	Madagascar	Pakistan
Bulgaria	Costa Rica	Philippines	Mali	Sri Lanka
Georgia	Dominican Republic	Vietnam	Niger	
Kazakhstan	Ecuador		Senegal	
Kyrgyz Republic	El Salvador		South Africa	
Moldova	Guatemala		Togo	
Romania	Mexico		Uganda	
Serbia	Panama			
Tajikistan	Paraguay			
Ukraine	Peru			

A.2 CORRELATION MATRIX

TABLE 15: PAIRWISE CORRELATION MATRIX OF MAIN VARIABLES AND INSTRUMENTAL VARIABLES

	Poverty headcount ratio	GLPPC	Ratio of borrowers	EDU	GDPPC	Domestic Credit	Time to enforce a contract	5-year lag of w. GLPPC	5-year lag of w. ratio of borrowers
Poverty headcount ratio	1								
GLPPC	-0.38***	1							
Ratio of borrowers	-0.22***	0.67***	1						
EDU	-0.16**	0.15**	0.09	1					
GDPPC	-0.69***	0.17**	0.02	-0.08	1				
Domestic Credit	-0.17**	0.15**	0.04	0.25***	0.40***	1			
Time to enforce a contract	0.15*	-0.12*	-0.11	-0.11	0.17**	0.14***	1		
5-year lag of w. GLPPC	-0.16	0.41***	0.61***	-0.21*	-0.04	-0.06	-0.08	1	
5-year lag of w. ratio of borrowers	-0.13	0.18	0.60***	-0.17	0.09	-0.0968	-0.08	0.62***	1

* significance at the 10 % level, ** significance at the 5 % level, *** significance at the 1 % level

A.3 RESULTS OF THE FIRST STAGE OF THE 2SLS REGRESSIONS

TABLE 16: FIRST STAGE RESULTS FOR THE ROBUSTNESS CHECK USING A 2SLS STRATEGY

Explanatory variables	Log of GLPPC		Ratio of borrowers	
	(i)	(ii)	(iii)	(iv)
Contract enforcement time	-0.001*	-0.001	-0.0001	-0.0002
	(0.00)	(0.00)	(0.00)	(0.00)
Log of weighted. 5 year-lag of GLPPC	0.283***	0.071		
	(0.54)	(0.06)		
Weighted 5 year lag of borrower			0.011***	0.010***
			(0.00)	(0.00)
Gov. exp. education	0.048	0.199	0.083***	0.072***
	(0.08)	(0.15)	(0.02)	(0.03)
Log of GDP per capita		1.031***		0.136*
		(0.01)		(0.08)
Domestic credit		-0.012		0.001
		(0.01)		(0.00)
Constant	2.669***	-5.522*	0.022	-1.092
	(0.52)	(3.19)	(0.18)	(0.70)
Obs.	114	114	114	114

Table 16 reports the estimates from the first stage of the 2SLS panel regressions with random effects. The dependent variables are log of GLP per capita and ratio of borrowers respectively. The independent instrumental variables are contract enforcement time, a weighted 3-year lag of average GLPPC or number of active borrowers respectively government expenditure on education (as % of GDP), log of GDP per capita and domestic credit to private sector (as % of GDP). For the regressions, countries in the regions of Sub-Saharan Africa, Latin America and the Caribbean, South-East Asia, South Asia, Europe and Central Asia are used and the years from 1999 to 2013 are considered. The standard errors are reported in parentheses and are heteroskedasticity adjusted.

* significance at the 10 % level, ** significance at the 5 % level, *** significance at the 1 % level