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The Impact of Financial Inclusion on Poverty in Low-and Middle-Income Countries.

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The Impact of Financial Inclusion on Poverty in Low- and Middle-Income Countries

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Executive Summary

The purpose of the study is to investigate the effects of financial inclusion on poverty in low- and middle-income countries.

It contributes to the existing literature by 1) developing a financial inclusion measure which uses available cross-country data, 2) focusing on low- and middle-income countries specifically and 3) understanding the link between financial inclusion and poverty in low- and middle-income countries.

A large body of economic literature supports the view that through the availability of finance, investments can be made that increase the productivity of an individual or an enterprise which in turn promotes growth. One can apply this concept also on the very poor who can increase their income through investing in a small business.

The financial inclusion index of this paper contains both the access to as well as the usage of financial products. The empirical analysis focuses on the impact of financial inclusion, along with other control variables, on different measures of poverty.

The results using the fixed effects estimation show that financial inclusion has an alleviating effect on poverty in low- and lower middle-income countries. The absolute reduction in the poverty headcount ratio of 5,50 USD per day is greater than the one at 1,90 USD per day. The negative effect of financial inclusion on poverty holds true under different robustness checks.

It is therefore recommended to encourage financial inclusion through policies and a sound regulatory framework, in order to give the very poor the opportunity to invest in productive business ideas and grow their own businesses.

Also, the range of financial products should be broadened to meet the specific needs of the clients, which may be special savings, loans or insurance products.

The empirical results also reveal other determinants which have an alleviating effect on poverty. Especially education, internet access and trade openness have a significant negative effect on the different poverty measures. Contrary to the endogenous growth theory, external factors, such as net official development aid, also affect the poverty measures.

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Abbreviations

E.g.	For example
Et al.	And others
GDP	Gross Domestic Product
GNI	Gross National Income
ILO	International Labour Organisation
MFI	Microfinance Institution
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PPP	Purchasing Power Parity
PPP	Purchasing Power Parity
SDG	Sustainable Development Goal
UNDP	United Nations Development Programme

1. Introduction

Recently, financial inclusion has gained much attention by policymakers, for instance in development cooperation, as well as in the academic field. With increasing inequality and social divides, the support of financial integration is viewed as a means of closing income and social imbalances.

There is a clear upward trend in the number of people with access to financial products, for example through Microfinance Institutes (MFIs) and instruments like financial technology and mobile banking. This enables a better access to financial products, like micro credits, micro insurances and micro savings. There has been a remarkable increase in banked adults over time. According to the World Bank (2019) In 2011, 51% of the adults worldwide had access to a bank account, whereas 69% of all adults were banked in 2017.

At the same time, poverty is one of the core problems of every economy all over the world. According to the most recent estimates of the World Bank (2019), in 2015, 10 percent of the world's population lived on less than 1,90 USD a day. More than half of the extreme poor live in Sub-Saharan Africa.

In the "2030 Agenda for Sustainable Development" of the United Nations (2015), promoting financial inclusion and closing income gaps is a main target, especially through the commitment to the "Financial Inclusion Action Plan". This is a commitment of the G20 to promote financial inclusion in a way that is beneficial for all countries and people, including the poor, women, young people and the rural population. One of the main goals is the mainstreaming of financial inclusion and also increased access and usage of financial services to the poor, by strengthening the emphasis on underserved and vulnerable groups.

Mostly, financially excluded people stem from the bottom of the income pyramid. In this context, one must raise the question if there is an effect of financial inclusion on poverty and how great this effect is. Understanding the link between financial inclusion and poverty at the country level will support policymakers to create and implement programs that will broaden access to financial services.

The given paper is therefore divided into six sections, of which the introduction is the first section. Section 2 represents a literature review, where the state of the arts of existing literature on financial inclusion, poverty and the relation between the two is covered. The third section follows up with the methodology and in section 4 the empirical results are presented. Finally, section 5 comprises some robustness checks and section 6 finishes with a conclusion of the research as well as with policy recommendations, followed by section 7 covering directions of future research.

2. Literature Review

2.1 Poverty

Poverty is not only resulting from a single factor, but often considered as a multidimensional issue. Economic, social and political determinants are the reason for its creation as well as for its alleviation. In the following, some approaches to define poverty are presented.

One possible, earlier definition of poverty, mostly used in welfare economics, is the income or consumption approach. Here, well-being is measured in terms of income, consumption or expenditure with their monetary value. This approach puts a special focus on the fulfilment of material needs, as stated by Ravallion and Bidani (1994).

Furthermore, Streeten (1982) comes up with the basic human needs approach of defining poverty. It extends the upper concept of the income or consumption approach to basic human needs, which include nutrition, health, sanitation, education, mortality, life expectancy and others. It is considered as an improvement to the latter indirect approach to poverty, since this method of defining the poor bases on direct, adequate levels for each of the different basic human needs. Streeten also argues that the basic needs are not a welfare concept in the first line, however, improved education and health can contribute significantly to increase productivity.

Sen (1993) expands the knowledge about poverty by the capabilities approach, which equals poverty to the capabilities a person has in order to achieve different valuable functionings as part of living. The capability of the person represents the various combinations of functionings a person has access to, meaning what he or she can or cannot do; whereas functionings reflect parts of the state of the person, that is the things that a person is or is not doing. Whereas taking a person's income captures only a single input to an individuals' capability and functioning rather than a complex arrangement of inputs. Sen's definition of poverty assumes a large set of entitlements, such as nutrition, food, education and health, to which people should have access, so that their capabilities are increased and their functioning in a society is guaranteed. Also, individuals can greatly differ between their ability to translate the same resources into valuable functionioning.

Besides, Chambers (1995) includes issues of powerlessness, isolation and vulnerability into the epistemology of poverty. His participatory approach relies on local perceptions and understandings, where poor people are engaged in defining and conceptualising the definition of poverty. Here, the definition of deprivation, as perceived by poor people, places a higher weight on the social elements of poverty, such as dignity, security, justice or power, than on the physiological elements.

Later, the social exclusion approach by Figueiredo, Gore and Rodgers (1995) expands the existing theory on poverty. Following this approach, poverty may also be understood as experienced as inequitable social relationships, a facet of asymmetrical social status and a low capacity to develop significant associates with other people in society. The poor are therefore defined as those with a lack of resources to participate in activities and enjoy the living standards, which are widely accepted in the society. It also creates a stronger emphasis on multiple forms of exclusion, such as the exclusion in legal systems, markets, communities or in the family.

Parallel to these developments, the concept of social capital, such as by Coleman (1988) has gained attention as a new analytical concept, emphasising the importance of social networks to overcome poverty. Criticism on this approach is that poverty can be understood as the non-existence of linking social capital, such as Woolcock and Narayan (2000) bring up. There is a lack of vertical relations between people in different levels of the income pyramid, such as the

poorer and the more influential. Another point of criticism is the decrease of bonding social capital, that is the weakening ties connecting immediate family members of poor families, colleagues or friends.

Three major shifts in thinking about poverty have become popular in the early 2000s. The concept of poverty has broadened, with an increasing focus on inequality, vulnerability and human rights.

Shaffer (2008) focuses on the analysis of the causality and includes variables such as environmental, political, cultural and social capital. The third shift is a deepening in the causal structure to focus on flows into and out of poverty, and not solely on the development of the stock of poverty.

Recently, researchers re-focus on the importance of the analysis of poverty at the macro-level. For example, Beck, Demirgüç-Kunt and Levine (2007) measure poverty in their analysis in terms of the growth of the headcount poverty ratio, which is the percentage of people in a society living below a certain income per day. Similarly, in their paper on the impact of financial inclusion on poverty, Schmied and Marr (2016) distinguish between three different possible measures, which are poverty incidence, the poverty gap index and poverty severity, following the income or consumption approach.

2.2 Financial Inclusion

Financial inclusion is often understood as the provision of micro credits, insurances or micro-saving accounts to populations without access to financial products.

The concept of financial inclusion covers a broad range of conditions that need to be given. According to Sarma (2008), financial inclusion is the both the access, the availability and the usage of a proper and formal financial system for all individuals and participators of an economy. Mubiru (2012) categorises financial inclusion as an aspect of social inclusion, which is the possibility for members of an economy to actively be part of economic and social advancements, both to benefit from it and to contribute to it.

Other researchers, such as Amidžić, Massara and Mialou (2014) define financial inclusion as an economic state where individuals and firms are not denied access to basic financial products and services. These services can be remittances, payments, savings and insurance services. In accordance to this definition, any means of financial inclusion has not solely to be accessible, but also affordable to the excluded borrowers as well as practicable in usage. It should also ensure a reduced dependence on informal money lenders over time and a smooth integration and inclusion into the formal banking network.

In this context, the World Bank (2019) differentiates between voluntary and involuntary exclusion, since there can be members of the economy that choose not to make use of financial services and exclude themselves voluntarily. This may be due to no special need of the usage or because their cultural or religious background does not allow the usage of certain financial products. On the other hand, the case of involuntary exclusion may exist because of a high-risk profile or insufficient income and wealth of the client, or because of market failures or market imperfections. Parc and Mercardo (2015) argue that appropriate programs can address the issue of involuntary exclusion and can correct market failures and imperfections.

Typically, financial exclusion is higher in rural than in urban areas, since the density of bank branches is much lower in remote areas. The higher distance between bank branches makes the access more difficult for people living there. In addition, the profit potential in those areas resulting from a lower level of economic activity makes rural areas unattractive for banks. Also, the education level and therefore the level of financial literacy is usually lower in remote areas,

as stated by Hussaini and Chibuzo (2018), so that clients are less likely to make use of financial products.

Former research, as stated by Dashi, Lahaye and Rizvanolli (2013), has also shown that financial services are typically not offered due to an inconvenient regulatory framework or an inflexible product structure.

Moreover, Honohan (2008) tested country characteristics that may have an influence on financial access. In his assessment, he found that variables such as aid as a percentage share of gross national income (GNI), population density and the age dependency ratio significantly reduce financial access. According to his study, variables that increase financial access significantly are mobile phone subscriptions and the quality of institutions.

In order to measure financial inclusion, various researchers have constructed different financial inclusion indices. One example is the composite indicator of Amidžić et al. (2014), who include variables of the geographic and demographic coverage, the usage of deposit and lending financial products, and quality. The latter consists of assessments of disclosure requirements, dispute resolutions and the cost of usage, such as interest payments. Another, much simpler, financial access indicator by Honohan (2008) is the fraction of the adult population in a given economy with access to formal financial intermediaries. In case of no available data on individual's financial access, the indicator is derived using information on bank account numbers. Beck et al. (2007) use the broader concept of financial development and the measure of private credit, which is the fraction of private sector credit over the GDP. Private sector credit does not include credits by the central bank or by development banks and captures the transformation of credit by savers through banks to private firms.

The concept of financial inclusion can be classified as part of financial development in general. Levine (2005) states that financial contracts, markets and intermediaries are needed because of the costs of making transactions, enforcing contracts and acquiring information. Throughout history, various types and combinations of transaction costs, information and enforcement, together with various legal, regulatory and regulatory systems produced different financial contracts, markets as well as intermediaries in different countries. Also, the development of bond and stock markets, as part of the financial development, may greatly change the extend and the products people use to allocate their savings.

The allocation of resources across space and time is in this context a natural consequence of combating market frictions, as described by Merton and Bodie (1995). The emergence of banks clearly modifies the allocation of credit through the improved information about firms. Additionally, the confidence in the repayment of loans by firms will rise among investors through the use of financial contracts. This, in turn, is likely to impact people's decision of how to allocate their savings.

There are various ways of how to classify the functions provided by the financial system. Merton and Bodie (1995) distinguish six core functions: The financial system provides means to clear and settle payments that facilitate trade, to pool resources and therefore to subdivides shares in firms and to provide ways to manage risk. It also provides ways to transfer economic sources across time, borders and industries, it provides price information and it provides means of how to solve incentive problems.

Levine (2005) concentrates on the following five functions, where the first two are the provision of information about possible investments beforehand and allocate financial resources and the monitoring of investments and exertion of corporate governance after providing finance. Through financial systems the trading, diversification and management of risk is facilitated, savings are mobilised and pooled and the exchange of goods and services is facilitated.

Even though all financial systems provide these core financial functions, there are big differences in the quality of how these functions are provided. So, financial development takes place when financial instruments, markets and intermediaries provide those functions in an improved way. Each of the stated functions may have an impact on investment and savings decisions.

Financial sector development thus takes place the effects of information, enforcement, and transaction costs are eased by financial intermediaries, instruments and markets and therefore provide the core functions of the financial sector in the economy in a better way. According to the World Bank (2019), a proper measurement of financial development is important to assess the development of the financial sector and to understand the influence of financial development on economic growth and poverty reduction. In practice, however, it is difficult to measure financial development as it is a enormous concept including several dimensions.

Čihák, Demirgüç-Kunt, & Levine (2012) develop a framework which identifies four sets of proxy variables characterising a well-functioning financial system: financial depth, access, efficiency, and stability. In this context, financial depth is the size of financial institutions and markets and financial access is the extend to which people can and also make use of financial services. Efficiency represents the efficiency of financial intermediaries and markets when facilitating transactions and providing means to intermediate resources and the stability is the stability regarding financial institutions and markets.

Here, it can be seen that the concept of financial inclusion is part of the broader concept of financial development. In particular, financial inclusion is one dimension of financial development, since it considers rather the access, availability and usage of financial products and services.

2.3 The Impact of Financial Inclusion on Poverty

Even if financial inclusion gained attention in the international political environment, such as on the agenda for sustainable development of the United Nations, economic literature and research has not yet covered all dimensions and effects of financial access. Many studies focus on the effective and efficient measures of financial inclusion at country and household levels. Some researchers analyse the effect of financial inclusion on lowering income inequality or poverty, while others investigate varying levels of financial inclusion in developing economies compared to advanced economies. All these papers make up a foundation in this field and build a good basis and benchmark for further research. Papers assessing the effect of financial inclusion on poverty are still rare, as stated by Schmied and Marr (2016).

Beck et al. (2007) look at the effect of financial inclusion on poverty, by taking the income growth of the lowest income share as well as the headcount growths of people living of less than 1 USD per day as the dependent variable. The variable for financial inclusion is measured by the share of private credit over the GDP. They found a significant positive relationship between private credit and poverty alleviation. Further than this, they also found a disproportional benefit of financial inclusion for the poor compared to the rich, resulting in a lower income inequality.

A study by Ellis, Alberto and Juan-Pablo (2010) shows that households with access to financial products and services are enabled to invest in activities contributing to a higher future income and, as a consequence, to growth. Even in the poorest income groups, borrowing and saving decisions take place for a variety of investment purposes.

Other researchers, such as Burgess and Pande (2005), analyse if the state-led expansion of rural bank branches in India had a negative effect on poverty. They find a robust negative impact of

newly opening bank branches in rural and unbanked areas in India with rural poverty rates in those locations.

Inoue (2011) points out that main formal financial services comprise loans, savings, insurance, payments and also remittances. When having no access to these formal services, individuals oftentimes depend on costly informal financial sources. Financial exclusion is therefore likely to put a high cost burden on people with a low income.

Morawczynski and Pickens (2009) analyse the adoption, usage and the impact of mobile money in Kenya. The basis for their findings is an ethnographic study which has been made in a slum, called Kiberia, in 2007. They find that incomes of rural mobile money owners have augmented because of the reception of remittances, which also resulted in higher savings by the households.

In the same light, Andrianaivo and Kpodar (2011) study the effect of information and communication technology (ICT) and financial inclusion on growth in Africa, using data on a country-level from 1988 to 2007. Their analysis focuses on the impact of mobile phone rollout on economic growth, especially through the channel of financial inclusion through the mobile phone development. The results show that ICT, mobile phone development included, is a significant contributor to economic growth in Africa. Here, financial inclusion plays a key role in this positive influence of mobile phone development on economic growth

Further than this, Bruhn and Love (2009) analyse the impact of the provision of financial products to individuals with a low income on their employment, entrepreneurial activity and their income. Using cross-municipality and cross-time variation and a difference-in-difference strategy, they measure those effects during the opening of Banco Azteca in Mexico. In 2002, this bank opened over 800 branches within the same year that all targeted low-income groups. Their study reveals that the number of informal businesses increased by 7,6% and the employment rate has increased by 1,4% within two years, and so, in a nutshell, including low-income individuals contributes to economic growth.

Moreover, Mwaitete and George (2018) assess financial inclusion and economic growth in Tanzania. They found that when more people have access to financial services, the economic growth measured by GDP, will reflect this significantly. However, increased economic growth does not necessarily imply a positive effect of financial inclusion on poverty. Further than this, Kelkar (2010) finds in his study that improved financial inclusion will radically decrease the farmers' indebtedness, which is one of the major reasons of farmers' suicides. Similarily, Brune Giné, Goldberg and Yang (2011) focus on rural banks in Malawi and find that increased financial inclusion through commitment saving accounts improves the access to savings for agricultural input use and therefore improve the well-being of households in poverty.

Honohan (2008) assesses the cross-country link with data from 160 countries between poverty and financial access and observed that financial access significantly reduces poverty. However, his result is solely valid under the condition that financial access is the only regressor, which means including other variables as regressors reduces the significance. Also, Hussaini and Chibuzo (2018) found a negative effect of financial inclusion on poverty in Nigeria.

Schmied and Marr (2016) assessed the relationship of financial inclusion and poverty in Peru. In their studies, financial inclusion has a small, but eradicating effect on different measures of poverty. In their study, they made use of three different measures of poverty: Poverty incidence, a poverty gap index and poverty severity. However, the coefficients and therefore the impact of information and communication technology, like the internet, has a larger effect on poverty reduction in Peru.

This paper extends the existing literature with a unique financial inclusion index and a focus on low- and middle-income countries, as well as by taking various measures of poverty into account.

3. Empirical Methodology and Data Sources

In the following chapter, the complete methodology, including the selection and description of data as well as the hypothesis development, will be explained.

3.1. Data

This analysis focuses on low- and middle-income economies, taking the World Bank's income classifications, which divides the world's economies into four income groups: low, lower middle, upper middle and high.

The thresholds to distinguish between the income groups have been adjusted for prices over time. As of 2018, low-income economies are per definition those with a GNI per capita less or equal to 995 USD; lower middle-income economies have a GNI per capita between 996 USD and 3.895 USD; upper middle-income economies are those between 3.896 USD and 12.055 USD; high-income economies are all economies with a per capita GNI of greater or equal to 12.055 USD. Hence, economies with a GNI per capita below 12.055 USD will be considered in the analysis.

The countries considered in this research are Argentina, Armenia, Benin, Burkina Faso, Bosnia and Herzegovina, Belarus, Bolivia, Brazil, China, Cameroon, Republic of Congo, Colombia, Costa Rica, Dominican Republic, Algeria, Ecuador, Gabon, Georgia, Guatemala, Honduras, Indonesia, India, Islamic Republic of Iran, Kazakhstan, Kyrgyz Republic, Lebanon, Moldova, Mexico, Montenegro, Mongolia, Mauritania, Malaysia, Nicaragua, Pakistan, Panama, Peru, Paraguay, Senegal, Sierra Leone, El Salvador, Chad, Togo, Thailand, Turkey, Tanzania, Ukraine, Vietnam, South Africa and Zimbabwe.

```
Country:  1, 2, ..., 49                                    n =        49
   Year:  2011, 2014, ..., 2017                            T =         3
          Delta(Year) = 1 unit
          Span(Year)  = 7 periods
          (Country*Year uniquely identifies each observation)

Distribution of T_i:   min      5%     25%       50%       75%     95%     max
                         1       1       1         2         3       3       3

     Freq.  Percent    Cum. |  Pattern*
 ---------------------------+-----------
       17     34.69   34.69 |  111
       14     28.57   63.27 |  1..
        9     18.37   81.63 |  .1.
        7     14.29   95.92 |  11.
        1      2.04   97.96 |  ..1
        1      2.04  100.00 |  1.1
 ---------------------------+-----------
       49    100.00         |  XXX
 ---------------------------+-----------
 *Each column represents 3 periods.
```

Table 1: Panel data properties
Data: World Bank, UNDP, International Labour Organisation, OECD

The data, as described in table 1, is made up of a total of 49 countries and three time periods. Concerning the structure of the data, for 17 countries, data on all years are available, while for 14 countries data are only available in the first year, for 9 countries only in the second and for one country only in the third year. For seven countries, data are available for the first two years and for one country in the first and the last.

3.1.1 Poverty

There are different ways to measure poverty based on the income or consumption approach. One measure is the poverty headcount index, which is, according to the World Bank (2005), the share of the population not being able to afford a predefined food basket. However, this measure is limited since it does not take into account how poor the poor are. It can be expressed as the simple ratio of the number of people living below a predefined poverty line N_P and the total population size N:

$$P_1 = \frac{N_P}{N} \qquad (1)$$

Secondly, the poverty gap index, a more sophisticated concept, does not only count poor households, but it takes into account to which extent they fall under the poverty line, and therefore both the incidence of poverty as well as its depth. The poverty gap G needs to be defined beforehand.

$$P_1 = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{G_n}{z}\right) \quad with \quad G_n = \left(z - y_j\right) I\left(y_j \leq z\right) \qquad (2)$$

Here, N is the population size, z is the poverty line, y_j is household j's income and I(.) is an indicator that equals to one if the expression in the bracket is true and zero otherwise. The World Bank's poverty gap, for instance, is the mean shortfall of the total population from the poverty line at either 1,90 USD per day, 3,20 USD per day or 5,50 USD per day. The non-poor have zero shortfall.

Another possible measurement is the concept of poverty severity and simply averages the squares of the poverty gap index. It is part of the Foster-Greer-Thorbecke type of poverty defined by Foster, Greer and Thorbecke (1984).

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{G_n}{z}\right)^{\propto} \quad with \quad \propto \geq 0 \qquad (3)$$

The exponent α serves as a parameter that defines the weight on the position of the poorest.

Alternatively, one can use the Sen-Shorrocks-Thon index to measure poverty. This measure allows one to decompose poverty into three components of the poverty incidence, the poverty depth and the inequality among the poor. It is defined as:

$$P_{SST} = P_0\, P_1^P\, (1 + G^P) \qquad (4)$$

where P_0 is the headcount index, P_1^P is the poverty gap index for the poor only, and G^P is the Gini index for the poverty gaps for the whole population as described by Sen (1976).

There are also some other indexes, such as the distribution-sensitive poverty measure proposed by Watts (1968) or a poverty statistic which considers the time to exit by Morduch (1998). The latter may be calculated by dividing the Watts Index by the growth rate of income or expenditure of the poor.

This analysis focuses on first two of the above-described measures using the income approach of defining poverty for each country i at time t. The headcount ratio and the poverty gap at 1,90 USD/day or also at 5,50 USD/day, as defined by the World Bank (2019), are taken as measures of poverty. By using the purchasing power parity (PPP) as of 2011, economic variables in different countries are measured so that irrelevant exchange rate variations do not distort the comparison.

	Poverty Headcount Ratio at 1,90 USD a day (%)	*Poverty Headcount Ratio at 5,50 USD a day (%)*	*Poverty gap at 1,90 USD a day (%)*	*Poverty gap at 5,50 USD a day (%)*
Mean	7,833	35,745	2,529	15,265
Standard Error	1,371	2,820	0,487	1,638
Median	3,000	29,000	0,800	10,400
Standard Deviation	13,074	26,904	4,648	15,629
Sample Variance	170,939	723,817	21,601	244,262
Kurtosis	5,012	-0,584	6,921	1,463
Skewness	2,402	0,715	2,686	1,484
Minimum	0,000	0,400	0,000	0,100
Maximum	54,200	94,700	23,200	59,600
Observations	91	91	91	91

Table 2: Summary statistics for the dependent variable poverty
Data: World Bank

As shown in table 2, the poverty headcount ratios as well as the poverty gap exhibit a high variation. On average, 7,83% of the population in the given countries live with less than 1,90 UDS per day and around 35,75% live with less than 5,50 USD per day. Closely related, the poverty gap at 1,90 USD per day averages at 2,53% and the poverty gap at 5,50 USD per day at 15,265%.

Concerning the poverty measures, there is also much variation among countries. To give an example, in all time periods in Belarus, all poverty measures amount to 0%. An example of a high poverty incidence and a high poverty depth is Togo in 2011, where 54,20% of the population live with less than 1,90 USD per day and 90,10% with less than 5,50 USD per day, while the poverty gap at 1,90 USD per day is 23,20% and the poverty gap at 5,50 USD per day amounts to 58,70%.

All measures exhibit a positive skewness, which indicates that the distribution is rather left modal, meaning that there are a few severe cases of poverty, but more moderate ones.

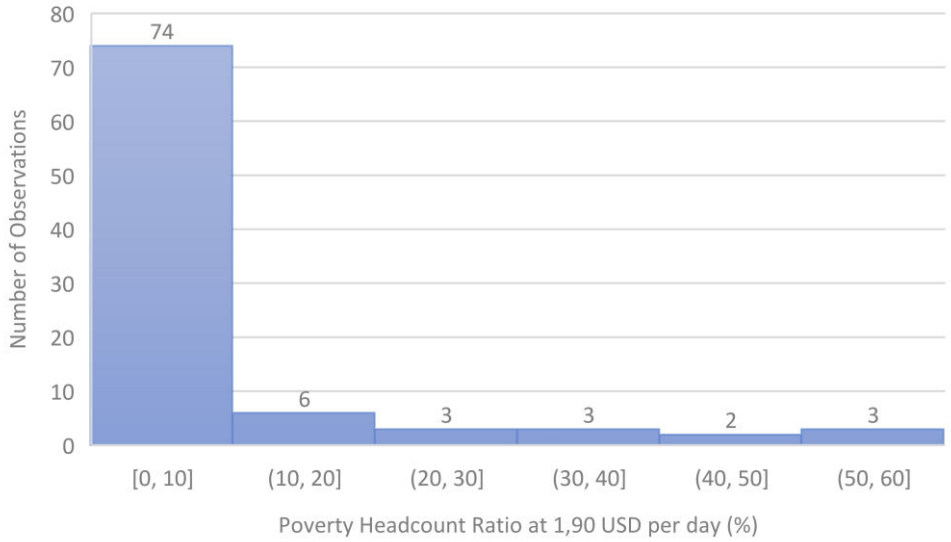

Figure 1: Positively skewed distribution of the poverty headcount ratio at 1,90 USD per day
Data: World Bank

A highly left-modal pattern can be observed when looking at the distribution of the poverty headcount ratio at 1,90 USD per day, as shown in figure 1. Here, 74 observations have a poverty headcount ratio of up to 10%. There are a few extreme cases, for instance 3 observations where more than 50% of the population lives with less than 1,90 USD per day.

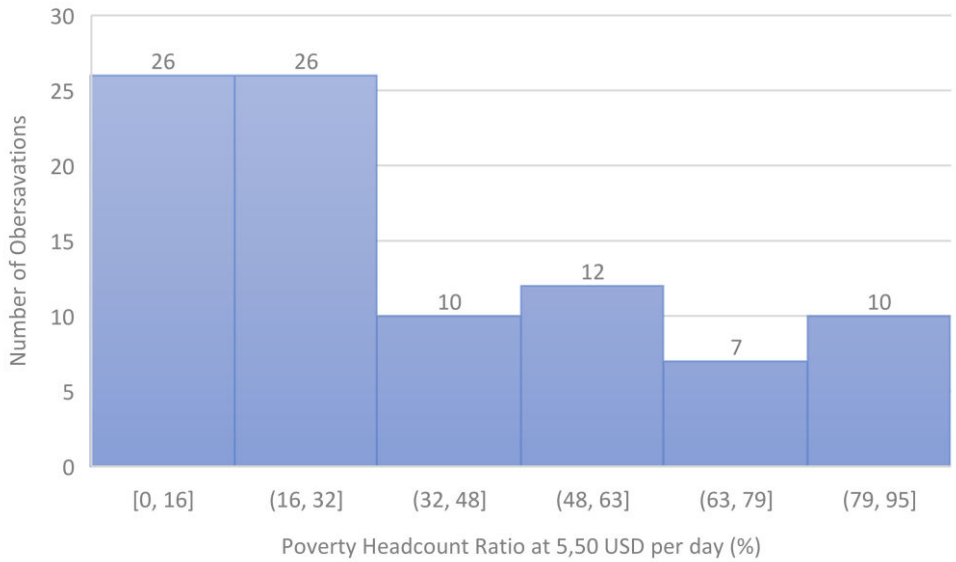

Figure 2: Positively skewed distribution of the poverty headcount ratio at 5,50 USD per day
Data: World Bank

Figure 2 shows the distribution of the poverty headcount ratio at 5,50 USD per day across countries. There are 17 observations that exhibit poverty rate greater or equal to 63% of the population living below 5,50 USD per day. 52 out of 91 observations do have a poverty headcount ratio at 5,50 USD per day of less or equal to 32%. The distributions of the respective poverty gap have a similar pattern, as shown in the appendix.

3.1.2 Financial Inclusion

The basis of the underlying database is the Global Findex Report of the World Bank. Since 2011 data on different dimensions of financial inclusion are gathered through national surveys with approximately 150.000 adults in more than 140 economies. In this analysis, the available data of 2011, 2014 and in 2017 is included.

Given the above-described definition of financial inclusion of Sarma (2008) that covers not only the access, but also the availability and usage of financial inclusion, this paper will also concentrate on a multi-dimensional approach to the concept of financial inclusion.

From the whole lot of possible variables of the Global Findex database, this thesis focuses on a weighted sum of four variables in country i at time t as an index for financial inclusion:

The population share aged 15 of and above with a bank account $\left(\frac{N_{itA}}{N_{it}}\right)$,

the population share aged 15 and above owning a debit card $\left(\frac{N_{itD}}{N_{it}}\right)$,

the population share aged 15 and above that borrowed from a financial institution $\left(\frac{N_{itB}}{N_{it}}\right)$ and

the population share aged 15 and above that saved at a financial institution $\left(\frac{N_{itS}}{N_{it}}\right)$.

$$f_{it} = \frac{1}{4}\sum_{n=1}^{4}(x_{it}) = \frac{1}{4}\left(\frac{N_{itA}}{N_{it}} + \frac{N_{itD}}{N_{it}} + \frac{N_{itB}}{N_{it}} + \frac{N_{itS}}{N_{it}}\right) \qquad (5)$$

Here, f_{it} is the financial inclusion index of country i at time t. The four composite terms are available for each country in each year of the survey, so that the number of observations is maximised.

Each term's weight is 0.25 in order to account both for the access (the first of the two terms) as well as for the usage (the latter of the two terms). This construction ensures that the financial inclusion index lies between 0 and 100, since the components are expressed in percentage points. Thus, the higher the index the more inclusiveness of the individuals in a country in the financial sector.

This approach does not take into account the entire concept of financial inclusion since neither financial services like insurances are included here, nor barriers, such as high interest payments or maintenance costs because data are not sufficient. As already mentioned before, financial inclusion may be defined in a very simple concept, for instance by the provision of loans to people or by the number of people who saved and the general access to services. Therefore, this conceptualisation of financial inclusion can serve as a proxy variable in the analysis, under the assumption that those other financial services, such as insurances, and the barriers, exhibit the same dynamics as loans, savings and the general access to an account.

	Account (% age 15+)	*Debit card ownership (% age 15+)*	*Borrowed from a financial institution (% age 15+)*	*Saved at a financial institution (% age 15+)*	*Financial Inclusion Index*
Mean	42,162	27,071	12,254	13,329	23,704
Standard Error	2,231	1,866	0,672	1,021	1,261
Median	41,349	25,309	11,933	11,913	22,713
Standard Deviation	21,278	17,801	6,414	9,736	12,025
Sample Variance	452,738	316,877	41,141	94,787	144,594
Kurtosis	-0,609	-0,230	1,720	1,359	0,041
Skewness	0,234	0,660	0,983	1,266	0,558
Range	88,523	74,357	34,165	41,983	52,903
Minimum	3,757	0,738	1,498	0,819	3,701
Maximum	92,280	75,094	35,664	42,803	56,604
Observations	91	91	91	91	91

Table 3: Summary statistics for the financial inclusion index and its components
Data: World Bank

Given the data, the differentiation between the access to and the usage of financial products makes much sense, since only one of those variables would not approximate financial inclusion sufficiently. As it can be seen in table 3, on average, 42,16% of the population have an account, out of which 27,07% possess a credit card. About 12,25% of the population borrowed from a financial institution and approximately 13,33% saved at a financial institution. Here, there is much variation between observations as well. For instance, in Senegal in 2011 only 3,76% of the population had a formal bank account, whereas in Iran in 2014 it is 92,28%. The observation with the lowest financial inclusion index is Senegal in 2011 with a financial inclusion index of 3,70%, while Mongolia in 2014 has the highest financial inclusion index of 56,60%.

Also, the sample variance of the population share that saved at a financial institution is much higher than the population share that borrowed from a financial institution.

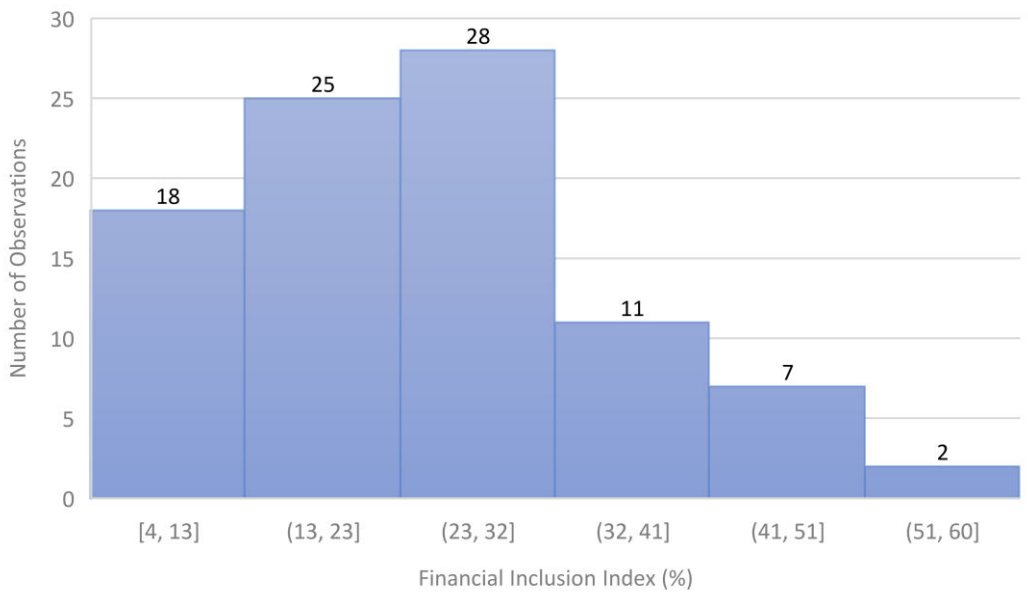

Figure 3: Distribution of the financial inclusion index across observations
Data: World Bank

The financial inclusion index itself as well as all the determinants of the index are positively skewed, meaning that there are a few extremes with a high degree of financial inclusion. Most observations lied in the lower area of the whole range of the financial inclusion index. In figure 3, one can see that 71 out of 91 observations have a financial inclusion index lower or equal than 32%.

	Account	*Debit card ownership*	*Borrowed from a financial institution*	*Saved at a financial institution*
Account	1			
Debit card ownership	0,911	1		
Borrowed from a financial institution	0,537	0,458	1	
Saved at a financial institution	0,618	0,506	0,283	1

Table 4: Correlation matrix of the components of the financial inclusion index
Data: World Bank

The correlations between the different components of the financial inclusion index are described in table 4. There is a high positive correlation (0,911) between the possession of an account and the debit card ownership. Also, there is quite a low positive correlation (0,283) between the share of a population that borrowed at a financial institution and the share of the population that saved at a financial institution.

3.1.3 Other variables included in the regression

To avoid omitting variable bias and to allow for a ceteris paribus analysis, all variables that can possibly determine a countries' poverty gap need to be included in the estimation model. Following the endogenous growth model as proposed by Romer (1994), data for important macroeconomic variables is chosen in this context, as well as some external drivers:

Variable	Abbreviation	Measurement
Poverty	PovH190	Poverty Headcount Ratio at 5,50 USD a day (2011 PPP), (%)
	PovH550	Poverty Headcount Ratio at 5,50 USD a day (2011 PPP), (%)
	PovG190	Poverty Gap at 5,50 USD a day (2011 PPP), (%)
	PovG550	Poverty Gap at 5,50 USD a day (2011 PPP), (%)
Financial Inclusion	FinInc	Financial Inclusion Index (%)
Income	GDPCapita	Gross domestic product (GDP) per capita (1.000 USD)
Education	Educ	Mean Years of Schooling
Technology	Internet	Individuals using the internet (% of population)
Employment	Empl	Employment (% of population)
Rurality	Rural	Rural population (% of population)
Development cooperation	NetODA	Net official development aid (ODA) received per capita (USD)
Trade openness	Trade	Sum of exports and imports (% of GDP)

Table 5: Overview of the variables included

The per capita income proxy is calculated by dividing the gross domestic product (GDP) by the population size for each country in a given year, reported in terms of 1.000 USD.
A proxy for education, determined by the mean years of schooling and provided by the United Nations Development Programme (UNDP), serves as an additional control variable. The UNDP (2019) proposes two different measures to account for education, which are the education index, which is the simple geometric average of the mean years of schooling and the expected years of schooling, and the mean years of schooling. This analysis focuses on the mean years of schooling in the given year as an approximation of the education level, since expectations rather concern the future and not the present.

Following the analysis of Schmied and Marr (2016), the degree of technology, approximated by the share of people in a country who have access to the internet, is included as well. Another variable is trade openness, calculated by the share of trade, that is the sum of exports and imports, of the countries' GDP. The above stated control variables, apart from the variable for education, stem from the World Banks' country database as of 2019.

The variable controlling for employment is based on the data of the International Labour Organisation's (ILO, 2019) computation of the employment-to-population ratio.

Since the estimation model focuses on low-income and lower middle-income countries, additional poverty-related indicators are included in the model, which are the amount of development aid, approximated by the net ODA received per capita, and the degree of rurality, measured by the share of the rural population of the total population. The degree of rurality is

retrieved from the World Bank's Database (2019), and the net ODA received per capita is retrieved from data of the OECD (2019) with population measures of the World Bank (2019). According to the OECD (2019), ODA is defined as government aid with the aim to promote developing countries in their economic development and in welfare.

All variables expressing a share are expressed in percentage values between 0 and 100. Those are the poverty measures, the financial inclusion index, the internet usage, the employment rate, the degree of rurality and the share of trade of the GDP.

	GDP/Capita (1.000 USD)	*Mean Years of Schooling*	*Individuals using the Internet (%)*	*Employment Rate (%)*	*Rural population (%)*	*Net ODA received per capita (USD)*	*Trade (% of GDP)*
Mean	5,657	8,384	37,817	58,869	38,472	43,719	80,076
Standard Error	0,394	0,262	2,067	1,089	1,715	5,196	3,721
Median	5,357	8,200	39,350	59,510	36,330	21,930	73,118
Standard Deviation	3,761	2,495	19,714	10,390	16,358	49,566	35,499
Sample Variance	14,147	6,225	388,643	107,950	267,588	2456,749	1260,193
Kurtosis	-0,426	0,243	-0,839	-0,167	-0,490	0,802	-0,462
Skewness	0,667	-0,500	-0,083	-0,324	0,322	1,125	0,530
Range	14,751	11,400	75,527	48,000	69,695	253,719	145,600
Minimum	0,445	1,400	0,900	34,720	8,251	-49,503	23,934
Maximum	15,196	12,800	76,427	82,720	77,946	204,216	169,535
Observations	91	91	91	91	91	91	91

Table 6: Summary statistics for other explanatory variables
Data: World Bank, International Labour Organisation, UNDP, OECD

Concerning the variables to control for, there is also much variation among the observations, which is shown in table 6. For instance, the GDP per Capita distribution ranges from 445,05 USD in Sierra Leone in 2011 to 15.196,00 USD in 2017 in Panama. There are also high differences in the mean years of schooling that range from 1,4 years in Burkina Faso in 2014 to 12,8 years in Georgia in 2017, with a total average of 8,4 years of schooling.

Also, the access to technology, approximated by the percentage of people using the internet, is unequally distributed among countries, regarding the negative kurtosis. According to Mansour, Jutten and Ohnishi (2000), the notion of kurtosis describes the distribution by measuring extreme values in both tails. Skewness, in contrast, differentiates extreme values in one tail in comparison to the other. So as for the internet usage, there are more extreme outliers compared to a normal distribution. The arithmetic mean of the internet usage lies at 37,82% of the population, where the lowest value is 0,90% in Sierra Leone in 2011 and the highest value amounts to 76,43% in Kazakhstan in 2017.

The lowest employment ratio in the given dataset is observed in Bosnia and Herzegovina in 2011 with an employment-to-population ratio of 34,72%, whereas the highest is observed in Tanzania in 2011 with a ratio of 82,720%. Among the observations, the mean employment-to-population ratio is 58,87%.

Even more remarkable are the differences in the variables for rurality and net ODA per capita. Here, there are quite high standard deviations. On average, around 38,47% of the country's populations live in rural areas. The population is most concentrated in cities in Argentina in

2017, where only 8,25% of the population live in rural areas, while, on the other hand, in Chad in 2011 the vast majority of 77,95% of the population live in rural areas.

The average net official development assistance amounts to 43,72 USD per capita and ranges from -49,50 USD in Panama in 2014 to 204,22 USD per capita in Montenegro in 2011. A negative net ODA per capita results from the fact that the country pays more back than it receives as explained by the World Bank (2019). It does not include development aid provided for other countries.

Finally, the trade as a share of the country's GDP is not equally distributed either: with a mean of 80,08%, it ranges from the lowest observed value of 23,93% in Brazil in 2011 to the highest of 169,53% in Vietnam in 2014.

3.1.4 Statistical Inference

In this section, the relationship between the variables described above will be examined. The main intention of this paper is to find whether financial inclusion has a significant effect on poverty.

	Pov H190	*Pov H550*	*Pov G190*	*Pov G550*	*FinInc*	*GDP Capita*	*Educ*	*Internet*	*Empl*	*Rural*	*Net ODA*	*Trade*
PovH190	1,000											
PovH550	0,789	1,000										
PovG190	0,979	0,721	1,000									
PovG550	0,932	0,955	0,879	1,000								
FinInc	-0,498	-0,620	-0,477	-0,593	1,000							
GDPCapita	-0,497	-0,696	-0,455	-0,629	0,466	1,000						
Educ	-0,694	-0,586	-0,660	-0,679	0,386	0,368	1,000					
Internet	-0,642	-0,737	-0,597	-0,734	0,511	0,700	0,660	1,000				
Empl	0,289	0,200	0,294	0,252	-0,058	-0,097	-0,198	-0,173	1,000			
Rural	0,520	0,669	0,459	0,634	-0,398	-0,701	-0,381	-0,599	0,206	1,000		
NetODA	0,103	0,190	0,118	0,138	-0,265	-0,416	0,148	-0,172	-0,384	0,283	1,000	
Trade	-0,100	-0,103	-0,056	-0,122	0,031	-0,259	0,272	-0,105	-0,032	0,284	0,336	1,000

Table 7: Pearsons correlations between all variables
Data: World Bank, International Labour Organisation, UNDP, OECD

Table 7 shows the correlations between all variables considered. The correlation coefficients between financial inclusion and all possible poverty measures are all negative. The correlation using the different poverty measures at 5,50 USD per day are a bit higher than the ones at 1,90 USD per day. The poverty headcount ratio at 5,50 USD per day has a higher negative correlation with financial inclusion (-0,620) than the poverty headcount ration at 1,90 USD per day (-0,498).

There is a relatively high negative Pearson correlation coefficient (-0,593) between the poverty gap at 5,50 USD per day (%) and the financial inclusion index. The correlation between the poverty gap at 1,90 USD per day (%) and the financial inclusion index is also negative and a slightly smaller in its absolute value (-0,477).

As expected, the variable GDP per capita has a rather high negative correlation with both measures of poverty. One must pay attention to the fact that GDP per capita is highly positively

correlated to internet usage, and highly negatively correlated to rurality. That is why, in a latter step, the regression will be made without GDP per capita as well.
Also, education, measured by the mean years of schooling, exhibits a high negative degree of correlation with all poverty measures. The same holds true for internet usage. This is, however, not the case for the labour participation rate, which has a rather low positive correlation with the poverty measures.
As suspected, the poverty-related indicator rurality correlates positively with both variables for poverty, the correlation degree being rather high. The variable net ODA received per capita exhibits a low positive correlation with poverty. Trade openness is slightly negatively correlated the poverty variables with correlation coefficients.

Figure 4: Relation between the financial inclusion index and the poverty headcount ratio at 5,50 USD per day
Data: World Bank

The scutter diagram in figure 4 shows the individual observations for the financial inclusion index together with the poverty headcount ratio at 5,50 USD per day. It illustrates a negative relationship between financial inclusion and poverty. Using other poverty measures, a similar pattern is observed, as it can be seen in the annexe.

3.1.5 Limitations

Since the data of the Global Findex, such as explained below, has been gathered for the years 2011, 2014 and 2017, the exact same years for each of the countries are taken into account for the dependent variable poverty as well as for all the other variables.

In the analysis, the countries of interest are the low- and middle-income countries, whereby the income classifications of the World Bank (2019) serve as a reference. Starting with 494 observations as of the Global Findex for all income groups in the three given years, there are 297 observations for the low- and middle-income groups. However, in most of the cases, the data for the poverty headcount ratio and the poverty gap are not available, resulting in only 91 observations where data on the different poverty measures are available.

In most of the cases, the data are unavailable for poorer countries. This can be shown by the fact that the average GDP per capita lies at 4.005,58 USD for all low- and middle-income countries of the Global Findex dataset with both available and non-available data on the poverty measures, given available data for the other variables. However, the average GDP per capita for the countries with available data on poverty makes up 5.656,92 USD, in contrast, on only 3.136,95 USD per capita for the countries where the poverty gap is not defined.

Consequently, there are missing data on a non-random basis, because information especially for low-income countries is missing. Wooldridge (2016) also discusses the problem of missing data on a non-random basis and argues that this leads to inconsistent estimates. If the data are missing completely at random, then missing data cause no statistical problems. This is not the case here, since the probability is higher that data for poverty are missing in low-income countries.
One may conclude that taking all low- and middle-income countries into account, the results may differ from the analysis with the given data. In order to make more general inferences more countries and years have to be taken into consideration. Still, it makes sense to analyse the link between financial inclusion and poverty, being aware of the limitations in the data.

3.2. Hypothesis Development

Different impact channels of financial inclusion on poverty alleviation are possible. The endogenous growth theory for macroeconomic outcome suggests that macroeconomic income variables are due to dynamics from the country itself and not from external drivers. This implies that financial inclusion plays a superior role in poverty alleviation, since it sets free economic potential of the population. This theory also implies that external aid, for instance through development cooperation, has no significant effect on the macroeconomic outcome in a country, such as explained by Schmied and Marr (2016). Contrary to this theory, the variable of net official development aid per capita, as an external determinant, is still added in the regression.

The investment theory suggests that financial exclusion has a disproportional effect on poor people, due to a bad credit rating because of an initial lack of collateral and resources as securities for bank loans. Thus, the poor members of the economy have the highest benefits from financial inclusion since the initial barriers of collateral requirements and borrowing costs are reduced. As every economy has a certain percentage of skilled labourers, those individuals are enabled to make use of loans to set up and grow small and medium-sized businesses. This has a certain leverage effect, since also other individuals may be employed by such new companies.

According to Beck and Lekvov (2007), some local moneylenders charge high interest rates on borrowing money, so formal access to financial products can unleash the skilled labourer's potential to start an own business. Another channel of how financial inclusion can affect poverty is that the loans can be used by parents to pay for the education or job training of their children or for themselves. The education in return can have an alleviating effect on poverty, especially when the creditors had ex-ante a poor educational background.

Chithra and Selvam (2013) state that financial inclusion is a requirement for poverty alleviation, since it gives people access to financial services. Every poor person must have access to financial services in order to invest in a productive activity and therefore to contribute towards economic development.

The question raised in this thesis is whether poor people experience growth in their income by being included into the financial system. Regarding the impact channels, one can also consider the broader concept of financial development. A large body of evidence suggests that financial

sector development is a key factor in economic development, however, this has spurred a long-lasting debate in the economic literature.

Schumpeter (1911) highlights the importance of financial intermediaries for economic development, for instance through mobilizing savings, providing financial services, managing risk or facilitating transactions. He demonstrates that there are underlying principles of money, credit, and entrepreneurial profit that counterpart his earlier ideas of interest and the business cycle. Schumpeter predicts that access to finance enables an entrepreneur to invest in productive activities, and therefore to encourage economic growth.

He identifies five forms of "new combinations" that are the drivers of economic development: 1) creation of new goods; 2) the application of new means of production and commercial usage of existing goods; 3) development of a new commodity market; 4) new sources of the development of raw material development and 5) sector structure modification.

He finds two different ways to make the new combinations work, through administrative power and in case of a market economy by means of banking credits. The Schumpeterian banker is an intermediary between those who want to realise new combinations and the possessors of capital, which is a necessary input for the realisation of new combinations. Thus, when a bank gives a credit, it allows the employment of "the new combinations" on behalf of the entire society. Banking activity is designed to stimulate economic development. Simultaneously, it should be well-thought-out that the bank loans are of a highest importance only at the moment when "the new combinations" are created. However, in a steady state of the economy, when firms already have all necessary inputs and means of production or are able to provide them themselves due to retained earnings, finance just plays a secondary role. In the latter case, financial institutions only participate in the financial system by monetary mediation of immutable, regularly repeated routines. By the same token, Schumpeter (1934) argues that financial development encourages economic growth, not only by simplifying capital accumulation, but also by allowing for the funding of innovations.

However, there is also much scepticism among economists, summarised by Robinson (1952) statement saying, where enterprise leads, finance follows. Or, according to Stolbov (2013), in the theories J. Keynes's first followers, the financial system plays a significant, but not the primary role in economic development. The mutual understanding is here that financial development is a by-product of economic growth rather than a force stimulating it.

Later, Patrick (1966) elaborates on two ways of intertwining of financial development and economic growth, calling them "demand-following" and "supply-leading". When finance is essential to attract external financing to spur economic growth, the situation is "demand-following". On the other side, a situation is "supply-leading" when financial institutions accumulate savings and transform them into investments, which are crucial for the development of modern industries of the economy. This is one of the first attempts to discuss the problem of causality in the finance–growth nexus literature.

Goldsmith (1969) states that finance impacts economic growth through an increased effectiveness and an accumulation of the aggregate volume of investments. He is the first to calculate correlation coefficients for 35 countries between the ratio of financial assets to GNP and GNP per capita, with the result of positive sign and statistical significance.

Following the analysis of Stolbov (2013), the modern theoretical landscape concerning the causality between finance and growth can be divided into three approaches or paradigms which researchers follow. The first of them assumes imperfectly competitive financial markets that stimulate and spur economic growth. The second group uses endogenous growth models to also allow for a formal explanation of a positive impact of financial development on growth. The third group works with empirical papers relying on econometric techniques and continuously

rising data availability. There is some evidence for the rise of a fourth group which follows a neo-institutional paradigm.

Various approaches are also reviewed in Levine (2003) and Levine (2005), including both theoretical and empirical studies. The latter ones reached from historical case studies, to time series studies on a single country or on a certain number of countries, to studies on the level of an enterprise, to cross-sectional and panel data analyses. Within the cross-sectional and panel data analyses, there are some focusing on industries, like Rajan and Zingales (1998), and some focusing on countries.

According to the World Bank (2019), financial sector development promotes economic growth through capital accumulation as well as through technological progress through increases in the savings rate, the mobilisation and the pooling of savings, the provision of information about investments, and the facilitation and encouragement of inflows of foreign capital as well as the optimisation of the allocation of capital.

There is also much evidence for positive correlation between countries with a better developed financial system and faster growth in those countries. The causality of this relationship has been, as stated above, highly discussed in economic literature, however, many researchers support that financial development is not only a result of economic growth, but it rather contributes to it. The World Bank (2019) also states that financial system development reduces poverty and inequality by broadening access to finance to the bottom of the income pyramid, facilitating risk management by decreasing their vulnerability to shocks, and improving investment and productivity that result in higher income generation. Further than this, financial sector development can promote the growth of small and medium-sized enterprises (SMEs) by the provision of access to capital. Since SMEs are normally labour intensive, they have the potential to provide more working places than large enterprises. Consequently, they play a crucial role in the economic development of emerging economies.

Park and Mercardo (2015) share this viewpoint and predict, financial inclusion increases, poverty rates are expected to decline. Since more people have access to financial services and are able to engage in productive activities in the economy or to smooth their consumption. A well-developed financial system can effectively alleviate poverty. Microfinance banks increase the economic opportunities for low-income people through financial inclusion, which leads to a positive effect on social progress, economic development, economic empowerment and legal empowerment (Mondal, 2015).

All in all, there is much economic reasoning in the literature on the question of causality. The purpose of this study is to examine if this can be observed taking real-life data. Even when economic theories are not most naturally defined in terms of causality, they often contain predictions that can be tested using econometric methods, as stated in Wooldridge (2016).

So, with a regression of

$$Poverty_{it} = \beta_0 + \beta_1 FinInc_{it} + \beta_2 GDPCapita_{it} + \beta_3 Educ_{it} + \beta_4 Internet_{it} + \beta_5 Empl_{it} + \beta_6 Rural_{it} + \beta_7 NetODA_{it} + \beta_k Trade_{it} + \gamma_i + \varepsilon_{it} \ \ with\ t = 1,2,3 \qquad (6)$$

where γ_i is a intercept for each country and ε_{it} is the error term, the hypotheses are the following: H_0: $\beta_1 = 0$ and H_1: $\beta_1 < 0$

The null hypothesis is that there is no effect of financial inclusion on poverty. The alternative hypothesis is that there is a negative effect. Thus, it is hypothesised that: Financial inclusion has a positive relationship with poverty reduction.

3.3 Choice of the Estimation Method

It is very important to choose the right estimation method in order to have both efficient and consistent estimators.

After running various regressions, such as pooled OLS, first-difference estimation, population-averaged estimation, between estimation, fixed effects and random effects estimation, the use of statistical tests on the test results reveal which method is the best. In the next chapters, the functioning of those methods will be further explained. The software used to analyse the data is Stata, version 13.

First, it is tested, if the pooled OLS model is efficient or it is preferable to use another model, such as the random effects model that accounts for individual-specific effects. Pooled OLS assumes a linear relationship between the explanatory variables and the dependent variable. Here, the Breusch-Pagan Lagrange Multiplier Test can be used. It tests whether the variance of the error term σ_ε^2 is significantly different from zero.

```
PovH190[Country,t] = Xb + u[Country] + e[Country,t]

Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+-----------------------------
         PovH190 |   170.9387       13.07435
               e |   1.331641       1.153968
               u |   102.7844       10.13827

Test:   Var(u) = 0
                     chibar2(01) =     7.17
                  Prob > chibar2 =   0.0037
```

```
PovH550[Country,t] = Xb + u[Country] + e[Country,t]

Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+-----------------------------
         PovH550 |   723.8169       26.90385
               e |   9.822774        3.13413
               u |   211.7552       14.55181

Test:   Var(u) = 0
                     chibar2(01) =    23.35
                  Prob > chibar2 =   0.0000
```

```
PovG190[Country,t] = Xb + u[Country] + e[Country,t]

Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+-----------------------------
         PovG190 |   21.60051       4.647635
               e |      .1451       .3809199
               u |   15.54466       3.942671

Test:   Var(u) = 0
                     chibar2(01) =     4.67
                  Prob > chibar2 =   0.0153
```

```
PovG550[Country,t] = Xb + u[Country] + e[Country,t]

Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+-----------------------------
         PovG550 |   244.2616       15.62887
               e |   2.844764       1.686643
               u |   89.86084       9.479496

Test:   Var(u) = 0
                     chibar2(01) =    11.80
                  Prob > chibar2 =   0.0003
```

Table 8: Test results of the Breusch-Pagan Lagrange Multiplier Test
Data: World Bank, International Labour Organisation, UNDP, OECD

The test's p-value is very small with all the different possible dependent variables of poverty. This means, the OLS model should not be used, but rather the one of the models that control for individual specific effects. Also, the functioning of the pooled OLS method does not fit the data, since many different countries are included in the database with individual-specific effects. Pooled OLS would not account for those but pool the panels independently.

In the next step, it still has to be identified if the random effects or the fixed effects model are the most consistent and efficient ones. This is because the random effects estimator is inconsistent when the appropriate model is the fixed effects model. Only if the random effects estimator is consistent, it is the most efficient model. The fixed effects estimation always gives consistent results, but they may not be the most efficient (Wooldridge, 2016). With the fixed effects estimation, one eliminates a time-constant fixed effect. When the variables do not

change much over time, this method will not be very useful. However, in the given data, there is much variation over time: the poverty measures decrease, while the financial inclusion index increases.

Using the Hausman test, we can check whether there is a significant difference between the random effects model and the fixed effects model. The Hausman test checks whether the coefficients of the fixed effect estimation and the random effect estimation are very similar to each other or not. This test has been first proposed by Hausman (1978).

The Hausman test's null hypothesis is that the random effect estimation is appropriate, unless the Hausman test rejects, and the alternative hypothesis is that the fixed effect estimation is appropriate (Wooldridge, 2016).

After running the test, the p-value of the chi-square statistics is rather small regarding the poverty headcount ratio and the poverty gap at 1,90 USD per day, so we have significant results here. That means that the two estimations differ, and we should use the fixed effect estimation.

However, this is not the case for the poverty headcount ratio and the poverty gap at 5,50 USD per day, so in this case it is better to refer to the results of the random effects estimation. We have different results taking different poverty measures.

Since the Hausman test gave ambiguous results for the various poverty measures, it makes sense to argue economically.
The core issue that determines whether the fixed effects or the random effects estimation is adequate is whether one can assume that the intercept γ_i is uncorrelated with all variables x_{it}, meaning only when the variables are strictly exogenous.
However, in the given application with panel data on a country-level, one cannot treat the sample as a random sample from a large population, especially since the unit of observation is a large geographical unit (say, states or provinces). The use of a fixed effects estimation is also more convincing in policy analysis using aggregated data, as compared to the random effects estimation (Wooldridge, 2016). In the given case, it makes sense to think of every γ_i as a separate intercept to estimate for each individual country effect.

So, in this case, the fixed effects approach will be most appropriate because, by using the fixed effects approach, a different intercept for each country is allowed in the regression.

Another possibility to remove the unobserved effect is to difference the data from one time period to another. The differencing can significantly decrease the variation in the explanatory variables. Then, another pooled OLS analysis on the differences can be used. However, this would greatly reduce the number of observations in the sample, in fact, there would be only 42 observations left with this method. The fixed effect approach is still superior in this case.

The same is true for the between estimation, which uses the time-averaged variables for each country and applies an OLS estimation to the data. It therefore also significantly reduces the number of observations.

Later, in the chapter 5, the pooled OLS, the random effects estimation, the between estimation and other variations will be used to test, if the results still hold true with some modifications and different estimation methods.

4. Empirical Results

The fixed effects transformation is a method to eliminate the individual-specific effects. These individual-specific effects are the leftover variation in the dependent variable that cannot be explained by the regressors. The fixed effects approach assumes that the unobserved effect γ_i is a parameter to be estimated for each i. The key assumption is that there are unique attributes of countries that do not vary across time. According to Wooldridge (2016), these attributes may or may not be correlated with the individual dependent variables. In the presence of time constant attributes, the fixed effects approach is asymptotically more efficient than Pooled OLS.

Thus, in the following equation γ_i is the intercept for country i that is to be estimated to account for the country fixed effect that is not related to the other explanatory variables. Therefore, a dummy variable is created for each cross-sectional observation.

$$y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 x_{it} + .. + \beta_k x_{it} + \gamma_i + \varepsilon_{it} \ with\ t = 1, 2, 3 \qquad (7)$$

or, alternatively

$$Poverty_{it} = \beta_0 + \beta_1 FinInc_{it} + \beta_2 GDPCapita_{it} + \beta_3 Educ_{it} + \beta_4 Internet_{it} + \beta_5 Empl_{it} + \beta_6 Rural_{it} + \beta_7 NetODA_{it} + \beta_k Trade_{it} + \gamma_i + \varepsilon_{it} \quad with\ t = 1,2,3 \qquad (8)$$

Also, a time fixed effect is taken into consideration as well with γ_t as an intercept for various years.

$$y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 x_{it} + .. + \beta_k x_{it} + \gamma_i + \gamma_t + \varepsilon_{it} \ with\ t = 1, 2, 3 \qquad (9)$$

The given data set is an unbalanced panel because there are missing years for at least some cross-sectional units in the sample. However, this dummy variable regression with an unbalanced panel also works in exactly the same way as with a balanced panel (Wooldridge, 2016). The unbalanced panel used is a short panel with many countries and a few time periods.

The following table presents some results, taking different measures of poverties, and different independent variables.

VARIABLES	(10) PovH190	(11) PovH190	(12) PovH190	(13) PovH190	(14) PovH550	(15) PovH550	(16) PovH550	(17) PovG190	(18) PovG550
FinInc	-0.155***	-0.148***	-0.183***	-0.141*	-0.511***	-0.254*	-0.253	-0.048**	-0.218**
	(0.035)	(0.035)	(0.063)	(0.076)	(0.092)	(0.150)	(0.171)	(0.021)	(0.092)
GDPCapita		-0.216	-0.297	-0.284	-1.023**	-0.797	-1.284**	-0.080	-0.571*
		(0.192)	(0.216)	(0.227)	(0.500)	(0.514)	(0.585)	(0.071)	(0.315)
Educ			-0.790	-0.135		-2.415	-3.529	-0.615	-1.735
			(1.158)	(1.370)		(3.086)	(3.144)	(0.382)	(1.692)
Internet			0.019	0.044		-0.101	-0.086	0.006	-0.009
			(0.026)	(0.042)		(0.073)	(0.072)	(0.009)	(0.039)
Empl			-0.199	-0.215		-0.125	-0.115	-0.077*	-0.187
			(0.137)	(0.141)		(0.375)	(0.373)	(0.045)	(0.201)
Rural			0.301	0.227			0.594	0.058	0.400
			(0.199)	(0.229)			(0.541)	(0.066)	(0.291)
NetODA			-0.033**	-0.032**			-0.021	-0.010**	-0.030
			(0.015)	(0.015)			(0.040)	(0.005)	(0.022)
Trade			-0.046**	-0.052**			-0.120**	-0.017***	-0.070**
			(0.019)	(0.021)			(0.053)	(0.006)	(0.028)
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	No	No	No	Yes	No	No	No	No	No
Constant	24.891***	24.954***	32.654*	31.735	86.511***	108.746***	88.386*	14.988**	49.931*
	(1.519)	(1.515)	(19.605)	(20.183)	(3.947)	(32.854)	(53.245)	(6.471)	(28.654)
Observations	91	91	91	91	91	91	91	91	91
R^2 within	0.995	0.995	0.996	0.997	0.993	0.995	0.995	0.997	0.995
between	0.999	0.996	0.999	1.000	0.999	0.998	0.998	0.999	0.999
overall	0.996	0.996	0.997	0.997	0.993	0.995	0.995	0.998	0.996
Number of Year	3	3	3	3	3	3	3	3	3

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9: Empirical results using the fixed effects estimation
Data: World Bank, International Labour Organisation, UNDP, OECD

Using various regressions and measures of poverty, as represented in table 9, and also when including a time fixed effect, the coefficients of financial inclusion are always negative.

Regarding dependent variable using the poverty headcount ratio at 1,90 USD per day, the share of extremely poor people is predicted to decrease by 0,155 percentage points when the financial inclusion index increases by 1 percentage point, all else equal (10). This is, when using financial inclusion as the sole independent variable. When the regressor GDP per capita is added, the share of extremely poor people is predicted to decrease by 0,148 percentage points when the financial inclusion index increases by 1 percentage point, ceteris paribus (11). When including all independent variables, the share of people living below 1,90 USD per day is predicted to decrease by 0,183 percentage points when the financial inclusion index increases by 1 percentage point (12). Those three coefficients of financial inclusion are significant at the 1%-level. When adding the time fixed effect, the poverty headcount ratio at 1,90 USD per day is

predicted to decrease by 0,141 percentage points when the financial inclusion index increases by 1 percentage point (13).

Including the time fixed effect for the other poverty measures results always in negative coefficients of financial inclusion, that are significant at the 10%-level when only adding at certain number of variables, but with all independent variables included, there are mostly insignificant.

Taking the poverty headcount ratio at 5,50 USD per day, the model predicts a decrease of this poverty ratio by 0,511 percentage points when the financial inclusion index as the only explanatory variable rises by one percentage point, all else equal, and the country-fixed effect taken into account (14). This is significant at the 1%-level.

In regression (15) the country-fixed effect estimation is also used, and four independent variables are included, namely, the financial inclusion index, GDP per capita, education and employment. In this case, the coefficient of the financial inclusion index is smaller in magnitude (-0,254) and significant at the 10%-level.

When taking all independent variables into consideration (16), the p-value is 0,138, which means that this is not significant at the 10%-level. Still, we see a negative coefficient of the financial inclusion index of -0,253, which is very close to the previous regression.

Moreover, taking the poverty gap of 1,90 USD per day as the dependent variable, the model predicts a decrease of this poverty gap of 0,048 percentage points when the financial inclusion index increases by one percent (17). This is significant at a 5%-level. Here, all variables are taken into account.

Also, taking the poverty gap at 5,50 USD per day as an independent variable, the reduction is even higher in absolute terms, since the coefficient of the variable for financial inclusion is here -0,218 with significance at a 5%-level (18).

So, regarding the dependent variable of a poverty gap and the poverty headcount ratio at 5,50 USD per day, the magnitude is greater in absolute values compared to the one at 1,90 USD per day. However, the relative predicted decrease in poverty, predicted when using the poverty headcount ratio and the poverty gap at 1,90 USD per day, compared to the relative predicted decrease of the poor, measured at the respective measures at 5,50 USD per day, is different. The reason is that the share of extremely poor, measured with the poverty line at 1,90 USD per day, is much lower than the share of the less poor, measured with the poverty line at 5,50 USD per day. We can see this by calculating the percentage decreases of the number of people living below a certain poverty line.

Looking at the given results of the fixed effect estimation (12), the share of the population with an income of less than 1,90 USD per day would decrease by 0,183 percentage points, that is from 7,833% to 7,650%, when the financial inclusion index increases by one percentage point. The change in percent is therefore

$$\frac{7{,}650\% - 7{,}833\%}{7{,}833\%} = -\frac{0{,}183\%}{7{,}833\%} = -0{,}02336 = -2{,}336\% \qquad (19)$$

So, this is a predicted decrease of - 2,336% of the people living with an income of less than 1,90 USD per day.

Regarding the poverty headcount ratio at 5,50 USD per day and the prediction of the fixed effect estimation, the change of people below this poverty line when the financial inclusion index increases would be

$$\frac{35{,}492\% - 35{,}745\,\%}{35{,}745\,\%} = -\frac{0{,}253\%}{35{,}745\%} = -0{,}00708 = -0{,}708\% \qquad (20)$$

To sum it up, the number of people living below 1,90 USD per day is expected to decrease by 2,336% and the number of people living below 5,50 USD per day is expected to decrease by 0,708% when the financial inclusion index increases by one percentage point, all else equal and using the fixed effects results. However, the latter result has not been significant at the 10%-level, as described above. The relatively smaller effect still has to be confirmed in the robustness checks.

The effects of some control variables are predicted to affect poverty negatively. This is the case for GDP per capita, education, employment, net official development aid received per capita, and the percentage of trade of the whole GDP. Rurality is predicted to influence the different poverty measures positively, and the effect of the internet usage is relatively small with ambiguous signs.

The R-squared from the dummy variable regression is rather high, both, regarding the within and the between goodness-of-fit as well as the overall goodness of fit. This is because for each cross-sectional unit a dummy variable is included, which explains much of the existing variation in the data.

5. Robustness Checks

This chapter focuses on robustness checks of the given results, both by using other estimation methods, as well as by looking at different subsamples and variations in the sample size.

5.1 Using other Estimation Methods

This chapter covers the analysis, whether the results obtained by the fixed effects estimation still hold true when using other estimation methods. Therefore, the results will be compared to the ones obtained by a pooled OLS estimation, a between estimation and a random effects estimation.

In the pooled OLS regression, the panels are independently pooled. That means that there are no unique attributes of individuals within the measurement set, and no universal effects across time.

$$y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 x_{it} + .. + \beta_k x_{it} + \varepsilon_{it} \ \ with\ t = 1,2,3 \qquad (21)$$

The between estimation answers the question about the effect of the independent variable x when x changes between countries. This can be compared with the results of the fixed effects estimation, which answers the question about the effect of x when x changes within countries (Stata, 2019). It is an OLS regression on the time-averaged dependent variable on the time-averaged regressors for each country. That means, the data are collapsed for one observation per country and the number of observations equals to the number of countries in the dataset. It takes the form:

$$\bar{y}_i = \beta_0 + \beta_1 \bar{x}_i + \beta_2 \bar{x}_i + .. + \beta_k \bar{x}_{it} + (\gamma_i - \gamma) + \bar{e}_i \qquad (22)$$

Finally, a random effects estimation adjusts for the serial correlation which may be present through unobserved time constant attributes. There are unique, time constant attributes of individuals which are distributed independently of the regressors. Therefore, the individual specific γ_i effect is included in the error term. Each country has therefore the same slope parameters and a composite error term $\propto_{it} = (\gamma_i + e_{it})$.

$$y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 x_{it} + .. + \beta_k x_{it} + (\gamma_i + e_{it}) \ \ with\ t = 1, 2, 3 \qquad (23)$$

Using the three mentioned estimation techniques, the following results are obtained:

	Pooled OLS		Between Estimation		Random Effects Estimation			
	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)
VARIABLES	PovH190	PovH550	PovH550	PovG550	PovH190	PovH550	PovG190	PovG550
FinInc	-0.148*	-0.500***	-0.566**	-0.258*	-0.140**	-0.322**	-0.030*	-0.195***
	(0.090)	(0.148)	(0.229)	(0.145)	(0.057)	(0.128)	(0.016)	(0.074)
GDPCapita	-0.023	-1.708**	-0.713		-0.423**	-1.789***	-0.157**	-0.799***
	(0.405)	(0.667)	(1.297)		(0.206)	(0.473)	(0.067)	(0.270)
Educ	-2.528***	-0.513	0.017	-1.295	-2.474***	-2.671***	-1.042***	-2.515***
	(0.552)	(0.910)	(1.460)	(0.898)	(0.604)	(0.994)	(0.204)	(0.622)
Internet	-0.070	-0.357***	-0.685**	-0.384***	0.027	-0.105*		-0.015
	(0.081)	(0.134)	(0.265)	(0.131)	(0.025)	(0.059)		(0.033)
Empl	0.257***	0.114	0.152	0.211	0.059	0.130	0.024	0.094
	(0.098)	(0.162)	(0.209)	(0.134)	(0.098)	(0.174)	(0.035)	(0.107)
Rural	0.113	0.493***	0.405**	0.200*	0.248**	0.520***		0.314***
	(0.081)	(0.133)	(0.199)	(0.114)	(0.098)	(0.159)		(0.100)
NetODA	0.048**	0.007	-0.019	0.021	-0.019	-0.023	-0.005	-0.016
	(0.024)	(0.040)	(0.058)	(0.036)	(0.014)	(0.031)	(0.005)	(0.018)
Trade	-0.026	-0.197***	-0.160**	-0.081*	-0.055***	-0.145***	-0.020***	-0.080***
	(0.030)	(0.049)	(0.072)	(0.046)	(0.017)	(0.039)	(0.006)	(0.022)
Constant	15.867*	64.892***	68.529***	32.724***	26.348***	65.455***	13.607***	36.191***
	(8.149)	(13.424)	(18.286)	(10.585)	(8.814)	(14.683)	(2.662)	(9.177)
Observations	91	91	91	91	91	91	91	91
R^2 0.348	0.543	0.543	0.165	0.426	0,499	0,625	0.429	0,598
0.991	0.948	0.948	0.785	0.785	0,605	0,768	0.498	0,746
0.385	0.578	0.578	0.724	0.727	0,573	0,730	0.447	0,715
Rho (ρ_α)					0.987	0.956	0.991	0.969
Number of Country	49	49	49	49	49	49	49	49
Number of Year	3	3	3	3	3	3	3	3

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10: Robustness checks using other estimation methods
Data: World Bank, International Labour Organisation, UNDP, OECD

With the poverty headcount ratio of 1,90 USD per day as a dependent variable, the coefficient of financial inclusion is negative and significant at the 10%-level, all variables included. Using the pooled OLS estimation, the poverty headcount ratio of 1,90 USD per day is expected to decrease by 0,148 percentage points, all other variables held constant (24).

Also, it is significant at the 1%-level that education affects the percentage of the population living with less than 1,90 USD per day negatively: All other variables included, with one more mean year of schooling, the poverty headcount ratio is expected to decrease by 2,5 percentage points, under the ceteris paribus condition. Surprisingly, employment seems to have a positive, significant effect on the poverty ratio at 1,90 USD per day.

Replacing the dependent variable by the poverty headcount ratio of 5,50 USD per day, the absolute value of the coefficient of financial inclusion is higher. With an additional percentage point increase of the financial inclusion index, the poverty headcount ratio of 5,50 USD per day is expected to decrease by 0,5 percentage points, all other variables held constant (25). This is significant at the 1%-level.

As before, one must differentiate between the percentage point decrease, which, looking at the poverty ratio of 5,50 USD per day may seem much higher, and the percentage decrease. On average there are 7,833% living with an income of less than 1,90 USD per day and 35,745% with an income of less than 5,50 USD per day.

Looking at the upper results of the pooled OLS estimation, the share of people with an income of less than 1,90 USD per day would decrease by 0,148 percentage points, that is from 7,833% to 7,685% when the financial inclusion index increases by one percentage point. The change in percent is therefore

$$\frac{7{,}685\% - 7{,}833\%}{7{,}833\%} = -\frac{0{,}148\ \%}{7{,}833\ \%} = -0{,}01889 = -1{,}889\% \qquad (32)$$

So, this is a predicted decrease of -1,889% of the people living with an income of less than 1,90 USD per day.

Regarding the poverty headcount ratio at 5,50 USD per day and the prediction of the pooled OLS estimation, the change of people below this poverty line when the financial inclusion index increases would be

$$\frac{35{,}245\% - 35{,}745\%}{35{,}745\%} = -\frac{0{,}500\ \%}{35{,}745\ \%} = -0{,}01399 = -1{,}399\% \qquad (33)$$

To sum it up, the number of people living below 1,90 USD per day is expected to decrease by 1,889% and the number of people living below 5,50 USD per day is expected to decrease by 1,399% when the financial inclusion index increases by one percentage point, all else equal and using the pooled OLS results.

Also, when using the between estimation, there are similar results. The model predicts here a negative impact of financial inclusion on poverty as well, which are significant at a 5%-level (26) when using the poverty headcount ratio at 5,50 USD as a poverty measure and at a 10%-level (27) when using the poverty gap at 5,50 USD per day . The coefficient, using the poverty headcount ratio of 5,50 USD per day, is similar to the result of the pooled OLS estimation.

Using the predictions of the random effect estimation, the number of people living below 1,90 USD per day is expected to decrease 0,140 percentage points, meaning by 1,787 percent (28) when the financial inclusion index increases by one percentage point, all other variables held constant. The number of people living below 5,50 USD per day is expected to decrease by 0,322 percentage points, meaning by 0,901 percent (29) when the financial inclusion index increases by one percentage point, all other variables held constant. So, in all of the results the percentage point decrease of the number of poor people below the poverty line of 5,50 USD per day is greater in absolute values than the percentage point decrease of the people below the poverty line of 5,50 USD per day, however, the percentage decrease shows a larger reduction of the amount of poor with an income of less than 1,90 USD per day. This result confirms the one observed with the fixed effects approach.

The empirical result also shows highly significant negative effects of the GDP per capita, education, internet usage and trade. Rurality, which is measured by the percentage of people living in rural areas, is expected to increase poverty significantly.

However, as described earlier, the pooled OLS regression does not account for unobserved effects.

Additionally, the random effects methodology confirms previous findings: all coefficients of the financial inclusion index are negative and significant, but the coefficients are smaller in absolute value compared to the pooled OLS estimation and the between estimation. In fact, they are quite similar to the coefficients of financial inclusion when taking the fixed effects approach.

What is interesting here is that the interclass correlation of the error is the fraction of the variance in the error due to the individual-specific effect:

$$\rho_\alpha = \frac{\sigma_\gamma^2}{\left(\sigma_\gamma^2 + \sigma_e^2\right)} \qquad (34)$$

If it reaches 1, it means that the individual-specific effects dominate the idiosyncratic error. This is the case all the time when taking different poverty measures: the interclass correlation of the error is always greater than 0.95.

Again, the different R^2 measures give information about how much variance between separate panel units the model accounts for, how much variance within the panel units my model accounts for and the overall goodness of fit. The R^2 between the panel units is much smaller than the one between them, however, there are only 3 time periods.

Another possibility to remove the unobserved effect is to difference the data from one time period to another (32). The differencing can decrease the variation in the explanatory variables. Then, a pooled OLS analysis on the differences within countries can be used (Wooldridge, 2016).

$$y_{it} = \beta_0 + \beta_1 \Delta x_{it} + \beta_2 \Delta x_{it} + .. + \beta_k \Delta x_{it} + \Delta u_{it} \ \ with\ t = 1,2,3 \qquad (35)$$

Since the model only looks at the differences, the first time period is removed from the model now. There are also only 42 observations left. Since many countries are not included in this model anymore, this approach will not be considered in this paper.

Moreover, a test on heteroskedasticity revealed that the data are heteroskedastic. Because of this, another regression with the heteroskedasticity-robust feasible general least squares method is included. Correcting for heteroskedasticity means obtaining in the same coefficients as with the pooled OLS regression, but different standard deviations and therefore different p-values. Still, all coefficients of the financial inclusion index are significant at least at the 10%-level. The results are not very different from the previous one which is why they are not interpreted again. The results can be found in the annexe.

Furthermore, a population-average estimation showed similar results. This is included in the appendix.

All in all, regarding the results using different estimation methods, there is evidence for the results to be robust.

5.2 Variations in the Sample Size

Concerning the effect of financial inclusion using other income groups three other income segments are taken into account. Those are two subsamples, namely low- and lower-middle-income countries and also lower and upper-middle-income countries and one larger sample of all income groups, meaning low, medium and high-income countries.

	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)
Income Group	Low and lower middle				middle		All income groups	
VARIABLES	PovH190	PovH550	PovG190	PovG550	PovG190	PovG550	PovH550	PovG550
FinInc	-0.251***	-0.385	-0.074*	-0.293**	-0.048**	-0.218**	-0.132*	-0.087*
	(0.097)	(0.248)	(0.038)	(0.115)	(0.021)	(0.092)	(0.078)	(0.048)
GDPCapita	-3.079*	-14.522***	-0.569	-6.894***	-0.080	-0.571*	-0.032	-0.036
	(1.871)	(4.787)	(0.736)	(2.227)	(0.071)	(0.315)	(0.078)	(0.086)
Educ	3.915	17.290**	-0.293	9.132***	-0.615	-1.735	-3.739***	-0.538
	(2.929)	(7.494)	(1.152)	(3.486)	(0.382)	(1.692)	(0.690)	(0.794)
Internet	-0.044	-0.387***	0.008	-0.174***	0.006	-0.009	-0.097**	-0.056*
	(0.051)	(0.131)	(0.020)	(0.061)	(0.009)	(0.039)	(0.047)	(0.028)
Empl	-0.666*	-1.700*	-0.234*	-0.978**	-0.077*	-0.187	0.189	-0.114
	(0.348)	(0.890)	(0.137)	(0.414)	(0.045)	(0.201)	(0.132)	(0.129)
Rural	0.455	0.571	0.024	0.635	0.058	0.400	0.587***	
	(0.383)	(0.980)	(0.151)	(0.456)	(0.066)	(0.291)	(0.109)	
NetODA	-0.081***	-0.108	-0.023*	-0.091**	-0.010**	-0.030		
	(0.030)	(0.077)	(0.012)	(0.036)	(0.005)	(0.022)		
Trade	-0.041	-0.018	-0.017	-0.034	-0.017***	-0.070**	-0.017	
	(0.038)	(0.097)	(0.015)	(0.045)	(0.006)	(0.028)	(0.021)	
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Random Effects	No	No	No	No	No	No	Yes	No
Constant	31.212	75.775	28.851	25.880	16.930***	58.253***	41.322***	51.414***
	(47.355)	(121.161)	(18.626)	(56.354)	(5.070)	(22.450)	(10.821)	(10.953)
R^2 within	0.999	0.996	0.998	0.998	0.988	0.989	0.548	0.995
between	1.000	1.000	0.999	1.000	0.972	0.997	0.967	1.000
overall	0.999	0.997	0.999	0.999	0.988	0.989	0.560	0.995
Observations	43	43	43	43	83	83	161	161
Number of Year	3	3	3	3	3	3	3	3

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11: Robustness checks using different sample sizes
Data: World Bank, International Labour Organisation, UNDP, OECD

The results in table 11 confirm again the negative effect of financial inclusion on poverty. The coefficients of the subsamples are negative, such as it is the case for the main results of this paper. The alleviating effect of financial inclusion on poverty is significant in most of the cases.

When comparing the coefficients of financial inclusion among the samples, taking for instance the poverty gap measure at 5,50 USD per day as the dependent variable, the magnitude is highest for low and lower middle-income countries (39) with a coefficient of -0,293. For lower and upper middle-income countries (41) the coefficient is -0,228 and for all countries it is -0,087. To interpret this result, one needs to take into account that the poverty gaps are greater, the lower the income classification of a country is. One may conclude that it implies a diminishing effect of financial inclusion on poverty reduction. That means, increasing the financial inclusion index by one percentage point does not have the same effect in countries, where the financial inclusion index is already at a high level and where the poverty rates are lower, as compared to countries, where the opposite is the case. However, a further analysis of this diminishing effect would not fit the scope of this paper.

Regarding the percentage decreases of the number of people below a certain poverty line, one obtains the same result as in the predictions in the main part of this paper. Taking the subsample of only the low- and lower middle-income countries, one has a mean poverty headcount ratio of 13,928% at the 1,90 USD per day and one of 55,095 USD per day at the 5,50 USD per day level. Taking the predictions into account, the changes will be:

$$\frac{13{,}677\% - 13{,}928\%}{13{,}928\%} = -\frac{0{,}251\%}{13{,}928\%} = -0{,}01802 = -1{,}802\% \qquad (44)$$

for the poverty headcount ratio at 1,90 USD per day and

$$\frac{54{,}710\% - 55{,}095\%}{55{,}095\%} = -\frac{0{,}385\%}{55{,}095\%} = -0{,}006988 = -0{,}699\% \qquad (45)$$

Again, the absolute change is greater taking the headcount ratio at 5,50 USD per day, meaning that there are more people that do not live under a income of less than 5,50 USD per day. But, the percentage change of people with an income below 1,90 USD per day is greater than the one at 5,50 USD per day. There is evidence that financial inclusion does not only help the poor, but also the extremely poor.

Overall, the results show that there is indeed a negative effect of financial inclusion, measured by an account and a credit card ownership and the use of formal financial products like loans and savings, on different measures of poverty.

6. Conclusion and Policy Recommendations

This study demonstrates that financial inclusion has an alleviating effect on different measures of poverty, such as the poverty headcount ratios and the poverty gaps at different monetary levels. Furthermore, the obtained results show that an increase in financial inclusion does not only help poor people with an income of less than 5,50 USD per day, but also the poor with an income of less than 1,90 USD per day. The negative effect of financial inclusion on poverty holds true under different robustness checks.

Given the evidence of a strong correlation between financial inclusion and poverty rates, policy makers should implement policies that encourage the access, availability and usage of financial products for the bottom of the income pyramid. In this regard, policies should also address impediments to financial inclusion to avoid financial exclusion. Complemented efforts should be made to promote inclusive growth. Microfinance is in this context and important instrument, since it makes credit available to lower income groups that are normally not creditworthy and bankable. This unleashes their economic potential, enables them to invest in productive activities and smoothen their consumption to face short-term adverse shocks. It is, furthermore, crucial to broaden the range of financial products in order to meet the specific needs of the clients, which may be special savings products or health or climate insurances.

From existing literature, we also know that financial system development exceeds the presence of financial intermediaries and financial infrastructure. The global financial crisis is an example of weak financial sector policies and their negative economic outcome. Therefore, financial system development involves robust policies for regulation and supervision of all the important agents in the financial system. Also, through digitalisation a higher level of transparency can be reached.

The study, furthermore, reveals that there are other channels, through which poverty can be reduced. The empirical results show that especially education, internet access and trade openness have a negative effect on poverty rates with a high explanatory power.

This implies that policy makers ought to allocate not only financial services, but also education and technology, such as the access to the internet, towards the poor. A combination of those is likely to unleash the economic potential of new entrepreneurs: Given the skills through education, communication technology and the access to finance can boost small business growth. Therefore, the costs of education, both at the school- as well as at the university-level, should be kept low. The government should give incentives, even to adults, to upgrade one's education by advanced training.

In the empirical analysis, it can be, furthermore, seen that both internal as well as external factors matter in alleviating poverty, which is contrary to the endogenous growth theory. For instance, the variable net official development aid per capita is an external factor, which has an impact on the different measures of poverty.

7. Directions for Future Research

As mentioned before, there are certain limits to this study, for instance the problem of missing data and also the number of years and countries considered. Especially because data on lower-income countries are missing at a non-random basis in this analysis, the results are biased. Future research could therefore take a higher number of countries and years into account, at best with more estimates for poverty. Also, the financial inclusion index could be enhanced by taking high interest rates or other barriers into account as well as the availability of a wide product range.

Another possible direction for future research is to analyse a possible diminishing effect of financial inclusion on poverty. In the robustness checks of this paper, different samples of income groups were considered. One could proceed by group countries by their financial inclusion index and compare the effect of one percentage point increase of the financial inclusion index on poverty between different those groups.

Also, the identification problem caused by reversal causality could be addressed by future researchers. Does financial inclusion have an impact on poverty or does poverty have an impact on financial inclusion? Although this paper bases on the theoretical framework of finance as a means to increase productivity and therefore generate more income, the question of reversal causality is still not completely answered. If the relation between financial inclusion and poverty is happening at the same time, the gained estimates will be biased and inconsistent. There will be a correlation with the error term, which leads to endogeneity, if an independent variable is determined together with the dependent variable.

One can make use of the method of instrumental variables in order to estimate this causal relationship. Here, the instrumental variable taken instead of the financial inclusion index is highly correlated with the explanatory variable of financial inclusion the financial inclusion index but has no independent effect on the dependent variable. This allows to uncover the causal effect of the explanatory variable, meaning of financial inclusion, on the dependent variable of poverty (Wooldridge, 2016).

To solve the problem of reversal causality, one could also make a difference in differences analysis (Wooldridge, 2016). Therefore, regions or countries could be divided into two groups, one treatment group and one control group. Then, the financial inclusion index is increased only in the treatment group and not in the control group. Data should be collected for at least one time period. In a later step, the changes in poverty between the two groups will be compared. However, in a real-life situation, this is very difficult to implement and demands a high organisational effort.

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Appendix

A. Detailed Summary Statistics with overall, between and within variation

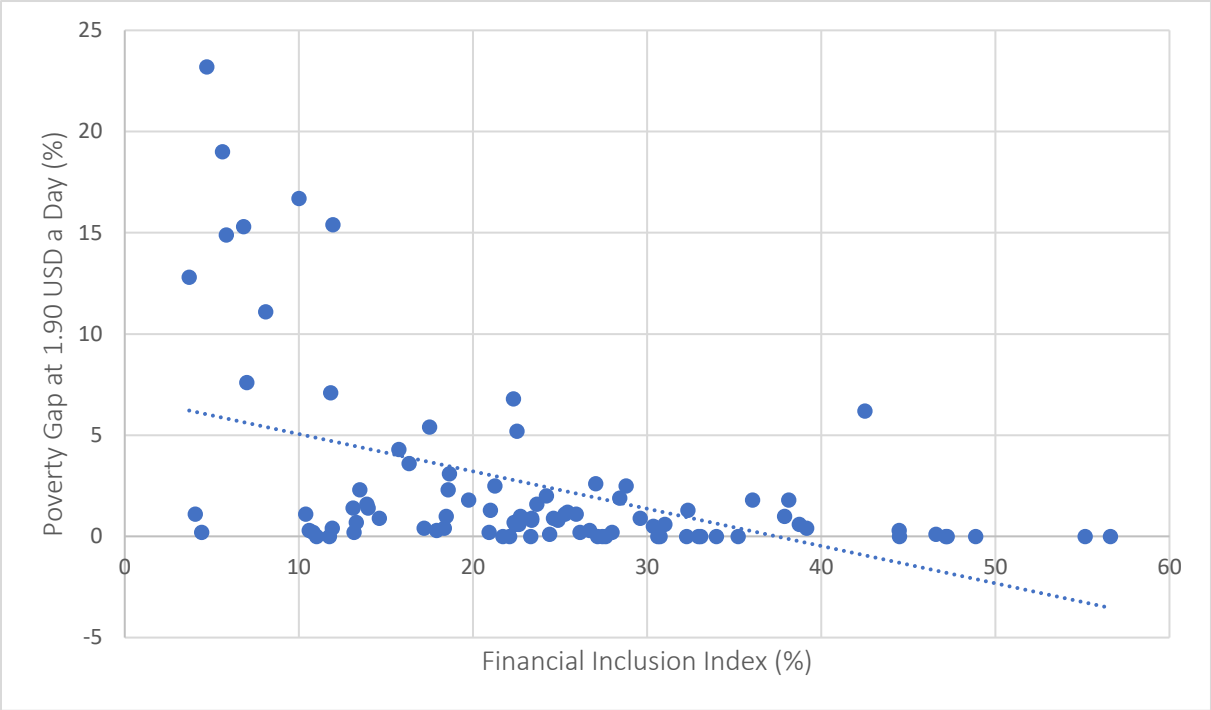
Variable		Mean	Std. Dev.	Min	Max	Observations
Country	overall	23.24176	13.9661	1	49	N = 91
	between		14.28869	1	49	n = 49
	within		0	23.24176	23.24176	T-bar = 1.85714
Year	overall	2013.341	2.315262	2011	2017	N = 91
	between		1.448742	2011	2017	n = 49
	within		1.987461	2010.341	2016.341	T-bar = 1.85714
PovH190	overall	7.832967	13.07435	0	54.2	N = 91
	between		16.56857	0	54.2	n = 49
	within		1.069077	4.5663	12.1663	T-bar = 1.85714
PovH550	overall	35.74505	26.90385	.4	94.7	N = 91
	between		30.29706	1.233333	94.7	n = 49
	within		3.187365	26.89505	45.47839	T-bar = 1.85714
PovG190	overall	2.528571	4.647635	0	23.2	N = 91
	between		5.929899	0	23.2	n = 49
	within		.3393076	1.495238	4.061905	T-bar = 1.85714
PovG550	overall	15.26484	15.62887	.1	59.6	N = 91
	between		18.87206	.2	59.6	n = 49
	within		1.686136	9.431502	21.1315	T-bar = 1.85714
FinInc	overall	23.70371	12.02474	3.701221	56.60393	N = 91
	between		12.37933	3.701221	55.14289	n = 49
	within		3.937407	14.35653	34.86086	T-bar = 1.85714
GDPCap~a	overall	5.656923	3.761187	.445052	15.1964	N = 91
	between		3.658633	.445052	13.12351	n = 49
	within		.7219265	2.565675	8.407093	T-bar = 1.85714
Educ	overall	8.383516	2.495074	1.4	12.8	N = 91
	between		2.72588	1.4	12.53333	n = 49
	within		.1946507	7.883516	8.81685	T-bar = 1.85714
Internet	overall	37.81715	19.71404	.9	76.42675	N = 91
	between		19.52551	.9	64.34225	n = 49
	within		8.743051	17.70351	55.97327	T-bar = 1.85714
Empl	overall	58.86901	10.38988	34.72	82.72	N = 91
	between		12.02912	34.72	82.72	n = 49
	within		.9729121	55.96568	61.87901	T-bar = 1.85714
Rural	overall	38.47237	16.35813	8.251	77.946	N = 91
	between		17.86582	8.628	77.946	n = 49
	within		.9756231	35.70204	41.39404	T-bar = 1.85714
NetODA	overall	43.71931	49.5656	-49.50325	204.2159	N = 91
	between		46.95441	-3.22317	182.8561	n = 49
	within		10.64396	-2.56077	76.65566	T-bar = 1.85714
Trade	overall	80.0762	35.4992	23.93441	169.5345	N = 91
	between		34.51904	24.25476	169.5345	n = 49
	within		8.583219	44.59468	119.5154	T-bar = 1.85714

Data: World Bank, International Labour Organisation, UNDP, OECD

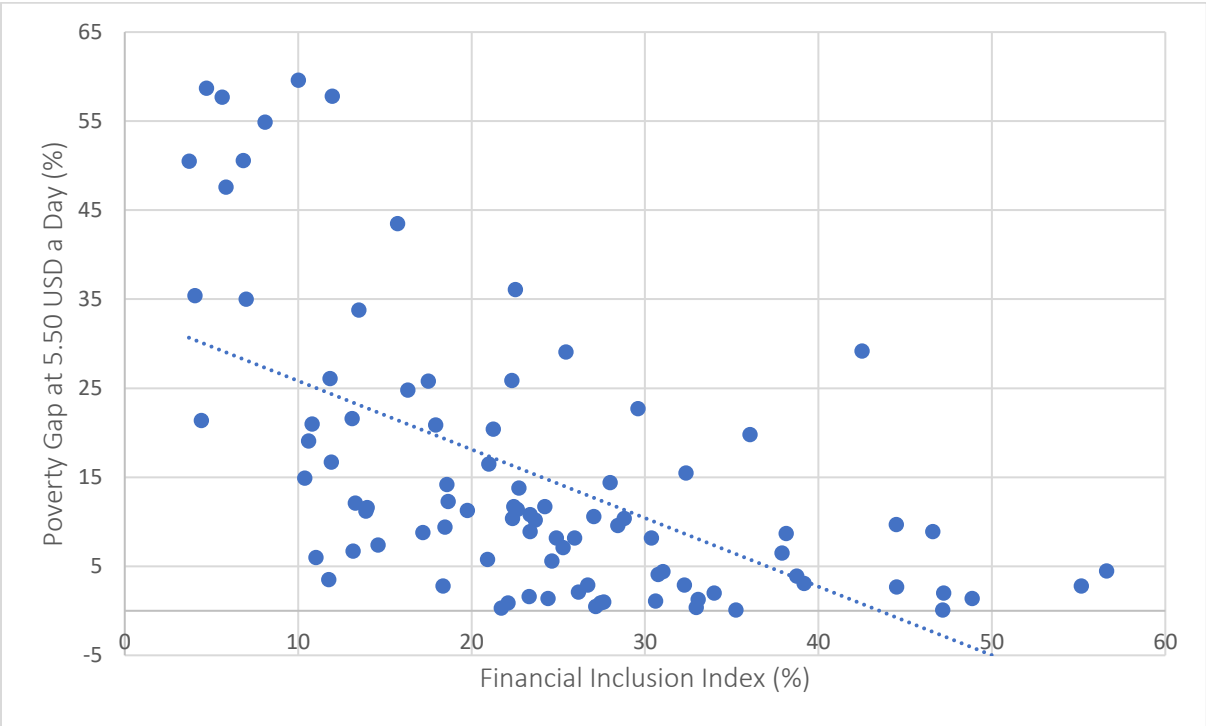
B. Scutter Diagrams: Negative Relation between Poverty and Financial Inclusion

B.I. Relation between the financial inclusion index and the poverty headcount ratio at 1,90 USD per day; Data: World Bank

B.II. Relation between the financial inclusion index and the poverty headcount ratio at 5,50 USD per day; Data: World Bank

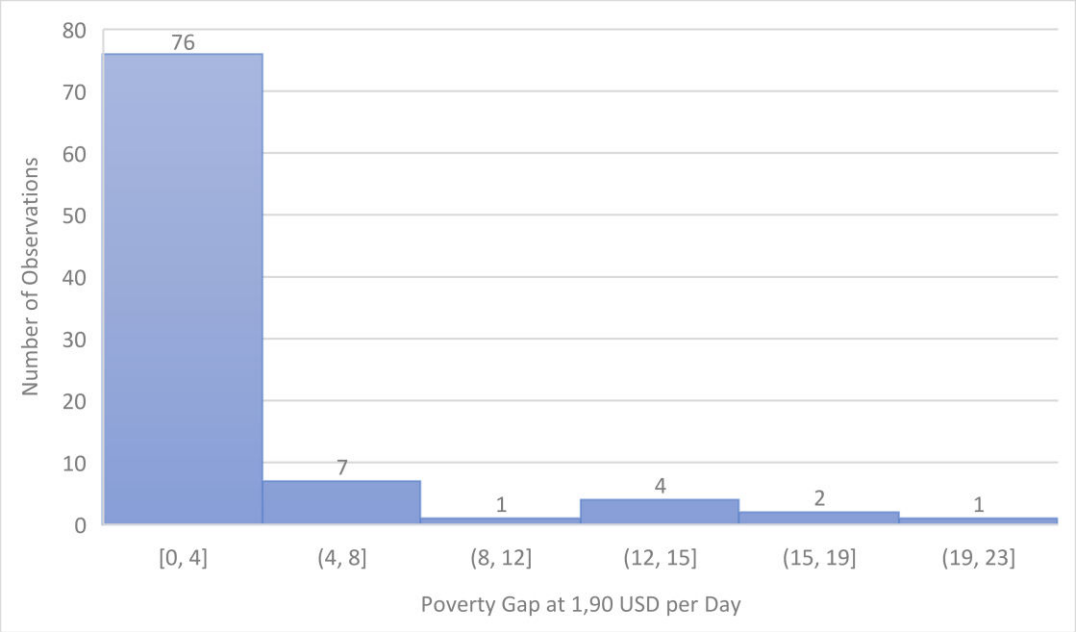


B.III. Relation between the financial inclusion index and the poverty gap at 1,90 USD per day; Data: World Bank

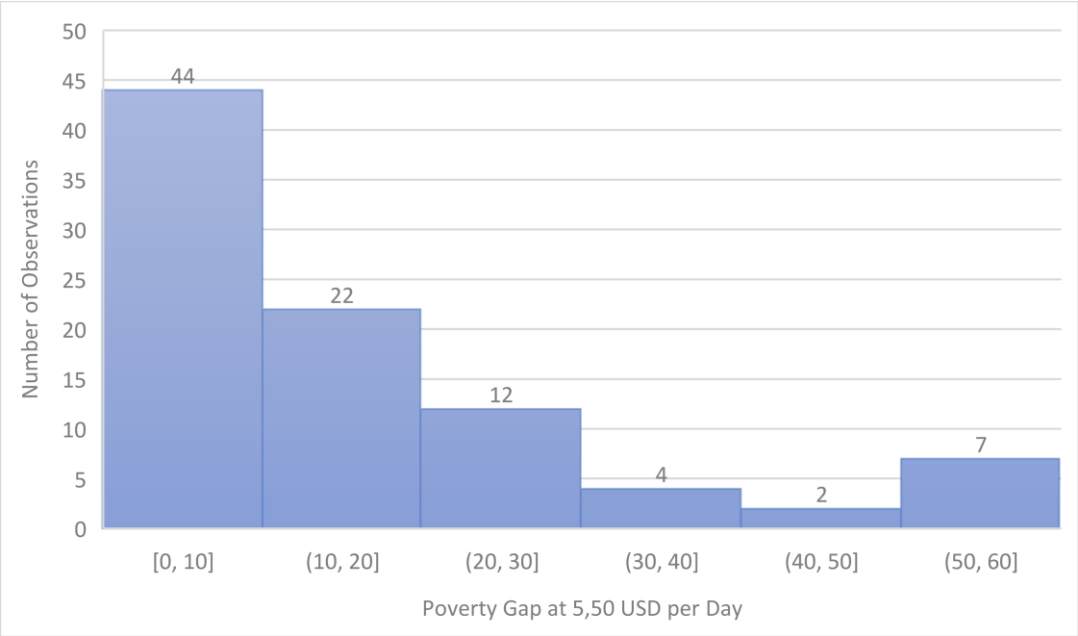


B.IV. Relation between the financial inclusion index and the poverty gap at 5,50 USD per day; Data: World Bank

C. Distributions of the Poverty Gaps



C.I. Positively skewed distribution of the poverty gap ratio at 1,90 USD per day across observations; Data: World Bank



C.II. Positively skewed distribution of the poverty gap ratio at 5,50 USD per day across observations; Data: World Bank

D. Fixed Effects Estimation

VARIABLES	(A1) PovH190	(A2) PovH550	(A3) PovG190	(A4) PovG550
FinInc	-0.183***	-0.253	-0.048**	-0.218**
	(0.063)	(0.171)	(0.021)	(0.092)
GDPCapita	-0.297	-1.284**	-0.080	-0.571*
	(0.216)	(0.585)	(0.071)	(0.315)
Educ	-0.790	-3.529	-0.615	-1.735
	(1.158)	(3.144)	(0.382)	(1.692)
Internet	0.019	-0.086	0.006	-0.009
	(0.026)	(0.072)	(0.009)	(0.039)
Empl	-0.199	-0.115	-0.077*	-0.187
	(0.137)	(0.373)	(0.045)	(0.201)
Rural	0.301	0.594	0.058	0.400
	(0.199)	(0.541)	(0.066)	(0.291)
NetODA	-0.033**	-0.021	-0.010**	-0.030
	(0.015)	(0.040)	(0.005)	(0.022)
Trade	-0.046**	-0.120**	-0.017**	-0.070**
	(0.019)	(0.053)	(0.006)	(0.028)
Constant	25.063	76.250*	13.160**	41.076*
	(15.086)	(40.972)	(4.980)	(22.049)
Observations	91	91	91	91
R-squared	0.560	0.635	0.524	0.622
Number of Country	49	49	49	49

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Data: World Bank, International Labour Organisation, UNDP, OECD

E. Pooled OLS Estimation

VARIABLES	(A5) PovH190	(A6) PovH550	(A7) PovG190	(A8) PovG550
FinInc	-0.148	-0.500***	-0.058*	-0.250***
	(0.090)	(0.148)	(0.034)	(0.089)
GDPCapita	-0.023	-1.708**	0.014	-0.528
	(0.405)	(0.667)	(0.154)	(0.401)
Educ	-2.528***	-0.513	-0.988***	-1.588***
	(0.552)	(0.910)	(0.210)	(0.547)
Internet	-0.070	-0.357***	-0.016	-0.171**
	(0.081)	(0.134)	(0.031)	(0.081)
Empl	0.257**	0.114	0.111***	0.164*
	(0.098)	(0.162)	(0.038)	(0.098)
Rural	0.113	0.493***	0.013	0.245***
	(0.081)	(0.133)	(0.031)	(0.080)
NetODA	0.048*	0.007	0.022**	0.022
	(0.024)	(0.040)	(0.009)	(0.024)
Trade	-0.026	-0.197***	0.001	-0.086***
	(0.030)	(0.049)	(0.011)	(0.030)
Constant	15.867*	64.892***	4.629	30.806***
	(8.149)	(13.424)	(3.104)	(8.072)
Observations	91	91	91	91
R-squared	0.632	0.764	0.578	0.747

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Data: World Bank, International Labour Organisation, UNDP, OECD

F. Feasible General Least Squares Regression (heteroskedasticity-robust)

VARIABLES	(A9) PovH190	(A10) PovH550	(A11) PovG190	(A12) PovG550
FinInc	-0.148*	-0.500***	-0.058*	-0.250***
	(0.085)	(0.140)	(0.032)	(0.084)
GDPCapita	-0.023	-1.708***	0.014	-0.528
	(0.385)	(0.634)	(0.147)	(0.381)
Educ	-2.528***	-0.513	-0.988***	-1.588***
	(0.524)	(0.864)	(0.200)	(0.519)
Internet	-0.070	-0.357***	-0.016	-0.171**
	(0.077)	(0.127)	(0.029)	(0.077)
Empl	0.257***	0.114	0.111***	0.164*
	(0.093)	(0.154)	(0.036)	(0.093)
Rural	0.113	0.493***	0.013	0.245***
	(0.077)	(0.127)	(0.029)	(0.076)
NetODA	0.048**	0.007	0.022**	0.022
	(0.023)	(0.038)	(0.009)	(0.023)
Trade	-0.026	-0.197***	0.001	-0.086***
	(0.028)	(0.047)	(0.011)	(0.028)
Constant	15.867**	64.892***	4.629	30.806***
	(7.736)	(12.743)	(2.947)	(7.663)
Observations	91	91	91	91
Wald-Chi	156.41	295.07	124.43	269.29
p-value	0.000	0.000	0.000	0.000
Number of Year	3	3	3	3

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Data: World Bank, International Labour Organisation, UNDP, OECD

G. Population-averaged Estimation:

VARIABLES	(A13) PovH190	(A14) PovH550	(A15) PovG190	(A16) PovG550
FinInc	-0.101	-0.387**	-0.043	-0.199**
	(0.099)	(0.161)	(0.037)	(0.100)
GDPCapita	-0.333	-2.162***	-0.073	-0.908**
	(0.429)	(0.634)	(0.162)	(0.422)
Educ	-2.876***	-2.061**	-1.074***	-2.211***
	(0.592)	(1.003)	(0.221)	(0.599)
Internet	-0.032	-0.143	-0.009	-0.082
	(0.071)	(0.088)	(0.028)	(0.066)
Empl	0.284***	0.167	0.119***	0.193*
	(0.103)	(0.176)	(0.039)	(0.104)
Rural	0.107	0.467***	0.011	0.235**
	(0.092)	(0.159)	(0.034)	(0.094)
NetODA	0.043*	-0.024	0.020**	0.009
	(0.026)	(0.040)	(0.010)	(0.026)
Trade	-0.035	-0.164***	-0.002	-0.083***
	(0.032)	(0.050)	(0.012)	(0.032)
Constant	17.994**	66.859***	5.262	33.115***
	(8.716)	(14.744)	(3.255)	(8.812)
Observations	91	91	91	91
Wald chi2(8)	143.98	208.45	116.76	221.72
p-value	0.000	0.000	0.000	0.000
Number of Country	49	49	49	49

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Data: World Bank, International Labour Organisation, UNDP, OECD

H. Between Estimation

VARIABLES	(A17) PovH190	(A18) PovH550	(A19) PovG190	(A20) PovG550
FinInc	-0.128	-0.566**	-0.055	-0.261*
	(0.158)	(0.229)	(0.061)	(0.148)
GDPCapita	0.492	-0.713	0.225	0.115
	(0.893)	(1.297)	(0.347)	(0.841)
Educ	-2.258**	0.017	-0.842**	-1.259
	(1.006)	(1.460)	(0.391)	(0.947)
Internet	-0.288	-0.685**	-0.107	-0.399**
	(0.182)	(0.265)	(0.071)	(0.172)
Empl	0.327**	0.152	0.136**	0.211
	(0.144)	(0.209)	(0.056)	(0.135)
Rural	0.077	0.405**	-0.005	0.208
	(0.137)	(0.199)	(0.053)	(0.129)
NetODA	0.064	-0.019	0.027*	0.023
	(0.040)	(0.058)	(0.016)	(0.038)
Trade	-0.037	-0.160**	-0.002	-0.081*
	(0.050)	(0.072)	(0.019)	(0.047)
Constant	16.558	68.529***	4.986	32.029**
	(12.597)	(18.286)	(4.893)	(11.853)
Observations	91	91	91	91
R-squared	0.685	0.802	0.629	0.785
Number of Country	49	49	49	49

Standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1

Data: World Bank, International Labour Organisation, UNDP, OECD

I. Random Effects Estimation

VARIABLES	(A21) PovH190	(A22) PovH550	(A23) PovG190	(A24) PovG550
FinInc	-0.140**	-0.322**	-0.036*	-0.195***
	(0.057)	(0.128)	(0.020)	(0.074)
GDPCapita	-0.423**	-1.789***	-0.114	-0.799***
	(0.206)	(0.473)	(0.070)	(0.270)
Educ	-2.474***	-2.671***	-0.963***	-2.515***
	(0.604)	(0.994)	(0.225)	(0.622)
Internet	0.027	-0.105*	0.009	-0.015
	(0.025)	(0.059)	(0.008)	(0.033)
Empl	0.059	0.130	0.010	0.094
	(0.098)	(0.174)	(0.035)	(0.107)
Rural	0.248**	0.520***	0.066*	0.314***
	(0.098)	(0.159)	(0.037)	(0.100)
NetODA	-0.019	-0.023	-0.006	-0.016
	(0.014)	(0.031)	(0.005)	(0.018)
Trade	-0.055***	-0.145***	-0.018***	-0.080***
	(0.017)	(0.039)	(0.006)	(0.022)
Constant	26.348***	65.455***	10.539***	36.191***
	(8.814)	(14.683)	(3.257)	(9.177)
Observations	91	91	91	91
R-squared	0.573	0.730	0.480	0.715
Number of Country	49	49	49	49

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Data: World Bank, International Labour Organisation, UNDP, OECD