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THE EFFECT OF THE INFORMAL ECONOMY ON POVERTY:

The role of Information and Communication
Technologies (ICT)

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Abstract:

This study investigates how access and usage of Information and Communication Technologies (ICT) could affect the relationship between the size of the informal economy and poverty in developing countries. This topic has yet to receive much scholarly attention apart from one previous study, who argued that the moderating effect of ICTs is through the mechanism of greater financial inclusion. This thesis expands upon this argumentation by arguing that ICT also could affect this relationship by allowing information and communication improvements. This in turn is argued to increase the productivity of the informal workers by allowing them to overcome some of the limitations of informal employment, thereby influencing the poverty levels associated. To empirically test these arguments, a cross-country analysis is performed in a sample of 67 developing countries in the year 2014, using a more substantial proxy for poverty in comparison to previous research. The analysis did not show a significant effect in contrast to the previously mentioned study. The null-findings of this thesis are argued to be due to limitations in data and methodology.

Keywords: Informal economy, informal sector, shadow economy, poverty, ICT, developing countries

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1. Introduction

The informal economy (IE), defined by the International Labour Organisation (ILO) as “*all economic activities by workers and economic units that are - in law or in practice - not covered or insufficiently covered by formal arrangements.*” (ILO, n.d, paragraph 4.), is expansive throughout the world (ILO, 2018). A statistical report on the IE by ILO (2018) shows that 61 percent of the working population in the world get their income through informal employment. This is especially widespread in developing countries. In Africa, for example, 85 percent of workers are informally employed (ILO, 2018). Working without formal arrangements entail several negative consequences for these people. Chen (2012) argues that the informally employed earn considerably less than their formal counterparts. Moreover, they lack legal and social protection, they lack the ability to exercise economic rights, and they work in vulnerability and insecurity (Chen, 2012).

Given the IE’s prevalence in developing countries, much scholarly attention has been paid to how it relates to the high incidence of poverty. However, the literature has reached different conclusions. On the one hand, some argue that the IE has a poverty reducing effect (Adhikari, 2020; Hieu et al., 2014; Rogan & Cichello, 2020). This is because the IE provides an income to marginalised people excluded from formal work opportunities, who otherwise would be unemployed (Adhikari 2020; Rogan & Cichello 2020). In contrast, others argue that due to these workers being unprotected from social and legal safety nets, lacking legal ownership of crucial assets for growth, and due to tax avoidance resulting in less tax income the capacity of the state gets limited to implement meaningful poverty reducing initiatives. Hence, the IE acts instead acts as a poverty trap, cementing and deepening the marginalised position of those living in poverty (Maloney, 2003; Nikopour & Habibullah, 2010; Rogan & Cichello, 2020; Williams, 2014). With the literature being divided, it opens the question of what other factors could affect the relationship between the IE and poverty levels.

One recent explanation brought forth in the literature is about access to, and usage of, Information and Communication Technology (ICT), mainly mobile phones and the internet (Kelikume, 2021). The literature on the effect of these technologies on poverty is well established (e.g., Flor, 2001; Gillwald, 2010; Kelles-Viitanen, 2003), but rarely in connection to the IE. The scarce literature that does exist on the subject have highlighted how ICT could have the ability improve the productivity of informal workers (Choi, Dutz, & Usman, 2020;

Danquah & Owusu, 2021; Nguimkeu & Okou, 2021), which is generally very low (Amin, Ohnsorge, & Okou, 2019; ILO, 2021). However, only Kelikume (2021) have empirically investigated the moderating effect of ICT to the relationship between the IE and poverty. The study argues that greater ICT usage allows informal workers greater financial inclusion, which in turn increases their productivity and decreases the poverty levels associated with the IE (Kelikume, 2021).

While Kelikume (2021) provides some interesting first insights, the study has a few methodological flaws, and does not establish theoretical arguments of besides that of financial inclusion. Thus, the moderating effect of ICT on this relationship remains largely unexplored. This thesis aims fill this gap by developing theoretical arguments based on the literature on how ICTs could improve the productivity of informal workers, by not only increasing their financial inclusion, but also through opening vast new avenues for information and communication gains, and, in turn, alleviating some of the poverty levels connected to the IE. The research questions this thesis aims to answer is: ***How does access and usage of ICT affect the relationship between the size of the IE and poverty in developing countries?***

To do so, I draw on data from 67 developing countries in a cross-country statistical design in 2014. If the hypothesis is supported, it would emphasise the value for governments and other organisations in leveraging, developing, and educating people on ICTs as a pro-poor development strategy, with the potential of reducing poverty in developing countries with a large IE, and in turn contributing to meeting several of the UN's Sustainable Development Goals (UNDP, n.d.a.).

This thesis is structured as follows; firstly, I discuss previous literature and develop my own theoretical arguments based on the literature and present my hypotheses. Next, the data, method, and operationalisations are presented, followed by an analysis and discussion of the results. The thesis concludes with a summarising conclusion.

2. Literature review & Theory

2.1 What is the informal economy?

The informal economy is often used synonymously with the shadow-, unofficial- or the black-market economy, or the informal sector in the literature (Huynh & Nguyen 2020). Yet there is no consensus over a distinct conceptualisation of the IE (Dell'Anno, 2021). Given the size of it, the wide array of workers within it, and the lack of direct information due to its unofficial nature, scholars and organisations have conceptualised it in different ways (Chen, 2012). This has in turn produced different estimates and thereby different conclusions on what drives informality, its size, and its effects (Dell'Anno, 2021). The literature is to a large extent marked by this definitional debate (Dell'Anno, 2021). This merits a short discussion on the different conceptualisations, to give an overview of the different perspectives.

There have been two primary waves of definitional debates, according to Williams, Horodnic, and Windebank (2015). The first wave of discourse can be classified into four different theoretical schools of thought (Chen, 2012). Those are the *legalists*, *voluntarists*, *structuralists* and *dualists*, each with different perspectives on what the informal sector is, which people work in it and why they work there (Chen, 2012). Simplified, *legalist* and *voluntarist* emphasise the entrepreneurs, those who choose to operate informally. They choose to exit the formal economy due to a burdening legal system, costly registration fees, complicated tax systems and slow bureaucracy which stifles their growth (De Soto, 1989; Chen, 2012; Perry et al., 2007; Williams et al., 2015). *Dualists*, however, primarily see the informal sector comprised of the poor and the marginalised, those who are excluded from modern work opportunities in the formal sector (Chen, 2012; Hart, 1973). Lastly, *structuralists* perceive the informal sector as a natural by-product of the capitalistic system, where production costs and employment can be lowered by informal activity in the name of competition and profit (Chen, 2012). Given the wide array of workers within the informal economy, these perspectives are not necessarily mutually exclusive, but should instead be viewed as emphasising different aspects of informality (Chen, 2012).

The second wave, spearheaded by international organisations such as ILO and the World Bank (Chen, 2012; Williams et al., 2015), presented a more holistic approach, defining the IE in a way that encompasses the wide array of workers and activities described by the previous four

perspectives. Perry et al. (2007) presents a model of informality where informal actors are grouped into three categories, *labour workers*, *micro-firms* and *firms* which are driven to informality either by willingly *exiting* the formal or by *exclusion* from the formal economy, (Chen, 2012; Perry et al., 2007). The former leaning on the *legalist* and *voluntarist* perspective, highlighting the entrepreneurs as voluntarily *exiting* economy as to avoid the costs, time, and struggle of formal registration in a weak or burdensome institutional context (Perry et al., 2007; Williams et al., 2015). The latter highlighting the marginalised workers who are *excluded* from the formal economy due to labour market segmentation and burdensome entry regulations preventing them from formalising or higher skill requirement for formal jobs (Chen, 2012; Perry et al., 2007). ILO instead provides a holistic view by more so focusing on employment relationships that are not regulated, workers without legal and social protection, both in the formal and informal sector (Chen, 2012; ILO, 2018)

As to attempt to paint a clearer picture of who primarily works in the IE, according to data from the ILO (2018) statistical rapport, the majority of informal employed in developing countries are *own-account workers* operating without any employees, constituting 45.5 percent of total informal employment. *Employees* in informal businesses, or informally employed in formal businesses, make up 35.4 percent of the informal economy, while 16.6 percent are *contributing family workers*. Lastly there is a small group of *employers* who employ at least one worker, which account for 2.5 percent (ILO, 2018). The great majority of businesses and enterprises in the IE are small units, with 75 percent of total informal employment composed of businesses with less than ten people (ILO, 2021), and 45.5 percent of these consisting of own-account workers (ILO, 2018; ILO 2021). Informality is especially prevalent in agriculture, as it is the industry sector with the highest rate of informal employment, constituting 93.6 percent worldwide (ILO, 2018).

2.2 How does the informal economy affect poverty levels?

- *How the informal economy could alleviate poverty levels*

A sizeable amount of the literature argues that the IE alleviates poverty levels (e.g., Adhikari, 2020; Rogan & Cichello, 2018). This is reflective of the *dualist* perspective on the IE, where it is distinctly separate from the formal economy and provides livelihoods to largely self-employed workers that are unable to acquire work in the formal economy (Chen, 2012; Hart,

1973). They work informally as a means of survival (Chen, 2012). In other words, it is argued that if it was not for informal employment, most of these workers would be unemployed and without income, therefore informal employment and the IE alleviates poverty by providing some source of income.

Empirical evidence for this has mainly relied on investigating what poverty levels would have been without incomes from informal employment (Adhikari, 2020, Cichello & Rogan, 2018; Hieu et al., 2014). Hieu et al. (2014) shows that if all informal workers would instead be unemployed in Vietnam, it would raise the poverty rates by 11 percent. Similarly, Cichello and Rogan (2018) find that the “per job” impact of informal work on poverty is similar to that of formal work in South Africa. One *self-employed* job has 63 percent of the poverty-reducing impact at the extreme poverty line in comparison with a job in the formal economy. Moreover, informal *employees* and *domestic workers* jobs have 81 percent and 85 percent poverty reduction respectively compared to a formal job. With these results, they conclude that informal work makes important contributions to alleviating poverty levels, and policies that negatively impact informal jobs and earnings should instead focus on protecting and elevating the earnings of the workers in the IE in the name of poverty reduction (Cichello & Rogan, 2018; Rogan & Cichello, 2020)

- ***How the informal economy could increase poverty levels***

Looking at the connection between informal employment and poverty, the little data available to us shows that these workers earn substantially less than their formal counterparts (ILO, 2021). In this vein, Chen et al. (2005) produced a hierarchy of earnings for the different categories of informal employment (*own-account workers, employees, contributing family workers, and employers*), which according to Chen (2018), suggests that on average, the only category of informal workers who are not poor are the informal *employers* (Chen, 2018). According to ILO (2018), however, informal employers only make out 2.5 percent of the informal workforce in developing countries. Furthermore, the poor labour salaries also translate into increased household poverty levels, as most households in developing countries rely on informal labour income as their main source of income (ILO, 2021). According to ILO (2021), these high levels of poverty are, to a large extent, indicative of the low levels of productivity among informal enterprises. This has also been shown in academic literature; Amin et al. (2019), for example, show that labour productivity among informal firms is on average one-quarter of that of formal firms. They explain this by the low education levels among informal

workers, restricted access to financial services and markets, lack of legal ownership of key assets for growth and lack of legal and social protection (Amin et al., 2019; ILO, 2021).

Hence, research and international organisations largely argue that informality reinforces the marginalised position of workers rather than reducing it. This is coined as the *reinforcement thesis* by Williams (2014). There are several theoretical arguments as to why working in the IE reinforces marginalisation. Most theoretical arguments are grounded in factors of informal employment that stifle informal operators' productivity and growth. Firstly, it is argued that the poor and the marginalised lack resources that will allow them to take part in wider markets (Williams, 2014; Williams 2007). This could be extended to the lack of legal ownership of key assets for growth, such as land, offices, or equipment (ILO, 2021). Secondly, due to lost tax revenue, the state is less able to implement meaningful poverty alleviating initiatives for informal workers, and the loss of tax revenue have been argued to hinder economic growth, which in turn increases poverty levels (Nikopour & Habibullah, 2010). Thirdly, due to the workers being unprotected by social and legal means, they are more susceptible to being abused by for example corruption or crime (ILO, 2021). Moreover, due to them being unprotected by income replacements benefits, they are especially vulnerable to poverty during economic crises, such as the economic hardships caused by the COVID-19 pandemic (ILO, 2021). Lastly, not being able to access formal financial services leads to economic constraints and lack of business development (Claessens, 2006; ILO, 2021).

- ***Direction of causality***

The literature discussed thus far surrounding this relationship have argued from the perspective of the informal economy effecting poverty. However, a few studies have highlighted the opposite impact of poverty on the informal economy, indicating a potentially reverse relationship (Devicienti, Groisman, & Poggi, 2010). In other words, that the mechanism at play is that the impoverished seek informality which causes the informal economy to grow, explaining the connection. This raises the question whether the poverty levels associated with the IE are explained by the poor seeking informal work or whether their poverty is due to working informally? This thesis relies on the latter conception, with the many aspects of informality hindering growth and productivity, thus affecting poverty. Even so, there is uncertainty surrounding the direction of causality, as there are credible arguments that it could flow both ways, which is problematic for the validity of the study.

To summarise, both perspectives discussed on how the IE effects poverty agree that most informal workers are poor and unproductive. However, the more “optimistic” perspective sees informality as a pathway to alleviating extreme poverty by providing the unemployed with an income. Contrastingly, a large amount of literature sees informality as reinforcing their marginalised position due to limitations imposed by working informally hindering their productivity and growth, thus deepening poverty levels. Given that the literature is divided on this issue, the questions arise how recent developments such as the spread of ICTs in developing countries could reinforce either of the two potential effects of the IE?

2.4 The moderating effect of ICTs

The arguments for the moderating effect of ICTs to the relationship between the IE and poverty has only recently formally attracted attention by research, mainly formalised in a study by Kelikume (2021) in Africa. Kelikume (2021) argues that informal workers exclusion from the formal financial services is a critical mechanism of generating poverty. According to his theory, the spread of ICTs, mainly through mobile banking, enables workers in the IE to have greater financial inclusion, thus generating lower poverty levels in a context where mobile and internet penetration is greater (Kelikume, 2021). A perspective that is also supported by Farazi (2014), who argues that lacking access to financial services is one of the main causes of low income and productivity levels among informal enterprises. Kelikume (2021) finds empirical evidence for his claims in a panel-data analysis of 42 African countries.

However, regarding the theory presented, the possibilities of ICT for informal workers does not *only* allow for greater financial inclusion as per the theory by Kelikume (2021). This technology could also open new avenues to learn and improve their operations by accessing a vast new world of information, and moreover, enable communication with greater ease and reach (Choi et al., 2020; Danquah & Owusu, 2021; Nguimkeu & Okou 2021). This in turn could also improve productivity, which is something that Kelikume (2021) did not formalise in his study.

Moreover, the data employed in Kelikume (2021) make his findings questionable in light of the theoretical arguments he proposes. The main issue of his study is the operationalisation of the dependent variable “*poverty reduction*” as the composite Human Development Index (Kelikume, 2021). The problems with using this as a proxy for poverty reduction is apparent, as the UNPD themselves claim that “*It does not reflect on inequalities, poverty, human security, empowerment etc.*” (UNDP, n.d.b., paragraph 3). The index consists of three indicators, gross

national income per capita (GNI), mean and expected years of schooling, and life expectancy at birth (UNDP, n.d.b). GNI, meaning the sum of all income in the population divided by number of people, does not reflect on poverty levels. For instance, two countries could have the same GNI, but different levels of poverty depending on the inequality of earnings. Even though the other two indices are loosely related to some conceptions of poverty, none measure it as an absolute or relative measure of poverty would. As for example, rate of household poverty, poverty headcount or by the poverty gap.

As this brief discussion highlighted, more research is needed on the moderating effect of ICTs on the relationship between the IE and poverty, since a positive effect of them would underscore the value for governments and other organisations in investing in infrastructure, education, and availability of these basic technologies as a pro-poor development strategy. The following section outlines theoretical arguments on how ICTs could do this by gains in not only *financial inclusion*, but also *information*, and *communication* benefits, which together are argued to increase productivity and affect the relationship between the IE and poverty.

2.5 Theory

With the increasing widespread of ICTs, research has focused increasingly in more general terms on how ICTs increases productivity among firms and businesses, and its importance for countries development and growth (e.g., Flor, 2001; Gilwald, 2010; Kelles-Viitanen, 2003). A small but growing field of literature have highlighted how ICT have the potential improve the productivity of the informally employed and the informal businesses, overcoming some of the limitations of informal work. In broad terms, the arguments could be divided into three channels, through gains in *financial inclusion*, *information*, and *communication*.

Financial inclusion:

Financial inclusion, generally defined as the access to formal financial service for all members of society (Diniz, Birochi, & Pozzebon, 2012), is recognised in the literature as a pathway for poverty reduction and growth (Claessens, 2006; Diniz et al., 2012; Kelikume 2021) Lack of access to these services is often highlighted as a key factor hindering informal enterprises growth and productivity (e.g., Farazi, 2014; ILO, 2021; Kelikume, 2021). Formal financial institutions often do not have an incentive to serve low-income informal workers and enterprises in developing countries (Diniz et al., 2012; Kelikume, 2021). This is because banks have poor cost-benefit returns in serving them, due to only handling small amounts of money,

and are difficult and often expensive to reach due to their location in rural or less populated areas, without telephone communication or the internet (Diniz et al., 2012; Kelikume, 2021). This lack of access to financial services leads to capital constraints, inefficient scale of production, lack of access to business development strategies, lack of access to financial markets in terms of investment and access to key public goods (ILO, 2021).

Through ICTs, mainly through mobile phones and mobile banking, this would allow poor informal operators a pathway to financial inclusion (Nguimkeu & Okou, 2021; Kelikume, 2021). M-Pesa, for example, is a mobile banking system in Kenya which has provided services such as money transferring, loans- and savings account to informal workers and enterprises who were previously not able to access formal banking services and was cited in qualitative literature as a factor that improved financial inclusion (Danquah & Owusu, 2021; Mbiti & Weil, 2016). To illustrate the benefits of these systems, Kirui, Okello, Nyikal, and Njiraini (2013) found that mobile phone-based money transfer systems raised annual incomes, on average, by 224 USD among a sample of agricultural households in rural Kenya. Another example, rural informal farmers could access the digital platform and education marketplace *Arifu*, designed to educate them on the value and how to use finance, increasing uptake and usage of savings and borrowings, in aim of increasing their financial inclusion (Choi et al., 2020; Kim et al., 2020). Furthermore, mobile banking allows for financial bookkeeping, which leads to greater opportunities of securing loans and investments, which in turn, enables informal units to expand their businesses (Danquah & Owusu, 2021). The growth in financial inclusion in Sub-Saharan Africa over the last decade have been driven primarily by these mobile banking systems (Nguimkeu & Okou, 2021).

Information:

However, an increase in productivity through ICTs does not have to be driven merely by financial inclusion but can also be driven by increased access to information. The internet, or more often, mobile phones with internet access, opens a new world of information for informal workers and enterprises for them to learn about how to operate their business more efficiently and improve their productivity. According to Danquah and Owusu (2021), many informal enterprises and workers still rely on radio, newspapers, and personal travels to find information about markets, prices, potential buyers and sellers. Personal travel is costly due to transportation (Danquah & Owusu, 2021) and information from the radio and newspapers might not be relevant to their operations and businesses. Having a mobile phone with internet access is in

comparison a much more efficient way of obtaining information relevant to them, and less costly in the long run, especially in comparison to personal travel (Danquah & Owusu, 2021).

To exemplify, to help low-scale and unproductive farmers gain knowledge on how to improve their yields, having a mobile phone allows access to several informational services directed to their needs (Choi et al., 2020; Kim, Shah, Gaskell, & Prasann, 2020). The *8028 Farmer Hotline* in Ethiopia, for instance, is telephone-based service where the Agricultural Transformation Agency delivers information directly to the farmers by Interactive Voice Response or by text/SMS response (Choi et al., 2020). Another example cited in the literature is the Digital Green Organization providing informational videos, often customised to the farmers' local needs and capabilities, in service of upscaling their productivity through education (Kim et al., 2020; Choi et al., 2020). Access to information through ICTs can not only increase productivity directly but also alleviate some of the vulnerabilities of working informally. In an interview study of informal workers by Chen (2016), a home-based worker in Thailand was involved in a legal twist, where she had not been paid for her work by a subcontractor, who denied ever making the order. Not having any formal written documents as evidence, she was able to present the messages between the two parties as evidence in court that proved that they had made the order (Chen, 2016, p. 416-417).

Communication:

Another virtue of ICTs is the ease, and greater reach, of communication with customers, suppliers, and business partners. Danquah and Owusu (2021) argue that this enables informal enterprises to expand their businesses by selling in more markets and generate more market contacts via social media. Moreover, it allows enterprises to advertise their business online, and communicate about opening hours and prices. This improvement in reach and communication is argued to increase productivity, competitiveness, and income (Danquah & Owusu, 2021; Nguimkeu & Okou, 2021).

Chen (2016) provides an example of this; an informal garment worker in Durban (South Africa) discusses how she takes orders from clients and makes appointments through her mobile phone without having to meet them in person. The worker explains that this has allowed her to expand her customer base beyond her own city, as when orders come from further away, she asks about their measurements via SMS and makes their clothes to order (Chen, 2016, p.415). In the same study, waste pickers in Lima (Peru) are cited to use their phones to generate more work

opportunities, by for example arranging contracts with clients to use their three-wheelers to transport furniture or other materials (Chen, 2016, p. 416).

3. Hypotheses

In sum, given the research and theory presented in the literature review, the thesis formulates two hypotheses. The first is that IE is expected to increase poverty levels in developing countries. This is due to overwhelming evidence that most informal workers are poor, and the many factors at play impeding their productivity and growth due to them working informally, reinforcing their marginalised position. These include lack of legal and social protection, lack of financial inclusion, lack of legal ownership of key assets for growth and the state’s decreased ability to introduce meaningful poverty reducing initiatives.

H1: An increase in the size of the informal economy is expected to increase poverty in developing countries.



Figure 1. Causal model between the IE and Poverty

The second hypothesis, based on the theoretical arguments presented in the literature review, is that where access and usage of ICTs is widespread, it is expected that the informal operators are, in general, more productive by this technology enabling *informational, communicational, and financial inclusion* gains. Having access to ICTs allows participants of the IE to overcome some of the challenges of informal employment, which in turn, is expected to increase their productivity, income levels and provide improved livelihoods for themselves and their families, thus decreasing the “bad” effect of the IE on poverty levels.

H2: The positive effect of the IE on poverty becomes weaker as general access and usage of ICTs increases in developing countries.

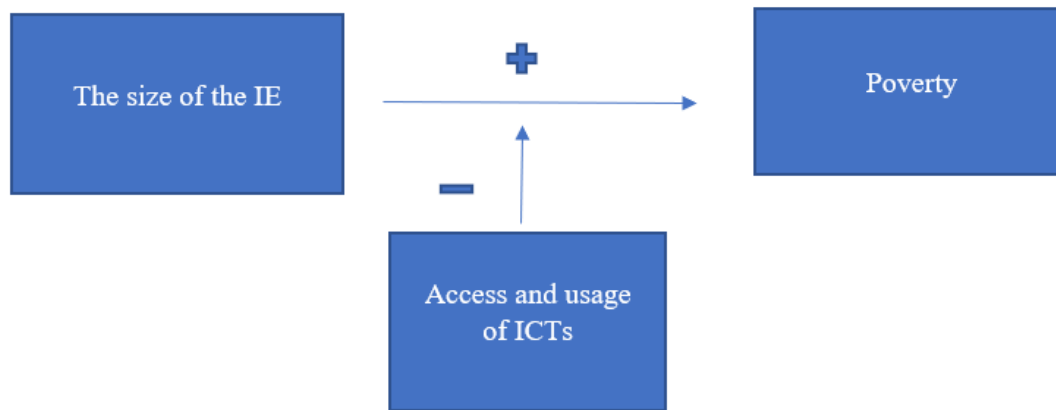


Figure 2. Causal model of how access and usage of ICT moderates the relationship between the IE and poverty.

4. Method, Definitions & Data

To empirically evaluate the hypotheses, the method of choice is a quantitative study with statistical analysis. A quantitative study is chosen because it allows to investigate the hypotheses in a wide array of developing countries, which allows to make empirical conclusions about the theories presented and fulfils the aim of this study. Multivariate regression analysis is applied to achieve this, where several potential confounding variables are included in the model and held constant to decrease the risk of presenting a spurious relationship (Teorell & Svensson, 2007)

Regarding the design, the optimal choice would be to use panel data for a sample of developing countries, as this would allow us to study changes over time in the same countries, thus partly eliminating the danger of omitted variable bias, as many factors that are constant over time are held constant by design (Ruist, 2021). However, this is not possible given the scarcity and unreliability of poverty data, as most countries, especially low-income developing countries, do not have household level surveys available on a yearly basis (PovcalNet, n.d.).

Instead, a cross-country design is employed, where I study differences in values for the developing countries at the same point in time, which allows to test the hypotheses with a sufficient sample size. The year chosen for this analysis is 2014. The data from this year has two advantages, first, it is appropriate as a rather recent time in which ICT development have taken place, allowing for variation in the moderating variable. Second, this is the year with the most reliable poverty data with the widest country coverage.

The units of analysis are developing countries. Developing countries were chosen because both the IE and poverty are especially ubiquitous in these countries (ILO, 2018), while at the same time, having varying degrees of ICT development (GII, n.d.). Furthermore, most of the literature cited focuses on developing countries regarding this relationship. Even though there is not a clear theoretical conception on what constitutes a developing country, the study will use the categorisation by the UN in their World Economic Situation and Prospects rapport (UN, 2020). A list of all developing countries identified according to this classification can be found under the categorisation “*Developing economies by region*”, and contain 127 countries in total (UN, 2020, p.166). This study covers 67 of the developing countries for which data was available for all variables (see appendix A for full list).

4.1 Definitions and operationalisations

In this section, I define the concepts to provide a clear explanation on what I am focusing on. Thereafter, I will discuss different ways of operationalising these, and elaborate on the reasoning behind the chosen operationalisation. It is of great importance for the validity of this thesis that the indicators measure the concepts reliably (Esaiasson et al., 2017), which motivates this discussion.

- *Poverty (dependent variable)*

Poverty is a multifaceted idea, leading to different conceptualisations and in turn, measurements of its prevalence. As described by Lok-Dessallien (1999), poverty can be viewed in an *absolute* or *relative* sense, where *absolute* poverty refers to people living without the bare necessities, such as food, water, or acceptable living conditions, whereas *relative* compares the within country aspect, where one is poor in relation to the other members of a society (Lok-Dessallien, 1999). Moreover, there are *objective* and *subjective* perspectives on poverty, where the *objective* approach, also called the welfare approach, emphasises what would be needed for the poor to exit poverty, whilst the more *subjective* perspective focuses on how the poor themselves value goods and services, highlighting individual utility (Lok-Dessallien, 1999).

Even though there is credence to all these perspectives, for the purpose of this study, I chose to rely on a more *absolute* and *objective* definition. This is to be able to have a common concept and measurement between a wide variety of developing countries, as the *subjective* and *relative* approach limits comparability. Moreover, there is not sufficient and reliable data for relative,

societal, or multidimensional poverty in a cross-country context. Poverty is thereby defined, for the sake of this thesis, as a state in which a household, and the individuals within it, are not able to acquire the assets to sufficiently fulfil basic human needs, defined more specifically by if they fall below a set poverty line.

In line with this approach, several poverty lines have been set as “benchmarks” for living in poverty based on household consumption and expenditure required to meet basic human needs (World Bank, 2020). The international poverty line at 1.90 USD/day was set using the national poverty lines in the poorest economies in the world (World Bank, 2020). This was reflective of when 60 percent of the world’s population lived in low-income countries (World Bank, 2020). However, in 2017, only 9 percent of the world’s population lived in these countries (World Bank, 2020). To reflect this change, other poverty lines have been introduced. The poverty line of 3.20 USD/day was set to reflect the national poverty of lower-middle-income countries, where 41 percent of the global population lived, and 5.50 USD/day for upper-middle-income countries, where 35 percent of the population lived (World Bank, 2020).

With this discussion in mind, I chose to operationalise poverty by the percentage of a countries population living below 3.20 USD/day in 2014 based on 2011 Purchasing Power Parity (PPP) currency rates from PovcalNet, the World Banks source of regional and country level poverty estimates (PovcalNet, n.d.). Simplified, PPP is used to find a common scale and currency to measure poverty through consumption and expenditure across countries and regions, as prices of goods and services vary between countries (PovcalNet, n.d.).

This source is chosen firstly, due it being a more absolute and intuitive measure of poverty in comparison to the HDI-index employed in the study by Kelikume (2021), secondly, for allowing cross-country comparison, and thirdly, due to it having the largest country coverage. The international poverty line of 3.20 USD/day is chosen due to it reflecting poverty in low-middle income countries (World Bank, 2020), which are the countries that mainly constitute developing countries by the UN categorisation (UN, 2020; World Bank, n.d.). However, as suggested by PovcalNet (n.d.), multiple poverty lines should be used to test the robustness of global poverty comparisons. Because of this, the thesis will also use the two most widely used international poverty lines of 1.90 USD/day and 5.50 USD/day as robustness checks.

It is important to note however, that since many countries do not collect household data on consumption every year, the PovcalNet dataset consists of extrapolated and interpolated

poverty estimates from other years to allow for more complete data (PovcalNet, n.d.). Acknowledging that poverty estimates for many of the countries could be quite unreliable, caution should be exercised when interpreting the results. This data is still appropriate for the purpose of this thesis, as it is the most reliable alternative, with it also being used in the World Bank Global Poverty and Shared Prosperity reports (e.g., World Bank, 2020) while at the same time, providing a sufficient sample size.

- ***The Informal Economy (independent variable)***

As discussed, the literature is largely divided on what the IE is and how to define it (Dell'Anno, 2021). This thesis defines it as by the ILO, "...*all economic activities by workers and economic units that are - in law or in practice - not covered or insufficiently covered by formal arrangements.*" (ILO, n.d. paragraph 4). This definition is chosen firstly due to being the most encompassing definition, measuring a wide range of workers and activities, and secondly due to it being the primary definition used by the literature that examines its connection to poverty and the data presented on income- and poverty levels in the IE (Chen et al., 2005; Chen 2018; Cichello & Rogan, 2018; Hieu et al., 2014).

To add complexity to this definitional issue, due to the hidden nature of informal activity, the concept is especially difficult to measure (Schneider & Buehn, 2018). Two primary methods of estimating its size are through *direct* or *indirect* observations (Elgin, Kose, Ohnsorge, & Yu, 2021).

Direct methods are primarily through surveys, either labour-, firm opinion-, or household-, or tax analyses (Elgin et al., 2021; Huynh & Nguyen, 2020). These measures do not come without problems. Firstly, people or firms may not want to admit that they are not paying taxes, so the survey data are expected to underestimate the real extent of informality due to social desirability bias and underreporting (Huynh & Nguyen, 2020). Secondly, direct surveys only capture certain aspects or segments of the IE. Thirdly, little data is available for cross-country analysis as most datasets are based on single or few countries.

Indirect methods are based on mathematical modelling, grounded in assumptions of the IE. Two primary indirect methods exist, either through the dynamic general equilibrium model (DGE) or by the multiple indicators multiple causes method (MIMIC). DGE which focuses on aspects that affect an agent's decision to work informally or formally through various channels, and through measuring these, producing an estimate of the economy's size (Elgin et al., 2021).

MIMIC is the most common estimation method in the literature and is constructed by compiling several causes of the IE, in combination with several indicators of the IE's prevalence, and then producing an estimate of the economy's size (Elgin et al., 2021; Schneider & Buehn, 2018).

I choose to operationalise the size of IE with data from Elgin et al. (2021) using the MIMIC method, as it captures a much wider range of informal activity than DGE, where both the extent of informal employment and productivity of the economy is measured (Elgin et al., 2021). The cause variables used by Elgin et al. (2021) are “: 1) *size of government (general government final consumption expenditure as a percent of GDP, from UN spliced with WDI)*; 2) *share of direct taxation (direct taxes in percent of overall taxation, WDI)*; 3) *fiscal freedom index from Heritage Foundation*; 4) *business freedom index from Heritage Foundation*; 5) *the unemployment rate and GDP per capita to capture the state of the economy (WDI, the latter is spliced with WEO)*; and 6) *government effectiveness (Worldwide Governance Indicators*” (Elgin et al., 2021, p. 36). The indicator variables are, “: 1) *growth rate of GDP per capita (WDI, spliced with WEO)*; 2) *the labor force participation rate (people over 15 economically active in percent of population, WDI, spliced with Haver Analytics)*, and 3) *currency as a ratio of M0 (currency outside the banks) over M1 (IMF IFS and Haver Analytics)* (Elgin et al., 2021, p. 36). To clarify, the last indicator variable, M0 over M1, is simplified a measure of how much cash (bills, coins) is in circulation, with the assumption that the more cash being used, the larger the IE. By combining these cause and indicator variables, an estimate of the size of the IE in different countries is calculated as the percentage of official GDP (Elgin et al., 2021).

However, the MIMIC approach is not ideal for this study mainly because the definition underlying Elgin et al. (2021) is not entirely coherent with the definition this study has chosen to rely on. They define the IE it as “*market-based and legal production of goods and services that is hidden from public authorities for monetary, regulatory, or institutional reasons*” (Elgin et al., 2021, p. 4). It captures most of the same aspects of informality as the definition by the ILO (n.d.), however it does not cover household production, nor the informally employed in the formal sector (Elgin et al., 2021). In turn, it does not capture the extent of informality as some of the figures presented by the ILO (2018), and the data on earnings and poverty by Chen et al. (2005). Therefore, the estimates used for analysis are expected to systematically underestimate the “true” extent of informality. This would in turn mean that if this study finds the anticipated effect of a negative effect of informal economy on poverty levels, the effect would most likely be underestimated rather than overestimated. The measure is nonetheless

appropriate for usage here mostly because of its wide country-coverage. As was stated above, data by the ILO and direct survey data lack cross-country coverage for developing countries.

- *Access and usage of ICT (moderator)*

ICT is a well-established concept in the literature. Regarding the specific technologies, this thesis defines ICTs as mobile phones, fixed telephones, computers, and the internet. *Access* refers to the overall technological infrastructure - the availability and the quality, - while *usage* refers to what extent the population utilises these technologies.

To operationalise this concept, I use the ICT composite index in the infrastructure pillar of the Global Innovation Index (GII) (WIPO, 2021). This index is a composite of four indicators, *ICT access*, *ICT use*, *Government's online service*, and *E-participation* (WIPO, 2021).

In more detail, the *ICT access* indicator is a composite of five indicators weighed 20 percent each, “(1) *Fixed telephone subscriptions per 100 inhabitants*; (2) *Mobile cellular telephone subscriptions per 100 inhabitants*; (3) *International Internet bandwidth (bit/s) per Internet user*; (4) *Percentage of households with a computer*; and (5) *Percentage of households with Internet access*.” (WIPO, 2021, p. 187) Secondly, *ICT use* is a composite of three indicators weighed 33 percent each, “(1) *Percentage of individuals using the Internet*; (2) *Fixed (wired) broadband Internet subscriptions per 100 inhabitants*; (3) *Active mobile broadband subscriptions per 100 inhabitants*.” (WIPO, 2021, p. 187). Thirdly, *Government's online service* is a composite indicator “*measuring the use of ICTs by governments in delivering public services at the national level*”. (WIPO, 2021, p. 187). Lastly, the *E-Participation index*, “*reflects the e-participation mechanisms that are deployed by its government in comparison to all other countries*.” (WIPO, 2021, p. 188).

These four indices are averaged to produce an ICT score from 0 to 100, with higher values indicating higher access and usage of ICTs (WIPO, 2021). This index is chosen due to it providing the most encompassing picture of the ICT development in a country, and the opportunities for its citizens to benefit from the services that it provides.

However, the variable has a skewed distribution, where most countries are located at the “bottom” end of the distribution with only a few much more technologically advanced countries (South Korea and United Arab Emirates in particular), and a clear non-linear relationship to the poverty variable (see appendix B). Therefore, the variable will be transformed using the natural

logarithm to achieve a more normal distribution, so that the values become more compressed, and the “extreme” values does not influence the results to such a large extent, while at the same time, achieving a more fitting linear form in relation to the dependant variable.

4.2 Control variables

The following section describes which factors could affect both the size of the IE and poverty, and influence the results presented as confounding factors. To account for these, the aim is to bring these into the model and hold them constant. This section introduces potential confounding factors as well as the operationalisation of them.

Education: Low levels of education are expected to increase the IE, as people without, or with only basic education are more likely to be excluded from formal work opportunities and work informally as a means of acquiring an income (Hart, 1973; ILO, 2018). Hence, a high share of individuals in a country with low education is likely to result in a larger informal economy.

Education is also expected to affect poverty levels, where an increase in the average level of education have been argued to decrease poverty through higher skill acquisition and growth rates, which in turn are related with lower poverty levels (UNESCO, 2017).

The average level of education is operationalised by the Education Index in the HDI, which measure expected years of schooling for children and mean years of schooling for adults and is given as a score between on a continuous scale from 0-1, with higher values indicating higher levels of average education (UNDP, n.d.b.). However, since the coefficient for this variable will tell us the effect of going from no education to max on the dependent variable, the variable will be multiplied by 100 to make it more sensible to interpret.

Institutional quality: Poor and inefficient institutions have been regarded by some to be a primary driver of informality (De Soto, 1989; Perry et al., 2007). A weak legal system, complicated registration processes, burdensome entry regulations, and corruption, have all been argued to incentivise informal activity (De Soto, 1989; Perry et al., 2007; Quedrago 2017).

Poor institutional quality has also been argued to increase poverty and create poverty traps, through various channels such as causing market inefficiencies, decreased economic growth

and corrupt officials exploiting the poor (Bowles 2011; Justesen & Bjørnskov, 2014; Tebaldi & Mohan, 2008; Tebaldi & Mohan 2010).

Institutional quality is operationalised by the Institutions pillar in the Global Competitiveness Rapport which measures the quality of the public and private institutions. The variable is scaled between 1-7, where a higher score indicates greater quality of institutions in a country (World Economic Forum, n.d.).

Economic prosperity: The economic prosperity of a country has been argued to be a key factor in determining the size of the IE (Feld & Schneider, 2010; Medina & Schneider 2018). The argument is that the lower the GDP, the lower quality of public sector services and higher unemployment rates, which then creates an incentive for people to work in the IE (Feld & Schneider, 2010; Medina & Schneider 2018). Therefore, greater economic prosperity is expected to decrease the IE.

Moreover, greater economic prosperity and growth has been argued to key in decreasing poverty, through various mechanism such as more people having access to education, and job creation (Rodrik, 2007). Hence, greater economic prosperity is expected to decrease poverty.

Given this discussion, and by the reasoning that the IE is generally the largest in low income and developing countries, where poverty levels are also generally the highest (ILO, 2018), I chose to control for the economic prosperity of a country. It also is common in the literature to control for some macro-economic aspect (e.g., Esaku, 2021; Kelikume, 2021; Huynh & Nguyen, 2020). It is operationalised as GDP per capita in USD by data from the World Bank (World Bank, n.d.d). However, since the variable was heavily skewed and show a clear non-linear relationship to the dependant variable, it will be transformed using the natural logarithm to approximate a normal distribution and a more fitting functional form (See appendix C).

Democracy: The theory of democratic economic policy suggests that if people are not able to exercise their political choice, they have a reason to exit the formal system and instead work informally to not pay taxes (Gerxhani, 2004; Solomon & Shresta 2014), suggesting that in non-democratic regimes or in regimes with weak democratic institutions the informal economy should be larger. Moreover, political instability through autocratic systems of governing have also been argued to increase informality (Elbahnasawy, Ellis, & Adom 2016). Therefore, the level of democracy is expected to affect the size of the IE.

Greater levels of democracy have also been argued to help the welfare of the poor through mechanisms such as greater economic growth, producing more public goods/services and greater propensity to invest in education, health, and other poverty alleviating initiatives given that democratically elected leaders and governments are held more accountable to voters' interests (Gerring, Thacker, & Alfaro, 2012; Ross, 2006).

It is operationalised by the Democracy Status index by Bertelsmann Stiftung in the BTI index, retrieved from the Quality of Government Basic Dataset (BTI Transformation Index, n.d.; Dahlberg et al., 2021). It measures democracy status in a country by five factors, stateness, political participation, rule of law, stability of the democratic institutions, and political and social integration (BTI Transformation Index, n.d.). It is measured on a scale between 1-10, with higher values indicating higher levels of democracy.

Regional fixed effects: Furthermore, since the developing countries used in the analysis are from different regions of the world, it is sensible to control for potential region-effects. That is, controlling for characteristics specific to certain regions that could affect the relationship between the IE, poverty and ICT not captured by the aforementioned control variables. These factors could include spill-over effects of spread of ICTs and poverty, but also for instance, different cultural perceptions and norms about how justified it is to work informally and not pay taxes. The field has only begun to investigate these questions, where Thai and Turkina (2014) for example found that different countries culture regarding entrepreneurship impacts the degree of informality.

The categorisation used is from the Quality of Government Basic Dataset where countries are grouped into the regions of Eastern Europe & post Soviet Union, Latin America, North Africa & the Middle East, Sub-Saharan Africa, Western Europe & North America, East Asia, South-East Asia, the Pacific, and the Caribbean (Dahlberg et al., 2021)

4.3 Descriptive statistics

Variable	N	Mean	Standard Deviation	Min	Max
<i>Poverty</i> (% of population)	108	36.38	29.69	0	91.5
<i>IE</i> (% of GDP)	95	36.63	10.51	11.61	62.38
<i>Ln (ICT)</i>	77	3.2	0.57	1.48	4.51
<i>Education</i> (0-100)	105	54.28	14.31	21.7	87.9
<i>Institutions</i> (1-7)	79	3.64	0.65	2.1	5.7
<i>Democracy</i> (1-10)	95	5.52	1.93	1	10
<i>Ln (GDP per capita)</i>	106	7.92	1.1	5.62	10.69

Table 1: Descriptive statistics. All values are rounded to two decimal points.

Table 1 illustrates descriptive statistics for all variables. As mentioned, many data sources are lacking in terms of country coverage. The total amount of developing countries according to the UN (2020) categorisation is 127, but the sample of complete observations for this thesis only covers 67, indicating that the loss of observations could induce bias.

In terms of variation between countries, there is large differences in some variables. With the dependant variable poverty, the lowest observation has 0 percent of households living below 3.20 USD per day (United Arab Emirates) while the highest have 91.5 percent of the population living below the poverty line (Madagascar), with a large standard deviation of 29.69 meaning that there is large variation in relation to the mean. The independent variable, the size of the IE, also has a large min/max difference, with the lowest value of 11.61 percent of GDP (China) and the highest 62.38 percent (Bolivia). However, in comparison to the poverty variable, has a lower variation in relation to the mean with a standard deviation of 10.51. Since the moderating variable ICT has been transformed, the values have been compressed and do not have large variation in relation to the mean with a standard deviation of 0.57.

5. Results

The following section presents the results from the analysis. First a correlation matrix is presented to gauge if our theoretical understanding of how the variables are related is supported by the data. Then the regression analysis for the first hypothesis is presented, followed by the analysis for the second hypothesis. For each of the hypothesis tests, I will first present a bivariate model without control variables, including region fixed effects, followed by the full model including all controls. To allow comparability of coefficients across models, all regressions will use the largest common sample of 67 developing countries with data available for all variables. Following praxis, the level of significance to reject the null hypothesis is set to a 5 percent significance threshold.

5.1 Correlation Matrix:

	<i>Poverty</i>	<i>Informal Economy</i>	<i>Ln (ICT)</i>	<i>Education</i>	<i>Institutions</i>	<i>Ln (GDP per capita)</i>	<i>Democracy</i>
<i>Poverty</i>	1.000						
<i>Informal Economy</i>	0.3134*	1.000					
<i>Ln (ICT)</i>	-0.7325*	-0.2933*	1.000				
<i>Education</i>	-0.7895*	-0.3183*	0.7359*	1.000			
<i>Institutional quality</i>	-0.3263*	-0.3030*	0.4204*	0.3817*	1.000		
<i>Ln (GDP per capita)</i>	-0.8193*	-0.2704*	0.8085*	0.3772*	0.4213*	1.000	
<i>Democracy</i>	-0.2496*	0.0137	0.3062*	0.3840*	0.3900*	0.3531	1.000

Table 2. Correlation matrix. * $p < 0.05$

Table 2 presents the correlations between all variables discussed, excluding the variable indicating the region. The correlations are for the most part in line with the theoretical understanding. As expected, IE is positively correlated with the level of poverty ($r=0.3134$). Moreover, ICT, education, institutional quality, and economic prosperity are all negatively correlated to the IE and poverty. However, contrary to theoretical expectations, the level of democracy in a country has a small but positive correlation with the size of the informal economy ($r = 0.0137$). This goes against some of the findings in Elbahnasawy et al. (2016) and Solomon and Shrestha (2014). Although, the coefficient does not reach statistical significance meaning that we cannot exclude that this correlation is different from zero.

5.2 The effect of the Informal Economy on Poverty

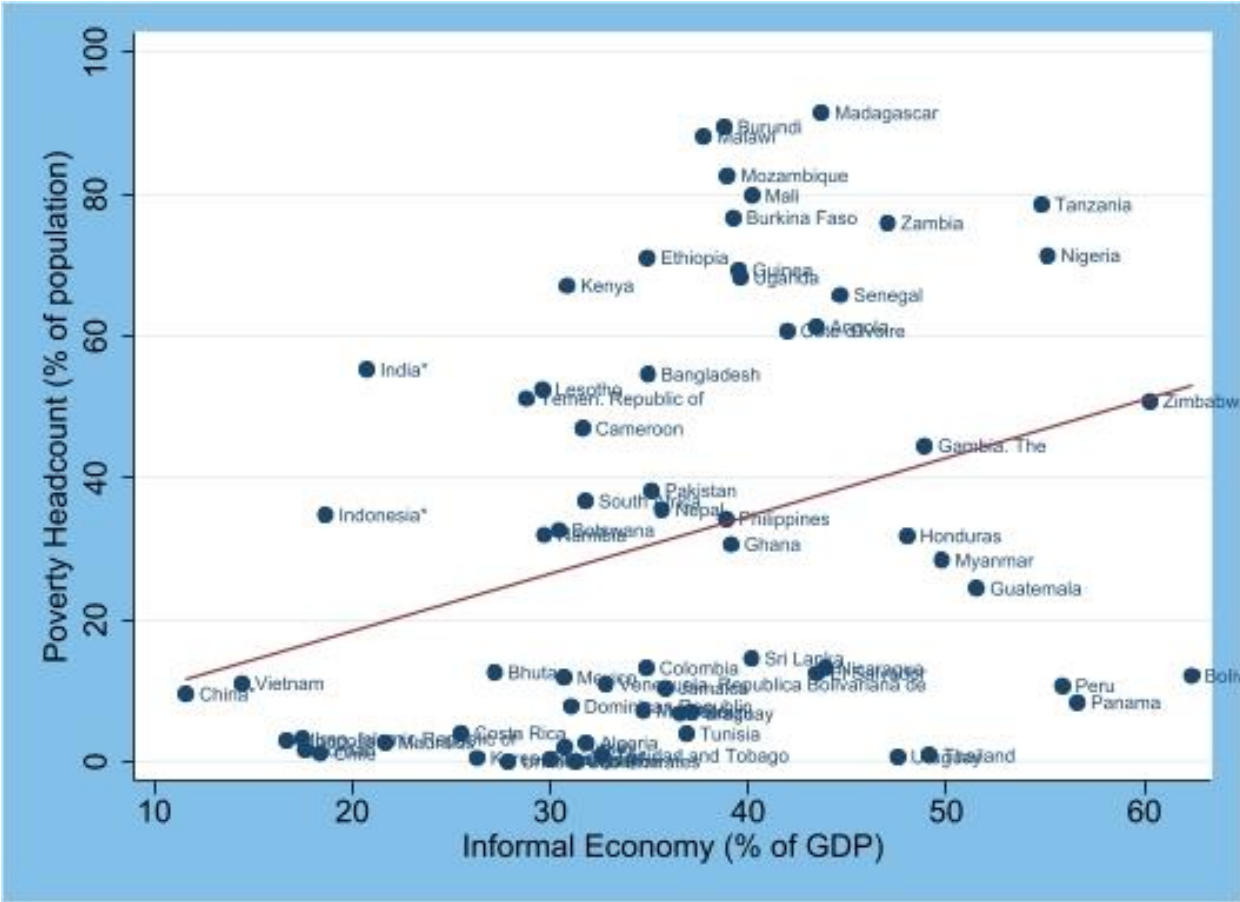


Figure 1. Scatterplot, Poverty Headcount on y-axis, size of the IE on the x-axis. Fitted regression line in red.

Figure 1 illustrates the bivariate relationship between the size of the IE and poverty levels with a fitted regression line. We see that the fitted regression line shows a trend where greater IE size tend to have higher poverty levels. However, the pattern is not entirely clear, and there seem to be clusters of countries. The countries in the cluster above the fitted linear regression line tend to be countries in Sub-Saharan Africa, while other regions tend to be below, which further justifies the use of regional fixed effects.

	(1)	(2)
Informal Economy	0.361 (0.214)	0.0371 (0.161)
Education		-0.420* (0.191)
Institutional quality		-4.607 (3.061)
Ln (GDP per capita)		-7.528** (2.623)
Democracy		-0.486 (1.152)
Intercept	-3.231 (9.396)	122.2*** (18.74)
Region Fixed Effects	YES	YES
<i>N</i>	67	67
<i>R</i> ²	0.697	0.859
adj. <i>R</i> ²	0.662	0.831

Table 3. Regression of the Informal Economy on Poverty levels.

Notes: Standard errors in parentheses. Both regressions were performed with region fixed effects.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3 presents the results from two regressions of the effect of the informal economy on poverty levels, testing the first hypothesis (H1). The first model presents the results of the bivariate regression with region fixed effects, while the second model presents the results of a multivariate regression including all controls and regional fixed effects.

The results in model 1 imply that the size of the IE has a positive (increasing) effect on poverty levels (0.361), such that a one unit increase in the size of the IE as percentage of total GDP is expected to increase the percentage of the population living in poverty by 0.361 percent. However, this effect is not significantly significant with a p-value greater than 0.05, meaning that we cannot reject the null hypothesis and conclude that the true effect is different from zero. This goes against the expectations formulated in the first hypothesis, such that a larger share of the informal economy increases poverty levels.

The intercept of the bivariate model is not necessarily meaningful in this analysis, since there is no country included in the sample which has an IE of 0. If one were to interpret it, it predicts

that in a country with no IE, on average, -3.231 percent of people would be living in poverty. This model can explain 66.2 percent of the variation in the dependent variable ($\text{adj. } R^2 = 0.662$). Adjusted R^2 is presented in favour of the “regular” R^2 , due to the latter increasing with every independent variable added to model, without necessarily allowing for greater explanatory power of the variation in the dependent variable (Ruist, 2021).

Moving on to the second, complete model for this hypothesis test, when controlling for other confounding variables, the coefficient for the IE shows a small and positive effect on poverty levels (0.0371). The coefficient has decreased from the previous regression, indicating that some of this effect was captured by the control variables. However, this coefficient is also not significant with a p-value greater than 0.05, meaning that one cannot exclude the possibility that the true effect is equal to zero. The two terms that reach statistical significance, when all other variables are constant, is firstly the level of education, where a one-unit increase is expected to decrease poverty by 0.42 percent (-0.420), and secondly the natural logarithm of GDP per capita, where a one percent increase in GDP per capita is expected to decrease poverty by 0.07528 percent (-7.528). This model can explain a rather large amount of the variation in the dependant variable, 83.1 percent ($\text{adj. } R^2=0.831$).

In sum, neither of the two regressions showed support for the first hypothesis. When using the alternative measures of different poverty lines in the regression, the null-result is largely confirmed (see appendix D & E).

5.3 The moderating effect of ICTs

	(1)	(2)
Informal Economy	0.365 (1.522)	0.763 (1.212)
Ln (ICT)	-0.198 (17.58)	11.65 (14.79)
Informal Economy *Ln (ICT)	-0.0510 (0.457)	-0.220 (0.364)
Education		-0.431* (0.210)
Institutions		-5.343 (3.278)
Ln (GDP per capita)		-8.389** (2.962)
Democracy		-0.468 (1.166)
Intercept	64.37 (59.78)	93.27 (48.33)
Region Fixed Effects	YES	YES
<i>N</i>	67	67
<i>R</i> ²	0.764	0.861
adj. <i>R</i> ²	0.726	0.827

Table 4. Standard errors in parentheses. Both regressions were performed with region fixed effects.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 presents the results of two regression models testing the second hypothesis (H2) of a moderating effect of ICT by including an interaction term between ICT and the IE. Model 1 shows the results of only including the main variables and interaction term, whereas model 2 presents the full model including controls.

The first model shows a positive but not statistically significant effect of the IE on poverty levels and a negative but also not significant effect of ICTs on poverty levels. As for the interaction effect, the coefficient is negative (-0.0154) but also fails to reach statistical significance, which goes against the theoretical expectations formalised in hypothesis H2. If the effect would reach statistical significance, it would imply that the positive effect of IE (increasing poverty) becomes weaker as the natural logarithm of ICT increases. This model can explain 71.2 percent of the variation in the dependant variable (adj. $R^2 = 0.712$)

In the second model, while controlling for education, institutions, GDP per capita and democracy, the main effects and the interaction effect still fail to reach statistical significance, therefore not supporting H2. The two variables that are significant, are once again education (0.431) and the natural logarithm of GDP per capita (-8.389). The model altogether can explain 80.9 percent of the variation in the dependant variable (adj. $R^2 = 0.809$).

This null result is also true for the two other poverty lines (see appendix F & G).

In sum, this analysis was not able to provide empirical evidence to the second hypothesis. We cannot conclude that access and usage of ICT affects the relationship between the IE and poverty.

6. Discussion

Together, neither of the two proposed hypotheses reached statistical significance. Several aspects could explain this. First option is that the IE might simply not influence poverty levels, and that the interaction effect of ICT is therefore not significant. Second, it could be due to the more direct operationalisation of poverty as in comparison to the previous paper who found a significant effect. Or, most likely, the null result is due to limitations in the data and/or flaws in the method. The following section is dedicated to exploring the last option.

- *Micro-level theory, Macro-level empirics*

Firstly, the arguments for the IE's relationship to poverty, and the moderating role of ICT, is for the most part grounded in micro-level theory, in other words, how access to ICTs specifically could affect the working of individuals in the IE. However, the relationship is tested empirically on the macro-level. The optimal study would have been conducted using "direct" survey data, with data over informal employment, what these workers or firms' income levels are, and the degree of ICT access and usage for these individuals and how this has affected their income. Then we could see if the data correlates in the way our theory suggests and argue for a potential causal relationship. Sadly, data for this does not exist. Even though significant steps forward have been made to improve the data collection for poverty and aspects of the IE, this is far from possible as of now.

- *Operationalisations and data*

Due to the manner of which the IE is measured as in the percentage of total GDP, it does not necessarily elucidate how many working poor are in the IE. For instance, one country could have many poor people contributing to the same output as percentage of GDP, while another country with the same output of GDP could have very few poor people working in the IE but are in general much more productive. Point being that in connection to poverty levels, this is not optimal. Furthermore, as previously discussed, due to a difference in the definition applied by Elgin et al. (2021), it systematically underestimates the extent of the informal economy as the theory and previous literature have presented. A fairly large portion of homebased workers, whom most often are poor (Chen et al., 2005), is not captured by this measurement.

Regarding ICT and poverty data, due to ICT development being rapid, where we can see substantial improvements on a yearly basis in developing countries (GII, n.d.), the fact that many poverty estimates are based on extrapolations and interpolations from other years, means that they might not adequately reflect the potential moderating effect of ICT access and usage.

- *Small sample size*

In terms of the null result, a rather small sample size could have contributed to this, due to simply not enough variation in our variables to reach statistical significance. Moreover, the loss of some observations where hypothetically this effect is more pronounced, could also be an explanation.

7. Conclusion

In conclusion, this thesis has aimed to develop the theoretical understanding for how access and usage of ICT could affect the relationship between the IE and poverty. By not only allowing for greater financial inclusion, but also through information and communication improvements leading to productivity increases, it was hypothesised that in a context where access and usage is widespread, it would have a moderating effect by in general increasing the productivity of informal workers and firms. To investigate this, a statistical analysis of 67 developing countries in 2014 was performed, with a more intuitive proxy for poverty in comparison to previous research. However, neither of the proposed hypotheses was supported by the empirical evidence in this thesis.

Due to the limitations in data and method discussed, it is difficult to argue that the null-result in this study is generalisable to the real-world relationship of the IE, poverty, and ICT. The core issue stem from the lack of “direct” data on the IE, informal employment, and the poverty levels associated. Once more data is produced, future studies should investigate this relationship in greater detail to test the theory presented. Other theoretical avenues that future studies should explore could be, for instance, the cultural and normative impacts on informality which has yet to receive much attention apart from a few papers (e.g., Thai & Turkina, 2014), and other potential moderating factors to this relationship.

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Appendix

Appendix A- Countries in sample

Algeria, Angola, Bangladesh, Bhutan, Bolivia, Botswana, Brazil, Burkina Faso, Burundi, Cameroon, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Dominican Republic, El Salvador, Ethiopia, Gambia. The, Ghana, Guatemala, Guinea, Honduras, India, Indonesia, Iran. Islamic Republic of, Jamaica, Jordan, Kenya, Korea. Republic of, Lebanon, Lesotho, Madagascar, Malawi, Malaysia, Mali, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Senegal, South Africa, Sri Lanka, Tanzania, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uganda, United Arab Emirates, Uruguay, Venezuela. Republica Bolivariana de, Vietnam, Yemen. Republic of, Zambia & Zimbabwe.

Appendix B – ICT variable transformation

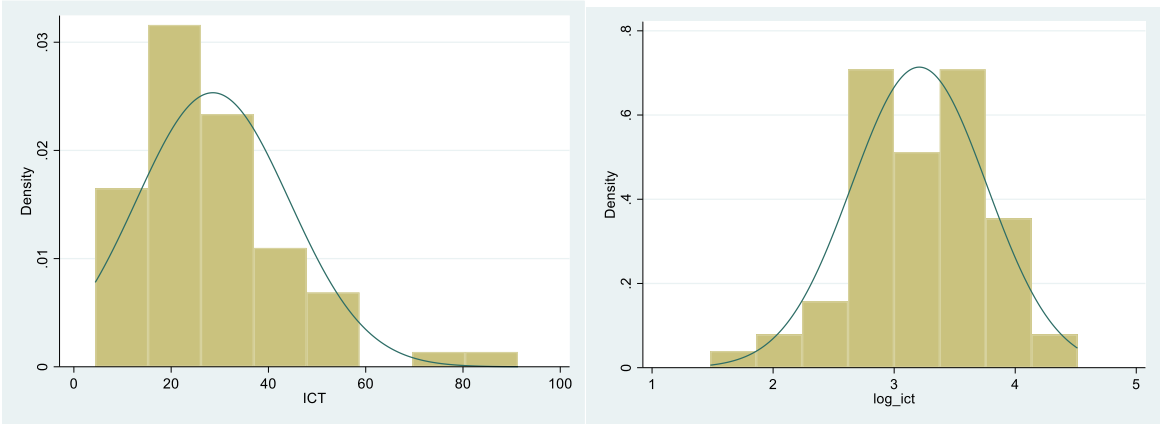


Figure 2 and 3. Left figure is the distribution before transformation. Right figure is after taking the natural logarithm of the variable.

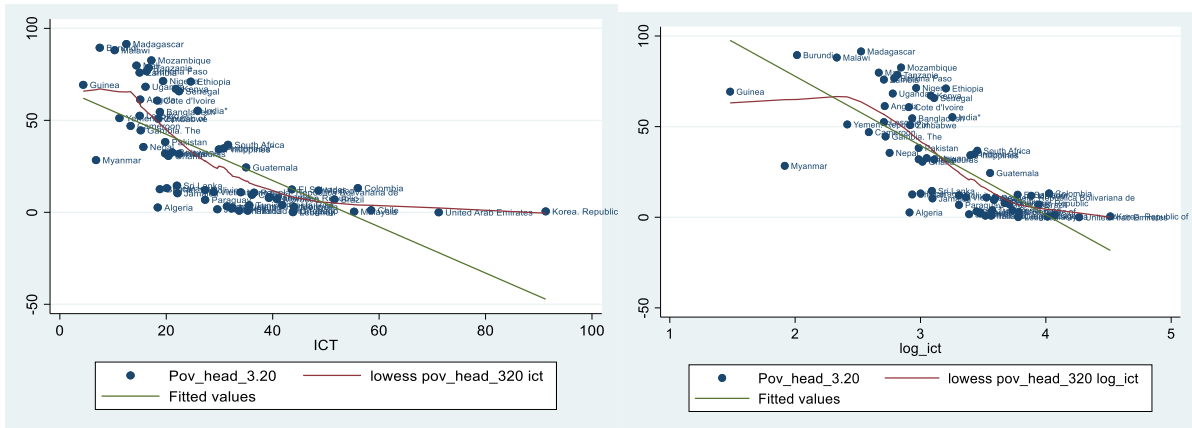


Figure 4 & 5, bivariate relationship between poverty and ICT. Left figure is before transformation, right figure is after transformation.

Appendix C- GDP per capita variable transformation

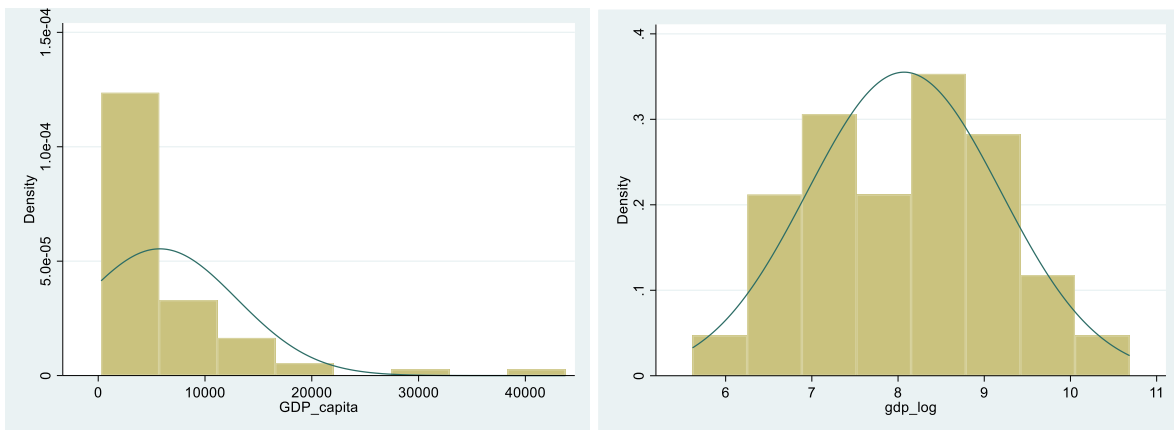


Figure 6 and 7. Left figure is the distribution before transformation. Right figure is after taking the natural logarithm of the variable.

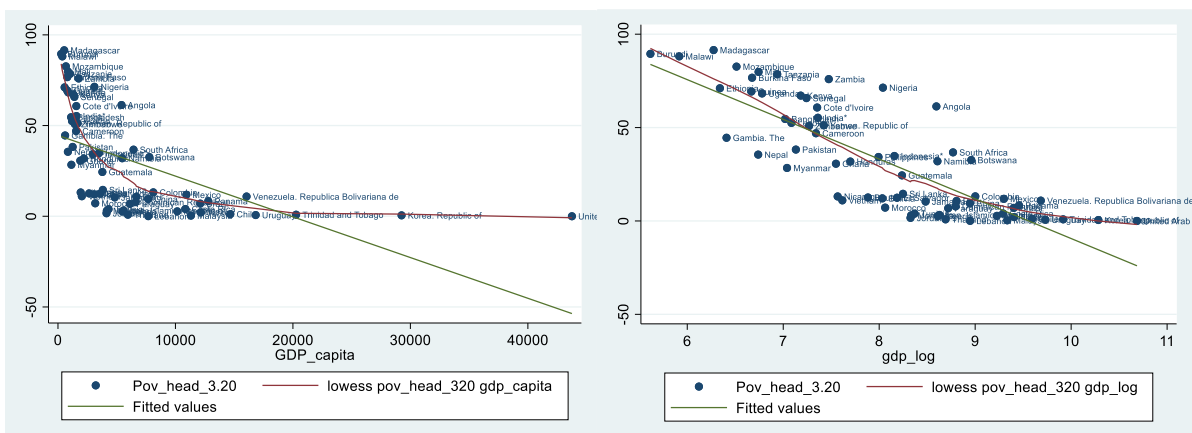


Figure 8 & 9, bivariate relationship between poverty and GDP per capita. Left figure is before transformation, right figure is after transformation.

Appendix D - Robustness check for H1: Poverty line 1.90 USD/day

	(1)	(2)
IE	0.264 (0.166)	0.107 (0.151)
Education		-0.0394 (0.195)
Institutions		-2.223 (2.871)
Ln (GDP per capita)		-7.061** (2.461)
Democracy		-0.889 (1.081)
Intercept	-6.355 (7.287)	72.96*** (17.58)
Region Fixed Effects	YES	YES
<i>N</i>	67	67
<i>R</i> ²	0.640	0.755
adj. <i>R</i> ²	0.597	0.706

Notes: Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix E - Robustness check for H1: Poverty line of 5.50 USD/day

	(1)	(2)
IE	0.380*	-0.0372
	(0.245)	(0.157)
Education		-0.596** (0.203)
Institutions		-5.822 (2.995)
Ln (GDP per capita)		-9.133*** (2.567)
Democracy		-0.419 (1.127)
Intercept	11.30 (10.77)	169.7*** (18.34)
Region Fixed Effects	YES	YES
<i>N</i>	67	67
<i>R</i> ²	0.679	0.891
adj. <i>R</i> ²	0.641	0.869

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix F - H2: Poverty Line 1.90 USD/day

	(1)	(2)
Informal Economy	0.841 (1.240)	1.086 (1.136)
Ln (ICT)	-3.707 (14.32)	12.95 (13.86)
Informal Economy * Ln (ICT)	-0.205 (0.372)	-0.297 (0.341)
Education		-0.0307 (0.197)
Institutions		-2.660 (3.071)
Ln (GDP per capita)		-7.539** (2.775)
Democracy		-0.888 (1.093)
Intercept	13.16 (48.70)	35.74 (45.28)
Region Fixed Effects	YES	YES
<i>N</i>	67	67
<i>R</i> ²	0.690	0.759
adj. <i>R</i> ²	0.641	0.699

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix G - H2: Poverty Line 5.50 USD/day

	(1)	(2)
Informal Economy	-0.460 (1.602)	0.0114 (1.193)
Ln (ICT)	-33.45 (18.51)	-1.581 (14.56)
Informal Economy *Ln (ICT)	0.183 (0.481)	-0.00819 (0.359)
Education		-0.591** (0.207)
Institutions		-5.445 (3.227)
Ln (GDP per capita)		-8.669** (2.915)
Democracy		-0.435 (1.148)
Intercept	139.3* (62.95)	170.0*** (47.57)
Region Fixed Effects	YES	YES
<i>N</i>	67	67
<i>R</i> ²	0.788	0.891
adj. <i>R</i> ²	0.755	0.865

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$