

Micro and Small Enterprises (MSEs) in Indonesia:

Three Essays

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Declaration

This thesis contains no material that has been accepted for the award of any other degree or diploma in any university. The publication status and extent of my contribution to the individual chapters is outlined as below:

A version of Chapter 2 has been accepted for publication in World Development: Falentina, Anna T., Resosudarmo, Budy P. (December 2019). The impact of blackouts on the performance of micro and small enterprises: Evidence from Indonesia. <https://doi.org/10.1016/j.worlddev.2019.104635>

I took sole responsibility for the data curation and analysis, and shared the write-up of the paper with my co-author, Budy P. Resosudarmo.

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I developed the research questions, design and took sole responsibility for data curation and analysis. I wrote the first draft of the paper, and my co-authors then helped to redraft it for submission.

Chapter 4: Falentina, Anna T., Resosudarmo, Budy. Targeted social assistance programs: Evidence of conditional cash transfers in Indonesia.

I took sole responsibility for data curation and analysis, and shared the write-up of the paper with my co-author, Budy P. Resosudarmo.

Other than where noted above, to the best of the author's knowledge, this thesis contains no material previously published or written by another person, except where due reference is made in the text.

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Abstract

This thesis presents three papers on issues related to the sustainable development of micro and small enterprises (MSEs) in Indonesia. The first paper examines the impact of electricity blackouts on the performance of manufacturing MSEs. The identification strategy involves first examining blackouts determinants, and then using these determinants as instruments in an instrumental variable (IV) dynamic panel fixed effects estimation while controlling for factors that potentially affect productivity and are correlated with blackouts. The findings show that the reasons why Indonesia has blackouts are under-investment in the power sector and poor Indonesian national electricity company (*Perusahaan Listrik Negara* or PLN) governance. The results show that electricity blackouts reduce average labour productivity and that the consequential loss for manufacturing MSEs amounts to approximately IDR 71.5 billion (USD 4.91 million) per year. Introducing a captive generator as a way to cope with power outages is positively associated with productivity and MSEs that have captive generators benefit when the power supply is poor.

The second paper examines the effects of internet utilisation, as part of digitalisation, on the performance of MSEs in Yogyakarta. Relying on primary data collected from MSEs in Yogyakarta, the province with the densest MSE population in Indonesia, the identification is achieved through an IV strategy. The paper exploits the fact that the differences in geographic topography produce conceivably exogenous variations in the strength of cellular signal that MSEs in various areas can receive to connect to the internet. Once geographical proximity had been controlled for, the difference in cellular signal strength should be due to geographical happenstance and building development. The findings show that internet utilisation has enabled MSEs to engage in the digital economy and has improved labour productivity and exports. The associated monetary benefit due to internet utilisation is substantial for local people.

The final paper evaluates the impact of targeted social assistance programs on MSEs performance as a proxy for the development of local economies. Exploiting variation in the timing of conditional cash transfer implementation in Indonesian subdistricts, the paper examines the effects of a key social assistance program on the performance of local MSEs in Indonesia. The analysis is based on a linear subdistrict fixed effects model, combining data from surveys of manufacturing MSEs with village census data. Results show that exposure to the program contributes to an increase in labour productivity in the medium term. The overall effect is driven by increased productivity in urban areas, in villages close to cities and in non-coastal areas. Women engaged in MSEs are also benefited from the program. No immediate impacts are observed. Relaxing credit constraints appears to be a mechanism through which the program affects MSEs in the local area.

List of Abbreviations

ASEAN	Association of Southeast Asian Nations
AIC	Australia-Indonesia Centre
Bappenas	Ministry of National Development Planning (<i>Badan Perencanaan Pembangunan Nasional</i>)
BPS	Statistics Indonesia (<i>Badan Pusat Statistik</i>)
BTSs	Base Transceiver Stations
CAPI	Computer-assisted Personal Interview
CCT	Conditional Cash Transfer
Gol	Government of Indonesia
GDP	Gross Domestic Product
IDR	Indonesia Rupiah
IV	Instrumental variable
JPS	<i>Jaring Pengaman Sosial</i>
LATE	Local Average Treatment Effect
MSEs	Micro and small enterprises
OLS	Ordinary Least Squares
PLN	<i>Perusahaan Listrik Negara</i>

PODES	<i>Potensi Desa</i>
PKH	<i>Program Keluarga Harapan</i>
RCT	Randomised Control Trial
RGDP	Regional Gross Domestic Product
SMEs	Small and medium enterprises
SDGs	Sustainable Development Goals
UCT	Unconditional Cash Transfer
USD	US Dollar
<i>Telkomsel</i>	<i>Telekomunikasi Seluler</i>

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Chapter 1

Introduction

1.1 Background and motivation

Micro and small enterprises (MSEs) play a pivotal role in many developing countries.¹ MSEs constitute a large portion of all enterprises, and provide employment and income for many people including those from disadvantaged backgrounds, such as low-skilled workers and poor women (Banerjee & Duflo, 2005; Berry & Mazumdar, 1991; Berry, Rodriguez, & Sandee, 2001; Sjöholm & Lundin, 2010; Tambunan, 2009). In some cases, MSEs provide an informal safety net mechanism (Resosudarmo, Sugiyanto, & Kuncoro, 2012). MSEs are also crucial for accomplishing sustainable and inclusive growth as promoted by the Sustainable Development Goals (SDGs), for instance, by encouraging decent work for all and reducing economic inequalities (International Labour Organization, 2015; World Bank, 2019b).

Nonetheless, most MSEs in developing countries exhibit low-productivity (Hill, 2001; International Labour Organization, 2015; Little, Mazumdar, & Page Jr., 1989; Mead & Liedholm, 1998; OECD, 2015; Tybout, 2000). MSEs in developing countries face many challenges in their operations both internal and external to the enterprise, such as access to finance, skill deficiencies, poor public services, limited access to digital technology, and regulatory burdens that can hinder their growth (Tambunan, 2009; Yoshino & Taghizadeh-Hesary, 2016). These challenges are among the key arguments for the implementation of programs designed specifically to help MSEs to perform better.

There is a vast literature on constraints that MSEs in developing countries confront (see, for instance Harvie, 2015; Rothenberg et al., 2016; Yoshino & Taghizadeh-Hesary, 2016). These

¹ There are also pessimist paper on the role of MSEs, for instance Martin et al., (2017)

works, however, tend to focus on credit access, managerial practice, skill development of workers or regulations and have overlooked the fact that MSEs confront other pressing challenges that may affect the performance of MSEs, such as the reliability of public services and the trend towards digitalisation. MSEs might also be affected by the environment they operate in, such as a community-sanctioned punishment created by competitive market pressures (Oo & Toth, 2014), and interventions that policy-makers have implemented even though the interventions, for instance targeted social assistance programs, do not directly target at MSEs. These internal and external challenges are essential for a supportive environment so that MSEs can perform better and thrive in a digital economy.

Majority of studies on MSEs provide evidence of the association between issues and outcomes, instead evidence of the causal effects. This is due to inherent challenges where the issue being examined is a function of many variables, making the identification of causal impacts difficult. Typically, in these existing studies, the presence of other factors confound the results, meaning that it is unclear as to whether or not the issue being examined truly caused the outcomes. Policies made based on findings from associational studies are at risk of failing to meet the objectives of the policies.

In recent years, however, there has been a significant growth in literature on MSEs and constraints faced by MSEs using rigorous causal inference methods. These studies provide evidence to guide policy-makers regarding policy option to improve the performance of MSEs around the world. For instance, a study conducted by McKenzie & Woodruff (2014) that looked at business training programs and entrepreneurship in the developing countries concluded for the need for future studies to improve the methodological concerns to have a better learning from these studies. Another work by Quinn & Woodruff (2019) analysed experiments and entrepreneurship around the developing world. They found that while traditional methods of delivering trainings to small enterprises might be not effective, positive demand shocks could be sufficient to generate firm growth.

Nonetheless, there is a limited availability of large datasets related to MSEs, which tend to be underrepresented in national surveys (Li & Rama, 2015). Therefore, previous studies have tended to use small unrepresentative datasets such that the analysis might be not applicable to a larger population of MSEs. Typically, little is known about whether any effects are heterogeneous.

Little is known on how the reliability of power supply, digitalisation or interventions implemented by policy-makers affect the performance of MSEs in developing countries. The reliability of electricity supply is one the most pressing challenges faced by many MSEs in developing countries. Little is known about how blackouts affect the performance of MSEs as most studies on this topic have focused on its effect on larger enterprises. The world is going digital. Digitalisation — which typically means the utilisation of digital technology, such as internet utilisation — has been widely expected to improve firm performance in developing countries, yet only few studies have explored this issue in relation to MSEs. Targeted social assistance programs have been implemented to alleviate poverty in many developing countries yet little is known about the impact of these programs on the development of local economies, which represents an important area for policy-making. Understanding the local economy-wide impact of such programs will reveal the side effects of the huge levels of investment that developing countries' governments put into such programs. The implication of these findings could be substantial as the poor rely on local economies for their livelihoods.

1.2 Research scope and objectives

This thesis analyses the causal impacts of three issues related to the sustainable development of MSEs — namely the reliability of electricity, the utilisation of digital technology and targeted social assistance programs — on the performance of MSEs in Indonesia. These issues are an integral part of the SDGs aimed at ensuring all people enjoy prosperity. SDG 7 focuses on reliable energy for all, SDG 9 emphasises digital inclusiveness, and SDG 1 encourages social assistance programs as a safety net for the poor.

Specifically, Chapter 2 seeks to analyse the impact of blackouts on the performance of MSEs and to investigate the effect of adopting a captive generator. The objectives of Chapter 3 are to evaluate the impact of internet utilisation on the performance of MSEs, and to examine what platforms assist MSEs in gaining benefits from the digital economy. Chapter 4 aims to examine the impact of targeted social assistance programs on the performance of MSEs, as a proxy for the development of local economies, and to reveal a possible channel through which the program affects MSEs.

In this thesis, the definition of an MSE is simply based on the number of workers, as per the definition employed by Statistics Indonesia (*Badan Pusat Statistik* or BPS), unless otherwise stated. Enterprises with fewer than five workers are categorised as micro enterprises, while those with 5–9 workers are small enterprises. MSEs operate in various sectors including agriculture, manufacturing, and services. The analysis in Chapter 2 focuses on MSEs in the manufacturing sector and covers blackouts at distribution lines that are experienced by customers due to interruption or maintenance at the generation as well as by transmission lines, as per the definition employed by PLN. Chapter 3 discusses digitalisation, which is defined as the use of digital technology and is represented in this study by internet usage by MSEs across various sectors in Yogyakarta province. Analysis in Chapter 4 focuses on MSEs in the manufacturing sector in local economies.

In general, this thesis uses labour productivity as a measurement for MSE performance and the definition of labour productivity follows that of the OECD (2001a). Labour productivity is a vital element in assessing the living standards for those engaged in a production process in which labour is the most essential input (OECD, 2001a) after controlling for other factors. Labour productivity is measured using gross output-based and value added-based productivity, and is based on constant prices. Gross output-based productivity measures captured disembodied technical change, while value added-based productivity measures reflected an industry's capacity to contribute to economy-wide income and final demand. These two measurements are complementary to one other. In addition, each chapter includes other

measures of enterprise performance, such as the proportion of (direct and indirect) exports in Chapter 3, and the number of workers in Chapter 4. Exports are considered to be a means of advancing MSEs in terms of productivity, and technological and managerial know-how (Sato, 2013; Setiawan, Indriastuti, Indrawati, & Effendi, 2016), while the number of workers reflects the effect on employment.

In this thesis I focus on Indonesia, the third-most populous developing country after China and India. As of 2016, over 250 million people live in Indonesia, with more than 40% of the workforce engaged in MSEs. The development and sustainability of MSEs are among the government's top priorities, particularly in the context of current rising inequality in the country (González Gordón & Resosudarmo, 2019; Yusuf & Sumner, 2015) as MSEs play a pivotal role in the economy yet face many internal and external challenges and their productivity is relatively low (Anas, Mangunsong, & Panjaitan, 2017; Hill, 2001). Furthermore, Indonesia is among a few countries with a substantial collection of data on MSEs in the manufacturing sector. The BPS had been conducting an annual national survey on MSEs in the manufacturing sector since 1998, missing only three years.²

1.3 Micro and Small Enterprises (MSEs) in Indonesia

There were 26 million MSEs in various sectors throughout Indonesia in 2016. Based on the 2016 Economic census listing data, among them, only 6 percent of MSEs were operated with a formal government license; and only around 5 percent of MSEs adopted a decent bookkeeping practice. Nevertheless, majority of these enterprises could survive for a relatively long period of time. The average age of MSEs in Indonesia is approximately 9 years old. Female plays an important role in developing MSEs. Almost half of home industries' owners in Indonesia are female (43%).

² Years with no MSEs data available are 2006, 2007 and 2008

It is recorded that MSEs in Indonesia face many constraints, such as lack of resources, lack of economic of scale, and lack of access to digital technologies (Tambunan, 2012; Yoshino & Taghizadeh-Hesary, 2016).

Since the 1970s the Indonesian government has been paying close attention to development of MSEs, as reflected in several MSEs development policies. These policies also range from technology, finance, marketing and general initiatives (Anas et al., 2017) as shown in Table 2. In general, the trend of this policy development is intensifying government support to MSEs. By mid 2010s, the development of MSEs has been among the top priorities of both the central and local governments of Indonesia.

Table 1.1 Policies related to MSEs in Indonesia, 1974-2000, 2008-current

Year	Technology Initiatives
1974	Establishment of BIPIK (Small Industries Development Program)
1994	BIPIK was replaced by PIKIM (Small-scale Enterprises Development Project)
2013	Presidential Regulation No.27/2013 concerns the development of an entrepreneurship incubator. The entrepreneurship incubator is an intermediary institution that performs the incubation process for business, especially start-up company.
	Finance Initiative
1974	KK (Small Credits), administered by Bank Rakyat Indonesia, was launched; subsequently (1984) it was changed to the KUPEDDES (general Rural Saving Program) scheme, aimed at promoting small business
1990	The subsidized credit programmes (KIK, KMKP) were abolished and the unsubsidized KUK (Small Business Credits) was introduced
2015	Bank central regulation No. 17/12/PBI/2015, in 2018 banks have to allocate minimum 20% of their lending to SMEs
2015	Economic package: the government subsidized interest rates from 22% to 12%. Through LPEI, the government also increase support for export oriented SMEs or those involved in the production of export products through loans or working capital loans with interest rates lower than commercial interest rates
	General initiatives
1978	A Directorate General for Small-scale Industry was established in the Ministry of Industry
2014	Government regulation No.98/2014 concerns licensing for micro and small enterprises (MSEs)
2014	Law No.23/2014 concerns local government role in the empowering and upgrading MSMEs
	Marketing initiatives
1977	A reservation scheme was introduced to protect certain markets for SMEs
2014	Presidential Regulation No. 39/2014 concerns the Investment Reservation List • 93 business activities reserved for MSMEs and cooperatives

	• 51 business activities opened for investment which requires partnership with MSMEs and cooperatives
2014	Asephi (<i>Asosiasi Eksportir dan Produsen Handicraft Indonesia</i> / Indonesia Handicraft Producer and Exporter Association) established INACRAFT Mall (http://inacraft-mall.com/) as online site as market place for SMEs product

Source: Adopted from Anas et al., (2017) and Hill, (2001)

There are, however, some critics on these initiatives. (Hill, 2001), among others, notes that, at least until 1998, these policies were ineffective for several reasons. First, limited resources were allocated. Second, there was a lack of a clear policy rationale as well as a supply-driven orientation. Last, there was a lack of large firms and commercial services that engaged in supporting MSEs development programs. Furthermore, Anas, Mangunsong, and Panjaitan (2017) reveal that after the Asian Financial Crisis in 1997–1998, the policies continued to be framed in a social welfare approach and reflected excessive protectionism methods to shield MSEs from competition, for instance, partnerships with MSEs, reservation of the business sector for MSEs. These policies, nevertheless, might work in supporting the development of MSEs. The Economic Research Institute for ASEAN and East Asia [ERIA] (2014) evaluates the MSE development policies and actions implemented by 10 countries of the Association of Southeast Asian Nations (ASEAN). Indonesia scored 4.1 out of 6.0 (good practice); which is not that bad among ASEAN countries (ERIA, 2014).

1.4 Basic methodology

The research questions, context and data availability dictate the empirical approach used in this thesis. Therefore, the analysis in this thesis applies a range of econometric techniques that suit the identification strategy to reveal the causal effects of each sustainable development aspect (electricity reliability, digital technology utilisation, and targeted social assistance programs) on the performance of MSEs. A general form of the estimation specification is as follows:

$$y_{ijt} = \beta Issue_{jt} + \gamma X_{it} + \varphi Z_{jt} + \delta_j + \delta_t + \varepsilon_{ijt} \quad (1.1)$$

where i represents an enterprise, j represents a region where enterprise i is located, t represents year t . y is a measure of enterprise performance, such as labour productivity, exports or number of workers. The main variable of interest is *Issue* that covers quality of electricity supply (Chapter 2), digital technology utilisation (Chapter 3), and targeted social assistance programs (Chapter 4). Variable *Issue* is identified either at enterprise level or at regional level. I also added time varying controls both at enterprise level X_{it} and regional level Z_{jt} , as well as several fixed effects, such as δ_j region fixed effects, and δ_t year fixed effects.

Coefficient β identifies the causal impact of each *Issue* variable. In Chapter 2, I use blackouts as a measurement for the reliability of power supply. Therefore, the coefficient β of blackouts is expected to be negative, as power outages negatively affect firm performance. In Chapter 3, I use internet adoption — which is part of digitalisation — as a proxy for digital technology utilisation. The coefficient β of internet utilisation is expected to be positive, as it enables creative production processes, improves marketing processes, and access to markets in which enterprises find new and efficient ways of doing business in place of old methods. Similarly, the coefficient β of targeted social assistance programs is expected to be positive, as the program positively affects MSEs through its conditionality and through the resource being transferred.

In chapter 2, I examine the impact of blackouts on labour productivity at enterprise cohort level. By utilising multiple cross-sectional surveys on manufacturing MSEs in Indonesia, I constructed enterprise cohort pseudo-panel data (Deaton, 1985; Guillerm, 2017; Verbeek, 2008). Cohorts are groups of enterprises with similar characteristics. The pseudo-panel data are constructed by grouping observations into cohorts on the basis of factor intensity (labour, resource, or capital intensive), size (micro or small) for each region where the enterprise is located. The cohort variables are formed as the mean values of the observations in each cohort. The cohorts are then tracked over time in each of the annual surveys, forming a panel. To identify a causal impact, I use an instrumental variable (IV) approach exploiting factors that

determine power blackouts in Indonesia. These factors are the length of medium voltage transmission lines (kilometre circuit) and account receivable (A/R) collection duration (days). The length of medium voltage transmission lines can be considered as investment in the power sector, while A/R collection periods reflects PLN governance. These variables are arguably exogenous to the performance of MSEs.

Chapter 3 evaluates the impact of internet utilisation, as part of digitalisation, on the performance of MSEs in Yogyakarta province. Using primary data collected from an MSE survey in the province, the causal effect of internet utilisation on labour productivity and exports is identified through an IV approach, instrumenting internet utilisation using cellular signal strength. The identification strategy exploits the fact that geographical differences create variation in the cellular signal strength that MSEs in various areas receive and use to connect to the internet. Once geographical proximity has been taken into account, the difference in signal strength should be due to geographical happenstance and building development. Utilising a mobile questionnaire, data on cellular signal strength and the geospatial location of MSEs were also collected in the survey.

Chapter 4 investigates the impact of targeted social assistance programs on the development of local economies, represented by the performance of MSEs. The analysis is based on a key social assistance program in Indonesia, namely the *Program Keluarga Harapan* (PKH) which is a conditional cash transfer (CCT) program. The study combines data from multiple cross-sectional surveys on manufacturing MSEs with village census data, and utilises a linear subdistrict fixed effects specification. The identification strategy exploits variation in different timings of the PKH implementation in Indonesian subdistricts. The timing of the PKH is arguably exogenous conditional on all covariates controlled in the estimation. Thus, the results from empirical work imply the causal impacts of targeted social assistance programs on the performance of MSEs.

1.5 Contribution

This thesis extends the current literature by linking MSEs and sustainable development issues in developing countries. The focus of this thesis is that while the role of MSEs may have already been acknowledged by policy-makers and some well-known constraints confronting MSEs have been analysed widely, MSEs nevertheless face many other disadvantages both internal and external to the enterprises, such as unreliable power supply, and poor access to digital technologies. In addition, MSEs might be indirectly affected by interventions that the government has implemented, such as targeted social assistance programs. Hence, understanding the effect of these sustainable development aspects (electricity reliability, digital technology utilisation, and targeted social assistance programs) will provide evidence for the construction of evidence-based policy to promote sustainable development of MSEs. Furthermore, the policy implications drawn from the empirical results provide wider implications for the results.

The thesis contributes empirically to the existing literature on MSEs and issues related to aspects of sustainable development in two ways. Firstly, the thesis contribute to the growing literature on MSEs that offers strategies to identify the causal impacts of issues related to sustainable development on MSEs. Chapter 2, firstly identifies factors as to why Indonesia experiences power outages at regional level. Then, these factors are used as instruments to reveal the causal impacts of blackouts on MSEs. Chapter 3 uses unique primary data collected specifically for this study on cellular signal strength among MSEs in Yogyakarta province, to instrument internet adoption while controlling for factors of geographical proximity, including elevation, number of Base Tranceiver Towers (BTSs) in village, and physical access. Data on cellular signal strength and elevation were collected using a mobile questionnaire executed using standardised smartphones and SIM cards. Although this kind of identification strategy that exploits geographical differences has been used in prior studies (Farré & Fasani, 2013; Olken, 2009; Yanagizawa-drott, 2014), the application of this strategy is new in the literature

of MSEs in developing countries. Chapter 4 argues that the timing of the PKH in Indonesia is exogenous conditional on covariates controlled in the estimation.

Secondly, the spatial analysis provided in Chapter 3 and 4 enriches the analysis and provides insights on spatial correlation as it relates to the issue being analysed (Anselin, 1988). In the context of digitalisation discussed in Chapter 3, enterprises located adjacent to villages might receive a cellular signal that they use to connect to the internet from their neighboring villages. Similarly, in Chapter 4, enterprises located in a village might experience spillover effects from neighbouring villages that received transfers from targeted social assistance programs as well. Therefore, incorporating space (or geography) in the analysis provides a better understanding on the spatial interaction of the issues being analysed.

Thirdly, the thesis uses a large, rich and unique dataset on MSEs that has rarely been explored or even available at a national level in many other developing countries. Chapters 2 and 4 employ an extensive dataset on manufacturing MSEs that is available from the BPS. In addition, for Chapter 3, I conducted a survey among MSEs in Yogyakarta province using a mobile questionnaire, and collected unique data on cellular signal strength and the geocode of sampled enterprises.

1.6 Outline of the thesis

This thesis comprises five chapters. Chapter 1 provides a brief introduction to the thesis. Chapter 2 to 4 comprise the core research of the thesis. Chapter 2 examines the impacts of blackouts on the performance of MSEs. Chapter 3 evaluates the effects of internet utilisation, as a part of digitalisation on MSEs labour productivity and exports. Chapter 4 evaluates the indirect effect of targeted social assistance programs on the performance of MSEs as a proxy of the development of local economies. Finally, Chapter 5 provides a conclusion and outlines the policy implications of the thesis.

Chapter 2

The impact of blackouts on the performance of micro, small enterprises: Evidence from Indonesia

2.1 Introduction

The reliability of electricity supply, a key component of industrial development, has been considered to be one of the crucial problems to overcome in developing countries (Asian Development Bank, 2009). Although the electrification rate might be high, the connections however, might not function well. For instance, in Nigeria the electrification rate has reached 96%, yet only 18% of these connections function for more than about half of the time (Penar, 2016). Similarly, around 80% of Indonesians are connected to the grid, yet electricity customers experienced 19 hours on average or nearly 13 blackout events during 2017 (Perusahaan Listrik Negara, 2018). This poor power supply could affect enterprises as electricity is a crucial input for enterprise operations, affecting for example, lights, motors and machinery (Allcott, Collard-Wexler, & O'Connell, 2016). Likewise, electricity reliability might be as important as electricity provision (Andersen & Dalgaard, 2013) because outages lead to economic losses (Pricewaterhouse Cooper, 2016) and can diminish output considerably. Reliable power supply is also mentioned as a necessary condition for flourishing micro and small enterprises (MSEs) (Masato, Troilo, Juneja, & Narain, 2012).

Although some researchers are pessimistic about the role of MSEs in the economy, for example, Martin, Nataraj, & Harrison (2017), an extensive body of work shows that MSEs play a crucial role in many developing countries. MSEs provide employment and an income source for many people including those from disadvantaged backgrounds, such as low-skilled workers and poor women (Banerjee & Duflo, 2005; Berry & Mazumdar, 1991; Berry, Rodriguez, & Sandee, 2001; Sjöholm & Lundin, 2010; Tambunan, 2009). MSEs generate at least 60% of

employment in the manufacturing sector and produce up to 50% of the sector's output in most countries (Hill, 2001; Little et al., 1989). Nonetheless, the productivity of MSEs remains low (Mead & Liedholm, 1998; Tybout, 2000) and is, as expected, lower than that of larger firms (Little et al., 1989; OECD, 2015). Labour productivity is a key element for assessing the standard of living of those engaged in production processes in which labour remains the single most important input (OECD, 2001a).

While larger firms might be able to substitute other electricity resources (Foster & Steinbuks, 2009), this choice would be limited for smaller firms since providing small-scale electricity is generally costly (Burke, Stern, & Bruns, 2018). Furthermore, MSEs are more financially constrained when compared with larger firms, meaning that MSEs are less likely to have their own captive generators. Data shows that only 8.2% of small firms either owned or shared a generator in 2016 (World Bank, 2016b).

Relying on data from Indonesia, I examined the causal impact of power supply interruptions on MSEs' performance. Indonesia, home to 3.5 million MSEs in the manufacturing sector, is struggling to provide reliable power in some regions. MSEs play an essential role mainly because they generate significant employment and are among the government's priorities. The productivity of MSEs however, is relatively low.

In this study, I employed a pseudo-panel dataset covering six cohorts and 21 regions the Indonesian national electricity company (PLN) operates in for the period 2010–2015. PLN is the major provider of all public electricity and electricity infrastructure in Indonesia. The pseudo-panel data were constructed from repeated cross-sectional surveys on MSEs by grouping enterprises into cohorts based on factor intensity (labour, capital, resource) and size (micro, small), then tracking them over time. Appendix A2.1 provides the grouping of 2-digit Indonesian Standard Industrial Classification (*Klasifikasi Baku Lapangan Usaha Indonesia* or KBLI) based on factor intensity. Micro enterprises are defined as enterprises with 1–4 workers, while small enterprises are those with 5–19 workers.

I used under-investment in the power sector and poor PLN governance, measured at regional level where PLN operates in, as instruments for blackouts. Using IV dynamic panel fixed effect estimations while controlling for factors that potentially affect productivity and are potentially correlated with blackouts, I found that blackouts reduce average labour productivity. The results are robust to a battery of robustness checks. The findings provide evidence for policy-makers to prioritise improving electricity reliability to support the development and sustainability of MSEs in developing countries.

This study is one of the few studies that links power supply reliability and MSE performance in developing countries using rich MSE national survey data. Existing studies on electrification and industrialisation have largely focused on the relationship between electricity provision and larger firm performance.

I begin with a brief review of the existing research on electricity reliability and firm performance. Next, I provide an overview of MSEs and the electricity sector in Indonesia. The following section sets out the models and data, after which I present the results and detail on checks for robustness. The paper concludes by discussing the broader implications of the findings for scholars and development practitioners.

2.2 Electricity reliability and firm performance

Infrastructure, such as electricity supply, is a crucial component needed for the economy, community, and industrial development (Calderón, Moral-benito, & Servén, 2015; Urrunaga & Aparicio, 2012). There are two means by which infrastructure leads to improvement in firm production. Firstly, infrastructure such as electricity represents an intermediate input, and a decline in input costs increases profitability, hence allowing greater output, revenue, or employment. Secondly, infrastructure boosts the productivity of other factors, such as labour and other capital (Kessides, 1993). In the case of electricity, it enables the firm to use electrical equipment. Furthermore, electricity facilitates the use of information and communication

technologies, and more productive organisation of manufacturing (Kander, Malanima, & Warde, 2014).

It is not only infrastructure provision but also its quality that matters. Two costs emerge from power outages. The first is the direct cost of production interruptions, such as the loss of unpreserved raw materials or outputs and the impairment of sensitive electronic equipment. Such costs might cause underutilisation of current productive capacity and limit short-run productive efficiency and output growth. The second cost is caused by the unreliability or lack of access to electricity, which leads to firms investing in alternative sources, such as the adoption of a captive generator, thus raising capital costs (Kessides, 1993). This additional cost adds another burden for MSEs, which notably, compared with larger firms, face many disadvantages, such as lack of finance, lack of technology, and lack of scale economies (Asian Development Bank, 2009; Harvie, 2015).

Research on the impact of electricity on firm performance has been conducted largely in medium to large firms using firm level data. Among others, Allcott et al., (2016) investigate the impact of power shortages on the Indian manufacturing sector between 1992 and 2010, whereas Fisher-Vanden, Mansur, & Wang (2015) quantify the impacts of electricity shortages in Chinese manufacturing firms from 1999 to 2004. Chakravorty, Pelli, & Marchand (2014) explore the effects of electricity grid expansion and quality of electricity on household income in rural India, while Alby, Dethier, & Straub (2012) study firms' generator investment decisions across countries over the period of 2002 to 2006. Further, Rud (2012a) investigates the effect of electrification provision on industrialisation in India.

Nevertheless, only a few studies explore the impact of electricity on MSE performance. For instance, Grimm, Hartwig, & Lay (2013) investigated the importance of electricity access among informal firms in seven African cities. They found that electricity access is not statistically significant for good performance. However, the study found a significant positive influence on the performance of tailoring industry. This demonstrates that a certain type of

informal industry might benefit from electricity access. Neelsen & Peters (2011) examined electricity usage in microenterprises in rural Southern Uganda. They found weak evidence for the benefits of electrification for firm profits or worker remuneration. A study on infrastructural deficiency, including electricity, among small and medium enterprises (SMEs) in Nigeria conducted by Obokoh & Goldman (2016) indicated that electricity interruptions were associated with reduced profitability and productivity. Meanwhile, Alby et al., (2012) find that in countries with frequent power failures, the proportion of small firms in electricity-intensive sectors is lower as investing in an electric generator is unaffordable for small firms.

Research focusing specifically on Indonesian power supply and firm performance is rare. Kassem (2018) finds that the expansion of electricity grid causes an increase in the number of manufacturing firms, manufacturing workers, and manufacturing output. Blalock & Veloso (2007) discovered that their dummy coefficient for electrical connection positively and significantly affects the production of Indonesian medium and large manufacturing establishments. A similar result was also found for small enterprises (Hill & Kalirajan, 1993). My study uses extensive data from MSE surveys, which are rarely explored by researchers, and is among the first to explore MSEs and electricity in Indonesia.

2.3 Micro and small enterprises and the electricity sector in Indonesia

As is the case in other developing countries, MSEs play a significant role in the Indonesian economy as a source of employment and income. MSE development and sustainability is clearly among the government's top priorities, particularly in the context of current rising inequality in the country (González Gordón & Resosudarmo, 2019; Yusuf & Sumner, 2015). Developing and sustaining MSEs is considered to be a vehicle for supporting indigenous Indonesian business, assets redistribution along ethnic lines (Hill, 2001), and for reducing inequality (World Bank, 2015). MSEs are also mentioned as being able to soften economic

shocks due to natural events and crop losses (Parinduri, 2014) as well as, in some cases, being able to provide an informal safety net mechanism (Resosudarmo et al., 2012).

Table 2.1 provides some statistics for manufacturing MSEs in Indonesia. In the last 10 years, although the MSEs share of total manufacturing value added has been relatively constant at around 10%, the number of MSEs in the manufacturing sector has grown faster than the number of medium and large enterprises (MLEs); i.e. from 2.6 million in 2005 (approximately 129 times the number of MLEs) to more than 3.6 million in 2015 (approximately 139 times the number of MLEs). In addition, the number of people engaged in manufacturing MSEs increased from 6.6 million in 2005 to 8.7 million in 2015.

Table 2.1 Statistics of manufacturing MSEs in Indonesia

	2005	2010	2015
Number of manufacturing MSEs (unit)	2,682,810	2,732,724	3,668,873
Number of employment (workers)	6,681,243	6,447,260	8,735,781
Value added (million IDR)	40,642,830	77,624,573	220,740,544
Contribution to manufacturing value added	9%	8%	10%

Note: Data for 2005 are based on Integrated Survey (SUSI), while 2010 and 2015 are based on Survey IMK. Value added is at market price. Source: Annual Statistics Indonesia from Statistics Indonesia (BPS).

In terms of production, manufacturing MSEs generally produce labour-intensive products. In 2015, 46% of MSEs produced food, beverages, and tobacco, while 23% of MSEs produced wood and furniture, and 15% of MSEs were engaged in textiles and clothing. Non-metallic mineral products, basic metals and fabricated metal products, and other types of manufacturing accounted for 7%, 4%, and 2%, respectively. The remaining products constituted 1% of the total. Therefore, MSEs may not use much electricity. However, when there are a large number of MSEs, the impact of electricity interruptions could correspondingly be substantial at a regional level.

Despite electricity under-supply in some regions such as Papua, East Nusa Tenggara, and West Sulawesi (Sambodo, 2016) where around 65% out of 12,000 villages without electricity are located (World Bank, 2017a), electricity reliability is improving. Data show a decreasing

trend of power blackouts both in terms of frequency as well as duration. In 2008, PLN consumers experienced 81 hours or thirteen occasions without electricity (Perusahaan Listrik Negara, 2010), accompanied by rolling blackouts from the supply system. However, in 2015, electricity outages declined to an average of five hours or six events per year (Perusahaan Listrik Negara, 2016).

There were relatively large variations of power quality among regions during 2004–2015, as shown in Figure 2.1. In terms of power blackout frequency, East Java and East Nusa Tenggara consistently experienced the fewest power blackout events, with 2.8 and 3.8 occasions per customer per year, respectively, while Jakarta and Bangka Belitung experienced slightly more frequent blackouts (4.5). Banten and West Java experienced 5.4 occasions without electricity, while Gorontalo, Central Sulawesi, and North Sulawesi had six power failure events, South Kalimantan and Central Kalimantan 6.2 events, and Lampung 6.8 events.

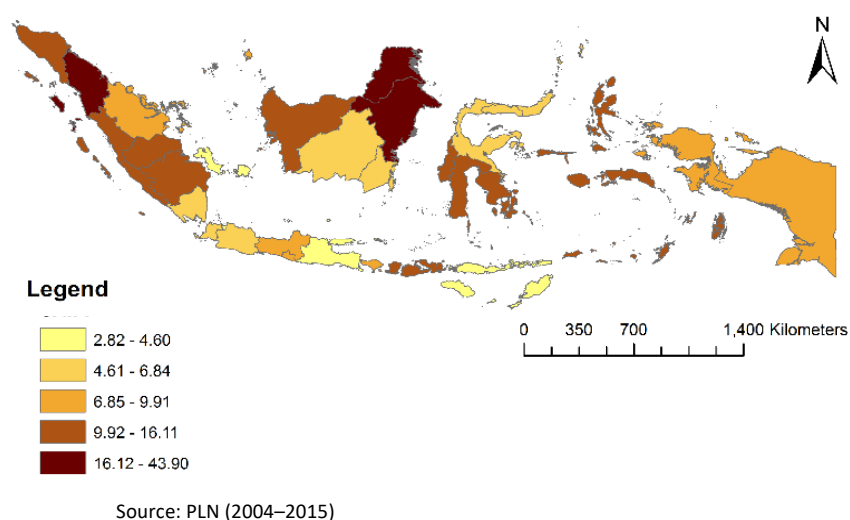


Figure 2.1 Frequency of electricity failure, 2004–2015

Between 2004 and 2015, people in Central Java and Yogyakarta lived without power supply during 8.2 events, and those in Bali experienced slightly more frequent events, at 9.2, while Riau had 9.5, and the Papua and West Papua region had 9.9 occasions. The West Kalimantan region, and the Bengkulu, Jambi, and South Sumatera region experienced 11 blackout events; West Nusa Tenggara, West, South and Southeast Sulawesi region had 12 events; West

Sumatera had 12.6 events; while Aceh experienced 16 events. The regions of East and North Kalimantan, and North Sumatera experienced the most frequent electricity failures at more than 27 and 44 events per year.

The improvement of electricity reliability varied greatly across regions during 2004–2015. While some regions experienced more than a 70% reduction in power interruptions, such as Aceh and North Sumatera, other regions experienced around a 30% reduction, such as Riau and Kepulauan Riau. Nonetheless, blackout events in Central Java and Yogyakarta, and South, South East and West Sulawesi regions more than doubled in 2015 compared with 2004.

It has been reported that improvement in power reliability was accomplished through supply-side initiatives, for instance, gradually implementing structural changes to the energy sector, boosting investment in infrastructure, and introducing a regulatory initiative to improve power supply quality. Furthermore, in 2011 the government enacted a policy stating that customers have the right to receive compensation from PLN when they experience a certain frequency or duration of blackouts. This policy helped the improvement of power supply reliability (World Bank, 2017a).

2.4 Empirical framework

2.4.1 Basic model

The main labour productivity outcomes in this paper concern gross output- and value added-based labour productivity. Gross output-based productivity measures capture disembodied technical change, while value added-based productivity measures reflect an industry's capacity to contribute to economy-wide income and final demand. I used the number of workers to quantify labour input in the production process.

My model examined the impact of blackouts on labour productivity at the firm cohort level. Cohorts are groups of firms with similar characteristics. I conducted the analysis at the firm

cohort level because MSE data from BPS are available for multiple cross-section surveys rather than for a panel. The pseudo-panel data are constructed by grouping observations into cohorts on the basis of invariant shared characteristics (Deaton, 1985). The cohort variables are formed as the mean values of the observations in each cohort. For the dummy variable, the “share” variable is equivalent to mean values of the continuous variable. The cohorts are then tracked over time in each of the annual surveys, forming a panel. Compared with a genuine panel, the pseudo-panel suffers from fewer problems of attrition and nonresponse, since cohorts are followed over time (Verbeek, 2008).

I developed a first-difference dynamic panel fixed effects estimation to estimate the impact of power blackouts on labour productivity; as seen in the equation (2.1).³ It is a dynamic panel in which current labour productivity is a function of past productivity. Literature shows that firms might learn from previous labour productivity and might expect current outcome based on previous experience (Bigsten & Gebreeyesus, 2009; De Loecker, 2007; Van Biesebroeck, 2005).

$$\Delta \ln y_{crt} = \alpha + \beta \Delta \ln E_{rt} + \gamma \Delta \ln y_{cr(t-1)} + \Delta X'_{crt} \vartheta + \Delta M'_{rt} \delta + \theta_c + \theta_r + \theta_t + \varepsilon_{crt} \quad (2.1)$$

where y_{crt} is labour productivity measurement, of cohort c in region r in year t . E_{rt} is power blackouts. I used the system average interruption frequency index (SAIFI) as the measurement of power blackouts. Past labour productivity at $(t-1)$ is also included in the specification. The X vector represents the time-varying firm cohort characteristics including logarithmic form ($\ln$) of average fixed assets per worker as a proxy of capital, share of cooperative member enterprise, share of privately owned enterprise, share of licensed enterprise, share of female-owned enterprise, and share of enterprise of which the owner has no education (Setiawan, Effendi, Heliati, & Waskito, 2019). I also controlled for infrastructure (road density and electrification

³ Before applying an empirical form, I examined the presence of unit root in the data of the log productivity, log blackout frequency, and log blackout duration. Using national figures, I could not reject the hypothesis that these variables contain unit roots. Accordingly, I applied models in first-difference.

rate) and weather factors (ln precipitation and temperature) M at the regional level. Δ is the first-difference operator.

The labour productivity is in terms of per labour, thus I do not include the average number of workers as a control. θ_c and θ_r are cohort and region fixed effects to allow for different underlying average productivity levels for each cohort and each region, respectively. θ_t is a set of year fixed effects to eliminate the effects of time-specific factors that might affect average productivity, such as macroeconomic shocks. ε_{crt} is an idiosyncratic error. Standard errors are robust to heteroskedasticity.

Negative estimates of β are expected, because power blackouts interrupt the production process. The interpretation of the blackout frequency measurement is that the more frequent the blackout events, the more unreliable the power supply.

The estimated results of equation (2.1) may suffer from endogeneity problems. Firstly, blackouts might be not naturally exogenous. Secondly, power blackout variable and labour productivity might have a reverse causality relationship. Thirdly, there may be measurement errors in the electricity blackout measurement and cohort variables.

Regarding the endogeneity concern, I would like to know whether electricity blackouts could be treated as naturally exogenous. Thus, I examine for possible factors that may affect blackouts using equation (2.2).

$$\Delta \ln E_{rt} = \alpha + \beta \Delta \ln P'_{rt} + \gamma \Delta W'_{rt} + \vartheta_r + \vartheta_t + \varepsilon_{rt} \quad (2.2)$$

where P is a set of time-varying PLN characteristics in region r at time t , which include energy produced, energy losses, length of medium voltage transmission lines, length of low voltage transmission lines, electricity price in real terms, accounts receivable (A/R) collection period; and demand side of electricity (proportion of residential, of commercial customer, regional gross domestic product (RGDP)). W is weather factors (temperature and ln precipitation).

ϑ_r is region fixed effects to allow for different underlying electricity interruption trajectories for each region. ϑ_t is year fixed effects to eliminate the effects of common time-specific factors that might affect blackout frequency and ε_{rt} is an idiosyncratic error.

The World Bank (2017a) reports that adequacy of energy production, power system infrastructure, financial and operational performance, and weather are factors that may affect electricity reliability. I include energy produced to indicate energy production, while the length of medium and low voltage transmission lines represents infrastructure. Variables of financial and operational performance are energy losses, A/R collection period, and electricity price (at constant price), whereas factors of weather are precipitation and temperature. The variables of energy produced, and length of medium and low voltage transmission lines are weighted by area of region to incorporate size of region.

If, by estimating equation (2.2), there is an indication that electricity blackouts could not be treated as naturally exogenous, I will then implement an instrumental variable (IV) estimation technique to equation (2.1). Significant variables in equation (2.2) will be used as the instrumental variables.

In equation (2.1), I included time-varying and time-invariant controls to minimise omitted variable bias. The inclusion of enterprise cohort time-varying characteristics, infrastructure and weather factors should minimise bias due to time variant omitted variables, while controlling for cohort and regional fixed effects will capture time-invariant cohort and regional average difference levels. In addition, I included year fixed effects to capture common shocks. However, I do not have information on workers' education and working experience that might affect labour productivity. Therefore, there still might be unobservable bias in the final estimation. However, given that I have included many control variables in the model, most likely the bias is minimal.

2.4.2 Data

I collected data from 2004–2015 on the power sector, infrastructure, weather, and MSEs, excluding 2006–2008 for which data on MSEs are not available. The dataset covers six cohorts, which vary by 21 regions. First differencing means the sample covers 2005 and 2010–2015, while the first-lag of the first-difference means the sample covers 2011–2015. All monetary amounts are deflated to real 2010 IDR using the gross domestic product deflator for the manufacturing sector (2010 = 100), while electricity price is deflated using consumer price index for electricity price (2012 = 100). Throughout the paper, I use the word “region” to refer to region PLN operate in. The appendix A2.2 provides details on variable constructions and the PLN regions.

All power sector data are at the region level. I obtained data of PLN characteristics from PLN statistics publications available online through the PLN website (Perusahaan Listrik Negara, 2005, 2006, 2010, 2011, 2012, 2013, 2014, 2015, 2016). Data on electricity blackouts per region are gathered from the PLN Research and Development Centre through a communication. Panel A in Table 2.2 summarises the region-by-year observations of power sector data, weather, and infrastructure, while Panel B shows MSE cohort data.

Table 2.2 Summary of descriptive statistics

Variables	Obs	Mean	Std deviation
<i>Panel A. Power sector, weather & infrastructure data (region-by-year) 2004–2005, 2009–2015</i>			
Blackout frequency (event/customer/year)	189	9.92	11.32
Blackout duration (hour/customer/year)	189	10.99	20.73
Energy produced (gigawatt hour)	189	8,240.27	12,811.51
Energy losses (%)	189	9.74	2.46
Length of medium voltage transmission lines (km circuit)	189	13,854.72	12,220.73
Length of low voltage transmission lines (km circuit)	189	20,290.41	23,663.75
Electricity price (IDR/kilowatt hour)	189	698.82	95.94
A/R collection (days)	189	55.12	461.62
Proportion of residential customer (%)	189	91.53	2.86
Proportion of commercial customer (%)	189	5.59	2.53

Variables	Obs	Mean	Std deviation
RGDP region (IDR billion)	189	340,663.20	379,259.60
Temperature (°C)	189	26.69	1.20
Precipitation (mm)	189	2,249.84	789.21
Road density (per km)	189	0.89	2.12
Electrification rate (%)	189	17.74	7.40

Panel B. MSE data (cohort-by-year) 2004–2005, 2009–2015

Output per worker (million IDR/year)	1,076	22.85	14.83
Value added per worker (million IDR/year)	1,075	9.28	6.70
Number of worker	1,076	4.16	3.04
Fixed asset per worker (million IDR)	1,076	12.40	10.63
Share of cooperative member enterprise	1,076	0.04	0.09
Share of privately owned enterprise	1,076	0.82	0.18
Share of licensed enterprise	1,076	0.25	0.39
Share of female-owned enterprise	1,076	0.31	0.28
Share of without education–owned enterprise	1,076	0.21	0.16

Source: PLN R&D Centre, PLN annual report, Matsuura & Willmott (2011), Statistik Indonesia, MSE Survey 2004–2005 and 2009–2015, author's calculation

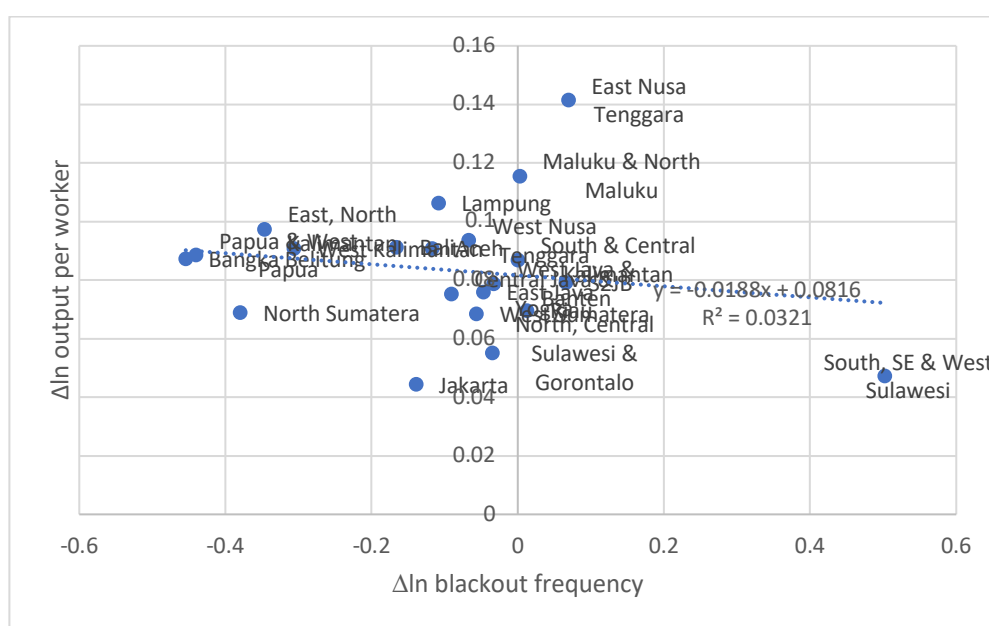
PLN reports the SAIFI and the system average interruption duration index (SAIDI) as the metrics of electricity reliability in its annual report. SAIFI is the average number of service interruptions experienced by a customer in a year, while SAIDI is the average total duration of outages over the course of a year for each customer served. SAIFI and SAIDI are calculated based on the following formula:

$$SAIFI = \frac{\sum F}{M} \quad (2.3), \quad \text{and} \quad SAIDI = \frac{\sum (H \times N)}{M} \quad (2.4)$$

where F is the number of blackout events, H is blackout duration, N is the number of customers who experienced blackout, and M is the total customers. Following PLN's definition, the coverage of blackouts are blackouts at distribution lines that are experienced by customers because of interruption or maintenance at generation as well as transmission lines (Perusahaan Listrik Negara, 2010).

I collected data on road density and electrification rates from the Statistical Yearbook of Indonesia (*Statistik Indonesia* or SI). Data on provincial temperatures and precipitation for 2011–2015 were obtained from SI, while data on temperature and precipitation before 2011 were obtained from Matsuura & Willmott (2011). I used Indonesia's annual survey of MSEs for 2004–2015, excluding 2006–2008 since there are no data available for those years. Data on MSEs are representative at the province level for one-digit KBLI or at the national level for two-digit KBLI.

Figure 2.2 shows the plot of the differenced log output per worker and the differenced log blackout frequency, using average cohort data. It appears that there is a negative association between the two variables. The regions with a higher blackout frequency experience lower outputs per worker.



Notes: A fitted line is shown. The line has a slope of -0.019 and an R^2 of 0.032 . Source: PLN R&D Center and BPS (2011–2015)

Figure 2.2 Scatter plot of differenced log blackout frequency and output per worker, 2011–2015

2.5 Results

2.5.1. Factors affecting blackouts

As previously explained, I need to know whether blackouts can be treated as naturally exogenous. The results indicate that underinvestment in the power sector and poor PLN governance might be among the reasons that Indonesia experiences blackouts.

In Column 1 of Table 2.3, I obtain the length of medium voltage transmission lines coefficient and electricity price coefficient, which are negative and significant at the 10% level, while the A/R collection coefficient is positive and significant at the 1% level. The remaining columns control for region fixed effects. Column 2 adds region fixed effects; I find electricity price is no longer statistically significant. Adding year fixed effects in Column 3, the significance of transmission lines disappears while the A/R collection period coefficient is significant at the 10% level. Similar results are found when I add RGDP in Column 4.

Table 2.3 Factors affecting blackout frequency

Variables	DV: $\Delta \text{blackout frequency } (\Delta \ln \text{SAIFI})$			
	(1)	(2)	(3)	(4)
$\Delta \ln$ length of medium voltage transmission lines	-0.306* (0.165)	-0.312* (0.174)	-0.332 (0.231)	-0.335 (0.223)
$\Delta \ln$ electricity price	-0.694* (0.397)	-0.745 (0.449)	0.842 (0.729)	0.729 (0.721)
$\Delta \ln$ A/R collection	0.137** (0.0593)	0.140* (0.0670)	0.181* (0.0951)	0.179* (0.0965)
$\Delta \ln$ RGDP regional				-1.406 (1.105)
Region FE	N	Y	Y	Y
Year FE	N	N	Y	Y
Observations	147	147	147	147
R squared	0.108	0.111	0.159	0.164

Notes: Other variables included in the estimations are energy produced, energy losses, length of low voltage transmission lines, share of residential, share of commercial customer, temperature and precipitation. However, these variables are not statistically significant. ***, **, and * indicate statistical significance at 1, 5, and 10 percent. Robust standard errors clustered by region are in parentheses.

The medium voltage transmission line is a part of the infrastructure that PLN requires to deliver electricity to customers (World Bank, 2017a) and might reflect investment in electricity sector, while A/R collection reflects the ability of PLN to collect revenue from customers and transform it into profit or investment. In this sense, A/R collection could be seen as PLN governance. Knowing that medium voltage transmission lines and A/R collection affect blackouts, I then use these factors as instruments for blackouts.

2.5.2. Instrumental variable approach

As shown in the previous section, due to the fact that medium voltage transmission lines and A/R collection period affect blackouts, I implemented an IV estimation technique in the main analysis. In this section, I therefore provide an argument that medium voltage transmission lines and A/R collection period can be the instruments, i.e. that these variables are not directly correlated with labour productivity of MSEs in the region. And so, the impact of these instruments to labour productivity is only through power blackouts.

To meet the fast-growing demand for electricity, the government announced two fast-track programs in 2004 and 2006 to accelerate the expansion of power capacity. In addition, the government launched the 35 gigawatts electricity project in 2015. PLN may have overestimated demand however as the actual demand has grown at a much slower rate when compared with projections, therefore putting PLN and their customers at risk of paying for unneeded power (Chung, 2017; Singgih & Sundaryani, 2017). In terms of pricing policy, balance in financial standing of the utility and affordability of electricity tariffs represent the main consideration for price setting meaning that tariffs are set below market levels. To compensate for this, the government provided subsidies allowing for a 7% profit margin to PLN. Therefore, medium voltage transmission lines that reflect the level of investment in the power sector are not directly related to labour productivity of MSEs in the region.

It might be argued that A/R collection might have a correlation with productivity. Those MSEs with low productivity might not be able to pay electricity bills on time, causing PLN to implement a longer A/R collection period. However, there are no data available on A/R collection for MSE-type customers. PLN provides A/R collection data by region or by customer, which could be differentiated into the public sector and the government sector. The public sector includes household, industry, and (larger) firms. In Indonesia, an MSE is an inseparable entity from the household such that the MSE does not have a separate electricity account from the household. It is very common that electricity accounts are registered under the household name instead of the enterprise name. From the A/R collection data available I could not untangle the information for MSEs only.

Based on PLN regulation, customers must pay fines if they are late paying the electricity bill by one month. Furthermore, if they still do not pay the bill plus fines in the second month, PLN will stop the power supply temporarily. Finally, PLN will disconnect the power supply permanently if customers fail to pay the bill in the third month (Perusahaan Listrik Negara, 2011). Moreover, in 2008, PLN released a prepaid system, in which those customers who choose this system buy the electricity upfront. Any post-paid customers who would like to increase their installed capacity, or whoever has experienced a disconnection previously and would like to re-install electricity, will have to adopt the prepaid system. Similarly, new customers will be registered under the prepaid system.

Data show that the public sector accounted for around 90% of PLN's A/R amount, and the rest belongs to the government sector (armed forces, non-armed forces, local government, and state owned enterprises). In practice, power disconnection actions were taken for the public sector, but not for the government sector. This might suggest that in general PLN governance is relatively poor and not related to productivity of MSEs in the region. Therefore, I argue that A/R collection period, which represents the quality of PLN governance, is relatively exogenous to productivity.

2.5.3. The impact of power blackouts

To examine the impact of blackouts on MSEs, I ran an IV dynamic panel fixed effects model, instrumenting blackouts using medium voltage transmission lines and A/R collection. Table 2.4 presents the main results. There are two panels of estimates, corresponding to two groups of outcomes: $\Delta \ln$ output and $\Delta \ln$ value added. The IV estimates show that a 1% increase in blackout frequency causes lower output per worker by 0.055%. The effect is slightly higher on value added per worker (0.061%). The FE point estimates differ from the IV estimates, and the directions are consistent, as expected. The fact that the FE panel point estimates are smaller than the IV estimates suggests that instrumenting helps to address endogeneity problems. Without instrumenting for blackouts, one might incorrectly conclude that the effect of blackouts is very small.

The Ordinary Least Squares (OLS) estimates in Column 1 on output per worker show a small (-0.007) and statistically significant negative effect at the 10% level, rising to -0.006 in Column 2. Column 3 of Panel A controls for cohort, region, and year fixed effects; I obtain a negative coefficient for blackouts, which is statistically significant at the 5% level (-0.054). Column 4 adds cohort and region characteristics (infrastructure and weather factors), for which I find a slightly higher negative coefficient for blackouts (-0.055), significant at the 10% level.

The OLS coefficient in Column 5 is negative and statistically significant at the 10% level, while that in Column 6 is not statistically significant. Similar to the estimates on output per worker, the IV estimation results on value added per worker are negative and statistically significantly different from zero at the 5% level. The IV estimates show that a 1% increase in blackout frequency causes a 0.061% decrease in valued added per worker. Column 7 controls for cohort, region, and year fixed effects; the coefficient for blackouts is -0.059 . When I add cohort and region characteristics in Column 8, the estimate is slightly higher and negative (-0.061).

Table 2.4 Effects of blackouts on productivity

Variables	A. $\Delta \ln$ output per worker				B. $\Delta \ln$ value added per worker			
	Dynamic panel FE (1)	Dynamic panel FE (2)	IV dynamic panel FE (3)	IV dynamic panel FE (4)	Dynamic panel FE (5)	Dynamic panel FE (6)	IV dynamic panel FE (7)	IV dynamic panel FE (8)
$\Delta \ln$ blackout frequency	-0.007* (0.004)	-0.006* (0.004)	-0.054** (0.026)	-0.055* (0.028)	-0.007* (0.004)	-0.006 (0.004)	-0.059** (0.027)	-0.061** (0.030)
$\Delta \ln$ output per worker (t-1)	0.0682 (0.0726)	0.0803 (0.0627)	0.083 (0.057)	0.091 (0.055)				
$\Delta \ln$ value added per worker (t-1)					0.0773 (0.0695)	0.0903 (0.0597)	0.0943* (0.0559)	0.102* (0.0544)
$\Delta \ln$ fixed assets per worker	0.0777** (0.0311)	0.0769** (0.0329)	0.080*** (0.025)	0.079*** (0.025)	0.0790** (0.0315)	0.0779** (0.0333)	0.081*** (0.026)	0.080*** (0.025)
<u>Coefficients for instruments:</u>								
$\Delta \ln$ length of medium voltage transmission lines (km circuit)			-0.383*** (0.077)	-0.387*** (0.078)			-0.383*** (0.077)	-0.387*** (0.078)
$\Delta \ln$ A/R collection period (days)			0.249*** (0.068)	0.239*** (0.069)			0.249*** (0.068)	0.239*** (0.069)
F-statistic on instrument			17.00	16.58			16.97	16.56
Hansen J statistic			2.325	2.429			2.341	2.378
Cohort characteristics	N	Y	N	Y	N	Y	N	Y
Region characteristics	N	Y	N	Y	N	Y	N	Y
Cohort FE	Y	Y	Y	Y	Y	Y	Y	Y
Region FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	547	547	547	547	547	547	547	547
R squared	0.299	0.309	0.219	0.225	0.288	0.299	0.191	0.196

Notes: ***, **, and * indicate statistical significance at 1, 5, and 10 percent. Robust standard errors are in parentheses

In addition, another variable vital in explaining labour productivity is fixed assets, a proxy of capital. In all specifications for all outcomes, I obtain positive and significant coefficients for fixed assets. It appears that fixed assets are a channel through which MSEs cope with unreliable electricity by, for instance, adopting a captive generator. However, because of data unavailability, I am only able to examine whether adopting a captive generator helps MSEs manage poor power supply using a cross-sectional estimation, as explained in the next section.

The first-stage results of the main estimation show that medium voltage transmission lines and A/R collections are valid instruments for blackouts. The signs for these two variables are as expected and statistically significantly different from zero. Column 3 controls for cohort, region, and year fixed effects; the coefficient for length of medium voltage lines is -0.383 , while that of A/R collection is 0.249 , and both are significant at the 1% level. The longer the length of medium voltage transmission lines, the less frequent the blackouts; the longer the period of A/R collection, the more frequent the blackouts. Column 4 adds cohort and region characteristics; I obtained a slightly smaller coefficient for medium voltage transmission line and of A/R collection, -0.387 and 0.239 , respectively.

While the exact coefficient estimates differ slightly because of the different controls, I find that the coefficients for instruments are the same for both output (Column 3–4) and value added (Column 7–8). The instruments are powerful, as seen in the heteroskedasticity-robust Kleibergen-Paap F-statistics range from 16.56 to 17. For comparison, the Stock & Yogo (2005) critical values for two instruments and one endogenous regressor are 11.59 and 19.93 for maximum 15% and 10% bias respectively.

Since I use two instruments for blackouts, I also conducted an over-identification test of all instruments. The Hansen J statistic is consistent in the presence of heteroskedasticity and autocorrelation. A rejection would cast doubt on the validity of the instruments. The results show that I cannot reject the joint null hypothesis that the instruments are valid instruments. Therefore, it is reasonable to assume that the instruments fulfil the exclusion restriction.

By inputting the average value added per worker per year of approximately IDR 9.28 million, it can be roughly estimated that with an average of four workers per enterprise, unreliable electricity supply lowers labour productivity by approximately IDR2 0.500 per enterprise per year. Furthermore, if this number can be interpreted as the average cost of experiencing unreliable electricity supply, and assuming there are around 3.5 million manufacturing MSEs in Indonesia, this paper estimates that the cost of unreliable power supply is approximately IDR 71.5 billion (USD 4.91 million) per year for the country⁴.

2.5.4. Robustness tests

To evaluate the sensitivity of estimation results, I conducted a battery of robustness checks by using other measurement of electric reliability, adding age of enterprise that reflects the experience of doing business, omitting cohort fixed effects, and clustering standard errors by cohort region.

In addition to blackout frequency, PLN also reported blackout duration (hours per customer per year), which is known as SAIDI. People care not only about how frequent power blackout events are, but also how long they last when they occur. Accordingly, it is vital to see whether or not the different measurement provides similar results with the main specification. As a measurement of reliability, SAIDI means the longer the duration of blackouts, the more unreliable the power supply is. Adding the age of enterprise enabled me to check for anything unobservable that might confound the results. Omitting cohort fixed effects allowed me to evaluate whether or not cohort effects drive the results. Furthermore, clustering the standard error by cohort-region enabled me to evaluate if there is any serial correlation among errors in the cluster (Cameron & Miller, 2015).

⁴ Please note that the estimated cost of blackouts here is only for MSEs in the manufacturing sector. If it is for the whole sectors in the economy, the estimated cost of blackouts is as much as IDR 2.7 trillion or USD 180.7 million per year. I multiply the productivity loss per labour per year, which is IDR 20,500, with the total number of employments in Indonesia that equal to approximately 128.8 million workers (in February 2015). This cost for the whole nation is relatively significant compared with the PLN's annual budget.

I found that the IV results are robust to a set of robustness checks, as depicted in Table 2.5. The estimates are similar and statistically indistinguishable when using the duration of blackouts instead of blackout frequency as the endogenous right-hand-side variable, adding age of enterprise as a control, or omitting cohort fixed effects θ_c . Clustering by cohort-region instead of robust standard error only mildly changes the standard errors; no discrete significance levels change, and no first-stage F-statistic drops below 10.

Table 2.5 Robustness checks

Change from base specification:	Use blackout duration (ln SAIDI) (1)	Add age of enterprise (2)	Without cohort fixed effects (3)	Cluster by cohort-region (4)
$\Delta \ln(\text{output per worker})$				
$\Delta \ln \text{ blackouts}$	-0.065** (0.032)	-0.060** (0.029)	-0.057** (0.028)	-0.055** (0.027)
Number of observations	547	546	547	547
First-stage F -stat	12.354	16.188	16.840	11.417
$\Delta \ln(\text{value added per worker})$				
$\Delta \ln \text{ blackouts}$	-0.071** (0.033)	-0.066** (0.031)	-0.062** (0.030)	-0.060** (0.029)
Number of observations	547	546	547	547
First-stage F -stat	12.354	16.173	16.840	11.417

Notes: This table presents alternative estimates for Table 2.4, instrumenting for blackouts using length of medium voltage transmission lines, and A/R collection period. All specifications include fixed assets per worker, cohort characteristics, region characteristics, cohort FE, region FE, year FE. F -statistic is for the heteroskedasticity and cluster-robust Kleibergen-Paap weak instrument test. Robust standard errors are in parenthesis. ***, **, and * indicate statistical significance at 1, 5, and 10 percent.

Table 2.6 informally evaluates the exclusion restriction of the instruments. For an instrument to be valid, it must affect blackouts without affecting MSEs other than through blackouts. I regressed a dependent variable ($\Delta \ln$ output per worker or $\Delta \ln$ value added per worker) on the instruments of medium voltage transmission lines and A/R collection period, controlling for region and year fixed effects. I found that regardless of the dependent variables, the coefficients for medium voltage transmission lines as well as those of the A/R collection period are statistically insignificant. Thus, there is no evidence that the instruments have a direct effect on labour productivity.

Table 2.6 Exclusion restriction checking

Variables	DV: $\Delta \ln$ output per worker			DV: $\Delta \ln$ value added per worker		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln$ length of medium voltage transmission lines (km circuit)	0.048 (0.043)	0.043 (0.040)	0.076 (0.046)	0.049 (0.044)	0.044 (0.042)	0.082 (0.049)
$\Delta \ln$ A/R collection (days)	0.005 (0.028)	-0.029 (0.024)	-0.022 (0.016)	0.004 (0.028)	-0.030 (0.024)	-0.024 (0.016)
$\Delta \ln$ output per worker (t-1)	N	Y	Y			
$\Delta \ln$ value added per worker (t-1)				N	Y	Y
Controls	N	N	Y	N	N	Y
Region FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	146	105	105	146	105	105
R squared	0.225	0.398	0.635	0.228	0.405	0.661

Controls include fixed assets per worker, share of enterprises female-owned, share of enterprises without education, share of enterprises that become cooperative member, share of licensed enterprises, share privately owned enterprises, electrification rate, road density, precipitation, temperature. Notes: ***, **, and * indicate statistical significance at 1, 5, and 10 percent. Robust standard errors clustered by region are in parentheses

2.5.5. The effect of adopting a captive generator

A potential behavioural response to higher electricity interruptions is to self-generate electricity by adopting captive generation (Alby et al., 2012; Rud, 2012b). The main results indicate that capital might be a channel through which MSEs secure their activities against unreliable electricity.

In this section, I specifically examined the impact on labour productivity of possessing a captive generator. I also explored the interaction between owning a captive generator and blackout frequency. Using equation (2.5), I conducted cross-section estimations since data on captive generation are available only for 2010. However, since more productive enterprises might be the ones who can afford to adopt a captive generator, the results on the effect of adopting a captive generator suggest an association between captive generator adoption and labour productivity. The estimation results indicate that those MSEs adopting a captive generator have benefited when electricity supply is poor.

$$\ln y_{ir} = \alpha + \beta \ln E_r + Gen_i + \gamma \ln E_r * Gen_{ir} + \ln X'_{ir} \theta + M'_r \vartheta + I_{ir} + S_{ir} + \mu_k + \varepsilon_{ir} \quad (2.5)$$

where $\ln y_{ir}$ is output per labour of firm i in region r , in million IDR (per month). Generator is a dummy equals one if firm i owned a captive generator. X is a set of time-varying controls (ln fixed assets per worker, cooperative membership dummy, ln proportion of privately owned capital, a set dummy for owner education level, female-owned dummy) and M is a vector of infrastructure (road density, electrification rate) and weather factors (temperature and ln precipitation) at the region level. I_{ir} is a two-digit KBLI dummy to represent industry effect. S_{ir} is a small-sized dummy, which equals 1 if a firm employs 5–19 workers, and 0 otherwise. μ_k is the island dummy to allow for different underlying productivity trajectories for each island. ε_{ir} is an idiosyncratic error.

As shown in Table 2.7, in all specifications, I find that blackout frequency coefficients are statistically not different from zero. Once I add controls, the signs for blackouts coefficients are negative, as expected. Column 1 does not add a control; I obtain a positive and insignificant coefficient for blackouts. The remaining columns control for island, KBLI and size dummy. In Column 2, I find that the coefficient for blackouts is negative yet statistically not different from zero. Column 3 adds region characteristics (road density, electrification rate, temperature, and precipitation); I obtain a higher negative coefficient for blackouts. In Column 4 I add firm controls; a lower negative and insignificant blackout frequency is obtained.

Table 2.7 The impact on labour productivity of owning a captive generator

	Dependent variable: ln output per worker			
	(1)	(2)	(3)	(4)
Blackout frequency (ln SAIFI)	0.089 (0.112)	-0.021 (0.099)	-0.062 (0.123)	-0.043 (0.103)
Owned a captive generator = 1	0.487*** (0.156)	0.118 (0.142)	0.059 (0.147)	-0.126 (0.116)
Owned a captive generator* blackout frequency	0.168* (0.090)	0.195** (0.080)	0.224** (0.082)	0.235*** (0.067)
ln fixed asset per worker	0.287*** (0.0148)	0.229*** (0.010)	0.227*** (0.010)	0.195*** (0.008)
Island dummy	N	Y	Y	Y
KBLI dummy	N	Y	Y	Y
Small-sized dummy	N	Y	Y	Y
Region characteristics	N	N	Y	Y
Firm controls	N	N	N	Y
Observations	52,428	52,428	52,428	49,984
R squared	0.215	0.358	0.367	0.423

Notes: ***, **, and * indicate statistical significance at 1, 5, and 10 percent. Robust standard errors clustered by region are in parentheses.

I also find that the coefficients for possessing a captive generator are not statistically significant, except when I add no control. Column 1 does not add a control; I obtain a positive and significant coefficient for owning a captive generator at 1%. However, once I add island, KBLI and size dummies in Column 2, the significance disappears. Similar results are also

obtained when I add region characteristics in Column 3. Column 4 adds firm controls; here I find a negative and insignificant coefficient for owning a captive generator.

In all specifications, I find that the coefficients for the interaction of possessing a captive generator and blackout frequency are positive and statistically significantly different from zero. Column 1 adds no control; I obtain a positive and significant coefficient for interaction at 10% (0.168). When I control for island, KBLI and size dummy in Column 2, I obtain a slightly higher coefficient. Columns 3 and 4 add region characteristics and firm control, respectively; still I obtain positive and significant coefficients for interaction, 0.224 and 0.235, respectively. The results point out that MSEs who adopt a captive generator are benefited, specifically when power supply is unreliable. I also find in all specifications that fixed assets coefficients are positive and statistically significantly different from zero.

2.6 Conclusion

In this paper, I have examined the impact of electricity outages on the labour productivity of MSEs using constructed pseudo-panel data for Indonesia over the period from 2010 to 2015. The identification strategy involves using factors affecting blackouts as instruments for blackouts in IV dynamic panel fixed effects estimation, while controlling for factors that potentially affect productivity and are correlated with blackouts. I found a negative and significant impact of electricity interruptions on labour productivity: power blackouts reduce average productivity.

The results are qualitatively similar under different approaches to using alternative power reliability measurement, adding more controls, removing cohort fixed effects, or clustering the standard error. The monetary loss associated with unreliable power supply for manufacturing MSEs in Indonesia is approximately IDR 71.5 billion (USD 4.91 million) per year. The results provide support for a growing body of work linking reliable power supply and firm performance (Alby et al., 2012; Allcott et al., 2016; Fisher-Vanden et al., 2015).

I also found that a way for firms to secure their production under poor power supply conditions is to the adoption of captive generators. The results suggest that using captive generators is associated with higher productivity and MSEs that own captive generators are benefited when the power supply is poor. Adopting a captive generator is, however, typically very expensive (Burke et al., 2018). Thus, policy-makers can support the adoption of captive generators by, for instance, promoting a wide range of technology adoption including renewable energy that can be small-scale and low cost, and that can be used either at the enterprise level or at the community level.

Bearing these results in mind, I argue that it is crucial that developing countries' government prioritise improving electricity reliability. Furthermore, since less frequent yet longer blackouts can be as damaging as more frequent yet shorter blackouts, policy-makers need to focus on making blackouts less frequent and shorter in duration.

This priority would help MSEs that commonly face economic disadvantage, including financial constraints, to improve their productivities; hence increase their profitability as well as the welfare of those participating in this sector. What policies and what developing countries should do to effectively improve electricity reliability while at the same time promote renewable energy and sustainability in their countries, unfortunately, is not within the scope of this paper. Further researchers might want to focus their questions on this issue.

Appendices

A2.1. The grouping of two-digit *Klasifikasi Baku Lapangan Usaha Indonesia* (KBLI) based on factor intensity

KBLI 2000 & 2005	KBLI 2009	Factor intensity
Labour intensive		
17	13	Manufacture of textiles
18	14	Manufacture of clothing
19	15	Manufacture of leather and related products
20	16	Manufacture of wood and products of wood and cork, except furniture
36	31	Manufacture of furniture
37	32	Other manufacturing
	33	Maintenance and repair of machinery and equipment
Resource intensive		
15	10	Manufacture of food products
15	11	Manufacture of beverages
16	12	Manufacture of tobacco products
21	17	Manufacture of paper and paper products
22	18	Printing and reproduction of recorded media
23	19	Manufacture of coke and refined petroleum products
24	20	Manufacture of chemicals and chemical products
	21	Manufacture of basic pharmaceutical products and pharmaceutical medicine
25	22	Manufacture of rubber and plastics products
Capital intensive		
26	23	Manufacture of other non-metallic mineral products
27	24	Manufacture of basic metals
28	25	Manufacture of fabricated metal products, except machine
30, 32, 33	26	Manufacture of computer, electronic, and optical products
31	27	Manufacture of electrical equipment
29	28	Manufacture of machinery and equipment not elsewhere classified
34	29	Manufacture of motor vehicles, trailer and semi-trailers
35	30	Manufacture of other transport equipment

Source: Aswicahyono, Hill, & Narjoko (2011) for KBLI 2009 and updated by the author for KBLI 2000 & 2005

A2.2. Variable descriptions and list of regions

Enterprise characteristics. Source BPS (2004–2005, 2009–2015)

Cohort variables are constructed as the mean of variables for firms within the same cohort.

The following variables are calculated for each cohort:

1. Output per labour, calculated for each enterprise by dividing total output (2010–real term) by number of worker, then for each cohort I calculate the average labour productivity per month. Average labour productivity per year = average labour productivity per month*12 months.
2. Value added per labour, calculated for each enterprise by dividing value added (= output minus input) (2010-real term) by number of worker, then for each cohort I calculate the average value added per month. Average labour productivity per year = average labour productivity/month*12 months.
3. Fixed assets per worker, calculated for each enterprise by dividing fixed assets by number of worker. Then, for each cohort I calculate the average fixed assets per worker.
I interpolate the fixed assets for 2011 since there was no question on this in the questionnaire.
4. Share of privately owned enterprise = summation of privately owned enterprise dummy, divided by total cohort member.
5. Share of cooperative member = summation of cooperative member enterprise dummy, divided by total cohort member.
6. Share of licensed enterprises = summation of licensed enterprise dummy, divided by total cohort member.
7. Share of female-owned enterprise = summation of female-owned enterprise dummy, divided by total cohort member
8. Share of without education-owned enterprise = summation of dummy of enterprise that is owned by entrepreneur without education, divided by total cohort member.

Energy sector. Source PLN annual report (2004–2005, 2009–2015):

9. SAIDI and SAIFI are at the region level, source PLN Research and Development Center.
10. Net energy production (GWh) = Purchased from outside PLN + received from other unit (GWh) + own production (GWh) – own use central (GWh) region-by-year, except 2004–2005 national figure proportional to 2009 distribution.
11. Length of medium voltage transmission lines (kilometre circuit) region-by-year, except 2004–2005 national figure proportional to 2009 distribution.
12. Length of low voltage transmission lines (kilometre circuit) region-by-year, except 2004–2005 national figure proportional to 2009 distribution.
13. Electricity price (IDR/kWh) = average price (region-by-year), except 2004–2005 = income/#sales (national figures), in nominal terms.
14. Energy losses (%) = transmission + distribution losses, region-by-year, except 2004–2005 = national figures.
15. A/R collection = average duration of A/R collection, in days.
16. Proportion of residential and of commercial (business and industry) calculated as share of number of residential and of commercial customer to total customers, region-by-year, except 2004–2005 national figure proportional to 2009 distribution.

Weather, infrastructure. Source: Matsuura & Willmott (2011) for 2004–2005), Statistik Indonesia (2009–2015), PLN annual report (2004–2005, 2009–2015):

17. Temperature = average temperature of province(s) in the same region, in °C.
18. Precipitation = average precipitation of province(s) in the same region, in mm.
19. Road density = proportion of total road length to region area (km²). Total road length is the summation of state, provincial, and regency/municipality road length (km).
20. Electrification rate = ratio of total PLN customer to region population.
21. RGDP region: summation of RGDP of province(s) in the same region, constant price 2010.

Source: BPS *Statistik Indonesia* 2004–2015

22. Regions: Aceh; North Sumatera; West Sumatera, Riau and Kepulauan Riau; South Sumatera, Jambi, Bengkulu; Bangka Belitung; Lampung; West Kalimantan; South Kalimantan and Central Kalimantan; North Sulawesi, Central Sulawesi and Gorontalo; South Sulawesi, South East Sulawesi, and West Sulawesi; Maluku and North Maluku; Papua and West Papua; Bali; West Nusa Tenggara; East Nusa Tenggara; East Java; Central Java and Yogyakarta; West Java and Banten; Jakarta Raya and Tangerang.

Chapter 3

Digitalisation and the performance of micro and small enterprises in Yogyakarta, Indonesia

3.1 Introduction

Micro and small enterprises (MSEs) play a significant role as a source of income and employment in many developing countries (Berry & Mazumdar, 1991; Berry et al., 2001; Tambunan, 2009). Banerjee & Duflo (2011) show that small and medium enterprises (SMEs) have generated most of the new non-farm jobs in India, Indonesia, and China. Small enterprises also play a role in exports and the supply of products and services to larger enterprises (Asian Development Bank, 2015; Sato, 2000). Furthermore, in some cases, MSEs function as an important informal social safety net mechanism (Resosudarmo et al., 2012). Nevertheless, the productivity of MSEs remains low (Mead & Liedholm, 1998; Tybout, 2000) and is, as expected, lower than that of larger firms (Hill, 2001; Little et al., 1989; OECD, 2015).

Digitalisation — which typically means digital technology utilisation, such as internet utilisation — has been widely expected to improve firm performance in developing countries. Globally, over 40% of people have internet access, and this figure continues to rise as new users connect online everyday (World Bank, 2016a). In 2015, 18.2 billion devices were connected to the internet; this number is predicted to increase threefold by 2020. Digitalisation is considered the basis of the fourth industrial revolution, in which technologies are transforming almost every aspect of life, including ways of doing business (Das, Gryseels, Sudhir, & Tan, 2016). The rise of e-commerce in China for instance with such sites as the Alibaba business-to-business portal has boosted the nation's economy, creating 10 million jobs in online stores and related services. M-Pesa, a digital payment platform, has enabled Kenyans to send low-cost remittances to their families in their hometowns.

The benefit of digitalisation in terms of firm performance has been acknowledged in several studies (Hjort & Poulsen, 2019) and the use of the internet as a general-purpose technology by various firms has been associated with higher labour productivity and firm growth (Clarke, Qiang, & Xu, 2015). Moreover, it is not only larger firms but also smaller firms with disadvantaged socioeconomic backgrounds that are expected to benefit from the use of digital technologies in all aspects of business activities. The adoption of the internet by small and medium enterprises has been predicted to help smaller firms achieve higher exports (Hagsten & Kotnik, 2017; Lal, 2004), and to be more competitive (Setiawan, Indriastuti, & Destevanie, 2015). Similarly, it has been argued that the internet has become a facilitator for inclusive innovations amongst small businesses across several nations (Paunov & Rollo, 2016). However, only a few studies show a causal impact of digitalisation on firm productivity among MSEs (Bertschek & Niebel, 2016; Colombo, Croce, & Grilli, 2013; Díaz-Chao, Sainz-González, & Torrent-Sellens, 2015; Tadesse & Bahiigwa, 2015).

This paper extends the existing literature that provides evidence on the causal impact that digitalisation has had on MSEs' productivity in developing countries. Using MSEs in Yogyakarta, Indonesia as a case study, this paper investigates the causal impact of internet utilisation as an aspect of digitalisation on the productivity as well as on the exports of MSEs. Yogyakarta province is a suitable place to study MSEs in Indonesia. With nearly 470 MSEs per 1,000 households in 2016 (Badan Pusat Statistik, 2017a), Yogyakarta has the densest MSE population in the Java island and most of Indonesia's internet users are located in Java (Jurriens & Tapsell, 2017). The primary identification strategy makes use of the fact that the differences in geographic topography produce conceivably exogenous variations in the strength of cellular phone signal that MSEs in various areas can receive to connect to the internet with.

I begin the present chapter with a brief review of current studies on digitalisation and firm performance, followed by a discussion of MSEs in the context of digitalisation in Indonesia. After this, I discuss the survey data and descriptive statistics that emerged from the survey.

The subsequent section then outlines the empirical framework and the results of the empirical analysis. The paper concludes by deliberating on the wider implications of the findings for researchers and policy-makers.

3.2 Digitalisation and firm performance

A relatively large body of literature has recently developed that shows the role of digital technology in promoting the welfare of developing countries. For instance, Aker & Mbiti (2010) revealed that the staggering level of mobile phone coverage and adoption in sub-Saharan Africa has greatly reduced search costs and improved markets. Muto & Yamano (2009) found that mobile phone coverage expansion had induced market participation of farmers in remote areas, while Jensen (2007) showed that the adoption of mobile phones by anglers and wholesalers in Kerala, India, reduced price dispersion and waste, and increased both the profits of fishermen and the welfare of consumers. Tadesse & Bahiigwa (2015) examined the impact of mobile phones on farmers' marketing decisions and the prices they achieved in rural Ethiopia. A study on fast internet deployment in Africa showed large positive effects on employment through changes in firm entry, changes in productivity in existing firms, and changes in exporting (Hjort & Poulsen, 2019).

Nevertheless, little evidence is available in regard to the impact of digital technology utilisation on MSEs. Colombo et al. (2013) investigated broadband internet technology adoption and its associated application among SMEs in Italy, utilising the generalised method of moments approach to handle the endogeneity issue. They found that the adoption of basic or advanced broadband applications does not have any positive effect on SMEs' productivity. Nonetheless, the adoption of advanced broadband applications that are potentially relevant in SME operations produces productivity gains. The benefit appears only when the adoption is associated with the undertaking of extensive strategic and organisational changes to SMEs' current way of doing business. Similar results have also been found in previous research that focused on larger enterprises (Bresnahan, Brynjolfsson, & Hitt, 2002). Díaz-Chao et al. (2015)

analysed new co-innovative sources—including internet use—of labour productivity in small firms that sell products locally in Girona, Spain. In contrast to other studies, they found that co-innovation does not directly affect small local firms' productivity. However, they established an indirect relationship between co-innovation and productivity in firms that initiate international expansion. Bertschek & Niebel (2016) showed that employees' mobile internet access caused labour productivity to be higher among German manufacturing and services firms in 2014.

Several mechanisms explain how digital technology promotes development. Firstly, digital technology generates 'creative destruction'. Schumpeter (1934, 1950) introduces this term to describe how innovations might increase productivity and efficiency, thus revolutionising the economic structure while at the same time destroying traditional industries and business models. Digitalisation has transformed physical markets and physical transactions into virtual ones and converted corporate-centric systems into crowd-centric and collaborative economic systems, thus generating the digital economy (Pangestu & Dewi, 2017).

Secondly, digital technology greatly lowers the cost of economic and social transactions for firms, individuals, and the public sector by reducing information costs. The World Bank (2016a) suggests three mechanisms via which the internet stimulates economic development. Firstly, the internet has enabled automation and coordination thereby promoting efficiency. Secondly, the internet enables almost frictionless communication and collaboration thereby supporting new delivery models, encouraging collective action, and accelerating innovation on account of scale economies and platforms. Thirdly, the internet creates market effects by expanding trade, creating jobs, and increasing access to public services that previously were out of reach thereby promoting inclusion.

Nonetheless, in reality, the positive effect of digitalisation is not always reflected in productivity. Solow (1987, p.36) stated, "You can see the computer age everywhere but in the productivity statistics". This is known as the Solow paradox, a concept that scholars are still exploring (Acemoglu et al., 2014). Researchers have developed some possible explanations for the

Solow paradox. Firstly, that digital technology is underutilised because of technical bottlenecks, for instance, the reliance on humans to input data (Triplett, 1999) or a lack of access to the latest computing equipment (Katz & Koutroumpis, 2012).

Secondly, it takes time for digital technology to have an impact on productivity. Basu & Fernald (2008) have confirmed that the sectors in the United States (US) that use digital technology have experienced a rise in productivity but with a long lag in terms of time. Meanwhile, David (1990) revealed that it takes decades for the impact of the breakthrough in electrification to become visible in productivity statistics.

Thirdly, there is a possibility of flawed or incorrect measurement in relation to the impact on aggregate output. It is possible that the increases in aggregate output resulting from digitalisation are not well measured (Triplett, 1999). Brynjolfsson & Hitt (2000) argued that traditional macroeconomic measurement approaches which determine digital technology usage performance do not capture complementary organisational investment well.

3.3 Micro and small enterprises and digitalisation in Indonesia

In Indonesia, MSEs are one of the major foundations of the nation's economy. MSEs constitute 98% of all firms in various sectors and represent the source of living for more than 53 million people and provide 76% of all employment (Badan Pusat Statistik, 2017b). Table 3.1 provides some statistical information about MSEs in Indonesia. Over two decades, the number of MSEs increased from 16 million in 1996 to 26 million in 2016. The sectoral distribution indicates that the share of MSEs in the mining sector decreased over time, from 2% to less than 1% in 2016. The proportion of MSEs in manufacturing was relatively constant, while those in the services rose. In 2016, the wholesale and retail trade dominated, accounting for more than 47% of MSEs, followed by accommodation and food services activities and manufacturing at around 17%. Further, over 60% of MSEs are found on Java, where more than 55% of Indonesians live.

Nonetheless, the productivity of MSEs is relatively low. The contribution of MSEs to the nation's gross domestic product (GDP) was around 40% in 1996-1997, and the share went up to around 46% in 2016. MSEs also have been associated with local economies that they buy inputs and sell outputs locally. As it can be seen in Table 3.1 that their contributions to Indonesian non-oil and gas exports have been relatively small at less than 3% in 1996-1997 and nearly 4% in 2016.

Table 3.1 Indonesian MSEs statistics

	1996–1997	2004	2016
Number of MSEs	16,780,631	17,145,244	26,263,649
Sectoral distribution (%)			
Mining	2.13	1.50	0.65
Manufacturing	17.0	15.58	16.65
Wholesale, retail ⁵	58.2	61.16	47.27
Accommodation and food services			16.93
Other services	22.59	21.76	36.43
Number of employment	28,876,422	30,547,132	53,641,524
Contribution to GDP ⁶ (%)	40.45	39.22	46.28
Share of non-oil & gas exports ³ (%)	2.79	5.18	3.85

Source: Data for 1996–1997 and 2004 are from Integrated survey of micro- and small-scale establishment (BPS); data for 2016 are from the 2016 Economic Census listing (BPS)

Internet connections have continued to grow since the arrival of the internet in Indonesia in the second half of the 1990s. The number of Indonesian people using the internet has followed an exponential growth trend, increasing sevenfold from 8.1 million (3.6%) in 2005 to 56.6 million (22.%) in 2015 (International Telecommunication Union, 2016). This trend was initiated by the use of internet cafés as the primary place where people accessed the internet; since then, smartphones have been the main means of facilitating access the internet. The percentage of those who connect to the internet through mobile phones rocketed from 29% in 2012 to 70% in 2016, due to the massive expansion of smartphone usage (Balea, 2016; Jurriens & Tapsell,

⁵ Including accommodation and food services (1996–1997 and 2004) and repair of motor vehicles/ motorcycles (2016).

⁶ Classification of MSEs is based on that of the Ministry of Cooperative and Small and Medium Enterprises

2017). Indonesia is the fastest growing nation among neighbouring countries in terms of internet and mobile penetration rates (Pangestu & Dewi, 2017).

Nonetheless, digitalisation is not yet widespread in Indonesia. The current penetration rate is below that of several Association of Southeast Asian Nations (ASEAN) member states and neighbouring countries and far behind that of developed countries. In addition, data from the 2016 Economic Census listing shows only 5% of all firms in Indonesia accessed the internet in 2016 (Badan Pusat Statistik, 2017b). With almost 95% of all enterprises still not connected to the internet, this means the level of connectivity among transactors is still very low. Similarly, across Indonesia's entire key sectors, such as the manufacturing, financial and business services, and social sectors, IT spending lags behind not only developed countries but also peer countries (Das et al., 2016).

3.4 Field survey

I conducted a field survey of MSEs in Yogyakarta province in January 2018. Undergraduate students from the Faculty of Social and Political Science, Gadjah Mada University, were trained as enumerators. The respondents were required to be either the owner or manager of the selected enterprise. I used a stratified sampling strategy to randomly sample 700 MSEs in Bantul district and Yogyakarta city in various sectors including manufacturing, wholesale, and services. The sample frame was constructed based on the MSE survey of September 2017, which was a more detailed sample survey of the 2016 Economic Census listing. Details on the stratified sampling strategy and sample calculation used to determine the samples are provided in appendix A3.1.

I developed a mobile questionnaire utilising the *Survey Solutions* application. *Survey Solutions* is a computer-assisted personal interview (CAPI) technology developed by the World Bank that is used to conduct surveys with dynamic structures using tablet devices such as smartphones. The mobile questionnaire I developed was installed on each smartphone

provided to the enumerators. I provided each enumerator with a smartphone (Xiaomi Redmi 3) and *Telkomsel* (the main cellular operator in Indonesia) SIM card so that they could use the same standardised equipment to collect the required data. The CAPI method enabled efficient data collection and data processing. Furthermore, it enabled the collection of information on variables such as the coordinate location of samples and cellular signal strengths. Figure 3.1 shows the location of sampled MSEs in Yogyakarta province.

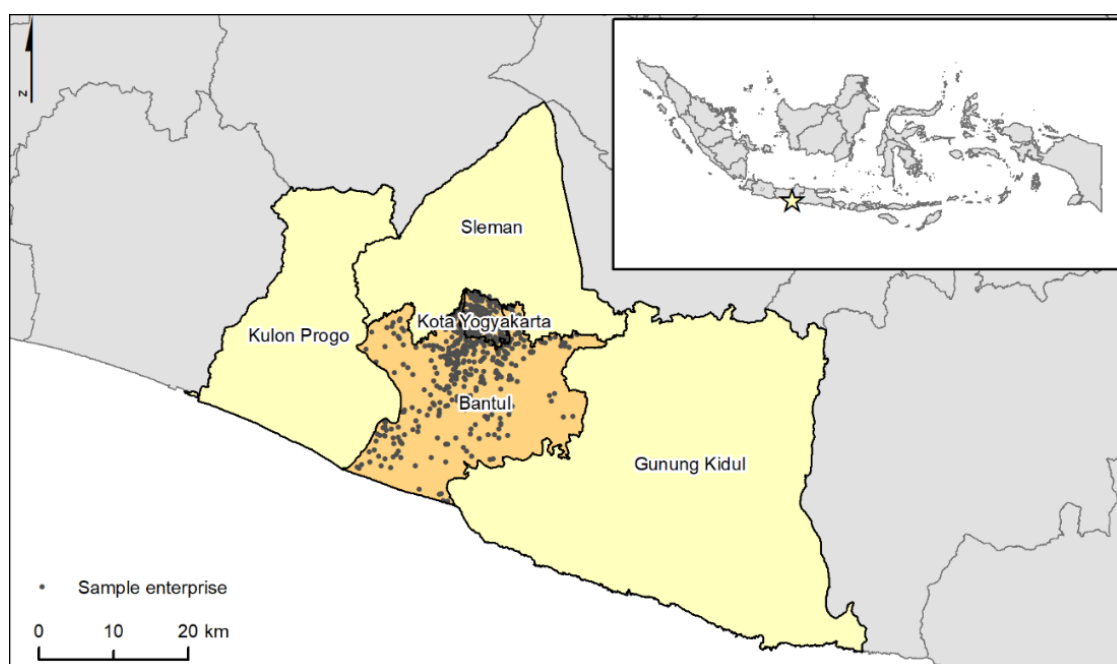


Figure 3.1 Map of survey location in Yogyakarta province

I explored internet utilisation among MSEs in several possible utilisation areas, such as website, email, social media and online trading platforms, for different purposes in business operations. The purposes of internet utilisation was focused around whether the MSEs used the internet to communicate with customers/suppliers, purchase input factors from suppliers, deliver services to clients, or advertise the products/services. Exports were categorised according to whether they were direct or indirect.

I managed to interview 576 MSEs out of a sample of 700. Table 3.2 presents the descriptive statistics of the survey data. It appears that the mean revenue per worker was IDR 7.7 million, while profit per worker was only half of the revenue per worker (IDR 3.4 million) and the mean

of export proportion was 7%. The mean age of entrepreneurs was 46 years old and on average they had more than 21 years working experience. Nearly one-third of MSEs possessed a license and around 11–15% were members of business associations or cooperatives. On average, the strength of the *Telkomsel* cellular signal was 4.5 bars, with 50 units of Base Transceiver Station (BTS) per village. A BTS is a piece of network equipment that facilitates wireless communication between a device and a network (Technopedia, 2018). Data in terms of the number of BTSs per village were collected from the *PT. Telkomsel* through a direct communication.

Table 3.2 Descriptive statistics

Variable	Obs	Mean	SD
<u>Data at enterprise level</u>			
Revenue per worker (IDR million)	567	7.70	17.89
Profit per worker (IDR million)	564	3.35	9.93
Proportion of exports (%)	576	7.03	19.61
Internet utilisation (1 = yes)	576	0.62	0.49
<i>Telkomsel</i> cellular signal strength (0 = no signal, 1-5 bars)	576	4.56	0.82
<i>Telkomsel</i> cellular data type (0 = no signal, 1 = 2G, 2 = GPRS, 3 = EDGE, 4 = 3G, 5 = 4G, 6 = LTE)	576	4.92	0.44
Elevation (metre above sea level)	576	91.24	55.08
Width of road (1 = <2 m, 2 = 2–4 m, 3 = 4–6 m)	576	2.10	0.71
Sector (1 = mining, 2 = manufacturing, 3 = service)	576	2.57	0.51
Home based enterprise (1 = yes)	576	1.40	0.49
Enterprise age (years)	576	15.37	14.10
Association membership (1 = yes)	575	0.15	0.36
Cooperative membership (1 = yes)	575	0.11	0.32
License (1 = yes)	576	0.37	0.48
Scale (1 = micro, 2 = small)	576	1.15	0.35
Gender (1 = male, 2 = female)	576	1.43	0.50
Education (0 = no education, 1 = primary & junior high school, 2 = senior high school or higher)	576	1.62	0.57
Experience (years)	575	21.87	8.58
Age (years)	575	45.75	12.56
<u>Data at village level</u>			
Number of <i>Telkomsel</i> BTSs in village (unit)	107	50.17	59.21

The above statistics are unweighted.

3.5 Empirical Framework

I used two measurements of firm performance, namely, labour productivity and exports. Labour productivity is represented by revenue per worker and profit per worker, instead of other measures of productivity such as Total Factor Productivity (TFP) or Technical Efficiency (Setiawan et al., 2019)⁷. Labour productivity is a vital element in assessing the living standards of those engaged in a production process in which labour is the most essential input (OECD, 2001a). In this paper, I used revenue per worker as the gross output-based productivity and profit per worker as the value added-based productivity⁸. Gross output-based productivity measures captured disembodied technical change, while value added-based productivity measures reflected an industry's capacity to contribute to economy-wide income and final demand. These two measurements were complements to each other.

Exports were considered as a means of upgrading MSEs in terms of productivity, and technological and managerial know-how (Sato, 2013; Setiawan et al., 2016). I expected the use of the internet by firms to have positive impacts on labour productivity and exports since it enables creative production processes, improves marketing processes, and access to markets in which enterprises find new efficient ways of doing business in place of the old methods, thus generating dynamism at the enterprise level.

The following estimation model was used to estimate the effect of internet adoption on firm performance:

$$y_{i,j,k,l} = \beta \text{Internet}_{i,j,k,l} + X'_{i,j,k,l} \cdot \gamma + \text{BTS}_{j,l} \cdot \delta + \theta_k + \theta_l + \varepsilon_i \quad (3.1)$$

⁷ I prefer to use measures of labour productivity that are directly available in the dataset, instead of using estimated measures of labour productivity, such as Total Factor Productivity (TFP). The estimation process could contain errors and coefficient bias.

⁸ To ensure the accuracy of on information related to the number of labour participating in each enterprise, during the training for our enumerators, we trained enumerators to carefully and correctly identify labour involved in each enterprise. We provided the concept and definition of labour included in the study and provided examples.

where i represents an enterprise, j represents a village where enterprise i is located, k represents a sector of enterprise i , and l represents a district where enterprise i is located. y is a measure of labour productivity or the export proportion in total sales. I used y at level since some of the samples showed that they experienced a loss (negative value of profit), such that I would lose observations if I took the natural log of profit. Coefficient β is the variable of interest to identify the impact from the uptake of the internet. *Internet* is a dummy variable of internet utilisation, which equals 1 if the enterprise utilises the internet in business activities and 0 otherwise. X is a set of firm characteristics (firm age, association membership, cooperative membership, license, scale, home based, export status (for labour productivity only)), including the width of road as a proxy for physical access, and elevation, as well as entrepreneur characteristics such as gender, age, education, and experience. BTS is the number of BTSs in the village j . θ_k is sector fixed effects and θ_l is district fixed effects. ε_i is an idiosyncratic term. Details on how I constructed variables are available in appendix A3.2. Estimations are weighted by sampling probability and standard errors are clustered at the subdistrict level.

3.5.1 Identification strategy

To cope with potential endogeneity issues, for instance, while internet utilisation might support labour productivity or exports, enterprises that are more productive also rely more on the internet, I instituted the following identification strategy.

I recorded *Telkomsel* signal strength at the location of the MSE samples. *Telkomsel* is documented as the cellular operator with the widest network coverage in Indonesia as well as in Yogyakarta. To minimise the possibility of measurement errors, I recorded *Telkomsel* signal strength using the same type of SIM cards and similar types of smartphones.

To ensure that cellular signal reception was orthogonal to other characteristics that might also affect firm performance, I also recorded the placement of BTSs in villages. The placement of BTSs is determined primarily by the cellular company, based on certain factors — among

others, the number of active subscribers, the usage capacity of the BTS, and location. In the specification, I included the number of BTSs in each village as control variables to capture further differences in cellular signal strength within villages and across enterprises. I also added district and sector fixed effects. Including these district fixed effects had the potential to remove most of the relatively subtle variations in the economic or infrastructure across Bantul district and Yogyakarta city. Similarly, sectoral fixed effects can remove the sector-specific factors that jointly affect internet utilisation and enterprise performance.

Once the proximity to the BTS site had been taken into account, geography was the main remaining determinant of cellular signal reception. In some areas, high buildings or mountains block cellular signal transmission, whereas in others they do not. MSEs located in areas where high buildings or a mountain block the 'line of sight' to a BTS might experience substantially less reception than nearby firms with a direct line of sight. Additionally, I controlled for elevation as MSEs located in mountainous areas might have different productivity or signal reception from those on the low plains. Moreover, I included the width of the road to control for physical access. Having controlled these geographic aspects, signal strength data would be driven largely by the happenstance of topography. I then used this cellular signal strength at the location of the samples as an arguably exogenous factor — an instrument variable — of internet adoption among the MSE samples.

This kind of approach that exploits differences in topography has been used in several previous studies. Olken (2009) examines the impact of media on local social interactions in Indonesia by exploiting mountains as the main source of television and radio signal reception. Once geographic factors, such as elevation, are taken into account, then the difference in signal reception is due to topography that varies randomly. A similar approach was adopted by Farré & Fasani (2013) to evaluate the impact of media exposure on internal migration in Indonesia, while Yanagizawa-drott (2014) used the differences in radio signal coverage to examine the role of mass media on genocide in Rwanda.

There is a possibility that the instrument correlates with omitted variables. For instance, a more ambitious entrepreneur will choose a better location for his or her business. However, MSEs, who are notably financially more constrained compared with larger enterprises, would just use the resources they have to work with; for example, where the entrepreneur's house is used as the base for his or her business activities. Data show almost 60% of the sample were home based enterprises. Furthermore, it would be very costly for MSEs to move to locations with better telecommunication signal to conduct their business, particularly in urban areas. Therefore, I argue that this concern is less likely to be an issue in the context of MSEs in Indonesia.

Similarly, there might be a concern on the endogeneity of the BTS placement. For instance, that towers were located near areas with more economic activity, but that also benefits the enterprises in those places. However, a cellular company has to get lands before for the placement of the BTSs in villages. This process of land acquisition is a random process. Therefore, the endogeneity of BTS placement is a less concern in this paper. Further, district FE can control for any other time-invariant unobservable at district level.

Another possibility is that entrepreneurs who experience weaker cellular signal strength might opt to use another cellular provider, instead of *Telkomsel*, to obtain a better signal. *Telkomsel* and *Indosat* are the two biggest cellular providers in Indonesia, and *Telkomsel* has a wider coverage when compared with *Indosat*. Accordingly, if an internet user's objective is to achieve a better signal strength, then he or she would prefer to use a provider with wider coverage, i.e. *Telkomsel*. Furthermore, cellular signal coverage in Yogyakarta is relatively good compared with other regions in the country so there is less of a reason not to use the provider with the wider coverage.

It might be argued that signal strength might benefits the enterprise directly but also many others, such as other enterprises, workers, customers, etc. Nonetheless, my estimation results using exports as the independent variables showed that this is not the case. For exports of

which the customers are from outside of the region, the customers are less likely to be benefited from signal strength. Similarly, I have examined the possibility of spillovers effect from the neighbouring regions and found no evidence that support the argument of that. Thus, the results could be interpreted as a direct firm-level effect.

3.6 Results

3.6.1 The impact of internet utilisation

Table 3.3 presents the results of the first stage of the IV estimates; indicating that cellular signal strength is a relevant and a valid instrument for internet utilisation. Cellular signal strength is positive and statistically significant at the 1% level, with around 60% of the variation in internet utilisation explained by cellular signal strength. The signal strength also passed the weak instrument test easily.

Table 3.3 First stages for base IV estimates

Variables	Revenue per worker		Profit per worker		(%) Proportion of exports	
	(1)	(2)	(3)	(4)	(5)	(6)
Coefficient on instrument:						
Cellular signal strength	0.095*** (0.008)	0.165*** (0.021)	0.095*** (0.008)	0.170*** (0.023)	0.095*** (0.008)	0.165*** (0.021)
Excluded <i>F</i> statistic	147.230	61.853	134.499	55.179	149.273	65.286
Controls & FE	N	Y	N	Y	N	Y
Observations	567	567	564	564	575	575
<i>R</i> squared	0.439	0.602	0.441	0.605	0.439	0.604

Note: Clustered standard errors by subdistricts in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Districts: Bantul and Yogyakarta; Sectors: mining, manufacturing, and services; Entrepreneur controls: gender, education, age, experience, Firm controls: home based, export status (for labour productivity only), association membership, cooperative membership, license, scale, firm age, road width, elevation; number of BTSs in village. Weighted using sampling weight.

Without controlling for other factors, the coefficient of signal strength is 0.095. The stronger the signal strength, the higher the probability of internet utilisation. Column 2 adds entrepreneur, firm characteristics, district FE, and sector dummy; here, I obtained a higher coefficient of signal strength (0.165). I find that the coefficients for signal strength are relatively the same in

the case that the second stage is an estimation of revenue per worker, profit per worker, or exports.

The instrument is statistically significant in the first stage and powerful, as seen also in the heteroskedasticity-robust Kleibergen-Paap F statistic range from 55.2 to 149.3. The Kleibergen-Paap Wald rk F statistic was used to test weak instruments when standard errors are clustered. Once I control for other factors, the F statistic drops but the instrument still passes the weak instrument test easily. For comparison, the Stock & Yogo (2005) critical value for one instrument and one endogenous regressor is 16.38 for a maximum 10% bias.

In Table 3.4, I present estimates of equation (3.1) computed using ordinary least squares (OLS) and IV for each dependent variable. The coefficients in the IV models can be interpreted as the causal impact of internet utilisation on enterprise performance (labour productivity, exports) associated with stronger cellular signal strength. Furthermore, this is a local average treatment effect (LATE) of utilising the internet because of stronger cellular signal strength. I find positive and significant coefficients of internet utilisation, suggesting that internet utilisation contributes positively to labour productivity and exports.

Table 3. 4 Productivity effects of internet utilisation

VARIABLES	A. Labour productivity								B. Exports			
	Revenue per worker				Profit per worker				(%) Proportion of exports			
	OLS		IV: cellular signal strength		OLS		IV: cellular signal strength		OLS		IV: cellular signal strength	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Internet utilisation	9.051*** (1.537)	4.466** (1.929)	16.15*** (3.887)	10.23*** (3.719)	4.300*** (1.182)	1.141^ (0.732)	7.957*** (2.119)	5.459* (2.832)	1.879*** (0.335)	1.364*** (0.262)	1.972*** (0.350)	1.729*** (0.581)
Controls & FE	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
Observations	567	567	567	567	564	564	564	564	575	575	575	575
R squared	0.098	0.283	0.038	0.264	0.064	0.227	0.018	0.197	0.040	0.059	0.040	0.058

Note: Clustered standard errors by subdistricts in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Districts: Bantul and Yogyakarta; Sectors: mining, manufacturing, and services; Entrepreneur controls: gender, education, age, experience, Firm controls: home based, export status (for labour productivity only), association membership, cooperative membership, license, scale, firm age, road width, elevation; number of BTSs in village. Fixed effects include district FE, and sector FE. Weighted using sampling weight.

Panel A of Table 3.4 illustrates labour productivity: revenue per worker and profit per worker. The estimated coefficients in Column 1 present the OLS coefficient without any control; I obtain a statistically significant positive effect at the 1% level (9.051). Similarly, the result holds when I add controls in Column 2, yet the magnitude of the coefficient is reduced to 4.466. Internet utilisation is associated with an IDR 4.5 million rise in revenue per worker. Columns 3 and 4 provide results for the IV estimation. Adding no control in Column 3, I obtain a positive and statistically significant coefficient of internet uptake at the 1% level (16.15). Internet utilisation, associated with stronger signal strength, increases revenue per worker by IDR 16.15 million. The coefficient becomes smaller as I add controls in Column 4 (10.23). Analogously, using profit per worker as a measurement for labour productivity, I obtain positive and significant coefficients for all specifications of OLS and IV estimates in Columns 5–8.

Regarding export performance shown in Panel B of Table 3.4, the coefficients of internet adoption are positive and statistically significantly different from zero. Both the OLS and IV estimates show a comparable magnitude. The measurement of export proportion is in percentage; thus, the interpretation of the magnitude is by percentage point. The IV estimates controls in Column 12 show that using the internet in business activities related to greater cellular signal strength corresponds to, on average, a 1.729 percentage point increase in the proportion of exports.

Using the OLS estimation results, I calculated the monetary benefit MSEs obtain from internet utilisation associated with stronger cellular signal strength. As shown in Table 3.4, internet uptake increases the revenue per worker by IDR 4.466 million per month (or approximately 58% of average revenue per worker) and increases profit per worker by IDR 1.141 million per month (or approximately 34% of average profit per worker). Please note that the local government regulation on minimum wage in Yogyakarta in 2018 was approximately IDR 1.454 million per month. The impact of internet use, hence, is significant for local people.

3.6.2 Robustness checks

In Table 3.5, I present the reduced-form estimates of the effect of the instrument on firm performance. The cellular signal strength, as shown in the smartphones used to measure it, ranges from the zero bar (no signal), to one bar, and all the way up to five bars for the strongest signal strength, which captures the availability and strength of the cellular signal. If broader cellular coverage exerted a positive effect on firm performance, I would expect the coefficients on signal strength to be positive and significant. In other words, I would expect the enterprise that experienced a stronger signal strength to perform better. As the columns show, I see that the coefficients of signal strength are positive and statistically significantly different from zero, except that on profit per worker once I take into account other factors. This indicates that broader cellular coverage leads to better performance.

Table 3.5 Reduced-form estimation results

Variables	Revenue per worker		Profit per worker		(%) Proportion of exports	
	(1)	(2)	(3)	(4)	(5)	(6)
Cellular signal strength	1.533*** (0.323)	1.380^ (0.840)	0.760*** (0.186)	0.769 (0.583)	0.187*** (0.0326)	0.317*** (0.113)
Controls & FE	N	Y	N	Y	N	Y
Observations	567	567	564	564	575	575
R squared	0.138	0.267	0.097	0.223	0.019	0.050

Note: Clustered standard errors by subdistricts in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Districts: Bantul (base) and Yogyakarta; Sectors: mining, manufacturing (base), and services; Entrepreneur controls: gender, education, age, experience, Firm controls: home based, export status (for labour productivity only), association membership, cooperative membership, license, scale, firm age, road width, elevation; number of BTSs in village. Weighted using sampling weight.

Columns 1–2 of Table 3.5 present the effects on revenue per worker. Column 1 adds no control; I obtain a positive and significant coefficient of signal strength at the 1% level (1.533). This means that a one-unit increase in cellular signal strength — that is, for instance, from no signal to one bar of signal strength — is associated with an increase in revenue per worker by IDR 1.5 million. Once I add controls in Column 2, the magnitude of coefficient becomes smaller (1.380) and is weakly significant. In Columns 3 and 4 of Table 3.5, I re-run the reduced-form

with revenue per worker as the dependent variable. Columns 5 and 6 show exports proportion as the dependent variable. The results show that a wider and stronger cellular signal strength promotes better performance.

I also examined whether the results were robust to different specifications. Firstly, I excluded the context variables, i.e., elevation, and the number of BTSs in the village. Secondly, I instrumented internet utilisation using cellular data type (e.g. 2G, 3G), instead of cellular signal strength. Thirdly, I evaluated whether there are spatial spillovers in which enterprises located adjacent to villages might receive a cellular signal from their neighbouring villages. Here, I added the weighted number of BTSs of neighbouring villages. The weighting uses a contiguity matrix, in which the off-diagonal elements equal one if village i is adjacent to village j , and zero otherwise (Anselin, 1988). This matrix is then row normalised, that is, the total of row elements is set equal to 1. If there are spatial spillovers, then the coefficient of this weighted neighbouring BTS variable should be significant. Fourthly, I removed outliers from the dataset to evaluate whether these drive the results. Small outliers are when a dependent variable is smaller than $\{Q_1 - 1.5*(Q_3 - Q_1)\}$, while large outliers are when a dependent variable is greater than $\{Q_3 + 1.5*(Q_3 - Q_1)\}$, where Q_1 is the first quartile and Q_3 is the third quartile.

In general, as shown in Table 3.6, I find that the estimation results are robust to these various specifications. The signs of the internet uptake coefficients are positive, and they are statistically significant. Nonetheless, depending on the specification, the magnitude is larger or smaller than the main estimations. I find that there is no evidence of spatial spillovers for profit per worker and exports because the coefficients of the weighted neighbouring BTS are not statistically significant. For the alternative IV estimation, the instruments are statistically significant in the first stage and pass the weak instrument test.

Table 3.6 Further robustness tests

VARIABLES	DV: Revenue per worker				DV: Profit per worker				DV: Proportion of exports (%)			
	Without context controls	IV = cellular data type	Spatial spillovers	Removing outlier	Without context controls	IV = cellular data type	Spatial spillovers	Removing outlier	Without context controls	IV = cellular data type	Spatial spillovers	Removing outlier
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Internet utilisation	7.154 [^] (4.573)	8.371*** (2.355)	14.53*** (4.002)	6.332*** (1.291)	4.419 (3.213)	3.643* (2.021)	4.821** (1.908)	2.216*** (0.574)	1.596*** (0.568)	1.914*** (0.506)	1.621*** (0.593)	48.84*** (15.82)
<u>First stage</u>												
Cellular signal strength	0.171*** (0.019)		0.152*** (0.026)	0.159*** (0.020)	0.175*** (0.020)		0.157*** (0.028)	0.160*** (0.025)	0.177*** (0.019)		0.158*** (0.025)	0.156*** (0.023)
Cellular data type												
2G		1.205*** (0.108)				1.225*** (0.105)				1.240*** (0.103)		
GPRS		1.585*** (0.093)				1.598*** (0.094)				1.602*** (0.095)		
EDGE		1.257*** (0.107)				1.269*** (0.110)				1.306*** (0.119)		
3G		1.301*** (0.143)				1.327*** (0.142)				1.342*** (0.150)		
4G		1.344*** (0.087)				1.375*** (0.096)				1.367*** (0.086)		
LTE		0.922*** (0.159)				0.945*** (0.163)				0.921*** (0.166)		
Excluded F statistic	78.625	63.835	35.585	63.359	74.712	66.744	31.865	40.642	84.335	60.652	37.465	45.612
Neighbouring BTSs (spatial spillovers)			-0.062* (0.032)				0.009 (0.030)				0.002 (0.004)	
Controls & FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	567	567	567	505	564	564	564	498	575	575	575	127
R squared	0.262	0.275	0.235	0.203	0.197	0.217	0.206	0.278	0.057	0.057	0.058	0.526

Note: Clustered standard errors by subdistricts in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, [^] $p < 0.11$. Districts: Bantul and Yogyakarta; Sectors: mining, manufacturing, and services; Entrepreneur controls: gender, education, age, experience, Firm controls: home based, export status (for labour productivity only), association membership, cooperative membership, license, scale, firm age, road width. Context controls: elevation, number of BTSs in village.

I also informally tested whether the instrument fulfils the exclusion restriction by evaluating the correlations between the instrument and the error terms. For this validity to be satisfied, while holding other variables constant, the cellular signal strength can have no relationship with the dependent variables, except through internet utilisation. In other words, having controlled all relevant covariates in the specification, the validity requires the instruments are not correlated with the residuals. The results can be seen in appendix A3.3. Firstly, I obtained the estimated internet utilisation from the first stage of the IV estimation. Next, I placed this estimated internet utilisation on the right-hand side of equation (3.1) and estimated the residuals for each dependent variable. Finally, I evaluated the correlations between the residuals and the instrument, cellular signal strength. I find no evidence of any correlations between errors and the instrument for all dependent variables.

3.6.3 Which internet platform help firms perform better?

As shown in the data, entrepreneurs use the internet to access various platforms, such as website launching, email, social media, and online shopping platforms. To achieve a better understanding of what kind of platform is associated with better performance, that is, higher labour productivity and exports proportion, I regressed the performance measurements on website launching, email, having a social media account, and online shopping platforms using OLS estimation. I focused on those MSEs that use smartphones to connect to the internet. The estimation results from this restricted sample provides an explanation as to what type of platform helps those who connected to the internet through smartphone to have higher productivity.

As shown in Table 3.7, I find that email and social media are the platforms that help enterprises to engage in the digital economy and gain benefits. Social media enables MSEs to advertise their products and sell them to customers in the wider domestic market, while email helps MSEs communicate and arrange sales with their customers abroad. This finding is similar to

those of Damuri et al. (2018) and Melissa et al. (2015) which show that social media supports Indonesian business to be more productive.

Table 3.7 Platforms used and firm performance

Variables	Revenue per worker		Profit per worker		Proportion of exports	
	(1)	(2)	(3)	(4)	(5)	(6)
Website	3.394 (4.535)	5.669 [^] (3.376)	2.353 (3.796)	3.843 (3.084)	3.094 (2.316)	2.642 (2.135)
Email	5.964 (5.206)	3.186 (3.728)	8.458* (4.408)	3.604 (2.557)	3.966** (1.488)	4.290** (1.893)
Social media	7.465*** (1.747)	4.985 (3.551)	3.136*** (1.035)	3.848** (1.405)	0.929* (0.465)	0.465 (0.801)
Online shopping platform	-0.123 (6.381)	-0.441 (5.807)	-6.753 (4.448)	-4.859 (3.699)	-1.611 (1.655)	-3.283 (1.984)
Controls & FE	N	Y	N	Y	N	Y
Observations	334	334	332	332	339	339
R squared	0.206	0.368	0.199	0.340	0.088	0.120

Note: Clustered standard errors by subdistricts in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Districts: Bantul and Yogyakarta; Sectors: mining, manufacturing, and services; Entrepreneur controls: gender, education, age, experience, Firm controls: home based, export status (for labour productivity only), association membership, cooperative membership, license, scale, firm age, road width. Context controls: elevation, number of BTSs in villages. Weighted using sampling weight.

However, there is no evidence that online shopping platforms are significantly linked to better performance. A possible explanation for this is that a very small proportion of MSEs in the sample use this online trading platform. Email and social media are relatively easy to access using smartphones and might require fewer skills or technological savviness, whereas website launching requires more skills and/or access to a computer. Although e-commerce platforms in Indonesia are growing rapidly, those who can utilise them for their business are still limited, as indicated in the low use of e-commerce among MSEs (see supplement S3.2 for more details).

3.7 Conclusion

In this paper, I have examined the causal impact of internet utilisation on the performance of MSEs and explored the extent of digitalisation among MSEs in Indonesia. The identification relies on geographical differences, which generate variation in cellular signal reception by enterprises in various areas.

I found that internet utilisation has helped MSEs to engage in the digital economy and improved their performance. The internet uptake increased labour productivity and exports. The findings are robust even after excluding some of the context variables, i.e., elevation and the number of BTSs in villages, replacing cellular signal strength with data type (e.g. 2G, 3G), and taking into account spatial spillovers from adjacent villages. Therefore, this paper has been able to provide evidence that the digital economy, represented by access to and use of the internet, has a significant potential to contribute to development and inclusiveness by expanding trade opportunities.

Among different types of digital related activities, I found that email and social media are the platforms that significantly help enterprises to engage in the digital economy and gain benefits. These results are encouraging since email and social media are relatively easy to access using smartphones and require less technological savviness. Hence, the barriers to participating in the digital economy are relatively low.

It is hoped that the evidence from this paper can contribute to providing stronger justification for developing public policies aimed at boosting good quality internet availability as well as fostering firms' use of the internet in developing countries. With a much higher penetration of decent quality internet, developing countries can expect that the productivity of their MSEs will be significantly improved. Further, policy-makers can promote the adoption of email and social media in business activities. Likewise, policy-makers can lower barriers to the adoption of website and online shopping platform so that more enterprises use these platforms. These

initiatives may include technological innovation on the supply side, and public assistance programs for MSEs on the user side.

Appendices

A3.1. Stratified sampling strategy adopted and sample calculation

Statistics Indonesia-BPS constructed the sampling frame, designed the sampling procedure, drew the MSE samples and calculated the sampling weight for this survey. The sample frame was constructed based on the MSE survey of September 2017, which was a more detailed sample survey of the 2016 Economic Census listing. This extended survey asked MSEs about internet utilisation, and export and import activities undertaken by the enterprises.

The following outlines the sampling procedure employed to select the samples. In the first stage, two districts were randomly selected out of five districts in Yogyakarta province using probability proportional to size sampling, in which the size is the number of MSEs in each district based on the 2016 Economic Census listing. Bantul district and Yogyakarta city were the districts selected in the first stage. In the second stage, four MSE strata were constructed based on internet utilisation (yes/no) and export or import activities (yes/no). Then, an equal number of MSE samples were randomly selected from each stratum.

The number of MSE samples are calculated based on the following equation (Sukmadi, Budianti, Hardjo, & Purwanto, 2008) which then we rounded up to 700 samples.

$$n = \frac{Z_{\alpha/2}^2 \times p \times q \times deff \times (1 + \text{non response})}{(\text{MoE})^2} = \frac{(1.96)^2 \times 0.5 \times 0.5 \times 1.5 \times (1 + 0.1)}{(0.05)^2} \approx 634$$

where:

$Z_{\alpha/2}$ is the statistic values for the level of α equals to 5% or the risk of willing to accept the true margin of error may exceed the acceptable margin of error = 1.96.

MoE is the acceptable margin of error, set equal to 0.05 which is within the usual range 0.05-0.1

$p \times q$ = estimate of variance, p = proportion of those utilising internet & doing exports/imports, and $q = (1-p)$.

DEFF is design effect = 1.5, and non-response is assumed to be 10%

A3.2. Explanation of variables

Variable	Description	Source
Cellular signal strength (0,1–5 bars)	<i>Telkomsel</i> cellular signal strength measured using <i>Telkomsel</i> SIM card and Xiaomi Redmi 3 smartphones	Survey
Number of BTSs (unit)	Number of <i>Telkomsel</i> BTSs in village	PT. <i>Telkomsel</i>
Elevation (metre above sea level)	Altitude measured by GPS installed in Xiaomi Redmi 3 smartphones	Survey
Road width	Dummy variable equals to: 1 if < 2 metre width (suits 1 car) 2 if 2–4 metre width (suits 2 cars) 3 if >4 metre width (suits >2 cars)	Survey
Log revenue per worker (IDR million per worker)	Log of revenue per worker	Survey
Log profit per worker (IDR million per worker)	Log of profit (= revenue-expenses)	Survey
Proportion of exports to total sales (%)	Share of exports to total sales	Survey
Gender	Dummy value equals 1 if male, 2 if female	Survey
Education	Dummy variables equal 0 = no education 1 = primary or secondary junior school 2 = if senior high school, undergraduate, graduate	Survey
Age	Calculated as (2017–year of birth)	Survey
Experience	Calculated as (2017–age started working)	Survey
Home based	Dummy variable equals 1 if business site is the same unit of household residential, 0 otherwise	Survey
Export status	Dummy variable equals 1 if firm export products abroad directly or indirectly, 0 otherwise	Survey
Association membership	Dummy variable equals 1 if firm is a member of a business association, 0 otherwise	Survey
Cooperative membership	Dummy variable equals 1 if firm is a member of a cooperative, 0 otherwise	Survey
License	Dummy variable equals 1 if firm has a license, 0 otherwise	Survey
Scale	Dummy variable equals 1 if number of workers = 1–4 (micro), or 2 if 5–19 (small)	Survey
Firm age	Calculated as (2017–year established)	Survey
Districts fixed effects	Bantul and Yogyakarta (base)	Survey
Sectors fixed effects	mining, manufacturing (base) and services	Survey

A3.3. Correlation of between errors and the instrument

	Residual of revenue per worker	Estimated Internet utilisation	Cellular signal
Residual revenue per worker	1.0000		
Estimated Internet utilisation	0.0500	1.0000	
Cellular signal	0.0210	0.4822*	1.0000

	Residual of profit per worker	Estimated Internet utilisation	Cellular signal
Residual profit per worker	1.0000		
Estimated Internet utilisation	-0.0622	1.0000	
Cellular signal	0.0162	0.4822*	1.0000

	Residual of exports	Estimated Internet utilisation	Cellular signal
Residual exports	1.0000		
Estimated Internet utilisation	0.0843	1.0000	
Cellular signal	-0.0335	0.5531*	1.0000

* significant at 1%. Error terms are not correlated with signal strength.

Chapter 4

Targeted social assistance programs and local economies: The case of conditional cash transfer in Indonesia

4.1 Introduction

Targeted social assistance programs have been carried out to alleviate poverty in many developing countries. The programs have become popular globally and are being expanded following experiments and pilot projects in the early 2000s. For the poor, targeted social assistance programs not only provide additional income but also encourage improvement in individuals' health and education. There is an increasing commitment for targeted social assistance programs as many countries tend to spend more on programs over time. During 2008–2014, developing countries spent an average of 1.5% of GDP on social assistance programs (World Bank, 2017b).⁹ This increase in spending has resulted in a significant increase in program coverage around the world (Gladieu, 2018).

A large body of literature has provided evidence that targeted social assistance programs reduce poverty, improve health and education access (Baird, McIntosh, & Özler, 2011; Fiszbein et al., 2009; World Bank, 2019a). Additionally, the existing literature indicates that these programs may have a domino effect on other things, for instance, on improving liquidity and trade at the local economy. Cash transfers received from the programs relax the budgetary constraints on the poor, thereby increasing consumption and demand for goods and services. Similarly, conditionality on health and education encourages the poor to invest more on health

⁹ The World Bank calculated social assistance spending following the definition of social assistance as non-contributory cash or in-kind transfer programs targeted in some manner to the poor or vulnerable (World Bank, 2012)

and education leading to the accumulation of human capital which eventually improves productivity (Banerjee & Duflo, 2011; Barrientos, 2012).

Understanding the local economy-wide impact of targeted social assistance programs is important since it will provide evidence-based analysis to policy-makers, who are usually budget-constrained, into the side effects of the substantial investment in such programs. If that investment can also expand the local economy, the implications would be substantial because the poor rely on the local economy for their livelihood.

Only a handful of studies have addressed the question of whether targeted social assistance programs stimulate the development of local economies. For instance, studies on *Oportunidades*, a conditional cash transfer program focusing on human development in Mexico, find that the program increased entry into entrepreneurship by enhancing willingness to bear risk (Bianchi & Bobba, 2013). Further, this program increased consumption of not only beneficiaries but also ineligible households (Angelucci & Giorgi, 2009). Sadoulet, De Janvry, & Davis (2001) show that recipients of *Procampo*, a productive transfer programs to small-sized farm owners in Mexico, managed to put the money they received into productive activities that multiplied the transfers into larger income effects. These studies, however, focus on the assets and consumption of beneficiaries, rather than entire societies.

Some studies have focused on evaluating social assistance programs that are specifically designed to encourage entrepreneurship among beneficiaries. These kinds of programs not only transferred resources but also provided training on business activities to beneficiaries. Gobin, Santos, & Toth (2017) evaluated the impact that randomised cash transfers had on entrepreneurship among ultra-poor women in remote northern Kenya. They show that the new petty trade enterprises set-up due to the program is the main channel through which the program increased the welfare of ultra-poor women. Other work conducted by Blattman, Green, Jamison, Lehmann, & Annan (2016), which examined another cash transfer program

for enterprise development in Uganda, shows that the program increased microenterprise ownership and income from petty trading.

Other studies also looked at the macro perspective of grant programs. For instance, Buera, Kaboski, & Shin (2014) evaluated the aggregate and long-run effects of asset grants on occupational choices and income in developing countries using a quantitative theory to interpret and extrapolate the micro-evidence. They found that the wealth grants have a positive effect on aggregate total factor productivity (TFP) but a relatively larger negative impact on aggregate capital.

Some studies specifically evaluated conditional cash transfers (CCT or *Program Keluarga Harapan/ PKH*) in Indonesia. Cahyadi et al. (2018) and the World Bank (2011) find that the PKH increased the utilisation of health and education services among the poor. Triyana & Shankar (2017) show that the PKH improved antenatal care coverage for women. These studies, however, utilised the RCT design of the PKH, which constitute a fraction of the total treated regions in which the external validity might not hold. Research done by Christian, Hensel, & Roth (2018) found that PKH reduced the rate of suicides at a subdistrict level. A study conducted by Ferraro & Simorangkir (2018) reveal that PKH has reduced deforestation.

The present study extends the existing literature that estimate the local economy-wide impact of such targeted social assistance programs in developing countries. Specifically, this study extends a study conducted by Bianchi & Bobba (2013) that focused on extensive margin of receiving *Oportunidades* on entrepreneurship. My study provides intensive margin analysis on the impact of such programs on the development of local economy. Specifically, the present study exploits variation in the different timings of PKH implementation in Indonesia to examine the causal impact of targeted social assistance programs on the development of local economies, represented by micro and small enterprises (MSEs). In addition, I evaluate the heterogeneity of the effects and examine a possible mechanism through which the program affects local MSEs.

My study focuses on the impact of targeted social assistance programs on MSEs for the following reasons. MSEs are crucial engines of the local economy in many developing countries. MSEs also contribute to welfare by providing employment and income (Banerjee & Duflo, 2005; Berry et al., 2001) and in some cases, MSEs provide an essential informal safety net mechanism (Resosudarmo et al., 2012). Nonetheless, the productivity of MSEs in Indonesia remains low (Hill, 2001; Mead & Liedholm, 1998; OECD, 2015).

The results show that there are significant local economic impacts of targeted social assistance programs. Exposure to this program raises the labour productivity of MSEs in the medium term. Nonetheless, no evidence of immediate effects is observed. The effects are heterogeneous across different regions. I also show that credit constraint is a mechanism through which the programs affect the local economy. The results justify public policy encouraging the extension of such programs up to 5–6 years so that the domino effect can penetrate local economies. The results also highlight the importance for policy-makers to ease credit access for MSEs.

I start by providing a framework that shows the links between the programs and the local economies. In Section 4.3, I provide the context of targeted social assistance programs in Indonesia. Next, I explain the identification strategy. Then, I present the results and robustness checks. Finally, I conclude the paper by providing the policy implications of the findings.

4.2 Framework: From targeted social assistance programs to local economies

This section briefly discusses the potential mechanisms by which targeted social assistance programs lead to the development of local economies. There are two main mechanisms for how changes in household income affect the local economy, namely resource transfers and conditionality. These two mechanisms would then affect a set of other mechanisms. Figure 4.1 summarises how targeted social assistance programs affect local economies.

The literature suggests three processes by which resource transfers received from the programs affect local economies. Firstly, resource transfers, in the form of cash or in-kind, relax liquidity and credit constraints. It is widely acknowledged that households in poverty are credit constrained. They do not have the collateral to get loans from financial institutions and they tend to face default on these loans. The resources received from the program increases the poor's capacity to save, and improves their access to credit. Therefore, poor households that are often excluded from credit markets can have better access to credit.

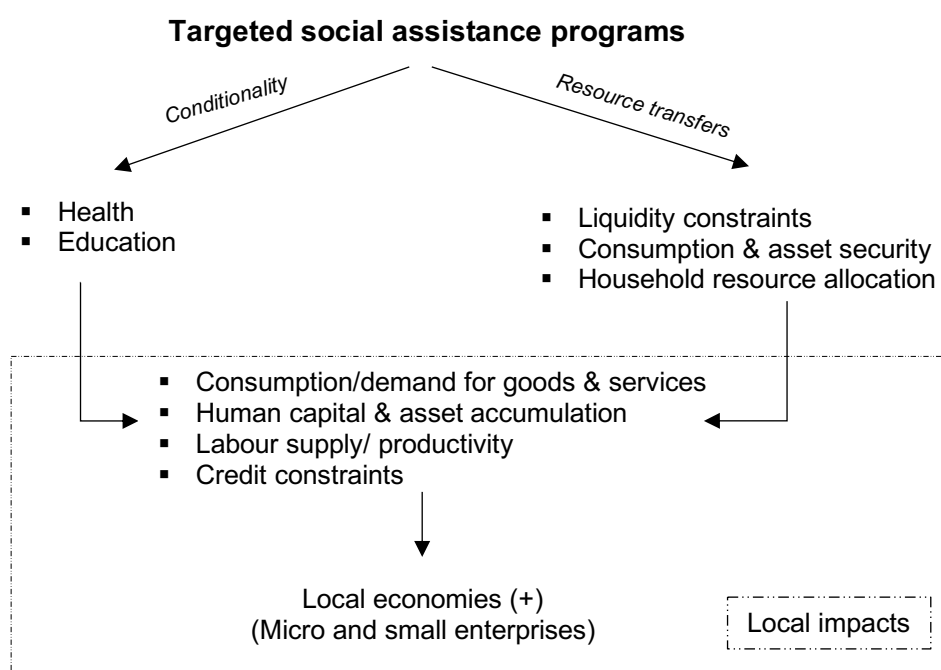


Figure 4.1 The links between targeted social assistance programs and local economy

Secondly, resource transfers improve consumption and asset security. The insurance market rarely reaches the poor meaning that the poor are less protected from hazards. The transfers provide protection for poor households' consumption and assets against vulnerabilities, thus increasing physical or financial assets or technological adoption that in turn facilitates production expansion, for instance, through agricultural intensification (Sadoulet et al., 2001; Shortle & Abler, 1999; World Bank, 1992). The increase in households' consumption due to the programs would then raise the demand for goods and services. Thus, resource transfers from the programs represent a massive demand shock. Because of this shock, cash are going

into enterprises, which then improve the way the enterprises get access to credit by, for instance, having resource for collateral.

Thirdly, resource transfer improves household resource allocation. The existing literature indicates that unequal intra-household resource allocation in poor households might affect their capacity to take economic opportunities. The resource from transfers could help to change intra-household resource allocation and enable them to benefit from the economy. For instance, cash transfers paid to the mother of beneficiary households could improve her bargaining power within the household, thus enabling greater investment in children's health and education (Banerjee & Duflo, 2011).

In addition, program conditionality might act as another plausible mechanism by which targeted social assistance programs lead to the development of local economies. Targeted social assistance programs conditional on health or schooling utilisation are expected to boost investment in human capital greater than additional income effects from the transfer (Barrientos, 2012). Therefore, improvement in access to healthcare, education and other non-income effects of targeted social assistance programs facilitate investment in human capital that affect labour supply as well as productivity of those engaged in production process.

4.3 Targeted social assistance programs in Indonesia

The social assistance system in Indonesia has evolved over time. The World Bank (2012) provides a brief history of the evolution of social assistance in Indonesia. During the Soeharto era (1965–1997), the Government of Indonesia (GoI) introduced government-funded social policies, publicly-provided basic education and health services to fulfil the state's responsibility to provide for the rights of the citizens and care for the poor, and to provide social security as stipulated in the constitution.

During the Asian Financial Crisis in 1997–1999, the Gol reduced costly universal subsidies for food, fuel and electricity and replaced these with safety net programs and scaled up existing programs, such as *Inpres Desa Tertinggal*. A set of new social safety net programs, known collectively as the *Jaring Pengaman Sosial* (JPS) was introduced in early 1998. Over the next decade, many of the JPS initiatives evolved into permanent programs with financing shifting from donors to the Gol regular budget. In the early 2000s, the Gol started to establish the financial and legal foundations of targeted social assistance programs to support sustainable growth. Starting in October 2005, an unconditional cash transfer (UCT) was introduced. The UCT provided quarterly cash transfer as much as IDR 300,000 per household per quarter to 19.1 million poor and near poor households to reduce the inflationary shocks following the removal of the universal fuel subsidy in 2005.

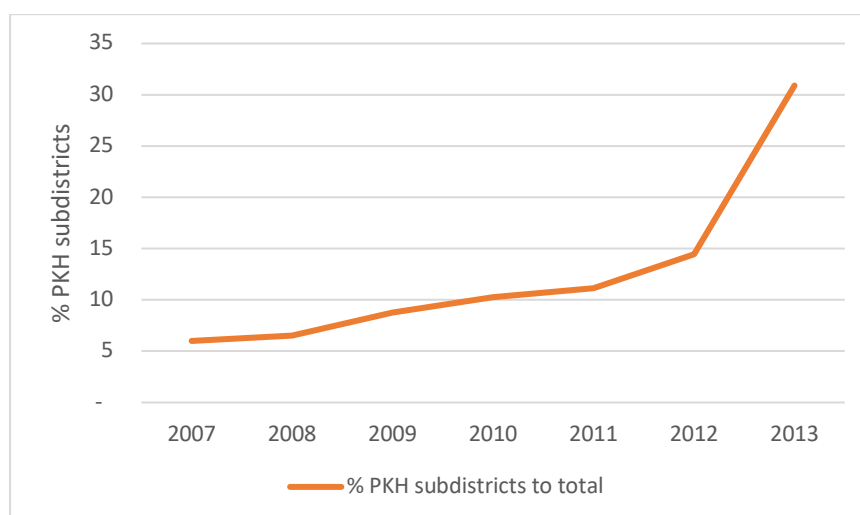
In 2007, as a part of the efforts to increase the efficiency and improve the effectiveness of targeted social assistance programs, the Gol introduced the PKH, a conditional cash transfer program that provides assistance to the targeted poor households. The program provided a substantial amount of money quarterly to households with school age children, or to lactating or expecting mother to an amount up to IDR 600,000–2,200,000 (USD 45 to 165) per year for up to six years when individuals meet specified health or education requirements. This money is equal to 10% of the annual pre-program beneficiary household expenditure. It is reported that between 2011 and 2016, the government spent an average of 8.5% of annual national public expenditure on PKH implementation and the program covered 6 million households (10% of the country population) by the end of 2016 (World Bank, 2017b). Previous studies have shown that PKH improved welfare and health-seeking behaviour and that PKH households have greater access to health and education (Cahyadi et al., 2018; World Bank, 2011). PKH also improved antenatal care coverage for women (Triyana & Shankar, 2017).

The PKH used a dual-targeting system that targeted regions and households. During the first stage of the program, the central government decided the province and district level quotas of PKH recipients. In 2007, the PKH was implemented as a pilot program in six provinces: West

Java, East Java, North Sulawesi, Gorontalo, East Nusa Tenggara (NTT) and DKI Jakarta. The top 20% of income quintile districts were excluded from PKH eligibility within the selected provinces. Then from among these eligible districts, the provincial and district governments selected subdistricts based on an index that reflected supply-side readiness in terms of education providers and health care services. From 2008 to 2010, the PKH was further expanded in Nanggroe Aceh Darussalam, North Sumatera, Banten, South Kalimantan, West Nusa Tenggara, and Yogyakarta provinces so that by 2010, the program covered all Indonesian provinces.

The second stage of the program targeted households. The government extracted a list of eligible beneficiaries within these supply-side ready subdistricts utilising a unified database combined with a proxy mean test method (World Bank, 2011). After this, the local office of Social Affairs Ministry validated and updated the basic information on eligible beneficiaries and registered eligible household after which the households received their first payment. During the year, local coordinators verified the compliance of beneficiaries with the conditions. Finally, beneficiaries received a second and then subsequent payments. However, the verification system started in 2010 was not always imposed.

As seen in Figure 4.2, the program reached 6% of all subdistricts in 2007 and by 2012 the program covered more than 14% of all Indonesian subdistricts. The vast majority of the PKH was rolled out in 2013, in line with the intention of the government to expand the programs to all provinces. The requirement for every beneficiary's eligibility and conditionality on meeting the target to be verified meant that households did not necessarily receive the PKH in a consecutive pattern. For instance, due to a natural exit from the program in households that had passed over the poverty line, meaning that they were no longer eligible for the PKH in the following year. As a result, there are some gaps between years up to when each subdistrict received the PKH for the subsequent time.



Source: Bappenas (for PKH subdistricts based on actual payment) and BPS (for total number of subdistricts)

Figure 4.2 Expansion of the PKH over time

In addition to the PKH, there are other active targeted social assistance programs, such as subsidised rice for the poor, subsidised social health, and cash transfers for poor and at risk students. Although the coverage of PKH is much lower than that of the other targeted social assistance programs, the PKH is noted as being one of the most effective Indonesian targeted social assistance programs due to its targeted nature (World Bank, 2017b). The PKH also introduced innovations in facilitation approach, such as the 2013 “Family Development Sessions (FDS) that provided a group-level training in early childhood education, parenting, health and nutrition and improved the outcome of the program.

4.4 Empirical framework

4.4.1 Data

I combined data for the period 2004–2012 from the manufacturing MSEs survey (2004, 2005, 2009, 2010, 2011 and 2012), village census-PODES (2003, 2005, 2008 and 2011), and the list of PKH subdistrict recipients from the Ministry of National Development Planning (Bappenas) (2007–2012). I limited the study period to 2012 as the PKH expanded to a large

degree by covering all provinces in 2013 so that the timing of receiving the PKH can be predicted easily.

The MSEs survey is an annual cross-sectional survey that sampled MSEs in the manufacturing sector across Indonesia. MSEs are categorised simply based on the number of workers. Enterprises with 1–4 workers are micro, while those with 5–19 workers are small enterprises. The information collected in the MSEs survey includes owner and enterprise characteristics. The village census (*Potensi Desa* or PODES) is conducted every two or three years and provides information on all rural villages and urban areas in Indonesia, including details on infrastructure and the availability of educational institutions and health care providers. The list of PKH subdistrict recipients outlines the subdistrict and the year when the residents received the PKH annually.

The data on MSEs are enterprise level data, while the PKH identifier is at subdistrict level. I merged the data from the PODES with the pooled MSEs survey data based on a village identifier. After this, I merged it with the list of PKH recipients based on subdistrict identifier. Subdistricts that do not appear in the list are considered as non-beneficiaries. The data on MSEs come from surveys, therefore the panel of subdistrict is a non-balanced one since a subdistrict might not be sampled in every MSE survey round/year.

The enterprises included in the sample are MSEs selected at the time of the survey. In total I have 158,341 enterprise-observations spread over 20,636 villages and 6 survey years. The combined data allowed me to match the subdistrict where MSEs were located with the introduction and presence of PKH in that specific year. That is, the data constitutes subdistrict identifiers with variation in outcome variables and PKH by year of survey and subdistrict.

Table 4.1 shows descriptive characteristics for the pooled data. Male entrepreneurs owned nearly 55% of sampled enterprises, and the rest 45% were female-owned. The average age of owners in the sample is 44 years old and on average owners attained primary school

education. On average, the sampled enterprises established in 1992, operate in a resource-intensive industry, and over 50% hold a license.

Table 4.1 Descriptive statistics of enterprise data and village characteristics

	Mean	SD
Panel A. Enterprise level data (MSEs survey, n=158,341)		
<u>Enterprise characteristics</u>		
Total output (million IDR)	1.600	2.197
Output per worker (million IDR)	0.841	1.253
Value added (million IDR)	0.633	0.968
Value added per worker (million IDR)	0.336	0.554
Number of worker	2.079	1.630
Year established	1992.805	12.656
% of enterprises with license	50.830	
% of enterprises in labour intensive industry	40.670	
% of enterprises in resource intensive industry	42.360	
% of enterprises in capital intensive industry	16.970	
<u>Owner characteristics</u>		
Age	44.086	11.898
Education	2.145	1.023
Sex (Male)	54.740	
Panel B. Village information (PODES, n=20,636 in 6-year)		
% of villages with asphalt road	75.750	
% of electrified household	72.550	
% of villages with light on main roads	78.580	
% of villages with primary school	97.720	
% of villages with secondary school	56.220	
% of villages with hospital	5.880	
% of villages with maternity hospital	13.560	
% of villages with community health centre (<i>puskesmas</i>)	22.280	
% of villages with maternal & natal health centre (<i>posyandu</i>)	98.630	

Source: MSEs survey (2004-2005: SUSI, 2010-2012 *Survei IMK*), and PODES 2003-2011

There is a substantial variation in key infrastructure characteristics in respect to village features. Over the four PODES data, over 75% of villages are accessible by an asphalt road and over 72% of households in the villages are connected to the electricity grid. With respect to health services, on average only 6% of villages have hospitals, while maternity hospitals,

community health centres (*puskesmas*), and maternal and natal health centres (*posyandu*) are found in 14%, 22% and 99% of the villages. In terms of educational institutions, 98% of villages have primary schools and 56% have secondary schools.

In this study, I focus on labour productivity (output per worker and value added per worker) and the number of workers as the dependent variables (outcomes). Gross output-based productivity captures disembodied technical change, whereas value added based labour productivity reflects an industry's capacity to contribute to economy-wide income and final demand (OECD, 2001a). Labour productivity is a proxy of the standard of living of those engaged in production process after controlling for other factors, while the number of workers reflects the effect on employment the program has in response to the expected increase in demand. Table 4.2 provides an overview of the development of output per labour from 2004–2012.

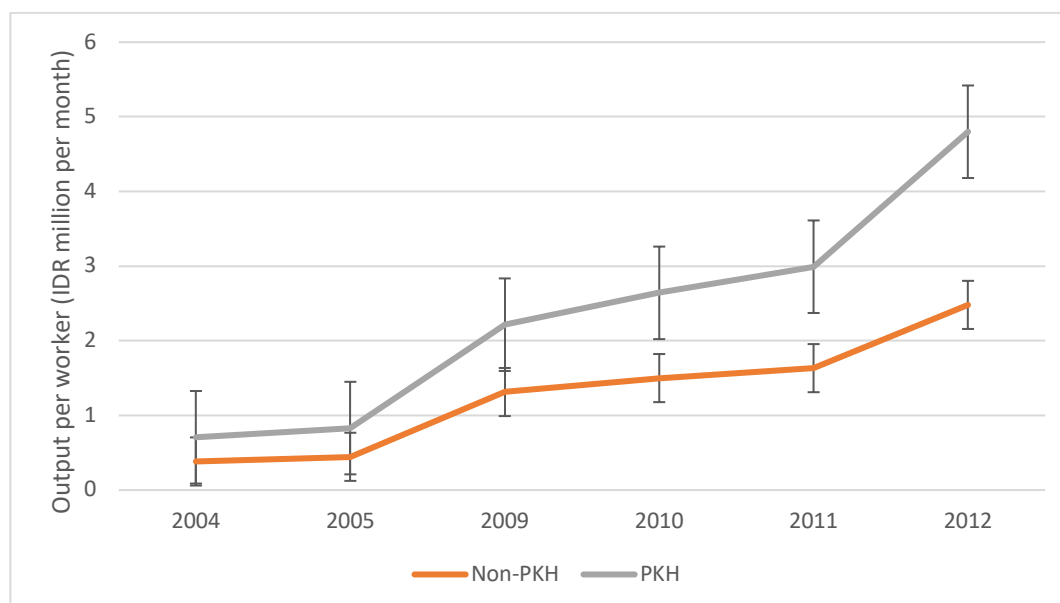
Table 4.2 Evolution of outcome measures over time

Outcome	2004	2005	2009	2010	2011	2012
Output per worker	0.331	0.390	0.925	1.172	1.377	2.312
Value added per worker	0.145	0.170	0.746	0.543	0.609	0.724
Number of workers	2.151	2.068	2.011	2.117	2.073	1.771

Unit: IDR million per month, except number of workers (persons). Source: MSEs surveys

Figure 4.3 shows that PKH subdistricts and non-PKH subdistricts have similar pre-program outcome trends (2004-2005). The overlapping standard error bars of the pre-trend showed no evidence of a steeper pre-trend for PKH subdistricts.

However, they differ in some important economic attributes (Table 4.3). In regard to road access, electricity access, and lights on road, PKH subdistricts tend to be better with similar trends in primary school, hospital, and *posyandu* availability. Nonetheless, it appears that there is no difference in terms of secondary school, maternity hospital, and *puskesmas* availability between the two groups.



Note: Non-PKH subdistricts are those subdistricts never get PKH during 2007-2012, while PKH subdistricts are those received PKH at least once. Source: MSEs surveys

Figure 4.3 Output per labour (IDR million per month) by year

Table 4.3 Economic attributes based on group in 2004

	Mean		t-test
	Non-PKH	PKH	p-value
Asphalt road (1=yes, 0=no)	0.707	0.734	0.030
Proportion of electrified households	0.668	0.703	0.000
Lights on main road (1=yes, 2=no)	1.271	1.173	0.000
Primary school availability (1=yes, 2=no)	0.975	0.988	0.000
Secondary school availability (1=yes, 2=no)	0.532	0.530	0.888
Hospital availability (1=yes, 2=no)	1.935	1.951	0.012
Maternity hospital availability (1=yes, 2=no)	1.843	1.838	0.651
Community health centre (<i>puskesmas</i>) availability (1=yes, 2=no)	1.763	1.767	0.732
Maternal & natal health centre (<i>posyandu</i>) availability (1=yes, 2=no)	1.028	1.012	0.000

Note: Non-PKH subdistricts are those subdistricts never received PKH during 2007-2012, while PKH subdistricts are those received PKH at least once during 2007-2012. Source: PODES 2003

4.4.2 Identification strategy and estimation

The main identification strategy exploits variations occurring from the different timing of PKH implementation across subdistricts. It has been documented that the variation in the timing for

receiving the PKH is due to the pressure to cover all provinces and at the same time to stay within the budget during the expansion of the program (Cahyadi et al., 2018; Ferraro & Simorangkir, 2018). Although subdistricts located in eligible districts are more likely to receive the PKH compared to that outside the districts, no one really knows the exact timing of when a subdistrict will receive the PKH.

Moreover, a natural exit from the program and conditionality compliance also drive variation in the sequence of receiving the subsequent PKH. Households receiving a transfer during a specific year might not necessarily receive one in the following year as, for instance, they might have exceeded the poverty line or no longer have children of school age. As a result, I have variation at subdistrict level in the sequence of receiving the next PKH. It has been reported that compliance is around 80% for both the education and the health component in the randomised control trial (RCT) villages (World Bank, 2017b). Nonetheless, the enforcement of compliance only started after 2010 and is very weak (Cahyadi et al., 2018).

A similar approach has been used in previous studies. For instance, Stevenson & Wolfers (2006) utilised natural variation in the introduction of unilateral divorce law in the US to evaluate its impact on suicide and spousal homicide. Hartwig et al., (2018) exploited the different timing of local subsidized health services (*Jamkesda*) to evaluate the impact of the program on maternal care from 2004 to 2010. The closest study to mine is Ferraro & Simorangkir (2018) which used a similar approach to assess the impact of the PKH on deforestation at the village level. However, their main estimation considered that once a village received the PKH then the village continued to receive the PKH for the rest of study period.

Other studies that evaluated the PKH include work done by the World Bank (2011) and Cahyadi et al. (2018). They focused on the education and health effects and utilised the RCT design of the PKH that constitutes a subsample of the whole PKH subdistricts instead of the whole community as in this study. Christian et al. (2018) examined the effect of PKH on suicide by using two-stages of the PKH roll-out: the first stage of subdistricts who received the

treatment from 2007-2011 and the second stage of subdistricts who received the treatment in 2012 and 2013.

Utilising a linear subdistrict fixed effects specification, I estimate the average effect of targeted social assistance program by the timing of receiving PKH on the performance of MSEs as indicated in labour productivity (output per worker and value added per worker) and the number of workers¹⁰. The observation also allows me to identify pre-treatment period (2004 and 2005) and post-treatment period (2009-2012).

$$\log y_{ivst} = \beta_0 T_{st} + X'_{ivt} \gamma + Z'_{vt} \vartheta + \delta_s + \delta_t + \varepsilon_{ijt} \quad (4.1)$$

$$\log y_{ivst} = \beta_1 t_{1st} + \beta_2 t_{2st} + \beta_3 t_{3st} + \beta_4 t_{4st} + \beta_5 t_{5st} + X'_{ivt} \gamma + Z'_{vt} \vartheta + \delta_s + \delta_t + \varepsilon_{ijt} \quad (4.2)$$

where y_{ivt} represents one of the three outcome variables for enterprise i in village v subdistrict s at year t . In equation (4.1), T_{st} is a dummy variable equals 1 if people living in subdistrict s received the PKH at year t , and 0 otherwise. Subdistrict is an administrative area, one level above village. In equation (4.2) the main variables of interest are t_1 , t_2 , t_3 , t_4 , and t_5 that are a dummy variable indicating whether a subdistrict whose residents received the PKH during a certain year, received it as the first, second, third, fourth or fifth time. I have five dummies of the PKH timing as data indicates that during 2007–2012 a subdistrict received the PKH a maximum of five times. Note, t_1 – t_5 equals 0 for subdistricts that never received the PKH from 2007 to 2012. By construction, $T_{st} = \sum_1^5 t_{st}$.

I prefer to use the specification in equation 4.2 because the duration of receiving the PKH differs among subdistricts. Out of the eligible subdistricts included in the analysis, most of the subdistricts received the PKH only once (43%) or twice (31%) during 2007-2012. Those who received the PKH three times are nearly 19%, while those received the PKH four or five times account for 6% and less than 1%, respectively. Furthermore, a subdistrict might receive the

¹⁰ Our analysis does not focus on the level of PKH since data on the number of people at subdistrict level needed to weight the level of PKH is not available.

PKH in a non-consecutive pattern due to a natural exit or a central government budget constraint. The impacts might also differ due to a cumulative process (Cahyadi et al., 2018). The sign of the variables of interest is expected to be positive if the program positively affects local economies.

I control for village characteristics Z'_{vt} , such as infrastructure (electrification rate, road access, education institutions and health care providers). The vector X'_{ivt} controls for owner (gender, age and education) and enterprise characteristics (year established, industry and license). Time-invariant subdistrict characteristics are controlled by including δ_s subdistrict fixed effects, while δ_t year fixed effects control for common shocks. The design of the PKH, in which provincial governments determine target subdistricts suggests there might be a correlation within province due to unobserved random shocks at province, therefore I clustered the standard errors by province.

In the absence of unobserved confounding factors, equation 4.2 will yield an unbiased estimation of the PKH. The subdistrict fixed effects eliminate any time invariant factors such as topography, institutions and endowments, while inclusion of owner, enterprise and village characteristics should minimise bias due to time variant omitted variables.

The main confounding factor that I do not control for in the specification is the introduction/presence of other targeted social assistance programs where the timing might coincide with the PKH. In addition to the PKH, in a certain year residents of a village might receive other welfare programs, such as *Askeskin*, and a village may also receive community-driven development programs. In the robustness check, I evaluate whether the results suffer from omitted variable bias by controlling for other welfare programs such as *Askeskin* and other development programs, such as PNPM Mandiri, *Keluarga Usaha Bersama* (KUBE). In addition, I assess whether adding fixed assets in the specification has effect on the main variable coefficients. Data on fixed assets are available for most years, except for 2011.

I also evaluate the possibility of self-selection bias by estimating the impact only for subdistricts that eventually received PKH by 2012. Any difference in the main coefficients would be evidence of confounding trends between controls and treatment. I also estimate spatial regression for spillover effects as adjacent subdistricts might receive PKH and have impacts to its neighbouring subdistricts. In order to evaluate reverse causality, I examine whether current productivity drives the possibility of receiving PKH at $(t+1)$. Furthermore, I examine the impact heterogeneity by type of regions (urban/rural, villages that are near/far from the city, coastal/non-coastal, Java & Bali and other islands).

4.5 Results

4.5.1 Impact of PKH

Table 4.4 presents the average effects of receiving PKH based on equation (4.1) and (4.2). There are two panels, A and B, for log output per worker and other outcomes, respectively. Column (1) shows the coefficient of T_{st} as in equation (4.1) controlling for all covariates, while the remaining columns show coefficient t_1 until t_5 based on equation (4.2). Column (2) shows the coefficients for different timing of receiving the PKH in the base specification controlling for subdistrict fixed effects. Column (3) shows the coefficients controlling for year fixed effects. Column (4) accounts for owner and enterprise characteristics, while column (5) is the full specification that also controls for village characteristics. Overall, significant effects of the PKH on output per worker appear during the fifth time the PKH is received.

As it can be seen in Column (1), controlling for all covariates and using a dummy variable to indicate whether a subdistrict receive PKH, I find that the coefficient T_{st} is not statistically significant. The next columns present the results using decomposition for timing of receiving the PKH. The results in Column (2) show that there is a positive association between PKH and labour productivity. That is, output per worker is higher if receiving PKH regardless of the timing it is was received such as the first, second, third, fourth or fifth time. Nonetheless, this

correlation seems to be a spurious one because as I add year fixed effects and control variables, the correlation in the first, second, third, and fourth time becomes weaker.

Table 4.4 Effect of targeted cash transfer program

Variables	A. Main estimations					B. Other outcomes	
	log output per worker					log value added per worker	log number of workers
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dummy of receiving PKH = 1	-0.0357 (0.0396)						
1 st time receiving PKH = 1		0.636*** (0.0826)	-0.0144 (0.0426)	-0.00810 (0.0413)	-0.00693 (0.0427)	-0.0522 (0.0617)	0.0223* (0.0126)
2 nd time receiving PKH = 1		0.664*** (0.0904)	-0.0611 (0.0619)	-0.0619 (0.0623)	-0.0587 (0.0611)	-0.105 (0.0680)	0.00916 (0.0304)
3 rd time receiving PKH = 1		0.626*** (0.0562)	-0.0402 (0.0381)	-0.0430 (0.0431)	-0.0507 (0.0446)	0.00597 (0.0497)	-0.0158 (0.0176)
4 th time receiving PKH = 1		0.694*** (0.0864)	-0.124 (0.0769)	-0.0612 (0.0656)	-0.0645 (0.0681)	-0.122 (0.119)	-0.0730* (0.0364)
5 th time receiving PKH = 1		1.696*** (0.152)	0.296*** (0.0618)	0.230*** (0.0654)	0.211*** (0.0707)	0.238 (0.373)	0.0629 (0.0488)
Subdistrict FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	N	Y	Y	Y	Y	Y
Owner & enterprise characteristics	Y	N	N	Y	Y	Y	Y
Village characteristics	Y	N	N	N	Y	Y	Y
Observations	158,341	158,341	158,341	158,341	158,341	135,831	158,341
R-squared	0.642	0.517	0.607	0.640	0.642	0.600	0.353

Control variables not displayed for convenience: owner characteristics (gender, age and education), enterprise characteristics (year established, industry and license), and village characteristics (electrification rate, road access, education institutions and health care providers). Clustered standard errors by province in parentheses. *** p<0.01, ** p<0.05, * p<0.1

A positive effect appears when I use a decomposition specification. The results in Column (5) suggest no evidence of any significant effect from receiving the PKH in the first and the second time (short term) on output per worker. That local MSEs were not able to increase their production capacity in such a short time might be due to constraints they faced, hindering their productive capacity. Similar results were also found in less integrated markets such as in Uganda, where local trader markets faced difficulties in increasing the supply of goods to meet the increased demand following short-term cash injections (Creti, 2010). Likewise, there is no evidence of significant effect when the PKH has been received for the third and fourth time. It is widely acknowledged that MSEs are more credit-constrained than larger enterprises. In the penultimate section, I examined whether credit constraint is a reason for the lack of such immediate effects.

In contrast to the short term, I found positive and significant effects when the PKH was received a fifth time (medium term). As the duration of receiving the PKH gets longer, perhaps entrepreneurs discovered ways to increase their production or perhaps they acquired more capital, and thereby were able to supply more to the market to catch up with demand. On average, the PKH led to an increase in output per worker by 21% during the fifth time the cash transfer was received.

Using other measurements for outcome, as shown in Column (6) – (7), I find no evidence of a significant impact on value added per worker nor on the number of workers. Using value added per worker as a dependent variable, none of the coefficients of PKH timing is statistically significant. With regards to the effect on employment, Column (7) shows that at the first time the PKH was received, the coefficient of receiving the PKH for the first time is positive and statistically significant, suggesting the number of workers engaged in manufacturing MSEs increased at the first time of receiving the PKH. However, the coefficient of receiving the PKH for the fourth time is negative and statistically significant at 10% level.

4.5.2 Robustness

Table 4.5 shows that the estimations are robust to different specifications, strengthening the interpretation of the main specification results as causal effects. I find no evidence of confounding policy effects through other targeted social assistance programs or through fixed assets and no evidence of self-selection bias. Further, there is no evidence of spillover from neighbouring subdistricts that received PKH and the main results is not driven by reverse causality.

Column (2) includes other social assistance program, that is *Askeskin* and other social assistance programs, such as PNPM Mandiri, *Keluarga Usaha Bersama* (KUBE), conducted by the local government. The result shows marginal difference of the coefficient from the preferred results in Column (1) that suggests no confounding policy factors. Also, when I add fixed assets per worker in Column (3), the coefficient at the fifth time of PKH stays significant and the magnitude is marginally different from that in Column (1), suggesting no other confounding factors.

Column (4) shows estimates only for subdistricts that eventually received PKH by 2012; I find similar results to that in Column (1). Estimating only on the sample of subdistricts that are eventually exposed to the PKH helps control for unobservable factors that determine exposure to PKH and are held in common by all PKH subdistricts. The result suggests no evidence of self-selection bias.

Column (5) adds the weighted PKH of the neighbouring subdistricts. I find no evidence of spillover from the neighbouring subdistricts that might also receive the PKH as the coefficient of border-shared subdistricts is not statistically significant. On the coefficient of PKH, I found that the point estimates in Column (5) are marginally different from that of the preferred estimation in Column (1).

Table 4.5 Robustness checks

Variables	Dependent variable					dummy of receiving PKH (t+1)
	log output per worker					
	Robustness					
	Preferred estimation	Include other programs	Include fixed assets per worker	Eligible subdistricts	Spatial Spillovers	Reverse causality
	(1)	(2)	(3)	(4)	(5)	(6)
1 st time receiving PKH = 1	-0.00693 (0.0427)	-0.00531 (0.0433)	-0.000589 (0.0736)	-0.0126 (0.0468)	0.00475 (0.0444)	
2 nd time receiving PKH = 1	-0.0587 (0.0611)	-0.0590 (0.0609)	-0.0915 (0.0645)	-0.0816 (0.0677)	-0.0490 (0.0681)	
3 rd time receiving PKH = 1	-0.0507 (0.0446)	-0.0478 (0.0445)	-0.0654 (0.0604)	-0.0559 (0.0471)	-0.0407 (0.0501)	
4 th time receiving PKH = 1	-0.0645 (0.0681)	-0.0608 (0.0703)	0.152 (0.116)	-0.0650 (0.0639)	-0.0568 (0.0776)	
5 th time receiving PKH = 1	0.211*** (0.0707)	0.208*** (0.0699)	0.339*** (0.0769)	0.205*** (0.0748)	0.215*** (0.0706)	
Other local social assistance programs = 1		0.0207 (0.0343)				
Askeskin availability = 1		0.0266 (0.0399)				
log fixed assets per worker			0.151*** (0.00736)			
Weighted PKH of border-shared subdistricts					-0.0230 (0.0579)	
log output per worker (t)						-0.00267 (0.00472)
Subdistrict FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Owner & enterprise characteristics	Y	Y	Y	Y	Y	Y
Village characteristics	Y	Y	Y	Y	Y	Y
Observations	158,341	158,341	140,296	69,867	158,341	69,867
R-squared	0.642	0.642	0.674	0.636	0.642	0.569

Column (1)–(5) dependent variable is log output per worker, while that of Column (6) is a dummy of receiving PKH at time t. Control variables not displayed for convenience: owner characteristics (gender, age and education), enterprise characteristics (year established, industry and license), and village characteristics (electrification rate, road access, education institutions and health care providers). Column (3) excludes year 2011 as data on fixed assets are not available for that year. Clustered standard errors by province in parentheses. *** p<0.01, ** p<0.05, * p<0.1

In column (6), I examine the presence of simultaneity by assessing correlation between next year's PKH and current productivity. I estimate placebo regression by regressing the probability of receiving PKH at $(t+1)$ on current labour productivity. I find that the coefficient of labour productivity is not statistically significant, suggesting no evidence of simultaneity bias in the main findings.

4.5.3 Heterogeneity

Previous research has pointed out that regional/infrastructure differences are a source of heterogeneity in the effects of targeted social assistance programs (Creti, 2010; Cunha, De Giorgi, & Jayachandran, 2011; Hartwig et al., 2018). In rural areas, productivity might be limited due lack of physical infrastructure, and access to services. Similarly, in villages far from cities access to market might be limited due to distance. Similarly, coastal area is where poverty rate found to be higher than in non-coastal area. While Java and Bali are where the development is concentrated, the other islands of Indonesia may experience lagging in development. Therefore, I examined the heterogeneity of PKH effects with respect to type of precinct (urban/rural, coastal/non-coastal), access to outside market (near/far from city), and region (Java & Bali compared to other islands). I also conducted heterogeneity for male-/women-owned enterprises, and women-related industries/ other industries as the funds might go more to women and some industries might benefit from women having more cash.

The heterogeneity impacts results, as shown in Table 4.6, provide some insight on the impact on different regions and the limitations of the effects. The overall effect of increased productivity is mainly driven by increased productivity in the following areas; in urban areas, by better infrastructure; in villages close to cities, by better access to outside markets; in non-coastal areas, by people relying on the manufacturing sector. Since most of the poor live in rural areas with less access to other markets, these findings suggest the need to recognize the possible effects of the economy wide impact of targeted social assistance programs directed toward poorer households. Women engaged in MSEs are also benefited from the PKH.

In urban areas (Column (2)), I find that the impact on MSEs is positive and significant in the first, third and fifth time of receiving PKH. In contrast to these urban precincts, I find no evidence of effect in rural areas (Column (3)). This is possibly due to the fact that markets in rural areas tend to be less integrated with markets elsewhere, thus limiting MSEs to get input factors sourced from outside that are needed to increase production to respond to the increase in demand. Alternatively, people living in rural areas do not rely very much on manufacturing MSEs.

Given that villages that are closer to cities might have better access to outside markets, I defined villages as being near to cities if the distance from the village to the nearest city is less than 60km. The results in Column (4) and Column (5) show that in short term there is no evidence of effect in both villages near to cities and those far from cities. However, a positive effect is observed in villages near cities when receiving the PKH for the fifth time.

Columns (6) and (7) differentiate the results for coastal and non-coastal areas. In coastal areas, no evidence of impact of the program is observed. A possible explanation is that people in coastal areas might not rely very much on manufacturing, but instead depend more on other activities, such as fisheries. On the contrary, a positive and significant medium term effect is observed in non-coastal area, but not in the short term.

Java and Bali are where the number of MSEs per 1,000 households is the largest. Column (8) and (9) compare the estimation between Java and Bali, and other islands. During the second and third time, the effect is negative in Java & Bali, while the effect at the second time is positive in other islands. A negative coefficient appears in the fifth time in other islands, but no evidence of impact is observed in Java & Bali.

As cash transfers might go more to women, I differentiate the estimation between male- and female-owned enterprises. The results in Column (10) and (11) show that in the fifth time of receiving PKH both male-owned and female-owned enterprises experienced an increase

labour productivity. The coefficient for the fifth time of receiving PKH is positive and statistically significant at 1% level for both male- and women-owned enterprises. This indicates that women also benefiting from the targeted social assistance programs.

Similarly, industries that would tend to benefit from women having more cash in hand, such as food, clothing, would experience more of a demand shock. Column (12) shows the estimation results for women-related industries, while Column (13) is that of the other industries. Women-related industries were defined based on two-digit KBLI of industries that produced food, beverages, tobacco, textiles, clothing, and leather products. Similar to the results of other industries, women-related industries experienced an increase in labour productivity at the fifth time of receiving PKH. The coefficient for the fifth time of receiving PKH is positive and statistically significant at 1% level. Thus, the PKH also benefited women engaged in MSEs.

Table 4.6 Effects of targeted cash transfer programs by urban/rural location, coastal/non-coastal, access to city, and region

Variables	Dependent variable: log output per worker												
	Preferred estimation	Urban	Rural	Near city	Far from city	Coastal	Non-coastal	Java & Bali	Other islands	Male-owned	Women-owned	Women-related industries	Other industries
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1 st time receiving PKH = 1	-0.00693 (0.0427)	0.0810* (0.0445)	-0.0622 (0.0579)	-0.00855 (0.0423)	0.0703 (0.143)	-0.0325 (0.106)	-0.00197 (0.0429)	-0.0346 (0.0577)	0.0348 (0.0666)	-0.0456 (0.0768)	0.0358 (0.0443)	-0.0637 (0.0758)	-0.0187 (0.0628)
2 nd time receiving PKH = 1	-0.0587 (0.0611)	-0.121 (0.0842)	-0.00904 (0.0820)	-0.0639 (0.0570)	0.175 (0.212)	0.0941 (0.106)	-0.0652 (0.0618)	-0.156* (0.0642)	0.143* (0.0727)	-0.130 (0.101)	0.0130 (0.0430)	-0.0102 (0.0846)	-0.0455 (0.0520)
3 rd time receiving PKH = 1	-0.0507 (0.0446)	0.112* (0.0658)	-0.122 (0.0784)	-0.0509 (0.0414)	0.151 (0.178)	0.224 (0.219)	-0.0511 (0.0458)	-0.0788* (0.0338)	0.0931 (0.147)	-0.0394 (0.0362)	-0.0144 (0.0512)	-0.106 (0.0707)	0.00493 (0.0407)
4 th time receiving PKH = 1	-0.0645 (0.0681)	0.0702 (0.0606)	-0.114 (0.121)	-0.0372 (0.0898)	-0.214 (0.232)	-0.0135 (0.207)	-0.0333 (0.0840)	-0.0772 (0.0879)	-0.0309 (0.182)	0.203** (0.0930)	-0.250*** (0.0646)	-0.269*** (0.0808)	0.110 (0.0923)
5 th time receiving PKH = 1	0.211*** (0.0707)	0.655*** (0.189)	-0.0227 (0.0807)	0.220*** (0.0692)			0.210** (0.0788)	0.140 (0.0937)	-0.407** (0.149)	0.294*** (0.0658)	1.467*** (0.0860)	0.691*** (0.0675)	0.216*** (0.0508)
Subdistrict FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Owner & enterprise characteristics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Village characteristics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	158,341	48,498	109,843	142,786	15,555	20,196	138,145	98,683	59,658	86,676	71,665	75,309	83,032
R-squared	0.642	0.565	0.670	0.641	0.667	0.641	0.645	0.626	0.592	0.650	0.657	0.619	0.731

Notes: Control variables not displayed for convenience: owner characteristics (gender, age and education), enterprise characteristics (year established, industry and license), and village characteristics (electrification rate, road access, education institutions and health care providers). Column (10) and (11) excluding sex as a control variable. Women-related industries are industries that produced food, beverages, tobacco, textiles, clothing, and leather products. Clustered standard errors by province in parentheses. *** p<0.01, ** p<0.05, * p<0.1

4.5.4 Credit-constrained enterprises

In this section, I examine a possible mechanism through which social assistance programs affect MSEs in the local area. It is widely acknowledged that MSEs face a number of constraints, for instance credit constraints, when compared to larger enterprises that might limit MSEs productive capacity. Credit is needed for business investment and in the case of MSEs credit is very useful for cash flow so that enterprise could buy materials for production or pay their workers (Kaboski & Townsend, 2012).

Using data of those who received loans, I differentiate whether or not the enterprise received loans from institution that required collateral, that is from a bank, cooperative or non-bank financial institutions, e.g., pawnshop, leasing or factoring. I regress a loan dummy on the timing of receiving the PKH controlling for other factors similar to that in the main estimation. The loan dummy equals 1 if enterprises received credit from a bank or cooperative or non-bank financial institution, and 0 otherwise.

Table 4.7 shows no immediate effect on credit. This result explains the main estimation findings that MSEs were unable to respond to an increase in demand in the short term as they were unable to access credit. Nevertheless, borrowing from a bank, cooperative and non-bank institution rises when receiving the PKH for the fourth and fifth time. There is no evidence of impact on bank-sourced credit, as the estimation of bank-sourced credit shows none of the coefficient is statistically significant.

Table 4.7 PKH and credit access

Variables	Dependent variable: log output per worker	
	Credit from bank, coop, non-bank	Credit from bank
	(1)	(2)
1 st time receiving PKH = 1	0.00592 (0.0189)	0.00774 (0.00485)
2 nd time receiving PKH = 1	-0.00779 (0.0148)	-0.00123 (0.00659)
3 rd time receiving PKH = 1	-0.0233 (0.0219)	0.00263 (0.0161)
4 th time receiving PKH = 1	0.0766** (0.0314)	-0.000214 (0.0116)
5 th time receiving PKH = 1	0.272*** (0.0508)	-0.0132 (0.0123)
Subdistrict FE	Y	Y
Year FE	Y	Y
Owner & enterprise characteristics	Y	Y
Village characteristics	Y	Y
Observations	93,726	93,726
R-squared	0.495	0.241

Control variables not displayed for convenience: owner characteristics (gender, age and education), enterprise characteristics (year established, industry and license), and village characteristics (electrification rate, road access, education institutions and health care providers). Clustered standard errors by province in parentheses.

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

It seems that MSEs obtained credit mainly from non-bank agencies as significant coefficients are found for credit from all type of sources (Column 1) but not for bank-sourced credit (Column 2). The data indicates that two major reasons for MSEs not borrowing from banks are (i) they do not know the procedure for getting a loan (16.99%) and (ii) they do not have collateral (15.44%). MSEs might not know the procedure for getting a credit, but even had they known the procedure to get a credit, that does not guarantee that they have the collateral needed to get a credit. It is important therefore for policy-makers to ease access to credit for MSEs.

4.6 Conclusion

I have examined the effect of a targeted cash transfer program on the development of local economies in Indonesia. By exploiting the variation occurring from different timing of conditional cash transfer implementation in Indonesia, and utilising subdistrict fixed effects, I have showed the causal impact of PKH and added to the existing literature by focusing on MSEs in the local area. In general, I found that the PKH benefited MSEs in treatment subdistricts by increasing their output per labour in the medium term by about 21%. Nevertheless, there is no evidence of any immediate effect on labour productivity or impact on employment. The results are robust to an array of robustness checks. Thus, the findings suggest that targeted social assistance programs indeed exert positive side effects on local economies development.

The heterogeneity estimation results provide some insights into the limitations of such programs. The overall effect of the increase in labour productivity is mainly driven by increased labour productivity in urban areas where infrastructure is arguable better, in villages near city where access to outside markets is better, and in non-coastal area where local people might rely on manufacturing MSEs. The PKH also benefited women engaged in MSEs. The results on a possible mechanism indicated that credit constraint seems to be a channel through which the program affects local MSEs. Furthermore, MSEs who managed to get credit, utilised non-bank sourced credit.

These results have a number of implications for policies regarding targeted social assistance programs and the development of local economies. Firstly, they highlight the importance for sustainability for at least 5 years so that the domino effects of the program can penetrate into local economies. Secondly, since most of the poor live in rural areas with less infrastructure and limited access to other markets, the results are pertinent to the need to recognise the limitation of the side effects of such programs on the development of local economies in rural

areas and in villages located far from cities. Thirdly, in relation to limited access to credit, policy-makers could ease access to credit for MSEs to help them finance their business activities.

Due to the unavailability of data, however, I am not aware of other channels through which the PKH affect MSEs, for instance an increase in demand. Therefore, future studies might want to look at the consumption levels amongst the local people or the demand from outer regions for goods supplied by MSEs in local areas.

Chapter 5

Conclusion

5.1 Key findings

This thesis has examined the impacts that three issues related to sustainable development (electricity reliability, internet utilisation and targeted social assistance program) have on the performance of MSEs in Indonesia. The empirical results have showed that the performance of MSEs is indeed strongly affected by power blackouts, internet utilisation, and targeted social assistance programs. Therefore, the reliability of public services and the utilisation of digital technology are crucial to improve the performance of MSEs. In addition, targeted social assistance programs were found to have had positive local economic impacts on MSEs in the medium term.

On the issue of power supply reliability (Chapter 2), results reveal that under-investment in the power sector and poor PLN governance are the reasons why Indonesia has blackouts. While MSEs might use electricity less intensively than larger enterprises, it has been shown that electricity blackouts reduced the average labour productivity of MSEs in the manufacturing sector. The results are robust to different approaches to measuring power reliability using either blackout duration or blackout frequency, adding more controls, removing cohort fixed effects, or clustering the standard errors. The loss associated with unreliable power supply is approximately IDR 71.5 billion (USD 4.91 million) per year. One response to cope with unreliable power supply is adopting a captive generator. Results indicate that MSEs utilising a captive generator benefited when the power supply is poor. As previous research indicates, however, adopting captive generators can be very expensive for the country (Burke et al., 2018).

Therefore, improving power supply reliability is essential and should be on the list of policy-makers' priorities in developing countries. Specifically, policy-makers need to focus on making blackouts less frequent and shorter in duration since less frequent yet longer blackouts can be as damaging as more frequent yet shorter blackouts. Prioritising electricity reliability would help MSEs that commonly face economic disadvantages improve their productivities that in turn eventually improve the welfare of those engaged in this sector.

Regarding digital technology utilisation (Chapter 3), a case study of MSEs in Yogyakarta province showed that the use of the internet — as part of digitalisation — by MSEs in any business activity, such as communication, advertisement, or transaction, has allowed MSEs to participate in the digital economy. Internet adoption also has assisted MSEs to improve their productivity and exports. The findings are robust even after excluding some of the context variables, using a regressor of either cellular signal strength or cellular data type, and taking into account spatial spillovers. The estimated monetary benefit generated from internet adoption is substantial for local people. Findings also unveiled that email and social media are platforms that help enterprises engage in and gain benefit from the digital economy. This finding is promising as these platforms are relatively easy to access using smartphones and might require less technology savviness when compared to websites or online shopping platforms which were adopted by only a small portion of MSEs in Yogyakarta. Therefore, the barriers to participating in digital economies are relatively low.

Chapter 4 discussed a targeted social assistance program and provided evidence of the positive side-effects of the huge investment that policy-makers have put into such programs. Empirical findings show that there are significant local economic impacts of targeted social assistance programs. Exposure to this program raises the labour productivity of local manufacturing MSEs in the medium term. There is no evidence of confounding policy effects, or spillovers observed from neighbouring villages that also may be exposed to the same program. The overall effect of increased productivity is mainly driven by increased productivity in urban areas, with better infrastructure; in villages near a city, with better access to outside

markets; and in non-coastal area where people may rely on the manufacturing sector. The PKH also benefited women engaged in MSEs. Relaxing credit constraints appears to be a channel through which the programs affect MSEs in the local economy. This explains why no significant impact was observed in the short term since MSEs are unable to access credit. Furthermore, it seems that MSEs utilised credit mainly from non-bank agencies.

5.2 Concluding remarks and policy implications

The empirical results in the thesis have important policy implications for policy-makers who aspire to assist MSEs to perform better. The results underline the fact that inclusive growth for MSEs is strongly supported by better public services, that is, by reliable power supply and better internet quality provision, by digital technology utilisation, and by programs aimed at improving the livelihood of the poor in the local economy through targeted social assistance programs.

The findings on the impact of blackouts highlight the importance for policy-makers in developing countries to prioritise improving power supply reliability. This priority can assist MSEs that generally confront economic disadvantages, including financial constraints, to increase their productivities, thus escalating their profitability and the prosperity of those involved in this sector.

The main findings on the impact of internet utilisation provides evidence supporting the argument that the digital economy, represented by access to and use of the internet, has significant potential to contribute to development and inclusiveness by expanding trade opportunities. The findings also justify public policies directed at advancing good quality internet availability along with promoting enterprises' use of the internet in developing countries. With much higher penetration of decent quality internet, developing countries can expect the productivity of their MSEs to improve considerably. Similarly, promoting the use of

the internet by MSEs will support MSEs to take up opportunities arising from the digital economy and to expand the market.

The key findings on the local economy wide-impact of targeted social assistance programs emphasised the importance of the sustainability of such programs for a minimum of 5 years so that the trickledown effect of the program can penetrate in the local economy. Findings also suggest that access to credit is crucial for MSEs to support their business. While MSEs appear to obtain loans from non-bank sources, policy-makers could ease credit access for MSEs so that entrepreneurs can run their business smoothly.

5.3 Limitations and future research

One challenge of doing research on MSEs is data availability and quality. It is understandable that collecting data on MSEs might be more challenging than collecting data on established larger enterprises. This type of enterprise might survive for a shorter period when compared to larger enterprises and might not survive during multiple survey rounds so that it is difficult to conduct panel survey on MSEs. Further, MSEs often have poor managerial practices, for instance no bookkeeping, such that it is very challenging to record the accurate financial data of MSEs.

This thesis therefore comes with several caveats. Firstly, due to data unavailability, Chapter 2 assumed that every MSE in a region experienced the same level of blackouts as the data on blackouts was reported by the PLN and not by the enterprises themselves. Secondly, due to panel enterprise data being unavailable, Chapter 2 focused on cohort panel data, instead of enterprise panel data. While cohort data is used to represent similar enterprises, it would be better to have enterprise panel data such that each enterprise's time-invariant unobservables can be taken into account. Thirdly, Chapter 3 is based on a case study in Yogyakarta province with a limited number of samples such that the results might be not generalisable to a larger population, for instance at the national level. Lastly, Chapter 4 cannot identify whether a

household owning an enterprise or being engaged in enterprise activities is a beneficiary of social assistance programs.

There are several potential future research questions arising from this thesis. Firstly, on blackouts, a more detailed study of what developing countries should do to improve electricity reliability while at the same time promote renewable energy and sustainability in their countries may be of significant value. Secondly, Chapter 3 did not consider digital finance by MSEs, a hot topic for the growing digital economy. MSEs have started using online payment platforms, such as PayPal, to simplify transaction for customers. Future studies might want to look at the effects of such digital payment on MSEs. Lastly, in terms of targeted social assistance programs, exploration of other potential mechanisms, for instance the increase of demand, through which targeted social assistance programs affect MSEs could be an interesting topic to look at.

Supplements

S2.1. Manufacturing MSEs in Indonesia

In addition to firm characteristics, surveys on MSEs collect data about entrepreneur characteristics. When there is more than one entrepreneur in an enterprise, data are collected for only the entrepreneur who possesses the biggest share. The data show that most MSE entrepreneurs are male (59%), while women account for 41%. Further, 23% of owners have not attained primary education. While 39% of owners attained primary education (39%), those with secondary education and tertiary education account for 34% and 2%, respectively. This low level of education indicates that the skill level of the owners might be limited.

MSEs in Indonesia are able to survive for a relatively long time as an MSE is 14 years old on average. Nonetheless, only around 3% of MSEs become members of a cooperation. Whereas 3% of MSEs have a license to operate, most MSEs do not (97%). More than 59% derive capital from their own private sources, and approximately 40% received capital from external sources. Around 6% of MSEs distribute their product partially or entirely to other provinces and abroad, while 94% distribute their output within the same province.

The development of MSEs is among the top priorities for both the central and local governments of Indonesia. Since the 1970s the Indonesian government has been paying close attention to small firms, as reflected in several small and medium enterprise (SME) development policies. These policies range from general, technology, finance, and marketing initiatives (Anas et al., 2017).

Table S2.1. SMEs policy in Indonesia, 1969-2000, 2008-current

Year	Technology Initiatives
1969	Establishment of Metal Industry Development Centre (MIDC)
1974	Establishment of BIPIK (Small Industries Development Program)
1979	As part of BIPIK, LIK (Small-Scale Industry Area), and PIK (Small Industry Estates) were established and technical assistance to SMEs was intensified through the UPT (Technical Services Units), staffed by TPL (Extension Field Officers)

1994	BIPIK was replaced by PIKIM (Small-scale Enterprises Development Project)
2012	Ministry of Research and Technology Regulation No.1/2012 concerns research and development technical assistance for business entities
2013	Presidential Regulation No.27/2013 concerns the development of an entrepreneurship incubator. The entrepreneurship incubator is an intermediary institution that performs the incubation process for business, especially start-up company.
2014	Minister of Industrial Regulation No. 11/2014 concerns reorganization of small and medium enterprise machinery and/or equipment
Finance Initiative	
1971	PT. ASKRINDO was established as a state-owned credit insurance company
1973	KIK (Small Investment Credits) and KMKP (Working Capital Credits) were introduced to provide subsidized credit for SMEs
1973	PT. BAHANA, a state-owned venture capital company, was established
1974	KK (Small Credits), administered by Bank Rakyat Indonesia, was launched; subsequently (1984) it was changed to the KUPEDDES (general Rural Saving Program) scheme, aimed at promoting small business
1989	SME loans from state-owned enterprises were mandated
1990	The subsidized credit programmes (KIK, KMKP) were abolished and the unsubsidized KUK (Small Business Credits) was introduced
1999	Directed credit programmes were transferred from the Central Bank to PT PNM (a state-owned corporation got SMEs) and <i>Bank Ekspor Indonesia</i>
2000	All government credit programmes for SMEs are to be abolished
2009	Law No. 2/2009 concerns LPEI (Indonesia Exporting Fund Agency). One of the focus is to stimulate micro, small, and medium enterprises (MSMEs) and cooperatives to develop export-oriented products by providing funding. LPEI also may provide assistance and consultancy for MSMEs
2015	Bank central regulation No. 17/12/PBI/2015, in 2018 banks have to allocate minimum 20% of their lending to SMEs
2015	Economic package: the government subsidized interest rates from 22% to 12%. Through LPEI, the government also increase support for export oriented SMEs or those involved in the production of export products through loans or working capital loans with interest rates lower than commercial interest rates
General initiatives	
1978	A Directorate General for Small-scale Industry was established in the Ministry of Industry
1984	The <i>Bapak Angkat</i> (foster parent) scheme was introduced to support SMEs. It was extended nationally in 1991.
1991	SENTRAs (groups of SMEs) in industrial clusters were organized under the KOPINKRA (Small-scale Handicraft Cooperatives)
1993	The Ministry of Cooperatives was assigned responsibility for small business development
1995	The Basic law for promoting small-scale enterprises was enacted
1997	The <i>Bapak Angkat</i> programme was changed to become a Partnership (<i>Kemitraan</i>) programme
1998	The Ministry of Cooperatives and Small Business added medium-scale business to its responsibilities
2008	Law No.20/2008 concerns MSMEs
2009	Government regulation No.24/2009 concerns the Industrial Park. The industrial park company is obliged to provide land for activities of MSMEs
2013	Law No.1/2013 concerns microfinance institutions was launched

2013	Government regulation No.17/2013 regards the implementation of Law No.20/2008 was enacted
2014	Government regulation No.98/2014 concerns licensing for micro and small enterprises (MSEs)
2014	Law No.23/2014 concerns local government role in the empowering and upgrading MSMEs
Marketing initiatives	
1977	A reservation scheme was introduced to protect certain markets for SMEs
1999	The anti-monopoly law included explicit provisions in support to SMEs
2008	Ministry of Trade Regulation No. 53/2008 focuses on partnership between MSMEs and shopping centre/modern markets including the provision of areas and product marketing/MSMEs as supplier
2010	Presidential Regulation No. 54/2010 concerns procurement of goods/services for the government. Government procurement needs to expand opportunities for micro and small enterprises as well as small cooperatives
2013	Ministry of Trade Regulation No. 53/2008 was replaced by Ministry of Trade Regulation No. 70/2013. Encourages MSMEs development through product marketing, provision of areas, for MSMEs suppliers.
2014	Presidential Regulation No. 39/2014 concerns the Investment Reservation List • 93 business activities reserved for MSMEs and cooperatives • 51 business activities opened for investment which requires partnership with MSMEs and cooperatives
2014	Asephi (<i>Asosiasi Eksportir dan Produsen Handicraft Indonesia</i> / Indonesia Handicraft Producer and Exporter Association) established INACRAFT Mall (http://inacraft-mall.com/) as online site as market place for SMEs product

Source: Adopted from Anas et al., (2017) and Hill, (2001)

However, Hill (2001) notes that until 1998 these policies were ineffective for several reasons. Firstly, limited resources were allocated. Secondly, there was a lack of a clear policy rationale as well as a supply-driven orientation. Lastly, there was a lack of large firms and commercial services that engaged in supporting SME development programs. Moreover, Anas et al. (2017) reveal that after the Asian Financial Crisis in 1997–1998, the policies continued to be framed in a social welfare approach and reflected excessive protectionism methods to shield SMEs from competition, for instance, partnerships with SMEs, a reservation of the business sector for SMEs.

The Economic Research Institute for ASEAN and East Asia [ERIA] (2014) evaluates the SME development policies and actions implemented by 10 countries of the Association of Southeast Asian Nations (ASEAN), including Indonesia. Using surveys and in-depth interviews, an independent research team assessed the policy implementation in each country. There are

eight factors of assessment: institutional framework, access to support services, the cost and speed to start a business, access to finance, technology and technology transfer, international market expansion, promotion of entrepreneurial education, and representation of SME's interests. The index was constructed through a peer-review process, and Indonesia scored 4.1 out of 6.0 (good practice).

S2.2. Electricity sector in Indonesia

PLN is the major provider of all public electricity and electricity infrastructure in Indonesia, including power generation, transmission, distribution, and retail sales (Tharakan, 2015). Electricity demand in Indonesia increased significantly during 2002–2015. In 2015, the total electricity production of Indonesia was 225.7 TWh, more than double that of 2002 (108.3 TWh). Indonesia's total power generating capacity (including captive and off-grid generation) was about 52,859 MW in 2015, of which 64% was from Java. Of this capacity, PLN owned more than 73%. Independent power producers (IPPs) owned the remainder of the electricity.

Indonesia's electricity production in 2015 was dominated by fossil fuel power (89.3%), which consists of coal-based, natural gas-based, and oil-based power, with shares of 55.8%, 25.3%, and 8.2%, respectively. The portion of renewable energy-based power enterprises was relatively small (10.7%), consisting of hydroelectric (5.9%), and geothermal and other (4.8%). Existing power capacity contributes a yearly average per capita electricity consumption of approximately 794 kWh, which is among the lowest in ASEAN (Tharakan, 2015).

As an archipelago, the Indonesian transmission network is segregated into many power grids—8 interconnected networks and 600 separate grids that are all operated by PLN. PLN currently owns and operates about 41,682 circuit km of transmission lines and 92,651 megavolt ampere (MVA) of main transformer capacity. In 2015, PLN operated about 890,099 circuit km of distribution lines and 50,151 MVA of distributor transformer capacity.

In 1999, the government of Indonesia started to invite the private sector to enter the electricity sector. Consequently, Indonesia's power capacity expanded dramatically. In 2015, IPPs and private utilities accounted for 26% of Indonesia's installed generation capacity. The Gol has announced two fast-track programs to meet the fast-growing electricity demand to accelerate the expansion of power capacity. The first fast-track program was launched in 2004 and aimed to construct new coal-based electricity generators with a total capacity of 10,000 MW. In 2006, the second fast-track program began to install another 10,000 MW of new power capacity by 2014, including 5,000 MW from geothermal enterprises and 1,250 MW from hydropower.

In 2015, Indonesia's president launched the 35 gigawatts electricity project. Based on PLN's Electricity Business Plan (RUPTL) 2017–2026, electricity demand growth is projected to be approximately 8.3% per year. The additional capacity of power generation that will be developed up to 2026 is approximately 77,873 MW or 7,787 MW per year on average. However, actual demand has grown at a much slower rate compared with the projections, leading to uncertainties about the government's projection of 35 gigawatts by 2019 (Singgih & Sundaryani, 2017). Further, PLN might have overestimated demand and that this project put PLN and customers at risk of paying of unneeded power (Chung, 2017). In 2011, the Gol enacted a policy stating that customers have the right to receive compensation from PLN when they experience a certain level of blackouts. As a deterrent, this policy helps the improvement of power supply reliability (World Bank, 2017).

On the demand side, Indonesia has not sought to limit consumption through tariffs. The pricing policy pursued by the government aims to balance the financial standing of the utility with the affordability of electricity tariffs. Tariffs are set below market levels, but PLN is compensated through subsidies that allow for a profit margin of 7%. Tariffs are also routinely reviewed by the regulator. End-use tariffs were raised by 15% in 2013, for example, to help improve PLN's financial performance in the wake of rising energy prices (World Bank, 2017).

S2.3. Data explanation for Chapter 2

There are two different sources of MSEs from the BPS. Prior to 2006, the BPS collected data for non-directory/household enterprises, including the manufacturing industry, with less than 20 workers, known as *Survei Terintegrasi* (SUSI). I only extracted data from SUSI for the manufacturing sector. Starting in 2009, BPS regularly conducted a designated survey to specifically collect data on MSEs in the manufacturing sector, known as *Survei Industri Mikro Kecil* (*Survei IMK*). Data from SUSI 2004 uses KBLI 2000, while data from SUSI 2005 uses KBLI 2004, and data from *Survei IMK* 2009–2015 uses KBLI 2009.

The reason for grouping KBLI into factor intensity is that the number of firms at two-digit KBLI per region is very limited, as indicated by the level of representativeness of the MSE surveys. Moreover, if I split the samples for two size categories of MSEs, the observations per category become smaller. Province Nanggroe Aceh Darussalam was not covered by MSE survey in 2005 because of the tsunami that occurred in December 2004. Furthermore, some categories consist of no observations. Thus, there are 1,076 cohorts created overall. The PLN working areas consist of 23 regions. However, I merged the Tarakan and Batam regions into their main provinces of East Kalimantan and Kepulauan Riau since these two regions constitute a tiny number of MSE samples; thus, I have 21 regions in total.

While SAIFI and SAIDI are available at the regional level for all periods of observation, other power sector data, such as energy produced and energy loss, are available at the regional level starting from 2009. Therefore, to obtain regional power sector data for 2004–2005, I disaggregated national figures proportionally based on the 2009 regional power sector data. These variables are energy produced, energy losses, length of medium voltage transmission lines, electricity price, accounts receivable (A/R) collection period, total number of customer, and number of customers based on the categories of residential and commercial.

I had two measurements for infrastructure: road density and electrification rate. Road density is the proportion of total road length to region area. Total road length is the summation of state, provincial, and regency/municipality road length (km). Following the PLN definition, electrification rate is constructed as the ratio of total PLN customers to region population. I collected data on road length and population number from the Statistical Yearbook of Indonesia (*Statistik Indonesia* or SI). SI provides provincial total road length, population and area; then I totalled the provincial figures into regional ones.

Data on provincial temperature and precipitation for 2011–2015 were obtained from SI, while data on temperature and precipitation before 2011 were obtained from Matsuura & Willmott (2011). Matsuura & Willmott provide monthly precipitation for geographic grid points spaced at half-degree intervals. I added the total annual precipitation by grid point, then calculated district-by-year average temperature by averaging across all grid points within each district. Finally, I calculated the provincial data as the average of district level data within each province. There was some missing temperature data from SI; in this case, I inputted the data using previous year's data, assuming that the temperature level was the same as that in the previous year.

S2.4. The effects of blackouts on productivity by factor intensity

Table S2.2 The Effects of blackouts on productivity by factor intensity

	A. $\Delta \ln$ output per worker			B. $\Delta \ln$ value added per worker		
	IV dynamic panel FE					
	Labour intensive	Resource intensive	Capital intensive	Labour intensive	Resource intensive	Capital intensive
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln$ blackout frequency	-0.0466 (0.0550)	-0.0399 (0.0426)	-0.0639** (0.0279)	-0.0564 (0.0587)	-0.0467 (0.0443)	-0.0658** (0.0286)
$\Delta \ln$ output per worker (t-1)	0.174** (0.0882)	-0.0592 (0.0999)	-0.0890 (0.0756)			
$\Delta \ln$ value added per worker (t-1)				0.183** (0.0867)	-0.0470 (0.0991)	-0.0721 (0.0751)
$\Delta \ln$ fixed assets per worker	0.0692* (0.0389)	0.103*** (0.0310)	0.0104 (0.0339)	0.0702* (0.0413)	0.106*** (0.0314)	0.00997 (0.0345)
Cohort characteristics	Y	Y	Y	Y	Y	Y
Region characteristics	Y	Y	Y	Y	Y	Y
Cohort FE	Y	Y	Y	Y	Y	Y
Region FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	189	186	172	189	186	172
R squared	0.342	0.369	0.294	0.299	0.350	0.277

Notes: ***, **, and * indicate statistical significance at 1, 5, and 10 percent. Robust standard errors are in parentheses. Industry intensity is defined based on A2.1.

As it can be seen in Table S2.2, the impact of blackouts on output per worker is negative and statistically significant for labour intensive industry. Similar observation also found on value-added per worker. However, there is no evidence of significant effect on labour productivity for labour or resource intensive industries. As expected, the impact of blackouts is greater for capital intensive industries compared with labour intensive or resource intensive industries.

S3.1. MSEs and digital development in Indonesia

MSEs are among the top priority of Indonesian government. Since the 1970s, the Indonesian government has been paying close attention to the small firms as reflected in the number of SME development policies. These policies range from technology, finance, general, and marketing initiatives. However, Hill (2001) noted that up to 1998 these policies were ineffective for several reasons. Firstly, the limited resources allocated. Secondly, the lack of a clear policy

rationale, as well as a supply-driven orientation. Lastly, the lack of large firms and commercial services engagement in supporting the SMEs development programs. It is also recorded that that MSEs in Indonesia face many constraints, such as a lack of resources, lack of economic of scale, and the lack of access to digital technologies (Tambunan, 2012; Yoshino & Taghizadeh-Hesary, 2016).

Meanwhile, to support digital communication infrastructure, the government launched the *Palapa* ring project in 2014, which aimed at laying 35,000-kilometre undersea and terrestrial fibre optic cable networks spread from Sumatera to West Papua by 2020. It is reported that in mid of 2018, the West *Palapa* Ring had finished, while that of the Central and the East *Palapa* Ring are at 75% and 40% of their targets, respectively (Indotelko.com, 2018). However, rural and mountainous areas will have to wait longer to be connected to the main fibre optic cable (Purbo, 2017). The Indonesian government is developing its digital economy, aimed at making it the source of economic growth. By 2025, it is estimated that the Indonesian digital economy worth USD150 billion, equivalent to 10% of the nation's GDP (Das et al., 2016).

Research shows that the information and communication technologies infrastructure in Indonesia is very unevenly distributed with low internet penetration rates (around 20–35%), low internet speeds, and limited coverage of electronic payment systems (Azali, 2017). The online communication infrastructures are progressing quickly in urban areas. In contrast, those in disadvantaged regions are underdeveloped or unavailable. There is also a widespread lack of trust in online transactions, due to particularly high levels of fraud and cyberattack (Rahardjo, 2017). Das et al. (2016) showed that the internet in Indonesia is inexpensive but the average quality is poor, while (Purbo, 2017) indicates that those in rural areas experience less quality internet. Mobile data in Indonesia cost a half that of what customers in Malaysia pay, yet the average connection speed and internet bandwidth can be very low (Azali, 2017).

Studies on digitalisation and firm performance in Indonesia are very limited. Das et al. (2016) observed that IT spending, as a proxy of internet intensity, across Indonesia's business sector

is low when compared to neighbouring countries as well as developed countries. They argue that this low digitalisation among business is because of the availability of cheap labour and the poor internet quality. For instance, in Indonesia the average connection speed is 3.9 megabyte per second (Mbps), and the internet bandwidth is 6.2 kilobyte per second (Kb/s) per user. In contrast, that of Thailand the peer neighbouring country is 9.3 Mbps per user and 54.8 Kb/s per user, respectively. They urge the need for Indonesia to boost its labour productivity through digitalisation. Pangestu and Dewi (2017) find a positive relationship between website and email usage and larger manufacturing firms' productivity and export. They emphasise the role of the government to provide hard and soft-infrastructure, as well as regulation and incentives.

Damuri, et.al (2018) estimated the impact of mobile internet and social media on the Indonesia local economy. They extracted BTS coverage in 2014 from 73.709 villages, and found a strong correlation between mobile and social media penetration and RGDP growth. A 10% increase in network coverage is associated with a 0.92% increase in RGDP growth. Melissa, et. al. (2015) examined the role of social media in empowering Indonesian women. They show that online businesses have assisted women becoming entrepreneurs. These studies, however, treat and assume internet utilisation as exogenous, while, for instance, firm performance might also be affected by the intensity of internet utilisation and therefore involves reverse-causality. My study contributes to the current literature by addressing endogeneity issues.

S3.2. Stylised facts on digitalisation among MSEs in Yogyakarta

In this section, I present the insights related to digitalisation among MSEs revealed from the survey. I explore the extent of digitalisation and the main uses that Indonesian MSEs are making of the internet and the digital divides. The statistics shown in this section are weighted using the sampling weight provided by the BPS, thus it is representative at district level.

The survey data show that 43% MSEs in Bantul district and Yogyakarta city access the internet, while nearly 57% do not connect to the internet. By adopting internet in their business activities, MSEs are able to utilise various platforms to do business, including website launching, email, social media, advertising and e-commerce platforms. Some firms use the combination of these platforms, while others just use one type of platform, for instance social media. As shown in Figure S3.1, I find that social media is the most popular platform, as 65% of responses cited use social media, for instance, to advertise their products through Instagram, or to communicate with their customers using *Whatsapp*. The popularity of social media has risen rapidly over the last few years. The second most popular platform is email (21%). Nonetheless, only 8% cited launch a website/blog and 6% have online trading platform account.

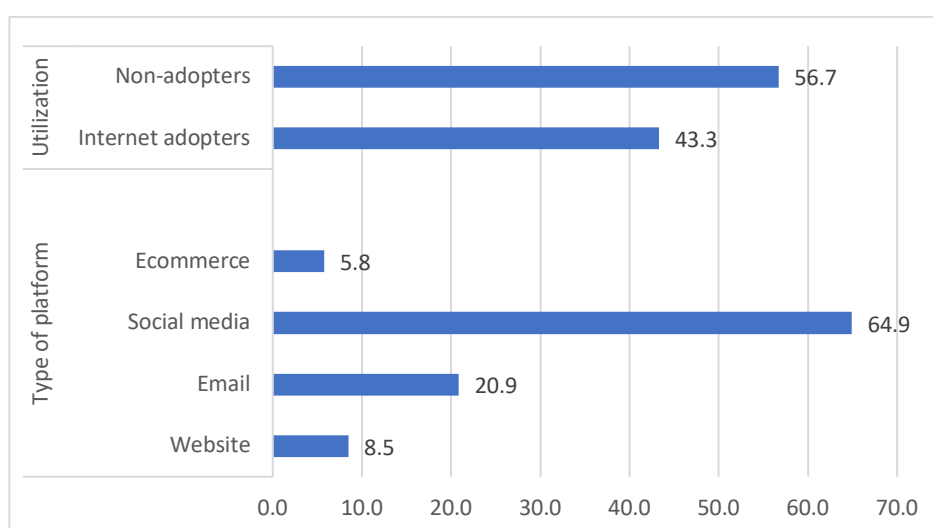


Figure S3.1. Internet utilisation and platforms used

I also explored the objectives of internet utilisation in business activities. Figure S3.1 shows multiple purposes of internet utilisation. I calculated the percentage as the proportion of total multiple responses. Business communication is the most cited purpose of internet usage (35%). The second most cited purpose is for browsing information (21%). Sales/purchasing and advertising constitute for 20% and 18%, respectively. However, only 6% responded using the internet for mobile financial banking. With only 6% of responses using the online trading platform and 6% enterprises using e-banking, this observation might support the argument of Pangestu and Grace (2017) that the use of the internet to extract value from business activities is relatively low in Indonesia.

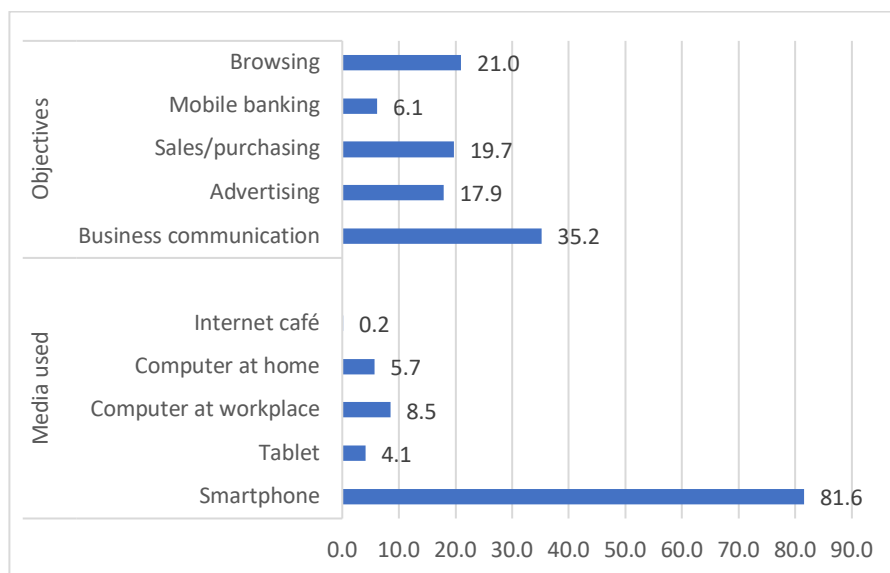


Figure S3.2. Purposes of internet utilisation and media used to access the internet

Multiple media were used by MSEs to connect to the internet. Smartphones are the mostly used media to access the internet with nearly 82% of multiple response admitted they used smartphones to connect the internet. The second mostly used media are computers at the business site, which stood at 8%. I found that 6% of total multiple-response cited they used computer at home to connect to the internet, 4% responded as using a tablet to access the internet, and less than 1% through the internet café as mobile phones are now more affordable than before. This finding is in contradiction to the situation in developed countries where

various devices including desktop computers, laptops and notebooks are more widespread forms of accessing the internet (Pangestu & Dewi, 2017).

I also found digital divides between internet-adopters and non-adopters as illustrated in Figure S3.3. Digital divides are defined as the gap between individual, households, businesses and geographic areas at different socio-economic levels with regard to their opportunities to access digital technologies and their use of the internet (OECD, 2001b). In terms of revenue, those internet-adopters generate more revenue. Female entrepreneurs are slightly more likely to use the internet compared to men. Furthermore, entrepreneurs who adopt internet in their business activities have a higher mean year of schooling and are younger.

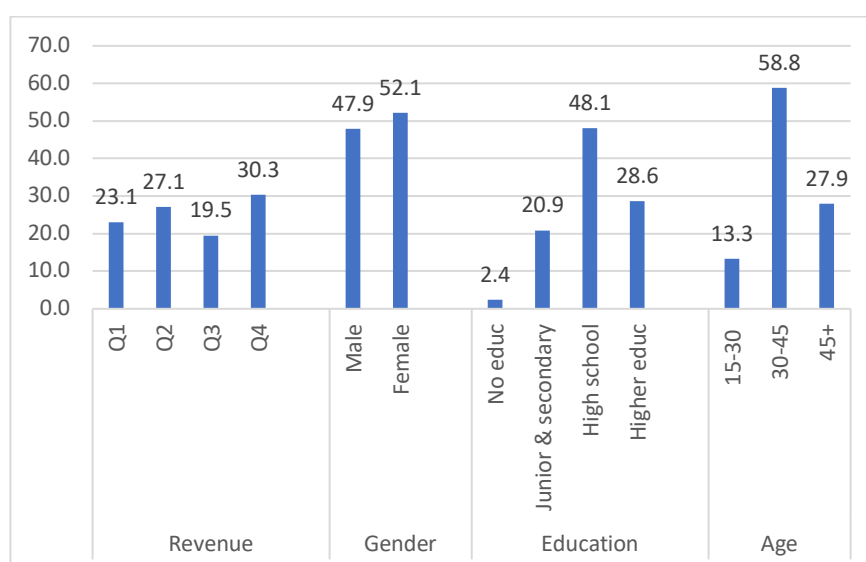


Figure S3.3. Internet-connected MSEs/entrepreneurs

S3.3 Distribution of signal strength

Figure S3.4 shows the distribution of Telkomsel signal strength among the selected samples. It appears that most samples had a higher signal strength of four and five bars, with only a few samples had a lower signal strength of one or two bars.

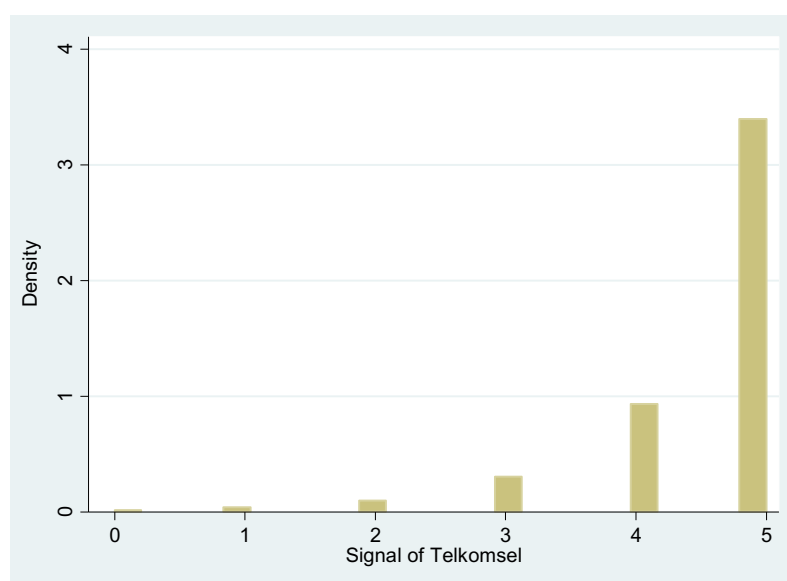


Figure S3.4 Distribution of signal strength

S4.1 Robustness checks using outcomes at level

There might be a concern on the approach of using outcomes per-worker term. Therefore, to evaluate whether this approach is problematic, I conducted robustness check using alternative measures of outcomes at level. If the results using outcomes at level are similar to that of using outcomes per-worker term, then this problem is less concerning.

Table S4.1 shows the estimation results using alternative outcomes of output and value-added at level. The coefficient of receiving PKH at the fifth time is positive and statistically significant. The coefficient also similar to that of the main results in Table 4.1. Similar observation that the alternative outcomes also produce similar results as that in the main specification. Using value-

added at level in Column (2), the coefficient of receiving PKH for the fifth time is positive but statistically insignificant. Therefore, there is no evidence to support the concern on the problematic approach of using outcomes in per-worker terms.

Table S4.1 The impact of PKH on output and value-added

Variables	Dependent variable:	
	log output	log value-added
	(1)	(2)
1 st time receiving PKH = 1	-0.00232 (0.0441)	-0.0347 (0.0633)
2 nd time receiving PKH = 1	-0.0568 (0.0621)	-0.0966 (0.0662)
3 rd time receiving PKH = 1	-0.0540 (0.0448)	-6.74e-05 (0.0479)
4 th time receiving PKH = 1	-0.0796 (0.0667)	-0.156 (0.109)
5 th time receiving PKH = 1	0.224*** (0.0771)	0.0831 (0.416)
Subdistrict FE	Y	Y
Year FE	Y	Y
Owner & enterprise characteristics	Y	Y
Village characteristics	Y	Y
Observations	158,341	135,831
R-squared	0.699	0.618

Control variables not displayed for convenience: owner characteristics (gender, age and education), enterprise characteristics (number of workers, year established, industry and license), and village characteristics (electrification rate, road access, education institutions and health care providers). Clustered standard errors by province in parentheses.

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

S3.3. Questionnaire

Survey of Internet-based Information and Communication Technology (ICT) and Micro Small-sized Enterprises (MSEs) attitude toward participation in international transactions

Instructions for enumerators

- Introduce yourself as an enumerator of ICT survey conducted by the Centre for Social Development Studies, Department of Social Development and Welfare, Faculty of Social Science and Politics, University of Gadjah Mada.
- Provide the Information Sheet.
- Explain the purpose of this interview (You can use the Information Sheet). Explain that:
 - You are going to ask them about their enterprise and their economic activity in the last 12 months; and
 - This interview is for the purpose of academic research only (not politics or others).
- Many questions are related to the enterprise economic activity over the last 12 months. Guide the respondent patiently to remind them about the period of time we are interested in
- For a multiple choice question, circle the “number” corresponding to your answer to each question (eg. ① Yes, 2. No). Where instructed, circle multiple numbers

A. Sample identity

A01	Province	[34] Yogyakarta	
A02	District	[02] Bantul	
A03	Subdistrict	[][]	(to be filled by field coordinator)
A04	Village	[][]	(to be filled by field coordinator)
A05	Urban/rural category	1. Urban 2. Rural	(to be filled by field coordinator)
A06	Census block number		(to be filled by field coordinator)
A07	Sample code number		
A08	Sample number	[][][]	
A09	Enterprise name		
A10	Address		
		RT... RW...	Postal code [][][][]
A11	Telephone/Mobile phone no		
A12	Email		
A13	Website		
A15	Interviewer: Location of enterprises (use your GPS)	Longitude	Latitude
A16	Interviewer: How many bars of signal do you see on your Xiaomi mobile phone? []		
	1. One bar	4. Four bars	
	2. Two bars	5. Five bars	
	3. Three bars	6. No networks detected	

B. Interviewer identity

B01	Code and name of interview	[][]	
B02	Date and time of interview	Date	Start time/end time
	(please fill in the 2 nd row and 3 rd row if interview is conducted more than once)	I. [][]/[][]/ 2018	[][]:[][]/[][]:[][]
		II. [][]/[][]/ 2018	[][]:[][]/[][]:[][]
		III. [][]/[][]/ 2018	[][]:[][]/[][]:[][]

C. Identify of the owner or the manager of the enterprise

- Identify the owner/ entrepreneur or the manager of the enterprise
The owner is the person who own the majority share of the enterprise
The manager is the person who is responsible for the enterprise production activity

FIRST VISIT

- C1. Are you the owner/entrepreneur or the manager of the enterprise?
 1. I am the owner/entrepreneur → C3 2. I am the manager → C3 3.
 No → C2
- C2. Could I speak to the owner/entrepreneur or the manager of the enterprise?
 1. Yes → C3 2. No (ask when to come back and re-commence the survey form)
 Date/time to come back: [] [] / January / 2018
- C3. Were there any production activities in your enterprise in the last 12 months?
 1. Yes 2. No

SECOND VISIT (if the contact is made at the first visit, go to Part D)

- C1. Are you the owner/entrepreneur or the manager of the enterprise?
 1. I am the owner/entrepreneur → C3 2. I am the manager → C3 3.
 No → C2
- C2. Could I speak to the owner/entrepreneur or the manager of the enterprise?
 1. Yes → Q3 2. No (ask when to come back and re-commence the survey form)
 Date/time to come back: [] [] / January / 2018
- C3. Were there any production activities in your enterprise in the last 12 months?
 1. Yes 2. No

THIRD VISIT (if the contact is made at the second visit, go to Part D)

- C1. Are you the owner/entrepreneur or the manager of the enterprise?
 1. I am the owner/entrepreneur → C3 2. I am the manager → C3 3.
 No → C2
- C2. Could I speak to the owner/entrepreneur or the manager of the enterprise?
 1. Yes → Q3 2. No (thank and stop)
- C3. Were there any production activities in your enterprise in the last 12 months?
 1. Yes 2. No

D. Cognitive ability

Now, I will ask you some simple questions.

- C01. Please mention date, month and year of today (BC Calendar)
 1. [] [] / [] [] / [] [] []
 Date / month / year
 2. Don't know

Interviewer: check the answer of the answer 1. Correct 2. Wrong

- C02. Please mention what day is today? 1. Monday 2. Tuesday 3. Wednesday 4. Thursday 5. Friday
 6. Saturday 7. Sunday

Interviewer: check the answer of the answer 1. Correct 2. Wrong

Now I will read a list of words consists of 10 words and I will ask you to remember those words as many as possible.

I intentionally make a long list so that it is hard for anyone to remember all the words. Most people only remember some of the words.

Please listen carefully when I read along the list as I will only read once for each word. When I done in read them, I ask you to mention as many as words that you are remember and not necessarily in order.

Is that clear enough?

Interviewer check one of the list code: A. B. C. D

I. ENTERPRISE MODULE

This module consists of questions regarding activity, characteristics, employee, ICT usage of the enterprise that belongs to or under the leadership of the respondent
Respondent is the person the owner or the manager of the enterprise

Now, I am going to ask you questions regarding your enterprises.

E. Enterprise characteristics at the time of interview

[illegible]

	f. From what age did you start working? [][] g. What is your main reason for choosing this economic activity? 1. Family tradition 2. The only profession that I know 3. Income is greater than other activity 4. The profit is more stable
E05	Does it have a business license? 1. Don't have any license → E07 2. Industrial Business License (SIUI) 3. Company Registration Certificate (TDP) / Company Registration Number (NRP) 4. HO Intrusion/Interference License 5. Permit from National Agency of Drug and Food Control (BPOM) 6. Taxpayer Identification Number (NPWP) 7. BPJS Kesehatan dan BPJS Ketenagakerjaan 8. MUI Halal Certificate 9. Others (specify)
E06	Why did you not get the required licenses? 1. Don't see the need to 2. Don't know what licenses are required 3. The procedure is too difficult/complicated 4. Costs too much money 5. Afraid of tax and insurance contributions 6. Other (specify...)
E07	If I arrange for someone to get the licenses for you and waive the registration fees, would you get the licenses? 1. Yes 2. No
E08	a. Legal status of business entity 1. PT 2. CV 3. Firma 4. Permit from the competent authority 5. No legal status/individual b. If the legal status is "4" or "5", does it have a financial report/ bookkeeping? 1. Yes 2. No
E09	In what year did the business commence its commercial activity? [][][][][][]
E10	a. Does this enterprise become a member of any business association or cooperative? 1. Yes 2. No → E10f b. If "Yes", what is the name of the business/cooperative association? - _____ c. Do you contribute money to the business association? 1. Yes 2. No d. If Yes, how much do you contribute? Rp [][][][][][] per month e. What does the business association provide? 1. Right/ protection to operate in the current location 2. Raw material/ intermediate inputs/ inventory to the business 3. Information on market trends, new regulations, etc 4. Credit 5. Other (please specify____) f. Is it member of a business group in social media, such as Whatsapp group, Facebook group? 1. Yes 2. No
E11	Is the enterprise located in an industrial centre? 1. Yes 2. No

F. Enterprise environmental condition at the time of interview

Enterprise environmental condition at the time of interview	
F01	Business site: 1. Combined with dwelling/ residential house 2. Separate building from dwelling/ residential house
F02	Area (for economic activity only): 1. Land = ... metre ² 2. Building = ... metre ²
F03	How big is the width of the road in front of the business location? (surveyor observe the road) 1. ≤1 metre (fit 1 person to walk on) 2. 1-2metre (fit 1 motorcycle) 3. 2-3metre (fit 1 car) 4. 3-4metre (fit 1 car and 1 motorcycle) 5. 4-6metre (fit 2 cars) 6. >6 metre (fit >2 cars)
F04	What is the status of the enterprise site: 1. Enterprise-owned/Self-owned 2. Rented/contracted 3. Occupying 4. Other (specify _____)
F05	What is the rent of the enterprise site? (How much monthly/yearly rent would you pay if you were renting the enterprise site?) 1. Rp [] [] [] [] [] [] [] [] yearly 2. Rp [] [] [] [] [] [] [] [] monthly
F06	a. What is the main electricity source for the economic activity? 1. PLN 2. Non-PLN → F07 3. Generator → F07 4. Other (....) → F07 b. How much power is installed? 1. 450 watts 2. 900 watts 3. 1.300 watts 4. 2.200 watts 5. >2.200 watts 6. Without a meter reader c. Is the electricity account registered under the business name? 1. Yes 2. No, it is under personal/household name 3. Don't have an account
F07	a. Does it have a generator? 1. Yes 2. No → F08 b. If "Yes", how much power is installed? 1. _____ KVA 2. _____ KW
F08	What is the main source of water for business activity? 1. Pipe water 2. Wells / pumps 3. Springs 4. Rain water 5. River water 6. Pond 7. Other (specify _____)

G. Use of Internet-based ICT during 2017

G0 Does this business have access and use the internet during 2017?
 1 1. Yes → G03
 2 2. No
 G0 If "No", what is the main reason you don't have access or use internet?
 2 1. Don't have the tools, such as smartphone/computer, to be able to access to the internet

2. Can't afford paying/buying the data/internet quota 3. No network in the business site/residence 4. Don't need it 5. The cost of using the internet is too expensive 6. Not understanding the benefits of the internet / do not know can be used for what 7. Do not understand how to use it 8. No specific reason → go to I01		
G0 3	a. What media did you use to access the internet? (multiple choice) 1. Smartphone 2. Tablet 3. Computer at business site 4. Computer at home 5. Internet cafe	b. When (year) did you start using the media? [][][][][] [][][][][] [][][][][] [][][][][] [][][][][]
G0 4	What are the purposes for using internet? Business communication 1. Yes 2. No Product marketing/advertising 1. Yes 2. No Selling or purchasing 1. Yes 2. No Financial transactions (mobile banking) 1. Yes 2. No Browsing 1. Yes 2. No Other (specify____) 1. Yes 2. No	

H. International transaction during 2017

H01. During 2017, did the enterprise have	H02. If "Yes"	H03
a. a website/blog?	1. Yes, in Indonesian only 2. Yes, in English only 3. Yes, in Indonesian and English 4. No → H01b 1. Yes 2. No → H01c	What is the name of the website/ blog? _____ → H04a What is the email address? _____@_____ → H04b
b. an electronic mail (email) account?	1. Yes 2. No → H01c	What is the account name in the social media? _____ → H04c
c. a social media account?	1. Yes 2. No → H01d	What type is that social media? 1. Facebook 2. Instagram 3. Other (specify____) → H04c
d. an account in online store?	1. Yes 2. No → H05	What is the account name in the online store? _____ → H04d
		What is the online store name? 1. Tokopedia 2. Lazada 3. Other (specify____) → H04d

	H04a through website/ blog	H04b through email	H04c through social media	H04d through online store
1 During 2017, have you ever submitted an advertisement / product offer to				
a. domestic potential customer	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No
b. foreign potential customer	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No	1. Yes 2. No

	H04a through website/ blog	H04b through email	H04c through social media	H04d through online store
2 During 2017, have you ever received any inquiries / correspondence about products / capital goods from a. domestic potential customer b. foreign potential customer	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No
3 During 2017, have you ever sent inquiries / correspondence about raw materials / capital goods to a. domestic prospective suppliers b. foreign prospective suppliers	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No
4 During 2017, have ever received orders of products / capital goods from a. domestic potential customer b. foreign potential customer	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No
5 During 2017, have you ever sent orders for raw materials or requests for lending of capital goods to a. domestic prospective suppliers b. foreign prospective suppliers	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No
6 Have ever been selling products / lending capital goods to a. domestic customer b. foreign customer	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No	1. Yes 2. No 1. Yes 2. No
7 Have you ever purchased raw materials or borrowed capital goods from a. domestic supplier/creditor b. foreign supplier/creditor	1. Yes 2. No 1. Yes 2. No ➔ H01b	1. Yes 2. No 1. Yes 2. No ➔ H01c	1. Yes 2. No 1. Yes 2. No ➔ H01d	1. Yes 2. No 1. Yes 2. No ➔ H05

H05	What percentage of raw materials that were used during 2017 coming from these area? a. Domestic 1. Bantul district ...% 2. Others district/city in Yogyakarta province ...% 3. Other provinces ...% b. Overseas ...% If "overseas" is filled, c. What percentage of the imported raw materials coming from these countries? 1. ASEAN ...% 2. Rest of Asia ...% 3. Australia ...% 4. America ...% 5. Europe ...% 6. Africa ...% d. Did you buy them directly from suppliers abroad? 1. Yes, all imported goods are purchased directly from overseas suppliers 2. Yes, but only some imported goods are purchased from overseas suppliers, specify ...% (of total imported goods) 3. No, all imported goods are purchased from the domestic market
H06	During the year 2017, what percentage of goods sold to these area? a. Domestic

	1. Bantul district	...	%
	2. Others district/city in Yogyakarta province	...	%
	3. Other provinces	...	%
	b. Overseas	...	%
	If "overseas" is filled,		
	c. What percentage of the exported goods sold to these countries?		
	1. ASEAN	...	%
	2. Rest of Asia	...	%
	3. Australia	...	%
	4. America	...	%
	5. Europe	...	%
	6. Africa	...	%
	d. Did you sell them directly to consumers abroad?		
	1. Yes, all sold directly to consumers abroad		
	2. Partially sold directly to overseas consumers, specify ...% (of total exported goods)		
	3. No, all sold through exporters / distributors in the country		
H07	a. Do you know about Indonesia export financing institutions (LPEI)?		
	1. Yes	2. No → H08	
	b. Have you ever received export financing service/help from LPEI for your export?		
	1. Yes	2. No	
H08	a. Did you borrow funds / capital from international institutions during 2017?		
	1. Yes	2. No	
	b. Have you ever received guidance / training / counselling services from international agencies during 2017?		
	1. Yes	2. No	
H09	During 2017, what percentage of products are sold to:		
	a. Final consumer (household)	...	%
	b. Retailers	...	%
	c. Large traders (exporters, distributors, agents, wholesalers, collectors)	...	%
	d. Industry and other commercial actors	...	%
	e. Government / institution	...	%
H10	Does the enterprise have a national / international scale certificate during 2017?		
	a. Certificate of Indonesian National Standard (e.g., SNI, SNI-ISO)	1. Yes	2. No
	b. Other national certificates (e.g., Halal MUI)	1. Yes	2. No
	c. International certificates (e.g., ASTM, ISO)	1. Yes	2. No
H11	Does the business have patents / copyrights / Intellectual Property Rights (IPR)?	1. Yes	2. No
H12	a. During 2017, has the business ever partnered with		
	1. Domestic partners	1. Yes	2. No
	2. Foreign partners	1. Yes → H12b	2. No → I01
	b. What type of partnership?		
	1. Provision of money / capital goods	1. Yes	2. No
	2. Supply of raw materials	1. Yes	2. No
	3. Marketing	1. Yes	2. No
	4. Guidance / training / counselling	1. Yes	2. No

I. Workers and payments during last month (last production month)

- I01 Workers, working days, and hours of work during the past month or last month of production
1. Number of production months during 2017 ... months
 2. Average working days per month ... days
 3. Average working hours per day ... hours
 4. Average number of workers per month ... workers

I02.Characteristics of workers (including manager) aged 10 years old or over; **excluding owner**

No	Name	Gender (code)	Age (year)	Highest education attained (code)	Job status (code)	Do you have a work agreement/ contract? (code)	Wages/ salary and earnings for last month (Rupiah)	Basic wage/salary payment (code)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
	Code for gender:	Code for highest education attained:			Code for working status:	Code for working contract:	Code for wage/salary payment basis:	
	1.Male	1. Primary school year 1			1. Worker /	1.Yes, written	1.Per week	
	2.Female	2. Primary school year 2			employee /	employment	2.Per month	
		3. Primary school year 3			permanent	agreement	3.Every day per	
		4. Primary school year 4			employee	2.Yes, the verbal	hour	
		5. Primary school year 5			2. Contract	agreement	4.Per job	
		6. Primary school year 6			worker	3.No work	5.In-kind	
		7. Junior high school year			3. Casual / daily	agreement	6.Not paid	
		1			worker			
		8. Junior high school year			4. Outsourced			
		2			worker			
		9. Junior high school year			5. Unpaid			
		3			worker/family worker			
		10.Senior high school year						
		1						
		11.Senior high school year						
		2						
		12.Senior high school year						
		3						
		13.Undergraduate year 1/ Diploma1						
		14.Undergraduate year 2/ Diploma 2						
		15.Undergraduate year 3/ Diploma 3						

16. Undergraduate year 4/
Diploma 4
17. Master year 1
18. Master year 2
19. Doctoral S3

I03. Worker's remuneration and wages during the past month or last month of production
Expenses Amount (Rupiah)

- a. Remuneration of permanent workers and contracts
b. Casual/ daily workers' wages
c. Expenditures for outsourced workers
d. Total

I04. The number of workers who have been certified expertise / profession ... people

		Organizer (Code)				
		1.	2.	3.	4.	5.
I05. The type of training / counselling that was / is being followed by some / all workers	1. Yes	1. Own business	2. Government	3. Other private business	4. Non-governmental Organizations (NGOs)	5. Others (write down ...)
	2. No					
a. Managerial		1	2	3	4	5
b. Skills / production techniques		1	2	3	4	5
c. Marketing		1	2	3	4	5
d. Other (specify ...)		1	2	3	4	5

J. Expenses during last month (last production month)

J01. General expenses

No	Description	Unit	Volume	Amount Rupiah (last month)
1	Fuel and lubricants			
a.	Fuel (petrol, diesel, kerosene, fuel oil)	Litre		
b.	Coal/coal briquettes	Kg		
c.	LPG	Kg		
d.	Biomass (firewood, charcoal, husk)			
e.	Other (specify...)			
f.	Lubricants	Litre		
2	Electricity	KWh		
3	City gas / natural gas from PGN	M3		
4	Water	M3		
5	Telephone, internet, and other communications			
6	Stationery			
7	Packaging, packing materials, and packing			
8	Administration of banks and financial intermediaries			
9	The value of subcontracted work			
10	Transport, shipping / expedition, warehousing, post and courier services			
11	Purchase of parts and maintenance / repair of small capital goods			
12	Workers travel expenses			
13	Research and development (R & D)			
14	Fees for the use of the services of other parties (experts / professions, promotion / advertising, vehicle rental and machine with operator, etc.)			
15a	Rental or contracts payment for a building			
15b	Rental of vehicles, machinery and equipment (without operator), and equipment			

No	Description	Unit	Volume	Amount Rupiah (last month)
16	Education and training			
17	Value added tax on goods and services, PBB, import duty and duty, export / import tax, sales tax, other taxes			
18	BPJS Kesehatan contribution			
19	BPJS Ketenagakerjaan contribution			
20	Depreciation and amortization			
21	Other costs (e.g., levies, organizational fees, expenses for clothing, food, etc.)			
Total				

J02. Specific expenses (Raw material and services used **last month**)

No	Name of raw materials and services	Unit	Quantity	Amount (Rupiah)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11	Other (specify...)			
12	Total			

J03. Non-operating expenditure

No	Description	Last year	Rupiah Last month
1	Dividends/earning shared		
2	Interest paid		
3	Loss insurance premium paid		
4	Land lease payments		
5	Other expenses (donation, CSR, penalties, other transfer)		
6	Total		

K. Production / operating income during the past month or last month of production

K01. Operating / operating income from main activities: Production / revenue of goods / services produced (not makloon)

No	Type of Products/Goods	Standard	Quantity	Value (Rp)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11	Other (...)			
12	Total			

K02. Other revenue

No	Description	Value(Rp)
1	Revenues from industrial services (makloon)	
2	Other revenue	

- 4 Total**

Month	Jan 17	Feb 17	Mar 17	Apr 17	Mei 17	Jun 17	Jul 17	Ags 17	Sep 17	Okt 17	Nov 17	Des 17
-------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------

K04. What was the production value per month for 12 months ago (Rupiah)		
No	Amount of production	Rupiah
1	Minimum	
2	Average	
3	Maximum	

L. Balance sheet

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M. Capital

M01. What is the value of adding / repairing capital goods (buildings, machinery, vehicles, etc.) during 2017?

Rp [] [] [] [] [] [] [] [] [] []

M02. Capital investment composition	At the time of establishment	During the interview
a. Self-owned	...%	...%
b. Loans from the bank	...%	...%
c. Loans / investment from non-bank financial institutions (cooperatives, venture capital)	...%	...%
d. Loans/investment from individuals, families, others	...%	...%
e. Foreign loans/investment	...%	...%
Total	100%	100%

M03. If the detail of the capital from the bank is filled:

- a. How much is the bank loan?
 1. Up to Rp50 million
 2. More than Rp50 million - 500 million
 3. More than Rp500million
- b. Percentage of loan value proportional to collateral value:
 1. Not using collateral
 2. <50%
 3. 50% -100%
 4. > 100%
- c. Type of bank loan obtained
 1. People's Business Credit (KUR)
 2. Others (specify ...)

M04a. Has the business ever received credit from financial institutions during 2017?

1. Yes
2. Never
- b. If "2. Never", what is the main reason?
 1. Do not know the procedure
 2. The procedure is difficult
 3. No collateral
 4. High interest rates
 5. Proposal was rejected
 6. Others (specify ...)

N. Business constraints and prospects

N01. Has this business experienced the following obstacles / difficulties for the year 2017?

- | | | |
|--|--------|-------|
| a. Capital | 1. Yes | 2. No |
| b. Raw materials | 1. Yes | 2. No |
| c. Marketing | 1. Yes | 2. No |
| d. BBM and energy | 1. Yes | 2. No |
| e. Infrastructure (roads, water, communications, etc.) | 1. Yes | 2. No |
| f. Labour | 1. Yes | 2. No |
| g. Government regulations and bureaucracy | 1. Yes | 2. No |
| h. Illegal charges | 1. Yes | 2. No |
| i. Competitors | 1. Yes | 2. No |
| j. Others (specify ...) | 1. Yes | 2. No |

N02. What is the outlook for this business in 2018 compared to 2017?

1. Rising
2. Constant
3. Decrease
4. Not comparable

N03. Are there any plans to expand / expand this business in the future?

1. Yes
2. No
- a. If "Yes, what is the plan to do?
 1. Expanding place of business
 2. Opening branch
 3. Improving skills

- | | | |
|----------------------------|--------|-------|
| 4. Product diversification | 1. Yes | 2. No |
| 5. Others (specify...) | 1. Yes | 2. No |
- b. If "No", what is the main reason?
1. Lack of capital
 2. Marketing difficulties
 3. Lack of expertise
 4. Other (specify ...)
- N04. Is this business being a cooperative member?
1. Yes
 2. No
- N05. Kind of service of cooperatives ever received during 2017
- | | | |
|--------------------------------------|--------|-------|
| 1. Loan money / capital goods | 1. Yes | 2. No |
| 2. Procurement of raw materials | 1. Yes | 2. No |
| 3. Marketing | 1. Yes | 2. No |
| 4. Guidance / training / counselling | 1. Yes | 2. No |
| 5. Others (please specify ...) | 1. Yes | 2. No |

O. Risk-aversion Game

People's livelihood and fortune might chance over time due to the uncertain nature of life. On this occasion, I would like to ask you to imagine your future better livelihood and fortune due to a good production and sales or adopting ICT, resulting in an increase in income. To mimic the situation and to help you think about it, I would like to ask you to participate in an "ICT adoption" experiment. Again, this experiment is part of our research. We are interested in understanding how people make decisions. There is no right or wrong decision in this experiment. I would like you to make a decision that feels right for you.

The experiment is as follows:

Initial capital

We are going to provide you with some initial capital for this experiment.

I have two marbles, blue and yellow. I am going to put them behind my back, shake them and put one in each hand and bring them forward. I have one marble in each hand, concealed. Now, you must pick one hand. If you pick the hand containing the blue marble, the amount of initial capital you have is Rp5,000. If you pick the hand containing the yellow marble, the amount of initial capital you have is Rp20,000.

- O01. Now, please pick one hand. (record the outcome. **do NOT make a payment yet**)
1. Blue (Rp5,000)
 2. Yellow (Rp20,000)

ICT adoption scenarios

Now, if you invest your initial capital into one of the six alternative livelihood options, you will get the money. How much you can get depends on your initial capital as well as your luck. You choose one of the livelihood options and I will use the "which hand is it in" game to determine your winnings.

I have two marbles, red and green. I am going to put them behind my back, shake them and put one in each hand and bring them forward. Now, I have one marble in each hand, concealed. Now, you must pick one hand. If you pick the hand containing the red marble you receive the amount of money on the column of Red Marble. If you pick the hand containing the green marble you receive the amount of money on the column of Green Marble.

Finally, I will pay you according to what happened in the experiment. Any money you receive is real money and is yours to keep.

For question N02:

Use Table 1 if respondent got **Blue** marble in N01

Use Table 2 if respondent got **Yellow** marble in N01

O02.

- a. Now, please choose your livelihood option you prefer

1. A
 2. B
 3. C
 4. D
 5. E
 6. F
- b. Now, please pick one hand. (*record the outcome and make payment accordingly*)
1. Red
 2. Green

Use Table 1 if the respondent got BLUE (Rp5,000) for the initial capital

Use Table 2 if the respondent got YELLOW (Rp20,000) for the initial capital

Scenario	Table 1 BLUE Low initial capital (Rp 5.000)		Table 2 Yellow High initial capital (Rp 20.000)	
	Red	Green	Red	Green
A	Rp5.000	Rp 5.000	Rp20.000	Rp20.000
B	Rp4.500	Rp 6.500	Rp16.000	Rp25.000
C	Rp4.000	Rp 8.000	Rp12.000	Rp30.000
D	Rp3.000	Rp10.000	Rp 8.000	Rp35.000
E	Rp2.000	Rp12.000	Rp 4.000	Rp40.000
F	Rp 0	Rp14.000	Rp 0	Rp50.000

II. HOUSEHOLD MODULE

This module contains questions about the household of the enterprise owner / manager

A. Household members profile

Name of household members (write anyone who live and eat in this household)	Relationship with the head of hh	Gender: 1. Male 2. Female	Age (year)	Marital status	HH members 10 years old and more			HH members 5 years old and more	
					Did he/she in last week work? 1. Yes 2. No	Does he/she having a job / business, but temporarily not working for the past week ? 1. Yes 2. No	Whether is he/she looking for a job or preparing for a business for the past week ? 1. Yes 2. No	School participation	The highest level of education ever / is attained (highest grade level)
(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)	(10)
01.	☐	☐		☐	☐	☐	☐	☐	☐
02.	☐	☐		☐	☐	☐	☐	☐	☐
03.	☐	☐		☐	☐	☐	☐	☐	☐
04.	☐	☐		☐	☐	☐	☐	☐	☐
05.	☐	☐		☐	☐	☐	☐	☐	☐
06.	☐	☐		☐	☐	☐	☐	☐	☐
07.	☐	☐		☐	☐	☐	☐	☐	☐
08.	☐	☐		☐	☐	☐	☐	☐	☐

09.	☐	☐	☐	☐	☐	☐	☐	☐	☐
10.	☐	☐	☐	☐	☐	☐	☐	☐	☐

Code relationship with head of hh	Code for marital status	Code for school participation	Code for education attainment
1. Head of household	1. Not married yet	1. No / have not attended school yet	1. Primary school year 1
2. Wife / husband	2. Marry	2. Still in school	2. Primary school year 2
3 children	3. Divorced life	3. Not attending school	3. Primary school year 3
4. In-laws	4. Divorce is dead		4. Primary school year 4
5. Grandchildren			5. Primary school year 5
6. Parents / in-laws			6. Primary school year 6
7. Other families			7. Junior high school year 1
8. Maid			8. Junior high school year 2
9. Other			9. Junior high school year 3
			10. Senior high school year 1
			11. Senior high school year 2
			12. Senior high school year 3
			13. Undergraduate year 1/ Diploma 1
			14. Undergraduate year 2/ Diploma 2
			15. Undergraduate year 3/ Diploma 3
			16. Undergraduate year 4/ Diploma 4
			17. Master year 1
			18. Master year 2
			19. Doctoral S3

B. Socio-economic (for head of household)																		
Socio-demography																		
Q0 1	Where are you born?	: a. Province. : b. District/City.																
Q0 2	What is the location of your birthplace?	1. Rural 2. Small Town 3. Big city 8. Do not know																
Q0 3	Where did you live when you are 12 years old?	a. Province. : b. District/City.																
Q0 4	Since what year did you live in Yogyakarta?	: year																
Q0 5	Since what year did you live in this house?	: year																
Home and living conditions																		
Q0 6	What is the status of this house?	1. Own property → Q08 2. Contract 3. Rent 4. Free rent belonging to others → Q09 5. Free rental of property of parents / relatives → Q09 6. Service Dinas → Q09 7. Other → Q09																
Q0 7	What is the rent value? → P10	1. Rp /year 2. Rp /month 3. Do not know																
Q0 8	[If Q06=1 (Own property)] Status of residential land:	1. Property right 2. Right to use the building 3. Right to use 4. Other.....																
Q0 9	How much money do you have to pay if you have rented this house every month / year?	1. Rp /year 2. Rp /month 3. Do not know																
Q1 0	What is the main power installed in this house?	<table border="1"> <thead> <tr> <th>a. Source of lighting</th> <th>b. Installed capacity (If Electricity of PLN)</th> </tr> </thead> <tbody> <tr> <td>1. Electricity of PLN</td> <td>1. 450 watts</td> </tr> <tr> <td>2. Electricity of non PLN</td> <td>2. 900 watts</td> </tr> <tr> <td>3. Petromak/aladin</td> <td>3. 1.300 watts</td> </tr> <tr> <td>4. Pelita/sentir/orbor</td> <td>4. 2.200 watts</td> </tr> <tr> <td>5. Generator</td> <td>5. >2.200 watts</td> </tr> <tr> <td>6. Other.....</td> <td>6. Without a metre reader</td> </tr> <tr> <td></td> <td>9. Question is irrelevant (not PLN)</td> </tr> </tbody> </table>	a. Source of lighting	b. Installed capacity (If Electricity of PLN)	1. Electricity of PLN	1. 450 watts	2. Electricity of non PLN	2. 900 watts	3. Petromak/aladin	3. 1.300 watts	4. Pelita/sentir/orbor	4. 2.200 watts	5. Generator	5. >2.200 watts	6. Other.....	6. Without a metre reader		9. Question is irrelevant (not PLN)
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6. Other.....	6. Without a metre reader																	
	9. Question is irrelevant (not PLN)																	

B. Socio-economic (for head of household)																													
Q1 1	What is the main water source for cooking used by this household?	01. Branded water 02. Pipe water 03. Wells / pumps 04. Sumur timba/perigi 05. Springs 06. Rain water 07. River water / times 08. Pond 09. Bak penampungan 10. Other.....																											
Q1 2	Do you have toilet wash facility (MCK) in your house?	1. Yes 2. No																											
Q1 3	Type of roof:	1. Concrete 2. Concrete 3. Shingle 4. Seng 5. Asbestos 6. Ijuk/rumbia 7. Other.....																											
Q1 4	Type of wall:	1. Wall 2. Wood 3. Bamboo 4. Other.....																											
Q1 5	Type of floor:	1. Marble / ceramic / granite 2. Tegel / terrazzo 3. Cement 4. Wood 5. Land 6. Other.....																											
Q1 6	How big is.....?	a. Total land area m ²	b. Floor area of the building m ²																										
Q1 7	What goods/appliances does this household have and how many? (write 0 if it does not have)	<table border="1"> <thead> <tr> <th>Goods</th> <th>Number of goods/appliances</th> </tr> </thead> <tbody> <tr><td>a. Bicycle</td><td> </td></tr> <tr><td>b. Motorcycle</td><td> </td></tr> <tr><td>c. Cars</td><td> </td></tr> <tr><td>d. Cars</td><td> </td></tr> <tr><td>e. Cars</td><td> </td></tr> <tr><td>f. Cars</td><td> </td></tr> <tr><td>g. AC</td><td> </td></tr> <tr><td>h. Washing machine</td><td> </td></tr> <tr><td>i. Mobile phone</td><td> </td></tr> <tr><td>j. Video/digital camera</td><td> </td></tr> <tr><td>k. Laptop/Computer</td><td> </td></tr> <tr><td>l. VCD/DVD player</td><td> </td></tr> </tbody> </table>	Goods	Number of goods/appliances	a. Bicycle		b. Motorcycle		c. Cars		d. Cars		e. Cars		f. Cars		g. AC		h. Washing machine		i. Mobile phone		j. Video/digital camera		k. Laptop/Computer		l. VCD/DVD player		
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j. Video/digital camera																													
k. Laptop/Computer																													
l. VCD/DVD player																													

Income							
Q1 8	What is the average total income earned by all members of the house per month	1. < 1.500.000 2. Rp 1.500.000 – Rp 2.499.999 3. Rp 2.500.000 – Rp 3.999.999 4. Rp 4.000.000 – Rp 6.999.999 5. Rp 7.000.000 – Rp 9.999.999 6. Rp 10.000.000 – Rp 14.999.999 7. ≥ Rp 15.000.000					
Q2 0	Are there household members who have the following government social welfare program?	a. BPJS Kesehatan	b. Jamkesda				
Q2 1	Other Insurance Ownership		a. Life insurance	b. Health insurance other than BPJS	c. Vehicle insurance	d. Home insurance	e. Education insurance
	1. Are there household members who have the following financial schemes? (1. Yes; 2. No)						
	2. Does he/she pay the insurance by him/herself? (1. Yes; 2. No)						
	3. What are the premiums paid each month?		Rp	Rp	Rp	Rp	Rp

C. Use of digital equipment

Questions for members of households aged 7 - 15 years

Questions for all household members

Name of household member	Household member number (see part C)	Height (cm)	Weight (kg)	This year's report card value (scale 1 – 10)			Does he/she have access and use the internet in the past month ? 1. Yes 2. No	What is the media used to access the internet? (can select more than one options)	The main purpose of internet usage (can select more than one options)
				Indonesia	English	Mathematics			
01	02	03	04	05	06	07	08	09	10
1.....									
2.....									
3.....									
4.....									
5.....									
6.....									
7.....									
8.....									
10.....									
11.....									
12.....									

RO9 Media (which currently works perfectly)

1. Computer/ laptop
2. Tablet

4. Internet cafe
5. Computer in the office

R10 Main purpose of internet usage

1. Personal communication
2. Business / work communication
5. Online shopping

3. Mobile phone

6. Computer at school

3. Social media

4. Mobile banking [online banking]

6. Entertainment / games

7. School tasks

8. Browsing general
information

R11. The availability and use of digital media in household

Types of digital media

a. Number of well-functioning
digital mediab. The average length of day-
to-day usage by the most
frequently used household
members

a. Television (TV)

|_|_|

|_|_| hours

b. DVD Player

|_|_|

|_|_| hours

c. Computer

|_|_|

|_|_| hours

d. Laptop

|_|_|

|_|_| hours

e. Mobile phone

|_|_|

|_|_| hours

f. Tablet

|_|_|

|_|_| hours

g. Xbox / Playstation

|_|_|

|_|_| hours

h. Other

|_|_|

|_|_| hours

D. Interviewer note

(In this column the interviewer can write down the things that are considered important that occurred during the interview or the respondents who influenced the interview results)

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