연세대학교 상경대학
**경제연구소**
Economic Research Institute
Yonsei University

서울시 서대문구 연세로 50
50 Yonsei-ro, Seodaemun-gu, Seoul, Korea
TEL: (+82-2) 2123-4065 FAX: (+82-2) 364-9149
E-mail: yeri4065@yonsei.ac.kr
http://yeri.yonsei.ac.kr/new

# Credit and Child Labor Complementarity in the Wake of Natural Disaster: Evidence from Indonesia

**Michell Yoonjei Dong**
*Green Climate Fund*

**Hee-Seung Yang**
*Yonsei University*

December 2024
2024RWP-235

**Economic Research Institute**

**Yonsei University**

# Credit and Child Labor Complementarity in the Wake of Natural Disaster: Evidence from Indonesia*

Michell Yoonjei Dong† Hee-Seung Yang‡

*Acknowledgements. We are grateful to Taejong Kim, Booyuel Kim, Joshua Merfeld, Chungeun Yoon and seminar participants at KDI School, Yonsei University, the 2021 Asian and Australasian Society of Labour Economics Conference, and the 2022 Korean Association for Public Administration for providing helpful comments. We also thank for funding from the KDI School of Public Policy and Management. All errors are our own. The authors report there are no competing interests to declare.

†Green Climate Fund. Email: mdong@gcfund.org.

‡School of Economics, Yonsei University. Email: heeseung.yang@yonsei.ac.kr.

# Credit and Child Labor Complementarity in the Wake of Natural Disaster: Evidence from Indonesia

**Abstract**

This paper examines the impact of an earthquake in Indonesia on children's school and work activities and how that relationship differs by access to credit. We find that the earthquake decreases educational attainment while increasing child labor and the effect is stronger for households with access to credit. Following the 2006 Yogyakarta earthquake, years of schooling for earthquake-affected children aged 7-14 decreased by 0.5 years, but the effect was stronger for those living close to a microfinance institution. Heterogeneity in treatment effects suggests that the opportunity cost of schooling increases as households with micro-loans open up businesses. Our finding indicates the complementary effect between credit and child labor and suggests the need for policies to increase educational investment when providing micro-loans to help households affected by shocks.

**Keywords:** natural disaster, earthquake, education, child labor, microfinance, Indonesia

**JEL Classification**: I20, O12, J13, H81

# 1 Introduction

An increasing number of countries around the world have experienced natural disasters in the past decades. Natural disasters can bring considerable damages to households in terms of destruction of houses, loss of physical assets, and casualties of household members. In addition to the direct impacts, natural disasters can produce unforeseen consequences on health and education through indirect channels (Baez et al. 2010, Rodriguez-Oreggia et al. 2013). After a natural disaster, households may have lower accessibility to schools and hospitals due to damage of basic infrastructure, including roads and bridges. The negative impact on health and education is further reinforced if households respond to the shock by reducing food consumption or increasing the labor supply of children (Baez et al. 2017, Beegle et al. 2006).

Properly-provided reconstruction activities can mitigate these negative impacts of natural disasters, especially on human capital outcomes. Previous studies find that natural disasters followed by efficient government responses can have non-negative and even positive impacts on household welfare and wage growth (Gignoux and Menéndez 2016, Heger and Neumayer 2019, Kirchberger 2017). Research also shows that access to finance, including microcredit, can play an insurance role in face of a negative income shock (Alvi and Dendir 2011, Gertler et al. 2009). As microcredit helps households smooth consumption and positively affects household income, the demand for children's schooling may also increase. At the same time, microcredit often leads to the establishment of micro-enterprises that require extra labor, including children, and it is uncertain how the impact of negative shocks on human capital differs by access to credit (Augsburg et al. 2015, Lakdawala 2018).

In this paper, we employ an exogenous shock that happened in Indonesia to test the hypothesis that children's school and work activities change following shocks and that the relationship differs by access to credit. We address this question by exploring the impact of the 2006 Yogyakarta earthquake, which was followed by large reconstruction programs, on school enrollment and child labor among Indonesian children. Especially, we examine if there is a substitution or complementary effect between credit and child labor in the aftermath of the Yogyakarta earthquake. If credit is intended for consumption purposes, the substitution between child labor and credit as means of consumption smoothing would be apparent. In other words, an increase in credit would lead to a reduction in child labor (Alvi and Dendir 2011, Gertler et al. 2009). At the same time, production credit is expected to complement, and thus, increase child labor (Augsburg et al. 2015, Lakdawala 2018).

In case of the Yogyakarta earthquake, the affected regions are known to be centers for artisanal and other small enterprises. Thus, a large percentage of affected households were self-employed micro-entrepreneurs (Khan 2012). To increase access to credit for these households, international aid agencies implemented a large-scale microfinance program following the earthquake. We find that, following the Yogyakarta earthquake, education level decreased among children under 15 and child labor increased. This effect was especially pronounced for households with access to credit and those that owned home-based business. Thus, our study suggests the complementarity between credit and child labor – access to microcredit led to an increase in child labor in the short-term, as the households required extra labors to restart their micro-enterprises.

Our paper mainly contributes to three strands of literature. First, we contribute to the literature that investigates the impact of shocks on child labor and schooling. In response to shocks, households may smooth consumption by reducing educational expenditure and relying on child labor (Beegle et al. 2006, Jacoby and Skoufias 1997, Takasaki 2017). Following accidental crop losses, Beegle et al. (2006) find that households in Tanzania increased child labor and decreased schooling. The work closest to our study is the one done by Gignoux et al. (2017), who find that children affected by an earthquake in Indonesia before the age of five completed 0.7 years less of schooling and the negative effect is partly explained by an increase in child labor.

This paper also contributes to the literature that examines the effects of credit on child labor and schooling. Existing literature shows that access to credit, especially microfinance, can mitigate the negative impact of shocks on child's schooling (De Janvry et al. 2006, Guarcello et al. 2010, Kandulu et al. 2020). De Janvry et al. (2006) find that conditional cash transfer programs in Mexico helped protect school enrollment, whereas the program had little impact on child work. Guarcello et al. (2010) show that adverse shocks push children to work, while access to insurance increases education and reduces child labor. On the other hand, microcredit often leads to the establishment of home enterprises which require extra labor. Some research shows that an increase in entrepreneurship, followed by an increase in access to credit, can have an unintentional consequence and increase child labor (Islam and Choe 2013, Lakdawala 2018). By examining rainfall shocks in Tanzania, Dumas (2020) argues that shocks are likely to have a positive impact on child labor, and access to credit only reinforces this impact.

Lastly, findings from this paper are in line with and expand previous studies that examine the impact of the Yogyakarta earthquake. Previous studies find that natural disasters followed by efficient government responses can have non-negative impacts on household welfare as well as wage growth (Gignoux and Menéndez 2016, Kirchberger 2017). Using information from individuals affected by a set of earthquakes in Indonesia, Gignoux and Menéndez (2016) find that affected individuals experience short-term economic losses but recover in the medium run, and even exhibit income and welfare gains in the long term. Kirchberger (2017) finds that the 2006 Yogyakarta earthquake in Indonesia had a positive effect on wage growth for workers who were employed in the agricultural sector as labor shifted out of the agricultural sector into the construction sector. Further, De and Thamarapani (2022) find that subjective wellbeing levels declined for earthquake-affected individuals following the Yogyakarta earthquake and the effects persisted into the medium term. Our finding is largely in line with the existing literature, especially Kirchberger (2017), as we also find that the Yogyakarta earthquake led to labor market reallocation away from agriculture. We complement the study by showing the impact of micro-credit that facilitated this shift.

This study stands out from the previous literature largely in three aspects. First, the existing studies have mainly focused on the labor market and household wealth outcomes following a natural disaster, while this paper looks at human capital outcomes, especially child labor and credit through which a natural disaster affects education. Second, this study investigates the medium-term effects eight years after the earthquake occurred. By looking at the medium-term effects, we can shed light on the persisting effects of a negative income shock on children's human capital outcomes. Lastly, this study looks into the differential impacts by access to credit and finds that children from earthquake-affected households with access to credit are more likely to reduce their schooling.

The remainder of the paper proceeds as follows. Section 2 describes the background, Section 3 introduces the data, and Section 4 presents the empirical strategy. Section 5 reports the main findings and Section 6 discusses the potential mechanisms. We conduct several robustness checks in Section 7 and Section 8 concludes.

# 2 Background

## *2.1 Yogyakarta Earthquake*

Indonesia, a Southeast Asian country composed of many volcanic islands, has endured numerous natural disasters including earthquakes, tsunamis, and volcanic eruptions. As the country is located between several tectonic plates, the country has especially experienced a large number of earthquakes.

The Yogyakarta earthquake, which occurred on May 26, 2006, has been one of the major earthquakes with a magnitude of 6.3 that killed more than 5,000 people and injured more than 36,000. The damage caused by the earthquake was particularly large compared to its magnitude as the earthquake affected densely populated areas and the duration of strong shaking was unusually long. The housing sector was especially affected destroying over 280,000 homes, and many home-based small and medium-sized firms were destroyed (Java Reconstruction Fund 2007). The earthquake affected two provinces, Central Java and Yogyakarta. The districts that were affected by the earthquake are Bantul, Solo, Yogyakarta, Pati, and some parts of Semarang. The total damage was estimated at about 3.1 billion dollars. Appendix Figure A1 shows the intensity map where red-shaded areas indicate the region most severely affected.

The reconstruction and rehabilitation activities were swift. According to the Java Reconstruction Fund (2007), 52% of affected houses were rebuilt by March 2007, and some communities were able to experience public infrastructures with better living conditions than before including new village roads, water supply facilities, and sanitation facilities. The region affected by the Yogyakarta earthquake is known for home-based enterprises, and around 95% of those enterprises reported complete or partial destruction of their business assets (Java Reconstruction Fund 2007). In order to help the small business owners affected by the earthquake, micro-credits were provided for 15,000 earthquake-affected micro, small and medium enterprises. The 2007 Indonesia Family Life Survey (IFLS) data corroborate that communities affected by the earthquake enjoyed better infrastructure, including new roads and hospitals. As shown in Appendix Table A1, 30% of communities that experienced the earthquake with intensity five or above reported that they enjoyed new road openings during the 2007 IFLS. Gignoux and Menéndez (2016) argue that these improvements could have possibly led to improved businesses productivity.

## 2.2 *Micro-finance Institutions in Indonesia*

Following the earthquake, donor agencies tried to help earthquake-affected households in Yogyakarta by providing microloans. As a result, more than five million USD was disbursed to microfinance institutions in the region, especially the People's Credit Bank (BPR) (Khan 2012). Unlike commercial banks, the BPR is a rural bank with limited business activities under the Banking Law of Indonesia. The main objective of the BPR is to provide loans for micro and small businesses and serve low-income population with branches in remote and rural areas in Indonesia. In total, there are 1,600 BPRs with 6,225 branches within Indonesia as of 2019 (International Labor Organization 2019). One thing to note is that unlike other developing countries, NGO-based microfinance institutions play only a limited role in Indonesia (Goenka and Henley 2013), and therefore, BPRs play an important role in providing loans for small-business owners.

As shown in Appendix Table A2, there was a large increase in the number of communities with BPR in 2007 following the earthquake, especially in earthquake-affected regions. While 20% of communities in the Yogyakarta region had a BPR within their village in 2000, the percentage increased to 50% in 2007. This large increase in microfinance institutions following the earthquake helped more than 15,000 earthquake-affected micro, small and medium enterprises (Khan 2012).

# 3 Data

We test our hypothesis with data mainly from the Indonesia Family Life Survey (IFLS), a large-scale household panel survey, to measure the impact of an Indonesian earthquake on various household and individual outcomes. In total, there are five waves of the IFLS – the first wave was conducted in 1993, and follow-ups took place in 1997, 2000, 2007, and 2014. The sample is representative of about 83% of the Indonesian population and contains over 7,000 households living in 13 of the 27 provinces in the country. One important aspect of this survey is that attrition rates are extremely low, which makes it easier to track the longer-term impact of the Yogyakarta earthquake.

The IFLS contains detailed socio-economic information including consumption and asset information at the household level and detailed education and work status information at the individual level. The IFLS also contains community-level information including the availability of banking institutions, physical and social environments, and access to health and educational facilities. We use household-level information on ownership of assets and access to credit, and individual-level information on children's school and work activities.

We measure schooling in Indonesia for children 7-14 years of age using two variables - currently attending school and years of education. The latter variable, years of education, reflects past interruptions to schooling, which shows how households may respond to shocks and alter their children's schooling.[1] For the child labor variable, we were not able to use the child labor module (DL4 section) as the questions were updated after 2000, and thus were not comparable across the three waves (2000, 2007, and 2014). Instead, the child labor variable is created using a variable from the household roster section (AR section) and takes value one if a child was primarily working in the past week. For this reason, our measure of child labor may underestimate the actual child work participation rate in Indonesia.[2]

We examine the impact of the 2006 Yogyakarta earthquake by employing a difference-in-differences strategy using the 2000, 2007, and 2014 IFLS data sets. The 2007 IFLS was conducted from November 2007 to April 2008, nearly two years following the Yogyakarta earthquake, and we estimate the short-term effects of the earthquake on child enrollment as well as child labor while the reconstruction activities are taking place. Using the 2014 IFLS, we examine the medium-term effects of the earthquake approximately 8 years after the earthquake. We use geophysical information at the community level to match households to the earthquake intensity in 2006.

To measure exposure to the earthquake, we use data on the intensity of the Yogyakarta earthquake from the United States Geological Survey (USGS). In particular, we use the ShakeMap to estimate the modified Mercalli intensity at each village in our sample. Figure A1 shows the intensity map using data from the USGS. We define high-intensity regions as communities that experienced intensity levels five or above using data from the USGS. According to the USGS, a modified Mercalli intensity of five corresponds to moderate shaking where the earthquake is felt by nearly everyone and windows are broken. Considering the sample size, we use the cutoff of five to define earthquake-affected households. In total, 20 communities in our sample (490 households at baseline year 2000) were affected by the earthquake with intensities five or above.

[1] We follow Fitzsimons (2007) to create the years of education variable.

[2] While child labor has been decreasing in Indonesia in the past decade, child labor still remains a pressing challenge in the country. Approximately 7.9% of children aged 7-15 were estimated to be in employment in Indonesia in 2009 (International Labor Organization 2012). Children's involvement in work in rural areas (9.9%) is more prevalent than in urban areas (4.2%). Also, the majority of child workers in Indonesia (65.2%) are employed in the agricultural sector.

# 4 Empirical Strategy

## 4.1 Sample Selection

There are several islands within Indonesia, and each island has its distinct characteristics. For this reason, we restrict the sample to the Java Islands where Yogyakarta is located. One remaining concern after this sample restriction is that the communities affected by the earthquake are relatively urbanized compared to other communities in the Java Islands. The majority of households in the Yogyakarta region (62%) report to be residing in urban areas, compared to 54% for non-Yogyakarta regions within the Java Islands. This difference may lead to different household business choices, subsequently affecting children's school and work outcomes. For this reason, we further restrict the sample in order to select communities within the Java Islands that are comparable to the communities in Yogyakarta. Following Kirchberger (2017), we select 14 cities within the Java Islands with more than 250,000 residents. We draw circles around the 14 cities with a radius of 50km and all communities within the circles are included in our sample. Figure 1 shows the map of communities included in our sample. Red circles indicate the communities included in our sample, while yellow triangles indicate communities excluded from the sample.[3]

[Figure 1]

## 4.2 Identification Strategy

This paper exploits the exogenous nature of the earthquake to identify the short-term and medium-term impacts of the 2006 Yogyakarta earthquake. Under the assumption that communities affected by the Yogyakarta earthquake followed a parallel trend with those not affected by the earthquake, we use a difference-in-differences approach with multiple time periods, incorporating a time-varying treatment effects model, as explained in Wing

[3] In Section 7, we also use a propensity score matching approach to construct a valid comparison group and the result does not change significantly.

et al. (2018).[4] We use the following specification:

$$
\begin{aligned}
Y_{ijt} = \alpha + \beta_1 post_{2007} + \beta_2 post_{2014} + \beta_3 (midintensity)_j + \beta_4 (highintensity)_j + \\
\beta_5 (midintensity_j * post_{2007}) + \beta_6 (highintensity_j * post_{2007}) + \\
\beta_7 (midintensity_j * post_{2014}) + \beta_8 (highintensity_j * post_{2014}) + \\
X_{it} + \gamma_s + \varepsilon_{ijs}, \qquad (1)
\end{aligned}
$$

where $Y_{ijt}$ denotes the outcome variables of interest (education and child labor) for individual $i$ living in community $j$ at time period $t$, $midintensity_j$ equals to one if community $j$ was affected by the 2006 Yogyakarta earthquake with Mercalli Modified Intensity three or above and under five, and $highintensity_j$ equals to one if community $j$ was affected by the 2006 Yogyakarta earthquake with Mercalli Modified Intensity five or above. $Post_t$ equals to one if the survey was collected in 2007 (or 2014 for the medium-term effect), $X_{it}$ is a vector of individual and household-level control variables, and $\gamma_s$ is a district (kabupaten) fixed effect. In Equation (1), by excluding the base year 2000, the event time coefficients ($beta_5$ to $beta_8$) are designed to quantify the earthquake's impact compared to the year before the earthquake. This approach enables us to analyze the percentage change in key outcomes in the treatment regions between 2000 and 2007 (or 2014) relative to the control regions.

Even after the sample selection described in Section 4.1, there could be differences in local labor market conditions that affect households' business choices, which could subsequently affect child labor and schooling outcomes. To address this concern, we additionally control for community characteristics, including the presence of paved roads, factories, community crops, and common livestock within a community at the baseline.[5]

The measure of earthquake intensity is crucial for correctly estimating the effects. As

[4]Similar event study models have been employed in other research, including Kleven et al. (2019) and Gathmann et al. (2020).

[5]The full list of control variables include child age, child age squared, gender, religion, rural/urban location, the household head's literacy, access to electricity, presence of paved roads, factories, community crops, common livestock, BRI, and commercial banks within a community.

previously explained, we define an earthquake-treated region as communities that experienced intensity five or above using data from the USGS. This cutoff is applied considering the sample size as well as the level of destruction. We have chosen to compare the earthquake-treated region to communities that experienced intensities lower than three to overcome any concerns that the region is still affected by the earthquake. In total, there are 20 communities (490 households in 2000) that were affected by the earthquake with intensities five or above.

### *4.3 Summary Statistics*

Table 1 compares the household characteristics at the baseline year (2000) by earthquake intensity. After the sample selection reported in Section 4.1, households not affected by the earthquake share similar demographic and socio-economic characteristics with earthquake-affected households. 19% of households are female-headed, and households heads have, on average, five years of education. The majority of households (60%) are residing in urban areas. More than 80% of household heads are working and 50% of them run non-farm businesses.

[Table 1]

### *4.4 Attrition*

There are concerns that households affected by the earthquake might leave their communities, which might bias the results. One benefit of using a panel survey is that we can track individuals who moved to another area following the earthquake. In this sub-section, we examine the characteristics of households that decided to migrate following the earthquake and test differences in observable characteristics between migrants and non-migrants. We construct a variable that equals one if households in our sample moved to another district after the year 2000. Only 1.09% of the households have moved to another district since the year 2000 – 1.1% of the households living in communities affected by the earthquake with an intensity lower than five and 0.9% of households in communities affected by the earthquake with an intensity five or above. As shown in Appendix Table A3, movers are less likely to own a business and less likely to involve child labor. There is a trade-off from including or excluding the movers from the sample. First, including the movers can result in compositional change. At the same time, excluding the movers can result in sample selection and non-random attrition. While we include movers when presenting our main results, we also exclude households that moved to another community since 2000 in Appendix Table A4 and confirm that the results do not differ.

### *4.5 Parallel Trend*

Although we exploit the exogenous nature of the earthquake, it is important to ensure that villages affected by the earthquake follow a similar trajectory relative to the villages not affected by the earthquake in terms of our main outcome variables. In order to test the parallel trend, we follow the standard method from the literature, which is to run placebo regressions before the earthquake. In Table 2, we compare outcomes in the year 2000 and 1997 to those in 1993. We implement the placebo test for our main outcome variables, including (i) ownership of farmland, (ii) ownership of non-farm businesses, (iii) asset index, and (iv) school enrollment. The 1993 questionnaire does not include a question on child labor, and for this reason, we are not able to check the parallel trend for child labor. **To address this limitation and to better control for potential selection bias, we apply propensity score matching methods with an event study approach to report our main results.**

In all cases, the coefficient for the interaction term between the year dummy (including 1997 and 2000) and the high-intensity dummy is statistically indistinguishable from zero. This result supports our assumption that regions affected by the earthquake follow the same trajectory as regions not affected by the earthquake prior to the 2006 Yogyakarta earthquake. One concern is the potential impact of the 1997 Asian Financial Crisis, which could invalidate our empirical strategy if the treatment regions were differently affected by the crisis from the control regions. While Table 2 suggests no differential impact of the Asian Financial Crisis in terms of our outcomes of interest, we further argue that this concern is less of a problem in our study for two reasons. First, previous studies find that urban households in Indonesia were more severely affected by the Asian Financial Crisis (Friedman and Levinsohn 2002). As we restrict our sample to households living in relatively urbanised communities, there is little rural-urban difference in our sample. Also, when we exclude Jakarta, the region that was most affected by the Asian Financial Crisis, from our analysis, we find consistent results (Appendix Tables A8 and A9).

[Table 2]

# 5 Results

## *5.1 Human Capital*

Table 3 presents the impact of the earthquake on schooling and child labor outcomes based on equation (1). Overall, we find a decline in schooling and an increase in child labor for earthquake-affected children between 7 and 14 years of age. After the Yogyakarta earthquake, there is a drop in years of education for children aged 7-14 by 0.53 years in the short term and by 0.45 years in the medium term. While the coefficient for children currently at school is negative, it is not statistically significant in the short term. The medium-term results show that the negative impact on schooling persists eight years after the earthquake. Child labor increases by 2.2 and 2.3 percentage points in the short and medium term. This is a significant increase considering that only 2% of children were employed in child labor at baseline. One thing to note is that this measure may be a lower bound for the actual child labor participation, as the child labor indicator is derived upon whether the child worked during the previous week.

[Table 3]

Natural disasters may have differential impacts on child education by gender, partly due to the gendered division of child labor. Takasaki (2017) finds that cyclones in rural Fiji lowered boys' schooling more than girls, as boys were more likely to be involved in child farm labor. Consistent with the literature, we find that boys were more likely to be involved in child labor and experience a decrease in years of education compared to girls in the short term. Explain better why boys are more likely to be affected.

[Table 4]

We find little difference in the earthquake's impact on education outcomes by household head's education.

[Table 5]

# 6 Mechanisms

Until this section, we investigate the impact of the Yogyakarta earthquake on children's school and work activities and find that the negative impact of the earthquake persists into the medium term. The lasting effects of the earthquake on human capital outcomes are surprising, especially given the fact that reconstruction activities were swift and earthquake-affected households did not experience a significant decline in their wealth index following the earthquake. To shed light on this puzzle, we explore the different mechanisms through which the earthquake could have affected children's school and work activities. The four main channels include (1) income shock, (2) reconstruction activities, especially the roll-out of microcredit, (3) school destruction, and (4) the health status of children.

## 6.1 *Ownership of Productive Assets and Income Shock*

First, we examine how the earthquake affected households' ownership of productive and general assets based on equation (1). One noticeable observation in Table 6 is that households affected by the earthquake are more likely to own non-farm businesses immediately after the earthquake. Two years after the earthquake, earthquake-affected households are 6.8 percentage points more likely to own a non-farm business. Our findings corroborate previous literature, which shows that adverse shocks trigger self-employment. Existing studies find that households affected by shocks or prolonged illness are likely to switch from the agricultural sector into starting non-farm businesses (Rijkers and Söderbom 2013, Adhvaryu and Nyshadham 2017).

[Table 6]

Previous studies show that households may use extra labor in case of a negative income shock. Provided that parents from poor households are more likely to reduce schooling of children and increase child labor in face of an income shock, we expect poor children to be more affected by the earthquake. To test this hypothesis, we explore the heterogeneous impacts by asset index. Consistent with our expectations, Table 7 shows that children from households with below-median assets were more likely to reduce their schooling and engage in child labor following the earthquake.

[Table 7]

### 6.2 *Reconstruction Program: Microfinance*

In face of a negative income shock, parents may decide to smooth consumption by reducing schooling of their children and increasing child labor. At the same time, poverty may not necessarily be the primary cause of child labor (Basu et al. 2010). In order to achieve a deeper understanding of the parental responses to a negative income shock, we conduct heterogeneity analysis by access to credit. We are primarily interested in understanding the role of loan or microfinance in mitigating the negative impact of the earthquake. In our study, we measure access to finance following Gertler et al. (2009) by using the distance to banks or microfinance institutions. In Indonesia, there are mainly two types of banks, Bank Rakyat Indonesia (BRI) and People Credit Bank (BPR). BRIs provide financial services for relatively less poor and non-poor households, while BPRs primarily aim to provide loans for micro-enterprise owners. Following the earthquake, donor agencies, including the German Agency for Technical Cooperation (GTZ), tried to help micro and small business owners in Yogyakarta by providing funds mainly to BPRs (Khan 2012). Since we are interested in the mitigating impact of loans provided to micro-enterprises following the earthquake, we create a dummy variable taking value one if the household is located within a community with a BPR (or within 1 km from a community with a BPR) and zero otherwise.

#### 6.2.1 *Access to Loan before the Earthquake*

We first analyze if living close to a BPR indeed increases the likelihood of receiving loans and explore the purpose for which the loans were received. As shown in Table 10, if households live within a community with a BPR (or within 1 km from a community with a BPR), they are 10.5 percentage points more likely to know a place to borrow money, and 7.8 percentage points more likely to borrow money in the past 12 months. In addition, those households are 3.1 percentage points more likely to receive loans for their business. These findings derive from the IFLS 2000 data, illustrating borrowing behavior prior to the earthquake.

[Table 10]

#### 6.2.2 *Impact on Business*

Table 11 shows the heterogeneous impact on ownership of farm and non-farm businesses by access to credit. As shown in Table 11, households affected by the earthquake with access to credit are more likely to own a business in both the short and medium terms. At the same time, households that were affected by the earthquake but did not have access to credit are more likely to engage in a farm business in the short run.

One noticeable observation is that earthquake-affected households that do not live close to a bank are also likely to own a business in the medium term (i.e., eight years after the earthquake). This finding suggests that living close to a bank may be important immediately after the earthquake, while there is little difference in the medium term.

[Table 11]

#### 6.2.3 *Loans, Education and Child Labor*

We turn to the relationship between access to credit and the impact of the earthquake on children's school and work activities. Table 12 shows that when having access to credit, years of schooling decrease by 0.64 years in the short term, and school attendance declines by 12 and 10 percentage points in both the short and medium terms among children most affected by the earthquake. Column (5) shows that when having access to credit, child labor increases by around 8 percentage points in the short term and medium term. Recall that earthquake-affected households that do not live close to a BPR are also likely to open up a non-farm business in the medium term (Table 11). Consistent with this finding, the households that opened up non-farm businesses in the medium term are more likely to be engaged in child labor in the medium term. These findings substantiate our hypothesis that households that opened up businesses following the earthquake required extra labor, and thus relied on child labor and reduced schooling for their children.

Our study in general shows that children under 15 who were affected by the earthquake were more likely to be working when the household had increased access to credit. This result seems counter-intuitive at first as we expect households to use child labor as a means to smooth consumption. At the same time, following the Yogyakarta earthquake, most of the loans were provided to help micro-entrepreneurs reopen their businesses. Those with access to credit were more likely to restart their business and receive help from their children, while those without access to microfinance were less likely to restart their businesses and thus did not need extra help from their children.

[Table 12]

### 6.3 *Other Mechanisms*

Following a large-scale natural disaster, such as the Yogyakarta earthquake, school infrastructures and facilities are destroyed, which could lead to lower school attendance.

We compare the number of schools that were destroyed following the earthquake between the earthquake-affected communities and non-affected communities. As shown in Table 8, in the short term there is no effect on the number of schools. This may stem from the fact that destroyed schools were swiftly rebuilt following the earthquake prior to the 2007 IFLS data collection. Eight years after the earthquake, there is a large and significant increase in the number of primary schools and senior high schools as shown in columns (1) and (3) of Table 8. This finding suggests that school destruction is not the main mechanism for the persisting effects of the Yogyakarta earthquake on children's school and work activities.

[Table 8]

Large-scale natural disasters can negatively affect children's health, which can subsequently lead to worse schooling outcomes (Almond and Currie 2011, Thamarapani 2021). In this sub-section, we examine if the earthquake led to worse health outcomes among children using three outcome variables – (1) if a child is unhealthy; (2) the number of days spent in bed due to poor health in the past four weeks; and (3) if a child's health has worsened compared to 12 months ago. As shown in Table 9, none of the results are significant, and thus, we cannot confirm if the worse schooling outcomes were driven by poor health of children.

[Table 9]

# 7 Robustness Check

## *7.1 Alternative Sample Selection*

The reason behind the sample selection used in this paper is that Yogyakarta region is more urbanised compared to other areas in the Java Islands. One concern is that due to this sample selection, communities in the control areas could be located far away from communities in the high-intensity regions. This may be problematic if there are unobserved local labor market conditions that affect household's business choices, and consequently the children's human capital outcomes, even though households in the sample share similar characteristics as shown in Table 1. While we control for community characteristics, we also conduct additional analysis using a propensity score matching approach. To construct a valid comparison group to the treatment group of interest, we use the single nearest-neighbour within a caliper of 0.001 imposing common support. Using different matching algorithms such as kernel and radius matching or increasing/decreasing the number of neighbours does not significantly change the main results. Table A5 shows the differences between highly affected households and control households. After the matching most variables become balanced between them except for the working status and ownership of fridge. Appendix Tables A6 and A7 show that the results are consistent when using this approach.

Another concern of our sample selection is that the control group includes households living in the capital city, Jakarta, and these households may have different characteristics and experience different local labor market conditions. For this reason, we exclude Jakarta from our sample and run the same analyses. We confirm that our story holds even when we exclude Jakarta from the sample (Appendix Tables A8 and A9).

## *7.2 Randomization Test*

As a falsification test, we randomly assign earthquake intensity to communities and run the same specification on schooling and child labor. Figures 2 and 3 show the distribution of coefficients for schooling and child labor from 1,000 iterations. Both of the distributions are centered at zero which suggest that it is unlikely that a misspecified model is driving our results.

[Figure 2 and 3]

# 8 Conclusion

In this paper, we use an exogenous shock that happened in Indonesia to understand how children's school and work activities change following shocks and how the relationship differs by access to credit. In particular, we study the impact of the 2006 Yogyakarta earthquake, followed by large reconstruction programs, on education and child labor in Indonesia. In case of the Yogyakarta earthquake, the affected regions are known to be centers for artisanal and other producing small and micro enterprises, and thus, a large percentage of affected households were small business owners. To increase access to credit for these households, a large-scale microfinance program was rolled out following the earthquake. We find that after the Yogyakarta earthquake the education level decreased among children under 15 and they were more likely to be working. This effect was observed especially among households with access to credit and those that run a family-owned business. This finding suggests that the micro-loans rolled out following the earthquake had an impact on households to restart their family-based business, and in turn led households to rely on child labor. In accordance with the existing studies on child labor in developing countries, our findings suggest that poverty may not necessarily be the primary cause of child labor and child labor may increase with asset ownership.

Our study provides policy implications for the way in which limited resources should be effectively spent after natural disasters. In the aftermath of a natural disaster, many countries implement different policies and packages to recover the affected industries, including cash grants, wage subsidies, and increasing access to credit. In the case of the Yogyakarta earthquake, a special policy was implemented to help micro-entrepreneurs, one of the most affected by the earthquake, increase access to credit. The micro-loans that were rolled out following the earthquake had a positive impact on households to restart their home-based business, and in turn led households to rely on child labor. Our findings suggest important policy implications for the way in which reconstruction aid should be given in the aftermath of a natural disaster. One policy that can be considered is attaching conditions related to schooling when providing micro-loans for households with children under 15.

# References


Adhvaryu, A. and Nyshadham, A. (2017). Health, enterprise, and labor complementarity in the household. *Journal of Development Economics*, 126:91–111.

Almond, D. and Currie, J. (2011). Killing me softly: The fetal origins hypothesis. *Journal of Economic Perspectives*, 25(3):153–72.

Alvi, E. and Dendir, S. (2011). Weathering the storms: Credit receipt and child labor in the aftermath of the great floods (1998) in Bangladesh. *World Development*, 39(8):1398–1409.

Augsburg, B., De Haas, R., Harmgart, H., and Meghir, C. (2015). The impacts of microcredit: Evidence from Bosnia and Herzegovina. *American Economic Journal: Applied Economics*, 7(1):183–203.

Baez, J., De la Fuente, A., and Santos, I. V. (2010). Do natural disasters affect human capital? An assessment based on existing empirical evidence. *IZA Discussion Paper*, No. 5164.

Baez, J. E., Lucchetti, L., Genoni, M. E., and Salazar, M. (2017). Gone with the storm: rainfall shocks and household wellbeing in Guatemala. *The Journal of Development Studies*, 53(8):1253–1271.

Basu, K., Das, S., and Dutta, B. (2010). Child labor and household wealth: Theory and empirical evidence of an inverted-U. *Journal of Development Economics*, 91(1):8–14.

Beegle, K., Dehejia, R. H., and Gatti, R. (2006). Child labor and agricultural shocks. *Journal of Development Economics*, 81(1):80–96.

De, P. K. and Thamarapani, D. (2022). Impacts of negative shocks on wellbeing and aspirations–evidence from an earthquake. *World Development*, 154:105876.

De Janvry, A., Finan, F., Sadoulet, E., and Vakis, R. (2006). Can conditional cash transfer programs serve as safety nets in keeping children at school and from working when exposed to shocks? *Journal of Development Economics*, 79(2):349–373.

Dumas, C. (2020). Productivity shocks and child labor: The role of credit and agricultural labor markets. *Economic Development and Cultural Change*, 68(3):763–812.

Fitzsimons, E. (2007). The effects of risk on education in Indonesia. *Economic Development and Cultural Change*, 56(1):1–25.

Friedman, J. and Levinsohn, J. (2002). The distributional impacts of indonesia's financial crisis on household welfare: A "rapid response" methodology. *The World Bank Economic Review*, 16(3):397–423.

Gathmann, C., Helm, I., and Schönberg, U. (2020). Spillover effects of mass layoffs. *Journal of the European Economic Association*, 18(1):427–468.

Gertler, P., Levine, D. I., and Moretti, E. (2009). Do microfinance programs help families insure consumption against illness? *Health Economics*, 18(3):257–273.

Gignoux, J. and Menéndez, M. (2016). Benefit in the wake of disaster: Long-run effects of earthquakes on welfare in rural Indonesia. *Journal of Development Economics*, 118:26–44.

Gignoux, J., Menéndez, M., and Music, A. (2017). In the wrong place, at the wrong time: Long-run effects of income shocks on children's education and health outcomes. Technical report, Working paper 25, ECINEQ.

Goenka, A. and Henley, D. (2013). *Southeast Asia's credit revolution: from moneylenders to microfinance*. Routledge.

Guarcello, L., Mealli, F., and Rosati, F. C. (2010). Household vulnerability and child labor: the effect of shocks, credit rationing, and insurance. *Journal of Population Economics*, 23(1):169–198.

Heger, M. P. and Neumayer, E. (2019). The impact of the Indian ocean tsunami on Aceh's long-term economic growth. *Journal of Development Economics*, 141:102365.

Islam, A. and Choe, C. (2013). Child labor and schooling responses to access to microcredit in rural Bangladesh. *Economic Inquiry*, 51(1):46–61.

Jacoby, H. G. and Skoufias, E. (1997). Risk, financial markets, and human capital in a developing country. *The Review of Economic Studies*, 64(3):311–335.

Kandulu, J., Wheeler, S., Zuo, A., and Sim, N. (2020). The impact of microcredit loans on school enrolment in bangladesh. *The Journal of Development Studies*, 56(9):1725–1744.

Khan, S. (2012). Disaster response and preparedness: From innovations to good practice-Java Reconstruction Fund (JRF) Final Report 2012. Technical report, The World Bank.

Kirchberger, M. (2017). Natural disasters and labor markets. *Journal of Development Economics*, 125:40–58.

Kleven, H., Landais, C., and Søgaard, J. E. (2019). Children and gender inequality: Evidence from denmark. *American Economic Journal: Applied Economics*, 11(4):181–209.

Lakdawala, L. (2018). From loans to labor: Access to credit, entrepreneurship, and child labor. *Entrepreneurship, and Child Labor (July 10, 2018)*.

Rijkers, B. and Söderbom, M. (2013). The effects of risk and shocks on non-farm enterprise development in rural Ethiopia. *World Development*, 45:119–136.

Rodriguez-Oreggia, E., De La Fuente, A., De La Torre, R., and Moreno, H. A. (2013). Natural disasters, human development and poverty at the municipal level in mexico. *The Journal of Development Studies*, 49(3):442–455.

Takasaki, Y. (2017). Do natural disasters decrease the gender gap in schooling? *World Development*, 94:75–89.

Thamarapani, D. (2021). Natural disasters and child health. *Environment and Development Economics*, 26(1):26–44.

Wing, C., Simon, K., and Bello-Gomez, R. A. (2018). Designing difference in difference studies: best practices for public health policy research. *Annual review of public health*, 39:453–469.

# Tables and Figures

Table 1: Summary Statistics

| | (1) Control | (2) High-Intensity | (3) Difference |
|---|---|---|---|
| female-headed household | 0.189 | 0.196 | 0.177 |
| | [0.010] | [0.027] | |
| years of education | 5.237 | 5.178 | 0.391 |
| | [0.165] | [0.278] | |
| working | 0.845 | 0.878 | 0.125 |
| | [0.010] | [0.020] | |
| urban/rural status | 0.620 | 0.610 | 0.476 |
| | [0.051] | [0.124] | |
| own business | 0.503 | 0.494 | 0.730 |
| | [0.017] | [0.039] | |
| access to electricity | 0.964 | 0.980 | 0.076* |
| | [0.013] | [0.007] | |
| have pipe water | 0.322 | 0.118 | 0.211 |
| | [0.036] | [0.040] | |
| have fridge | 0.178 | 0.104 | 0.678 |
| | [0.020] | [0.024] | |
| Number of households | 2,546 | 490 | |

*Notes:* Data from the 2000 IFLS household survey. "Control" refers to communities that experienced Mercalli Intensity less than three from the Yogyakarta earthquake and "High-Intensity" refers to communities that experienced intensity higher than five from the earthquake. Standard deviations are reported in brackets. Column (3) reports the p-value from the test of equality between columns (1) and (2).

Table 2: Placebo Test on 1993-2000

| | (1) Own farmland | (2) Own business | (3) Asset index | (4) Attend school (7-14) |
|---|---|---|---|---|
| High*1997 | -0.041 | 0.030 | -0.127 | 0.003 |
| | (0.030) | (0.042) | (0.137) | (0.024) |
| High*2000 | -0.067* | -0.050 | 0.129 | -0.011 |
| | (0.035) | (0.042) | (0.139) | (0.032) |
| Observations | 7,857 | 7,857 | 7,840 | 5,577 |
| R-squared | 0.753 | 0.712 | 0.598 | 0.452 |

*Notes:* "High" indicates households living in communities that were affected by the 2006 Yogyakarta earthquake with intensity over five. Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We also include district fixed effects and standard errors are clustered at the community level. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Impact of Earthquake on Child Outcomes

| | (1) Currently at school | (2) Years of education | (3) Child labor |
|---|---|---|---|
| (Intensity over 5)*year2007 | -0.026 | -0.536*** | 0.022* |
| | (0.018) | (0.164) | (0.013) |
| (Intensity over 5)*year2014 | -0.077*** | -0.451** | 0.023*** |
| | (0.023) | (0.199) | (0.006) |
| Observations | 4,603 | 4,603 | 4,626 |
| R-squared | 0.077 | 0.695 | 0.036 |
| Mean of dependent variable | 0.927 | 4.275 | 0.019 |

*Notes:* Sample includes children aged 7 to 14 years old. The variable "child labor" takes value one if the child's main activity in the past week was working. Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We also include district fixed effects and standard errors are clustered at the community level. Mean of dependent variable reports the mean value of the dependent variable in year 2000. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Impact of Earthquake on Child Outcomes by Gender

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Currently at school | | Years of education | | Child labor | |
| | *boy* | *girl* | *boy* | *girl* | *boy* | *girl* |
| (Intensity over 5)*year2007 | -0.009 | -0.043 | -0.677*** | -0.351 | 0.038* | 0.006 |
| | (0.025) | (0.028) | (0.185) | (0.285) | (0.021) | (0.015) |
| (Intensity over 5)*year2014 | -0.070** | -0.083*** | -0.718*** | -0.148 | 0.022*** | 0.024*** |
| | (0.035) | (0.024) | (0.240) | (0.249) | (0.008) | (0.009) |
| Observations | 2,295 | 2,308 | 2,295 | 2,308 | 2,308 | 2,318 |
| R-squared | 0.066 | 0.107 | 0.724 | 0.672 | 0.035 | 0.051 |
| Mean of dependent variable | 0.937 | 0.918 | 4.160 | 4.389 | 0.0167 | 0.0228 |

*Notes:* Sample includes children aged 7 to 14 years old. The sample for odd columns includes boys and the sample for even columns includes girls. The variable "child labor" takes value one if the child's main activity in the past week was working. Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We also include district fixed effects and standard errors are clustered at the community level. Mean of dependent variable reports the mean value of the dependent variable in year 2000. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Impact of Earthquake on Child Outcomes by Household Head's Education

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Currently at school | | Years of education | | Child labor | |
| | *basic* | *educated* | *basic* | *educated* | *basic* | *educated* |
| (Intensity over five)*year2007 | -0.016 | 0.000 | -0.430* | -0.604*** | 0.030 | 0.004 |
| | (0.018) | (0.034) | (0.233) | (0.230) | (0.020) | (0.009) |
| (Intensity over five)*year2014 | -0.122*** | 0.007 | -0.430 | -0.326 | 0.030*** | 0.007 |
| | (0.040) | (0.014) | (0.277) | (0.245) | (0.009) | (0.008) |
| Observations | 3,382 | 1,221 | 3,382 | 1,221 | 3,396 | 1,230 |
| R-squared | 0.095 | 0.058 | 0.680 | 0.755 | 0.045 | 0.029 |
| Mean of dependent variable | 0.937 | 0.918 | 4.160 | 4.389 | 0.0167 | 0.0228 |

*Notes:* Sample includes children aged 7 to 14 years old. The sample for odd columns includes households where the household head's highest level of education is below secondary high. The sample for even columns includes households where the household head's highest level of education is secondary high or higher. The variable "child labor" takes value one if the child's main activity in the past week was working. Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We also include district fixed effects and standard errors are clustered at the community level. Mean of dependent variable reports the mean value of the dependent variable in year 2000. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Impact of Earthquake on Household Outcomes

| | (1)<br>Own farmland | (2)<br>Own business | (3)<br>Asset index |
|---|---|---|---|
| (Intensity over 5)*year2007 | 0.003 | 0.068** | 0.024 |
| | (0.024) | (0.030) | (0.116) |
| (Intensity over 5)*year2014 | -0.025 | 0.055 | -0.103 |
| | (0.027) | (0.040) | (0.094) |
| Observations | 9,226 | 9,226 | 9,226 |
| R-squared | 0.296 | 0.049 | 0.061 |
| Mean of dependent variable | 0.292 | 0.499 | -0.021 |

*Notes*: The asset index is created using principal component analysis from a list of household assets. Household assets include assets owned by household members that are not used for farm or non-farm business, including land, house, poultry, livestock, hard stem plant, vehicles, household appliances, savings, receivables, jewelry, and furniture. All regressions control for age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We also include district fixed effects and standard errors are clustered at the community level. Mean of dependent variable reports the mean value of the dependent variable in year 2000. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Impact of Earthquake on Education by Asset Index

| | (1)<br>Low | (2)<br>High | (3)<br>Low | (4)<br>High | (5)<br>Low | (6)<br>High |
|---|---|---|---|---|---|---|
| | Current school | | year education | | child labor | |
| (Intensity over 5)*year2007 | -0.051* | 0.014 | -0.523** | -0.419* | 0.017 | 0.029 |
| | (0.027) | (0.027) | (0.236) | (0.240) | (0.013) | (0.024) |
| (Intensity over 5)*year2014 | -0.106*** | -0.027 | -0.577** | -0.197 | 0.037*** | 0.005 |
| | (0.026) | (0.029) | (0.291) | (0.241) | (0.011) | (0.005) |
| *diff. for 2007* | 0.463 | | 0.707 | | 0.448 | |
| *diff. for 2014* | 0.049* | | 0.120 | | 0.009*** | |
| Observations | 2,460 | 1,999 | 2,460 | 1,999 | 2,475 | 2,006 |
| R-squared | 0.121 | 0.053 | 0.688 | 0.710 | 0.054 | 0.033 |
| Mean of dependent variable | 0.892 | 0.969 | 3.985 | 4.620 | 0.026 | 0.013 |

*Notes*: Odd columns (low) present results for households with below-median asset index, and even columns (high) present results for households with above-median asset index. We also report the p-values testing the difference between the two columns. The asset index is created using principal component analysis from a list of household assets. Household assets include assets owned by household members that are not used for farm or non-farm business, including land, house, poultry, livestock, hard stem plant, vehicles, household appliances, savings, receivables, jewelry, and furniture. Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We also include district fixed effects and standard errors are clustered at the community level. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: School Destruction

| | (1)<br>Num. primary | (2)<br>Num. junior | (3)<br>Num. senior |
|---|---|---|---|
| (Intensity over 5)*post2007 | -0.050 | -0.781 | -0.461 |
| | (1.801) | (0.975) | (1.081) |
| (Intensity over 5)*post2014 | 5.509*** | 0.443 | 3.236*** |
| | (1.802) | (0.965) | (1.070) |
| Observations | 410 | 408 | 407 |
| R-squared | 0.164 | 0.104 | 0.182 |

Table 9: Child Health

| | (1)<br>Child is unhealthy | (2)<br>Days in bed | (3)<br>Worse health |
|---|---|---|---|
| (Intensity over 5)*year2007 | -0.016 | 0.126 | -0.008 |
| | (0.029) | (0.134) | (0.032) |
| (Intensity over 5)*year2014 | 0.004 | -0.138 | -0.034 |
| | (0.028) | (0.138) | (0.022) |
| Observations | 4,578 | 4,576 | 3,959 |
| R-squared | 0.018 | 0.020 | 0.023 |
| Mean of dependent variable | 0.081 | 0.293 | 0.054 |

*Notes*: Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We also include district fixed effects and standard errors are clustered at the community level. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Access to Bank and Borrowing before the Earthquake

| | (1)<br>Tried to borrow | (2)<br>Loan | (3)<br>Borrowed for business |
|---|---|---|---|
| Access to bank | 0.105*** | 0.078*** | 0.031** |
| | (0.030) | (0.030) | (0.013) |
| Observations | 10,058 | 2,653 | 2,653 |
| R-squared | 0.067 | 0.070 | 0.033 |
| Mean of dependent variable | 0.207 | 0.190 | 0.0501 |

*Notes*: Results from the 2000 IFLS. Access to bank equals to 1 if a BPR exists within the community or within 1km from the community. Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road within community, presence of factory within community, presence of community crop within community, presence of common livestock within community, presence of BRI within community, and presence of commercial bank within community. We also include district fixed effects and standard errors are clustered at the community level. *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Impact of Earthquake on Business by Distance to Bank

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Bank | No Bank | Bank | No Bank | Bank | No Bank |
| | Own farmland | | Own business | | Asset index | |
| (Intensity over 5)*year2007 | 0.020 | 0.105** | 0.267*** | 0.044 | 0.951*** | -0.098 |
| | (0.078) | (0.053) | (0.057) | (0.048) | (0.296) | (0.125) |
| (Intensity over 5)*year2014 | -0.003 | -0.009 | 0.185** | 0.097* | 0.808** | -0.311** |
| | (0.075) | (0.051) | (0.070) | (0.053) | (0.345) | (0.142) |
| *diff. for 2007* | 0.645 | | 0.050** | | 0.032** | |
| *diff. for 2014* | 0.540 | | 0.969 | | 0.061* | |
| Observations | 2,041 | 6,362 | 2,041 | 6,362 | 2,040 | 6,359 |
| R-squared | 0.206 | 0.341 | 0.076 | 0.063 | 0.164 | 0.136 |
| Mean of dependent variable | 0.232 | 0.301 | 0.556 | 0.491 | 0.397 | 0.183 |

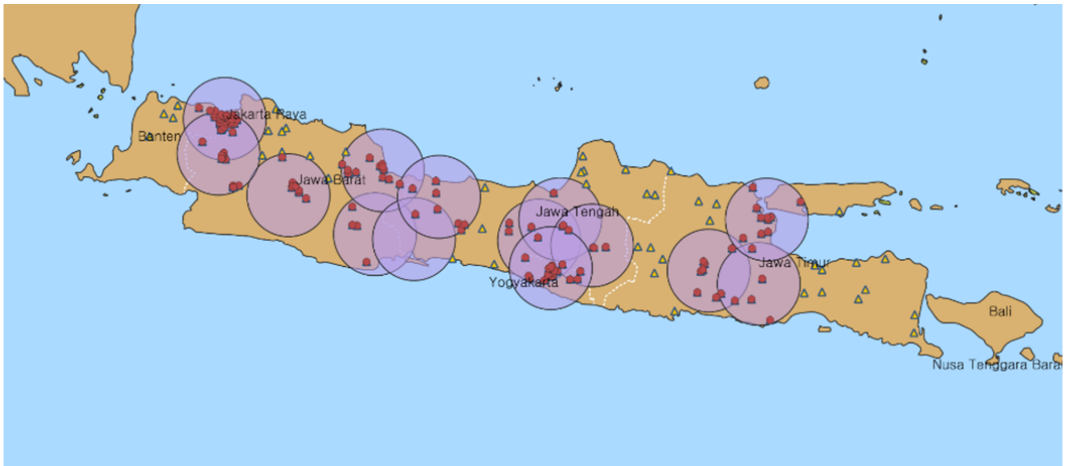
*Notes*: The asset index is created using principal component analysis from a list of household assets. Household assets include assets owned by household members that are not used for farm or non-farm business, including land, house, poultry, livestock, hard stem plant, vehicles, household appliances, savings, receivables, jewelry, and furniture. Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We report the p-values testing the difference between the two columns. We also include district fixed effects and standard errors are clustered at the community level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 12: Impact of Earthquake on Education by Distance to Bank

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Bank | No Bank | Bank | No Bank | Bank | No Bank |
| | Current school | | year education | | child labor | |
| (Intensity over 5)*year2007 | -0.118** | 0.010 | -0.648** | -0.213 | 0.084** | 0.004 |
| | (0.045) | (0.023) | (0.318) | (0.176) | (0.034) | (0.010) |
| (Intensity over 5)*year2014 | -0.103** | -0.090*** | -0.290 | -0.629*** | 0.079*** | 0.023*** |
| | (0.043) | (0.031) | (0.378) | (0.227) | (0.024) | (0.009) |
| *diff. for 2007* | 0.045** | | 0.334 | | 0.006*** | |
| *diff. for 2014* | 0.414 | | 0.602 | | 0.108 | |
| Observations | 857 | 3,186 | 388 | 1,390 | 402 | 1,377 |
| R-squared | 0.314 | 0.219 | 0.242 | 0.223 | 0.168 | 0.198 |
| Mean of dependent variable | 0.952 | 0.918 | 0.764 | 0.705 | 0.557 | 0.453 |

*Notes*: Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We report the p-values testing the difference between the two columns. We also include district fixed effects and standard errors are clustered at the community level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure 1: Sample Selection




Note: Red circles indicate communities included in our sample and yellow triangles indicate communities excluded from the sample.

Figure 2: Randomization Test for Child Labor

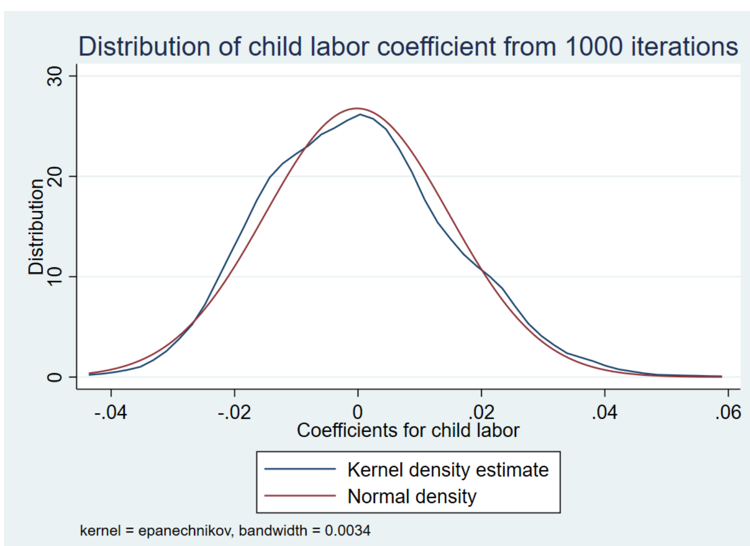
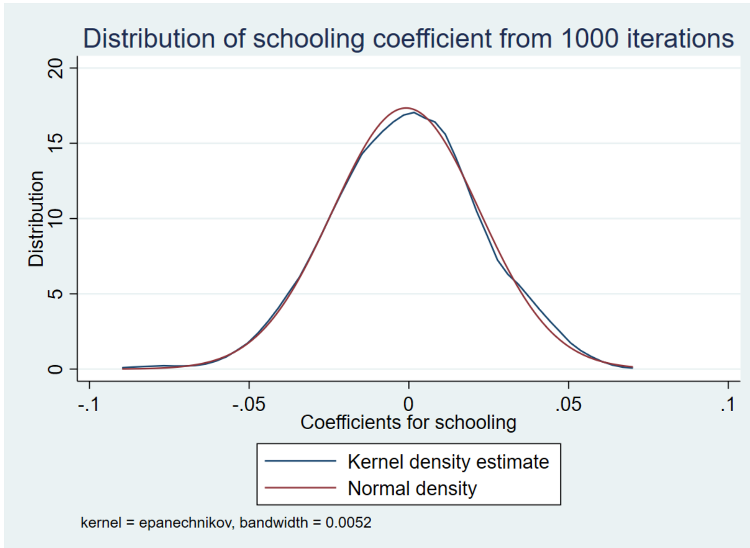


Figure 3: Randomization Test for Schooling




# Appendix

Table A1: Earthquake Intensity and New Community Events in 2007

| New Events in 2007 | New road | New hospital | New school |
|---|---|---|---|
| Intensity under 3 | 0.03 | 0.09 | 0.14 |
| Intensity 3-4 | 0.03 | 0.03 | 0.03 |
| Intensity 4-5 | 0.11 | 0.11 | 0.00 |
| Intensity over 5 | 0.30 | 0.20 | 0.10 |
| Total | 0.07 | 0.09 | 0.10 |
| Number of communities | 137 | 137 | 137 |

*Source:* IFLS Community 2007.

Table A2: Percentage of Communities with BPR

| BPR | 2000 | 2007 | 2014 |
|---|---|---|---|
| No intensity | 0.01 | 0.13 | 0.19 |
| Intensity 3-5 | 0.13 | 0.26 | 0.18 |
| Intensity over 5 | 0.20 | 0.50 | 0.30 |
| Total | 0.07 | 0.22 | 0.21 |
| Number of communities | 137 | 137 | 136 |

*Source:* 2000, 2007, and 2014 IFLS.
*Notes*: BPR (People's Credit Bank) operates as a rural bank in Indonesia, primarily focusing on offering loans to micro and small enterprises and catering to the low-income population.

Table A3: Attrition

| | (1) Non-mover | | (2) Mover | | T-test Difference |
|---|---|---|---|---|---|
| | N | Mean/SE | N | Mean/SE | (1)-(2) |
| Loan | 3003 | 0.156 | 33 | 0.212 | -0.056 |
| | | [0.010] | | [0.066] | |
| Own business | 3003 | 0.501 | 33 | 0.303 | 0.198*** |
| | | [0.015] | | [0.082] | |
| Own farmland | 3003 | 0.294 | 33 | 0.121 | 0.173 |
| | | [0.026] | | [0.055] | |
| Currently attending school | 2299 | 0.886 | 19 | 0.947 | -0.061 |
| | | [0.014] | | [0.048] | |
| Years of education | 1865 | 4.273 | 13 | 4.538 | -0.265 |
| | | [0.091] | | [0.721] | |
| Child working | 1909 | 0.020 | 13 | 0.000 | 0.020*** |
| | | [0.004] | | [0.000] | |

*Notes*: Data from the 2000 IFLS. "Mover" equals to one if the household moved to another district since 2000. Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We also include district fixed effects and standard errors are clustered at the community level. *** p<0.01, ** p<0.05, * p<0.1.

Table A4: Robustness Check: Excluding Movers

| | (1) Farmland | (2) Business | (3) Attend school | (4) Years of edu. | (5) Child labor |
|---|---|---|---|---|---|
| (Intensity over 5)*year2007 | 0.015 | 0.097*** | -0.025 | -0.517*** | 0.018 |
| | (0.024) | (0.027) | (0.019) | (0.165) | (0.011) |
| (Intensity over 5)*year2014 | -0.006 | 0.072* | -0.075*** | -0.547** | 0.020** |
| Observations | 7,566 | 7,566 | 4,102 | 4,102 | 5,656 |
| R-squared | 0.301 | 0.060 | 0.080 | 0.691 | 0.062 |

*Notes*: Excluding individuals that moved to another district since 2000. Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We also include district fixed effects and standard errors are clustered at the community level. *** p<0.01, ** p<0.05, * p<0.1.

Table A5: PSM Balance Test

| | Control | High-Intensity | Difference |
|---|---|---|---|
| female-headed household | 0.185 | 0.193 | 0.292 |
| | [0.007] | [0.027] | |
| years of education | 5.209 | 5.152 | 0.669 |
| | [0.118] | [0.273] | |
| working | 0.851 | 0.875 | 0.019** |
| | [0.007] | [0.020] | |
| urban/rural status | 0.512 | 0.609 | 0.811 |
| | [0.031] | [0.124] | |
| own business | 0.442 | 0.489 | 0.239 |
| | [0.012] | [0.038] | |
| access to electricity | 0.953 | 0.979 | 0.365 |
| | [0.017] | [0.007] | |
| have pipe water | 0.212 | 0.112 | 0.593 |
| | [0.036] | [0.041] | |
| have fridge | 0.159 | 0.100 | 0.058* |
| | [0.011] | [0.023] | |
| Number of households | 4,509 | 481 | |

*Notes:* Column (3) reports the p-value from testing the difference between columns (1) and (2). We include district fixed effects and standard errors are clustered at the community level. *** p<0.01, ** p<0.05, * p<0.1.

Table A6: PSM: Impact of Earthquake on Education

| | (1) Currently at school | (2) Years of education | (3) Child labor |
|---|---|---|---|
| (Intensity over 5)*year2007 | -0.045** | -0.583*** | 0.022 |
| | (0.018) | (0.168) | (0.013) |
| (Intensity over 5)*year2014 | -0.067** | -0.489** | 0.021*** |
| | (0.026) | (0.204) | (0.007) |
| Observations | 3,949 | 3,949 | 4,020 |
| R-squared | 0.074 | 0.714 | 0.038 |
| Mean of dependent variable | 0.921 | 4.164 | 0.023 |

*Notes:* Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We also include district fixed effects and standard errors are clustered at the community level. *** p<0.01, ** p<0.05, * p<0.1.

Table A7: PSM: Impact on Education by Distance to Bank

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Bank | No Bank | Bank | No Bank | Bank | No Bank |
| | Current school | | year education | | child labor | |
| (Intensity over 5)*year2007 | -0.094 | -0.013 | -0.663** | -0.278 | 0.069* | 0.004 |
| | (0.057) | (0.025) | (0.279) | (0.196) | (0.037) | (0.011) |
| (Intensity over 5)*year2014 | -0.049 | -0.072** | -0.362 | -0.639*** | 0.047* | 0.019** |
| | (0.058) | (0.033) | (0.343) | (0.239) | (0.024) | (0.009) |
| Observations | 894 | 3,055 | 894 | 3,055 | 914 | 3,106 |
| R-squared | 0.066 | 0.086 | 0.768 | 0.703 | 0.046 | 0.050 |
| Mean of dependent variable | 0.962 | 0.920 | 4.274 | 4.229 | 0.018 | 0.019 |

*Notes:* Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We also include district fixed effects and standard errors are clustered at the community level. *** p<0.01, ** p<0.05, * p<0.1.

Table A8: Excluding Jakarta: Impact of Earthquake on Education

| | (1) Currently at school | (2) Years of education | (3) Child labor |
|---|---|---|---|
| (Intensity over 5)*year2007 | -0.052*** | -0.756*** | 0.023 |
| | (0.019) | (0.176) | (0.014) |
| (Intensity over 5)*year2007 | -0.097*** | -0.735*** | 0.027*** |
| | (0.026) | (0.216) | (0.007) |
| Observations | 3,826 | 3,826 | 3,848 |
| R-squared | 0.091 | 0.707 | 0.037 |
| Mean of dependent variable | 0.922 | 4.153 | 0.0210 |

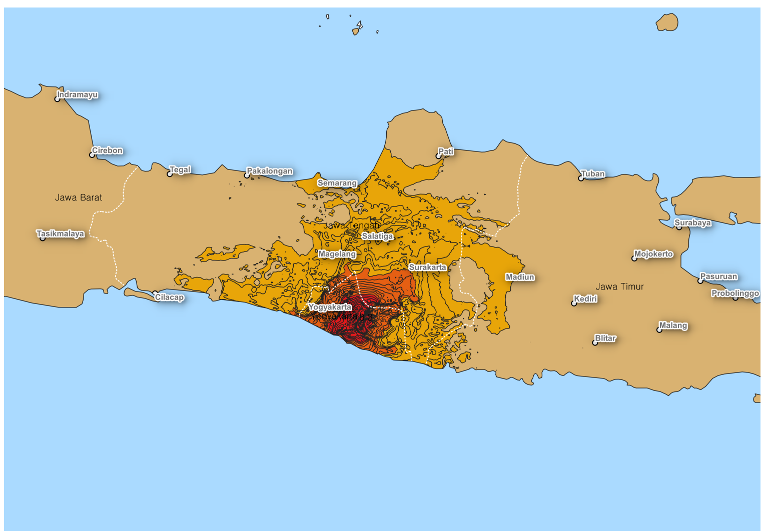
*Notes:* Sample excludes households residing in Jakarta. Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We also include district fixed effects and standard errors are clustered at the community level. *** p<0.01, ** p<0.05, * p<0.1.

Table A9: Excluding Jakarta: Impact on Education by Distance to Bank

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Bank | No Bank | Bank | No Bank | Bank | No Bank |
| | Current school | | year education | | child labor | |
| (Intensity over 5)*year2007 | -0.111** | -0.017 | -0.600* | -0.508** | 0.084** | 0.006 |
| | (0.043) | (0.024) | (0.311) | (0.197) | (0.035) | (0.012) |
| (Intensity over 5)*year2014 | -0.109** | -0.118*** | -0.331 | -1.013*** | 0.080*** | 0.027** |
| | (0.043) | (0.037) | (0.367) | (0.250) | (0.024) | (0.011) |
| Observations | 973 | 2,853 | 973 | 2,853 | 975 | 2,873 |
| R-squared | 0.083 | 0.102 | 0.765 | 0.693 | 0.042 | 0.049 |
| Mean of dependent variable | 0.962 | 0.917 | 4.362 | 4.125 | 0.016 | 0.021 |

*Notes:* Sample excludes households residing in Jakarta. Control variables include age of child, age of child squared, gender, religion, rural/urban location, household head's literacy, access to electricity, presence of paved road, factory, community crop, common livestock, BRI, and commercial bank within a community. We also include district fixed effects and standard errors are clustered at the community level. *** p<0.01, ** p<0.05, * p<0.1.

Figure A1: 2006 Yogyakarta Earthquake




Note: The map was created with QGIS using data from the U.S. Geological Survey. Darker shades indicate regions experiencing higher modified Mercalli intensity.