Can Human Capital Improve Firm Resilience in Financial Crises? Evidence from the 1997 Indonesian Crisis

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Abstract

Do returns to human capital rise during crises? This paper examines whether human capital accumulation from Indonesia's INPRES school construction program improved firm resilience during the 1997 Asian Financial Crisis. The crisis struck about a decade after the first generation exposed to INPRES, who gained higher educational attainment due to the program, entered the workforce. I compare changes in labor productivity following the crisis between manufacturing plants in districts with greater INPRES exposure and those with lower exposure. The results show that INPRES significantly improved post-crisis plant performance. Each additional INPRES school per 1,000 children in a plant's district led to a 2 percent increase in real output per worker, on average, after 1997, compared to what would have been expected otherwise. I also find that plants benefiting from INPRES-produced human capital engaged in greater skilled labor hoarding, likely due to the higher costs of replacing educated workers after the crisis.

JEL classification: O12, J24, D22, G01

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1 Introduction

There is a premium on human capital during economic crises (Schultz, 1975). To deal with the disequilibrium of a crisis, firms must reallocate resources, adjust production decisions, and adapt to new economic conditions while minimizing losses. Their ability to navigate the crisis successfully depends on the speed and effectiveness of these decisions. Firms often respond by laying off workers to cut costs, securing additional financing to maintain cash flow, or implementing technological and organizational changes (Guimbert and Oostendorp, 2016; Kwapil, 2010; Westergård-Nielsen and Neamtu, 2012). Since workers are responsible for making and executing these decisions, the strength of a firm's crisis response is inevitably shaped by their skills.

The role of worker characteristics in firm performance during recessions has received little attention in the economics literature. The standard view, dating back to Schumpeter (1939), is that the strongest, most efficient firms survive. A natural extension of this idea is that highly skilled workers contribute to this survival by helping firms adapt. Indeed, following Schultz's (1975) argument, one could argue that skills matter the *most* during periods of crises, as that is when they are tested to their limits. The impact of a plant manager's decision to optimize production, the speed and precision with which a machine operator adapts to new technology, and the ability of a procurement specialist to secure critical raw materials amid supply chain disruptions all become even more important in a crisis. When firms are on the brink of shutdown, these factors can determine whether they adapt and survive or fail.

To test this hypothesis, I examine the impact of Indonesia's INPRES school construction program on human capital formation and its role in facilitating firm recovery after the 1997 Asian Financial Crisis. Between 1974 and 1978, the Indonesian government undertook an ambitious expansion of the education system, doubling the stock of schools by constructing 61,000 new primary schools across the country. This large-scale intervention significantly improved educational attainment. Duflo (2001) found that the program

increased schooling levels by 0.25 to 0.40 years, with each additional school per 1,000 children contributing 0.12 to 0.19 years of education.

In a later paper, Duflo (2004) examined the medium-run labor market effects of the INPRES program from 1986 to 1999. By 1986, 12 years after the program began, the first generation exposed to INPRES had entered the workforce, increasing the share of primary school graduates in regions where the program had a greater impact. By the time the 1997 crisis struck, many workers in the labor market had benefited from INPRES, meaning a substantial portion of the workforce had higher educational attainment due to the program. This provides a natural setting to assess whether improved human capital helped firms navigate the crisis more effectively.

To test this, I use data from the Statistik Industri (SI) census of manufacturing plants with 20 or more employees from 1986 to 1999, combined with regency-level data from Duflo (2001) on the rollout of the INPRES program. I first show that plant workforce education levels in 1995-1997 are strongly correlated with plant performance, with the relationship being even stronger in 1997, during the crisis. To isolate the causal impact of INPRES-induced human capital gains, I then use a difference-in-differences approach to compare changes in labor productivity (real output per worker) following the crisis between plants in high and low-INPRES exposure districts. I find that INPRES significantly improved post-crisis plant performance. On average, one additional INPRES school per 1,000 children in a plant's district led to a 2 percent increase in real output per worker after 1997 compared to what would have been expected otherwise.

There are two main challenges to interpreting these results. First, high and low-INPRES-intensity regencies (referred to as "districts" hereafter) differ in fundamental ways, as more schools were built in areas with initially low enrollment rates. Second, worker mobility could weaken the link between district-level education and plant-level workforce composition, as workers may live in low-INPRES districts but commute to high-INPRES districts for work, or vice versa.

I address the first challenge by testing the robustness of my results across three different specifica-

tions and verifying parallel trends between high and low-INPRES districts, along with additional robustness checks discussed later. First, I include sector and year fixed effects while controlling for the same district-level covariates as Duflo (2001). Second, I add district fixed effects to account for time-invariant regional differences. Finally, I estimate a within-plant specification using plant and year fixed effects to control for all time-invariant plant characteristics.

To address the second challenge, I use the SI plant data from 1995, which includes workforce education details, and merge it with district-level labor force education data from Duflo (2001) for 1995 to test whether district education levels translate into plant workforce composition. Regressing the share of primary-educated and above workers in plants on district-level average years of education shows a strong positive correlation, even when controlling for INPRES intensity. This suggests that most plants primarily hire locally, and workforce mobility across districts is likely limited.

Next, I explore potential mechanisms. I find evidence that plants benefiting from INPRES-produced human capital engaged in greater labor hoarding. Labor hoarding was widely observed in Indonesia, Thailand, and Malaysia after the 1997 crisis (Hallward-Driemeier, Dwor-Frécaut, and Colaco, 2000). Guimbert and Oostendorp (2016) show that firms prefer to smooth input adjustments during negative demand shocks when they expect the shock to be temporary and face high adjustment costs.

I find that plants in high-INPRES districts retained more workers after the crisis, which likely contributed to their ability to weather the downturn more effectively. Furthermore, I find that not only were more workers retained, but the retained workforce was also better educated in plants that benefited from INPRES-produced human capital. The higher quality of their workers may have played a role in plants' decisions to retain them, as the cost of replacing skilled labor after the crisis would have been high.

This paper contributes to the literature on firm risk-coping strategies, resilience, and performance during economic crises, a topic that has received much attention in management research but remains understudied in development contexts. Most notably, Bartoloni et al. (2021) examine firm survival probabilities

conditional on firms adopting corporate strategies that emphasize skill accumulation. They find that Italian manufacturing firms that invested in human capital, innovation, or international expansion had higher survival rates following the 2008 Great Recession.

In the Indonesian context, Hallward-Driemeier and Rijkers (2013) use the same dataset as this paper to show that the 1997 crisis led to the exit of relatively productive firms but also led to the entry of more productive ones, partially offsetting the crisis's negative impact on aggregate productivity. While their findings suggest that the crisis weakened the link between productivity and firm survival, my results highlight how pre-crisis skill accumulation helped firms better withstand the shock. Narjoko and Hill (2007) also use the same dataset and find that foreign ownership, export orientation, and industry labor intensity were positively associated with firm survival after the crisis.

Finally, this paper closely relates to the literature on household resilience to shocks (Barrett et al., 2021). Recent studies, including Do et al. (2025), D'Errico et al. (2018), and Smith and Frankenberger (2018), show that human capital and education plays a significant role in enhancing households' adaptive capacity to negative shocks. The rest of this paper is organized as follows. Section 2 provides background on the 1997 crisis, the INPRES program, and the available data. Section 3 presents descriptive statistics and charts illustrating trends in outcomes before and after the crisis. Section 4 outlines the empirical strategy. Sections 5, 6 and 7 discuss the main results, additional robustness checks, and mechanisms, respectively.

2 Context and Data

2.1 The 1997 Crisis in Indonesia

Indonesia experienced rapid industrial growth, averaging over 9 percent annually from the 1970s until the onset of the 1997 crisis (Narjoko and Hill, 2007), making it one of the fastest-growing economies in Southeast Asia. The country maintained low inflation, modest current account deficits, rapid export growth, and

strong foreign exchange reserves. Given these conditions, economists initially expected Indonesia to be relatively insulated from the crisis when it was triggered by the devaluation of the Thai baht in July 1997 (Iriana and Sjöholm, 2002). However, the contagion spread rapidly, and Indonesia became one of the hardest-hit countries, experiencing massive capital outflows, a sharp depreciation of the rupiah, a surge in inflation, and a severe economic contraction, with GDP declining by 13 percent in 1998. Manufacturing was the hardest hit due to its reliance on imports and vulnerability to exchange rate fluctuations (Hallward-Driemeier and Rijkers, 2013).

2.2 Plant Data

I use plant-level data from the Statistik Industri (SI) census of manufacturing plants with 20 or more employees from 1986 to 1999. This is administered by the Indonesian Statistical Agency, Badan Pusat Statistik (BPS). These data include details on plant output, employment, investment, capital stock, material inputs, wages, and ownership. Importantly for my analysis, the data also provide information on worker education levels from 1995 to 1997, which allows me to analyze the relationship between workforce education and plant performance before and during the crisis and to test whether educational patterns in districts are reflected in the workforce composition of plants.

The extensive coverage of this dataset ensures representation across regions (see Figure A.1 in the Appendix) and sectors, classified according to the Klasifikasi Baku Lapangan Usaha Indonesia (KBLI), which is largely compatible with ISIC Rev.3. The data allow me to control for 5-digit sector and district fixed effects in regressions and also enable a within-plant specification with plant fixed effects, as plants are observed repeatedly over time. However, a limitation of the data is that it does not distinguish between firms and plants, meaning I cannot identify whether multiple plants are owned by the same entity.

Since district boundaries in Indonesia have changed frequently over this period, I harmonize them to their 1995 definitions to merge with the INPRES data. Additionally, the dataset includes product-level price

and quantity information from 1994 onward, allowing me to test the robustness of my results by using plant-level deflators instead of a GDP deflator, following Cali et al. (2024, 2022).

2.3 INPRES Data

To measure regional INPRES program intensity, I use district-level data from Duflo (2001) on the rollout of the Sekolah Dasar INPRES primary school construction program. Launched in 1973, this large-scale initiative aimed to expand access to primary education by rapidly increasing the number of schools across Indonesia. Between 1974 and 1978, the government built 61,807 new schools, effectively doubling the number of schools per capita.

There was substantial variation in program intensity across regions (see Figure A.1 in the Appendix), with districts that had lower initial enrollment rates in 1971 receiving more schools. To capture this, I use new schools per 1,000 children aged 5-14 as the primary measure of INPRES exposure. Additionally, in my basic specification, I control for the 1971 pre-program population enrollment rate and the population of children, following Duflo.

3 Descriptive Statistics

Table 1 shows summary statistics for key variables in the plant-level and district-level INPRES data. On average, establishments employ approximately 177 workers, though there is substantial variation in scale, as reflected in total output, goods produced, and value added. Of particular interest to this study, log output per worker averages 9.15 with a standard deviation of 1.33, indicating meaningful differences in labor productivity across establishments.

Plant-level education data from 1995-97 indicate that most formal-sector establishments have a relatively high proportion of primary-educated workers, but fewer with higher levels of education. However, since this is many years after the first INPRES-exposed cohort entered the workforce, the 91 percent primary education

Table 1: Summary Statistics of Plant-Level Data and District-Level INPRES Data

	Obs	Mean	Std. Dev.	Min	Max
Total workers	249934	177.23	645.05	10.00	116052.00
Log total output	208352	13.35	2.08	3.40	23.14
Log output per worker	208352	9.15	1.33	-3.51	17.30
Log total goods produced	234355	13.35	2.07	0.59	22.72
Log value added	249833	12.21	2.01	-80.78	22.44
Log total investment	128920	12.12	2.95	0.34	24.27
Log total machinery value	43220	11.14	2.48	0.69	21.19
Log TFPR	201722	9.44	3.08	-283.56	147.51
Log total wages per worker	249702	7.05	0.86	-0.58	15.38
Share workers primary and above	66450	0.91	0.18	0.00	1.11
Share workers junior high and above	66450	0.53	0.34	0.00	1.00
Share workers senior high and above	66450	0.29	0.29	0.00	1.00
Share workers bachelors and above	66450	0.01	0.03	0.00	0.81

	Obs	Mean	Std. Dev.	Min	Max
No. of INPRES schools built per 1000 children	290	2.34	1.25	0.59	8.60
Children aged 5-14 in 1971	290	114350.54	97747.91	3796.00	542835.00
Primary school enrollment rate in 1971	288	0.18	0.10	0.00	0.99

rate likely reflects the long-term impact of INPRES. At the district level, data show substantial variation in program intensity across regions, with an average of 2.34 INPRES schools per 1,000 children and values ranging from 0.59 to 8.60.

Before running regressions, I first examine overall trends in plant performance by INPRES intensity. Figure 1 plots the mean real output and output per worker for plants in above and below-median INPRES intensity districts, weighted by district plant count. These values are inflation-adjusted using a GDP deflator. The figures show that plants in above-median INPRES intensity districts experienced a smaller decline in real output and labor productivity compared to those in below-median INPRES intensity districts. In the next section, I outline an empirical strategy to test whether this pattern reflects the role of INPRES-produced

human capital in helping plants better withstand the crisis.

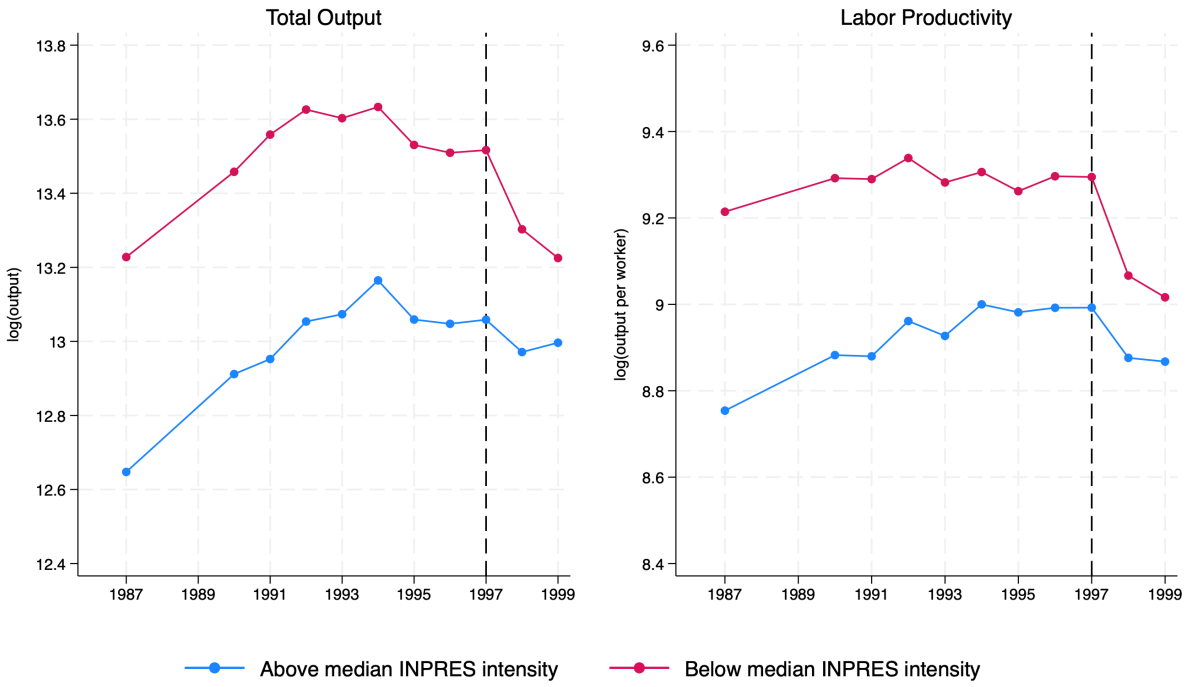


Figure 1: Mean real output and output per worker by INPRES intensity before and after the crisis (weighted by district plant count).

4 Empirical Strategy

To test the impact of INPRES during the 1997 crisis, I estimate the following regression specifications:

$$y_{isdt} = \alpha + \beta(\text{Post 1997}_t \times \text{INPRES}_d) + \nu_s + \lambda_t + \gamma \text{INPRES}_d + \delta \mathbf{X}_d + \varepsilon_{isdt}, \tag{1}$$

$$y_{isdt} = \alpha + \beta(\text{Post 1997}_t \times \text{INPRES}_d) + \nu_s + \lambda_t + \mu_d + \varepsilon_{isdt}, \tag{2}$$

$$y_{isdt} = \alpha + \beta(\text{Post 1997}_t \times \text{INPRES}_d) + \nu_s + \lambda_t + \mu_d + \phi_i + \varepsilon_{isdt}. \tag{3}$$

Here, y_{isdt} is the labor productivity (real output per worker, in logs) of plant i in sector s, located in district d at time t. The variable INPRES_d measures the intensity of the INPRES school construction program,

defined as the number of schools built per 1,000 children in district d.

In the first specification, I include sector (ν_s) and year (λ_t) fixed effects, and control for the same pre-program district-level covariates as Duflo (2001), represented by $\mathbf{X}_d$, which includes the 1971 children's population and enrollment rate. In the second specification, I add district fixed effects (μ_d) to account for all time-invariant regional differences. Finally, I estimate a within-plant specification using plant (ϕ_i) and year fixed effects to control for all time-invariant plant characteristics. Standard errors are clustered at the district level in all three specifications.

5 Main Results

Table 2: Relationship between Plant Workforce Education & Labor Productivity, Pre vs. During Crisis

	1995-96	1995-96	1997	1997
VARIABLES	Labor Prod.	Labor Prod.	Labor Prod.	Labor Prod.
Share of workers with	0.860***	0.663***	0.982***	0.792***
primary educ. & above	(0.0910)	(0.0710)	(0.0893)	(0.0722)
Constant	8.419***	8.603***	8.322***	8.495***
	(0.136)	(0.0644)	(0.145)	(0.0661)
Observations	44,291	44,284	21,986	21,975
R-squared	0.367	0.439	0.375	0.449
Duflo preprogram controls	Yes		Yes	
Year FE	Yes	Yes		
Sector FE	Yes	Yes	Yes	Yes
District FE	No	Yes	No	Yes

SEs in parentheses are clustered at the district level

*** p<0.01; ** p<0.05; * p<0.1

Before estimating the main specifications to test the impact of human capital development driven by the INPRES program, I first establish the relationship between plant workforce education levels and labor productivity. Since my hypothesis is that skills matter in general but become even more important during a crisis, we should expect a positive correlation between workforce education and labor productivity before

the crisis, with an even stronger association during the crisis.

In Table 2, I show results from regressions of labor productivity on the share of workers with primary education and above for the periods before the crisis (1995–1996) and during the crisis (1997), the only three years for which plant workforce education details are available. Since the crisis began in July 1997, and the SI data are collected at the end of each year or the beginning of the following year, the last two regressions likely capture the relationship between education and labor productivity while the crisis was ongoing. I report results including controls from specifications (1) and (2) above.

As expected, all coefficients on the education variable are positive and highly significant, indicating a strong relationship between workforce education and labor productivity. Moreover, the coefficients are larger in magnitude during the crisis than before, suggesting that human capital may have played an outsized role in firm resilience during the downturn.

Table 3: Regression Results Showing INPRES Impact on Labor Productivity During the 1997 Crisis

	(1)	(2)	(3)
VARIABLES	Labor Prod.	Labor Prod.	Labor Prod.
INPRES	-0.0484		
	(0.0379)		
Post 1997 x INPRES	0.0573***	0.0351***	0.0200**
	(0.0156)	(0.0126)	(0.00876)
Constant	9.150***	9.134***	9.156***
	(0.143)	(0.00688)	(0.00483)
Observations	208,084	208,082	200,097
R-squared	0.340	0.411	0.837
Duflo preprogram controls	Yes		
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
District FE	No	Yes	Yes
Plant FE	No	No	Yes

SEs in parentheses are clustered at the district level

*** p<0.01; ** p<0.05; * p<0.1

To now isolate the causal effect of human capital on plant performance during the crisis, I exploit variation from the INPRES program. Table 3 shows regression results from the three main specifications above. In all three models, the coefficient on the interaction between Post-1997 and INPRES intensity is positive and highly significant. However, its magnitude declines as additional fixed effects absorb more variation. This suggests that, as expected, exposure to a more educated workforce due to INPRES helped plants perform better during the crisis relative to those in districts with lower program intensity.

Using the third specification as the preferred model, the results suggest that, on average, one additional INPRES school per 1,000 children in a plant's district resulted in 2 percent higher real output per worker after the crisis in 1997 than would have been expected otherwise. Similar results are observed when using real output as the outcome variable (see Table A.1 in the Appendix).

6 Robustness Checks

6.1 Do Educational Patterns in Districts Reflect the Workforce Education Levels of Plants?

One key assumption in interpreting my results is that the characteristics of a plant's workforce are shaped by the district in which the plant is located. In other words, most plants primarily employ workers from within their own district, so district-level labor force characteristics closely reflect plant-level workforce composition. However, worker mobility could weaken this link, as individuals may live in low-INPRES districts but commute to high-INPRES districts for work, or vice versa.

To test this assumption, I use district-level labor force education from Duflo (2001) for 1995 and merge it with the plant-level data. Regressing the share of primary-educated and above workers in plants on district-level average years of education shows a strong positive correlation (see Table A.2 in the Appendix), even when controlling for INPRES intensity, confirming that district education levels are directly reflected in plant workforce composition. This suggests that most plants primarily hire locally, and workforce mobility

across districts is likely limited.

6.2 Placebo Tests

To further validate my difference-in-differences analysis, I point to two pieces of evidence. First, Figure 1 shows clearly observable parallel trends in real output and labor productivity between above and below-median INPRES intensity plants before the crisis. Second, I conduct placebo tests using specification (3) above, dropping all observations after 1997 and testing whether INPRES had a differential impact in 1994, 1995, and 1996, treating these years as placebo crisis periods.

None of the three coefficients on the interaction between Post and INPRES intensity are significantly different from zero (see Table A.3 in the Appendix). This confirms that the INPRES-produced human capital advantage only becomes relevant once the crisis occurs. In other words, there is no evidence of a pre-trend effect, suggesting that plants in high-INPRES districts did not systematically outperform before the crisis but benefited from a more skilled workforce when the shock hit.

6.3 Using Plant-Level Price Deflators

Using a GDP deflator to adjust for inflation may introduce bias if sectoral, regional, or local price changes differ substantially from the national average. To address this, I construct plant-level price deflators using product-level price and quantity data from 1994 onward, following Cali et al. (2024, 2022), which builds on the methodology of Eslava et al. (2004) and Mertens (2019). I then re-estimate the main regression specifications using outcomes adjusted with these plant-level deflators.

The dataset requires unit standardization, as they vary across years for the same products. Additionally, some units are unclear or difficult to convert into consistent measures such as volume, weight, count, area, or length. To ensure consistency, I first keep only products that appear in all years for each plant. I then keep only products with clear and convertible units that can be standardized into volume, weight, count, area, or

length. Finally, following Cali et al. (2024), I drop any products where the price changes by more than a factor of 10 between consecutive years.

To capture variations in price changes across 9-digit products produced by each plant, I construct plant-level Tornqvist price indices, defined as:

$$\pi_{it} = \prod_{p=1}^{n} \left(\frac{P_{pit}}{P_{pit-1}} \right)^{0.5(S_{pit}+S_{pit-1})} \pi_{it-1},$$

where P_{pit} is the price of product p in plant i at time t, calculated as unit values, i.e., total revenue divided by total quantity. S_{pit} is the share of product p in the plant's total product market sales at time t. The price index π_{it} grows as a weighted geometric mean of product price growth rates, where weights are determined by the average sales share of each product in periods t and $t-1$. For missing values, I follow Cali et al. (2024) and impute values using the average price change within the same sector and district.

The coefficients on the interaction between Post-1997 and INPRES intensity remain positive and significant, with only a slight reduction in magnitude (see Table A.4 in the Appendix). However, in the plant fixed effects specification, the coefficient is now significant at the 10 percent level, which may be due to the smaller sample size or the exclusion of certain products when constructing plant-level deflators. This confirms that the estimated impact of INPRES is not driven by aggregate price movements but instead reflects real differences in plant performance during the crisis.

7 Mechanism

In Table 4, I show results from estimating the same specifications as above but with the change in plant workforce (in logs) as the dependent variable. The coefficient on the interaction between Post-1997 and INPRES intensity is positive and highly significant across all three specifications. The results in column (3) suggest that, on average, the change in workforce after the crisis was about 1 percent higher for every

Table 4: Regression Results Showing INPRES Impact on Change in Workforce During the 1997 Crisis

	(1)	(2)	(3)
VARIABLES	ΔWorkers	ΔWorkers	ΔWorkers
INPRES	-0.00370**		
	(0.00162)		
Post 1997 x INPRES	0.00848***	0.0100***	0.00993***
	(0.00221)	(0.00227)	(0.00275)
Constant	0.0282***	0.0113***	0.0121***
	(0.00855)	(0.00115)	(0.00138)
Observations	206,453	206,453	200,821
R-squared	0.011	0.014	0.117
Duflo preprogram controls	Yes		
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
District FE	No	Yes	Yes
Plant FE	No	No	Yes

SEs in parentheses are clustered at the district level

*** p<0.01; ** p<0.05; * p<0.1

additional INPRES school per 1,000 children in a plant's district.

Additionally, not only were more workers retained, but the retained workforce was also better educated in plants that benefited from INPRES-produced human capital. I observe this by estimating the same three main regression specifications, but with the number of primary-educated and above workers (in logs) as the dependent variable. The coefficient on the interaction between Post-1997 and INPRES intensity is positive and significant, indicating that plants in high-INPRES districts had more primary-educated workers after the crisis (see Table A.5 in the Appendix).

However, because plant-level education details are only available for 1995-1997, these regression have much lower power, particularly since the post-crisis period is represented by only one year (1997). Consequently, while the coefficient of interest on Post-1997 × INPRES remains positive, it is not statistically significant in the third within-plant specification with plant fixed effects.

These results suggests that plants in high-INPRES districts not only had a more educated workforce but also retained more of those skilled workers after the crisis, which likely contributed to their ability to weather the downturn more effectively. The findings are consistent with the broader literature on labor hoarding, where firms with higher-skilled workers may be more reluctant to lay them off (Guimbert and Oostendorp, 2016; Hallward-Driemeier, Dwor-Frécaut, and Colaco, 2000). Preserving a more educated workforce may have provided firms with a productivity advantage in the recovery period, allowing them to adapt more quickly to post-crisis conditions.

Moreover, these results support the idea that human capital serves as a form of resilience, not just by improving productivity but also by reducing labor turnover during crises. Firms in high-INPRES districts may have been more reluctant to lay off skilled workers due to higher training costs and potential hiring difficulties after the crisis. Together, these findings suggest that INPRES-induced human capital accumulation played a dual role, improving both workforce quality and stability, which helped firms navigate the 1997 crisis more effectively.

8 Conclusion

In this paper, I examine whether human capital accumulation from Indonesia's INPRES school construction program improved firm resilience during the 1997 Asian Financial Crisis. The crisis struck about a decade after the first generation exposed to INPRES, who gained higher educational attainment due to the program, entered the workforce (Duflo, 2001, 2004). Using manufacturing plant data from the Statistik Industri census and district-level data from Duflo (2001) on the rollout of the INPRES program, I compare post-crisis changes in labor productivity between manufacturing plants in high and low-INPRES-exposure districts. The results show that INPRES significantly improved post-crisis plant performance. On average, one additional INPRES school per 1,000 children in a plant's district led to a 2 percent increase in real output per worker after 1997 compared to what would have been expected otherwise.

I also find that plants benefiting from INPRES-produced human capital engaged in greater labor hoarding, likely due to higher adjustment costs associated with replacing skilled workers after the crisis. This highlights the role of human capital in improving firm resilience, not only by improving productivity but also by reducing labor turnover during crises. Future research could further examine the mechanisms through which skilled workers contribute to firm adaptability and survival in periods of economic distress.

References

Bartoloni, E., Arrighetti, A. and Landini, F., 2021. Recession and firm survival: Is selection based on cleansing or skill accumulation?. Small Business Economics, 57(4), pp.1893-1914.

Barrett, C.B., Ghezzi-Kopel, K., Hoddinott, J., Homami, N., Tennant, E., Upton, J. and Wu, T., 2021. A scoping review of the development resilience literature: Theory, methods and evidence. World Development, 146, p.105612.

Cali, M., Johnson, H.C., Perova, E. and Ryandiansyah, N.R., 2022. Caring for Children and Firms?. The Impact of Preschool Expansion on Firm Productivity. World Bank Policy Research Working Paper, 10193.

Calì, M., Le Moglie, M., and Presidente, G. 2024. Gain without pain? Non-tariff measures, plant markup, and productivity. Review of International Economics, 32(3), 1364–1397.

D'Errico, M., Romano, D. and Pietrelli, R., 2018. Household resilience to food insecurity: Evidence from Tanzania and Uganda. Food Security, 10(4), pp.1033-1054.

Do, M.H., Nguyen, T.T. and Grote, U., 2025. Insights on household's resilience to shocks and poverty: evidence from panel data for two emerging economies in Southeast Asia. Climate and Development, pp.1-15.

Duflo, E., 2001. Schooling and labor market consequences of school construction in Indonesia: Evidence from an unusual policy experiment. American Economic Review, 91(4), pp.795-813.

Duflo, E., 2004. The medium run effects of educational expansion: Evidence from a large school construc-

tion program in Indonesia. Journal of Development Economics, 74(1), pp.163-197.

Eslava, M., Haltiwanger, J., Kugler, A. and Kugler, M., 2004. The effects of structural reforms on productivity and profitability enhancing reallocation: Evidence from Colombia. Journal of Development Economics, 75(2), pp.333-371.

Guimbert, S. and Oostendorp, R., 2016. Risk Coping by Firms during the Crisis. Economic Development and Cultural Change, 65(1), pp.87-118.

Hallward-Driemeier, M., Dwor-Frécaut, D. and Colaco, F.X., 2000. Asian Manufacturing Recovery: A Firm-Level Analysis. In Asian Corporate Recovery: Findings from Firm-level Surveys in Five Countries, The World Bank, Washington DC.

Hallward-Driemeier, M. and Rijkers, B., 2013. Do crises catalyze creative destruction? Firm-level evidence from Indonesia. Review of Economics and Statistics, 95(5), pp.1788-1810.

Iriana, R. and Sjöholm, F., 2002. Indonesia's economic crisis: Contagion and fundamentals. The Developing Economies, 40(2), pp.135-151.

Kwapil, C., 2010. Firms' reactions to the crisis and their consequences for the labour market. Results of a company survey conducted in Austria. ECB Working Paper No. 1274.

Mertens, M., 2019. Micro-mechanisms behind declining labour shares: Market power, production processes, and global competition. IWH-CompNet Discussion Papers.

Narjoko, D. and Hill, H., 2007. Winners and losers during a deep economic crisis: Firm-level evidence from Indonesian manufacturing. Asian Economic Journal, 21(4), pp.343-368.

Schumpeter, J.A., 1939. Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process. McGraw-Hill.

Schultz, T.W., 1975. The value of the ability to deal with disequilibria. Journal of Economic Literature, 13(3), pp.827-846.

Smith, L.C. and Frankenberger, T.R., 2018. Does resilience capacity reduce the negative impact of shocks

on household food security? Evidence from the 2014 floods in Northern Bangladesh. World Development, 102, pp.358-376.

Westergård-Nielsen, N.C. and Neamtu, I., 2012. How are firms affected by the crisis and how do they react? (No. 6671). IZA Discussion Papers.

A Appendix

Figure A.1: Regional distribution of plants from the SI data and INPRES intensity.

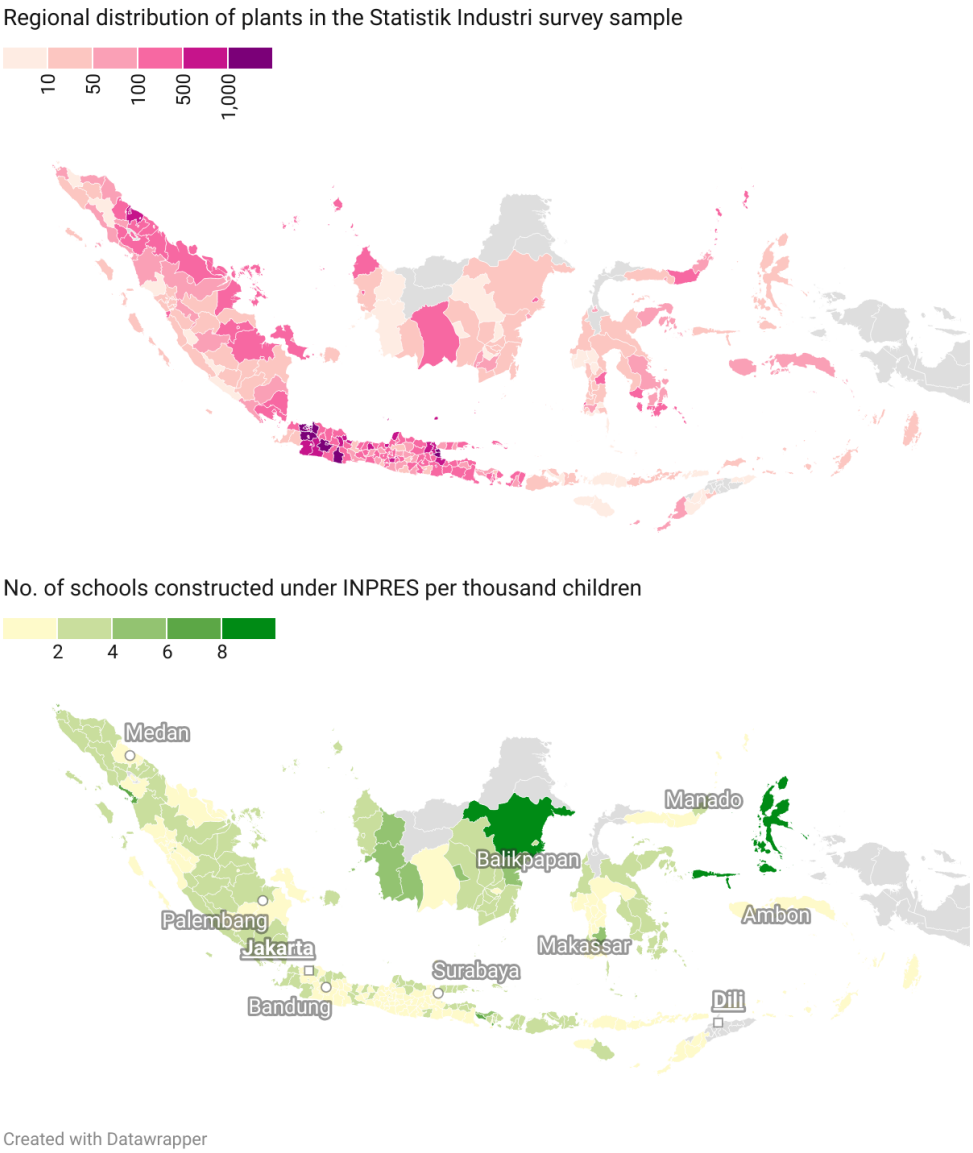


Table A.1: Regression Results Showing INPRES Impact on Real Output During the 1997 Crisis

VARIABLES	(1) Output	(2) Output	(3) Output
INPRES	-0.0495		
	(0.0573)		
Post 1997 x INPRES	0.0699***	0.0466**	0.0249*
	(0.0243)	(0.0227)	(0.0130)
Constant	13.40***	13.33***	13.37***
	(0.238)	(0.0124)	(0.00718)
Observations	208,084	208,082	200,097
R-squared	0.341	0.417	0.918
Duflo preprogram controls	Yes		
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
District FE	No	Yes	Yes
Plant FE	No	No	Yes

SEs in parentheses are clustered at the district level

*** p<0.01; ** p<0.05; * p<0.1

Table A.2: Relationship Between District Labor Force Education and Plant Workforce Education in 1995

VARIABLES	(1) Share primary & above (plant)	(2) Share primary & above (plant)
Avg. years of education (district)	0.0137***	0.0116***
	(0.00393)	(0.00363)
INPRES		-0.0130*
		(0.00782)
Constant	0.788***	0.829***
	(0.0362)	(0.0344)
Observations	21,359	21,359
R-squared	0.215	0.218
Sector FE	Yes	Yes

SEs in parentheses are clustered at the district level

*** p<0.01; ** p<0.05; * p<0.1

Table A.3: Testing for the Differential Impact of INPRES on Labor Productivity in Placebo Crisis Years

	(1)	(2)	(3)
VARIABLES	1994	1995	1996
Post 1994 x INPRES	-0.00277		
	(0.00935)		
Post 1995 x INPRES		-0.00458	
		(0.00771)	
Post 1996 x INPRES			-0.00460
			(0.00785)
Constant	9.212***	9.212***	9.211***
	(0.00862)	(0.00551)	(0.00376)
Observations	158,913	158,913	158,913
R-squared	0.854	0.854	0.854
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
District FE	Yes	Yes	Yes
Plant FE	Yes	Yes	Yes

SEs in parentheses are clustered at the district level

*** p<0.01; ** p<0.05; * p<0.1

Table A.4: Main Regression Results with Plant-Level Deflators

	(1)	(2)	(3)
VARIABLES	Labor Prod.	Labor Prod.	Labor Prod.
INPRES	-0.0314		
	(0.0387)		
Post 1997 x INPRES	0.0314**	0.0248**	0.0168*
	(0.0123)	(0.0107)	(0.00926)
Constant	13.93***	13.88***	13.89***
	(0.155)	(0.00944)	(0.00814)
Observations	110,701	110,700	106,976
R-squared	0.371	0.438	0.866
Duflo preprogram controls	Yes		
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
District FE	No	Yes	Yes
Plant FE	No	No	Yes

SEs in parentheses are clustered at the district level

*** p<0.01; ** p<0.05; * p<0.1

Table A.5: Regression Results Showing INPRES Impact on Educated Workforce During the 1997 Crisis

	(1)	(2)	(3)
VARIABLES	Primary+ educ.	Primary+ educ.	Primary+ educ.
INPRES	-0.0410		
	(0.0315)		
Post 1997 x INPRES	0.0240**	0.0249**	0.0144
	(0.0115)	(0.0105)	(0.00937)
Constant	4.079***	4.030***	4.066***
	(0.143)	(0.00619)	(0.00546)
Observations	66,130	66,125	61,882
R-squared	0.289	0.359	0.966
Duflo preprogram controls	Yes		
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
District FE	No	Yes	Yes
Plant FE	No	No	Yes

SEs in parentheses are clustered at the district level

*** p<0.01; ** p<0.05; * p<0.1