Does higher spatial resolution of identification strategy can detect weaker causal effect of forest fire on human health in Indonesia?

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1. Introduction

Indonesia experienced the worst forest fires catastrophe in 1997 which lead to child mortality, respiratory problems, to children stunting. Those impacts were proven by many literatures, some of those literatures used satellite spatial information that was called TOMS (Total Ozone Mapping Spectrometer) in measuring aerosol index or haze level above the ground which already grounded in 2005, to identify which areas were exposed and not. After 1997, there was another forest fires episode in 2006. Literally, it was much less severe than the previous, which is impossible to measure via TOMS aerosol index. Other measurement of aerosol is offered by MODIS (Moderate Resolution Imaging Spectroradiometer) through aerosol optical depth (AOD) which is still operated until today. Fortunately, this new measurement has better spatial resolution than the predecessor, which means we can more precise in identifying the locations exposure severity. By utilizing this measurement, our research question: is that possible finding the effect(s) on people's health from lower exposure in 2006 forest fires, by conducting causal inference approach to large scale panel dataset.

2. Methodology

In this research firstly we conduct identification strategy by utilizing MODIS AOD to identify which areas/regions were impacted and not. Secondly, we use IFLS (Indonesian Family Life Survey) which contain individual health status and location information of every household and individual until village level. Thirdly, we match between locations exposed status with household and individual locations, in order to determine treated and control group. Lastly, we implement econometric approach to find the causal effects, because we use panel data and forest fires are considered as natural experiment. Therefore, we use difference-in-differences (DiD) to assess individual health status from those two groups before and after treatment. Health status that we analyze is related with new born babies, either this weaker exposure has effect to babies death, miscarriage/stillbirth, or babies weight.

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3. Results

By comparing the treated and control group before and after treatment with DiD, we found that 2006 forest fires have negative significant effect to new born babies weight around -0.2 kg. Which means individual mothers during prenatal periods who lived in exposed regions are tended to have less weight new born babies 0.2 kg, compared to mothers who lived in non-exposed locations during their prenatal periods. On the other hand, we did not find any significant result in the other two outcomes (babies death and miscarriage/stillbirth). These findings are supported by some robustness and consistency checks that we did in order to make sure that the findings are purely because of 2006 exposure. Robustness and consistency check that we did are placebo test, compare to alternative control, and sensitivity analysis.

Table 1. DiD regression of main analysis

	(i)	(ii)
Babies Death	0.013	0.003
	(0.022)	(0.022)
Sample Size	1873	1751
Miscarriage/Stillbirth	0.056	0.027
	(0.038)	(0.031)
Sample Size	2070	1876
Birth Weight	-0.221**	-0.17*
	(0.093)	(0.095)
Sample Size	1636	1557
Babies & Mothers Characteristic	No	Yes

- Means and Standard Errors are estimated by linear regression
- Inference: *** p<0.01; ** p<0.05; * p<0.1
- S. Err. in parentheses
- 0 = Baby Death; 1 = Baby Alive
- 0 = Miscarriage/Stillbirth; 1 = Livebirth
- Birth Weight in kg

4. Conclusion

Even though, 2006 forest fires event was not as great as 1997 calamity, but it was still as an environmental tragedy that the haze exposure could lead to serious health issues. Through this research, it is proven that the event had significant negative effect to the new born babies weight. Furthermore, the exposed pregnant mothers will tend to have less weight of new born babies around 0.2 kg, compared to the non-exposed pregnant mothers. This finding is strengthen by several robustness and consistency checks. The main reason that we can find the effect from the weaker exposure, because from the beginning we utilize better identification strategy than the previous literatures which discuss the 1997 event. By using this higher spatial resolution, we can identify more precisely if the locations were really exposed or not.