Economic risks of COVID-19

A local perpsective

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Introduction/summary

- While SARS-Cov-2 virus does not discriminate, the geographical spread depends on the response to it.
- Indonesia is one of the most severely affected countries in the world.
- But there are variations at sub-national levels.
- We investigate this using HEVR approach (Noy et al. 2020).
- We confirm that *economic* risks of COVID-19 correlates strongly with the spread.
- The highest economic risks are in the Western part of Indonesia, especially in Java.

Updates on COVID-19 in Indonesia

Measuring the economic risks

Research questions

- What is the economic risk posed by COVID-19 pandemic?
- How is it distributed geographically across Indonesia?
- Can we consistently monitor the development?

Approach

- We follow Noy et al. (2020) in examining the interaction of disasters factors, namely *hazard*, *exposure*, *vulnerability*, and *resilience*.
- Noy et al. (2020) find that the economic risk of the pandemic is particularly high for most African countries, India, and Southeast Asia continent. We are interested to see how it looks like *within* Indonesia.
- This is a data-intensive work and we hope to provide a systematic way of looking at the economic risks of COVID-19 at the sub-national level.

Risk as a function of HEVR

$$\begin{aligned} Risk_g = {} & a_1 Hazard_g \\ & + a_2 Exposure_g \\ & + a_3 Vulnerability_g \\ & - a_4 Resilience_g \end{aligned} \tag{1}$$

Hazard

- Indicator: COVID-19 confirmed cases per 1,000 people.
- Source: KawalCOVID19 (www.KawalCOVID19.id)
- Level: district

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Exposure

- Indicators: population density, number of public areas (hotels, marketplaces, tourist sites, worship places, restaurants), transportation networks (airports, bus terminals, train stations, water ports and ferry ports), frequency of flights, internal migration data.
- Sources: PODES 2018, MOHA Dataset 2019, Open Street Maps 2020, Open Flight Data 2020.
- Level: district, sub-district, village, coordinate

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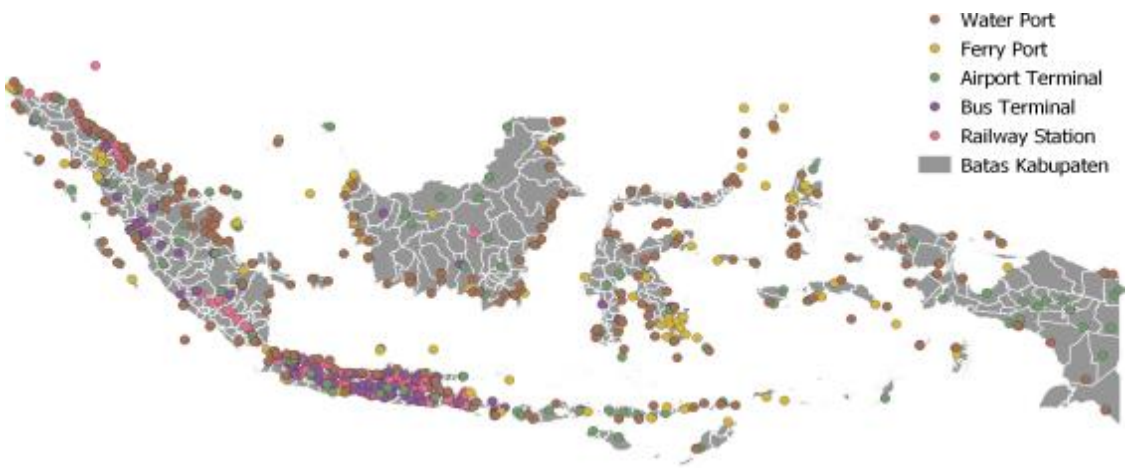
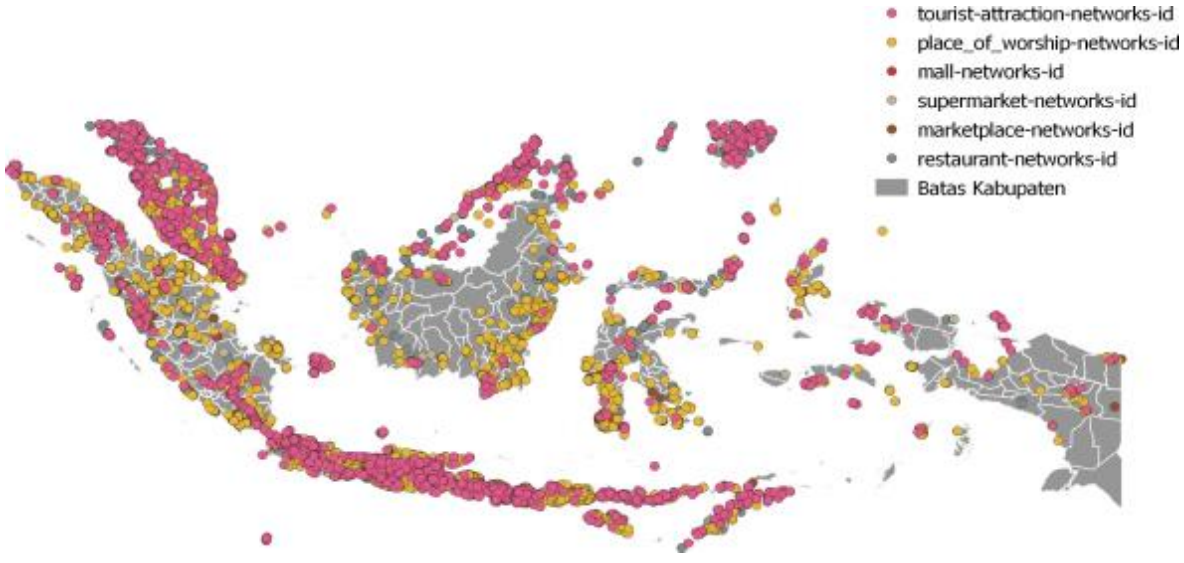
Exposure: transport networks



Source: authors' compilation

Exposure: public venues



Source: authors' compilation

Vulnerability

- Indicators: poverty rate (P0), share of elderly in the population, health care facilities, infant mortality rates, out-of-pocket health spending.
- Sources: SUSENAS March 2019, MOHA Data (Dukcapil) 2019, PODES 2018, MOH Data 2014-18, SMERU Poverty Map 2015.
- Level: district, sub-district, village

Resilience

- Indicators: smartphone ownership, internet access, language diversity, ethnic diversity, debt-to-GDP ratio, expenditure-to-GDP ratio.
- Sources: SUSENAS March 2019, MOHA Data (Dukcapil) 2019, PODES 2018, MOF APBD Data 2018-20.
- Level: province, district, sub-district, village

Risk: DALY

- To proxy risk we use disability-adjusted life years (DALY). It is the sum of years lost due to ill-health, disability or death from communicable diseases.
- 'Since previous DALY associated with communicable diseases is the outcome of previous events, it could be a good source for understanding the interactions between the (mostly zoonotic) hazard and exposure, vulnerability, and resilience to it' (Noy et al. 2020, p.7).
- To get closer to economic risk, we convert DALY from province level to district level using GDP share as the weight.
- Sources: Global Burden of Disease Study 2017, Institute for Health Metrics and Evaluation (IHME) 2018.
- Level: province

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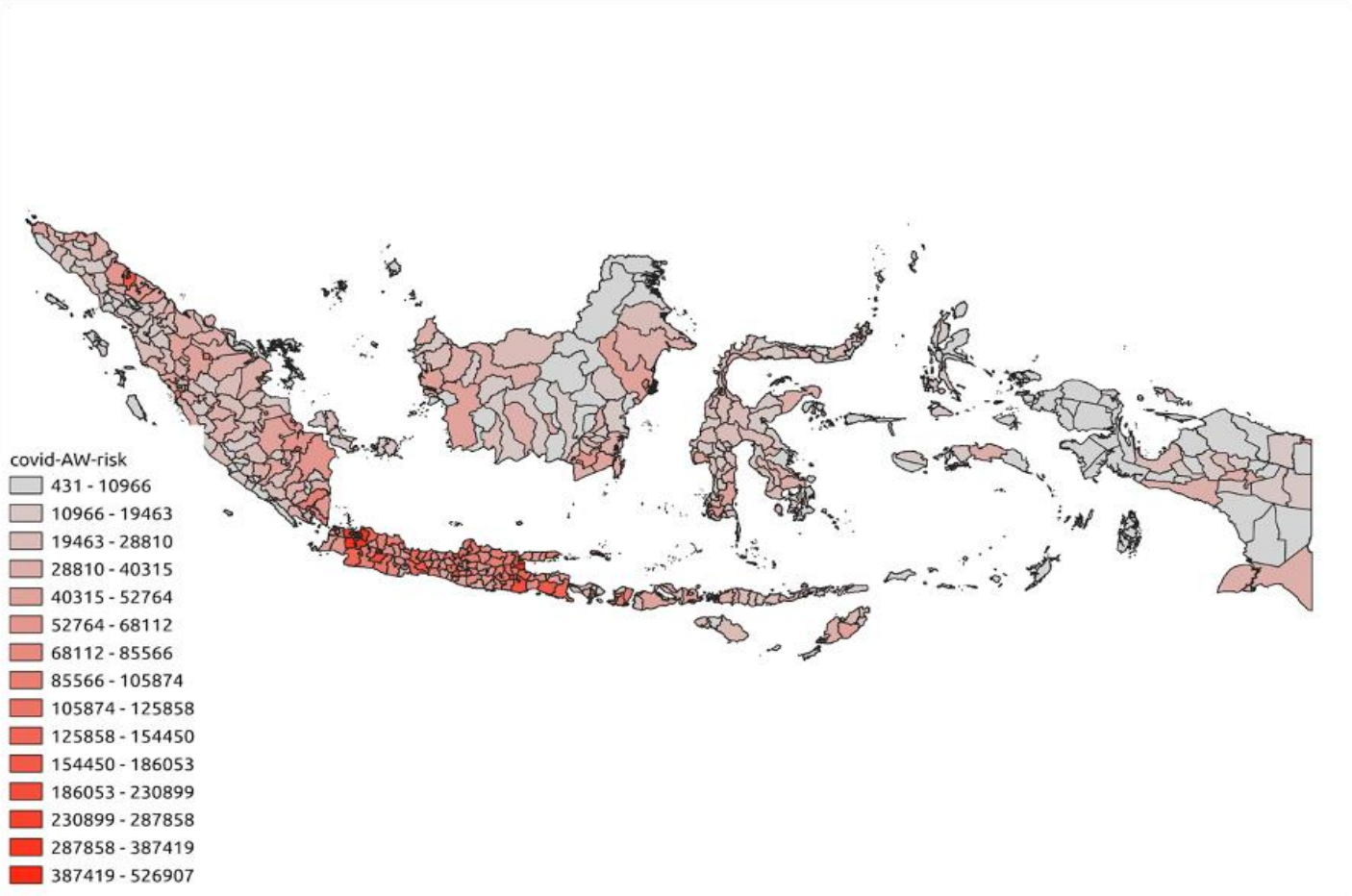
Distribution of converted DALY



Source: authors' calculation

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Data treatment

- As noted, DALY is converted down to district level.
- Hazard has only one indicator, i.e. COVID confirmed case, so no further transformation.
- For exposure, vulnerability, and resilience, we run a principal component analysis (PCA)

PCA exploration

	No. of components	No. of variables	Overall KMO
Exposure	4	15	0.71
Vulnerabilities	2	5	0.60
Resilience	2	5	0.53

Source: authors' calculation

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Descriptive statistics

	N	Mean	SD	Min	Max
DALY_conv	514	43975.6	56328.9	431.2	526907.4
Hazard_COVID	514	0.46	1.49	0	14.48
Exposure_PC1	512	5.25E-09	1.98	-1.48	19.82
Vulnerability_PC1	507	-1.59E-09	1.44	-4.58	5.77
Resilience_PC1	502	-8.39E-11	1.47	-7.97	5.36

Source: authors' calculation

Regression approach

- First we regress Equation 1 as is.
- Second, we assume equal hazard across districts, i.e. all are susceptible to COVID-19).
- Third, we re-calculate the economic risk using the weights implied by the coefficients from the first regression.

Weighting the risk

$$
\begin{aligned}
W\text{?}Risk_g = {} & \beta_0 \\
& + \beta_1 Hazard_g \\
& + \beta_2 Exposure_g \\
& + \beta_3 Vulnerability_g \\
& - \beta_4 Resilience_g
\end{aligned}
\tag{2}
$$

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The weights

$$\beta_j = \hat{a_j}\left(\sum_{j=0}^{4} \hat{\rho_j}\right)^{-1} \qquad (3)$$

Result: naive regression

Source: authors' calculation

Result: equal hazard

Source: authors' calculation

Result: weighted risk

Source: authors' calculation

Naive regression: June, September, December 2020

	Q2-2020	Q3-2020	Q4-2020
Hazard	83993.3*** (12125.9)	28455.9*** (3366.9)	19812.3*** (3850.9)
Exposures	5716.2* (2981.3)	4483.5 (2807.2)	3721.6** (1613.5)
Vulnerability	17978.8*** (3179.4)	17497.2*** (3014.5)	17961.0*** (3454.6)
Resilience	-974.1 (1354.3)	-2777.2*** (1395.1)	-7423.3*** (1824.0)
Constant	38987.4*** (1787.4)	34796.1*** (1977.0)	25494.3*** (2926.5)
N	496	496	507
R-squared	0.65	0.68	0.72
Prob > F	***	***	***

Source: authors' calculation

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Weighted DALY indices

	Q2-2020	Q3-2020	Q4-2020
Hazard	0.58	0.32	0.27
Exposures	0.04	0.05	0.05
Vulneability	0.10	0.20	0.24
Resilience	0.01	0.03	0.10
Constant	0.27	0.40	0.34

Source: authors' calculation

Updating the data

- Demographic data is updated with the new MOHA Data 2020.
- Corruption Index (KPK 2020) is included.
- Google Mobility Index 2020 is included.
- Both Corruption Index and Google Mobility Index are re-indexed using population data

Base v. updated data

	Jan 2021 (base) DALY	Weights	Jan 2021 (update) DALY	Weights
Hazard	12120.7*** (3450.0)	0.19	10882.4*** (1961.9)	0.21
Exposures	3365.1** (1555.3)	0.05	5682.7** (1018.4)	0.11
Vulnerability	17360.0** (3500.7)	0.27	7531.8** (3050.0)	0.15
Resilience	-6526.8 (2116.3)	0.10	-654.0 (1610.4)	0.02
Constant	25094.7*** (4459.3)	0.39	26075.4*** (3004.7)	0.51
N	507		507	
R-squared	0.69		0.69	
Prob > F	***		***	

Source: authors' calculation

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Summary

- Economic risks from COVID-19 pandemic are not evenly distributed across Indonesian districts.
- Those in Java suffer the most.
- It is possible to employ many different data sources (including high frequency data) to monitor the changes in economic risks associated with the pandemic.
- What's not yet considered here: health protocols (and their enforcement and efficacy) and disaster relief/fiscal stimulus.

Thank you!