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THE UNIVERSITY OF TEXAS AT DALLAS

Land-use transformation and conflict: The effects of oil palm expansion in Indonesia

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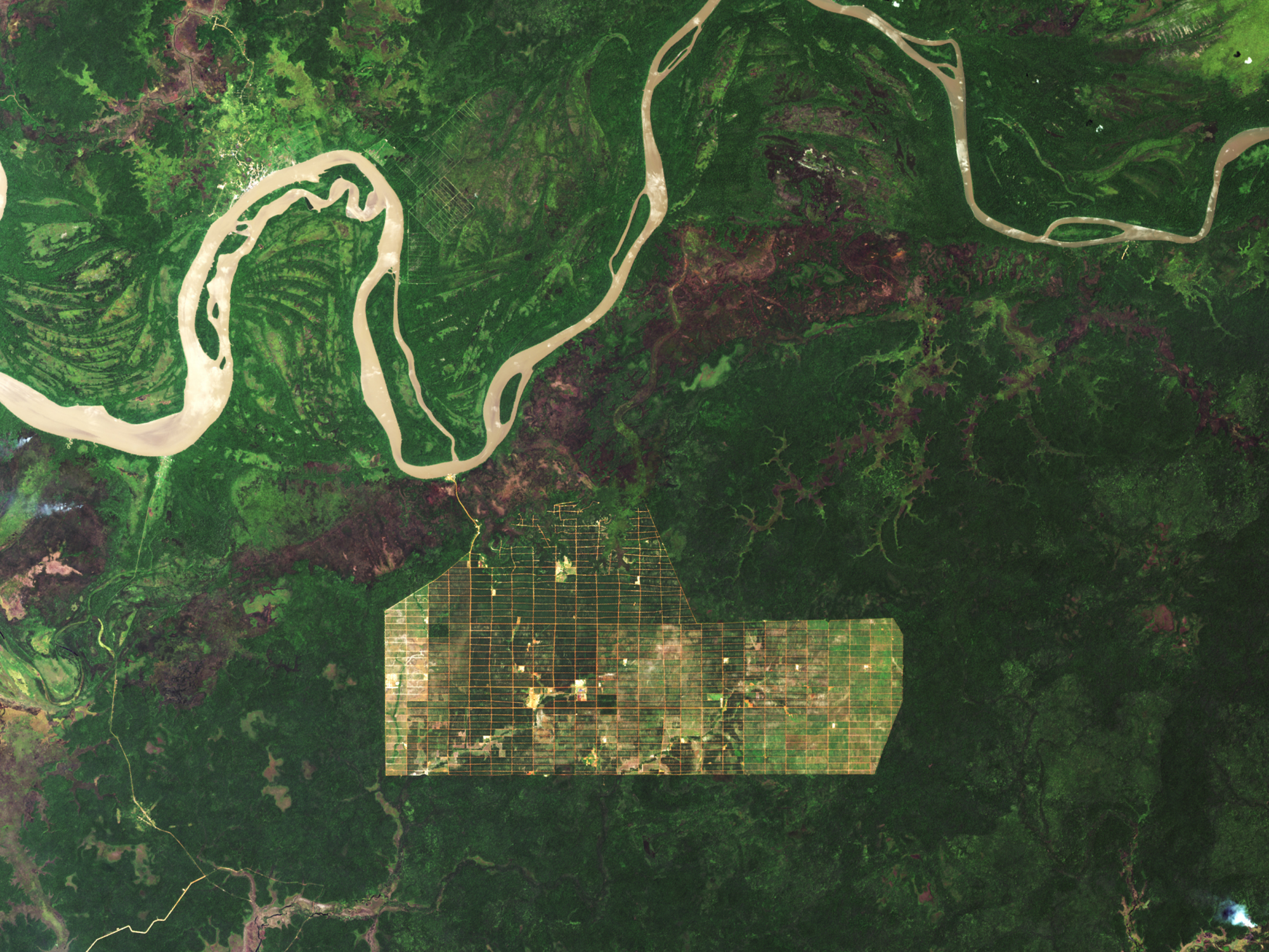
World Bank Land Conference 2024



Commodity booms and violent conflict

Theory

Increasing value of production:

- Opportunity cost effect:
  conflict ↓

Hirshleifer (1991; 1994), Collier and Hoeffler (1998; 2004), Dal Bo and Dal Bo (2011)

Commodity booms and violent conflict

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Hirshleifer (1991; 1994), Collier and Hoeffler (1998; 2004), Dal Bo and Dal Bo (2011) Stewart (2000, 2008), Kelly (2000), Østby (2008)

Commodity booms and violent conflict

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Increasing value of production:

- Opportunity cost effect: conflict ↓
- Inequality & rapacity effects: conflict ↑

Expansion pressure:

- Competition for land: conflict ↑
- Inequality effects: conflict ↑
  - Social grievances
  - Environmental grievances

Stewart (2000, 2008), Kelly (2000), Grossman and Mendoza (2003), Østby (2008), Bryant (1998), Homer-Dixon (1994), Grossman and Mendoza (2003), De Juan et al. (2022)

Commodity booms and violent conflict

Evidence

Increasing value of production:

- Opportunity cost effect: conflict ↓
- Inequality & rapacity effects: conflict ↑

Bazzi and Blattmann (2014), Berman and Couttenier (2015), Berman et al (2017), Ciccone (2018), Crost and Felter (2019), Dube and Vargas (2013), Dube et al. (2016), Fjelde (2015), Gehring et al. (2018), Hidalgo et al. (2010), McGuirk and Burke (2020), Millán-Quijano and Pulgarín (2023)

Expansion pressure:

- Competition for land: conflict ↑
- Inequality effects: conflict ↑
  - Social grievances
  - Environmental grievances

De de Jong et al. (2021), Kenny et al. (2020), Falcone & Rosenberg (2022),Grasse (2022),Tellez (2022), McGuirk and Nunn (2020)

→ *Evidence is mixed and inconclusive*

Research approach & findings

- Case study: Palm oil boom in Indonesia
  - Plantation expansion strongly followed global and national incentives
  - Time delay between land-use change and production increases
- Spatio-temporal data on violent conflict events
- Relate it to:
  - Remotely sensed yearly oil palm expansion
  - An indicator of expansion pressure
  - An indicator of oil palm related economic shocks

Research approach & findings

- Case study: Palm oil boom in Indonesia
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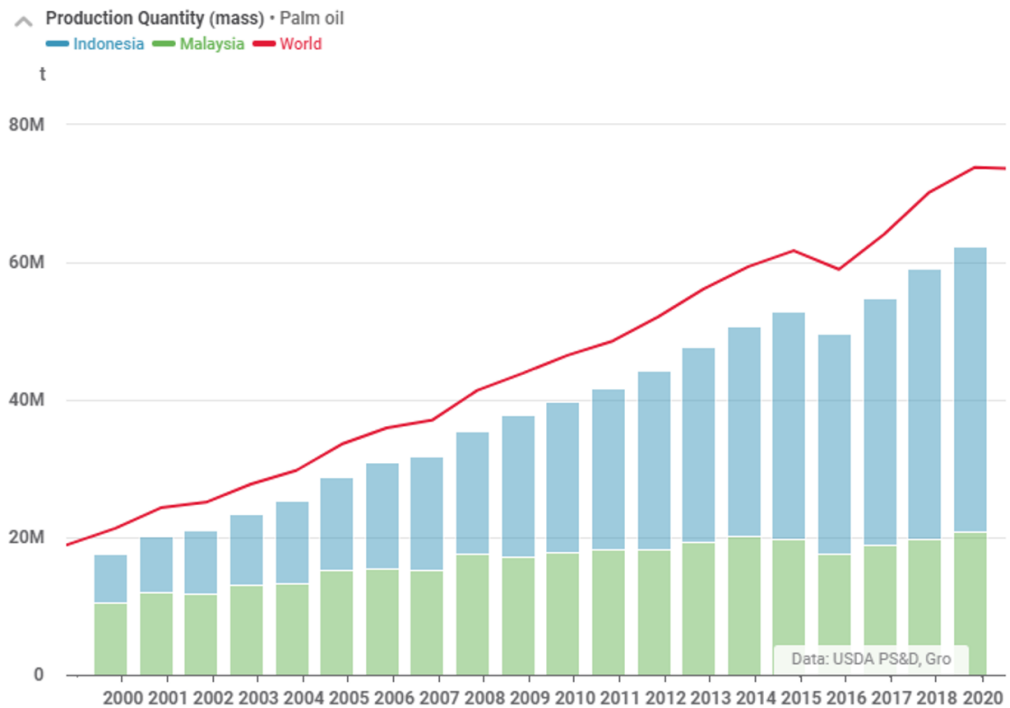
- Spatio-temporal data on violent conflict events
- Relate it to:
  - Remotely sensed yearly oil palm expansion
  - An indicator of expansion pressure
  - An indicator of oil palm related economic shocks
- Findings show:
  - An *expansion pressure effect* causing conflicts linked to land scarcity and competition
  - An *opportunity cost effect* in areas with pre-existing oil palm plantations

Related literature

- Economic causes of conflict (e.g., Dal Bo and Dal Bo, 2011; Dube and Vargas, 2013; Bazzi and Blattmann, 2014; Bermann and Couttenier, 2015; Fjelde, 2015; Ross, 2015; Dube et al., 2016; Berman et al., 2017; Harrari and La Ferrara, 2018; Crost and Felter, 2020; McGuirk and Burke, 2020; Gehring et al., 2023)
- Institutions and resource conflict (e.g., Besley and Persson, 2011; Fetzer and Marden, 2017; Castaneda-Dower and Pfutze, 2020; Fetzer and Kyburz, 2024)
- Resource scarcity and conflict (e.g., Almer et al., 2017; Castillo et al., 2020; Acemoglu et al., 2020; Unfried et al., 2022)
- Political economy of Indonesia (e.g., Bazzi and Gudgeon, 2021; Barron et al., 2009; 2016; Burgess et al., 2012; Cisneros et al., 2021; Balboni et al., 2021; 2023))
- Palm oil and conflict (Kenny et al., 2020; Grasse, 2022; Tellez 2022, Millan-Quijano and Pulgarin, 2023)

The palm oil boom

Palm oil production in Indonesia and Malaysia



Source: USDA/Gro Intelligence, 2021

Benefits

- Economic growth and development
  (Sayer et al., 2012; Euler et al., 2017; Gatto et al., 2017; Kraus et al., 2022)

Problems

- Deforestation
  (Gaveau et al., 2016; Austin et al., 2019)
- Corruption
  (Cisneros et al., 2021)
- Social conflict, land disputes, violence, crime
  (Persch-Orth and Mwangi, 2016 Abram et al., 2017; Li, 2018; Kenny et al., 2020)

Palm oil and conflicts in Indonesia

- More than 4000 land disputes related to palm oil in 2012 (BPN)
- Disputes frequently turn violent or even deadly (Berenschot et al., 2021)

In Mesuji (Lampung) in 2011 a clash between plantation security forces and villagers resulted in the death of seven people. The underlying land conflict, related to inadequate compensation for village land loss, is still unresolved.

Palm oil and conflicts in Indonesia

Sources: Reuters/AFP/FB Anggoro/Antara/Anadolu

Data: Violent conflicts

- In Bukit Jaya Village [...], **dozens of residents** of the Bayung Lincir Farmers Group were **involved in clashes** with the Bukit Jaya Farmers Group (KT) Unit 21. The clash was **triggered by oil palm land ownership rights** [...] (11/11/2014)
- In Ketahun District [...], residents of the surrounding villages carried out **destruction by burning** the office, mess and vehicles at PT. SIL due to **land conflict between the company and residents** (27/2/2013)
- **30 masked people** ordered by CV Kartika **attacked employees** of the PTPN II plantation, Tanjung Keliling plantation, Salapian sub-district, Langkat [...] (09/07/2008)
- Binjai Mayor's Office. **Hundreds of supporters** of the 3 mayoral candidates came to the Binjai mayor's office. They **demand justice and honesty** in holding regional elections. Because they could not find an agreement, the masses **went on a rampage**. (6/27/2005)

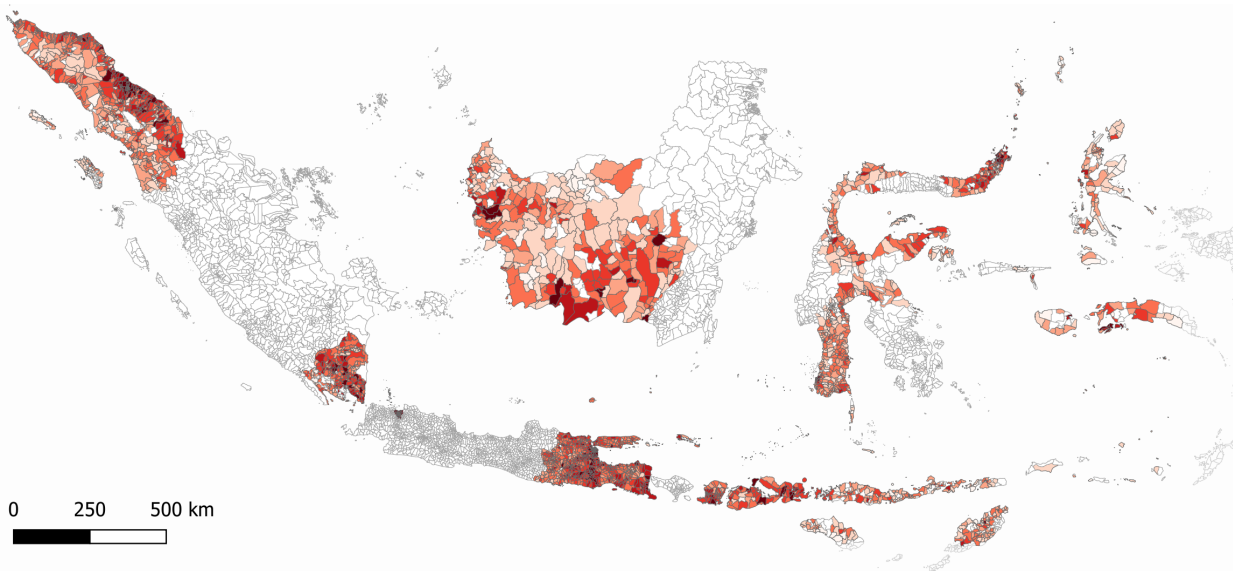
more

Source: National Violence Monitoring System (NVMS)

- Database of 160,000 conflicts and violent crime events from newspaper reports (NVMS, World Bank)

Data: Violent conflicts

Intensity of conflicts in subdistricts (2005–2014)



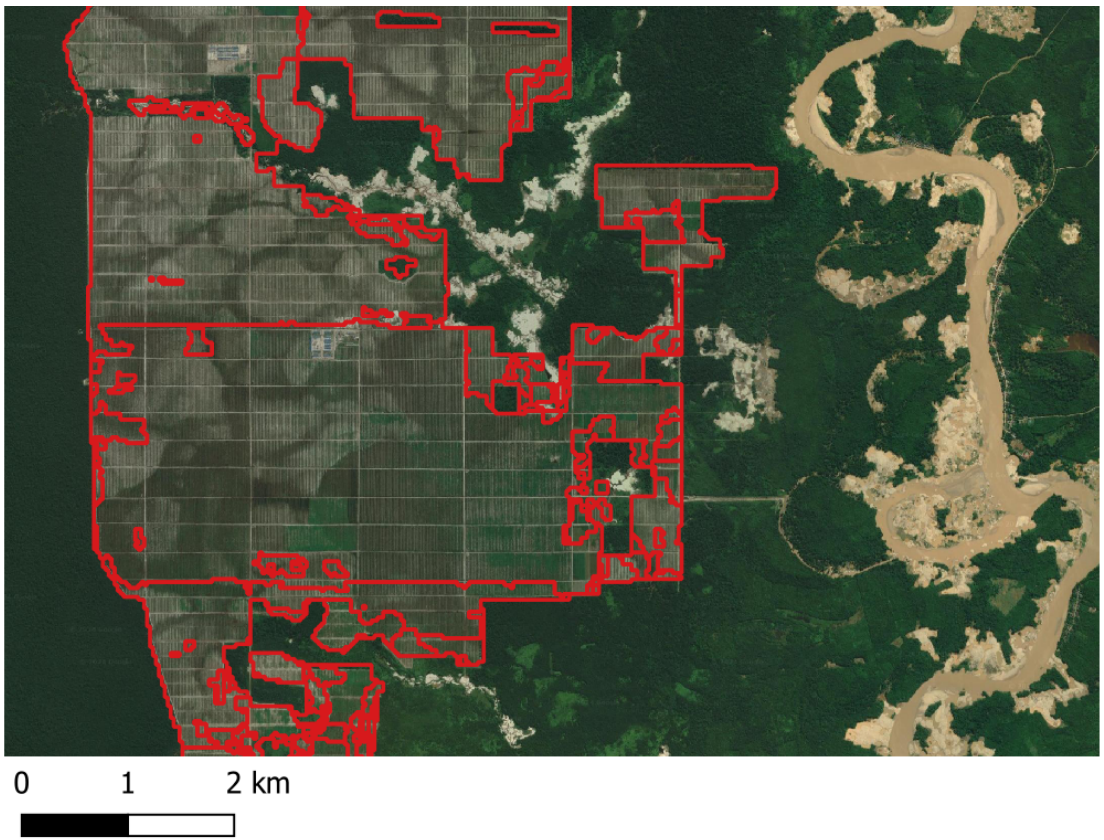
Source: National Violence Monitoring System (NVMS)

- Database of 160,000 conflicts and violent crime events from newspaper reports (NVMS, World Bank)
- Geo-localized to subdistricts
- Panel of
  - 2,755 units
  - 10 years
  - ca. 28% have a conflict incident each year

$\Rightarrow$ Yearly occurrence of violent conflicts at subdistrict level

Data: Oil palm expansion

Example of plantation expansion

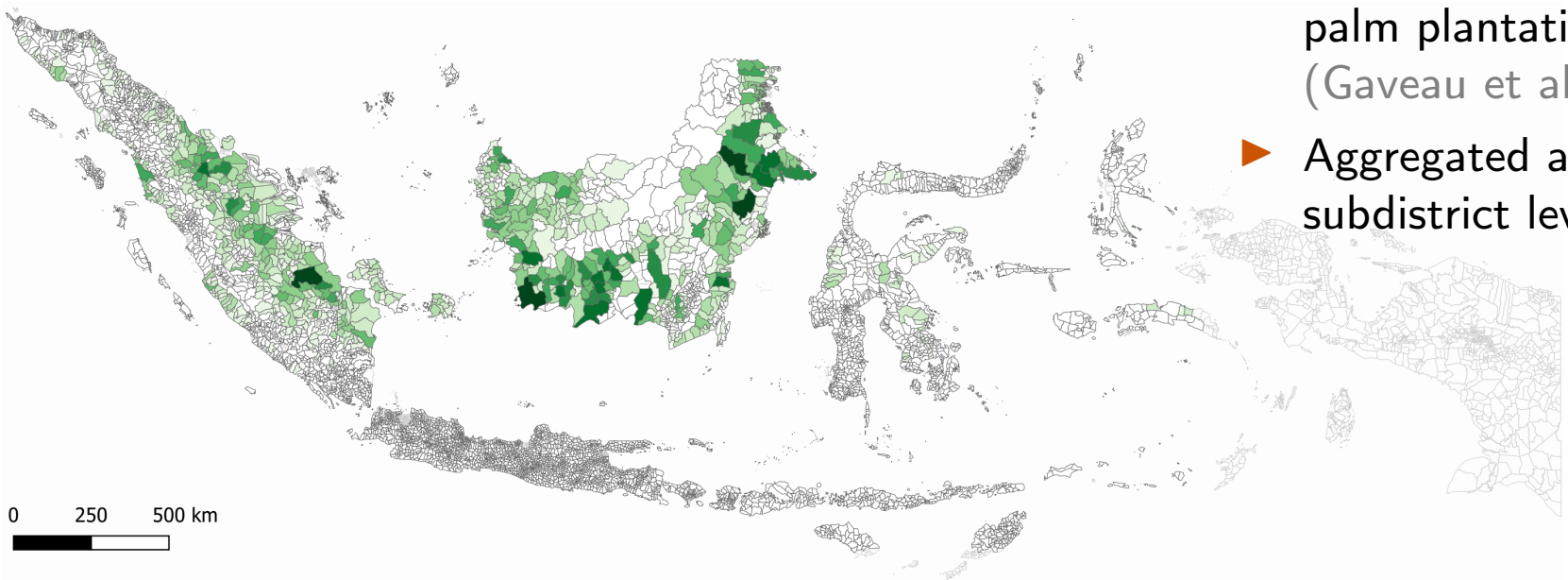


Source: Based on Gaveau et al. (2021), CNES/Airbus

- Yearly high-resolution remotely-sensed oil palm plantation maps (Gaveau et al., 2021)

Data: Oil palm expansion

Expansion of oil palm area (2005–2014)



- Yearly high-resolution remotely-sensed oil palm plantation maps (Gaveau et al., 2021)
- Aggregated at subdistrict level

Source: Based on Gaveau et al. (2021)

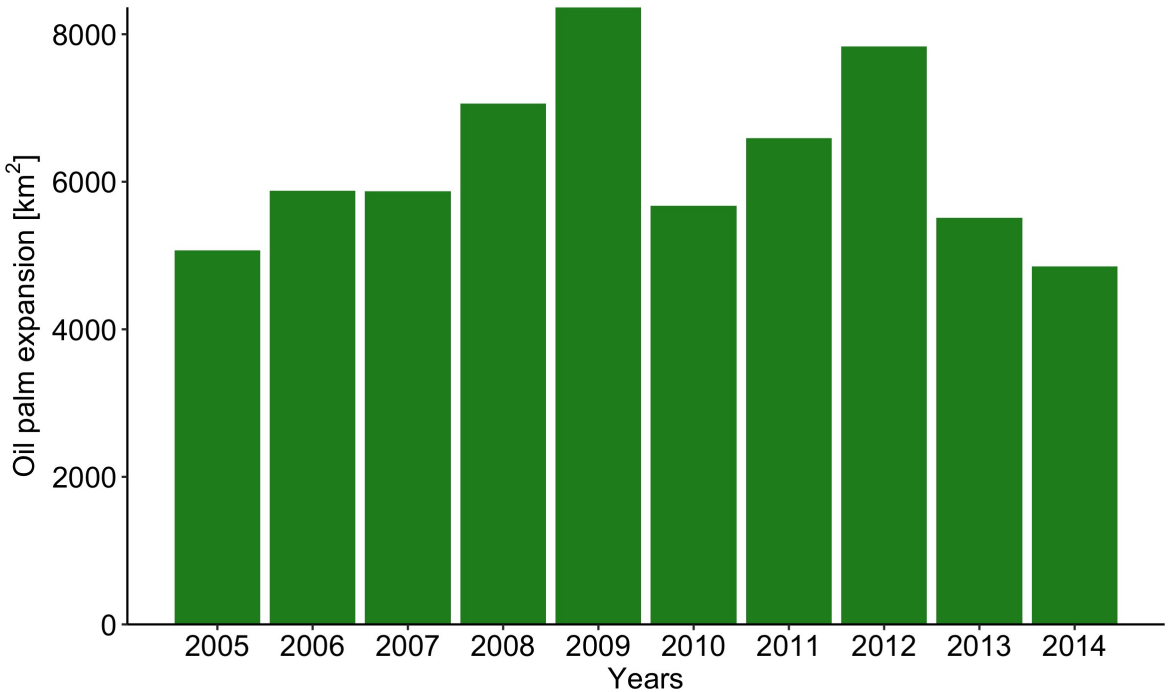
$\Rightarrow$ Yearly new oil palm plantation area per subdistrict

Further data sources

- Crop suitability (GAEZ/FAO)
- Village census (PODES 2003, 2006, 2014)
- Commodity prices (UNCTAD)
- Precipitation/droughts (SPEI/CRU)
- Forest cover (Hansen et al., 2013)
- Remoteness (Nelson et al., 2008)
- Elections (Cisneros et al., 2021)
- ... and many more

Measuring incentives to expand plantations

National oil palm expansion



Source: Gaveau et al. (2021)

Redistribution of

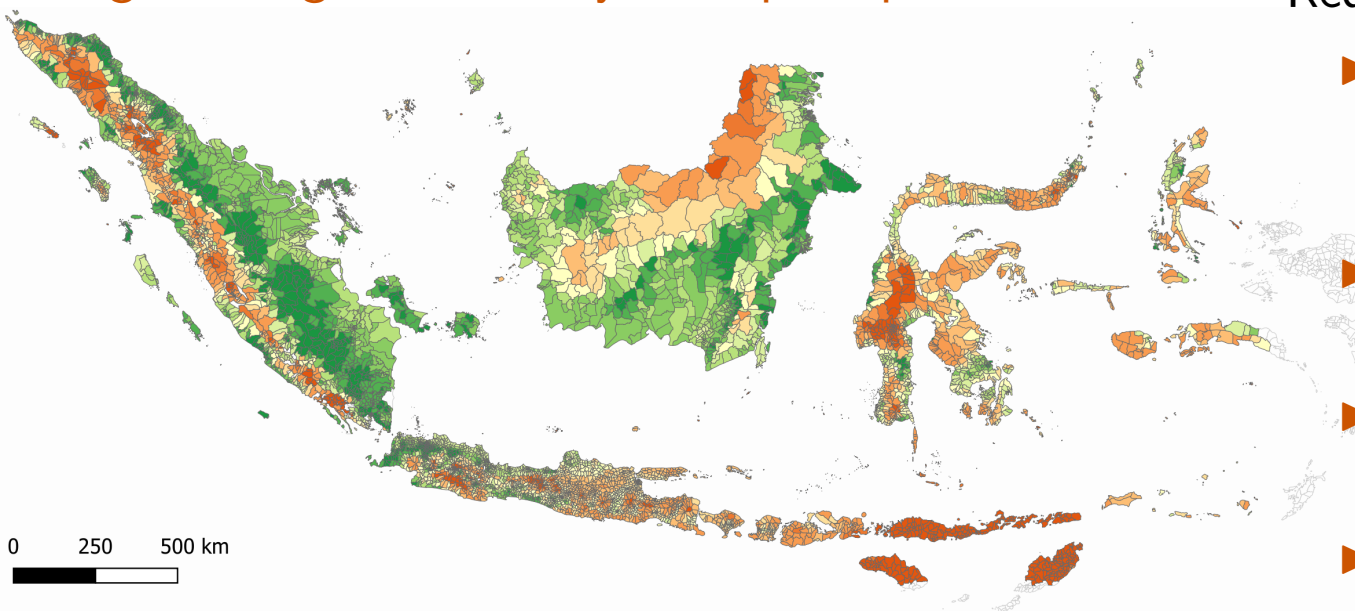
- National oil palm expansion, NE_t, via
- share of available area, γ_i,
- subdistrict area, A_i, and
- soil suitability to plant oil palm s_i

$$EP_{it} = \left(\frac{s_i \gamma_i A_i}{\sum s_i \gamma_i A_i} \times NE_t\right) \times \frac{1}{A_i}$$

→ details

Measuring incentives to expand plantations

Agro-ecological suitability of oil palm production



Redistribution of

- National oil palm expansion, NE_t, via
- share of available area, γ_i,
- subdistrict area, A_i, and
- soil suitability to plant oil palm s_i

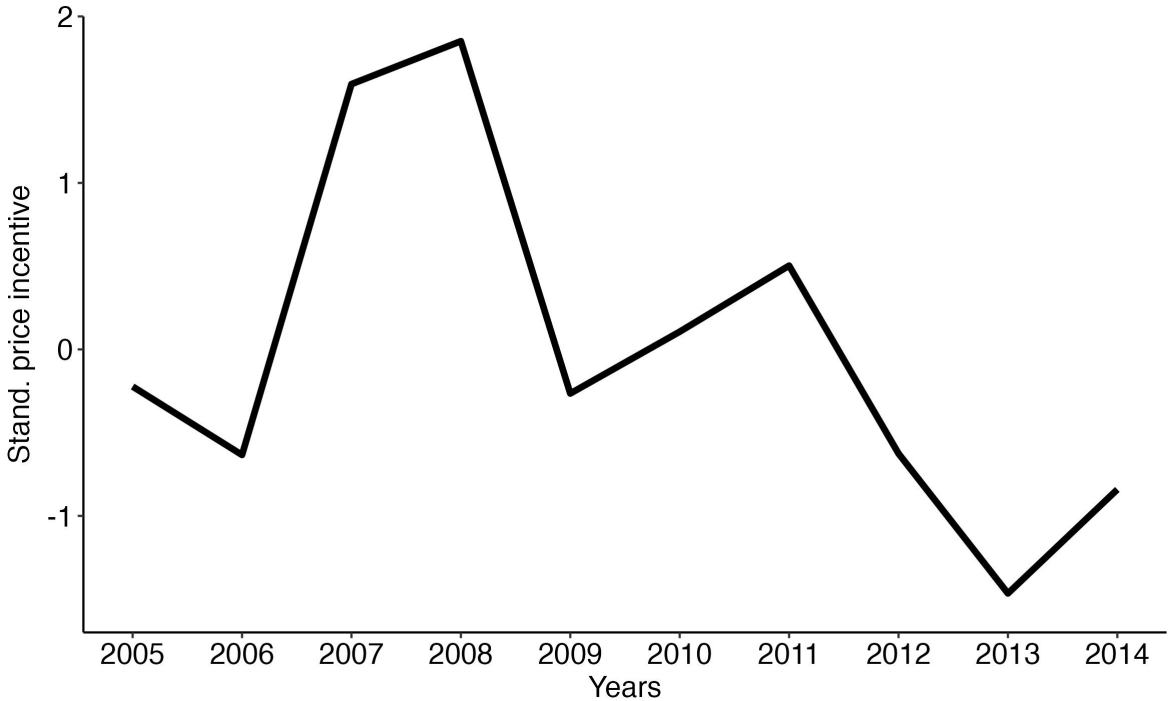
Source: Maps for Global Agro-Ecological Zones (FAO/IIASA)

$$EP_{it} = \left(\frac{s_i \gamma_i A_i}{\sum s_i \gamma_i A_i} \times NE_t\right) \times \frac{1}{A_i}$$

→ details

Explanatory variable: Economic shocks

International palm oil price fluctuation



Price exposure shock:

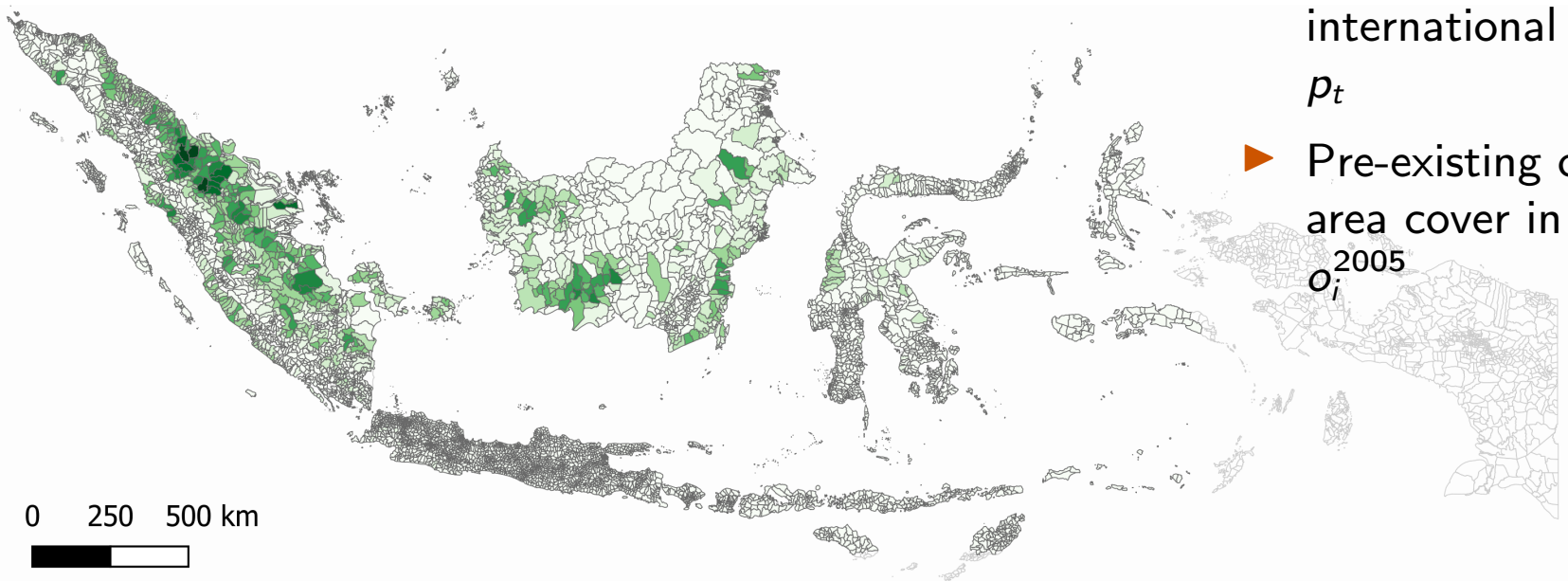
- Price incentive from international market, p_t

$$PE_{it} = o_i^{2005} \times p_t$$

→ details

Explanatory variable: Economic shocks

Oil palm area cover (2005)



Price exposure shock:

- Price incentive from international market, p_t
- Pre-existing oil palm area cover in 2005, o_i^{2005}

Source: Based on Gaveau et al. (2021)

$$PE_{it} = o_i^{2005} \times p_t$$

→ details

Empirical strategy

(1) The effect of land-use change

$$C_{it} = \gamma \ln \textit{Oil Palm Expansion}_{it} + X'_{i0} \times \eta_t + \lambda_i + \eta_t + \epsilon_{it}$$

- C_{it} - Any conflict incident
- X'_{i0} - Remoteness controls (Baseline: Travel time to major cities in 2000)
- η_t - Year fixed effects
- λ_i - Subdistrict fixed effects

Empirical strategy

(1) The effect of land-use change

$$C_{it} = \gamma \text{ ln } \textit{Oil Palm Expansion}_{it} + X'_{i0} \times \eta_t + \lambda_i + \eta_t + \epsilon_{it}$$

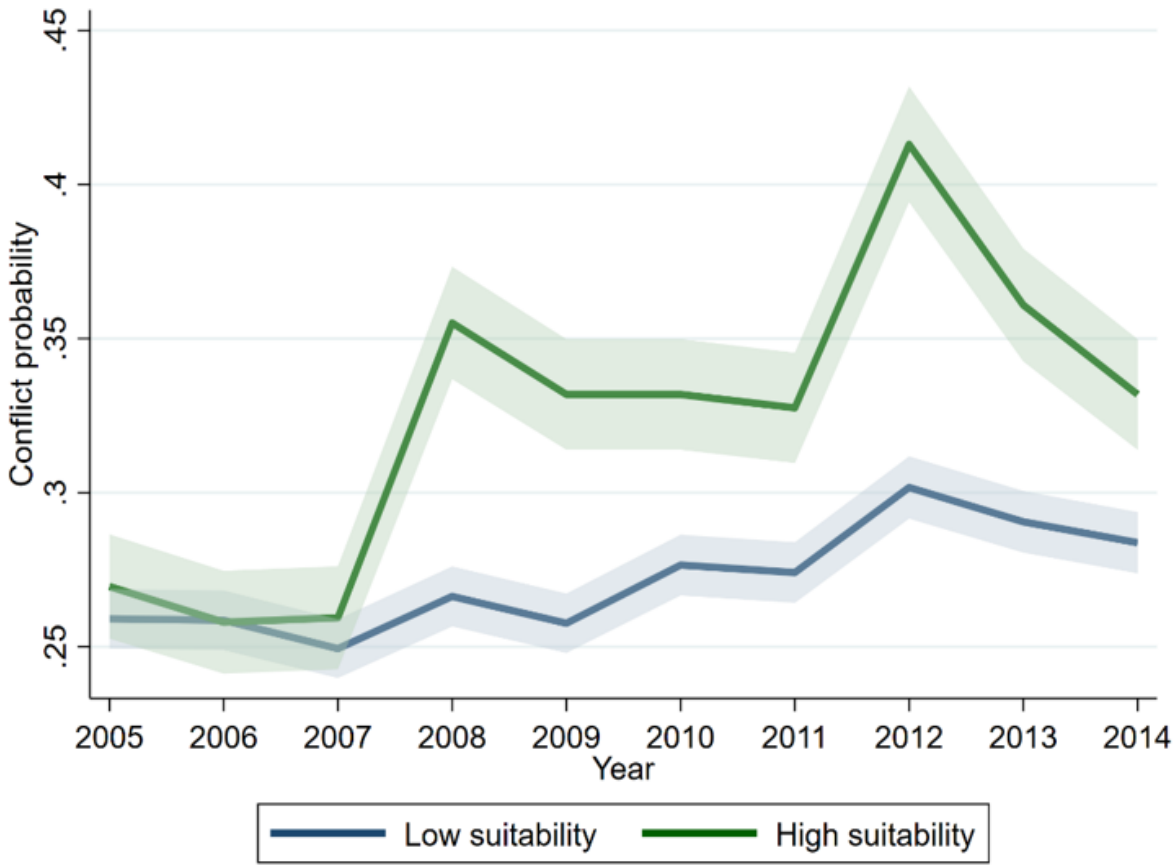
(2) The effect of expansion pressure and economic shocks:

$$C_{it} = \delta\, EP_{it} + X'_{i0} \times \eta_t + \lambda_i + \eta_t + \upsilon_{it}$$
$$C_{it} = \delta\, EP_{it} + \beta\, PE_{it} + X'_{i0} \times \eta_t + \lambda_i + \eta_t + \upsilon_{it}$$

- C_{it} - Any conflict incident
- X'_{i0} - Remoteness controls (Baseline: Travel time to major cities in 2000)
- η_t - Year fixed effects
- λ_i - Subdistrict fixed effects

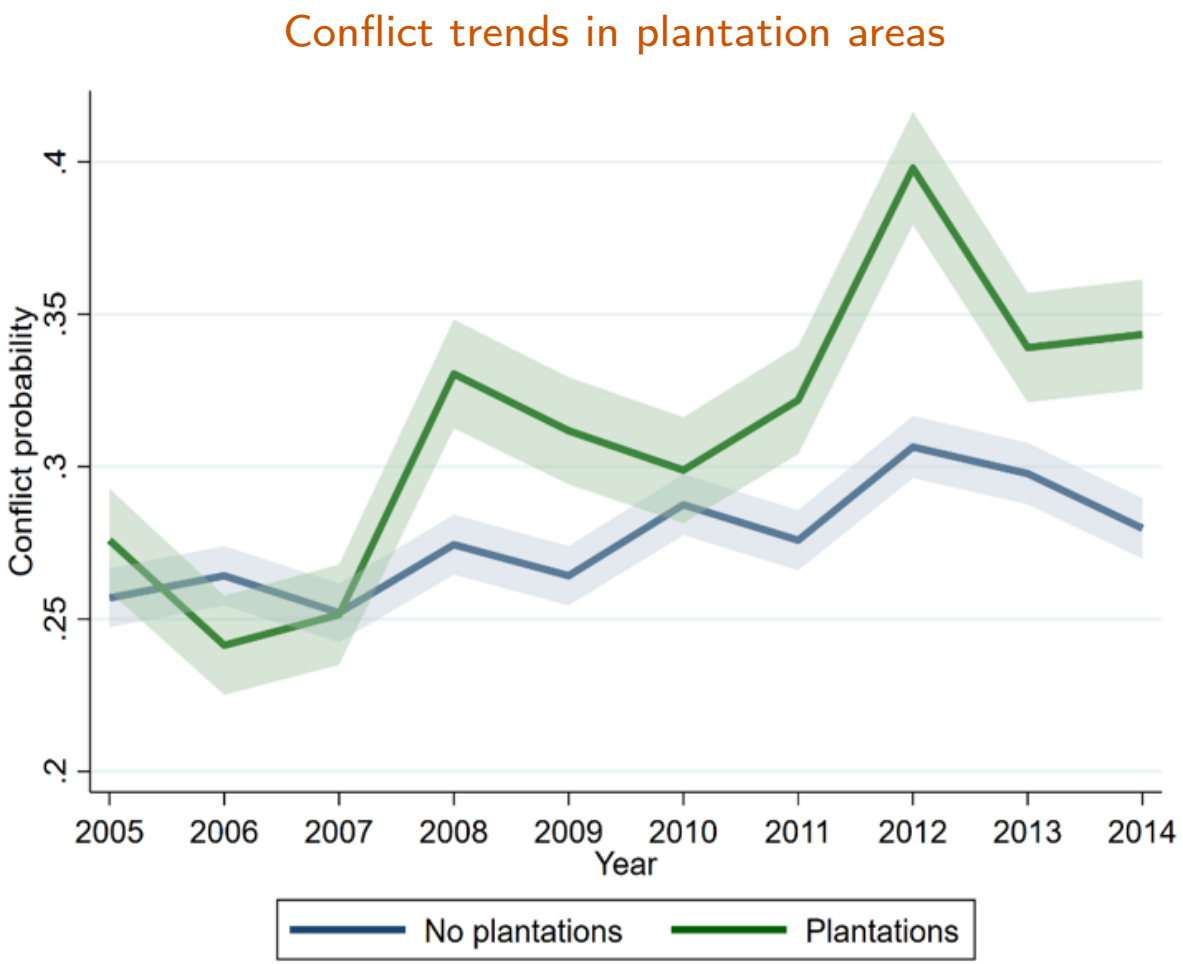
Descriptive trends

Conflict trends and oil palm suitability



- Strong increases in overall conflicts both in areas suitable for oil palm...

Descriptive trends



- Strong increases in overall conflicts both in areas suitable for oil palm...
- ... and in areas with actual plantations

Effects of oil palm expansion

Dependent variable:	Any conflicts		
	(1)	(2)	(3)
Any new plantation area	0.060***	0.077***	0.007
	(0.013)	(0.012)	(0.013)
ln New plantation area	0.011***	0.017***	0.000
	(0.003)	(0.003)	(0.003)
Oil palm expansion pressure (EP)	0.179***	0.063***	0.190***
	(0.023)	(0.021)	(0.047)
Mean dependent variable	0.285	0.285	0.285
Year FE	Yes	Yes	Yes
Province FE	Yes	Yes	No
Sub-district FE	No	No	Yes
Remoteness × year FE	No	Yes	Yes
Observations	27,550	27,550	27,550

- Plantation expansion pressure is strongly associated with conflict
- Incentives to convert 1% of sub-district area to plantation increase local conflict probability by 19 pp. (mean of 0.33%: 6.3 pp.)

Economic shocks in oil palm areas and conflict

Dependent variable:	Any conflicts			
	(1)	(2)	(3)	(4)
Oil palm expansion pressure (EP)	0.192***	0.193***	0.193***	0.199***
	(0.047)	(0.047)	(0.047)	(0.048)
Historical oil palm share × Price shock	−0.034*			
	(0.019)			
× Positive price shock		0.005		
		(0.032)		
× Negative price shock		0.098*		
		(0.050)		
× SPEI			−0.110**	
			(0.054)	
× Excess rain months				0.022
				(0.016)
× Drought months				0.038***
				(0.013)
Mean dependent variable	0.285	0.285	0.285	0.285
Year FE	Yes	Yes	Yes	Yes
Sub-district FE	Yes	Yes	Yes	Yes
Remoteness × year FE	Yes	Yes	Yes	Yes
Observations	27,550	27,550	27,550	27,550

- Negative income shocks increase conflicts

Robustness

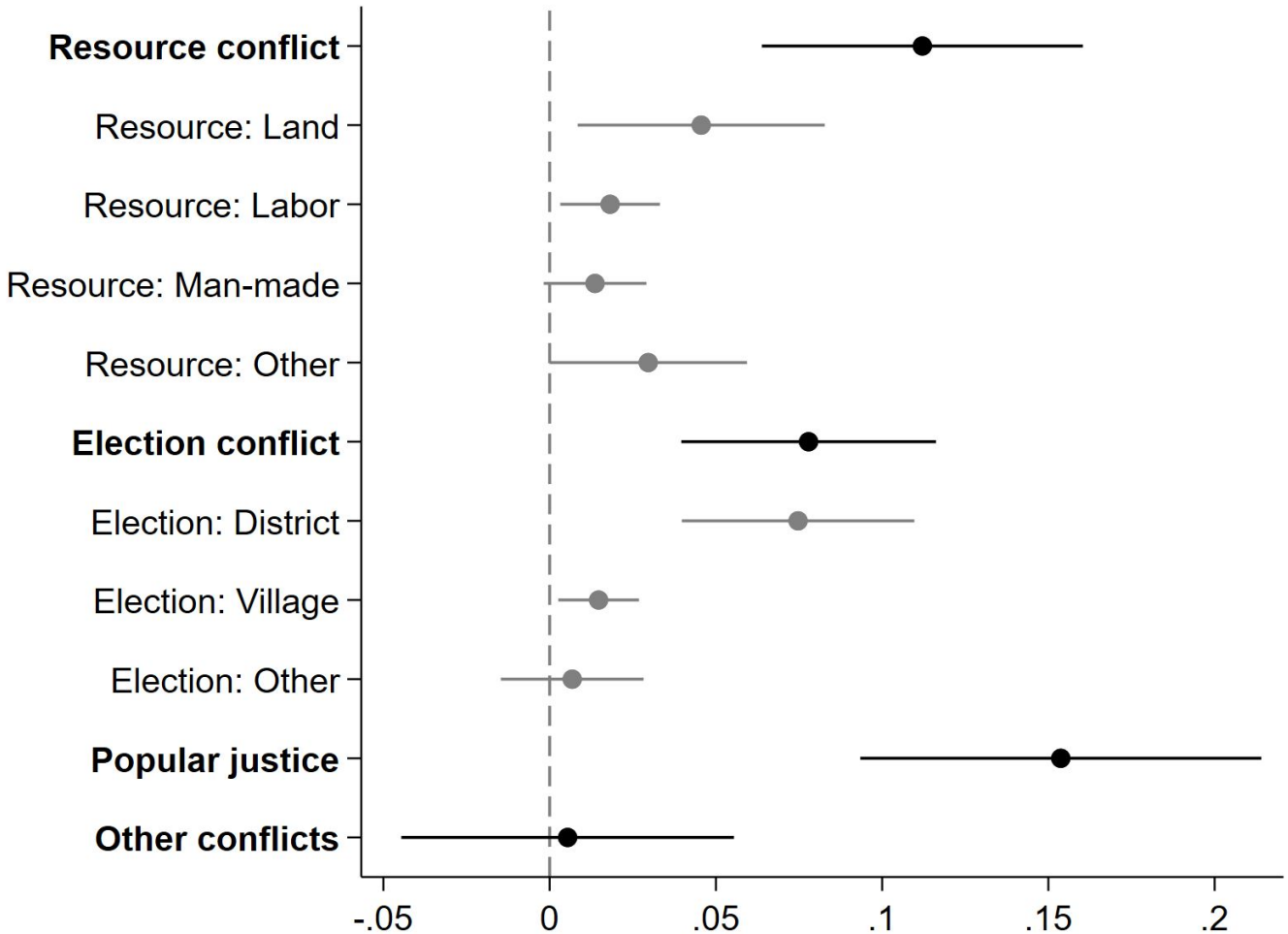
- Alternative specifications of expansion pressure →
- Effects using other crop suitabilities →
- Effects of other crop price exposures →
- Conditional exogeneity of shares →
- Timing of expansion pressure →
- Spatial Clustering →
- Sample variations (region & time) →
- Placebo tests with randomly reshuffled suitability →

Relevance of land-use rents

Dependent variable:	Any conflicts			
	(1)	(2)	(3)	(4)
Expansion pressure	0.220***	0.228***	0.201***	0.249***
	(0.050)	(0.049)	(0.047)	(0.051)
Expansion pressure × available area per household (ha)	−0.004**			−0.002
	(0.002)			(0.002)
Expansion pressure × any mining/oil/gas concessions		−0.219***		−0.198**
		(0.080)		(0.082)
Expansion pressure × low farming dependence			−0.218*	−0.211*
			(0.123)	(0.124)
Mean dependent variable	0.285	0.285	0.285	0.285
Year FE	Yes	Yes	Yes	Yes
Sub-district FE	Yes	Yes	Yes	Yes
Remoteness × year FE	Yes	Yes	Yes	Yes
Observations	27,550	27,550	27,550	27,550

- Effects are weaker where land is less scarce and less relevant as an income source

Effects by conflict types



- Expansion pressure causes (a) conflict over resources, (b) political discontent, and (c) social tensions

Role of land ownership

Dependent variable:	Any conflicts		Resource conflicts		Other conflicts	
	(1)	(2)	(3)	(4)	(5)	(6)
Oil palm exp. pressure	0.337***	0.323***	0.335***	0.283***	0.290*	0.222
	(0.186)	(0.132)	(0.128)	(0.095)	(0.172)	(0.142)
Expansion pressure ×	−0.065		−0.215**		−0.075	
% private land, of total	(0.189)		(0.131)		(0.174)	
Expansion pressure ×		−0.070		−0.202*		−0.006
% owner-cultiv. land, of private		(0.167)		(0.118)		(0.177)
Mean dependent variable	0.345	0.345	0.090	0.090	0.300	0.298
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sub-district FE	Yes	Yes	Yes	Yes	Yes	Yes
Remoteness × year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,210	17,800	17,210	17,800	17,210	17,800

- Resource conflicts are mediated where land is less contestable and less concentrated (ex-ante)

Electoral incentives

Dependent variable:	Any conflicts	Election conflicts	Other conflicts
	(1)	(2)	(2)
Oil palm expansion pressure	0.207***	0.073***	0.166***
	(0.048)	(0.024)	(0.046)
Expansion pressure × mayor election year	0.047**	0.042***	0.034*
	(0.020)	(0.014)	(0.020)
Mayor election year	−0.015*	0.028***	−0.031***
	(0.009)	(0.005)	(0.009)
Mean dependent variable	0.288	0.037	0.271
Year FE	Yes	Yes	Yes
Sub-district FE	Yes	Yes	Yes
Remoteness × year FE	Yes	Yes	Yes
Observations	27,090	27,090	27,090

- Expansion pressure causes election violence especially during local mayor elections

Some non-results

No effects via:

- Mitigation through development →
- Social factors and conflict (Δ pop., ethnicity, religion) →
- Environmental grievances →

Why do land conflicts turn violent?

- Weak and intransparent land rights situation, especially in the Forest Estate (*kawasan hutan*)
- Customary land rights (*adat*) are often not recognized in court

  $\rightarrow$ Solving conflicts through legal mechanisms is challenging
- Corruption and rent-seeking among community leaders, local politicians, authorities

  $\rightarrow$ Feelings of betrayal and failed mediation cause grievances and resentment

(Sources: Afrizal and Berenschot, 2020, 2022; Berenschot et al. 2021, Cramb and McCarthy, 2016; Nurhidayah et al., 2020, many more...)

Summary

- Oil palm boom in Indonesia is linked to local violent conflicts:
  - **Opportunity cost effect:** negative economic shocks in plantation areas increase conflict
  - **Expansion pressure effect:** incentives to expand production area increase conflict
- Likely mechanisms:
  - Land scarcity and competition
  - Inequality in the distribution of land rents
  - Land conflicts turn violent due to the lack of effective legal recourse

Policy implications

- Agricultural intensification at a large scale needs to be accompanied by better mechanisms to resolve conflicts
  - Reform of rural land and property rights
  - Mediation mechanisms
  - Better definition, monitoring and enforcement of land and ecological boundaries
  - Benefit-sharing, improved compensation for land loss

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TEXAS The University of Texas at Austin

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World Bank Land Conference 2024

NVMS conflict examples

- Popular justice: 11/11/2013. In District. Ngabang, Kab. Landak, West Kalimantan, A resident of Peluntan hamlet who worked as a surveyor at PT DLP **was beaten up for stealing palm fruit** belonging to the company. He was beaten **in a raid carried out by PT DLP staff** [...]
- Resource: 13/10/2014. In Sungai Daun Village, Pasir Limau Kapas District, Rokan Hilir Regency, Riau, it is suspected that **because of land issues**, a TNI retiree **shot 4 palm oil plantation workers** and assaulted one of the victims' wives [...]
- Governance: Governance: On April 24 2005, dozens of **police officers attacked residents** in Rano, South Sulawesi. This incident is thought to be due to the **rejection of the splitting of Polmas district into Polmas and Mamasa districts**. The result of the event [...]
- Elections: July 4 2005, there was a **demonstration and damage** at the Lutim KPUD office, the masses came from the Lotim community forum asking the KPU to **stop voting and hold a re-election**, as a result of this demonstration there were also **clashes between the masses and residents**
- Separatist: On August 9, 2010, a perpetrator who raised the GAM **[Free Aceh Movement]** Rusli flag was **shot by police officers** for not heeding police calls to lower the Gam flag, the victim was shot in the leg
- Identity: 2/7/2011 **Dozens of residents** of Gang Lurah and Gang Jampang were involved in **throwing stones** at each other on the side of the KS TUbun Pal Merah road, West Jakarta. This action is a tradition whose root cause is unknown.

back

to overview - III

Shift shares - Expansion

Redistribution of the national trend by the realized shares

A_i - Subdistrict area

O_{it} - Oil palm plantation area in subdistrict i and year t

o_{it} - Oil palm plantation area share in kecamatan i and year t

$$
\begin{aligned}
O_{it} &= o_{it} A_i \\
\Delta O_{it} &= o_{it} A_i - o_{it-1} A_i \\
&= (o_{it} - o_{it-1}) A_i \\
&= \Delta o_{it} A_i \\
&= \Delta o_{it} A_i \times \frac{NE_t}{NE_t}
\end{aligned}
\qquad
\begin{aligned}
NE_t &= \sum o_{it} A_i - \sum o_{it-1} A_i \\
&= \sum (o_{it} - o_{it-1}) A_i \\
&= \sum \Delta o_{it} A_i
\end{aligned}
$$

$$
\Rightarrow \Delta O_{it} = \frac{\Delta o_{it} A_i}{\sum \Delta o_{it} A_i} \times NE_t
$$

$$
\Rightarrow E_{it} = \Delta o_{it} = \left(\frac{\Delta o_{it} A_i}{\sum \Delta o_{it} A_i} \times NE_t \right) \times \frac{1}{A_i}
$$

→ back

to overview - IV

Shift shares - Expansion pressure

O^s_{it} - Oil palm plantation pressure area in kecamatan i and year t
$\gamma_i = (1 - o_{i,2005})$ - share of available area / non-oil palm
Redistribution of the national trend by suitability (only):

$$\begin{aligned} \Delta O^s_{it} &= \frac{s_i A_i}{\sum s_i A_i} \times NE_t \\ \Rightarrow EP_{it} = \Delta o^s_{it} &= \left(\frac{s_i A_i}{\sum s_i A_i} \times NE_t\right) \times \frac{1}{A_i} \end{aligned}$$

Redistribution of the national trend by suitability + available area:

$$\begin{aligned} \Delta O^s_{it} &= \frac{s_i \gamma_i A_i}{\sum s_i \gamma_i A_i} \times NE_t \\ \Rightarrow EP_{it} = \Delta o^s_i &= \left(\frac{s_i \gamma_i A_i}{\sum s_i \gamma_i A_i} \times NE_t\right) \times \frac{1}{A_i} \end{aligned}$$

→ back

Shift share - price exposure

price shocks on available oil palm area.

p_t^{int} - international deflated market price in IDR
p_t^{dev} - price deviation
p_t - standardized price deviation / price incentive

$$p_t^{dev} = p_t^{intern} - \frac{1}{5}\sum_1^5 p_{t-\kappa}^{intern}$$

$$\bar{p}^{dev} = \frac{1}{T}\sum_{t=1}^{T} p_t^{dev}$$

$$sd(p^{dev}) = \left(\frac{1}{T}(p^{dev} - \bar{p}^{dev})^2\right)^{1/2}$$

$$p_t = \frac{(p_t^{dev} - \bar{p}^{dev})}{sd(p^{dev})}$$

$$\begin{aligned} PE_{it} &= o_{i,2005} \times p_t \\ &= (O_{i,2005} \times p_t) \times \frac{1}{A_i} \end{aligned}$$

→ back

Altern. expansion pressure specifications

	Shift	Share	Formula	Estimate: Any conflicts
(1)	Aggregate national expansion	Suitability-weighted available sub-district area share relative to total	$\left(\frac{s_i \gamma_i A_i}{\sum s_i \gamma_i A_i} \times NE_t\right) \times \frac{1}{A_i}$	0.190*** (0.047)
(2)	Aggregate national expansion	Suitability-weighted available sub-district area relative to total	$ln\left(\frac{s_i \gamma_i A_i}{\sum s_i \gamma_i A_i} \times NE_t + 1\right)$	0.107*** (0.035)
(3)	Aggregate national expansion	Suitability-weighted yearly available sub-district area share relative to total	$\left(\frac{s_i \gamma_{it} A_i}{\sum s_i \gamma_{it} A_i} \times NE_t\right) \times \frac{1}{A_i}$	0.149*** (0.044)
(4)	Aggregate national expansion (std.)	Suitability	$s_i \times NE_t^s$	0.053*** (0.012)
(5)	Palm oil price (std.)	Suitability	$s_i \times P_{t-1}$	0.072*** (0.014)
Mean dependent variable				0.285
Year FE				Yes
Sub-district FE				Yes
Remoteness × year FE				Yes
Observations				27,550

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Effects using other crop suitabilities

Dependent variable:	Any conflicts			
	(1)	(2)	(3)	(4)
EP (general agricultural suitability)	−0.005	−0.110**		
	(0.049)	(0.053)		
EP (suitability of top 10 crops)			0.124**	−0.206**
			(0.063)	(0.100)
EP (oil palm suitability)		0.231***		0.312***
		(0.050)		(0.075)
Mean dependent variable	0.285	0.285	0.285	0.285
Year FE	Yes	Yes	Yes	Yes
Sub-district FE	Yes	Yes	Yes	Yes
Remoteness × year FE	Yes	Yes	Yes	Yes
Observations	27,550	27,550	27,550	27,550

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Effects of other crop price exposures

Dependent variable:	Any conflicts	
	(1)	(2)
Palm oil price exposure	0.038**	0.037**
	(0.016)	(0.017)
Other crops price exposure (wieghted by revenue)	0.008	
	(0.032)	
Other crops price exposure (weighted by value added)		0.012
		(0.032)
Mean dependent variable	0.285	0.285
Year FE	Yes	Yes
Sub-district FE	Yes	Yes
Remoteness × year FE	Yes	Yes
Observations	27,550	27,550

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Conditional exogeneity of shares

Dependent variable:	Any conflicts					
	(1)	(2)	(3)	(4)	(5)	(6)
Oil palm expansion pressure	0.190***	0.164***	0.190***	0.184***	0.186***	0.149**
	(0.047)	(0.057)	(0.047)	(0.047)	(0.047)	(0.058)
Mean dep. variable	0.285	0.285	0.285	0.285	0.285	0.285
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sub-district FE	Yes	Yes	Yes	Yes	Yes	Yes
Remoteness × year FE	Yes	Yes	Yes	Yes	Yes	Yes
Forest share × year FE	Yes	No	No	No	No	Yes
Elevation × year FE	No	Yes	No	No	No	Yes
Built-up share × year FE	No	No	Yes	No	No	Yes
Population density × year FE	No	No	No	Yes	No	Yes
Nighttime light × year FE	No	No	No	No	Yes	Yes
Observations	27,550	27,550	27,550	27,550	27,550	27,550

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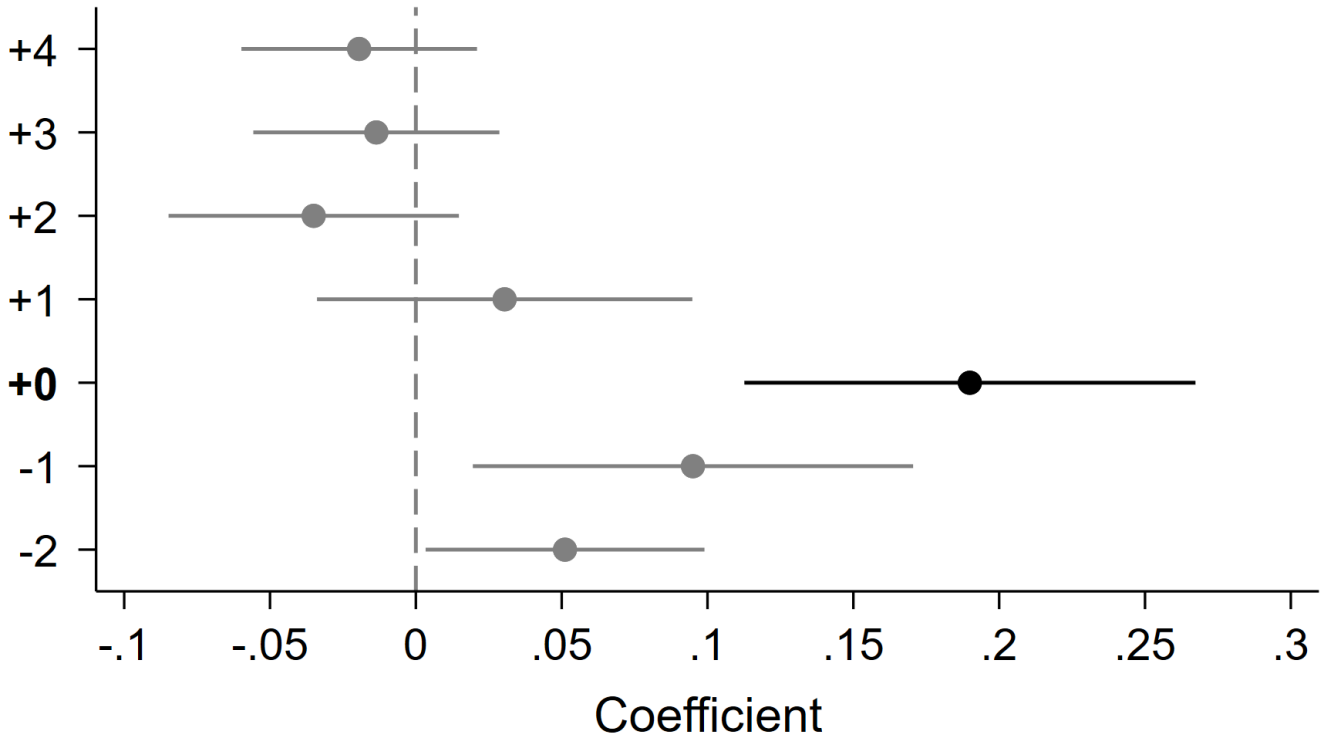
Placebo: Leads and lags of expansion pressure



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Spatial clustering

Dependent variable:	Any conflicts				
Specification:	(1) Clustering: District	(2) Spatial correction	(3) Spatial+ temporal HAC	(4) Clustering: Share pctiles (50)	(5) Clustering: Share pctiles (100)
Oil palm exp. pressure	0.188***	0.188***	0.188***	0.188***	0.188***
	(0.056)	(0.058)	(0.060)	(0.043)	(0.040)
Mean dep. variable	0.285	0.285	0.285	0.285	0.285
Year FE	Yes	Yes	Yes	Yes	Yes
Sub-district FE	Yes	Yes	Yes	Yes	Yes
Observations	27,550	27,550	27,550	27,550	27,550

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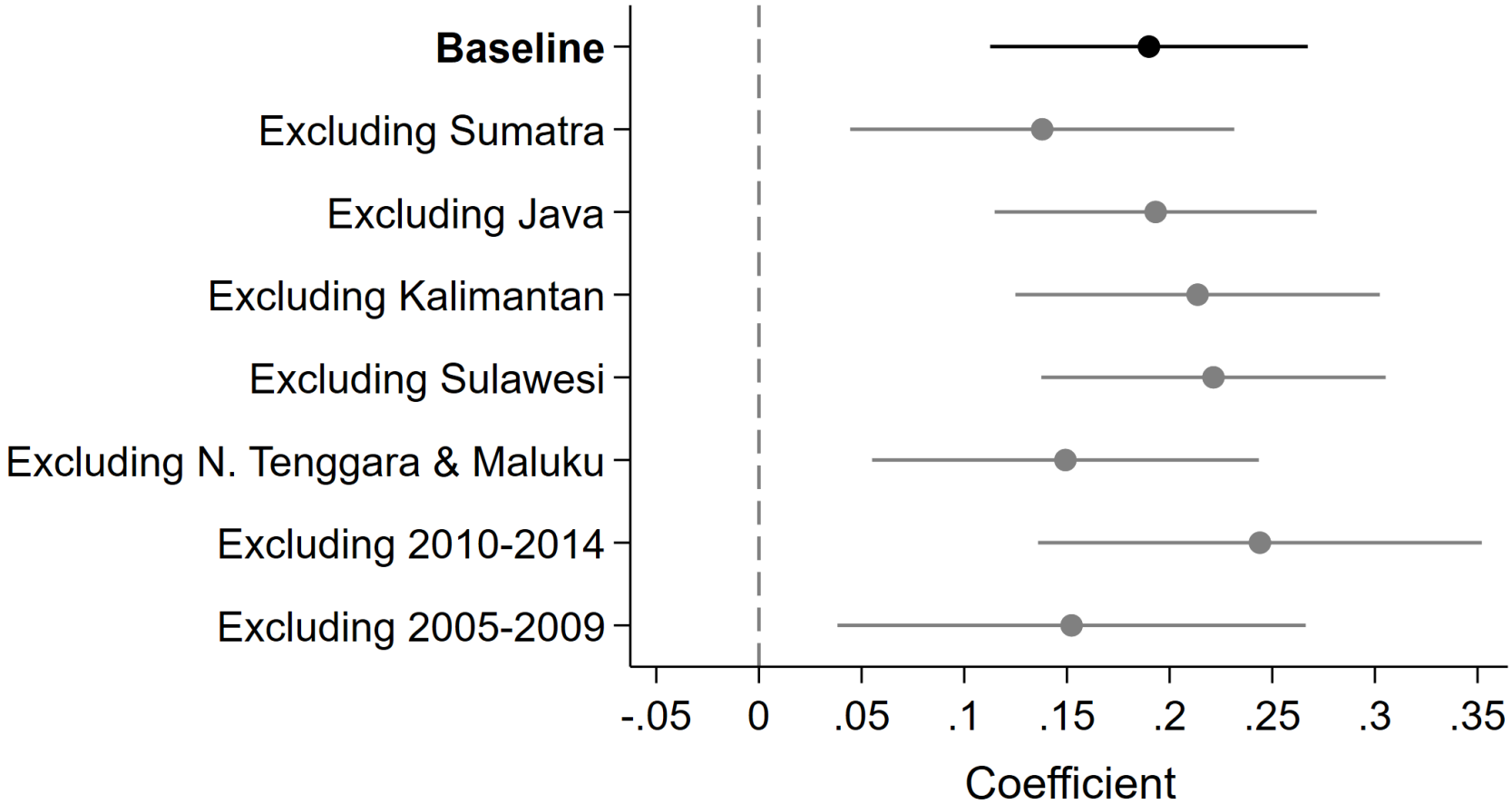
Sample composition



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Shift-share randomization

Dependent variable:	*ln* Conflict incidents
Randomization:	Suitability share
	(1)
Median Oil palm expansion pressure	0.016
	(0.061)
Share of significant estimates ($p < 0.1$)	13.4%
Iterations	1000
Subdistrict and year FE	Yes
Remoteness × year FE	Yes
Controlling for price incentives	Yes
Observations	27,400
Subdistricts	2,740
Median Adj. R^2	0.456

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Environmental grievances, population growth and ethnicity

Dependent variable:	Any conflicts			
	(1)	(2)	(3)	(4)
Expansion pressure	0.139**	0.193***	0.240***	0.237***
	(0.057)	(0.067)	(0.075)	(0.087)
Expansion pressure × share of forest loss	0.363			
	(0.244)			
Expansion pressure × population growth		0.029		
		(0.141)		
Expansion pressure × ethnic fractionalization			−0.119	
			(0.121)	
Expansion pressure × ethnic polarization				−0.098
				(0.129)
Mean dependent variable	0.285	0.285	0.285	0.285
Year FE	Yes	Yes	Yes	Yes
Sub-district FE	Yes	Yes	Yes	Yes
Remoteness × year FE	Yes	Yes	Yes	Yes
Observations	27,550	27,550	27,550	27,550

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