Cycles of Fire? Politics and Forest Burning in Indonesia

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January 12, 2021

Rapid deterioration of the natural environment may, in part, be due to political incentives driving a wedge between the design and implementation of environmental policies (Burgess et al., 2011; Duflo et al., 2013; Greenstone and Jack, 2015; Lipscomb and Mobarak, 2016). We test whether politics affects environmental degradation by exploiting the variation in political incentives induced by electoral cycles. Politicians have been shown to increase spending and postpone tax increases in the years leading up to an election (e.g., Nordhaus, 1975; Rogoff, 1990; Besley and Case, 1995) and these same electoral concerns may affect the degree to which the environment is protected.

To do this we exploit a large satellite data set on the ignition point and daily spread of 107,000 forest fires across Indonesia between 2000 and 2016 (Balboni, Burgess and Olken, 2020) combined with 879 district (*kabupaten*) elections. After the fall of former President Soeharto in 1998, Indonesia underwent extensive democratization and decentralization and a 1999 law devolved substantial power and resources to the district level, including responsibility for managing and protecting the forest estate. Popular elections to appoint district heads (*Bupati*) began in 2005 and take place every five years.[1] Crucially, these elections were phased in according to when the prior *Bupati*'s term expired. This implies that election dates are driven by idiosyncratic factors during the pre-1998 Soeharto regime and are uncorrelated with a host of socioeconomic and geographic characteristics (Skoufias et al., 2011).[2]

We use this asynchronous timing of district elections to study political cycles in the incidence of forest fires in Indonesia. While illegal, fire-setting is often used as a cheap means of clearing deforested land before it is converted to plantation crops such as wood fiber and oil palm. These fires can, however, burn out of control, creating significant local, regional and global externalities in the form of burnt land (Balboni, Burgess and Olken, 2020), smog and associated health costs (Jayachandran, 2009) and global warming (Page et al., 2002). The prevalence of fires in the tropical forest – and the associated external cost – keeps increasing even as global

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[1] The exceptions are 2009 and 2014, when presidential elections where held, and 2016.

[2] The same variation is exploited in studies by Martinez-Bravo (2014) and Bazzi and Gudgeon (2021).

fire incidence declined in recent decades (Andela et al., 2017).

Ex ante, it is unclear how the political processes surrounding an election might affect fire setting. On the one hand, politicians might gain from being more permissive before elections in an attempt to attract funds and votes from those engaged in this illegal activity. Similarly, enabling economic activity before an election may be electorally successful despite being environmentally destructive. On the other hand, forest fires impose highly visible negative externalities on the electorate, which might damage the electoral chances of incumbent politicians. It is therefore ambiguous whether we expect governments to be more or less permissive of forest fires in the run-up to an election.

This paper builds on previous work by Burgess et al. (2011), who use the same identification strategy to document a 'political logging cycle' in Indonesia. Recent work by Cisneros, Kis-Katos and Nuryartono (2020) expands this analysis and finds that political cycles in deforestation interact with economic incentives for palm oil production. Using a similar strategy, Pailler (2018) finds evidence for electoral cycles in deforestation in Brazil. We complement these findings by exploiting the Balboni, Burgess and Olken (2020) forest fires data set to look for electoral cycles in this environmentally destructive activity.

Data and Results

We model the impact of electoral cycles on forest fires with the following Poisson model:

$$\mathbb{E}\left[y_{it}\right] = \gamma_i \exp\left(\sum_{\tau=-2}^{1} \beta_\tau \text{Election}_{i,t-\tau} + \delta_t\right)$$

where y_{it} is a count of the outcome variable in a given district i and year t and $\text{Election}_{i,t-\tau}$ are dummies indicating the position of a district-year within the electoral cycle. District fixed effects, γ_i, and year fixed effects, δ_t, account for unobserved heterogeneity at the level of the 357 districts and for year-specific shocks, respectively.[3]

The election variables are constructed using the dates of district elections from 2005-2014 collected by Bazzi and Gudgeon (2021) which we extended to include 2015 and 2017. Given that Indonesia has five-year electoral cycles, we include indicator variables for two years before through one year after the election and use two years after the election as the reference category.[4]

For information on the outcome variables, we draw on data constructed by Balboni, Burgess and Olken (2020) on 107,000 individual fires in the Indonesian forest estate over 2000-2016 from NASA's MODIS satellite, which reports daily hotspots at a resolution of 1km^2. This data is complemented by annual deforestation data from 2001-2014 from Hansen et al. (2013) and

[3]Out of Indonesia's 514 districts in 2018, we restrict the sample to those on the main forested islands, excluding Java and the Lesser Sunda Islands, resulting in 357 districts. Results using district and province-year fixed effects are reported in the online appendix, and show similar qualitative patterns.

[4]We exclude district-years that lie outside this five-year cycle, which drops observations more than two years before the first elections and where two elections in the same district were six or more years apart.

by geospatial information on land type classifications from Global Forest Watch.

Figure 1 shows our main results, where each column corresponds to a different outcome measure.[5] The first column provides evidence for electoral cycles in the number of ignitions in a given district and year. The uppermost panel considers all fires in the forest estate and reveals an electoral cycle in this outcome, with fewer ignitions in election years relative to the election leads and lags. We report the difference in coefficients of election-this-year (t) and election-last-year (t-1) and its p-value. The results imply a statistically – and economically – significant rise in ignitions of 56.8% (i.e., $e^{0.45} - 1$) in the post-election year relative to the election year ($p< 0.01$). We also report the p-value of a test for the joint significance of all coefficients, in effect testing for the presence of any electoral cycle, and reject the null of no cycle ($p< 0.01$).

The bottom two panels of Figure 1 count only fires in productive or protected forest, respectively. Productive forest incorporates land that has been leased by the government through long-term concessions to private companies for logging or conversion to wood fiber and palm oil cultivation, as well as unleased areas of the forest estate that are not designated as protected. Protected forest consists of national parks and watershed protection areas where all deforestation is prohibited. Comparing these two panels in the first column of Figure 1 reveals that the electoral cycle is driven by fires set in productive forest, while we cannot reject the absence of an electoral cycle in protected forest. This is in line with the higher incentives for land clearance in productive forest versus protected areas.[6]

The second outcome, reported in the central column of Figure 1, is total area burned by fires originating within a district. This outcome is informative as the uncontrolled spread of fires, often beyond the burner's own land, is particularly likely to influence the voting behavior of the district electorate. This externality is partly under the agent's control (Balboni, Burgess and Olken, 2020) but might also be affected by district government efforts to contain fires. As with ignitions, Figure 1 rejects the absence of an election cycle and indicates a significant 65.9% increase in area burned in the post-election year relative to the election year. Area burned trends downwards in the two years before the election to a low point in the election year and then increases in the subsequent year. As with with ignitions, this pattern is driven by fires started in productive forest, with no electoral cycle observed in protected forest.

For the final outcome, we bring in deforestation as a driver of fires. Balboni, Burgess and Olken (2020) find that forest fires are much more likely to occur in pixels that have been deforested in the previous year. We therefore define a *slash-and-burn* pixel as a pixel that experienced deforestation in year t–1 and at least one fire in the following year t, and again aggregate this measure to the district level. In the last column of Figure 1 we see the same pattern for this restricted set of fires that follow deforestation: a declining trend in the two years prior to an election, a low point in the election year and then a significant increase of 40.2% in the post-election year. Tying fires to human activity in the form of deforestation in this way increases our confidence that fire setting as a means of clearing recently deforested land is being suppressed

[5] Tables including more detailed breakdowns by land type are available in the online appendix.

[6] In the online appendix we find similar patterns within concessions and unleased productive forest, suggesting that fires are used not only to clear land in concessions but also to burn into unleased forest, potentially to facilitate conversion.

when it might damage the electoral chances of the *Bupati*. These results complement those for the full set of forest fires in the first two columns of Figure 1.

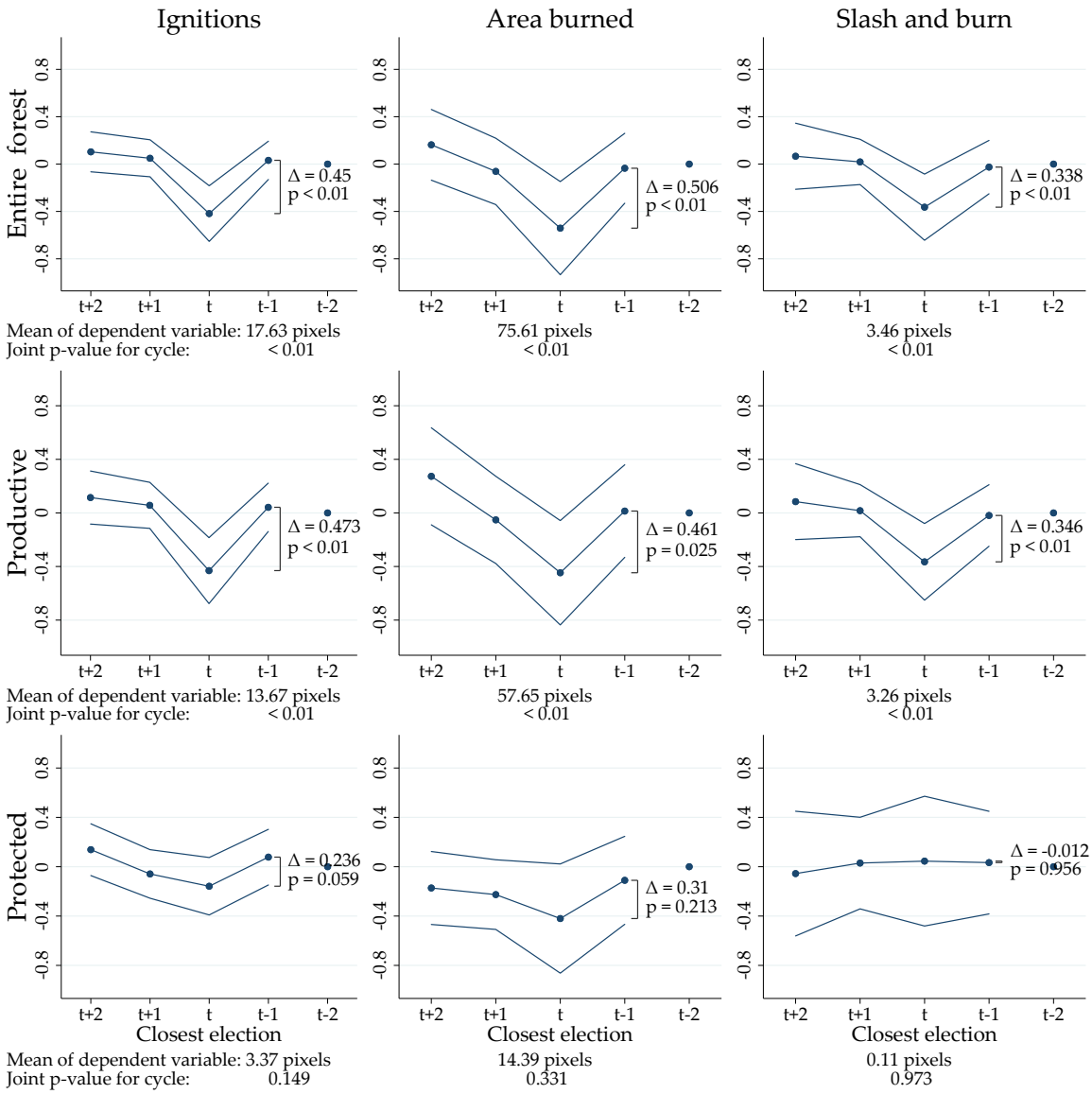

Figure 1: Electoral cycles in forest fires

Notes: The figures show the coefficients from the Poisson model with 95% confidence bands. The bracket shows the difference between the coefficients on election last year and this year and the p-value of a test of their equality.

Conclusion

The question of how to slow environmental degradation has become one of the most pressing issues of this century. We use variation in electoral incentives over the political cycle to test whether these influence the stringency of environmental protection. We consider this in the context of illegal fire-setting in Indonesia, which may confer private benefits but imposes significant social costs on the electorate. The state can intervene to reduce these actions, but

ultimately is comprised of individual politicians with incentives to capture rents and win elections.

Our first conclusion is that there is clear evidence for political cycles in forest fires, suggesting that electoral incentives influence how permissive district governments are towards firms engaging in this illegal activity.

The second conclusion is that we find a significant *decline* in fires in election years, followed by a steep increase the following year. This is in contrast to what is observed for (popular) spending increases in the political business cycles literature, and closer to what is observed for (unpopular) tax increases. Fires appear to be something that governments wish to suppress in periods when they might damage the *Bupati*'s election prospects.

Our third conclusion is that political cycles appear to vary across different land types, with more muted effects in protected forest than productive forest where the value of setting fires to clear land is higher. This indicates that the stringency of *existing* land use regulations matters and points to stricter and better enforced controls on land conversion as a means of reducing the incidence of forest fires.

Our overarching conclusion is that political considerations affect the degree to which governments protect the natural environment. How to move from the detection of political cycles to the design and implementation of effective environmental protection policies is, however, unclear. On this front, research focused on understanding the precise mechanisms via which firms, the state and the electorate interact to determine the incidence of environmental externalities (Morjaria, 2018; Cao, Kostka and Xu, 2019; Alesina, Gennaioli and Lovo, 2019; Cisneros, Kis-Katos and Nuryartono, 2020; Pailler, 2018; Balboni, Burgess and Olken, 2020) will be the best guide for designing policies to slow global environmental degradation.

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