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Land use policies in Indonesian districts:
Political economy and localization considerations

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Abstract

Since the fall of the Suharto regime in the late 1990s, Indonesian district governments received increased political power in environmental and land-related administration. This thesis aims to illustrate the fragmented and convoluted regulatory framework which determines licensing authorities of government agencies on different scales since 1998. It further discusses political-economic incentives for district officials to issue licenses, including improper mechanisms to hold politicians accountable for governance violations, local public revenues from the forestry and palm oil sectors, and corrupt interactions involving bribes or political support.

Finally, an empirical analysis using cross-sectional district data draws an exploratory picture of which district characteristics are (most strongly) associated with the localization of concessions (logging, planted timber, and palm oil) and protected areas. For instance, palm oil concessions are positively associated with favorable bio-physical conditions, whereas the reverse picture emerged for protected areas. Districts exhibiting high suitability for palm oil cultivation are associated with district splits and irregular elections. The results are discussed against the backdrop of the formerly laid out theoretical considerations.

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List of abbreviations

AMDAL	Environmental Impact Assessment (Analisis Mengenai Dampak Lingkungan)
APL	Area for Other Uses (Areal Penggunaan Lain)
BAL	Basic Agrarian Law (Undang-undang Pokok-pokok Pertanahan)
DAK	Special Allocation Fund (Dana Alokasi Khusus)
DAU	General Allocation Fund (Dana Alokasi Umum)
DBH	Revenue-Sharing Funds
DR	Reforestation Fund (Dana Reboisasi)
EIA	Environmental Investigation Agency
FAO	Food and Agriculture Organization of the United Nations
GAEZ	Global Agro-Ecological Zones (by FAO)
GDP (p.c)	Gross Domestic Product (per capita)
GFW	Global Forest Watch
GR	Government Regulation
HDI	Human Development Index
HGU	Land Use Permit (Hak Guna Usaha)
HPHH	Forest Product Extraction Permits (Hak Pemungutan Hasil Hutan)
IDR	Indonesian Rupiah
IHPH	Commercial Forest Concession License Fee (Iuran Hak Pengusahaan Hutan)
IHS	Inverse Hyperbolic Sine (transformation)
IPK	Timber Utilization Permit (Izin Pemanfaatan Kayu)
IPPK	Timber Use and Harvest Permit in conversion forest (Izin Pemungutan dan Pemanfaatan Kayu)
IUP	Plantation Business Permit (Izin Usaha Perkebunan)
IUPHHK	Business License for the Utilization of Timber Forest Products (Izin Usaha Pemanfaatan Hasil Hutan Kayu)
IUPHHK-HA	Business License for the Utilization of Timber Forest Products in Natural Forest (Izin Usaha Pemanfaatan Hasil Hutan Kayu Hutan Alam)
IUPHHK-HT	Business License for the Utilization of Timber Forest Products in Plantation Forest (Izin Usaha Pemanfaatan Hasil Hutan Kayu Hutan Tanaman)
MoEF	Ministry of Environment and Forestry (see MoF)
MoF	Ministry of Forestry (see MoEF)
MP3EI	Master Plan for the Acceleration of Indonesia's Economic Development
NGO	Non-Governmental Organization
NLA	National Land Agency (Badan Pertanahan Nasional)
OLS	Ordinary Least Squares (regression)
PAD	Regional Own-Source Revenue (Pendapatan Asli Daerah)
PSDH	Forest Resource Royalty (Provisi Sumber Daya Hutan)
PSI	Palm oil Suitability Index (based on GAEZ maps)
RAN-GRK	National Action Plan to Reduce Greenhouse Gas Emissions
REDD+	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
SK-PKH	Decree of Forest Estate Release (SK Pelepasan Kawasan Hutan)
Tahura	Grand Forest Park (Taman Hutan Raya)
USD	United States Dollar

1. Introduction

The country of Indonesia exhibits one of the highest deforestation rates worldwide (Margono *et al.*, 2014b), frequently linked to logging in natural forests and forest conversion into timber and agricultural plantations, particularly for palm oil cultivation (Abood *et al.*, 2015). Empirical studies using satellite data support the view that especially timber plantations (Indarto *et al.*, 2015) and palm oil plantations (Wheeler *et al.*, 2013) are significantly associated with deforestation. The latter has been found to be related to significant environmental losses, such as water pollution, soil erosion, and air pollution, and greenhouse gas emissions, especially if plantations were established on former carbon-rich peat land (Obidzinski *et al.*, 2012). According to Global Forest Watch data, more than half of Indonesian forest loss (i.e. over 4.5 million hectares) has occurred within legal concessions since 2000 (Wijaya *et al.*, 2017). Moreover, most of the forest loss occurring outside legal concessions – an estimated 3.6 million hectares since 2000 – can be traced back to concession holders who illegally expand operations across permitted boundaries (Wijaya *et al.*, 2017).

Nonetheless, both timber and palm oil plantations are target sectors explicitly mentioned in national development strategies like the Master Plan for the Acceleration of Indonesia's Economic Development (MP3EI), with the ambition of promoting the sectors' roles in generating income growth, creating jobs in rural areas, reducing poverty, and securing food and energy supply (see McFarland *et al.*, 2015; see FAO, 2017). The country has recently become the global number one producer of palm oil, making up for more than 50 percent of international supply (Indonesia Investments, 2017). National policies to reduce deforestation and land conversion such as Reducing Emissions from Deforestation and Forest Degradation (REDD+) strategies and the National Action Plan to Reduce Greenhouse Gas Emissions (RAN-GRK) partly conflict with these development objectives (Anderson *et al.*, 2016).

Government agencies at different scales play central roles in determining where and under which conditions logging and forest conversion may occur. Land use policies can include regulatory, economic and information instruments (McFarland *et al.*, 2015). As indicated above, central to this thesis will be concessions for logging in natural forests, timber, and palm oil plantations. After the fall of the military regime under Suharto in 1998, Indonesia introduced democratic elections and was transformed from one of the most centralized into one of the most decentralized countries worldwide (World Bank, 2003, p. 1). In doing so, provincial governments and especially district[1] governments received far-reaching political autonomy and rights

[1] Provinces and district represent the second and third tier of state administration. In this thesis, the term "district" refers to both regencies (kapupaten) and cities (kota) if not stated otherwise.

to independently manage forest and land use. Hence, local politicians could navigate different land- and forest-related stakeholders and possibly engage in rent-seeking behavior to maximize their personal benefits. The latter might be one of several contributors to inefficiencies in local land policy decision-making processes, especially in light of commonly acknowledged corruption prevalence in Indonesian politics (Merkle 2018).

The aim of this thesis is to give an account of how decentralization has created local discretionary power and political-economic incentives regarding land use licensing, based on empirical and non-empirical literature. As such incentives may vary conditional on the socio-economic context, bio-physical land conditions, and local governance quality, this thesis moreover explores cross-sectional data to draw up an exploratory picture of how palm oil, logging, timber concessions, and protected areas are distributed across Indonesian districts. The assignment may serve future research that aims to explore causal relationships between district characteristics, abuse of discretionary power by district politicians, and application of land use policies. For now, the central research questions are:

a. Who has been responsible for granting and monitoring land use licenses since the beginning of decentralization?

b. What are political-economic incentives for local politicians to allocate concession licenses?

c. Which district characteristics are (most strongly) associated with the localization of concessions and protection areas?

Section 2 explains reasons for land use choices and political decisions from an economic perspective. Section 3 deals with the political economy of land use licensing in Indonesian districts. Section 4 contains an empirical analysis regarding the localization of concession and protected area sizes across districts. Section 5 summarizes findings and draws conclusions.

2. Theoretical underpinning

2.1 The economics of land use

In economics, the term *land* covers both geographical land and natural resources like forests, fertile soil, wild plants, and mineral deposits (see Encyclopaedia Britannica, 2019). Land and natural resources can be used as factors of production and therefore have an economic value. Rational economic agents – individuals, communities, firms, and governments – have expectations on future returns to a specific area of land. Microeconomic theory assumes that agents choose the land use type which yields the highest expected returns (see Angelsen, 2010).

In a simplified model, agents can decide between two extremes of land use to generate private returns: Converting forests into agricultural plantations or maintaining them in their natural state[2] (Angelsen, 2010). In the case of land conversion, private returns increase with productivity and commodity prices and decrease with the costs of production. The former, more specifically agricultural productivity depends on bio-physical conditions like slopes, soil fertility, land cover, rainfall and irrigation, access to modern technology such as crop varieties or mechanization. The latter, i.e. operational costs include expenditure for labor, capital, and transportation. Apart from returns from land cultivation itself, additional revenue potential can be unlocked when targeted land is covered with trees, which can be logged. If a piece of land has been logged for purposes other than land cultivation initially, legal hurdles and costs for plantation development might be reduced (see Pfaff *et al.*, 2010; see Angelsen, 2010; McFarland *et al.*, 2015, p. 29).

If however operators choose to maintain natural forests, they can generate private returns by sustainable and limited production of forest products, especially by selectively harvesting timber (*extractive rents*) (Angelsen, 2010). Other examples for sustainable businesses in this realm include eco-tourism, legal exports of plants, and geothermal or water energy production (MoEF, 2018, p. 123; Hein *et al.*, 2015). Besides private profits, sustainable forest management in natural forests and peatland can generate benefits of local and global public good character (*protected forest rents*) (Angelsen, 2010). Public benefits include local water catchment and the improved pollination conditions as well as carbon sequestration and biodiversity maintenance which also matter on the global level. One should note however, that natural land has a limited capacity for sustainable production and exceeding these limits results in a decrease in future productivity (see Angelsen, 2010).

In that sense, both forest conversion, especially when done for monoculture cultivation, and excessive exploitation of natural forests can generate negative externalities like soil and water contamination, biological productivity losses, and erosion (Lankoski and Ollikainen, 2003; Dasgupta and Ehrlich, 2013). The release of carbon into the atmosphere, caused by deforestation and forest degradation, both through machinery and the destruction of carbon stocks stored in natural forests and peatland, is a heavy contributor of global warming (Margono *et al.*, 2014b). Climate change in turn threatens future agricultural yields through droughts and floods, while rising sea levels jeopardize the overall size of agricultural land, especially in flat and coastal areas which are often located in developing countries (Ignaciuk and Mason-D'Croz, 2014). On a similar note, improper land conversion like "slash and burning" can facilitate the

[2] There is a wide range of land use types between conservation and conversion, such as agroforestry and silviculture.

break-out of uncontrolled forest fires, as became evident in 2015, when such fires cost the Indonesian economy an estimated USD 16 bn (Glauber and Gunawan, 2016).

As it is difficult to measure the public benefits of the presence of forests and to remunerate land operators accordingly, externalities of forest degradation and conversion are typically ignored by operators, presumably leading to extraction and conversion levels above a hypothetical socially desired optimum (Lankoski and Ollikainen, 2003; Dasgupta and Ehrlich, 2013). In other words, private opportunity costs of forest conservation, representing forgone returns from the most profitable alternative land use, are likely to exceed social opportunity costs of conservation. Natural forests are therefore likely to be over-exploited and excessively converted into plantations for fast-growing timber, palm oil, or other commodities yielding higher private returns (see Pfaff *et al.*, 2010).

There are several instruments which governments have at hand to address market failure described above (Mankiw and Wagner, 2004, p. 232): Besides utilizing market intervention implements like taxes and subsidies, governments can regulate land use through licenses for or restrictions of land use to improve social welfare outcomes, with the latter often being employed in so-called protection and conservation areas. Moreover, public officials might be able to decide (to a certain extent) on the distribution of land between interest groups. The economic theory behind respective political decisions is dealt with in the next section.

2.2 Political economy and decentralization

In contrast to the assumption of public officials as social welfare maximizers, rational public officials might act as personal utility maximizers seeking political power, budget maximization, and personal profit while operating under re-election constraints (see Mankiw and Wagner, 2004, p. 529). Political agency models formalize situations in which public officials (agents) cannot be perfectly observed and punished for mismanagement by subordinated agencies or voters (principals) (Smart and Sturm, 2007). Such situation result in asymmetric information between agents and principals creating scopes of action to deviate from social welfare maximization (the principal's goal) and to pursue opportunistic goals instead (Voigt, 2009, pp. 84f).

In that sense, political *rent-seeking* describes strategies in which economic agents mobilize resources to influence political decision-making processes to their benefit (Voigt, 2009, p.102). Politicians can for instance influence the supply of "rents" by artificially restricting access to markets or resources, motivated by illicit payments or other privileges like political support (patronage) which they typically receive in turn from rent-seeking private actors (Lambsdorff, 2002; Kolstad and Søreide, 2009). Rent-seeking is therefore associated with *lobbying* and *corruption* (see Kolstad and Søreide, 2009), the latter being defined as an "abuse of entrusted power for private gain" (Transparency International, 2018a). Rent-seeking and corruption are costly for an economy, as resources are allocated and used inefficiently (Lambsdorff, 2002). Moreover, corruption undermines the democratic legitimacy of public offices and institutions and facilitates environmental degradation, when, for instance, public officials are bribed for not restricting environmental destruction or for not enforcing environmental regulations (Transparency International, 2018b).

In theory, the risk of rent-seeking and particularly of corruption increases with the value of rents which can be captured and with discretionary power to make political decisions in favor of those rents, and decreases with opportunities to hold public officials accountable for mismanagement and with sanctions which perpetrators envisage (see Søreide, 2007; Lambsdorff, 2002; Larmour, 2007). Political economy theory analyzes political actors' incentives under the assumption of a given institutional structure, which determines rules and sanctioning mechanisms (Voigt, 2009, p. 46). One sanctioning mechanism are democratic elections in which constituencies can hold politicians accountable by electing a different candidate in the next elections (see Smart and Sturm, 2007; Lambsdorff, 2002). Another sanctioning mechanism is a proper and reliable criminal prosecution and judiciary system that can punish public officials for not complying with the law, which would, for instance, be the case when politicians engage in acts of corruption (see Søreide, 2007). Transparency, i.e. access to information about how governments use public assets like forest and land resources, how they determine concession boundaries, and how awarding procedures are accomplished, is paramount for civil society to detect mismanagement in the first place so as to be able to hold district governments accountable for policy decisions and to push them to take into account social and environmental needs (Harwell and Bludell, 2013, p.19f).

Political decentralization – that is, the transfer of discretionary power over significant local matters from central to local governments and institutions, creating "domains of local autonomy" (Ribot *et al.*, 2006, p.1866) – can alter institutional settings and therefore public officials' incentive structures. Advocates of decentralization emphasize the chances to promote good governance and to incorporate social, economic, and environmental externalities in political decisions by increasing downward accountability of local representative bodies, better opportunities for political participation in general, as well as public service delivery that better matches local needs and increases equity in public resources (see Gadenne and Singhal, 2014). The topical argument against decentralization is the fear that local politicians are more prone to be captured (and held accountable only) by local elites and powerful corporations which aim to exert influence on policy design and implementation to their own interest in case there are no counterbalances on a higher government tier (see Gadenne and Singhal, 2014).

3. Land use licenses in Indonesian districts

Land legally owned or held in trust by the state is typically allocated to economic actors like companies or cooperatives, based on concessions, i.e. contractual agreements which grant rights for land exploitation and land conversion in a specified area and time period (Webb et al. 2017). This chapter elaborates on authorities held by government agencies to allocate land use licenses in Indonesian districts. This includes land use planning as well as the actual granting of licenses for logging in natural forests, timber, and palm oil plantations, and will focus on the timeframe since the beginning of Indonesia's political decentralization in 1998 (3.1). Then, against this backdrop, potential incentives for local public officials to issue licenses are discussed, namely the institutional framework which provides opportunities and loopholes for local policy making (3.2.1), the maximization of local government revenues (3.2.2), and corruption (3.2.3).

3.1 Legal framework and licensing

The legal framework for land use administration in Indonesia is complex, fragmented, and characterized by overlapping bureaucracies (Sahide and Giessen, 2015). Given that more than 50 percent of Indonesian total land is still covered with forests (Timber Trade Portal, 2018), considerations on land allocations are closely tied to the administration and management of forested areas. Approximately 63 percent of total land area has the status of State Forest Area (*kawasan hutan*) (MoEF, 2018, p. 7). State Forest is defined as "area[s] determined or designated by the government to be permanent forest" and which is not charged with a land title (Forestry Law 41/1999, Art.1), while area outside State Forest is defined as Area of other land uses (APL) (MoEF, 2018, p. 7). Note, that these categories do not necessarily correspond to whether areas are in fact covered by forests or not.

In principle, which government agencies are authorized and responsible for land planning and licensing depends on how a given land plot is categorized. The Ministry of Forestry (MoF)[3] is the main administrator of State Forest area and responsible for determining its boundaries. It operates on the basis of the Forestry Law and sub-categorizes State Forest area into Production Forests, Protection Forests, and Conservation Forests (Law 41/1999, Art.1). Whereas the former is dedicated to the generation of forest products and can theoretically be converted to non-forestry land uses, the commercial use of Protection Forests and Conservation is more restricted (MoEF, 2018, p. 17f). The National Land Agency (NLA), which operates on the basis of the Basic Agrarian Law (BAL), is responsible for coordinating and supervising spatial planning in

[3] The Ministry of Forestry (MoF) and the Ministry of Environment (MoE) merged into the Ministry of Environment and Forestry (MoEF) in late 2014. The names of the Ministry used in this thesis depend on the context and referred documents.

general, and implementing national spatial planning outside State Forests, i.e. in APL area (Ardiansyah *et al.*, 2015; Sahide and Giessen, 2015). Here, forested land plots are referred to as *titled forests*, where land titles manifest ownership or use rights, including individual forest ownership, rights-to-cultivate, and customary forest ownership (Sahide and Giessen, 2015). In the course of decentralization, local governments, especially district governments, received substantial administrative authorities, making them relevant players in both State Forest and APL areas (Sahide and Giessen, 2015).

These overlapping and sometimes contradicting legal bases and authorities, together with retarded land gazettement, facilitate an overall disconnect between national and local institutions in land and forest administration and can lead to diverging expectancies regarding uses of land plots (Sahide and Giessen, 2015). This section aims to illustrate the regulatory and legal frameworks and licensing authorities relevant for the types of concessions most relevant to this thesis, that is, logging and timber, and palm oil concessions. Among a multitude of national and regional laws and regulations, the legal documents mentioned in this thesis are those that are primarily discussed in the literature reviewed.

3.1.1 Logging and timber concessions

Logging concessions permit "selective" logging in natural forests (MoEF, 2018). In this thesis timber concessions refer to licenses for establishing timber *plantations*. The licensing authorities granted to district governments in the forestry sector are nowadays again limited, after having exhibited a substantial expansion during Indonesia's above-mentioned decentralization efforts.

During the Suharto era, forest administration was highly centralized and revenues from forestry were primarily channeled to Jakarta (Barr *et al.*, 2006, p. 1). With the onset of decentralization, Law 22/1999 on Regional Governance defined provinces and districts as "autonomous regions" and granted them (and district governments especially) substantial administrative autonomy in several public sectors, including land and environmental administration (Barr *et al.*, 2006). This extended previous Government Regulations (GR) 62/1998, which had already given district governments authority to oversee management with regard to planting, maintenance, harvesting, utilization, marketing, and development in "privately owned forest" and Community Forests areas, and GR 6/1999 which allowed them to issue small-scale Forest Product Extraction Licenses within Forest Estate (often referred to as HPHH) to individuals, farmer groups, and cooperatives within State Forest classified as Production Forest (Barr *et al.*, 2006, pp. 88ff). Based on Ministerial Decree 05.1/Kpts-II/2000, districts governments were moreover granted the right to issue large-scale forest licenses (referred to as IUPHHK)[4] of up to 50,000 ha per permit to cooperatives, small- to medium scale businesses and state-owned or privately-owned enterprises (Yasmi *et al.*, 2009; Barr *et al.*, 2006, p. 92). As a result, local governments had substantial authorities in the issuance of logging and timber concessions.

Shortly after the first decentralization reforms however, Forestry Law 41/1999 was introduced, which reaffirmed the principal role of the national Ministry of Forestry in defining statuses and functions of forests, determining boundaries and classification of forested lands, and managing forest protection and conservation. Several management tasks like forest supervision were still meant to be shared with local governments. District authority over State Forest area was then further reduced in 2002, when GR 34/2002 revoked GR 6/1999 (see above) and recentralized the right to issue IUPHHKs (Barr *et al.*, 2006, pp. 103f). District (and provincial) governments were nonetheless again expected to provide recommendations and take several administrative responsibilities under Law 41/1999 and GR 34/2002, theoretically leaving them some say in the matter (Barr *et al.*, 2006, pp.46ff). Moreover, they retained the official right to issue less important licenses in Production Forests, for instance regarding non-timber forest product extraction, or those with stronger restrictions regarding duration and harvesting levels compared to large-scale licenses (Barr *et al.*, 2006, pp. 46ff). In 2004, Law 32/2004 revised the initial decentralization law and strengthened the relative role of provincial governments by implementing review processes for district draft regulations, which were intended to increase coordination between government levels (Barr *et al.*, 2006, pp.52ff). Furthermore, villages and customary communities were (theoretically) granted more autonomy with regard to land use. While Law 41/1999 already recognized usufruct rights for these communities in State Forest areas, their rights were further strengthened by Constitutional Court Ruling 35/2012 and Joint Regulation 97/2014 declaring that customary forests exist outside State Forests and are subject to land titles (Banjade *et al.*, 2016). Finally, Law 23/2014 revoked the districts' rights to issue forestry permits altogether and transferred them to the provincial level, leaving districts only management authority over forest parks, also known as *Tahura* (Ardiansyah *et al.*, 2015, pp. 80f; Steni, 2016).

In sum, districts initially received widespread authorities to issue logging and timber plantation licenses in State Forest areas immediately after decentralization began. Their discretionary power has ever since been withdrawn bit by bit while the main authority has been re-centralized to the MoF and province governments.

[4] Here, forest license refers to logging and timber plantation licenses granted within State Forest area. Concessions for selective logging in natural forests (IUPHHK-HA) and for planting timber (IUPHHK-HT). IUPHHK licenses superseded HPH licenses as major licenses for large-scale logging (Barr *et al.* 2006, p. 47).

3.1.2 Palm oil concessions

Palm oil concessions refer to licenses allowing for the establishment of palm oil plantations. Development of such plantations in State Forest area is not intended under national Forestry Law 41/1999 in general. However, the Forestry Law (Art. 38) itself and GR 61/2012 provide loopholes for palm oil crops in State Forests, if classified as Production or Protection Forests, and if all involved agencies agree on the special purpose for national development (Sahide and Giessen, 2015, p. 105). Palm oil plantations can be developed in title forests (i.e. outside State Forest area) that are owned or leased by either individuals, communities or corporations. As mentioned above, the main regulator of land rights outside State Forest area is the NLA, while regional governments at the district and provincial level are supposed to act in a supporting role based on Law 32/2004 (Sahide and Giessen, 2015). GR 38/2007 and Law 23/2014 further specify that district governments have the authority to "design the needs and demands for palm oil, to develop maps and guide the development, management, and monitoring of plantations at the district level, and develop and implement spatial and land-use planning for local plantation development, including issuance of permits for the use of land" (Ardiansyah *et al.*, 2015, p. 84). The MoF's role is to regulate logging activity on plantations outside State Forest area as well, and to ensure ecosystem preservation on plantations (Sahide and Giessen, 2015).

The NLA has the authority to grant seven types of legal land tenure outside State Forest area – to be principally understood as property or use rights – which are tied to specific rights, restrictions, and responsibilities. Among the seven, the strongest right is the right of ownership. For agricultural plantations, including palm oil, the right-to-cultivate in state-owned land (referred to as HGU) is of special relevance. Plantation investors seeking to legally obtain HGU permits must go through an administrative procedure to be allowed to convert natural forest into palm oil plantations. The procedure starts with an application for a Location Permit (*izin lokasi*) at the district head (or, if the area covers two districts, the provincial governor). The Location Permit ensures compliance with local spatial planning and is a prerequisite for firms to negotiate with current rightsholders and the MoF (EIA, 2014).

The next step contains an environmental and social impact assessment (AMDAL), conducted by a commission consisting of NGOs, academics, community representatives, and public officials which is organized by the district or provincial Environmental Agency. If the assessment is completed, the district head or governor issues the Environmental Permit (*Izin Lingkungan*) as specified in Law 32/2009. Operations without Environmental Permits are considered illegal. Using the AMDAL and a range of other documents, applicants can apply for the Plantation Business Permit (IUP) which grants the right to operate inside the land specified in the Location Permit. Applications for IUPs are again handed in at the district head (or province governor).

Since 2007, IUP contracts have paid special attention to the involvement and financial benefits to local communities for at least 20 percent of the IUP area (EIA, 2014).

In cases where the targeted land is situated in a State Forest area, an application for the release of the targeted plot from "State Forest" status and for a classification change to APL area are addressed to the MoF, which has the authority to issue a Forest Area Release Permit (SK-PKH). Then, in order to be allowed to clear land, i.e. to harvest a given volume of timber in parts of the concession, an additional Timber Utilization Permit (IPK) is required which is issued by the District Forestry Agency after a timber survey, based on which companies must pay taxes on timber stands. Operations without official forest release are illegal according to Forestry Law. Finally, the NLA issues the land use title (HGU) to round up the process, and granting the right to cultivate for 35 years, which is extendable for another 25 years (EIA, 2014).

In 2011, as a part of its policy to reduce emissions from deforestation and degradation (REDD), the Indonesian Government declared a moratorium, prohibiting the issuance of new concessions for palm oil, timber, and logging in natural forests and peat lands (Presidential Instruction 10/2011), which has continuously been renewed until today (MoEF, 2018, p. 33). However, the moratorium has frequently been criticized for its small geographic and temporal scope, weak enforcement of regulations and encroachment in moratorium sites, loopholes for development objectives like energy and food supply, not covering of secondary forests, long grace periods between announcement and implementation, exceptions for deforestation and peatland development within existing concessions, and no existent sanctions for non-compliance (see Busch *et al.*, 2015; see Anderson *et al.*, 2016).

In short, many laws and regulations introduced with the decentralization process create confusion about explicit authorities and responsibilities regarding land use planning, licensing, and management. In addition, processes for the granting of land use concessions are lengthy and seem convoluted. As a consequence, government agencies at different layers of the government can resort to different laws and regulations for justifying their positions and legitimacy when pursuing their own land-related policy objectives (Dermawan *et al.*, 2011, p. 14; Enrici and Hubacek, 2016; Kunz *et al.*, 2017). While district governments' authority regarding State Forests, i.e. rights to issue logging and timber licenses in these areas, has been curbed, the existing legal framework still reserves a significant say in the matter for them regarding land zoning and licensing for palm oil plantations, for instance based on decentralization laws and local spatial planning.

3.2 Political-economic incentives

Section 3.1 showed that basically local public officials, especially district heads, have had several opportunities in land use policy decision making within their jurisdictions. As theoretically outlined in section 2.2, public officials may have incentives to pursue own opportunistic goals instead of serving the interest of their principals, i.e. constituencies or sub-ordinated government agencies. In order to specifically shed light on the incentive structure regarding land use policy making in Indonesian districts, the first part of the following section considers accountability and sanctioning mechanisms and their failure to discipline local public officials, thus, to lay out how the opportunistic use of discretionary power becomes possible. The second and third part discuss whether and how local public revenues on the one hand and forms of corruption on the other constitute incentives for local decision makers to (illicitly) expand licensing for timber and palm oil concessions in their districts.

3.2.1 Institutional framework

A country's and district's institutional framework significantly determine political-economic incentive structures for political actors as it sets up mechanisms to hold them accountable for their decisions and to penalize governance violations (see chapter 2.2). In this regard, weak institutions increase the opportunities for local politicians and bureaucrats to pursue opportunistic goals like sustaining political power and increasing personal wealth.

In their paper on decentralization and forest governance, Ribot *et al.* (2006) lay out that Indonesia's decentralization occurred without implementation of adequate upward and downward accountability. Top-down accountability as it had prevailed under Suharto was (theoretically) replaced by a political accountability framework through Law 22/1999 (Fitrani *et al.*, 2005). This meant that the district head was now elected for five years by and accountable to the local parliament, the latter by means of an annual accountability speech, while members of local parliaments, in turn, were elected by popular vote (World Bank, 2003). Since 2004, district governments have also been elected directly by the citizens as defined in Law 32/2004 (Barr *et al.*, 2006, pp. 54f). Contrary to the theoretical perception that local parliaments and district heads are more accountable to local citizens through these regular elections, they seemed to be mainly accountable to their parties (Nasution, 2016). Therefore, the new accountability system has not proven proper functioning, with regional governments and parliaments were perceived as not acting in accordance with their constituents' needs (World Bank, 2003, p. 6) and democratic discipline mechanisms seem hampered (Ribot *et al.*, 2006, p. 1874).

Upwardly, the unclear and overlapping legal policy framework described above makes it difficult to blame local governments for non-compliance with national laws and regulations (Enrici and Hubacek, 2016). They can easily shirk national guidelines, laws, and conservation objectives by referring to other, equally legal, decentralization and spatial planning laws which partially contradict and undermine other national regulations and therefore create a scope for corruption and mismanagement (Dermawan et al. 2011). Sometimes, laws and regulations even conflict within themselves, which can particularly be seen with the issuance of licenses in protected areas that have been designated on the national level (Indrarto *et al.*, 2012, p. 20).

Moreover, the judicial system is described as complex and subject to corruption (Bertelsmann Stiftung, 2018; Smith *et al.*, 2003). It consists of various courts – military, public, religious, administrative, and anti-corruption – marked by complex hierarchies (Merkle, 2018). A report by the Environmental Investigation Agency (EIA, 2014, p. 20) cites a MoF document from 2009 which concedes that corruption within forest crime enforcement underpins illicit collusion of district officials and companies regarding "un-procedural" permits. What is more, even convicted public officials seldom have to fear severe penalties (Indrarto *et al.*, 2012, pp. 24, 46). However, more recently national efforts have been made to detect illegal issuance of permits by district heads. In 2012, 13 regents were under investigation for illicit allocation of forest land and resources, for instance to palm oil firms, and the governors of Riau and East Kalimantan, of which both regions had suffered from dramatic deforestation, were jailed for the same reason (EIA, 2014).

An overarching problem which restricts the options for holding local officials accountable is low transparency (Austin *et al.*, 2014; Dermawan *et al.*, 2011). Additionally, land maps contain contradictory information and boundaries are subjects to frequent changes (Kunz *et al.*, 2017). Spatial data, including concession boundaries, is gathered by different government agencies – central and local – which use different methodologies and are reluctant to share information amongst each other and with the public; consequently, public officials, if corrupt, can easily manipulate and alter maps in accordance with their objectives (Anderson *et al.*, 2016). To this end, the President launched the One Map initiative in 2010, in order to consolidate existing maps (see Anderson *et al.*, 2016; see Wibowo and Giessen, 2015). Nevertheless, consistent and verified official data collection still appears difficult (Anderson *et al.*, 2016). Furthermore, (transparency regarding) awarding procedures and implications for rent-seeking would be interesting to elaborate on, however yet respective literature is scarce.

In sum, weak democratic control, the overlapping and contradictory landscape of laws and regulations, sluggish and corrupt criminal prosecution and law enforcement, and a general lack of transparent and consistent information on land use policies seem to have impeded proper sanctioning mechanisms to hold local politicians accountable, but instead created opportunities for them to pursue opportunistic objectives.

3.2.2 Local government revenues

The Indonesian timber and palm oil sectors have been yielding high profits driven by high demand for both commodities (Indrarto *et al.*, 2012). Consequently, respective plantations are central elements of Indonesian plans and strategies to spur economic development and growth (see introduction). For instance, in East Kalimantan, "de facto development" is heavily based on the expansion of palm oil (Anderson et al. 2016).

Besides private profits, logging, timber and palm oil plantations generate several types of government revenues including license fees, forest royalties and taxes on exports, as well as on personal and corporations' incomes. During the Suharto era, such revenues were captured solely by the central regime and its collaborators. Still today, most of taxes and charges on agricultural and forest products are collected at the national level. However, decentralization Laws 25/1999 and 33/2004 on Fiscal Balancing now devote higher shares of revenues, and the right to raise own revenues, to districts and provinces (Barr *et al.*, 2006, pp. 58ff; Indrarto *et al.*, 2012, pp. 29f).

Fiscal transfers are made through three major components: The General and Special Allocation Funds (DAU and DAK), and the Revenue Sharing Fund (DBH). One major objective is fiscal balancing, which redistributes substantial portions of natural resource revenues from sectors such as forestry back to the originating districts (and provinces) to finance administrative and local development expenditures. This includes 64 percent of forest concession license fees (IHPH) and volume-based forest resource royalties (PSDH), whereas 32 percent of PSDH payments go directly to the originating district and 32 percent to other districts in the same province (World Bank, 2003, p. 29; Barr *et al.*, 2006, pp. 67, 124f). In this way, IDR 504 bn (USD 56.4 million) of public revenues from forestry were channeled back to district and municipality governments in 2004 (Barr *et al.*, 2006, Table 4.5).

The largest single source of forestry revenue is constituted by the Reforestation Fund (DR), financed through a levy which is based on extracted volumes in natural forest (Barr *et al.*, 2006, pp. 72f). 40 percent of its revenues are granted to regional governments, specified in Regulation 35/2002 (Barr *et al.*, 2006, p. 73). Initially, the Reforestation Fund was distributed as part of the Special Allocation Fund (DAK), but has since 2004 been classified as "shared revenue", together with PSDH and IHPH (Barr *et al.*, 2006, p. 66). The Revenue-Sharing and the Reforestation Funds comprised approximately 80 percent of all forestry non-tax revenues (USD 291.1 million) in 2011 (Dermawan and Sinaga, 2015, p. 5). The use of IHPH and PSDH revenue shares can be decided upon by districts to finance regional development, while Reforestation Fund revenues are officially earmarked for forest and land rehabilitation. In reality however, these guidelines are often violated, which is encouraged through ineffective formal and public accountability (i.e. supervision and law enforcement regarding governance violations), flow of funds not being performance-based, and government capacity constraints at the local level (Indrarto *et al.*, 2012, pp. 29f).

Besides fiscal transfers from the central government, decentralization laws have given district governments authority to raise several own charges on natural resources from local sources (PAD) such as taxes and levies, and have graced them with the opportunity to run regional government enterprises for the purpose of financing regional budgets and development (Barr *et al.*, 2006). A striking feature of PAD revenues is their independence from the central government (Barr *et al.*, 2006, p. 80).

With this new fiscal system, expanded forestry and plantation development in licensed areas can be directly linked to greater public revenues at the disposal of district governments. Overall, combined with expanded district authorities outlined in chapter 3.1, the prospects of higher district-level public revenues had several implications on local officials' incentives to issue licenses. For instance, Karyaatmadja *et al.* (2006) suggested that the new fiscal framework would incentivize district governments to "exploit their forest resources to the greatest extent possible in order to maximize their allocation of DAU, DAK, and PAD payments" (p.10). Myers and Ardiansyah (2014) consistently write that the combination of expanded regulatory authority on one side and strong short-term economic benefits from revenue-sharing on the other has led to excessive provision of forest licenses by district officials, while the fiscal balancing system lacks sufficient incentives to address the issues of deforestation. Similarly, Indrarto *et al.* (2012) state that increased decision-making powers and the prospects for locally generated revenues have resulted in indiscriminate licensing and forest conversion. Specifically, with regard to palm oil development, land licenses are considered a "source of quick regional income" (Susanti and Maryudi, 2016, p. 135). An early, though striking example for how the newly expanded authority materialized, was the proliferation of "small-scale logging concessions" and forest conversion permits after 1999 without regard for environmental safeguarding in natural forests (Barr *et al.*, 2006, p. 100; Ribot *et al.*, 2006, p. 1873). These permits did not seldom overlap with concessions granted by the central government and were often located within national parks and protected areas (Barr *et al.*, 2006, p. 88).

In response to the revocation of forest authority, in some cases, district governments, at least officially, stopped issuing new timber licenses but continuously renewed and extended existing ones. This obedience to national regulations was possibly due to announcements of the central government that it would strengthen prosecution of illegal issuance and/or to a reliance on undisrupted transfer payments from the center; at the same time however, there is evidence that many district heads continued to issue logging licenses, hence revenues from licensing seem to have been still attractive enough to take the risk (Barr *et al.*, 2006, pp. 104f).

Presumably, re-centralization in the forestry sector has been linked to greater incentives of district heads and governors for palm oil and other industrial plantation development, where they retain stronger roles in respective land planning and licensing (Barr *et al.*, 2006, p. 106). Setiawan *et al.* (2016) used content analysis of key policy documents, participant observations, and expert interviews to collect data between 2014 and 2016 regarding the role of several government agencies in the process of issuing licenses for oil palm extension. They found that national regulations for forest conversion to palm oil plantations were easy to bypass, due to contradicting laws and regulations. The Spatial Planning Law No 26/2007, decentralization laws, or national priority programs promoting palm oil development gave local governments equal mandates and authority over land use and allocation. This led, they state, to plantation licenses which do not comply with MoF procedures under Forestry Law to be vigorously issued by local governments. The authors explain this behavior by district governments aiming for local economic development, increases public revenues, and accumulation of personal wealth and political power (Setiawan *et al.*, 2016). These findings comply with a report by the Environmental Investigation Agency also focusing on Central Kalimantan, which discerns that many palm oil concessions operate only on district-issued licenses which lack approval and additionally required licenses such as timber extraction and forest release permits issued by the Ministry of Forestry (EIA, 2014). In such cases, district governments would often invoke Spatial Planning Laws. Moreover, the report points out that AMDAL commissions provide Environmental Permits without proper assessment in many cases (EIA, 2014).

In sum, the combination of discretionary licensing power and regulatory loopholes for issuing local land use licenses on one side and potential budget increases from retaining higher shares of revenues from respective sectors on the other seem to have driven the amount of land and forests granted for commercial use and exploitation by district governments. The revocation of autonomy in the forestry sector, especially in timber extraction licensing, has seemingly fostered district officials' incentives to promote land conversion and license for palm oil concessions, where they retain substantial authority under decentralization, spatial planning laws, and national development strategies. The findings discussed in this chapter fit into optimal land use theory discussed in section 2.1: Local governments seem more interested in direct economic benefits and increased local budgets, and less concerned about environmental impacts or costs which only partially unfold immediately and within the own jurisdiction but constitute negative externalities beyond district borders and for future generations.

3.2.3 Corruption

As was outlined above, district officials have a motivation to increase district revenues from forestry and the palm oil sector through licensing of land use concessions. The following section elaborates on illicit ways taken by district officials to primarily secure personal benefits, namely their partaking in acts of corruption. Since district officials have some autonomy in licensing and regulation of land and forest use, they are prone to be influenced by powerful interest groups.

Corruption is perceived as a general, major institutional problem across all government levels in Indonesia (Merkle, 2018), especially so in the forestry sector (Dermawan *et al.*, 2011). Possibilities for this were opened up partly by decentralization, enabling district officials to extort informal payments in exchange for permits and licenses without effective monitoring (Merkle, 2018; Barr *et al.*, 2006, pp. 126f). Bribery is a very common form of corruption; Informal payments or other privileges are offered in exchange for preferential treatment, such as the issuance of licenses below or independent of market terms. Corruption in a (forest) concession system can occur at different stages, namely the design and awarding of concessions or afterwards during operations and logging activities (Søreide, 2007). The Ministry of Forestry has diagnosed areas in forest governance that are specifically exposed to corruption: Licensing, misreporting of production data and trade of forest products, manipulation of taxes and other charges, and auctions for confiscated timber (Dermawan and Sinaga, 2015, p. 19).

However, in land use planning, against many claims, Meehan and Tacconi (2017) only find little evidence that corrupt exchanges influence land use plans. They nevertheless assume, that political actors try to influence decisions on forest zoning in a way that prepares the grounds for engagement in corruption at subsequent administrative stages. For Central Kalimantan, this may explain disputes between central and local governments about the classification of state and non-state forest: Lower level governments have more leverage in licensing within non-State Forest area and thus better opportunities to skim corruption payments, so they first seek to retitle areas as non-State Forest. This has been confirmed with data from semi-structured interviews and focus group discussions with 111 civil society respondents in 2011 (Meehan and Tacconi, 2017), in line with findings from section 3.2.2.

Regarding the actual process of issuing licenses, Meehan and Tacconi's study highlight three purposes of corruption payments (Meehan and Tacconi, 2017). For one, illicit payments to bureaucrats might help in obtaining recommendations that can speed up bureaucratic procedures. Second, payments to government officials can prompt them to prefer a specific company's license application. This has especially been witnessed concerning palm oil concessions and happens either in exchange for unlawful and hidden payments or by means of different ways of nepotism. Once companies hold the licenses, their value increased, and they can be sold to other (foreign) companies which do not have access to the networks needed for obtaining licenses themselves. The first company's profits can then be shared with the government officials (Meehan and Tacconi, 2017). This confirms above-mentioned interview-based research by Setiawan et al. (2016) which revealed that plantation permits issued by district heads and other district agencies, including Localization Permits, Environmental Certificates, Business Licenses, and Forest Extraction Permits, are often linked to informal payments in Central Kalimantan. In this way, plantation firms could circumvent tedious formal procedures and higher costs connected to interactions with the central government. The online magazine Mongabay reports corruption by district chiefs who trade licenses for palm oil plantations for USD 400 to USD 1,200 per hectare (Mongabay, 2018b). The article highlights one example of a district head in particular who allocated plantation licenses to relatives and cronies through 18 shell companies.

The third purpose of corrupt exchanges outlined by Meehan and Tacconi (2017) refers to the *illegal* issuance of concession permits, i.e. concession decisions which would legally not be in the district official's hands at all. This involves licenses which are in conflict with the central Ministry's forest classifications (e.g. in conservation areas) and licensing within already existing concession areas. However, the confusion among multiple government levels operating on different land use plans hinders clear distinctions between legality and illegality (Meehan and Tacconi, 2017). In the same tenor, Sundström (2016, p. 783) cites a report by Transparency International Indonesia from 2011 saying that bribery facilitates illegal activities by, for instance, enabling loggers to encroach protected areas, providing ostensibly legal licenses to camouflage illegal operations, forging certifications, and thereby creating pressure on competitors acting with integrity. Regarding the case of Indonesia, based on industry and government data, estimated forgone government revenue due to lost fees for timber extraction without permits, "artificially low" market prices used for the calculation of timber royalties, and assessed fees which were not collected, amounted to USD 7 billion from 2007 to 2011, and USD 2 billion in 2011 alone (Harwell and Bludell, 2013, p. 7). This points towards the perception that local (and probably central decision makers, too) have an interest in non-transparent legislation, or even seek to influence laws and regulations, for the sake of better opportunities to engage in corruption deals. Maybe, this is further supported through informal linkages between central and local actors who then share respective benefits.

Monitoring and enforcement of regulations is generally believed to be subject to corruption likewise. In other words, corruption is considered to facilitate illegal practices in- and outside of concession areas such as exceeding harvesting limits, applying unsustainable methods, or simply operating without licenses. In general, local officials engaged in monitoring can leave illegal practices unnoticed, or if perpetrators get detected, they can accept bribes and let operators circumvent sanctions and criminal prosecution (see Søreide, 2007). Smith et al. (2003) cite key informants in Kalimantan, saying that bribes were being payed to officials to not prosecute illegal behavior like exceeding legally permitted volumes. Susanti and Maryudi (2016)'s interview-based research supports this view, by stating that institutional failures discussed above, namely weak property rights and spatial planning in general, inconsistent forest maps, weak rule of law and poor transparency in licensing were associated with "illegal" logging, clearing and burning of natural forests including national parks. Meehan and Tacconi (2017)'s interview-based research in Central Kalimantan further reveals corruption in the form that companies bribe government officials engaged in monitoring compliance to "facilitate" examinations. Some companies even connect with higher-level bureaucrats and elected politicians to avoid monitoring at all (Meehan and Tacconi, 2017). The above-mentioned EIA report from 2014 presents case studies that also suggest that logging operators and palm oil plantation firms do not comply with national regulations. In particular, the report says that companies in these sectors often operate without permits, or that these permits were obtained through corruption. Moreover, environmental assessments were again found to be not properly conducted by district agencies in many cases, possibly as a result of corruption (EIA, 2014).

Findings by Burgess *et al.* (2012) and Macdonald and Todt (2018) can also be tentatively interpreted in this manner. Burgess *et al.* (2012) first note that decentralization (i.e. a higher number of districts within a province, induced through district splits) spurs competition in provincial timber markets, restrains timber prices, and therefore reduces opportunities for local politicians and bureaucrats to capture timber rents. They suggest that district officials adjust production levels as a means of forest rent maximization by allowing more (illegal) logging, indicated by higher deforestation rates in such districts. The effect on deforestation rates has been found to be lower (in the short term) when district officials have alternative sources of rents and these actors hence depend less on timber revenues. These alternative rents possibly constitute higher losses for the corrupt individual if governance violation gets detected and penalized (Burgess *et al.*, 2012). Macdonald and Todt (2018)'s use forest fires – a publicly more visible form of illegal land use change – as dependent variable to show that newly created districts have suffered from more forest fires, especially those which exhibit suitable conditions for palm oil cultivation. The two studies tally in finding that the effect is strongest immediately after the split, possibly due to weakened governance and monitoring structures in the newly created districts.

As villages and communities receive volume-based royalties and community leaders can skim informal payments, they, as well, have "little incentives to report irregularities" with logging practices in customary forests (Smith *et al.*, 2003, p. 298). Purnomo *et al.* (2017) analyzed the role of patronage networks with respect to forest and land fires, which is considered a cheap and easy way to claim and prepare land for palm oil development, hence creating economic value, but causing severe social, environmental, and economic damage. Focusing on four districts in the province of Riau and by collecting survey and group discussions data (131 respondents), the authors find that such networks partake in rent-seeking by organizing illegal land fires and that they are linked to local public officials through the transfer of information on land transactions and fires, as well as through exchanging support, protection, and permission of access to forest and land resources (Purnomo *et al.*, 2017).

Finally, it should be emphasized that corruption regarding forest and land policies play major roles in local elections. The Indonesian campaign financing system is described as "highly dysfunctional" due to lack of sufficient state subsidies and no enforcement of party regulations, resulting in corruption as a strategy to obtain office (Bertelsmann Stiftung, 2018). Hence, external actors provide campaign funding in exchange for specific favors and privileges such as logging and plantation licenses once the candidate assumes office (Mongabay, 2018b). An anecdotal evidence is the story of Abdon Nabahan, an environmental activist who was offered funding for his presidency campaign in 2017 in exchange for handing over de facto control of budgetary and land allocations in the province to the land mafia (Mongabay, 2018a).

Opportunistic policy making with the objective to sustain or expand political power does not necessarily involve direct payments. In that sense, Bettinger (2015) finds that, for a national park in South Sumatra, the district head left local residents' protected area encroachment unnoticed, even after more and more people had already moved into the national park. In the next elections, he was able to count on their votes. Bettinger argues that decentralization sparked political processes that nowadays make national parks "arenas of contestation for candidates seeking district office" (p.12). While district politicians are obliged to enforce national regulations, it seems that they de facto do not face sanctions for not doing so, which makes it more compelling for them to let regulation violations slip and to use this approach to win (re-)elections. When the Ministry of Forestry has made efforts to make the district head reverse his actions in 2010, he granted grace periods for encroachers, which could theoretically be challenged by the Ministry of Home Affairs. Investigations into such matters however often lag behind, creating a "more-or-less permanent status", and encroachers are thus "informally shielded" by the district head (Bettinger, 2015).

The overall quintessence of this section is that corruption by means of bribery and patronage encourages local public officials to issue land use licenses in both legal and illegal ways, facilitated through the institutional framework and by unclear and overlapping fields of authority in land use planning and licensing. In that sense, personal political and economic incentives of policy makers likely shape the issuance of licenses. While, within the forest sector, major authority has been withdrawn from districts, district officials continue to seek ways to zone land as non-State Forest, in order to have more opportunities to issue licenses. Complying with the negative implications of decentralization theory, it appears that Indonesian decentralization reforms have resulted in many cases of elite capture, dispersing the corrupt system of the Suharto era to the local level, rather than increasing accountability to local constituencies with regard to forest and land policies and ensuring good governance and long-term sustainability of natural resources.

4. Empirical analysis

Chapter 3 showed that districts have several authorities and incentives to issue land use concessions in their jurisdiction. Against this background, it is an interesting question how socio-economic, bio-physical, and governance characteristics of districts are associated with the amount of concessions or land titles awarded there. The following chapter empirically answers this question with regard to logging, timber and palm oil concessions, and protected areas, quantified in covered spatial area.

Socio-economic development indicators might be positively or negatively associated with land use policies considered in this analysis. On one hand, low GDP and HDI levels, as well as high incidence of poverty and unemployment could pressure politicians to allow forest extraction and agricultural expansion for development purposes, while districts with higher human and technological capital and more diversified economies may depend less on forestry and agriculture. On the other hand, districts with large concession sizes might be richer and show better socio-economic levels *because* of forestry and palm oil cultivation. Dense populations might increase pressure and increase demand for agricultural land forest products, while public infrastructure in or near city districts (kotas) presumably facilitates physical access to forests and land (Busch and Ferretti-Gallon, 2017). DeFries *et al.* (2010), for instance, suggest that urban population growth, i.e. urban-based (and international) demand for agricultural products, is stronger associated with deforestation than rural population growth. Bio-physical land characteristics are of interest when examining land use policies because they determine the suitability for land activities which they can support (see Busch and Ferretti-Gallon, 2017) and therefore productivity and profitability. Consequently, a principle and obvious assumption in this analysis is that demand for concessions rises with districts' suitability for logging and plantation development.

In conjunction with political economy considerations from section 2, it is of special interest whether local political and governance conditions can be shown to be associated with issuance of concession licenses. District splits were often motivated by claims over natural resource wealth and new potential scopes for bureaucratic rent-seeking in newly created districts, for instance linked to the issuance of local licenses (Fitrani *et al.*, 2005). In that sense, splits might be the reflection of powerful political leaders which seek to extort their influence and economic gains. Similarly, elections occurring outside the regular intervals might indicate the existence of powerful political and economic forces pushing their personal agendas.

4.1 Data

To illustrate which district conditions are associated with the extent of logging, timber, and palm oil concessions, and protected areas respectively, a variety of socio-economic, bio-physical, governance quality, and control variables was gathered. The data is subsequently described in more detail. All data on Indonesian districts (in total 514 districts, involving both *kotas*, i.e. city districts, and *kapupaten*, i.e. regencies) used in this thesis was assembled and provided by the thesis supervisor (Chair of International Economic Policy). See the appendix for a detailed overview of original variable sources. Eight out of the 514 districts were excluded from the analysis due to missing data (six in the capital province Jakarta and two in the province Sulawesi Tenggara). Note also, that all results determined from the present data are to be interpreted under the assumption of data validity and reliability. While keeping in mind that administrative and political issues with transparency and responsibility overlaps, limited detail in information differentiation regarding for instance exact protected area classification, as well as competing definitions of the term "forest" may constrain to some extent the quality of the finding with regard to both criteria.

All information on area extents, needed for all dependent variables (logging, timber and palm oil concessions, protected areas, as of 2017), most bio-physical variables (area sizes of lowland, upland, mountains, wetland), and some controls (district and forested land size, denoted in km^2) was calculated from boundary information and provided by the thesis supervisor. The same goes for socio-economic indicators, for which all available information between 2000 and 2016 was averaged to compute a single value per district and variable.

Bio-physical variables entered into final analyses comprised lowland, mountain and wetland area (as of 2000) computed as percentage shares of total district area, and palm oil suitability indices (henceforth PSI). The latter indicates a land area's ecological suitability for cultivation of palm oil and was based on Global Agro-Ecological Zone (GAEZ) crop suitability maps measured on a scale from 0 to 100. Upland information was excluded in final analyses due to high multicollinearity with other land type shares. Socio-economic indicators included GDP per capita (inflation-adjusted, baseline 2000, measured in IDR million), a district's poverty rate (percentage of citizens living below the World Bank poverty line), unemployment rate (the number of citizens unemployed divided by total population size), and population density (number of citizens divided by total district area in km^2), and finally the Human Development Index (HDI, measured on a scale from 0 to 100).

As a third batch of variables, several indicators presumably related to governance quality were chosen. Namely, this included a generated dummy indicating whether a district had been split at least once (either as original "parent" or seceding "child" district) and a dummy variable indicating whether irregular elections, i.e. ballots ahead of schedule had taken place in the district at least once. Both dummies were then "interacted" (multiplied) with a district's palm oil suitability index and utilized as a third and fourth governance indicator, respectively, which were to indicate whether the estimated governance-policy relationship depended on favorable land conditions. Note that for 17 districts data on irregular elections is missing and that these districts are excluded from the analysis in regressions which include that indicator.

Control variables included district size, the amount of forested area in the district in 2000, and the district's "age", i.e. the number of years since its foundation. A dummy variable for whether a district was a *kota* district, and dummy variables indicating on which island a district was located were computed as additional controls.

4.2 Models

The aim of this study was to investigate the possibly existent relationships between the total size of concessions (palm oil, logging, timber) and protected areas in districts on the one hand, and the socio-economic, bio-physical, and governance-related district characteristics described above on the other, for the time period spanning from 2000 to 2017 (post-Suharto era). To this end, several Ordinary Least Squares (OLS) regressions were performed for each type of land use policy. Note that the present analyses are based on data averaged over the observed time and therefore cross-sectional. The results described are hence not necessarily appropriate for deductions about causality between variables. In the general model set up, one dependent variable P_j (j = palm oil, logging, and timber concession size, and protected area size) was regressed on different combinations of the above-described socio-economic variables **E** (GDP p.c., poverty and unemployment rate, HDI, and population density), bio-physical characteristics **B** (land type shares and palm oil suitability index), and governance indicators **G** (split dummy, irregular election dummy, and two interaction variables). Control variables **C** comprise district size, forest area, and district age which were included in all regressions. The additional controls (kota dummy and island dummies) were incorporated in some but not all models (see equation below).

Estimation equation: $ihs(P_{ji}) = \beta_0 + \boldsymbol{\beta}_1 * \boldsymbol{E}_i + \boldsymbol{\beta}_2 * \boldsymbol{B}_i + \boldsymbol{\beta}_3 * \boldsymbol{G}_i + \boldsymbol{\beta}_3 * \boldsymbol{C}_i + \varepsilon_i$

- P_{ij}: Policy (j = total size of palm oil concessions, logging concessions, timber concession, and protected areas)
- $\boldsymbol{E}_i$: **Socio-economic variables** (GDP p.c., poverty rate, unemployment rate, Human Development Index, population density)
- $\boldsymbol{B}_i$: **Bio-physical variables** (lowland area share, montane area share, wetland area share, palm oil suitability index)
- $\boldsymbol{G}_i$: **Governance indicators** (district split dummy, irregular election dummy, split and irregular election dummies interacted with palm oil suitability index)
- $\boldsymbol{C}_i$: **Control variables** (ihs of total district area, ihs of forested area in 2000, ihs of district age, kota dummy, island dummies)
- ε_i: Residuals
- *i:* District subscript

Distribution characteristics of all variables and further necessary preconditions for linear models were examined before running any analyses. All dependent variables as well as the control variables district size, forest area and district age were thereafter subjected to Inverse Hyperbolic Sine (IHS) transformations to address issues of distribution skew, heteroscedasticity, and influential observations (see Bellemare and Wichman, 2018). IHS transformations behave like log-transformations for large enough values but retain zero and negative values (see Burbidge *et al.*, 1988; see Friedline *et al.*, 2015). Hence, regression coefficients can be interpreted as approximated elasticities for "true zeros" and large values in the dependent variable when HIS-transformation is employed (Bellemare and Wichman, 2018). In order to further address possible heteroskedasticity issues, robust standard errors were employed. For the further sake of better interpretability, population density was standardized so that one standard deviation equaling ~1942 people per km^2.

Since districts by now primarily hold authority over the issuance of palm oil concessions (see section 3), this policy's association with district characteristics was analyzed in the most detail. Specifically, total palm oil concession area was first regressed onto socio-economic variables only and bio-physical indicators only. The two batches of variables were then incorporated simultaneously. Next, the additional controls were added, with the *kota* dummy first being introduced on its own and subsequently together with the island dummies (Table 1). Finally, governance indicators were incorporated, first the district split dummy alone, then in pair with its PSI-interaction term, the same for the irregular election dummy, and finally, all four variables together (Table 2). In order to test the robustness of results, for the full models (i.e. socio-economic, bio-physical indicators, and control variables in Table 1; governance indicators added in Table 2), three varied samples were applied: Excluding Javanese districts, excluding kota districts, and including only districts with a palm oil suitability greater than 10. These specific subsamples were chosen to reduce the number of districts exhibiting no palm oil concessions, either because they are located on Java where the palm oil sector plays a comparatively small role, because they are kotas which are in general assumed to have more diversified economies and less space for palm oil plantations[5], or because they do not fulfill minimum suitability criteria for palm oil cultivation. For each of the remaining three land use policies (size of logging and timber concession, and protected area size) the full model was estimated without (Table 3) and including (Table 4) governance indicators, while for each running the model with and without controlling for the kota dummy. As last robustness checks, Table A.3 (see appendix) presents regression results in which land type share variables for lowland, montane, and wetland area were replaced with their absolute size (in km^2, IHS-transformed), and Table A.4 (see appendix) shows the regression results if run on data from 2011 to 2016 only.

4.3 Results

The purpose of the present empirical analyses was to estimate the association, i.e. partial correlation, between socio-economic, bio-physical, and governance indicators of districts with the area size covered by palm oil, logging, and timber concessions, and protected areas.

Table 1 shows results for all palm oil concession models which did not include governance indicator variables as regressors. As shown in the upper part of Table 1, all socio-economic indicators exhibited positive associations with palm oil concession area size in all models, except for poverty and unemployment with the opposite association, thus indicating that better socio-economic characteristics of districts went along with more (or at least not less) palm oil concession area, on average. For instance, when not controlling for island effects, a one percentage point lower poverty rate is on average approximately associated with 4.4 percent larger palm oil concession size, a one percentage point larger HDI score with 8.7 percent larger concessions, and one standard deviation higher population (equal to 1942 people per km^2) with

[5] Here, the aim is to reduce the number of observations where the dependent variable takes the value zero in order to reduce the skew and kurtosis of distribution. In fact, roughly 90 percent of kotas don't have palm oil concessions. Absolute palm oil concession sizes are on average 60 times smaller in kotas compared to those in kapupaten (kota: $n = 89$, $M = 6.23$, $SD = 28.81$; kapupaten: $n = 419$, $M = 368.52$, $SD = 1082.99$). This should not to be confused with the idea that certain kota characteristics (like better transport infrastructure or consumption patterns) may affect incentive structures towards higher relative demand for concessions in kotas.

46.3 percent larger concessions, ceteris paribus (Column 4). These associations' significance levels were most stable throughout models for poverty rate, HDI score, and population density, the latter of which was the only one to remain significant when all controls (including kota and island dummies) were incorporated. The changes might be due to other district characteristics which are not included in this analysis, but which are associated both with the size concessions and with our explanatory variables, biasing the estimated coefficients (omitted variable bias). In turn, this implicates that a lot of variation in the dependent variable is explained by the island a district is located on. Hence, significance of the socio-economic coefficients is most likely driven by variation across all districts, and less by variation within island groups.

Table 1: Palm oil concessions: Socio-economic and biophysical indicators

	Full sample					Sub-samples		
	(1)	(2)	(3)	(4)	(5)	excl. Java	excl. Kotas	PSI>10
GDP p.c.	0.011*		0.007	0.006	0.003	0.001	0.014***	0.003
	(0.005)		(0.004)	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)
Poverty rate	-0.079***		-0.046**	-0.044**	-0.007	-0.012	-0.002	-0.004
	(0.016)		(0.016)	(0.016)	(0.016)	(0.019)	(0.017)	(0.018)
Unempl. rate	0.045		-0.082	-0.231*	-0.092	0.078	-0.077	-0.115
	(0.092)		(0.089)	(0.010)	(0.087)	(0.128)	(0.108)	(0.095)
HDI	0.086*		0.087**	0.087**	0.044	0.021	0.028	0.052
	(0.037)		(0.031)	(0.030)	(0.034)	(0.042)	(0.037)	(0.037)
Pop. density	0.552***		0.579***	0.463***	0.507***	0.509	0.252	0.595***
	(0.147)		(0.151)	(0.138)	(0.123)	(0.340)	(0.140)	(0.147)
Lowland share		0.011	0.019*	0.021*	0.015	0.010	0.009	0.006
		(0.010)	(0.010)	(0.009)	(0.009)	(0.012)	(0.011)	(0.012)
Montane share		-0.008	0.005	0.004	-0.015	-0.018	-0.016	-0.029
		(0.011)	(0.012)	(0.012)	(0.013)	(0.015)	(0.014)	(0.020)
Wetland share		0.031**	0.037***	0.037***	0.021*	0.014	0.009	0.013
		(0.010)	(0.010)	(0.009)	(0.010)	(0.012)	(0.012)	(0.012)
PSI		0.045***	0.030***	0.022**	0.002	0.010	0.016	0.007
		(0.007)	(0.008)	(0.007)	(0.008)	(0.010)	(0.011)	(0.010)
Kota dummy				1.723***	1.047*	0.686	n.a.	1.056*
				(0.412)	(0.423)	(0.559	n.a.	(0.449)
Island controls	no	no	no	no	yes	yes	yes	yes
General controls	yes	yes	yes	yes	yes	yes	yes	yes
Adj. R-squared	0.431	0.441	0.503	0.516	0.599	0.577	0.627	0.604
N	506	508	506	506	506	384	417	440

Notes: OLS estimates *b* with inverse hyperbolic sine (IHS) transformed dependent variable (total size of palm oil concession area). Population density is measured in standard deviations. General control variables include IHS-transformed district area, total forested area in 2000, and district age. Regressions include a constant. Table contains rounded values. Standard errors in parentheses. Significance levels: $*p < .05$, $**p < .01$, $***p < .001$.

Robustness checks using the full model with three subsamples (Columns 6-8) also produced mostly insignificant results including for population density. The smaller and insignificant re-lationship with population density in the non-kota sample shows that the significant effect in the full model is mainly influenced by the kota districts, which have comparatively high population densities, and less by population density differentials among kapupaten. Indeed, examining population density average values for kota vs. non-kota (kapupaten) districts pointed toward a meaningful difference between them (kota: n = 89, M = 3311.76, SD = 3269.983; kapupaten: n = 419, M = 344.9218, SD = 873.3231). For the subsample including only districts with a PSI score over 10, population density again exhibited a significant relationship. GDP p.c. and population density were also significant for the full model when run on only data from 2011-2016 (see appendix, Table A.4). Interestingly, when kotas were excluded, GDP p.c. exhibited a significant relationship, but poverty and unemployment rates did not.

Results for bio-physical variables, including PSI score, can be found in the lower section of Table 1. These district characteristics again exhibited mostly positive relationships with palm oil concession area size, except for montane land shares (significant when investigating HIS-transformed absolute land type sizes). When not controlling for islands and using the full sample, wetland share, and PSI, exhibited the most stable relationships with palm oil concession area size. In particular, the results suggest that districts exhibiting one percentage point a higher share of wetland area are approximately on average associated with 3.7 percent larger concession areas, while one percentage point higher PSI score is associated with 2.2 percent larger palm oil concession size, ceteris paribus. PSI's association was therein less stable, as shown also by it losing significance and even becoming negative (marginally significant) when only analyzing data between 2011 and 2016 or using IHS-transformed absolute land type sizes as regressors. Similar to the analysis of socio-economic indicators, most associations were however rendered insignificant by the introduction of island dummies and remained so in all subsample analyses. This again, might point towards correlations between the regressors, like it was the case socio-economic variables.

Table 2 comprises the results for the palm oil concession models including the entire set of variables from Table 1 and, additionally, governance indicators. District splits exhibited a positive (non-significant) association with palm oil concessions which indicated that having been involved in at least one split was associated with approximately 29.8 percent larger concession area[6], on average. Notably however, when this dummy's interaction with the PSI was included (Column 2), its coefficient turned negative while the interaction term was positively and significantly associated with palm oil concession sizes. This may be interpreted such that the estimated average relationship between splits and concessions was zero for districts with PSI scores around 19, but positive if PSI values are high. For instance, given a PSI score of 90, a district's

[6] Replacing the split dummy variable by "*number* of total splits" generates a marginally significant coefficient of 0.269. Number of splits *as parent* generates a marginally significant coefficient of 0.263, whereas in the case of splits *as a child* the coefficient is negative and insignificant.

experience of at least one split would be associated with a roughly 200 percent larger concession size[7]. The irregular elections dummy and its respective interaction term don't produce significant coefficients. However, in the non-kota subsample, the irregular election-PSI interaction term becomes significant, indicating a positive relationship between irregular elections and palm oil concession size for high PSI scores, similar to the district split findings. Apart from that, all governance indicator results, including the sole significant effect of the split-PSI interaction, emerged as principally robust to subsample variations and when IHS-transformed absolute land type areas (wetland, montane, wetland) instead of land type shares, or when alternatively, only data from 2011-2016, were applied.

Table 2: Palm oil concessions: Governance indicators

	Full sample					Sub-samples		
	(1)	(2)	(3)	(4)	(5)	excl. Java	excl. Kotas	PSI>10
Split dummy	0.298	-0.556			-0.446	-0.394	-0.760	-0.873
	(0.280)	(0.365)			(0.360)	(0.430)	(0.408)	(0.528)
Split dummy*PSI		0.029**			0.030**	0.026*	0.040**	0.039**
		(0.010)			(0.010)	(0.012)	(0.015)	(0.013)
Irreg. election dummy			0.207	-0.330	-0.368	-0.061	-0.598	-0.953
			(0.304)	(0.560)	(0.518)	(0.663)	(0.421)	(0.657)
Irreg. election dummy*				0.019	0.020	0.018	0.035**	0.033
				(0.020)	(0.017)	(0.018)	(0.012)	(0.020)
Kota dummy	1.072*	1.117**	1.003*	0.999*	1.097*	0.841	n.a.	1.038*
	(0.424)	(0.426)	(0.421)	(0.422)	(0.424)	(0.562)	n.a.	(0.456)
Socio-econ. controls	yes	yes	yes	yes	yes	yes	yes	yes
Bio-physical controls	yes	yes	yes	yes	yes	yes	yes	yes
Island controls	yes	yes	yes	yes	yes	yes	yes	yes
General controls	yes	yes	yes	yes	yes	yes	yes	yes
Adj. R-squared	0.599	0.602	0.608	0.607	0.612	0.589	0.642	0.611
N	506	506	490	490	490	369	401	426

Notes: OLS estimates *b* with inverse hyperbolic sine (IHS) transformed dependent variable (total size of palm oil concession area). Population density is measured in standard deviations. General control variables include IHS-transformed district area, total forested area in 2000, and district age. Regressions include a constant. Table contains rounded values. Standard errors in parentheses. Significance levels: *$p < .05$, **$p < .01$, ***$p < .001$.

Regarding the models overall, model fit as measured by R^2_{adj} was best, i.e. the most variance in palm oil concessions was explained, in the respective full models (Table 1, Column 5 and Table 2, Column 5), both regarding only non-governance-related variables and all variables. It was additionally improved slightly when kota districts were excluded from the sample. On a similar note, the kota dummy variable, introduced as a control variable, exhibited a significantly positive effect in almost all models that it was included in. This is in line with the above-mentioned interpretation that kota and non-kota districts may differ importantly. The fact that this effect is

[7] Based on following calculation: -0.556+90*0.029=2.054.

not present when Java is excluded is not surprising, as Java is home to many kota districts (28 out of 89 kotas are located on Java).

The following part reports on the estimation results for logging concessions, timber concessions, and protected areas. For each of these policies, four models were run using the full set of explanatory and control variables. Much like the results for palm oil concessions above, model coefficients are first presented excluding governance indicators (Table 3) and subsequently including them (Table 4), for each case running a model with and without inclusion of the kota dummy.

Table 3: Logging and timber concessions, and protected areas: Socio-economic and bio-physical indicators

	Logging concessions		Timber concessions		Protected areas	
	(1)	(2)	(3)	(4)	(5)	(6)
GDP p.c.	0.003	0.002	0.001	0.000	0.000	0.000
	(0.004)	(0.004)	(0.004)	(0.004)	(0.007)	(0.007)
Poverty rate	0.024	0.036	-0.026	-0.022	0.018	0.028
	(0.021)	(0.021)	(0.018)	(0.018)	(0.021)	(0.020)
Unempl. rate	0.036	-0.130	-0.006	-0.067	0.180	0.026
	(0.099)	(0.106)	(0.091)	(0.098)	(0.116)	(0.124)
HDI	0.152***	0.135**	0.010	0.004	0.042	0.026
	(0.045)	(0.044)	(0.041)	(0.041)	(0.050)	(0.051)
Pop. density	0.728***	0.623***	0.496***	0.457***	0.682***	0.585***
	(0.162)	(0.142)	(0.138)	(0.131)	(0.152)	(0.144)
Lowland share	-0.037**	-0.038**	0.020	0.020*	-0.016	-0.016
	(0.013)	(0.012)	(0.010)	(0.010)	(0.014)	(0.014)
Montane share	-0.061***	-0.065***	0.023	0.022	-0.012	-0.015
	(0.017)	(0.016)	(0.012)	(0.012)	(0.019)	(0.019)
Wetland share	-0.046**	-0.046***	0.018	0.018	-0.015	-0.015
	(0.014)	(0.014)	(0.012)	(0.012)	(0.014)	(0.014)
PSI	0.016	0.014	0.008	0.008	-0.037***	-0.039***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Kota dummy		2.219***		0.817		2.048***
		(0.507)		(0.508)		(0.539)
Island controls	yes	yes	yes	yes	yes	yes
General controls	yes	yes	yes	yes	yes	yes
Adj. R-squared	0.485	0.500	0.508	0.509	0.349	0.363
N	506	506	506	506	506	506

Notes: OLS estimates *b* with inverse hyperbolic sine (IHS) transformed dependent variable (total sizes of logging concessions, timber concessions, and protected areas). Population density is measured in standard deviations. General control variables include IHS-transformed district area, total forested area in 2000, and district age. Regressions include a constant. Table contains rounded values. Standard errors in parentheses. Significance levels: $*p < .05$, $**p < .01$, $***p < .001$.

Logging concessions were mostly positively associated with all socio-economic variables, solely the unemployment rate didn't show a robust and consistent sign across model specifications. Associations of GDP p.c., poverty, and unemployment however remained insignificant in both specifications, though GDP p.c. did emerge as significant with data from 2011 to 2016.

In line with palm oil concessions, population density exhibited a significant association with logging, as did the HDI. In that sense, the results suggest, ceteris paribus, that logging concessions are on average approximately 13.5 percent larger corresponding with one percentage point higher HDI (Column 2). A significantly positive association with population density could also be found for both timber concessions and protected areas, but no such finding emerged for GDP levels or any other socio-economic variable. Interestingly, coefficients for poverty and unemployment rate were negative (non-significant) for timber concessions but positive (non-significant) for protected areas, the former being more in line with palm oil and the latter with logging concessions. Overall, population density was positively associated with all three land use policies, such that one population density standard deviation was on average, ceteris paribus, associated with 72.8, 49.6, and 68.2 percent larger logging concession, timber concession, and protected areas, respectively (Columns 1, 3, 5). This finding is in line with concession sizes being, on average and all else equal, roughly 2-3 times larger in urban areas as indicated by the kota dummy coefficients.

Relationships between logging and bio-physical variables were significantly negative for lowland, montane, and wetland area shares, but positive (non-significant) for PSI. Importantly to note, when using IHS-transformed as regressors absolute sizes of land type area (Table A.3), these associations however were positive and highly significantly for lowland area, and marginally significant for wetland area in one model. Bio-physical land share indicators exhibited universally positive but mostly insignificant associations with timber concessions (marginally significant for lowland share). When using IHS-transformed absolute land type sizes, these turned negative (mostly non-significant). Contrastingly, protected areas exhibited negative relationships with all bio-physical land share indicators, significantly so in the case of PSI in both models. More specifically, a one percentage point higher PSI score is approximately associated with 3.9 percent smaller total size of protected areas, ceteris paribus (Column 6). The relationship of IHS-transformed absolute sizes of lowland, montane, and wetland area with protected areas in turn emerged positive, therein significant for montane area. One should bear in mind that size of district area is included as control, influencing coefficients for absolute land type sizes due to correlation, most likely explaining insignificant or even negative coefficients.

Table 4 illustrates the results of the full models, including all governance indicators, for logging and timber concessions, and protected areas. For each type of policy, again one regression was run with and one without the kota dummy. Logging concessions did not show any significant relationships with the governance indicators. For timber concession sizes, a significantly positive correspondence with the interaction of district split dummy and PSI was found, indicating positive relationships for those districts exhibiting high PSI scores (significance disappears when using data from 2011-2016 only). Overall, regarding timber concessions, the coefficients for district split and irregular election dummies, were negative, while those for their respective interaction with PSI counterparts were positive. For protected areas, again no significant relationship with any governance indicator could be found, with coefficients' signs being positive for the split dummy and negative for its interaction with PSI. The reverse picture, though also insignificant, emerged for the irregular election dummy and the respective interaction term. In sum, the indicators for governance exhibited, except for one case (timber concessions), no significant associations with logging, timber concessions, or protected areas. Model fit indicators reflect this finding, such that R^2_{adj} did not change importantly when governance indicators were introduced. Overall, the models for protected areas seem to explain the least variance compared to the other policies.

Table 4: Logging and timber concessions, and protected areas: Governance indicators

	Logging concessions		Timber Concessions		Protected areas	
	(1)	(2)	(3)	(4)	(5)	(6)
Split dummy	0.294	0.299	-0.264	-0.262	0.857	0.861
	(0.483)	(0.484)	(0.434)	(0.432)	(0.615)	(0.612)
Split dummy*PSI	0.000	0.003	0.023*	0.024*	-0.022	-0.019
	(0.013)	(0.013)	(0.011)	(0.011)	(0.014)	(0.014)
Irreg. election dummy	-0.770	-0.739	-0.113	-0.100	-0.884	-0.856
	(0.626)	(0.651)	(0.778)	(0.768)	(0.955)	(0.965)
Irreg. Election dummy*PSI	0.038	0.037	0.004	0.004	0.047	0.047
	(0.022)	(0.023)	(0.026)	(0.026)	(0.031)	(0.032)
Kota dummy		2.172***		0.940		1.983***
		(0.508)		(0.514)		(0.550)
Socio-econ. controls	yes	yes	yes	yes	yes	yes
Bio-physical controls	yes	yes	yes	yes	yes	yes
Island controls	yes	yes	yes	yes	yes	yes
General controls	yes	yes	yes	yes	yes	yes
Adj. R-squared	0.482	0.497	0.511	0.514	0.342	0.355
N	490	490	490	490	490	490

Notes: OLS estimates *b* with inverse hyperbolic sine (IHS) transformed dependent variable (total sizes of logging concessions, timber concessions, and protected areas). Population density is measured in standard deviations. General control variables include IHS-transformed district area, total forested area in 2000, and district age. Regressions include a constant. Table contains rounded values. Standard errors in parentheses. Significance levels: *$p < .05$, **$p < .01$, ***$p < .001$.

4.4 Discussion

The aim of this analysis was to see whether certain district characteristics (socio-economic, bio-physical, governance) are associated with differences in sizes of concessions or protected areas across Indonesian districts. In the following, the findings are discussed in the context of the political economy considerations laid out before.

The results on bio-physical district characteristics, i.e. the estimated relationship between logging, timber, and palm oil concessions with bio-physical conditions points toward the theoretically supported perception that economic actors may prefer land use types that yield the highest returns and possibly the lowest opportunity costs. Results on palm oil concessions, for instance, were for the most part positively associated with favorable bio-physical indicators (lowland and wetland extent, and PSI), hence higher potential revenues. This is not surprising, as wetland area is considered usable for conversion into industrial plantations (Margono *et al.*, 2014a). Steeper slopes in montane areas on the other hand, which exhibited rather negative or non-significant association with palm oil concession size, could be explained by higher operational and transport costs (Nelson and Chomitz, 2011). Elevation also serves as a proxy for temperature, indicating rising agricultural yields with lower altitudes (Brun *et al.*, 2015; Nelson and Chomitz, 2011). Results for timber which partly resembled those for palm oil concessions, however, were less robust and conclusive in the present models.

Contrastingly, logging concessions and protected areas, partly congruent because selective logging concessions are actually a type of multi-use protected areas (Gaveau *et al.*, 2013), exhibited rather negative associations with higher *shares* of lowland, wetland, and montane area (significant for logging concession, except for the association with PSI). The data hence suggests that that total logging concession sizes are smaller in districts with larger lowland, wetland, and montane land shares relative to upland shares. This might indicate that the former two land types are primarily used for more lucrative land use such as palm oil and timber cultivation, whereas comparatively mountainous districts exhibit less favorable geographic conditions and accessibility for logging operators. Measuring land type extents in absolute sizes reveals that districts with greater absolute lowland and wetland area are positively and significantly associated with logging concession sizes, showing that logging concessions are not restricted to upland abundant districts. Protected areas were therein most significantly associated with PSI scores, such that a higher PSI was associated with less protected areas. When examining bio-physical land characteristics by means of absolute size of area covered with respective land types, the analysis reveals a highly significant positive relationships of protected areas with the extent of montane area. These results are in line with former findings that protected areas are rather located in realms that face lower deforestation pressure, or in other words, in areas which yield low opportunity costs of conservation (Joppa and Pfaff, 2009).

As a whole, findings from bio-physical district characteristics were reliant on which policy was examined, with palm oil and timber concessions exhibiting rather positive associations with favorable cultivation contexts (PSI, lowland share, wetland share), and protected areas presenting negative coefficients. This allows for the cautious conjecture that the former two policies may be distributed especially where bio-physical conditions are most conductive while protected areas may be declared where cultivation conditions are suboptimal. Verification of this would however require more detailed data. Significance changes in many cases when island controls are included could mean that unobserved district characterizes bias coefficients in the reduced models. Finally, results might be different when excluding associated control variables such as total district area and forested area in 2000.

The most universally robust socio-economic finding was a positive association of population density with all policies, which may be due to higher demand for land and forestry resources when many people live in one place (or to the reverse, i.e. migration toward districts holding economically attractive land use opportunities). Since this finding seemed to be driven by high population densities in kota-districts and on the main island Java, it needs to be seen in the context of differences between islands and district types (i.e. kota vs. non-kota). Apart from its relationship with population density, a district's kota status likely holds additional information relevant to its socio-economic make-up which potentially affects the rentability of different land use and demand for respective concessions. This may, for instance, include better infrastructure, which can lower operational and transportation costs, hence increase profitability, or higher general demand for respective commodities in urban contexts. A significantly positive kota dummy coefficient across the models points toward this notion.

Estimates for GDP p.c. were positively associated with palm oil, especially so in the non-kota sample. A straight forward interpretation would be that income may be higher due to revenues from palm oil in non-kota districts which constitute the majority of total palm oil concessions. This would be in line, for instance, with Budidarsono et al. (2012) who find that many rural households in Indonesia were on average able to double and treble household incomes after five years of palm oil cultivation and even more in subsequent years, however with strong variation (Budidarsono et al. 2012). Interestingly, this higher association with wealth was not mirrored in significant negative associations with poverty or unemployment in the kapupaten (non-kota) subsample. Strong association with higher GDP levels in combination with the latter finding (or lack thereof) however could be seen as an indication, in line with other previous research, that rural communities may often benefit less from palm oil development than plantation owners and governments receiving tax revenues (see Zen and Nibulan, 2018). In addition, it may be in line with the fact that capital-intensive commercial plantations often import high-skilled workers from Java or abroad and export unprocessed raw materials, hence failing to benefit locals in terms of value added except for policy makers and business owners (Nasution, 2016, p. 16). These observations would therefore support the perception that Indonesia's palm oil sector may be prone to rent-seeking and corruption, such that wealth is generated but the benefits are not shared equally. The estimated significant relationship between GDP p.c. and palm oil concession size in the regression that uses data from between 2011-2018 may reflect the fact that Indonesia further expanded its palm oil sector in this time.

In the full sample however, poverty rates were significantly and negatively associated with palm oil concessions. Similarly, though insignificant, the association of poverty with timber plantation concessions is negative in the full model. This may likely be due to rural community-based timber concession schemes which potentially increase their incomes rather than subsistence activities. On the other hand, poverty rates exhibited a (non-significant) tendency for positive associations with logging concessions in natural forests and protected area networks. These land uses allow for, at most, limited production. One possible interpretation for a significant finding here would therefore be that citizens in these districts miss out on the opportunity to escape poverty by pursuing more profitable land uses. In addition, since logging and management of protected areas involve activities which can be performed by less skilled labor, these workers then in turn earn lower income. Results of unemployment rates, as was mentioned above, did not allow for a clear conclusion, which could mean that the land use types analyzed in this research lack the potential to directly enhance employment opportunities. Finally, a significant relationship between palm oil as well as logging concessions and HDI scores may reflect that the well-being of people living in districts with a high prevalence of these land policies might be based on higher incomes, or in the case of logging concessions, activities and environments being healthier and might be better suited to foster good health outcomes, which are one component of the HDI. Missing equivalent results for timber plantation concessions and protected areas might be explained by a lack of distinction between different types of timber plantation and protection schemes exhibiting differing implications for (rural) livelihoods.

Overall, socio-economic indicators of districts held some information regarding the extent of land use policies administered there. The estimated relationships depend on which policy was examined, though palm oil and timber concessions as well as logging concessions and protected areas often produced parallel results, respectively. The present results implicate that districts with better conditions exhibited more (at least not significantly less) concession areas. This was most apparent in terms of lower poverty (for palm oil) and better HDI scores (for palm oil and logging). The most reliably significant finding was a positive association of population density with more concession area of all policies, which likely overlapped with kota-specific characteristics. Again, it should be noted that the location on a specific island probably captures omitted variable information which possibly bias the results for socio-economic variables, indicated by respective changes when district dummies were included into the models.

In order to address the question of rent-seeking and corruption links to land use policies, a batch of governance indicators was investigated. The main finding here was a positive link between the interaction of district splits with the PSI and the total size of palm oil and timber concessions, as well as a positive, however less robust relationship of irregular election-PSI interaction with palm oil concession sizes (in the non-kota context). This may be interpreted such that the overall relationships of district splits and preponed elections with concession sizes become (more) positive for districts that exceed a certain PSI threshold. These results are in line with the notion that better bio-physical conditions possibly stimulate rent-seeking and engagement in corruption because the profitability of any land use increases, and thus potentially explaining larger palm oil and timber concession areas. The fact that this finding only occurred for palm oil and timber may, at least in the case of palm oil, be due to districts having the most say in the distribution of these concessions. Apart from this insight, the presently used governance information yielded no clear results for the tentative hypothesis that having weaker governance structures carries better opportunities for rent-seeking and corruption, incentivizing public officials to issue licenses.

There are some limitations to the present results. First, it is possible that the data used does not map the full picture of concessions and protected areas in Indonesia. Especially in the case of protected areas, no distinction between different types of protected areas and sponsor identities (local and central governments, national and international NGOs), community engagement, and other factors was possible, even though these may imply different incentive structures for policy makers. Secondly, the present analysis did not consider the temporal scope of land use and district characteristics, particularly regarding the time of issuance of concession permits and protected area declaration. This leaves the investigation of causal effects for future research projects, at best using detailed and comprehensive temporal data with methods of panel data analysis which would also allow for control of unobserved and time-invariant district heterogeneity. Other topics for future research unquestionably include tests for replicability of the present results and the application of other explanatory variables, in particular, more direct governance indicators.

5. Conclusions

Indonesia has experienced substantial deforestation and forest degradation for many years, for which logging in natural forests and plantation development for timber and palm oil are important contributors. Since land and forest ownership is in most areas claimed by the state, government agencies at different scales are supposed to navigate land use policies. Since the late 1990, local governments, especially district governments, have gained increased authorities and responsibilities concerning land use and environmental administration in the course of rapidly introduced decentralization reforms. With regard to the forestry sector, district authorities were afterwards continuously withdrawn and transferred to other governmental levels. Today, the regulatory framework remains unclear in several regards, due to contradicting and overlapping laws and regulations. As one realm, district governments have maintained major decision-making authorities regarding licensing for palm oil plantations. They therefore continue to have leeway to permit land conversion, including the clearing of standing forests.

As a result, different government agencies can pursue their own policy objectives while referring to different legal frameworks. Basic political economy theory suggests that public officials therein seek to maximize their personal (economic) benefits while provision of public goods and social welfare maximization is only pursued to the extent that it helps to gain or remain in power. Indeed, several important institutional factors seemingly fail to constitute accountability mechanisms but create scopes for rent-seeking and make governance violations at the expense of social welfare maximization attractive in Indonesian districts. These most prominently include dysfunctional local elections, low transparency with regard to land classifications and concession contracts, and improper criminal prosecution. In other words, the enforcement of regulatory restrictions appears to be a problem. In addition, as decentralization was accompanied by fiscal balancing, leaving the originating district governments a greater share of public revenues, local public officials have been incentivized to accelerate the issuance of land use permits to maximize local budgets at their disposal. While thereby increasing their possibilities to both finance public goods and pursue rent-seeking, adverse environmental externalities have often been neglected. Finally, corruption plays an important role in the processes of licensing and backing of illegal forest encroachment and land conversion in exchange for bribes and political support. While decentralization has often been justified by it improving governance and natural sustainability, the re-centralization in one sector – forestry –, but retaining local autonomy in another – palm oil – seems to have boosted local motivations to issue licenses in the latter sector, which is considered to be one of the most harmful to the environment.

A cross-sectional empirical analysis to investigate socio-economic, bio-physical, and governance patterns associated with concession and protected area localization across districts broadly confirms the theoretical view that lucrative palm oil concessions are granted in areas where palm oil cultivation is suitable. The reverse picture emerged for protected areas, in line with the theoretical view that high profitability of land conversion most likely hampers incentives for protection and conservation. Bio-physical conditions' associations with logging and timber concessions were less conclusive, though the former results resembled those of protected areas and the latter those of palm oil concessions.

All policies were found to be more prevalent in densely populated areas and, closely interlinked, in urban districts. Besides increasing concession demand due to more people living in the same place, better infrastructure and access to markets in rural and populated districts may increase forestry and agricultural profitability, hence spurring demand for concessions. However, the also higher incidence of protected areas in these districts might implicate necessity or stronger concerns for protection, too. Districts with large areas under palm oil concessions exhibited principally better socio-economic indicators, which may be due to income and profits from this sector. However, in rural districts, large palm oil concession areas were associated with a higher GDP p.c. but not with lower poverty rates. This result supports the perception that the palm oil sector could be an effective tool to fight poverty, but that this is possibly hindered by rent-seeking and corruption, where few corporations and politicians capture all wealth effects.

In the same tenor, larger sizes of palm oil and timber concessions were associated with districts which had been subject to at least one district split or to irregular elections (the latter not for timber concessions), only when a certain threshold of suitable conditions was given, which indicated higher potential revenues and more rents to capture. The significant relationships in these very sectors might be linked local officials retaining relatively strong authorities in respective licensing, especially for palm oil plantations, as discussed above. Apart from this insight, the presently used governance information yielded no clear results. For future research it would be interesting to investigate more direct indicators of corruption and to explore temporal data to infer causality relations between district characteristics and land use policies.

In conclusion, this thesis shows that the political economy of land use administration should be carefully considered when designing land-related administrative and management structures in decentralized Indonesia. On this basis, detangling overlapping authorities, increasing transparency, strengthening democratic participation, improving accountability mechanisms, or providing alternative sources of sustainable forest rents like payment for environmental service schemes seem to hold potential to reduce perverse incentives, to improve land use governance, and to support consolidation of socio-economic development and environmental interests.

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Appendix

Table A 1: Laws and regulations referred to in the thesis

Year	English name	Official name	see
1960	Law 05/1960 or Basic Agrarian Law	UU Nomor 5 Tahun 1960 tentang Peraturan Dasar Pokok-pokok Agraria.	Sahide/Giessen 2015
1999	Law 22/1999 on Regional Administration	UU Nomor 22 Tahun 1999 tentang Pemerintahan Daerah	Barr et al. 2006, Ardiansyah et al. 2015
1999	Law 25/1999 on the Fiscal Balance Between Central and Regional Governments	UU Nomor 25 Tahun 1999 tentang Perimbangan Keuangan antara Pemerintah Pusat dan Daerah	Barr et al. 2006
1999	Law 41/1999 on Forestry	UU Nomor 41 Tahun 1999 tentang Kehutanan.	Barr et al. 2006, Sahide/Giessen 2015
2004	Law 32/2004 on Regional Governance	UU Numor 32 Tahun 2004 tentang Pemerintahan Daerah	Barr et al. 2006
2004	Law 33/2004 on Fiscal Balancing Between the Central Government and the Regions	UU entang Perimbangan Keuangan antara Pemerintah Pusat dan Daerah	Barr et al.2006
2007	Law 26/2007 on Spatial Planning Law	UU Republik Indonesia Nomor Nomor 26 Tahun 2007 tentang Rencana Tata Ruang.	Sahide/Giessen 2015
2009	Law 32/2009 on Environmental Protection and Management	UU Nomor 32 Tahun 2009 tentang Perlindungan dan Pengelolaan Lingkungan Hidup	Ardiansyah et al. 2015
2014	Law 23/2014 on Regional Governance	UU Nomor 23 Tahun 2014 tentang Pemerintahan Daerah	Ardiansyah et al. 2015
1998	Government Regulation 62/1998 on the Granting to Local Governments of Some of the Central Governments	PP Nomor 62 Tahun 1998 tentang Penyerahan Sebagian Urusan Pemerintahan di Bidang Kehutanan Kepada Daerah	Ardiansyah et al. 2015
1999	Government Regulation 06/1999 on Forest Utilization and Forest Product Collection/ Harvesting in Production Forests	PP Nomor 6 Tahun 1999 tentang Pengusahaan Hutan dan Pemungutan Hasil Hutan pada Hutan Produksi	Ardiansyah et al. 2015
2002	Government Regulation 34/2002 on Forest Planning and the Formulation of Forest Management and Utilization Plans	PP Nomor 34 Tahun 2002 tentang Tata Hutan dan Penyusunan Rencana Pengelolaan Hutan, Pemanfaatan Hutan dan Penggunaan Kawasan Hutan	Ardiansyah et al. 2015
2002	Government Regulation 35/2002 on the Reforestation Fund	PP Nomor 35 Tahun 2002 tentang Dana Reboisasi	Ardiansyah et al. 2015
2007	Government Regulation 38/2007 on Government Afforestareairs Division of the Government, Provincial Government and the District/Municipality Government.	PP Nomor 38 Tahun 2007 tentang Pembagian Urusan Pemerintahan antara Pemerintah, Pemerintah Daerah Provinsi dan Pemerintah Daerah Kabupaten/Kota.	Ardiansyah et al. 2015
2012	Government Regulation 61/2012 on the Amendment to Gov-ernment Regulation 24 of 2010 concerning the use of forest area	PP Nomor 61 Tahun 2012 Tentang Perubahan Atas-Peraturan Pemerintah Nomor 24 Tahun 2010 Tentang PenggunaanKawasan Hutan.	Sahide/Giessen 2015
2014	Joint Regulation 97/2014 on Procedures for the Resolution of Land Control in the Forest Zone		Banjade et al. 2017
2000	MoF Decree 05.1/Kpts-II/2000 on Criteria and Standard of Licensing of the Utilization of Forest Products and the Harvesting of Forest Products in Natural Production Forest	Tentang Kriteria dan Standar Perijinan Usaha Pemanfaatan Hasil Hutan dan Perijinan emungutan Hasil Hutan pada Hutan Produksi Alam	Barr et al. 2006
2011	Presidential Instruction No. 10 of 2011	Instruksi Presiden Republik Indonesia No. 10 Tahun 2011 tanggal 20 Mei 2011 tentang Penundaan Pemberian Izin Baru dan Penyempurnaan Tata Kelola Hutan Alam Primer dan Lahan Gambut)	MoEF 2018
2012	Constitutional Court Decision 35/2012	Keputusan Mahkamah Konstitusi Nomor 35/PUU-X/2012.	Sahide/Giessen 2015

Table A 2: Variables[8]

	Indep. Variable	Measurement	Note	Original source	Mean	Std. dev.	Min	Max
Socio-economic indicators	GDP per capita	IDR million, inflation-adjusted, 2000 prices	Averaged data from 2001-2016 where available	Self-generated, GDP and number of people from INDO-DAPOER[9]	16.64	28.02	1.89	421.16
	Poverty rate	in percent [0;100]	Averaged data from 2001-2016 where available	INDO-DAPOER	17.56	9.76	2.40	49.81
	Unemployment rate	in percent [0;100]	Averaged data from 2001-2016 where available	Self-generated, number of people unemployed and number of people from INDO-DAPOER	2.70	1.42	0.31	7.54
	Human Development Index	[0;100]	Averaged data from 2001-2016 where available	INDO-DAPOER	69.49	4.68	48.67	78.63
	Population density[10]	Standard deviation (1941.65 people p. km2)	Averaged data from 2001-2016 where available	Self-generated, number of people from INDO-DAPOER	866.76	1941.65	0.93	15330.51
Bio-physical indicators	Lowland area in 2000	km2, IHS transformed	Not used in main regressions	Margono et al. (2014)				
	Upland area in 2000	km2, IHS transformed	Not used in main regressions	Margono et al. (2014)				
	Montane area in 2000	km2, IHS transformed	Not used in main regressions	Margono et al. (2014)				
	Wetland area in 2000	km2, IHS transformed	Not used in main regressions	Margono et al. (2014)				
	share lowland area	in percent of district area [0;100]		Self-generated	62.12	21.81	0.00	100.28
	share upland area	in percent of district area [0;100]	Excluded due to multicollinearity	Self-generated	15.05	13.55	0.00	54.61
	share montane area	in percent of district area [0;100]		Self-generated	6.56	14.22	0.00	98.27
	share wetland area	in percent of district area [0;100]		Self-generated	15.00	19.50	0.00	93.15
	Palm oil suitability (PSI)	[0;100]		Calculation by the supervisor, based on Global Agro-Ecological Zones (GAEZ) crop suitability maps.	29.43	17.16	0.00	76.65
Governance indicators[11]	Split dummy	"District split at least once" = 1		Self-generated from "number of splits" provided by the supervisor	0.87	0.96	0.00	7.00
	Irregular election dummy	"District held irregular election at least once" = 1		Self-generated from "number of irregular elections" provided by the supervisor	0.06	0.24	0.00	1.00
	Split dummy*PSI	Interaction term		Self-generated				
	Irreg.Elect.*Palm oil suitability	Interaction term		Self-generated				
Control variables[12]	Total district area	km2, IHS transformed		Calculation by the supervisor, based on spatial district boundaries obtained from gispedia.com	4172.50	6692.72	10.99	66119.36
	Forest area in 2000	km2, IHS transformed		Hansen *et al.* (2013)	3576.73	6237.80	0.55	50133.60
	Kota dummy	"district is a Kota"=1; "district is Kapup."=0		Provided by the supervisor	0.18			
	Age	Years since district creation, IHS transformed		Provided by the supervisor	39.22	24.24	3.00	67.00
Island dummies	Sumatra	[1 yes, 0 no]		INDO-DAPOER	0.30			
	Java	[1 yes, 0 no]	Excluded due to multicollinearity	INDO-DAPOER	0.24			
	Kalimantan	[1 yes, 0 no]		INDO-DAPOER	0.11			
	Sulawesi	[1 yes, 0 no]		INDO-DAPOER	0.16			
	Maluku Islands	[1 yes, 0 no]		INDO-DAPOER	0.10			
	Papua	[1 yes, 0 no]		INDO-DAPOER	0.08			
Dependent variables (Policies)[13]	Palm oil concession size	km2, IHS transformed	as of 2017	Calculation by the supervisor, based on Global Forest Watch data	305.05	993.03	0.00	10407.96
	Logging concession size	km2, IHS transformed	as of 2017	Calculation by the supervisor, based on Global Forest Watch data	372.07	1286.95	0.00	17846.78
	Timber concession size	km2, IHS transformed	as of 2017	Calculation by the supervisor, based on Global Forest Watch data	257.67	958.23	0.00	13199.49
	Protected area size	km2, IHS transformed	as of 2017	Calculation by the supervisor, based on World Database on Protected Areas (WDPA, 2019)	372.07	1286.95	0.00	17846.78

[8] The full data set was provided by the thesis supervisor.
[9] Indonesian Database for Policy and Economic Research, World Bank Group (2018).
[10] Summary statistics non-standardized.
[11] Summary statistics describe "number of splits" and "number of irregular elections".
[12] Summary statistics describe untransformed values in km^2 and number of years since creation respectively.
[13] Summary statistics describe untransformed values in km^2.

Table A 3: Regressions applying alternative specification of bio-physical indicators (IHS-transformed absolute sizes of land types)

	Palm oil concessions		Logging concessions		Timber concessions		Protected areas	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP p.c.	0.003	0.002	0.001	0.001	0.001	0.000	-0.001	0.000
	(0.006)	(0.006)	(0.003)	(0.004)	(0.004)	(0.004)	(0.007)	(0.007)
Poverty rate	-0.012	-0.015	0.035	0.039	-0.021	-0.022	0.024	0.018
	(0.016)	(0.016)	(0.020)	(0.021)	(0.018)	(0.017)	(0.020)	(0.020)
Unempl. rate	-0.088	-0.060	-0.139	-0.108	-0.054	-0.024	-0.037	-0.028
	(0.089)	(0.089)	(0.107)	(0.111)	(0.099)	(0.100)	(0.121)	(0.123)
HDI	0.044	0.035	0.146**	0.135**	-0.011	-0.011	0.034	0.018
	(0.034)	(0.033)	(0.045)	(0.046)	(0.040)	(0.040)	(0.048)	(0.048)
Pop. density	0.520***	0.521***	0.672***	0.640***	0.451***	0.422**	0.495***	0.460**
	(0.128)	(0.136)	(0.147)	(0.148)	(0.134)	(0.139)	(0.131)	(0.140)
Lowland area	0.144	0.148	0.794***	0.782***	-0.032	-0.090	0.371	0.443*
	(0.148)	(0.136)	(0.175)	(0.169)	(0.154)	(0.160)	(0.222)	(0.219)
Montane area	-0.112*	-0.108*	0.102	0.076	-0.072	-0.071	0.243***	0.216**
	(0.047)	(0.049)	(0.059)	(0.061)	(0.053)	(0.055)	(0.063)	(0.066)
Wetland area	0.098	0.101	0.171*	0.152	-0.116	-0.143*	0.141	0.144
	(0.072)	(0.065)	(0.083)	(0.082)	(0.070)	(0.073)	(0.091)	(0.092)
PSI	0.006	-0.017*	-0.001	-0.002	0.013	-0.006	-0.032**	-0.023*
	(0.008)	(0.008)	(0.009)	(0.011)	(0.009)	(0.010)	(0.010)	(0.012)
Split dummy		-0.635		0.409		-0.254		0.746
		(0.352)		(0.456)		(0.437)		(0.579)
Split dummy*PSI		0.034***		-0.002		0.024*		-0.014
		(0.010)		(0.012)		(0.011)		(0.013)
Irreg. election dummy		-0.324		-0.532		-0.166		-0.933
		(0.507)		(0.642)		(0.752)		(0.884)
Irreg. election		0.018		0.031		0.005		0.049
		(0.017)		(0.023)		(0.025)		(0.031)
Kota dummy	0.955*	1.003*	2.187***	2.114***	0.833	0.950	2.094***	2.050***
	(0.422)	(0.425)	(0.491)	(0.498)	(0.503)	(0.508)	(0.527)	(0.541)
Island controls	yes	yes	yes	yes	yes	yes	yes	yes
General controls	yes	yes	yes	yes	yes	yes	yes	yes
Adj. R-squared	0.595	0.609	0.501	0.497	0.510	0.515	0.386	0.375
N	506	490	506	490	506	490	506	490

Notes: OLS estimates *b* with inverse hyperbolic sine (IHS) transformed dependent variable (total sizes palm oil concession, logging concession, timber concession, and protected area). Population density is measured in standard deviations. Land types (absolute sizes of lowland, montane, and wetland area) measured in km^2 and IHS-transformed. General control variables include IHS-transformed district area, total forested area in 2000, and district age. Regressions include a constant. Table contains rounded values. Standard errors in parentheses. Significance levels: $*p < .05$, $**p < .01$, $***p < .001$.

Table A 4: Regressions using data from 2011-2016

	Palm oil concessions		Logging concessions		Timber concessions		Protected areas	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP p.c.	0.011**	0.011**	0.011*	0.011*	0.004	0.004	-0.007	-0.007
	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)	(0.009)	(0.009)
Poverty rate	-0.018	-0.017	0.021	0.026	-0.037	-0.031	0.025	0.025
	(0.018)	(0.018)	(0.021)	(0.021)	(0.020)	(0.020)	(0.021)	(0.021)
Unempl. rate	-0.063	-0.047	0.010	0.008	-0.119	-0.073	0.087	0.068
	(0.090)	(0.090)	(0.118)	(0.119)	(0.101)	(0.102)	(0.128)	(0.130)
HDI	0.030	0.018	0.084*	0.085	0.007	0.009	0.002	-0.002
	(0.036)	(0.036)	(0.042)	(0.043)	(0.039)	(0.040)	(0.049)	(0.050)
Pop. density	0.479***	0.491***	0.595***	0.561***	0.445***	0.431**	0.565***	0.530**
	(0.130)	(0.133)	(0.153)	(0.154)	(0.133)	(0.136)	(0.162)	(0.166)
Lowland share	0.015	0.011	-0.037**	-0.032*	0.019	0.017	-0.0158	-0.011
	(0.009)	(0.009)	(0.013)	(0.013)	(0.010)	(0.010)	(0.014)	(0.014)
Montane share	-0.014	-0.020	-0.065***	-0.062***	0.022	0.022	-0.016	-0.019
	(0.013)	(0.012)	(0.016)	(0.017)	(0.012)	(0.012)	(0.020)	(0.020)
Wetland share	0.021*	0.016	-0.047***	-0.044**	0.017	0.014	-0.016	-0.012
	(0.010)	(0.010)	(0.014)	(0.013)	(0.012)	(0.013)	(0.014)	(0.014)
PSI	0.002	-0.018*	0.011	0.005	0.009	-0.010	-0.038***	-0.029*
	(0.008)	(0.008)	(0.009)	(0.012)	(0.010)	(0.010)	(0.010)	(0.012)
Split dummy		-0.387		0.459		-0.133		0.828
		(0.363)		(0.487)		(0.432)		(0.616)
Split dummy*PSI		0.030**		0.002		0.022		-0.016
		(0.010)		(0.013)		(0.011)		(0.014)
Irreg. election dummy		-0.435		-0.543		0.015		0.373
		(0.451)		(0.817)		(0.769)		(0.855)
Irreg. election		0.015		0.023		0.022		-0.020
		(0.016)		(0.022)		(0.022)		(0.029)
Kota dummy	0.700	0.790	1.771***	1.775***	0.558	0.692	2.054***	2.034***
	(0.406)	(0.405)	(0.475)	(0.475)	(0.475)	(0.474)	(0.531)	(0.536)
Island controls	yes	yes	yes	yes	yes	yes	yes	yes
General controls	yes	yes	yes	yes	yes	yes	yes	yes
Adj. R-squared	0.601	0.615	0.495	0.491	0.513	0.521	0.362	0.351
N	506	490	506	490	506	490	506	490

Notes: OLS estimates *b* with inverse hyperbolic sine (IHS) transformed dependent variable (total sizes of palm oil concession, logging concession, timber concession, and protected area). The regressions take into account data since 2011. Population density is measured in standard deviations. General control variables include IHS-transformed district area, total forested area in 2000, and district age. Regressions include a constant. Table contains rounded values. Standard errors in parentheses. Significance levels: $*p < .05$, $**p < .01$, $***p < .001$.

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I hereby declare that I have written this paper without any help from others and without the use of documents and aids other than those stated in the references. I have mentioned all the sources used and I have cited them correctly according to established academic citation rules. Moreover, the topic or parts of it are not already the object of any work or examination of another course. The paper format and electronic version of the paper are the same[14].

Kilian Nußbaum

[14] Wording of the declaration taken from Guidelines for writing a master thesis at the Chair of International Economic Policy.