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Subnational Government Budgets and Resource Revenues in Indonesia: Indications of Resource Blessings?

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Abstract

We examine the economic consequences of resource extraction and the associated revenue windfalls on subnational government revenues and spending patterns. Making use of Indonesia's fiscal sharing rules and an offshore oil and gas production instrument, we find a positive impact of resource revenues on the center-local balancing funds including the general allocation fund, despite the latters' fiscal rebalancing purposes. Fiscal windfalls from resource extraction increase public sector spending on capital and infrastructure projects as well as public goods and services, with positive spillover benefits on local tax revenues. At the same time spending on personnel and administration increases less and decrease as percentage of total expenditures. Interaction with district economic governance index data indicates enhanced infrastructure spending but also increases in the balancing funds.

Keywords: Resource extraction; fiscal- and direct economic spillovers; decentralization; subnational government budgets; South-East Asia; Indonesia

JEL classification: H71, O13, Q32

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1 Introduction

The extraction of natural resources such as petroleum, minerals and metal ores is prone to resource curse-like problems such as currency appreciation, de-industrialization, weakening institutions and corruption (Frankel, 2010; van der Ploeg, 2011). This is particularly relevant in developing countries with weaker institutions, where it is often unclear whether fiscal revenues and economic benefits from extraction activity outweigh the potential economic imbalance and corruption problems.

Many studies have looked at this question both on national and subnational levels. Van der Ploeg (2011) provides an overview of many works examining the possible causes and dynamics of the resource curse at the macroeconomic and cross-country level. Counter examples indicate that resource windfalls can contribute to prosperity, such as in the case of Chile's mineral industry (e.g. Maxwell, 2004; Ebensperger et al., 2005). Other works have examined, at the cross country-level, the importance of governance (e.g. Collier and Hoeffler, 2005) and institutions (e.g. Sala-i-Martin and Subramanian, 2003; Cust and Harding, 2019). Complementary to such cross-country studies are investigations of how these factors operate within-country and at the subnational level (e.g. Monteiro and Ferraz, 2012; Caselli and Michaels, 2013; Aragon and Rud, 2013; Beine et al., 2015; Cust and Rusli, 2014)

Subnational level investigation of the impact of natural resource extraction is important for several reasons. First, we are concerned with the drivers of positive or negative economic performance associated with resource wealth. Examining the subnational and regional impacts of resource windfalls can help us identify the specific variables associated with the resource curse symptoms and root causes, including those related to local economic governance and potential policy remedies (Cust and Rusli, 2014). Second, extraction activity is spatially concentrated. Where direct project-related spillovers are associated with resource extraction, we expect these spillovers to accrue disproportionately to resource-rich regions, their neighbouring regions and the general locality of extraction. This phenomenon occurs due to several specific factors including the bulk weight of a resource, transportation requirements, local spending effects and inward investments.

Third, local government resource revenues are substantial, and thus the spending choices associated with resource windfalls are important. Where resource revenues are distributed regionally (such as through fiscal sharing rules), these windfalls will affect the regional economic picture. Many countries are now moving towards a greater degree of fiscal decentralization, transferring resource revenues back to the home districts of extraction activity and increasingly shifting spending discretion to subnational government units (Perez-Sebastian and Raveh, 2016). Understanding how these units respond to increases in budget and resource windfalls can help us better understand the challenges associate with this trend.

Petroleum extraction has three main beneficiaries. The first beneficiaries are the shareholders, which are typically private individuals and institutions located in urban centers at a distance from extraction or overseas. The second group is the government, which through equity stakes, government-linked companies, contractual terms, and taxation can be the recipient of upwards of 50% of overall revenues generated by extraction. This revenue can accrue solely to the center, or, as in the case of Indonesia, be shared with subnational administrative units following institutionalized fiscal sharing rules. These fiscal transfers may then increase economic activity on the subnational-level through their spending effects. The third group is composed of the regions where extraction activity is located, which benefit through direct capital outlays, employment and wider external effects such as agglomeration benefits arising from value-added activity, transportation or processing of extracted resources.

The present paper continues the work of Cust and Rusli (2014), who identify positive effects of petroleum extraction activity on district level output in Indonesia. They use a district-level panel dataset and the offshore production instrument outlined in Caselli and Michaels (2013) using Brazilian data. In other words, a kind of 'resource blessing' could be in play there. Moreover, Cust et al. (2019) observe that, where Indonesian firms are able to respond to booming local demand and raise productivity in response to upward wage pressures, they can overcome the crowding-out effects from resource windfalls. Caselli and Michaels (2013) on the other hand, trace the impact on socio-economic indicators (or lack thereof) from increased public expenditure and inward investments. They find no significant impact on economic outcomes, but do detect evidence of composition changes in local output.

In this paper we focus on local government fiscal response to revenue windfalls. We ask, how do fiscal transfers from resource extraction and their direct and indirect benefits affect subnational revenue patterns and spending behavior at the district level?[1] We use a rich annual panel dataset of disaggregated district level fiscal accounts in Indonesia, using both the revenue and expenditure side of the budget. We combine this with detailed petroleum extraction information at the well-level to link offshore extraction to specific districts. Our constructed district level annual oil and gas extraction indicator serves as an external instrument to district level natural resource transfers. We then estimate the effect of exogenous resource transfers on the other revenue and expenditure accounts.

Our main results can be summarized as follows. Firstly, fiscal transfers from resources and petroleum extraction create positive spillovers on indigenous tax revenues. Secondly, surprisingly, the impact of resource revenue windfalls on the central government-administered fiscal balancing fund and its main component is positive and significant. While the level of balancing funds on average favour the resource poor regions, this

[1] Throughout this paper, whenever unambiguous we use the term "districts" to denote both regencies (*Kabupaten*) and municipalities (*Kota*) in Indonesia.

slope estimator is inconsistent with the underlying fiscal gap-reducing purpose of such center-local transfer schemes and indicates possible local institutional issues (Fadliya and McLeod, 2010).

Thirdly, fiscal transfers from resource extraction increase public sector spending on capital and infrastructure projects as well as public goods and services. This is encouraging given the positive multiplier effect of infrastructure spending (Straub, 2008), especially as it also increases local tax revenues. Fourthly, spending on personnel and administration increases less and decreases as percentage of total local expenditures. Fifthly, personnel administrative and discretionary social aids expenditures only increase when the proportion of fiscal windfalls from resource extraction increases as a percentage of total public expenditures. Sixtly, interaction between resource revenues and a district-level economic governance index (EGI) (McCulloch and Prambudhi, 2007) indicate that municipalities with better governance ratings have higher public capital and infrastructure spending.

Lastly and interestingly, while district public spending is largely localized, neighboring-districts analysis enable us to isolate and identify direct economic spillovers from (cross-border) extraction projects. Moreover, reinforcing the usefulness of the offshore instrument, we find that only onshore private extraction projects directly induce public infrastructure investments. By contrast, offshore projects do not affect (or require) public infrastructure investments.

The paper's contribution to the literature is twofold. First, it contributes to the growing empirical work and case studies on the capacity of government to manage resource windfalls and to deploy them effectively for sustainable development. These include, for example, Maxwell (2004) and Ebensperger et al. (2005) on the Chilean mineral industry. In particular, our results indicate that in some countries resource revenues combined with fiscal decentralization could yield certain 'resource blessings' in the form of increased public spending on infrastructure and services with positive spillovers to the local economy. We do so using a previously under-used data source of Indonesian minicipality fiscal accounts.

Second, our findings contribute to the ongoing debate on the interaction between decentralization and institutional quality. On the one hand, Lessmann and Markwardt (2010) show that decentralization reduces corruption when press freedom and transparency is high. The study of Kruse et al. (2012) on healthcare spending in Indonesia shows that higher indigenous/own revenues increase district-governments' discretionary healthcare spending. Moreover, results in Skoufias et al. (2014) indicate that local directly elected officials may become more responsive to local voters' needs e.g., in the areas of healthcare. Also, Malesky and McCulloch (2011) study in-depth how in Indonesia district economic governance positively affects growth. On the other hand, Jin and Zou (2002) find that decentralization may increase the size of subnational governments. With regards to the resources sector, Cust and Harding (2019) show that institutional quality is one

key driver of global oil and gas drilling activity, while Perez-Sebastian and Raveh (2016) show how decentralization may lead to more pronounced resource curse-like effects.

Our findings are consistent with Lessmann and Markwardt (2010) if one hypothesizes that Indonesia's fiscal decentralization progressed simultaneously with higher levels of transparency and a free press. It also supports Skoufias et al. (2014) in that direct elections of subnational government executives (i.e. district heads) and legislators (i.e. district parliamentarians) may lead to better accountability and alignment with local voters. We also find significant evidence that, rather consistent with Malesky and McCulloch (2011), better district economic governance supports increases public capital and infrastructure spending. While we acknowledge that local institutional weaknesses and corruption cannot be completely ruled out, we identify growth and investment benefits from subnational governments' benevolent spending behaviour as a result of resource windfalls.[2]

Our results point to several policy implications. Despite resource curse-like risks national governments should continue selectively promoting highly potential resource projects. Among natural resource-rich regions and subnational jurisdictions, local governance quality and interregional competition should be the main criteria used to choose the key regions and resource projects to promote. To maximize local investment multipliers national and local governments should invest in public infrastructure that is complementary to such extraction projects. While onshore projects tend to stimulate local and regional economic activity directly, spillovers from offshore extraction projects can be induced by proactive local regulation, subsidy- and taxation policies.[3]

The remainder of this section is structured as follows. In the next section we provide an overview of Indonesia's decentralization process and its consequences on the country's resources and petroleum sectors, followed by a discussion of our conceptual framework and the relevant literature in section 3. Sections 4 discuss our dataset and empirical strategy, to be followed by a discussion of our results in section 5, conclusions and future questions in section 6.

2 Indonesia's decentralization and the resources sector

Indonesia's democratization and decentralization, which started in 1999, has significantly altered the regulation and political economy of its resources sector. The combination of direct executive and parliamentary elections and increased revenue and spending autonomy has had large consequences on the fiscal and administrative incentives and capacity

[2]We discuss below that higher public spending may reflect both positive and negative (i.e. captured) investments, as Lewis (2005) discussed. This is not inconsistent with Sjahrir et al. (2014), which makes insufficient local political accountability responsible for administrative overspending.

[3]Including, for example, local-content rules.

of subnational-level governments throughout the country.

This process and the associated political economy has been studied by many authors including, to name a few, Brodjonegoro and Asanuma (2000), Lewis (2005), Duek et al. (2010), Lewis (2005), Sjahrir et al. (2014), Agustina et al. (2011), Sjahrir et al. (2014) and Fadliya and McLeod (2010). Jurisdictional fragmentation is studied by Putra Erawan (1999), Fitrani et al. (2005) and Brata (2008) and the impact of decentralization on the economics, regulation and dynamics of the petroleum and resources sectors in the country by Barr et al. (2006) and Duek and Rusli (2010). Moreover there are studies on the political economy of the country's subnational institutions and elections (Burgess et al., 2012) and corruption (Henderson and Kuncoro, 2006; Barron and Olken, 2010; Pande and Olken, 2012; Rusli, 2018; Alatas et al., 2019).

2.1 Decentralization and government revenue sharing

Following Indonesia's 1998 democratic reforms and the 1999 decentralization laws, direct elections of the country's president as well as of subnational government heads have been held in most districts, municipalities and provinces across the country. The country's Law 22 of 1999 on local autonomy and Law 25 of 1999 on fiscal balance granted local governments, in particular the third-tier districts and municipalities, greater autonomy to arrange their own economic, administrative and social policies and local budgets.[4]

Prior to decentralization Indonesia's fiscal system was largely centralized, with about 80% of district revenues originating from central government funds, especially in form of subsidies for autonomous regions SDO (*Subsidi Daerah Otonomi*) and presidential instruction INPRES (*Instruksi Presiden*). The demands of regional stakeholders for greater shares in fiscal revenues associated with natural resource extraction activites in their jurisdictions were a significant driver of the country's decentralization (Barr et al., 2006). The general legislative framework was provided by Law 25 of 1999 (Duek and Rusli, 2010).

Law 25 allows provincial, district and municipal governments to finance decentralization and their regional budgets from four main sources. The Balancing Funds DP (*Dana Perimbangan*) comprise its largest component, the general allocation fund DAU (Dana Alokasi Umum), the special allocation fund DAK (*Dana Alokasi Khusus*) and the natural resource and land tax transfers DBH (*Dana Bagi Hasil*). The core of Indonesia's new system of inter-governmental transfers is the general allocation fund DAU. Every year the central government reserves about 25% of its national budget for the DAU, which is meant to close the fiscal gap for each subnational level government including districts, municipalities and governors.[5] The natural resource revenue sharing scheme defines how oil and gas, timber and mining royalties are to be re-divided among Indonesia's cen-

[4]See Ford and Brodjonegoro (2004), Azis (2008) and Duek et al. (2010).

[5]The proportion of the special allocation fund DAK, which covers case-specific needs, is generally smaller than DAU.

tral, provincial and district governments under regional autonomy. Besides the Balancing Funds, the three other sources of district government revenues include local taxes, levies and dividends from regional government-linked firms, regional borrowings and other legal sources.

Greater fiscal autonomy, together with the devolution of power and authority from the central to local governments, has had unintended consequences. On the one hand, the uneven distribution of resource endowments and revenues across the country has resulted in increased interregional disparity. Compared to historically much lower shares of government receipts, since 1999 individual districts home to resource extraction have become better financed, receiving approximately 6%, 12% and up to 32% shares of government revenues for oil, gas and mining output, respectively.[6] Together with a variety of new extraction project-related spillovers and new local government revenue sources and the country's unique post decentralization fiscal allocation scheme, this has led to increasing income disparity between resource-rich and resource-poor districts (Brodjonegoro and Asanuma 2000; Barr et al. 2006, pp.37-40 and Duek and Rusli 2010).

The general allocation fund DAU and the special allocation fund DAK were supposed to help cover fiscal imbalances and reduce fiscal capacity and fiscal gap differences among poor and rich provinces. In practice, local governments in resource-rich regions have developed strategies to maintain or even increase their DAU and DAK allocation. Usui and Alisjahbana (2003) discuss how fiscal decentralization in Indonesia started with a revenue- instead of expenditure based allocation system. Comprising resource revenue transfers and tax sharing as well as DAU and DAK, the overall revenue allocation in turn exacerbated regional inequality, especially in view of regional disparity in resource endowment. As a consequence, although the increase in resource revenue sharing did help reduce the previous "vertical imbalance" by creating better fiscal balance between the center and the regions, it also contributed to an increase in the "horizontal imbalance" and increased disparity in the fiscal balance among regions (Duek and Rusli, 2010).

On the other hand, the district-level increase in natural resource revenue sharing is argued to have contributed to the proliferation of new districts, municipalities and in some cases even new provinces. The incentive for local governments to carve out more autonomous, smaller jurisdictions with their own revenues and (at least partially) discretionary budget potential is strong. Indonesia had 26 provinces and around 310 districts and municipalities in 1998. By the end of 2008, the number of districts and municipalities had increased to more than 490, grouped into 33 provinces.[7]

As a result, Indonesia's decentralization has brought both benefits and challenges. On the political side decision making now involves local communities, for example through

[6] See section 2.3 below for details.

[7] For discussions on the district and provincial fragmentation dynamics see Putra Erawan (1999), Fitrani et al. (2005) and Brata (2008).

direct local elections. However, while direct elections promote local government accountability and reforms (McCulloch and Prambudhi, 2007), they also increase the prevalence of local patronage and government-business collusion on the subnational level (Duek and Rusli, 2010). Moreover, Brata (2008) points out that the proliferation of new districts, being one consequence of decentralization, has resulted in inefficient local governments, increased administrative cost as well as higher inequality in income and lower human development index (HDI).

In 2004, together with the revised regional autonomy Law 32 of 2004, the government made a number of changes to Indonesia's fiscal balancing Law 25/1999, with the adoption of Law 33 of 2004. More important changes concern the reforestation fund and the general allocation fund DAU. Under Law 33 of 2004, DAU will account for at least 26% of total domestic revenues as recorded in the national budget. The amount of DAU each region shall receive also depends on the number of civil servants in the region.

2.2 Resources sector regulation

In Indonesia, all natural resources are considered to be national assets. The various natural resource, e.g. forestry, mining and oil and gas, each have their own regulation and sharing arrangements. In the following we concentrate on those of oil and gas. The oil and gas industry was governed by a series of laws for more than four decades. Among them were Law 44 of 1960, regarding oil and gas exploration and production activities, laws 2 and 15 of 1962, regarding domestic oil obligations and Law 8 of 1971, regarding the state-owned oil and gas company Pertamina. In 2001, Indonesia's oil and gas Law 2 of 2001, replaced that series of laws.

Law 22 of 2001 defines upstream business activity as exploration and exploitation, which includes locating potential oil and gas reserves, drilling wells, the construction of transportation infrastructure, storage and processing facilities and the processing of natural gas into liquefied natural gas. A variety of Indonesian and foreign companies (e.g., state-owned, regional administration-owned, business entities and "permanent establishments") may engage in upstream business activities as long as they fulfil financial, regulatory, technical and operational requisites. The government established an upstream Implementing Body BPMigas (*Badan Pelaksana*) with the mandate and authority to regulate and supervise upstream oil and gas business activities, as well as a downstream Regulatory Body BPH Migas (*Badan Pengatur*) to regulate and supervise the downstream oil and gas business. These agencies replaced the national oil company's (Pertamina) historical regulatory and supervisory function, as well as its role as government representative countersigning production sharing contracts.

Table 1: Distribution of oil and gas revenues

Revenue source	Old sharing arrengement	Major change	New sharing arrangement
Oil revenues (Penerimaan negara dari pertambangan minyak bumi)	100% Center	Assignment of revenues after tax deduction to regional governments	85% Center 3% Province of origin 6% District/municpaility (kabupatan/kota) of origin 6% Other districts/municipalities in the province of origin
Liquid natural gas revenues (Penerimaan negara dari pertambangan gas)	100% center	Assignment of revnues after tax dedictoin to regional governments	70% center 6% Province of origin 12% District/municipality of origin 12% other districts/municipalities in the province of origin

Source: Ford and Brodjonegoro (2004, p.26) and updated by Duek and Rusli (2010). Additional shares of oil and gas revenues for the provinces of Nanggroe Ache Darussalam (former Aceh) and Papua are stipulated in the special autonomy Laws 18/2001 21/2001, respectively. In particular, under Law 18/2001 provincial shares of natural resource revenues include 70% of gas and oil revenues and 80% of revenues from forestry, fisheries and general mining. Increased oil and gas revenues are reduced after eight years. Under Law 21/2001 Papua also receives 70% of natural oil and gas taxes and 80 percent of forestry, fishery and general mining. Oil and gas revenues, however, are decreased to 50% after 25 years. According to Law 33/2004 (which replaces Law 25/1999), the share of oil and liquid natural gas revenues has been changed so that the central government (the "Center" above) would receive 84.5% and 69.5% of oil and gas revenues, respectively. The share of the regions remains the same. The difference of 0.5% of the oil and gas revenues will be allocated for basic education, from which provinces will receive 0.1%, originating districts will receive 0.2%, and other districts within the same provinces will get 0.2%.

2.3 Resources sector fiscal transfers and revenue sharing

Law 25 defines the subnational government shares of natural resources. The revenues from oil and gas extraction produced by a region are divided as follows: 85% of oil revenues produced in a region are allocated to the central government and 15% to the region, while 70% are allocated to the central government and 30% are allocated to the region. Table 1 outlines the changes in revenue allocations from the exploitation of natural resources and the reorganization of the transfer system.

Oil and gas revenues, royalties and taxes are first collected by the central government, to be used for its cost recovery i.e. cost reimbursement scheme. Following that the revenue portions pertaining to district and provincial governments are redistributed back to those subnational governments.

3 Conceptual framework

3.1 Decentralization, institutions and natural resources

Decentralization, subnational government institutions and natural resource endowment interact in a complex manner and affect the country's institutional and economic characteristics in different ways. Many studies contribute to our understanding of how decentralization, direct subnational government election, corruption and fiscal windfalls from resource extraction interact. They form the basis of our own hypotheses and interpretation of our results below.

We start with more recent papers that review the benefits and problems of decentralization, in particular in terms of bureaucracy, fiscal behaviour and corruption.[8] Jin and Zou (2002) show that expenditure decentralization leads to smaller national governments, larger subnational governments and larger aggregate governments. By contrast, revenue decentralization increases the size of subnational governments less than it reduces the size of central governments, hence resulting in smaller aggregate governments. *In this study we try to find out how fiscal windfalls from resources extraction may impact personnel and administrative spending across Indonesia's districts.*

Next, Lessmann and Markwardt (2010) analyze 64 countries and use a structural break model controlling for a the relationship between decentralization and an index for freedom of the press. The latter is a measure for effectiveness of public monitoring of bureaucrats. They show that decentralization reduces corruption when press freedom and transparency is high. Press freedom in Indonesia is given a "partly free" score of 49 (where 0 is most free and 100 is least free) by Freedom House (2017) and Cust and Harding (2019) observe positive effects of resource windfalls on economic growth of Indonesian districts. *Therefore, we search for indications that fiscal windfalls in decentralized Indonesia might have positive consequences on district government revenue patterns and spending behaviour.*

By contrast, Perez-Sebastian and Raveh (2016) argue and empirically show that fiscally decentralized economies are more vulnerable to the growth curse of natural resources than fiscally centralized ones. First, they quote Rodríguez-Pose and Ezcurra (2011) that poor and distant local governments are less efficient at providing public goods and are more prone to corruption temptations. Second, they argue that capital will thus be attracted to less productive regions. *If these forces were more dominant, we would anticipate signs of increasing inefficiency, cost mark-ups (and corruption) in our regressions. These could be indicated, for example, by disproportionate increases in personnel and administrative spending compared to public infrastructure spending.*

Back to Indonesia, however, Skoufias et al. (2014) show that across Indonesian districts, during pre-election periods, local officials tend to direct their spending on areas

[8] We only quote a few prior studies here. Many other works exist. For additional broad reviews of the relevant literature see for example Mookherjee and Bardhan (2005)

that cater to the local constituencies' preferences. In the process of doing that, the local directly elected officials may become more responsive to local voters' needs. They quote examples in the areas of healthcare investments. McCulloch and Prambudhi (2007) observe that direct elections across Indonesian districts do affect local (economic) governance positively. Also, Malesky and McCulloch (2011) observe positive growth effects of better local economic governance. We expect such strategically directed public investments, especially when planned and implemented by incumbent district heads facing reelections, may include public infrastructure projects as well. The latter brings further positive spillover effects on growth and development, as Straub (2008) observes across countries. *We thus seek to find indications that revenue windfalls may positively affect public infrastructure spending in resource-endowed Indonesia, and that this impact might be enhanced under better local public governance.*

Furthermore, Kruse et al. (2012) use a 2001-2004 panel of 207 districts in Indonesia to investigate public healthcare spending behaviour. They find, among others, that higher indigenous/own revenues increase district-governments' routine spending including permanent staff. By contrast, discretionary healthcare spending is correlated with central-local transfers such as DAU and DAK. They rationalize this as follows: local governments' enjoying higher indigenous/own tax revenues may feel more comfortable increasing more permanent administrative expenditures. *We wish to review the impact of resource revenues on district governments' indigenous taxes and own revenue sources, as well as on their overall spending behaviour.*

Lewis (2005) develops a budget model to describe and explain the differences in pre- and post decentralization local government spending, taxing and saving behaviour in Indonesia. He finds that post-decentralization spending is responsive to both voters' needs and elite capture. He also observes that local taxation became more aggressive post-decentralization, seemingly driven by increased routine overhead budgets. The latter is consistent with Kruse et al. (2012). *We thus seek indications as to how resource windfalls interact with or affect local tax revenues.*

Also noteworthy is the study by Sjahrir et al. (2014). The authors' results indicate that accountability mechanisms are weak at the local level and democratization has not yet contributed significantly to the reduction in wasteful local government spending on its own administration. These results contribute to the view that decentralization and democratization at the local level in Indonesia have yet to deliver tangible results in terms of better governance.

On the Indonesian fiscal decentralization and subnational government revenues and center-local balancing funds we cite Fadliya and McLeod (2010), Agustina et al. (2011) and Sjahrir et al. (2014). The Fadliya and McLeod paper lays out that the purpose of the balancing budgets DP and its biggest component general allocation funds DAU is to remedy fiscal imbalance across districts. The consequence is that resource-rich districts

should get lower DAU allocations. Agustina et al.'s paper describes that total aggregate DAU make up 26% of the total aggregate national revenues. They explain that aggregate national revenues include total aggregate resource revenues, part of which is transferred back to the districts of origin and their respective provincial neighbours. As a result, total aggregate DAU may correlate with total aggregate resource revenues, but unique district DAU allocations should not change in line with individual district resource revenues. *Despite Duek and Rusli (2010) and Usui and Alisjahbana (2003) we seek to verify that that resource-rich districts receive lower DAU allocations and the resulting correlation between fiscal transfers and DAU be negative.*

4 Data

This paper uses a dataset that brings together spatially disaggregated data across resource extraction and local government fiscal accounts. Our units of analysis are local administrative districts i.e. regencies (*Kabupaten*) and municipalities (*Kota*). Together with the often geographically smaller, less resource-endowed but more densely populated cities i.e. municipalities (*Kota*), districts make up the third administrative level in Indonesia, below the central and provincial governments.[9] We use data from the Indonesian Statistical Bureau BPS (Badan Pusat Statistik) on district level population, government revenues and expenditures, combined with WoodMackenzie oil and gas production (Wood Mackenzie, 2011).

4.1 Population and exchange rates

We express all data in terms of US$ per person. District and municipal level population data is available from BPS on an annualized basis. However direct census data was only collected for 2000 and 2010, with additional survey data for 2005. We use linear interpolation for the remaining and interim years. Exchange rates were obtained from the World Bank Official Exchange Rate database.

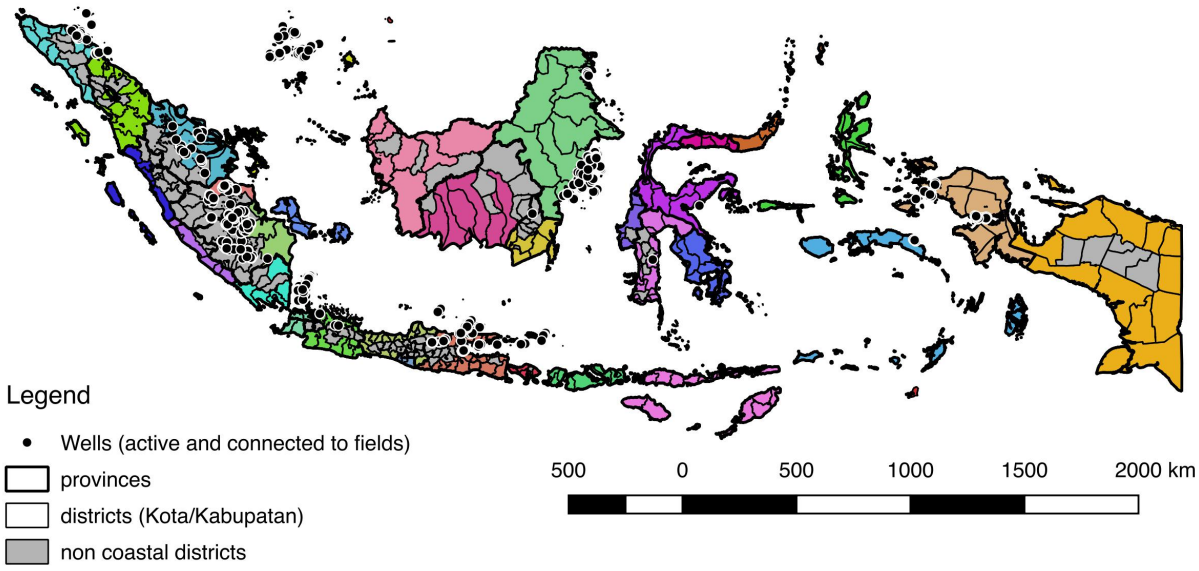
4.2 Oil and gas revenues

Our oil and gas data is drawn from the Wood Mackenzie PathFinder database (from 2011). The dataset contains records on over 1200 individual Indonesian oil and gas wells and fields.[10] The commercial database collects investment and production data for all major assets (i.e. contract areas) in Indonesia across state owned and privately owned

[9] In line with our budget and petroleum data from here onwards we use the term districts to represent both regencies and municipalities.

[10] Oil and gas fields are generally part of larger contract areas and typically contain multiple well sites.

Figure 1: Map of Indonesia with oil and gas wells



operations. We use the location of investment and production volume data and associate them with the administrative districts they lie within, or are proximate too.

Around 35 percent of our total sample of production fields are located offshore in Indonesian waters. This data can be linked to the most proximate coastline and linked to its 'home district' as defined by the fiscal sharing rules. Linking offshore production (and associated fiscal revenues) to home regions allows us to employ this measure as an instrumental variable for government disbursements to the districts otherwise isolated from direct project-related investments. The descriptive statistics of all coastal districts in the country is shown in Table 2.[11]

The three columns in the table represent averages for districts with only onshore oil and gas production, with both onshore and offshore production and without any oil and gas production. Resource fiscal transfer data is presented and used on a US$ per capita basis. Simulated revenue share is calculated using oil and gas production volume data and average fiscal revenues per barrel of oil and per barrel-of-oil-equivalent of gas.

4.3 District government budget, revenues and expenditures

Our data on government revenues and expenditures is drawn from official records (BPS Financial Statistics 2005-2009). This data contains reported resource revenue shares for 260 districts (and municipalities) and 30 provinces from the period 2005-2009 as well as district government revenues (including local and shared taxes, general- and special allocation funds) and expenditures (including Opex and Capex for administration and

[11]By coastal districts we exclude all districts and municipalities that possess no coastal border at all. These may have onshore production and may be beneficiaries of the revenue sharing through provincial balancing funds.

Table 2: Descriptive Statistics of coastal districts, 2005-2009

variable	only ons.	with offs oil	without oil
Population ('000)	826.640 (625.731)	686.360 (496.802)	488.955 (554.167)
Onshore prod. ('000 B/D)	21.904 (49.991)	0.338 (0.471)	0.000 (0.000)
Onshore prod. (US$/cap)	806.731 (1696.306)	5.054 (7.433)	0.000 (0.000)
Onshore prod., oil (US$/cap)	576.070 (1718.323)	3.294 (7.366)	0.000 (0.000)
Onshore prod., gas (US$/cap)	230.661 (342.842)	1.760 (3.936)	0.000 (0.000)
Offshore prod. ('000 B/D)	0.000 (0.000)	4.765 (3.697)	0.000 (0.000)
Offshore prod. (US$/cap)	0.000 (0.000)	171.680 (97.400)	0.000 (0.000)
Offshore prod., oil (US$/cap)	0.000 (0.000)	116.218 (130.506)	0.000 (0.000)
Offshore prod., gas (US$/cap)	0.000 (0.000)	55.462 (58.005)	0.000 (0.000)
Neighbours Offshore prod. (US$/cap)	19.980 (46.596)	1149.611 (2570.607)	100.787 (911.476)
Number of districts	15	5	240
Number of provinces	10	3	29
Number of observations	75	25	1184

Mean (sd) for all coastal district without 'extremes', and where budget data is available. Offshore production is for wells within 3 sea-miles of district's coast. Neighbours are limited to those of the same province.

Table 3: Overview of district government budget data

Revenues	Expenditures
Local government receipts (loc.tot)	Public service expenditures (pubserv.tot)
– Original (loc.orig.rev)	– Personnel expenditures (pubserv.pers)
— Local taxes (loc.tax)	– Goods and services (pubserv.goodserv)
— Business taxes (loc.bus)	– Capital expenditures (pubserv.capex)
— Local retributions (loc.retr)	
— Other	Civil Service Expenditures (civserv.tot)
– Balanced budget (balbgt.tot)	– Personnel expenditures (civserv.pers)
— Tax share (prov.alloc)	– Social aid (civserv.socialaid)
— Resources transfer (transf.natres)	– other
— General allocation (gen.alloc)	
— Special allocation (spec.alloc)	
— Other	
– Other	
Local government financing (rev.fin)	Local government financing (exp.fin)
Budget total revenue (budget)	Budget total expenditure

public goods) for all these years. Government receipts are broken down by source and explicitly include those revenues drawn from resource extraction. The main components of district (and municipal) government budgets are depicted in Table 3.

The main components include:

Indigenous district income. The variable loc.orig.rev comprises BPS data on local and business taxes and levies, redistributions, local government-linked business dividends and taxes as well as other local incomes such as retributions, interest, etc.

Balancing funds. These balbgt.tot include tax and non-tax sharing as well as the general allocation (DAU) and special allocation (DAK) funds. Tax-sharing originates from provincial government income allocated to the districts. Non-tax sharing comprise revenues, royalties and taxes from natural resource extraction (transf.natres), 15% of

which are shared between the home districts of origin and other districts within the same home provinces. These represent the fiscal transfer variables of interest to us, which district governments collect directly (especially for non-petroleum revenues) or indirectly receive allocation from central government. They can be treated as exogenous to the other budget items, in particular when instrumented with offshore production level data.

Administrative and public goods expenditures. These comprise civil service/ administrative (civserv.tot) and public service expenditures (pubserv.tot) from BPS. Civil service/ administrative expenditures are split into personnel, goods and services, official travel, maintenance and capital investments as well as social aid expenditures. Public service expenditures (pubserv.tot) comprise personnel, goods and services, official travel, maintenance, capital expenditures and infrastructure spending, sharing funds and financial aids.

Local government financing. On the revenue-side, rev.fin includes interest income, funds saved from previous year, transfers from the contingency fund, and proceeds from asset sales, while on the expenditure-side exp.fin includes repayment of borrowings, transfers to the contingency fund, equity in local government-linked companies, etc.

Table 4 presents descriptive statistics of the budget accounts by three groups of districts for our main sample. On the revenue side the sum of local district original revenues, local and business taxes and retributions plus non-oil and gas natural resource revenues are the portion of the total local government revenues controlled directly by the local district (and municipal) governments. This portion is much smaller than the Balanced Budget, i.e. the center-local balancing funds and transfer. The general allocation fund DAU makes up the largest component, with resource revenue transfers as the second largest component of the Balancing Budget. On the expenditure side one notices that the largest district expenditure components are typically public service personnel and capital expenditures as well as administrative personnel. We exclude the accounts titled 'other' from the analysis.

4.4 Economic governance index

We also make use of McCulloch and Prambudhi (2007)'s economic governance index (EGI) data to study the interaction between resource revenues and the quality of district-level governance across 243 districts the country. We calibrate this EGI data, which is time invariant since each of the two surveys in 2007 and 2010 covered a distinct subset of the country's districts, by dividing the deviations from the mean with the sample's standard deviation.

Table 4: Descriptive Statistics budget data of coastal districts, 2005-2009

variable	only ons.	with offs oil	without oil
Local government receipts (loc.tot)	155.044 (113.901)	208.014 (225.097)	237.774 (329.345)
– Original (loc.orig.rev)	9.457 (9.342)	9.877 (9.247)	10.637 (11.874)
— Local taxes (loc.tax)	2.271 (1.985)	1.443 (1.958)	2.519 (8.422)
— Business taxes (loc.bus)	0.763 (1.284)	1.085 (1.977)	0.791 (1.261)
— Local retributions (loc.retr)	1.638 (1.077)	2.074 (0.709)	2.608 (2.271)
Balanced budget (balbgt.tot)	137.690 (101.752)	180.916 (194.683)	208.018 (284.788)
— Tax share (prov.alloc)	26.282 (34.969)	25.330 (30.257)	17.252 (27.242)
—– Natural resources (tr.res)	46.265 (74.674)	79.529 (173.966)	20.420 (76.243)
—— only Oil and Gas (tr.res.og)	42.500 (70.656)	70.042 (154.888)	13.222 (63.622)
—— only non-Oil and Gas (tr.res.non.og)	3.765 (6.728)	9.487 (19.127)	7.198 (19.230)
— General allocation (gen.alloc)	54.804 (30.406)	69.155 (64.897)	145.311 (193.127)
— Special allocation (spec.alloc)	8.011 (11.883)	8.480 (8.637)	22.321 (36.291)
Local government financing (rev.fin)	63.181 (83.620)	59.486 (106.757)	37.964 (65.599)
Civil Service Expenditures (civserv.tot)	59.194 (30.673)	67.079 (45.596)	89.230 (88.611)
– Personnel expenditures (civserv.pers)	41.856 (16.709)	47.447 (27.722)	67.460 (51.220)
– Social aid (civserv.socialaid)	8.861 (10.786)	9.873 (13.499)	10.224 (28.138)
Public service expenditures (pubserv.tot)	93.203 (80.567)	130.013 (157.245)	141.158 (234.618)
– Personnel expenditures (pubserv.pers)	11.502 (8.053)	11.205 (8.357)	15.980 (17.177)
– Goods and services (pubserv.goodserv)	25.322 (19.641)	33.317 (33.478)	43.025 (79.849)
– Capital expenditures (pubserv.capex)	53.988 (52.860)	83.150 (114.723)	79.598 (142.060)
Local government financing (exp.fin)	65.828 (86.883)	70.408 (131.092)	45.571 (79.801)
Budget total revenue (budget)	218.225 (193.743)	267.500 (327.210)	275.639 (379.591)
Number of districts	15	5	240
Number of provinces	10	3	29

Mean (standard deviation) for all coastal district without 'extremes'. The 5 oil producing districts are: Gresik (Jawa Timur), Bangkalan (Jawa Timur), Sumenep (Jawa Timur), Penajam Paser Utara (Kalimantan Timur), Morowali (Sulawesi Tengah).

4.5 Empirical setup

We define our main sample as all coastal districts, while excluding those that produce onshore oil and gas only. We exclude the three largest producing districts: Bontang, Siak and Kutai Kertanegara. Thus our sample includes coastal districts, some of which have offshore production (a subset of which also onshore). Our empirical model compares offshore oil and gas producing districts with non-producing districts. We exclude the three mentioned districts as outliers with much higher production than recorded anywhere else in Indonesia. Including these districts skews the results towards observing larger effects of natural resources on district level budgets. Nevertheless, we are left with just 5 districts over 3 provinces that have direct offshore revenues (over five years). This may limit the validity of our results as ideally we would want to observe more districts to get a direct revenue stream. There are two main reasons for this small number, firstly, the instrument is limited to offshore extraction within th 0-3 miles from the coastline. A lot of extraction occurres at much further distances and so ends up at the provincial or central government allocation. Secondly, while we believe WoodMac's Pathfinder database is quite complete, omissions may be present. The results we present are quite stable and consistent for the

range of dependent variables that we use, which gives us confidence in the validity of our results.

Our main empirical model estimates the effects of district-level natural resource transfers on the various budget items, while using an instrumental variable (IV) approach using offshore oil and gas production as external instruments.

$$\begin{aligned} y_{i,t} =& \beta \times \text{transfer}_{i,t} + \theta_i + \gamma_t + \varepsilon_{i,t}, \\ & \text{E}\left[\varepsilon_{i,t} | \text{offshore}_{i,t}, \text{offshore}_{j,t}, \tilde{\theta}_i, \tilde{\gamma}_t, \right] = 0, \end{aligned} \tag{1}$$

where $y_{i,t}$ is the outcome variable (various municipal budget items), $\text{transfer}_{i,t}$ the natural resource transfer as given in the municipal budgets (which may be disaggregated to capture only revenues from the oil and gas sector), θ_i and γ_t represent municipality- and time fixed effects. The first stage of the IV model uses a district's own offshore production and the production of its provincial neighbours as external instruments as well as its own set of fixed effects, represent by $\tilde{\theta}_i$ and $\tilde{\gamma}_t$.

Resource transfers are not necessarily exogenous to other budget items. In particular, local economic policy affects both budgetary expenditures and other incomes, and in turn the decision of private parties to explore and extract natural resources. While district fixed effects θ_i may partially control for time-constant district characteristics, even including the economic governance index (EGI), this is clearly not sufficient. What we assume is that offshore oil and gas extraction is exogenous to local economic circumstances, e.g. infrastructure availability, and district budgets. We can justify this for the following reasons. Firstly, offshore deposits are predetermined. Secondly, the decision to extract is based on the success of exploration and appraisal, which is independent of the district(s) that will receive future revenues. While fiscal revenues go to the closest district, offshore oil and gas extraction facilities are not necessarily serviced from that district, and in certain cases the oil and gas will be transferred via/to ships for direct export and not actually come ashore. This argument is similar to that used by Caselli and Michaels (2013). We also assume that offshore extraction does not have direct effects on local economic outcomes, such that the offshore oil and gas extraction only affects local economies through the district budgets.

Thirdly, in Indonesia exploration and extraction is not dominated by one state owned entreprise, but is done by many different companies of various sizes. This makes oil extraction less dependent at the cross-section/time-dimension, because competing companies are much less likely to control and coordinate output in response to each other.

The time fixed effects will absorb effects that affect Indonesia broadly, such as the world economy and exchange rates. Therefore, while we use exchange rates to express the district budgets in US$, inflation of the real value of the US$ over the sample period will be absorbed by these fixed effects. We cluster standard errors at the province level as the

main level of treatment. The reason is that the fiscal rules of resource sharing are based on the provincial level. So, while a district receives the largest share of fiscal revenues from its own production, a substantial part also flows to other districts within the same province. This effect increases if a number of districts in the same province have resource extraction activities. Additionally, oil and gas extraction tends to be geographically concentrated, resulting in oil revenue that shows more variation in treatment between provinces than within provinces. Therefore, clustering at the provincial level, rather than the lower spatial region of the district seems appropriate. An alternative perspective on the spatial correlation of the treatment and outcome is that distance matters for such spillovers. Therefore, we present additional standard errors corrected for spatial correlation following Conley (1999), with a maximal spatial distance of 500km. This method does not respect the strict difference of provincial borders that underlies the fiscal sharing rules and could, therefore, account for some spatial economic spill-overs across provincial borders.

5 Results

5.1 First stage IV results

Since we use the same first stage regression for all subsequent models we present the first stage once. Table 5 presents the results where the standard errors and derived F-statistic for the excluded instruments are calculated using three variations of the variance-covariance matrix: firstly using clustering by province, secondly using clustering by district with Conley adjustment for spatial correlation, and thirdly using the Newey-White heteroskedasticity robust method. The last three models follow the same three methods, but exclude the own-offshore production as covariate. The striking feature is that own-offshore is much less correlated, even negatively, with natural resource transfers, while neighbours production is strongly positively correlated.[12] Any concerns that proximate offshore production might still have spill-overs to the local district outside of the resource transfer is therefore additionally mitigated, since such spill-overs are even less likely across districts.

The F-stat on the covariates (excluding the fixed effects) varies with the method of estimating the variance-covariance matrix. We note that the F-stat increases for the 'cluster-by-province' when moving to one covariate (columns [1] and [4]), even while own-offshore production is statistically significant at the 10% level, but decreases for the spatially adjusted standard errors (columns [2] and [5]).

[12]We would not expect a coefficient close to one since only a part of production is subject to royalties, of which only a part is directly captured by the nearest district. The reason for the negative coefficient of own offshore production on resource transfers is further explored in Appendix A.1.

Table 5: First stage, natural resources instrumented by offshore production

	Dependent variable:					
	Natural resources					
	Cl. prov.	Conley	NW-robust	Cl. prov.	Conley	NW-robust
	(1)	(2)	(3)	(4)	(5)	(6)
Offshore prod.	−0.030*	−0.030	−0.030			
	(0.018)	(0.022)	(0.033)			
Neighbours Offshore prod.	0.028***	0.028***	0.028***	0.029***	0.029***	0.029***
	(0.001)	(0.009)	(0.010)	(0.0004)	(0.008)	(0.010)
N. clusters	29	245	1209	29	245	1209
F-stat	2556.568	18.039	8.065	4843.456	11.774	8.467
fixed effects	t+i	t+i	t+i	t+i	t+i	t+i
Observations	1,209	1,209	1,209	1,209	1,209	1,209

This presents first stage regression of the main results using three difference variance-covariance estimators and combinations of external instruments. 'Cl. prov' indicates by province clustered standard errors, 'Conley' indicates standard errors adjusted for spatial correlation (up to 500km) following Conley (1999), and 'NW-robust' indicates Newey-White heteroskedastic robust standard errors. *p<0.1; **p<0.05; ***p<0.01

Table 6: Natural resources transfers effects on Main items revenues

	Dependent variable:				
	budget	loc.tot	loc.orig.rev	balbgt.tot	rev.fin
	(1)	(2)	(3)	(4)	(5)
Natural resources	2.449***	1.834***	0.053***	1.468***	0.613***
	(0.084)	(0.068)	(0.005)	(0.045)	(0.025)
Conley s.e.	1.102	0.537	0.053	0.420	0.675
fixed effects	t+i	t+i	t+i	t+i	t+i
Observations	1,209	1,209	1,209	1,209	1,209

Clustered SE at province. Instruments: total offshore production (within 3 miles) for own district and provincial neighbour, F-stat indicates the first stage F-statistic of the excluded instruments.*p<0.1; **p<0.05; ***p<0.01

Table 7: Natural resources transfers effects on Detailed revenues

	Dependent variable:					
	Original revenue			Balanced budget		
	loc.tax	loc.bus	loc.retr	prov.alloc	gen.alloc	spec.alloc
	(1)	(2)	(3)	(4)	(5)	(6)
Natural resources	−0.0003	0.018***	0.001	0.011*	0.559***	0.028*
	(0.002)	(0.001)	(0.001)	(0.006)	(0.031)	(0.014)
Conley s.e.	0.002	0.011	0.007	0.069	0.316	0.045
fixed effects	t+i	t+i	t+i	t+i	t+i	t+i
Observations	1,209	1,209	1,209	1,209	1,209	1,209

Clustered SE at province. Instruments: total offshore production (within 3 miles) for own district and provincial neighbour, F-stat indicates the first stage F-statistic of the excluded instruments. *p<0.1; **p<0.05; ***p<0.01

5.2 District's revenues and spending following resource extraction

We present the results first for revenues and subsequently for expenditures. Table 6 presents the results on main revenues. The numbers are interpretable as the effect on the budget item in US$/capita for a US$/capita resource fiscal revenue transfers. The first column in Table 6 indicates that this effect is about US$2.45, which is US$1.45 dollar on top of each US$ of resource revenue transfer. This effect is due to US$1.83 on local revenue (column [2]), and the remainder, US$0.61 from financing (column [5]). Within revenue, Table 6 indicates that there is some effect on the local revenue, US$0.05, but the majority affects the balanced budget accounts, US$1.47 (column [4], of which US$1.00 is the resource transfer). Column (3) and (4) do not add up to column (2) because we exclude the 'other' account. The coefficients are highly statistically significant according to the clustered standard errors. The Conley standard errors are often larger, up to 10 times. However, even with these much larger standard errors the coefficients remain generally within the 1% of statistical significance, although there are exceptions.

Table 7 presents a further disaggregation for the sub-accounts of local original revenues (loc.orig.rev) and the balanced budget accounts (balbgt.tot). The first disaggregation indicates that the main positive effect is due to local business tax revenue, which is a first indication that there is some spillover to local economic development, even, we might say, for offshore oil and gas extraction. On the one hand, district (and provincial) government-linked companies receive the right to participate in privately operated resource extraction projects. In this case the positive correlation is clear. On the other hand, we might expect but cannot yet verify the occurrence of direct project-level spillovers as a result of local government and government-linked company investments in related infrastructure projects and local businesses offering complementary goods and services to the resource extraction

project. Nevertheless, we shall discuss below how our neighbouring district regressions can isolate such direct economic benefits (as opposed to the pure fiscal revenue benefits).

The balanced budgets indicate that resource transfers are positively correlated with the central government allocation funds, where each US$ of own resource transfers gains another US$0.56 in general allocation funds (DAU). This observation is inconsistent with the underlying fiscal-gap-reduction objective of the general allocation fund, the main center-local allocation scheme that contributes to district-level budgets. Firstly, Fadliya and McLeod (2010) explain that since the general allocation fund is meant to compensate for insufficient local government revenues and income, it is expected to correlate negatively with a district's resource revenues allocation. Several possible explanations are conceivable. Firstly, the level of allocation is still benefitting resource poor districts more. While the levels are captured by the fixed effects, the regression result indicates that small changes in revenue seem to benefit the those with natural resource relevatively more through their (smaller) DAU allocation. As discussed above in the context Perez-Sebastian and Raveh (2016) results, local governments in resource-endowed (and often distant) locations maybe less efficient in managing their fiscal windfalls. Additionally, local government officials in resource-rich regions may have developed a variety of investment projects to increase and/or maintain higher shares of DAU transfers from the central government. These investments could in theory support beneficial physical and social infrastructure projects. Nevertheless, these funds could also be diverted to less socially optimal projects that, for example, cater to local officials' and business groups' interests (Tanzi and Davoodi (1998); Malesky and McCulloch (2011); Sjahrir et al. (2014)). A related explanation might be that district governments with large resource revenues can better negotiate and/or convince the central government decision makers to allocate higher-than-necessary DAU amounts to their districts.[13] Moreover, decentralization, bureaucratic inconsistencies and corruption could interact negatively with resource revenue windfalls as per Duek and Rusli (2010). The latter is consistent with some of the Leviathan-model challengers discussed by Jin and Zou (2002).

Next we analyse the effect of resource revenue transfers on fiscal spending in Tables 8-11. The first two tables represent figues in US$/capita as before, and the second two as % of the total budget, which offers a view on how district government spending patterns are adjusted. Table 8 presents the results for the Public service accounts, which includes spending on public projects and services. We find that one US$ of resource revenues increases public spending by US$1.21, of which the largest part is going towards capital expenditures, which include public infrastructure. Recall that we observe positive and statistically significant increases in tax and other revenues from local businesses especially

[13]Even in the case of the natural resource-rich special autonomous provinces of Aceh and Papua, that, together with East Kalimantan, are among the nation's three highest per capita revenue provinces, centrally-allocated general allocation and special allocation funds have become the main sources of revenues, making up an average of over 40 percent (Aceh) and 50 percent (Papua) of provincial revenues.

Table 8: Natural resources transfers effects on Public Service

	Dependent variable:			
	pubserv.tot	pubserv.pers	pubserv.goodserv	pubserv.capex
	(1)	(2)	(3)	(4)
Natural resources	1.206***	0.159***	0.462***	0.687***
	(0.073)	(0.013)	(0.030)	(0.044)
Conley s.e.	0.924	0.125	0.319	0.559
fixed effects	t+i	t+i	t+i	t+i
Observations	1,205	1,205	1,205	1,205

Clustered SE at province. Instruments: total offshore production (within 3 miles) for own district and provincial neighbour. *p<0.1; **p<0.05; ***p<0.01

Table 9: Natural resources transfers effects on Civil Service and Finance

	Dependent variable:			
	civserv.tot	civserv.pers	civserv.socialaid	exp.fin
	(1)	(2)	(3)	(4)
Natural resources	0.372***	0.125***	0.112***	0.870***
	(0.020)	(0.029)	(0.018)	(0.022)
Conley s.e.	0.157	0.076	0.071	0.100
fixed effects	t+i	t+i	t+i	t+i
Observations	1,205	1,205	973	1,205

Clustered SE at province. Instruments: total offshore production (within 3 miles) for own district and provincial neighbour. *p<0.1; **p<0.05; ***p<0.01

Table 10: Natural resources transfers effects on Public Service (% of budget)

	Dependent variable:			
	pubserv.tot	pubserv.pers	pubserv.goodserv	pubserv.capex
	(1)	(2)	(3)	(4)
Natural resources	0.287	−0.615	0.188***	1.035***
	(0.610)	(0.828)	(0.046)	(0.339)
F-stat	63.1	63.1	63.1	63.1
Conley s.e.	0.869	0.641	0.216	0.921
fixed effects	t+i	t+i	t+i	t+i
Observations	1,205	1,205	1,205	1,205

Clustered SE at province. Instruments: total offshore production (within 3 miles) for own district and provincial neighbour. F-stat indicates the first stage F-statistic of the excluded instruments. *p<0.1; **p<0.05; ***p<0.01

Table 11: Natural resources transfers effects on Civil Service and Finance (% of budget), IV

	Dependent variable:			
	civserv.tot	civserv.pers	civserv.socialaid	exp.fin
	(1)	(2)	(3)	(4)
Natural resources	0.321	0.097	0.213***	−0.608***
	(0.762)	(0.983)	(0.039)	(0.213)
F-stat	63.1	63.1	72.3	63.1
Conley s.e.	0.691	0.749	0.113	0.788
fixed effects	t+i	t+i	t+i	t+i
Observations	1,205	1,205	973	1,205

Clustered SE at province. Instruments: total offshore production (within 3 miles) for own district and provincial neighbour. F-stat indicates the first stage F-statistic of the excluded instruments. *p<0.1; **p<0.05; ***p<0.01

local government-linked companies. The positive impact on local business taxes could be an indication that infrastructure investments generate positive economic spillovers and spur local growth (Straub, 2008), including through the involvement of local government-linked companies.

The results in Table 9 also indicate that higher fiscal transfers from resources and petroleum extraction increase personnel and administrative expenditures, but significantly less than public infrastructure, projects and services spending. As a consequence, as fiscal transfers increase, personnel and administrative costs decrease as a percentage of total local expenditures. While this appears desirable, we make several notes in conjunction with district administrative spending. Sjahrir et al. (2014) argue that accountability mechanisms are still weak at the local level and that local public administration spending in Indonesian districts is still too high. Lewis (2005) description of higher local original taxes is also a consequence of the rule that local governments must fund recurring administration from indigenous sources.Following Jin and Zou (2002) discussion and observations this may indicate two possible countervailing effects in play. On the one hand, revenue and expenditure decentralization lead to larger subnational government sizes, possibly due to the increased need for public oversight and administration.[14] On the other hand, fiscal decentralization coupled with local elections can be expected to encourage local governments to become more prudent and ceteris paribus decrease the size or at least constrain the increase in the size of the bureaucracy. We think that these effects dominate in the case of Indonesian districts. Next, the positive and significant coefficient for finance expenditures is again intuitive, since it includes transfers to contingency funds, equity participation in government-linked companies, repayment of borrowings.

Tables 10 and 11 indicate that social aid, public capital expenditures and goods and

[14]Jin and Zou (2002) quote Oates (1972) hypothesis that fiscal decentralization may lead to local constituencies empowering subnational governments.

services are the main beneficiaries of natural resource revenue transfers in terms of their percentage share of the budget accounts. At the same time we find that finance expenditures is reduced. By contrast, the evidence in terms of effects on personnel expenditures between civil- and public services is mixed. For civil service personnel and administration the coefficient is relatively small and not statistically significant using either estimation of the standard error. For public service personnel the effect is negative, the size is larger, and statistically significant only using the Conley standard errors.

It is noteworthy here that Kruse et al. (2012) observe that higher subnational government's own revenues increase routine i.e. personnel and administrative public health spending more than discretionary development spending. In our case this may point towards fiscal transfers from resource extraction being a less secure source of revenue, since–especially in relation to the petroleum sector–central government collects the resource royalties and taxes prior to redistributing the shares pertaining to the relevant district governments. This is also consistent with the small albeit positive impact on social aid expenditures. The latter is often deemed to be part of discretionary outlays.

Still, it is also conceivable that higher fiscal transfers may incentivize local bureaucrats to invest more in capital and infrastructure projects, which in turn could enable said bureaucrats to enjoy higher private benefits in the form of related-party business activities or outright cost mark-ups and corruption. Malesky and McCulloch (2011) argue that public infrastructure investments might be recycled back to firms and individuals friendly to the local government. Lewis (2005) describes how decentralization and local autonomy induce both productive and captured investment activities by local governments.

5.3 Quality of local government and fiscal accounts

To explore the question of possible capture further, we make use of the economic governance index (EGI) data from McCulloch and Prambudhi (2007) to study how our resource revenue variable interacts with EGI in their combined effects on various district government revenue and expenditure items.

We estimate the following model,

$$\begin{aligned} y_{i,t} =& \beta_1 \times \text{transfer}_{i,t} + \beta_2 \times transfer_{i,t} \times egi_i + \theta_i + \gamma_t + \varepsilon_{i,t}, \\ & \text{E}\left[\varepsilon_{i,t} | \text{offshore}_{i,t}, \text{offshore}_{j,t}, \text{offshore}_{i,t} \times egi_i, \text{offshore}_{j,t} \times egi_i, \tilde{\theta}_i, \tilde{\gamma}_t, \right] = 0. \end{aligned} \tag{2}$$

Despite the limited and thus unbalanced EGI data our results are statistically significant and can be seen in Tables 12, 13 and 14, which we compare with Tables 7, 8 and respectively 9.

We make several observations. On the detailed revenues side, comparing Tables 12 with 7 indicates that local business taxes and the genereal allocation fund (DAU) increase

Table 12: Resources transfers and EGI effects on Detailed Revenues

	Dependent variable:					
	Original revenue			Balanced budget		
	loc.tax	loc.bus	loc.retr	prov.alloc	gen.alloc	spec.alloc
	(1)	(2)	(3)	(4)	(5)	(6)
Natural resources	−0.002	0.024***	−0.002	0.133***	0.708***	0.001
	(0.003)	(0.001)	(0.003)	(0.011)	(0.052)	(0.019)
Natural Resources × EGI	−0.002	0.007***	−0.005***	0.179***	0.320***	−0.020**
	(0.001)	(0.0005)	(0.001)	(0.005)	(0.023)	(0.009)
Conley s.e.						
Natural resources	0.003	0.021	0.010	0.088	0.493	0.084
Natural resources × EGI	0.003	0.013	0.005	0.093	0.307	0.048
fixed effects	t+i	t+i	t+i	t+i	t+i	t+i
Observations	1,196	1,196	1,196	1,196	1,196	1,196

Clustered SE at province. Instruments: total offshore production (within 3 miles) for own district and provincial neighbour. First stage F-stat of the excluded instruments for each model is 34619.1. *p<0.1; **p<0.05; ***p<0.01

Table 13: Resources transfers and EGI effects on Public Service

	Dependent variable:			
	pubserv.tot	pubserv.pers	pubserv.goodserv	pubserv.capex
	(1)	(2)	(3)	(4)
Natural resources	1.728***	0.268***	0.657***	0.963***
	(0.122)	(0.028)	(0.047)	(0.069)
Natural Resources × EGI	0.803***	0.155***	0.286***	0.443***
	(0.056)	(0.013)	(0.023)	(0.033)
Conley s.e.				
Natural resources	1.439	0.187	0.430	0.949
Natural resources × EGI	0.884	0.110	0.238	0.632
fixed effects	t+i	t+i	t+i	t+i
Observations	1,192	1,192	1,192	1,192

Clustered SE at province. Instruments: total offshore production (within 3 miles) for own district and provincial neighbour. First stage F-stat of the excluded instruments for each model is 34575.8. *p<0.1; **p<0.05; ***p<0.01

Table 14: Resources transfers and EGI effects on Civil Service and Finance

	Dependent variable:			
	exp.fin	civserv.tot	civserv.pers	civserv.socialaid
	(1)	(2)	(3)	(4)
Natural resources	1.279***	0.413***	0.115*	0.116***
	(0.042)	(0.041)	(0.065)	(0.029)
Natural Resources × EGI	0.536***	0.094***	−0.011	0.001
	(0.028)	(0.031)	(0.052)	(0.017)
Conley s.e.				
Natural resources	0.121	0.242	0.025	0.125
Natural resources × EGI	0.030	0.156	0.037	0.076
fixed effects	t+i	t+i	t+i	t+i
Observations	1,192	1,192	1,192	961

Clustered SE at province. Instruments: total offshore production (within 3 miles) for own district and provincial neighbour. First stage F-stat of the excluded instruments for each model is 34575.8. *p<0.1; **p<0.05; ***p<0.01

with better local economic governance. This means that better governance induces higher local revenue generation and results in higher DAU allocation from the center. While the increase in local business revenues is desirable, the higher DAU allocation continues to contradict the underlying balancing purpose.

On the expenditures side, comparing Tables 13 with 8 we first find that the coefficients for resource revenue transfers versus public capital and infrastructure investments increase by around half in the presence of EGI. This indicates that, if all districts had the same mean governance level, the effect of resource windfalls on public sector investments would be even more strongly positive. This in turn implies that at least a good portion of public infrastructure investments may be of the desirable type.Second, the interaction coefficients show that within roughly two standard deviations below the EGI sample mean the coefficient effectivelly decrease to zero. We interprete this as the significant negative effect of bad governance: district governments on the bottom of the EGI scale do not consistently invest in positive-multiplier capital and infrastructure projects. Third, by comparing Table 14 with Table 9 we find that for civil service personnel and administrative spending the presence of EGI and its interaction terms barely changes the impact of resource windfalls.

Nevertheless, we still cannot explicitly identify the effects of capture in such increases in public sector investments and administrative spending. Thus any hypothesis concerning capture and corruption remains rather ambiguous and highly country/district-specific and the jury is still out on how decentralization may affect corruption. This reflects the continuing debate in the literature. On the one hand, Lessmann and Markwardt (2010) and Skoufias et al. (2014) and others show that fiscal decentralization can reduce

corruption under a transparent and free press and democratic local elections. On the other hand, Perez-Sebastian and Raveh (2016) argue and show empirically that fiscal decentralization actually increases local government corruption propensity.[15]

5.4 Spillovers from fiscal spending

It is conceivable that fiscal expenditures resulting from natural resource extraction may have spillovers that go beyond the own district, and even beyond the province to districts in neighbouring provinces. To estimate this effect we calculate a measure of spillovers from our dataset. District i may find economic spillovers from the spending of neighbouring districts. We are particularly interested in the amount spend by neighbouring district governments from another province, called *non-provincial neighbours*. Hence, we calculate the combined spending of non-provincial neighbouring districts. As one district may have multiple neighbours, we divide the spillover amount by the number of neighbours,

$$\text{spill over}_{j,t} = \sum_i \left(\frac{x_{i,t}}{\#neighbours_i} \times \text{I}(i \text{ neighbours } j) \right),$$

where x is the source of the spillover, either the resource revenue transfers or public service capital expenditures. The $\text{I}(\cdot)$ function indicates whether district i is a neighbour of district j and therefore should be added to the sum of the spill over. In practice we use such an indicator function to distinguish between provincial and non-provincial neighbours; in the case of non-provincial neighbours there should be zero revenue transfers. For the number of neighbours in the denominator, we do not create the distinction between provincial and non-provincial neighbours.

The sample selection of districts should arguably be different here. Since we want to test for the spillovers from a neighbour of another province, there is much less, if any, concern of endogeneity. We can include all districts on a provincial border (practically speaking, where we have non-missing data on our independent variable). Therefore, we can remove the limitation of coastal districts only, while still removing the three largest producing districts. We only include districts without own district oil and gas transfers (as given from production data) to avoid conflation with own district natural resource transfers. We add the equivalent independent variable from *provincial neighbours* (neighbouring districts of the same province) to contrast the response with that of non-provincial neighbours.

The results are presented in Tables 15 and 16. Table 15 indicates that fiscal transfers affect local original taxes and revenues in neighbouring districts, both in the same and in different provinces. The first within-province observation is straightforward, since

[15]It should be noted, however, that in Perez-Sebastian and Raveh (2016) model increased local government inefficiencies arise not only from corrupt behaviour but also from insufficient administrative capacity.

Table 15: Main items revenues, neighbouring districts spillovers.

	Dependent variable:				
	budget	loc.tot	loc.orig.rev	balbgt.tot	rev.fin
	(1)	(2)	(3)	(4)	(5)
Resources, non-prov.	1.632***	1.228***	0.104***	1.142***	0.409
	(0.452)	(0.264)	(0.024)	(0.293)	(0.250)
Resources, prov.	0.941	0.824*	0.071**	0.691*	0.115
	(0.687)	(0.445)	(0.032)	(0.386)	(0.254)
Pub. capex, non-prov.	0.346	0.190	0.015	0.157	0.161
	(0.290)	(0.194)	(0.018)	(0.174)	(0.159)
Pub. capex, prov.	0.917***	0.761***	0.016*	0.660***	0.156
	(0.329)	(0.236)	(0.009)	(0.215)	(0.107)
Conley S.E.					
res., non-prov.	0.671	0.483	0.038	0.533	0.429
res., prov.	0.623	0.411	0.032	0.407	0.337
pub. capex non-prov.	0.295	0.221	0.020	0.193	0.135
pub. capex prov.	0.272	0.206	0.007	0.188	0.101
fixed effects	t+i	t+i	t+i	t+i	t+i
Observations	500	500	500	500	500

Clustered SE at province. All district bordering another province, without own oil production. Resources referes to natural resource transfers, Pub. Capex, refers to public services capital expenditures. Both non-provincial neighbours (non-prov.) and neighbours of the same province (prov.). *p<0.1; **p<0.05; ***p<0.01

districts within the same province do receive a share of the fiscal windfall from their neighbours. The second finding, regarding neighbouring districts from a different province, is interesting. Here we directly observe possible spillover effects, where fiscal windfalls in a district can only affect neighbouring districts in different provinces when there is direct economic spillovers on the level of the extraction projects (e.g. through infrastructure or complementary local businesses).

In particular, in Table 16 we find that the positive and generally significant effect of resource transfers on local original revenues arise mainly from local business taxes and from local government-linked companies' taxes and dividends. This applies for both provincial and non-provincial neighbours. It is conceivable that public infrastructure spending creates opportunities for not only government-linked businesses within the same and in neighbouring districts, but also for local private businesses, generating additional indigenous taxes.

Additionally, in Table 15 we find that the effects of public capital expenditures on neighbours in different provinces is very limited relative to the spillovers estimated within the same provinces. Interestingly, the estimation suggest that expenditures return almost 1-to-1 in total revenue to neighbouring districts (since the spillover variable is scaled by the

Table 16: Detailed revenues, neighbouring districts spillovers.

	Dependent variable:					
	Original revenue			Balanced budget		
	loc.tax	loc.bus	loc.retr	prov.alloc	gen.alloc	spec.alloc
	(1)	(2)	(3)	(4)	(5)	(6)
Resources, non-prov.	0.004	0.010**	0.011	−0.235	0.826***	−0.028
	(0.007)	(0.005)	(0.009)	(0.254)	(0.250)	(0.054)
Resources, prov.	0.006**	0.005*	0.010	0.142	−0.072	0.025
	(0.003)	(0.003)	(0.007)	(0.089)	(0.253)	(0.053)
Pub. capex, non-prov.	0.007	−0.002	−0.002	0.004	0.084	0.020
	(0.008)	(0.002)	(0.002)	(0.029)	(0.147)	(0.039)
Pub. capex, prov.	−0.001	0.002	−0.001	0.032	0.433**	0.074**
	(0.001)	(0.003)	(0.002)	(0.020)	(0.201)	(0.037)
Conley S.E.						
res., non-prov.	0.009	0.006	0.009	0.477	0.349	0.131
res., prov.	0.002	0.002	0.005	0.275	0.280	0.080
pub. capex non-prov.	0.002	0.002	0.002	0.057	0.137	0.049
pub. capex prov.	0.002	0.002	0.002	0.020	0.130	0.027
fixed effects	t+i	t+i	t+i	t+i	t+i	t+i
Observations	500	500	500	500	500	500

Clustered SE at province. All district bordering another province, without own oil production. Resources referes to natural resource transfers, Pub. Capex, refers to public services capital expenditures. Both non-provincial neighbours (non-prov.) and neighbours of the same province (prov.). *p<0.1; **p<0.05; ***p<0.01

number of neighbours, the interpretation is that the combined revenues of all neighbours sums to the original capital spending). For non-provincial neighbours, the coefficient on the aggregate budget account suggests that one US$/cap of spending in a non-provincial neighbour returns US$0.35, which is less than half of the coefficient estimated for the provincial neighbour. Moreover, the coefficient is not statistically significant.

5.5 Robustness

We present a number of alternative specifications in Appendix A. Firstly, we present results using OLS, without the use of external instruments (Appendix A.2). Secondly, we can differentiate natural resource transfers between oil and gas and non-oil and gas revenues (Appendix A.3). This will exclude all revenues from mining and forestry, but will still leave the potential for endogeneity. Therefore, we use the same instrument in this specification. Thirdly, given the relatively short time-span, it might be suspected that some results are driven by pre-existing trends. We present results in first differences, with time-fixed effects and cross-section fixed effects included, and using the first-difference of own and neighbouring district offshore oil and gas production to instrument for the

revenues (Appendix A.4). While given some different estimates for the coefficients of interest, these remain broadly in line with our IV results.

6 Conclusions

In summary, making use of Indonesia's fiscal sharing rules and an offshore oil and gas production instrument, our results indicate a complex interplay between Indonesia's decentralization, democratic elections and press freedom, and resource curse-like forces.

We observe positive spillovers from resource revenue windfalls on a district's local business taxes and government-linked company income, which is positive and intuitive. Surprisingly, the impact of resource revenue transfers on the general allocation fund (DAU) is positive and significant. This is inconsistent with the underlying fiscal gap-reduction objective of DAU, the largest center-local transfer scheme. We suspect this must at least partially stem from subnational-level institutional inefficiencies.

By contrast, fiscal transfers from resource extraction increase public sector spending on capital and infrastructure projects as well as public goods and services. This is positive, especially as it also increases local tax revenues. At the same time spending on personnel and administration increase less and decreases as percentage of total local expenditures. Indeed personnel administrative and discretionary social aids expenditures only increase when the proportion of fiscal windfalls from resource extraction increases.

Our economic governance index analysis shows highly positive interaction cofficients with resource revenues. In other words, better governed district governments generate higher local revenues and invest much more in capital and infrastructure projects than in worse managed districts. Nevertheless, the undesirable positive effect of resource revenues on the general allocation fund persists.

Interestingly, while district public spending is largely localized, neighbouring-districts analysis enable us to isolate direct economic spillovers from (cross-border) extraction projects. Moreover, reinforcing the usefulness of the offshore instrument we find that only onshore private extraction projects directly induce public infrastructure investments.

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Appendix A Additional empirical results

Appendix A.1 First stage

We present here some additional results for the first stage results, specifically to investigate the negative coefficient of own offshore production on natural resource revenues. The reason for the negative coefficient is probably due to the correlation between revenue transfers and the likelihood of offshore oil and gas production. Since transfers include other onshore extraction, the first stage regression in the main text seems to suggest that those (coastal) districts with offshore oil get relatively less transfers due to a lack of other onshore revenue relative to coastal districts without on/offshore oil. The district fixed effect controls for the (time-constant) resource extraction situation. If we remove the district fixed effect from the first stage, as done in Table A-1, the coefficient on own offshore oil production becomes positive, but not statistically significant. Importantly, the coefficient on the neighbouring offshore production remains positive and statistically significant.

Table A-1: First stage, natural resources instrumented by offshore production

	Dependent variable:			
	Natural resources			
	Cl. prov.	NW-robust	Cl. prov.	NW-robust
	(1)	(2)	(3)	(4)
Offshore prod.	0.003	0.003		
	(0.020)	(0.035)		
Neighbours Offshore prod.	0.064***	0.064***	0.064***	0.064***
	(0.001)	(0.005)	(0.001)	(0.005)
N. clusters	29	245	1209	29
F-stat	5458.466	115.538	10039.316	173.844
fixed effects	t	t	t	t
Observations	1,209	1,209	1,209	1,209

This presents first stage regression of the main results using three difference variance-covariance estimators and combinations of external instruments. 'Cl. prov' indicates by province clustered standard errors and 'NW-robust' indicates Newey-White heteroskedastic robust standard errors. *p<0.1; **p<0.05; ***p<0.01

Appendix A.2 OLS

Table A-2: Natural resources transfers effects on Main Revenues, OLS

	Dependent variable:				
	budget	loc.tot	loc.orig.rev	balbgt.tot	rev.fin
	(1)	(2)	(3)	(4)	(5)
Natural resources	1.133**	0.994***	0.020***	0.803***	0.139
	(0.450)	(0.306)	(0.005)	(0.170)	(0.146)
Conley s.e.	0.381	0.244	0.018	0.220	0.196
fixed effects	t+i	t+i	t+i	t+i	t+i
Observations	1,209	1,209	1,209	1,209	1,209

OLS with clustered SE at province. *p<0.1; **p<0.05; ***p<0.01

Table A-3: Natural resources transfers effects on Detailed Revenues, OLS

	Dependent variable:					
	Original revenue			Balanced budget		
	loc.tax	loc.bus	loc.retr	prov.alloc	gen.alloc	spec.alloc
	(1)	(2)	(3)	(4)	(5)	(6)
Natural resources	−0.001	0.005***	−0.0002	−0.178**	0.154**	0.043
	(0.001)	(0.001)	(0.001)	(0.090)	(0.073)	(0.050)
Conley s.e.	0.001	0.003	0.002	0.140	0.063	0.032
fixed effects	t+i	t+i	t+i	t+i	t+i	t+i
Observations	1,209	1,209	1,209	1,209	1,209	1,209

OLS with clustered SE at province. *p<0.1; **p<0.05; ***p<0.01

Table A-4: Natural resources transfers effects on Finance and Civil Service expenditures, OLS

	Dependent variable:			
	exp.fin	civserv.tot	civserv.pers	civserv.socialaid
	(1)	(2)	(3)	(4)
Natural resources	0.589***	0.064	0.073*	−0.012
	(0.119)	(0.043)	(0.044)	(0.024)
Conley s.e.	0.221	0.053	0.046	0.049
fixed effects	t+i	t+i	t+i	t+i
Observations	1,205	1,205	1,205	973

OLS with clustered SE at province. *p<0.1; **p<0.05; ***p<0.01

Table A-5: Natural resources transfers effects on Public Service expenditures, OLS

	Dependent variable:			
	pubserv.tot	pubserv.pers	pubserv.goodserv	pubserv.capex
	(1)	(2)	(3)	(4)
Natural resources	0.479	0.022	0.131**	0.351
	(0.303)	(0.019)	(0.059)	(0.225)
Conley s.e.	0.245	0.022	0.093	0.166
fixed effects	t+i	t+i	t+i	t+i
Observations	1,205	1,205	1,205	1,205

OLS with clustered SE at province. *p<0.1; **p<0.05; ***p<0.01

Appendix A.3 Oil and gas only

Table A-6: Main Revenues, Oil and gas transfers, IV

	Dependent variable:				
	budget	loc.tot	loc.orig.rev	balbgt.tot	rev.fin
	(1)	(2)	(3)	(4)	(5)
Oil and gas transfers	3.760***	2.792***	0.084***	2.230***	0.965***
	(0.153)	(0.125)	(0.008)	(0.083)	(0.044)
F-stat	3597.0	3597.0	3597.0	3597.0	3597.0
Conley S.E.	1.737	0.891	0.081	0.672	1.047
fixed effects	t+i	t+i	t+i	t+i	t+i
Observations	1,209	1,209	1,209	1,209	1,209

Clustered SE at province. Instruments: total offshore oil and gas production (within 3 miles) for own district and provincial neighbour. *p<0.1; **p<0.05; ***p<0.01

Table A-7: Detailed Revenues, Oil and gas transfers, IV

	Dependent variable:					
	Original revenue			Balanced budget		
	loc.tax	loc.bus	loc.retr	prov.alloc	gen.alloc	spec.alloc
	(1)	(2)	(3)	(4)	(5)	(6)
Oil and gas transfers	−0.001	0.028***	0.0005	0.016	0.839***	0.040*
	(0.002)	(0.001)	(0.002)	(0.010)	(0.053)	(0.022)
F-stat	3597.0	3597.0	3597.0	3597.0	3597.0	3597.0
Conley S.E.	0.003	0.017	0.011	0.105	0.516	0.071
fixed effects	t+i	t+i	t+i	t+i	t+i	t+i
Observations	1,209	1,209	1,209	1,209	1,209	1,209

Clustered SE at province. Instruments: total offshore oil and gas production (within 3 miles) for own district and provincial neighbour. *p<0.1; **p<0.05; ***p<0.01

Table A-8: Finance and Civil Service expenditures, Oil and gas transfers, IV

	Dependent variable:			
	exp.fin	civserv.tot	civserv.pers	civserv.socialaid
	(1)	(2)	(3)	(4)
Oil and gas transfers	1.345***	0.569***	0.194***	0.187***
	(0.038)	(0.032)	(0.045)	(0.034)
F-stat	3557.9	3557.9	3557.9	1929.0
Conley S.E.	0.076	0.286	0.106	0.121
fixed effects	t+i	t+i	t+i	t+i
Observations	1,205	1,205	1,205	973

Clustered SE at province. Instruments: total offshore oil and gas production (within 3 miles) for own district and provincial neighbour. *p<0.1; **p<0.05; ***p<0.01

Table A-9: Public Service expenditures, Oil and gas transfers, IV

	Dependent variable:			
	pubserv.tot	pubserv.pers	pubserv.goodserv	pubserv.capex
	(1)	(2)	(3)	(4)
Oil and gas transfers	1.843***	0.243***	0.710***	1.047***
	(0.127)	(0.022)	(0.051)	(0.075)
F-stat	3557.9	3557.9	3557.9	3557.9
Conley S.E.	1.545	0.192	0.534	0.934
fixed effects	t+i	t+i	t+i	t+i
Observations	1,205	1,205	1,205	1,205

Clustered SE at province. Instruments: total offshore oil and gas production (within 3 miles) for own district and provincial neighbour. *p<0.1; **p<0.05; ***p<0.01

Appendix A.4 First differences

There might be concerns that the results are driven by pre-existing trends. For example, if past oil/gas production and revenue prior to 2005 (the first year we have fiscal data), triggered economic development, then this might results in growing budgets accross the board. First differencing our variables in combination with year and municipality fixed effects go a long way to address that concern. We are estimating the following models,

$$\begin{aligned} \Delta y_{i,t} =& \beta \times \Delta transfer_{i,t} + \tilde{\theta}_i + \tilde{\gamma}_t + \tilde{\varepsilon}_{i,t}, \\ & \mathrm{E}\left[\tilde{\varepsilon}_{i,t} | \Delta \text{offshore}_{i,s}, \Delta \text{offshore}_{j,s}, \tilde{\theta}_i + \tilde{\gamma}_t\right] = 0, \end{aligned} \tag{A-3}$$

where the tilde-hats are there to differentiate these parameters from the level equations of the main text.

Table A-10: Main Revenues, first-differences, IV

	Dependent variable:				
	budget	loc.tot	loc.orig.rev	balbgt.tot	rev.fin
	(1)	(2)	(3)	(4)	(5)
Natural resource	1.032***	1.421***	0.026***	1.292***	−0.390***
	(0.034)	(0.039)	(0.004)	(0.030)	(0.015)
F-stat	3479.6	3479.6	3479.6	3479.6	3479.6
Conley s.e.	0.522	0.317	0.010	0.301	0.311
fixed effects	t+i	t+i	t+i	t+i	t+i
Observations	964	964	964	964	964

Clustered SE at province. Instruments: first difference of total offshore production (within 3 miles) for own district and provincial neighbour. *p<0.1; **p<0.05; ***p<0.01

Table A-11: Detailed Revenues, first-differences, IV

	Dependent variable:					
	Original revenue			Balanced budget		
	loc.tax	loc.bus	loc.retr	prov.alloc	gen.alloc	spec.alloc
	(1)	(2)	(3)	(4)	(5)	(6)
Natural resource	0.001	0.006***	−0.001	0.074***	0.255***	0.002
	(0.001)	(0.0005)	(0.001)	(0.004)	(0.023)	(0.011)
F-stat	3479.6	3479.6	3479.6	3479.6	3479.6	3479.6
Conley s.e.	0.001	0.004	0.005	0.058	0.105	0.026
fixed effects	t+i	t+i	t+i	t+i	t+i	t+i
Observations	964	964	964	964	964	964

Clustered SE at province. Instruments: first difference of total offshore production (within 3 miles) for own district and provincial neighbour. *p<0.1; **p<0.05; ***p<0.01

Table A-12: Finance and Civil Service expenditures, first-differences, IV

	Dependent variable:			
	exp.fin	civserv.tot	civserv.pers	civserv.socialaid
	(1)	(2)	(3)	(4)
Natural resource	0.935***	0.131***	0.014	0.068***
	(0.017)	(0.014)	(0.013)	(0.006)
F-stat	3472.1	3472.1	3472.1	2528.6
Conley s.e.	0.227	0.070	0.014	0.061
fixed effects	t+i	t+i	t+i	t+i
Observations	960	960	960	728

Clustered SE at province. Instruments: first difference of total offshore production (within 3 miles) for own district and provincial neighbour. *p<0.1; **p<0.05; ***p<0.01

Table A-13: Public Service expenditures, first-differences, IV

	Dependent variable:			
	pubserv.tot	pubserv.pers	pubserv.goodserv	pubserv.capex
	(1)	(2)	(3)	(4)
Natural resource	−0.034	0.029***	0.050***	−0.094***
	(0.046)	(0.006)	(0.018)	(0.029)
F-stat	3472.1	3472.1	3472.1	3472.1
Conley s.e.	0.434	0.033	0.160	0.287
fixed effects	t+i	t+i	t+i	t+i
Observations	960	960	960	960

Clustered SE at province. Instruments: first difference of total offshore production (within 3 miles) for own district and provincial neighbour. *p<0.1; **p<0.05; ***p<0.01