Oil exploitation and inequality in Chad

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Abstract

Inequality is a common concern, strongly perceived by people as well as by governments that redistribute resources through taxation and public expenditure. It is well known that economic growth in African countries is highly based on raw materials and natural resources, especially oil revenues in the case of Chad. In these circumstances, an important issue is to know the extent to which oil exploitation contributes to reduce poverty and inequalities countrywide. This study aims to investigate the effect of oil exploitation on poverty gap and inequality in Chad at the local level. Based on different databases collected at departmental level, the baseline identification strategy relies upon comparing oil producing and non-producing departments that are spatially close and institutionally similar by belonging in same region. The research uses several comparison cases to assess the effect of oil exploitation activity and oil revenues distribution policy across producing and non-producing departments on three socioeconomic outcomes: poverty incidence, extreme poverty incidence, and inequality of the consumption distribution (Gini coefficient).

Keywords: Oil exploitation, poverty, inequality, region, department, and Chad.

JEL Classification: H75, I38, O15, O20, Q33, Q38.
1. Background

Economic growth in most of African countries is based on the exploitation of several renewable and non-renewable natural resources. In Chad, oil constitutes the main natural resource since 2003 leading the country to the tenth currently producer-exporter rank over the continent. Before this date, agriculture and livestock were the two main economic activities in the country. Economic growth during this period was low. In the 1980s, the growth rate of gross domestic product was about 4% on average. During the 1990s, the growth rate dropped to 3% per year (INSEED, 2013). This low economic performance was mainly due to the recurrent political instability and inadequate levels of investments (Gadom, 2012).

Undoubtedly, oil industry has had a significant stimulatory effect on Chadian GDP growth. The oil investments made between 2000 and 2003, and the oil production which started in October 2003 have greatly accelerated economic growth since 2000. The oil GDP growth from 2002 to 2006 was 7.4% against 6.6% for the non-oil GDP (PND, 2013). The rate of GDP growth which was 3% average in the 90s, reached the peak of 34.7% in 2004 and remains on average about 7% from 2001 to 2013 (INSEED, 2013). This peak reached in 2004 coincided with the short period of maximum oil production from 2004 to 2005, with an annual production of 8.9 million tones (Ministry of Petroleum, 2013). Oil provides a bulk of funding to the Chadian government. It represents 88% of exports average since 2004 (PND, 2013). In addition, the commercialization of refined oil from "Djarmaya" since 2010, and the derivatives products (gas) have helped to strengthen the financial capacity of the Chadian authorities. Oil activity covers, on average, over 40% of GDP and provides at least 75% of ordinary budget revenues (BEAC, 2013). Oil revenues are used to finance major investments such as infrastructure, education, agriculture or even manufacture.

Although, the oil resources have improved growth, its effect on poverty/inequality reduction is very low. The poverty decreases only on average by 1% per year between 2003 and 2011 (World Bank, 2013). In addition, the inequality rose by 0.8% per year on average, since 2003, in all the

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1 National Institute of Statistic, Economic and Demographic Studies.
2 National Development Program.
3 According to the Ministry of Petroleum (2013), the country produces only 125,000 barrels on average per day.
4 Djarmaya is the site where the oil industry is installed.
5 Bank of Central African Countries.
regions of Chad. Given that the relation among growth, inequality and poverty is complex and interdependent (Kakwani et al., 2004), such a contrast leads a number of scholars to question the issue of inequality in the context of oil exploitation. The most important objective of development efforts is the reduction of poverty which could be achieved through economic growth and income distribution (Kakwani et al., 2004). The overall revenue growth is the key to increase the poor incomes, but this must be accompanied by improved income distribution and therefore the reduction of inequalities (Klasen, 2004). For that reason, before the beginning of oil project in Chad, The World Bank imposed the adoption of a program for managing oil revenues in exchange for financial support with the aim of ensuring that the use of oil revenues may help to poverty/inequality alleviation. But very quickly, a conflict arose in 2006 between Chadian government and the World Bank because of the unilateral change in the program management of oil revenues made by the government of Chad (Ndang & Nan-Guer, 2011).

It is acknowledged that higher economic growth benefits the poor only when levels of inequality are lower and the gains of development are equitably distributed through appropriate redistributive policies. The growth led by natural resources could be associated not only with the widening in differences of living standards across regions but also within regions (Buccellato & Mickiewicz, 2009). Inequality is a common concern, strongly perceived by people as well as by governments that redistribute resources through taxation and public expenditure. It is well known that economic growth in African countries is highly based on raw materials and natural resources, especially oil revenues in the case of Chad. However, the dismal performance of most countries is often ascribed to the resource curses because of weak linkages between the exploitation of mineral resources and the rest of the economy, thus the ability of government intervention to provide minimal poverty reduction is mitigated (Thorbecke, 2009, 2013).

2. Statement of the problem

Despite the economic performance due to oil, Chad does not record good indicators of development. For example, the country ranks 184th over 187 countries in 2013 according to its Human Development Index which was 0.35 (UNDP, 2013). Similarly, poverty indices are bad compared with those of sub-Saharan Africa. The results of the third Consumption and the Informal Sector Survey in Chad (ECOSIT 3) show that 46.7% of Chadians live in extreme income poverty in 2011 against 54.8% in 2003. The threshold of daily consumer expenditure is
equal to CFA 652\(^6\) francs. Poverty has reduced but the number of poor people has increased by 14\% from 4.111 to 4.673 million between 2003 and 2011 (World Bank, 2013). The depth of poverty is around 19.7\%, one of the highest gaps in Central Africa in particular and in Sub-Saharan Africa in general (World Bank, 2014). In 2011, the poverty rate was around 47.4\% for male against 42.6\% for female and affected more the unskilled households\(^7\) (World Bank, 2013). Since 2003, the government has set up National Poverty Reduction Papers (NPRP1 from 2003 to 2006 and NPRP2 from 2008 to 2011). These strategies are reinforced by the law 001/PRC/99 in 1999 and its modification in 2006 stating the management and allocation of oil revenues across the country in order to better contribute to poverty reduction. But the goal of reducing poverty by half in 2015 is far from being realized. The incidence and depth of poverty are reduced from only eight (8) and five (5) points respectively between 2003 and 2011, while the gap between the rich and the poor has widened (INSEED, 2013). The intensity of income inequality captured by the Gini index increased by 6.9\%, from 0.394 to 0.421 in the same period (World Bank, 2013), indicating an unequal distribution of the sources of growth in Chad. Spatially, disparities have been illustrated by the increase in the rate of poverty in some areas and it reduction in others. For instance, the results of the ECOSIT 2 and 3 surveys\(^8\) showed that the poverty rate has declined in all regions of Chad except the regions of Mandoul, Logone Occidental, Ouaddai and Tandjilé where poverty incidence increased. These poor results recorded in these four regions are partly attributable to the decline of agricultural activity (mainly cotton) in favor of oil activities (World Bank, 2013).

Unfortunately, the clumsy allocation of oil revenues across the country does not account for the disparities among regions. It is not concerned with the unequal levels of development and poverty reduction needs in more poor regions. The distribution of oil revenues is done unevenly and does respect neither the population density of the regions, nor the level of well-being. For example, the region of Mayo Kebbi which is the more populated and the poorest according to the ECOSIT2 results, has received on average only 1\% of oil revenues between 2003 and 2009 compared to the Borkou-Enne-diTibesti (BET) region, less populated and poor, that has received

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\(^6\) 652 CFA is equivalent to 1.25 dollars US

\(^7\) Unskilled households are those who have primary school level, secondary school level and without school.

\(^8\) The Chad household consumption and informal sector surveys, ECOSIT 2 and ECOSIT 3, were conducted in 2003 and 2011 respectively.
about 11% of these resources (CCSRP, 2012). The same sources indicate that N'Djamena, the capital of Chad, benefited about 50% on average of total oil revenues. This unequal distribution of sources of growth could undermine the government's actions in favor of the poor and raising the issue of pro-poor growth in Chad. Then, it is important to evaluate the distributional changes in the Chadian oil take-off period (2000 for exploration and 2003 for exploitation), as oil revenues are the main source of economic growth in the country.

Despite the high petroleum potential of Africa in general and specifically Chad, relatively few empirical studies were done on inequalities generated by oil resources. Banhoudel (2008) raised the issue of resource curse in Chad. To better design redistributive policies, government needs information about the underlying factors explaining how resources are distributed. More recently, World Bank (2013) attempted to raise the dynamic of the inequality since the emergence of oil production. But this study did not take specifically into account the inequality between and within regions and population. In addition, the study by World Bank didn’t raise the issue of oil revenue redistribution policy across the country. Therefore, our study by raising the problematic of oil revenue distribution, completes these studies and tries to fill the gap in existing empirical literature in Africa.

The real challenge faced by the Chadian economy is the inequitable distribution of the gains from higher economic growth to the citizens of Chad. The benefits of growth due to oil are not equitably spread across different income groups and regions of the country. Thus, the main question raised by this study is: How does oil exploitation affect income disparities across regions and population groups?

3. Objectives of the study

This study aims to investigate the effect of oil exploitation on poverty gap and inequality in Chad between 2003 and 2011.

4. Brief review of the literature

The starting point for the analysis of the impact of natural resources on inequality in the literature is the "resource curse" theory, also known as the ‘paradox of plenty’ which implies that resource

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9 College of Monitoring and Management of Oil Revenues.
rich countries growth less than resource poor countries (Sachs & Warner, 1995; Torres et al., 2013). According to Sachs and Warner (1995), "Dutch disease" in natural resource dependent countries is the main explanation of this result. It can be explained by the fact that the resource boom reduces the competitiveness of other economic sectors (non-resource sectors) as well as the total factor productivity growth rates through the appreciation of the real exchange rate. Other explanations for the resource curse have been provided in the literature, including the diversification of the economy (Mallaye et al., 2014). Additionally, poor governance, corruption and rent seeking are other transmission channels often mentioned (Torvik, 2002; Mehlum et al., 2006; Arezki & Brückner, 2011).

Specifically, the effect of natural resources on inequality has been an ongoing debate in the economic literature. While some authors, like Lopez-Feldman et al. (2006), Goderis and Malone (2008), Mehlum et al. (2012), Howie and Atakhanova (2014) show that natural resources can reduce inequality, others emphasize the depleting nature of these resources (Fields, 1989; Leamer et al., 1999; Sarraf & Jiwanji, 2001; Gylfason & Zoega, 2003; Ross, 2007; Buccellato & Alessandrini, 2009; Buccellato & Mickiewicz, 2009; Fum & Hodler, 2009; Carmignani, 2013; Mallaye et al., 2014). So, according to Goderis and Malone (2008) the boom in mineral resources reduces income inequality in the short run, but in the long run, these inequalities return to their original level. The same result is established by Mallaye et al. (2014) for which there is a non-linear relationship (U-shaped) between oil rent and inequality. Howie and Atakhanova (2014) in turn establishes that, when controlling the effect of certain variables (change in labor income, level of education, expenditure of public health care and the quality of institutions), the resource boom reduces inequality. Moreover, unlike rural areas, the quality of institutions is the most important factor in reducing inequality in urban areas.

In contrast, Gylfason and Zoega (2003) show that the dependence on natural resources leads to two effects: a decrease in the growth and increasing inequality. The major innovation in the approach adopted by these authors was the direct link between dependence on natural resources and both growth and inequality, in opposite of existing studies which advocated the existence of an indirect relationship. Fum and Hodler (2009) argue that, the ethничal composition of the societies is a key factor in reducing or increasing inequalities related to natural resources. In ethnically polarized countries, one group can have enough power to take over the entire resource
rents. Therefore, this group becomes richer than others. In contrast, in ethnically homogenous countries, none of the ethnic groups can capture the resource rents. Furthermore, Mallaye et al. (2014) suggest that, in the long-term: governance, inflation, corruption and military spending would reduce government social spending and thus increase inequality. Finally, Carmignani (2013) provides evidence that inequality is a transmission channel of the effect of natural resources on human development; since resource boom increases inequality and higher inequality contribute to lower human development.

In general, it appears that the initial conditions, governance and democracy, among others are important for a nation to transform the abundance of natural resources to a blessing; by reducing poverty and inequality. The most famous example and also an exception was the case of Norway, where natural resources have improved the living standard of population and reduce income inequality. The main factors that led to this success are: the redistribution of public spending on social security and social services; the accumulation of human capital through investment in education and health; and the creation of a stabilization fund Mehlum et al. (2012).

Oil is at the center of debates on the resource curse (Omgba, 2010). Because of its strategic place and importance of disposable income, oil is the natural resource with the highest probability of occurrence of the curse (Ross, 2004; Alexseev & Conrad, 2009). Furthermore, it should be worth mentioning that the main challenge for economic policy makers in rich resources countries is how natural resources can contribute to the reduction of inequality. Knowing the importance of the link between the abundance of natural resources and inequality is not only related to the interest of the question, but also in the fact that inequality has a strong involvement in certain aspects of economic development, including poverty (Buccellato & Mickiewicz, 2009).

5. Methodology

The objective of this study is to investigate the effect of oil exploitation on poverty gap and inequality in Chad. We are expecting to achieve this task at local level in order to raise out the local natural resource curse issue. In Chad, sub-national administrative units are called regions, departments, districts, and sub-districts in decreasing order of size according to the Decree N°419/PR/MAT/02 on 17th October 2002. The lowest local unit to be retained depends on the government policy of oil production distribution across the country as well as data availability.
which is a big issue in Chadian context. We are going to review these two points before the empirical strategy.

5.1. Data

There are two kinds of oil revenues that come from oil field production in Chad: the direct oil revenues (royalties and dividends) controlled by CCSRP and the indirect oil revenues (income taxes, fees and taxes paid by employees, work permits, customs duties and other charges) essentially and exclusively managed by the government through the national treasury. Unfortunately, none statistics are provided about the allocation of indirect revenues and its use depends on highly arbitrary government needs and are frequently used for military purposes. However, direct oil revenues are essentially allocated to priority sectors such as education, health, or infrastructure with aim to alleviate poverty. These revenues are allocated by the central government – in general arbitrarily (World Bank, 2013) – across the regions and each regional governor define once again an allocation strategy across departments. The CCSRP accounts for this oil production distribution at regional and departmental levels. None data are available about the distribution at district and sub-district levels leading us to choose departments as the lowest sub-national administrative units. There are 23 administrative regions and 67 departments, excluding the 10 municipal districts that stand as departments in the capital city N’djamena.

In order to investigate the local impact on socioeconomic outcomes of oil exploitation in Chad, which started since more than one decade in 2003, additional database is required especially to derive outcome variables. Three welfare indicators at the departmental level will be considered in this research: poverty incidence, extreme poverty incidence, and inequality of the consumption distribution (Gini coefficient). We will collect living standard measurement representative at departmental level by drawing directly from the 2003 and 2011 Chad household consumption and informal sector surveys (ECOSIT 2 and ECOSIT 3 respectively, in French) conducted by the National Institute of Statistics, Demographic and Economic Studies (INSEE, in French). ECOSIT 2 survey was carried out to fill the gap of the first ECOSIT 1 conducted in 1995. It was also useful to improve statistical knowledge about poverty profiles in Chad. In this survey, more regions were covered compared to the former and a total of 6,695 households were visited. ECOSIT 3 survey goes further by covering a large number of households (9,259). The choice of the ECOSIT 2 and ECOSIT 3 surveys is also motivated by the fact that this research will raise
the issue of oil exploitation and its link to poverty gap and inequality by considering an *ex-ante* and an *ex-post* oil exploitation period in Chad.

However, a specific harmonization is necessary to better match administrative units and derive the appropriate sample and its size given the CCSRP data about oil production and distribution across the country, and the ECOSITs data from which socioeconomic outcomes are derived. Indeed, the ECOSITs’ sampling design was based on a geographical stratification by region and department, and the use of a multistage-sampling procedure to select respondents in retained enumeration areas. Although all regions and departments were covered during these surveys, some regrouping and bursting of these administrative units were done to better ease the data collection process. Therefore, the number of regions and departments are quite changed. For instance, ECOSIT 3 presents 20 regions and 73 departments, while they are 12 and 67 according to the CCSRP. In this context, our sample size corresponds to the smaller number of each unit, that is, 12 regions and 67 departments.

Lastly, results first of the General Population and Housing Census (GPHC) conducted in 1993 by INSEED will be used to introduce some demographic control variables in *ex-ante* oil production period, that is, 2003\textsuperscript{10}. These variables are for instance the population density, the percentage of rural population, and the sex ratio composition of the population in each department. The rest of control variables such as the literacy rate, the school attendance rate, the percentage of households that have access to basic needs (electricity and drinking water) will be constructed from ECOSIT 2.

5.2. **Empirical strategy**

Following Loayza et al. (2013), our identification strategy is based on comparing socioeconomic outcomes in departments where oil fields and wells are located, with outcomes in neighboring or nearby departments of similar characteristics. The rationale of comparing neighboring or nearby departments comes from the need to mitigate omission variables biases related to endogenous location decisions. Indeed, at the departmental level, the location of an oil field or well is

\footnote{It will be useful to account for the estimated demographic growth rate provided annually by INSEED. This procedure will consist to adjust the values of the demographic control variables from 1993 to 2003. The second and most recent GPHC has been conducted in 2009.}
primarily dictated by geological factors \(^{11}\) instead of economic and political factors that may influence oil revenues distribution. Our base sample consists of 10 producing departments \(^{12}\) and 57 non-producing departments spread over 12 regions, with an average of 5 departments per region \(^{13}\).

However, regarding the governmental policy of allocation of oil revenues and the oil exploration across the country, one could distinguish between three types of departments: producing departments (\(PD\)) which host an oil field or well since 2003, non-producing departments in producing regions (\(NPDP\)), and non-producing departments in non-producing regions (\(NPDN\)). The \(NPDP\) do not host any oil field or well, but are likely to receive a non-negligible amount of oil revenues from the regional authorities who tend to avoid social conflicts in producing regions. Yet, the \(NPDN\) are sometimes neglected and receive the smallest shares of oil revenues since they are located in non-producing regions. Given that, our final sample consists of 10 producing departments, 8 non-producing departments in producing regions, and 49 non-producing departments in non-producing regions \(^{14}\).

We will implement our identification strategy using different comparison cases based on Loayza et al. (2013) sequence. The first case of comparison considers all departments from regions with oil exploitation activity and compares socioeconomic outcomes of producing departments with, in turn, outcomes of non-producing departments in non-producing regions and outcomes of non-producing departments in the same province of each oil department. We use information from the ECOSIT 2 survey and the first GPHC to control for department characteristics in the \textit{ex-ante} oil exploitation period in 2003. Given that, the baseline regression is as follows:

\[
y_{rd} = \alpha + \beta_0 I_{rd}^{PD} + \beta_1 I_{rd}^{NPDP} + \beta_2 X_{rd} + \nu_r + \epsilon_{rd} \tag{1}\]

\(^{11}\) The location of oil departments and regions across the Chadian territory shows that oil activity is concentrated in the South-West region.

\(^{12}\) These are Miandoun, Komé, Bolobo, Nya, Moundouli, Maikeri, Timbré, Mangara, Bemangra and Koudalwa.

\(^{13}\) In terms of household repartition based on ECOSIT surveys, 1 136 households (12.3\% of the sample) live in oil regions according to ECOSIT 3 in 2011, while 1 429 households (21.3\% of the sample) live in oil regions according to ECOSIT 2 in 2003.

\(^{14}\) The producing regions are named Logone occidental, Logone oriental, and Chari Baguirmi, with an average of 3 producing departments per region. Although the sample size is quite small, to our knowledge it is the best way to conduct this research in the Chadian context given a serious data availability issue.
Where \( r \) denotes the region, \( d \) the district, \( y_{rd} \) a socioeconomic outcome variable, \( 1_{rd}^{PD} \) a binary variable that takes a value 1 if the department is producing, \( 1_{rd}^{NPDP} \) a binary variable that takes a value of 1 if the department is non-producing in a producing region, \( X_{rd} \) a set of time invariant\(^{15} \) and 2003 district characteristics, and \( \nu_r, \varepsilon_{rd} \) region and department error terms respectively.

This baseline specification allows us to consider on the one hand two types of “treatment” departments: producing departments and non-producing departments in producing regions. On the other hand, we will consider the non-producing departments in non-producing regions as a type of “control department”. Therefore, the respective impacts of oil exploitation on the two types of treatments departments with respect to control departments are obtained from \( \beta_0 \) and \( \beta_1 \) coefficients in case of absence of region fixed effects. Since this assumption seems strongly unrealistic, we would consider region fixed effects and assess the additional impact of oil exploitation on producing departments with respect to non-producing departments in the same region. This impact is estimated by \( \beta_0 \) since the binary variable \( 1_{rd}^{NPDP} \) will be dropped out in this case. The baseline regression (equation 1) will be estimated by Ordinary Least Squares (OLS) using in each case socioeconomic variables corresponding to 2011 (ECOSIT 3)\(^{16} \).

Different analyses may extent the previous baseline specification. The first one consists to go beyond average effects by exploring whether varying magnitudes of oil exploitation activity affect socioeconomic indicators differently. This analysis is important because all oil fields and wells have not the same return and thus are valued differently by citizens and investors in order to boost local economic growth. Then, the regression specification given in equation (1) changes.

\(^{15} \) Variables such as area (square kilometers) and the location of regional capitals (in each region, there is an administrative department that represents the regional capital). These control variables help to differentiate producing and non-producing departments. In general, producing departments tends to be larger than non-producing ones. However, an endogeneity issue appears since the size of a department may be correlated with potential unobserved district characteristics. That’s why the second variable could serve as instrument in order to control for it.

\(^{16} \) It is also possible to correct for differences in observed characteristics between producing and non-producing departments. Indeed, based on a matching procedure and using time invariant variables, as well as department characteristics in the ex-ante oil exploitation period (2003), we could estimate Probit regression to explain the probability that a household belongs to a specific comparison group (producing or non-producing department). From such regression, we could derive propensity score useful to match producing departments with various subsamples of non-producing departments of similar characteristics. In such a context, the confounders at departmental level in 2003 may be the percentage of households without access to basic needs (electricity and drinking water), the literacy rate, the school attendance rate, or the percentage of urban population. However, given our sample size, we are pessimist about the respect of Propensity Score Matching assumptions.
We substitute $I^{PD}_{rd}$ with the logarithmic form of the cumulated value of oil production in each department between 2005 and 2010. Similarly, we substitute $I^{NPDPR}_{rd}$ with the logarithmic form of the oil production in other departments of the corresponding region between the same periods.

Another extension of the comparison will not treat all non-producing departments in producing regions as equals, but will distinguish between first and higher order neighbors in order to treat such departments differently even when province fixed effects are introduced. This specification helps to refine the spatial analysis by considering the geographic proximity between departments, instead of administrative proximity determined by whether departments belong to the same region. Given the small number of departments, we could use a detailed map of the country to easily identify direct neighbors of producing departments, as well as their second and higher order neighbors. The second regression specification is given as follows:

$$y_{rd} = \alpha + \beta_0 I^{PD}_{rd} + \beta_1 I^{FirstNeighbor}_{rd} + \beta_2 X_{rd} + \nu_r + \epsilon_{rd} \quad (2)$$

Where $I^{FirstNeighbor}_{rd}$ is a dummy variable of 1 if a non-producing department shares a border with a producing department. Thus, the non-producing departments that are not first neighbors constitute the control group. This specification is useful in our context of a small size of the lowest administrative units (departments). Specifically, in addition to the opposition between administrative and geographic proximity, this specification helps addressing further potential omitted variable biases by focusing on departments that are more likely to be similar because they share borders (Loayza et al. 2013, p. 11).

The last comparison account for information about the amount of oil revenues that each department has received during 2005-2010 period. These data are provided by the CCSRP. This specification case aims to isolate the impact on socioeconomic outcomes of the oil revenues distribution policy from the direct effect of oil exploitation activity. In such a context, the following regression specification could be considered:

$$y_{rd} = \alpha + \beta_0 I^{PD}_{rd} + \beta_1 I^{NPDPR}_{rd} + \beta_2 \log(oil_{rd}) + \beta_3 X_{rd} + \nu_r + \epsilon_{rd} \quad (3)$$
Where \( oil_{rd} \) represents the government transfers related to oil revenue received by each department during the 2005-2010 period\(^{17}\). However, this variable could be endogenous due to its correlation with omitted variables such as political forces included in the region and department error terms and because oil revenue distribution policy does factor in socioeconomic indicators for the provincial and departmental allocations. To deal with this endogeneity issue, we will instrument the amount of oil revenues received by each department with the value of oil extracted in each department and region between 2005 and 2010. These data are made available within the annual reports of the Ministry of Finance and Budget.

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\(^{17}\) There is no risk to consider this form of logarithmic transformation since each department has at least received a government transfer related to oil revenue during the 2005-2010 period. If not, we will use the transformation \( \log(1 + oil_{rd}) \).


