No. 27-2017

Morten Endrikat

Natural resource rents, autocracy and the composition of government spending

Natural resource rents, autocracy and the composition of government spending

Morten Endrikat*

RWTH Aachen University

2017

Abstract

This paper empirically analyzes the influence of rents from natural resources on the composition of government spending and investigates whether the relationship differs between democracies and autocracies.

Both panel data and instrumental variable regressions suggest that there is a negative joint effect of autocracy and natural resource dependency on education spending. Moreover, there is slight evidence in the results of a positive joint effect on spending for social protection, while other components of government spending do not seem to be influenced. In particular, the results do not suggest that autocratic regimes in resource-dependent countries spend relatively more on military.

JEL classification: H50, Q32, Q38,

Keywords: Natural Resources, resource curse, institutions, government spending

---

*RWTH Aachen University, School of Business and Economics, Templergraben 64, 52056 Aachen, Germany. E-mail address: morten.endrikat@rwth-aachen.de.

1 Introduction

Starting with the early works of Sachs and Warner (1995), a vast field of research has dealt with phenomena of the so-called *resource curse*, which describes the empirical observation that countries highly dependent on income from natural resources often perform worse in terms of economic and political development compared to rather resource-poor countries.[1] One strand of this literature focusses on the optimal management of resource income especially in developing countries, mostly motivated by the inherent characteristics of these types of rents. Resource rents are, compared to rents in other economic sectors, highly volatile and therefore uncertain due to fluctuating resource prices. Moreover, the reserves of non-renewable resources are by nature limited and so is the time span over which countries receive rents from resource depletion. This raises the issue of saving some of the rents for future generations when the reserves have been fully depleted. Nowadays, several resource-rich countries try to account for the volatility and the limitation of resource rents by investing at least parts of the rents in *Stabilization Funds* or *Future Generations Funds*, which - although not pursuing the same investment strategy - have the common aim to protect the domestic economy from the harmful consequences of large resource rents. Well known examples for these funds are the *Norwegian Government Pension Fund*, the *Alaska Permanent Fund*, or the *State Oil Fund of Azerbaijan*. In practice, the constituted strategies of these funds might diverge from those established, especially when the fund is hardly independent from the government and when there is a strong link between its revenues and the government budget. As an example, in the first quarter of 2015, the *State Oil Fund of Azerbaijan* transferred about 96 percent of its revenues directly to the state budget, which points to its real assignment as a short-term stabilization fund rather than a long-term instrument of saving (SOFAZ, 2015).

This makes clear that even in the presence of a resource fund, the government is the one with power over the revenue streams in many cases, and it draws attention to the way in which governments spend the resource income as well as which circumstances influence the spending patterns. This paper tries to contribute to the existing literature by analyzing the joint effect of high resource rents and autocratic regimes on the composition of government spending.

Besides the question of how much of the rents to save for future generations, resource-abundant countries also face the challenge of spending the residual in a way that is as welfare enhancing as possible. While some types of public spending just raise the current consumption level, others, such as investment in human capital or infrastructure, may also enable future generations to profit from current resource rents via long-term economic growth.[2] Especially countries with

---

[1]See, among others, Frankel (2012) and van der Ploeg (2008) for a review of the literature.

[2]The accurate impact of government expenditure composition on growth seems to be still somehow unclear, but there is evidence of growth-enhancing potential from spending on education and infrastructure across several

a relatively short remaining period of resource extraction should be concerned with investing in alternative sources for future income and diversifying their domestic economy. Gelb (2010) argues that public spending types which improve the productivity of the non-resource sector and political institutions will make a country's economy more attractive for domestic and foreign investors. This helps a country to economically diversify and to impede negative effects of resource abundance. Although it seems quite intuitive that resource-rich countries should diversify their economy and build up capital stocks, both physical and human, many such nations appear to get poorer instead of richer in terms of the total nation's assets.

Figure 1 illustrates this empirical observation by plotting the average adjusted net savings of 139 countries from all different income classes over the period 1992-2010 against the share of natural resources in their GDP.[3] Notice that the savings data is the net national savings plus investment in education minus the depletion of natural resources. This measure captures not only the physical savings of a country but also takes into account that human capital and the reserves of natural resources are part of a nation's wealth. As can be seen, there is a negative correlation between a country's degree of resource dependence and the average savings rate. Although this finding is far from new,[4] it raises the question how this pattern can be explained. Figure 2 shows the same graph but separates the total country sample into democratic and autocratic regimes according to their average score of a measure for democratic accountability.[5] On average, for both groups the correlation stays negative, but it can be seen that the negative relationship is stronger for the autocratic countries than for the democratic ones.

In the literature, there are both studies focussing on resource abundance and resource dependence. While resource abundance simply focusses on the (per capita) endowment of a country with natural resources, the concept of resource dependency relates the rents from the extraction of these resources to the country's GDP to measure their economic importance. Although these terms are sometimes used interchangeably, studies with different concepts may yield different findings. Brunnschweiler and Bulte (2008) underline the importance in differentiating between resource abundance and resource dependence, since the first might even positively influence growth, while they do not find any effect of the latter. In this paper I will focus on resource dependence measured as the share of natural resource rents in GDP rather than resource abun-

---

studies. Nijkamp and Poot (2004) conclude in their meta-analysis of 93 empirical studies on the impact of fiscal policy on economic growth that public spending on education and infrastructure is an important factor for long-run economic development. This finding seems to be consistent with the results of more recent studies (Gemmell et al., 2016).

[3]Resource rents include rents from the extraction of oil, gas, minerals, and coal as well as rents from deforestation. Data is taken from the World Development Indicators of the Worldbank.

[4]See, for example, Van der Ploeg (2008).

[5]The data stems from the International Country Risk Guide provided by the PRS Group. For more details about the data, see section 3.
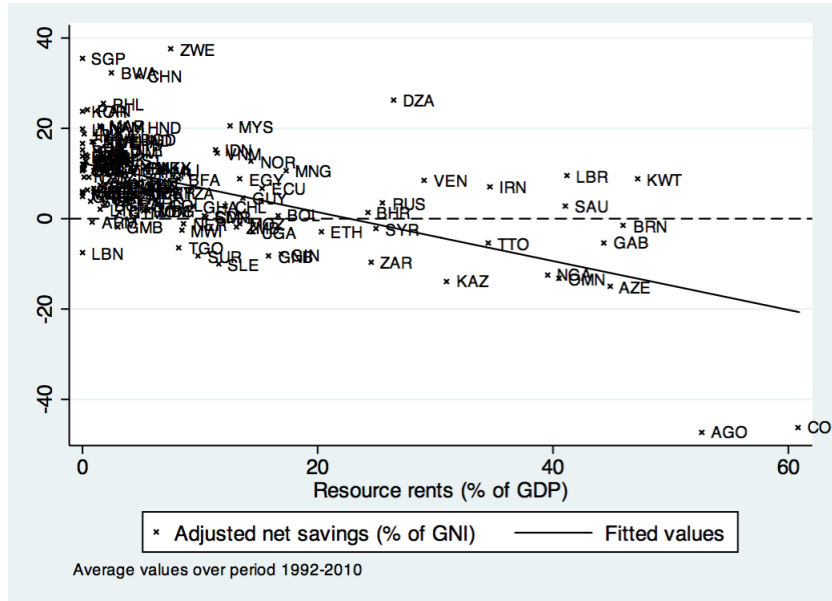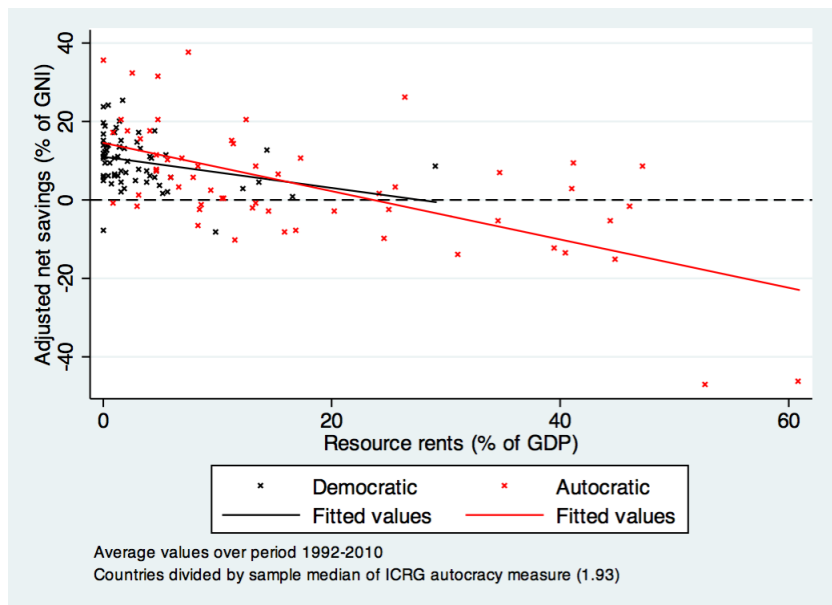
Figure 1: Resource rents and adjusted net savings

Adjusted net savings (% of GNI) ⓧ
Fitted values ——

Average values over period 1992-2010

Figure 2: Resource rents, adjusted net savings and autocracy

Democratic ⓧ   Autocratic ⓧ
Fitted values ——   Fitted values ——

Average values over period 1992-2010
Countries divided by sample median of ICRG autocracy measure (1.93)

dance. I argue that it is not the pure existence of natural resources that potentially influences fiscal policy, but the rents from them that actually flow into the government budget or that are at least about to flow in the near future.[6]

It is a common perception in the literature that being resource dependent makes a country more likely to be ruled by an autocrat or a ruling elite compared to resource-poor countries. This aspect of the "political resource curse" has been highlighted both theoretically and empirically to a great extent.[7] In this paper it is hypothesized that autocratic regimes have higher

---

[6]This argument might not be valid anymore if one looks at the influence of natural resources on institutional quality or on the likelihood of civil wars. In these cases, the pure existence of natural resources may encourage people to seek power.

[7]See, among others, Collier and Hoeffler (2005) and Ulfelder (2007).

incentives to spend money on rents for their political supporters rather than on sustainable investment compared to governments that have been elected in a democratic process.

In detail, I hypothesize that an autocrat spends, ceteris paribus, more on military defense and less on education compared to a democratic regime. An autocrat needs a strong military to prevent potential rioting by citizens. Moreover, members of the elite are often part of the military in autocratic countries, and allocation of public budget to this sector helps the autocrat to obtain their support.

Spending on education is able to promote the emergence of a middle class and might cause democratization tendencies among the citizens if better educated people are more likely to seek political participation.[8] An autocrat is by nature interested in preventing democratization movements.

The effect of autocracy on other types of public spending seems to be less clear. Concerning infrastructure spending, on the one hand, autocrats might tend to overspend if infrastructure projects are assigned to monopolistic companies and if these are owned by members of the elite. Infrastructure projects are often of high financial volumes and difficult to quantify, which makes them prone to rent-seeking. On the other hand, a good infrastructure, including telecommunication networks, enables citizens to organize themselves in groups, which is a catalyst for political protest. It does not seem to be clear which effect prevails, if, at all, the regime type has a direct influence on the level of public infrastructure spending. Spending on public healthcare and social security benefits mainly the poor citizens and is rather appropriate to maintain the support of this group than to distribute rents among the rich elite. This suggests that an autocrat tends to spend less on these purposes. Anyway, an autocrat might strive to prevent social riots by low income groups among the citizens by raising redistributional spending types. Again, which effect dominates does not seem to be clear following this argumentation.

Moreover, I assume that the presence of high rents from natural resources reinforces the above mentioned incentives of an autocrat concerning the allocation of public spending. Compared to government income generated by taxing the citizens, resource rents occur as a windfall and therefore may put less accountable pressure on those in power. Additionally, rents from natural resources differ substantially from inflows of foreign aid, which can also be characterized as a windfall, in the sense that foreign aid payments are often linked to requirements for a certain behaviour of the recipient's government. Alesina and Dollar (2000), for example, find

---

[8]The impact of a better educated society on democratization processes is not clear in detail. Especially, there is controversy over whether different levels (primary, secondary, tertiary) of education influence democratic tendencies differently. Anyway, the basic evidence that, in general, education equips citizens with the cognitive abilities to deal with political issues and with the socio-economic background to participate in political discourse seems to be consensus. See, among others, Hannum and Buchmann (2005) for a review of hypotheses about the impact of educational expansion on socio-economic development.

that within-country variation in foreign aid inflows can be partly explained as a reward for democratization.

A state that mainly generates its income by exploiting natural resources instead of taxing productive economic activities is known in the literature as a *rentier state*. Herb (2003, 2005) reviews the most important political and economic aspects of the *rentier state*. A government which does not need to tax the citizens, or just to a little extent, can ensure the provision of the citizens with goods and services without facing as much political pressure as a government in a system with taxes. One could argue that a regime that does not pay out the income from natural resources to the citizens faces the same political accountability as a regime taxing its citizens, but this does not seem plausible for at least two reasons.[9] First, it is difficult for an individual citizen to calculate the actual per capita amount of the natural resource rents, whilst her individual amount of (direct) taxes payed is much more apparent. Therefore, it seems unlikely that the average citizen knows about the share of resource rents that would account to her if the resource rents were directly distributed among the citizens. Second, according to Prospect Theory, a loss from tax payments is likely to be overstated compared to a foregone profit of the same amount.[10] These arguments suggest that high rents from natural resources partly release the regime from internal political accountability, which is not the case if the state budget is mainly generated from taxes.

While there are arguments in the literature - although far from uncontroversial - that rising income in general increases the possibility of democratic structures evolving, it remains unclear as to whether this holds true for all sources of income.[11] Following the aforementioned arguments, it seems plausible to assume that the composition of government spending not only depends on a country's political system, but also on the question of whether government revenue stems mainly from taxation or from windfalls. An autocrat in a *rentier state* is assumed to spend more on the distribution of rents among the elite and less on public goods and redistribution among the normal population than an autocrat relying on taxes.

2   Related Literature and Theory

The first field of research that this study is related to deals with the impact of government spending and especially its composition on long-run economic growth. Based on endogenous growth models, a broad range of empirical studies tries to analyze the growth-enhancing potential of several subcomponents of government spending. In an early empirical cross-country

---

[9]The *Alaska Permanent Fund* for example pays a yearly dividend to each resident of the State of Alaska, who fulfills certain requirements.

[10]See Kahneman and Tversky (1979) for the basic assumptions of Prospect Theory.

[11]The theory of social and economic requirements for democracy goes back to Lipset (1959).

study, Barro (1991) finds significantly positive effects of the initial stock of human capital on the growth rate. Moreover, his results suggest that government consumption is negatively related to economic growth, whereby he treats spending for education and defense not as government consumption but as investment. Even if Barro does not explicitly test different catageories of public expenditure with regard to their influence on economic growth, his results nevertheless give a first hint of potential mechanisms. Especially, they give rise to the assumption that government spending on education might lead to economic growth. Gemmell et al. (2016) find that a reallocation of public spending towards education and infrastructure may foster long-term economic growth in OECD countries, while high rates of spending on social welfare rather weaken it. Investigating the same research question using a sample of 44 developing countries and a dynamic GMM model, Yu et al. (2009) find that different types of government expenditure impact economic growth differently and that the effects vary over different regions. Their results indicate that public investment in human capital fosters economic growth in Africa and Asia, while for Latin American countries the authors do not identify any significant growth potential from different types of public expenditure. These observations underline the importance of the way governments deal with their monetary resources and raise the question of whether this is influenced by natural resource dependency. As described above, rents from natural resources may put less accountable pressure on the government compared to tax revenues and therefore may shift government expenditure away from growth-enhancing investments toward the distribution of rents. If the type of political regime in combination with resource dependency distorts the composition of government spending and if this has in fact an influence on a country's economic performance, this would be an additional explanation for why some resource-rich nations perform well, while many others seem to fail.

Another important aspect of the growth literature is the potential relationship between democracy, or more generally the quality of institutions, and economic performance. Hausken et al. (2004) provide a theoretical foundation for an inverse U-shape relation between the level of democracy and economic performance. In their model, the total population consists of an elite and the general population. The regime chooses a combination of paying rents and providing public goods in order to maximize the likelihood of staying in power. While the rents are only paid to the elite, only the general population benefits from the provision of public goods. Moreover, public goods are argued to have a potential growth-enhancing effect. Once a country moves from a full autocracy to a partial democracy, providing public goods will become more important from the elite's point of view compared to the initial situation. The regime decreases the amount of rents they pay and increases the spending on public goods. The increased provision of public goods might also have a positive effect on the economic performances. If the

country moves further toward full democracy, the government has an even higher incentive to expand the public sector, since the support of the general population becomes more and more important for the regime's staying in power. Once the provision of public goods exceeds a certain threshold, private investment might be crowded out, which depresses economic growth. Moreover, the authors also find support for their hypothesis that government spending is more efficient in democracies than in autocracies, although they do not explicitly use different types of government spending in their analysis.

While this first strand of the literature is rather motivational for this work, the paper is more closely related to research on the influence of democracy on the level of and efficiency of government spending. Differences in government spending patterns between different regime types may be due to different motivations of democratic and autocratic rulers regarding the redistribution of income and power.

Profeta et al. (2013) empirically tackle the question of whether democracy has an impact on taxation and on public spending and its composition. In their study, they use a combination of the Polity2 autocracy variable and the Freedom House indicator for civil liberties to measure democracy. Using panel regressions on a dataset of developing countries from the European Union, Latin America, and South-East Asia over the period 1990-2005, they find an inverse U-shape relationship between democracy and the public expenditure for defense. They conclude that after a certain degree of democracy, citizens exercise more control over the military budget, which leads to a decrease in defense spending.

In a very recent study, Kotera and Okada (2015) use a difference-in-difference estimation strategy and annual data from 1972-2010 for 125 countries to identify the influence of democratization processes on the level and the composition of government spending. They classify countries that have faced, according to the authors' definition, a transition to a democratic regime, as the treatment group, while countries without this transition process and those which have been democratic over the whole period are classified as the control group. The authors do not find a significant effect of democratization on the level of public expenditure, but do find one on the composition of it. According to their results, democratization significantly increases education and healthcare spending, while it significantly reduces military expenditure.

Moreover, this paper adds to several strands of the resource curse literature and theories about the influence of democracy on fiscal policy. First, there is a broad amount of work on the role of institutions in the question of whether high resource rents have positive or negative impacts on the economic development of affected countries. While Sachs and Warner (1995) find little evidence that the quality of institutions determines whether countries profit or suffer from natural resource wealth, Mehlum et al. (2006) claim that institutions are decisive in the context

of the resource curse. Their results are somewhat consistent with the findings of Mauro (1996) that bad institutions in the form of high levels of corruption, do have a negative impact on economic growth. One of the main arguments is that corruption - and perhaps other aspects of low quality institutions - have an adverse effect on the composition of government spending. This can, under the assumption that some types of government spending are more beneficial than others, lead to lower growth rates in countries with poor institutions. In addition to the potential moderator effect of institutional quality on economic growth in the natural resource literature, there are also many studies on the effect of resource abundance or dependence on institutions themselves. Among others, Bulte et al. (2005) and Sala-i-Martin and Subramanian (2003) conclude in their studies that natural resources and especially oil and minerals have negative effects on institutional quality, which is therefore identified as one of the main channels for the resource curse. When it comes to certain aspects of institutions, in many papers it is the level of democracy and the degree of corruption that are said to be adversely influenced by windfall rents. Leite and Weidmann (1999) show both theoretically and empirically that the abundance of natural resources enhances corruption, as it makes rent-seeking more profitable. This result holds true especially for resources whose exploitation is capital-intensive, rather than for, as an example, agricultural goods. Ross (2001) empirically shows that oil-rich nations are less likely to be democratic than others and that this finding is not only restricted to certain areas such as the Middle East, but also holds true for countries in other parts of the world. As potential arguments for this negative relation he mentions the possibility of governments for a) high public spending despite low tax rates - the so called *rentier effect* - and b) setting up instruments to impede national pursuit of democracy, which he calls a *repression effect*. This argument is consistent with the results of Ulfelder (2007), who finds that autocratic regimes are more likely to survive in countries with huge wealth of natural resources.

Sarr and Wick (2010) show in their model in the form of a Stackelberg game that the effect of high resource rents on the provision of public goods depends on the ability of a government to appropriate these rents. They conclude that powerful governments have, in the presence of a rather unproductive non-resource sector, less incentive to provide public goods than less powerful ones have. They test their theoretical findings empirically by using seemingly unrelated regressions and data on several measures for the stock of public goods, both physical and non-physical, resource dependence and government power measured as the relative strength of the military forces. Their empirical findings support the assumption that in the presence of high resource rents, powerful governments tend to underinvest in public goods compared to less powerful ones. Moreover, they find significantly positive direct effects of resource rents on many of their public goods variables. These findings are just partially in line with those

of Bhattacharyya and Collier (2014), who empirically show that high resource rents tend to decrease the stock of public capital, but that this effect is less severe in democratic countries compared to autocratic ones. Anyway, contrary to Sarr and Wick (2010), they find a significant negative direct effect of resource rents on the provision of public goods. Both of these mentioned papers use outcome variables, e.g. the stock of particular types of public capital, rather than variables measuring the direct effort of governments to change these stocks such as information on government spending.

The literature that this paper has the closest link to is a series of empirical papers by Cockx and Francken (2014, 2015a, 2015b). In these papers, the authors investigate the effect of natural resource wealth on the level of government spending for education and healthcare. Although their main interest lies in a potential direct effect, they also take into account institutional aspects and their interaction with resource abundance/dependence. In Cockx and Francken (2015a) the authors empirically investigate potential distorting effects of both resource abundance and resource dependence on the level of public spending on education. They use panel data for 140 countries from all income classes over the period 1995 to 2009 and find a robust and significant negative effect of resource dependence on educational spending as a share of GDP. Moreover, they find that government accountability, measured as the degree of executive constraints, potentially mitigates this effect. Their results are robust for different measures of resource dependency, different sets of control variables, and different estimation strategies.

Using the same data in a second paper, Cockx and Francken (2014) find an inverse relationship between resource abundance and dependence on public spending in the health sector. Again, they find a positive and significant effect of government accountability on public health spending, but no hints of a conditional effect.

The main shortcoming of the papers by Cockx and Francken is that they do not take into account potential endogeneity, either of their institutional variables or of their control variables. In particular, in both papers about education and health spending they treat GDP per capita as exogenous in their regressions, which seems problematic, since education and health are both supposed to influence economic growth (Barro, 2001). If this holds true, GDP per capita should not be treated as an exogenous regressor in regressions on public spending types. Additionally, one could also question whether government accountability can be treated as exogenous, especially when looking at education spending. Better educated people may be more likely to participate in political actions and hence put more pressure on the regime. If this is the case, then any political variables should be treated as endogenous.[12]

---

[12]One famous example of democratization efforts in recent past is the movement of the so-called Arab Spring that began at the end of 2010 in several Arab countries. Campante and Chor (2012) argue that during the years before the protests started, the share of well educated people among the young increased but that the

In countries highly dependent on natural resource rents, the government often faces fluctuations in the state budget which may lead to fluctuations in total government spending. If, in times of falling resource prices, the cut down in total government spending is different from the decrease of total GDP, potential changes in spending types relative to GDP do not say anything about the government's priorities. Therefore it seems more plausible to use the share of the spending types in total government spending, as Cockx and Francken partly do in their robustness checks.

With this paper, I add to the papers of Cockx and Francken by tackling potential endogeneity problems and investigating further types of government spending.

Given the results of the mentioned strands from the literature, the main hypothesis of this paper states that there is a joint effect of the democracy status and the degree of resource dependency on the composition of government spending. Since the direction of this distortion cannot be clearly predicted from the literature for all spending types, this paper deals with this issue empirically.

3 Data

3.1 Data Description

The data on the sectoral composition of government spending stems from the *Statistics of Public Expenditure for Economic Development database (SPEED)* published by the International Food Policy Research Institute (IFPRI). The database contains information about the public expenditure of 147 countries decomposed into eight subcategories, namely agriculture, education, health, defense, social protection, mining, transport, and communication. The database covers the period 1980-2011.[13] In my analysis, I use five of these eight subcomponents, whereby I sum together the expenditures on transport and communication into an aggregated infrastructure spending variable. In particular, I use information about spending on infrastructure, education, military defense, social protection, and healthcare.

To capture the degree of autocracy in the countries of the sample, two alternative measures from two different sources are used in this paper. The first indicator is the measure of democratic accountability from the *International Country Risk Guide (ICRG) dataset* constructed by the PRS Group, a commercial organisation dealing with country risk forecasting. The dataset covers 145 countries in total and the time period 1984-2014. The ICRG democratic accountability

---

absorptive capacity of the job market did not keep up with that. This led to high unemployment rates among the youth with secondary or higher education, which was one trigger of the revolution.

[13]The data is very incomplete for the year 2011, which is why the sample is limited up to the year 2010. For more details, see IFPRI (2015).

indicator originally ranges from 0 to 6, with the highest score indicating an alternating democracy and the lowest score indicating a pure autarchy.[14] I invert the scores such that a higher value indicates a higher degree of autocracy.

As an alternative indicator for the degree of autocracy I use the Polity2 variable from the *PolityIV database* issued by the Center for Systemic Peace. Originally, the score ranges between -10 and 10 with a higher value indicating a more democratic environment.[15] Again, the values are inverted leading to higher values for more autocratic regimes. Any other data about country risk dimensions, in particular I use the intensity of external military conflicts that a country is involved in, is also taken from the ICRG dataset and inverted the same way as the autocracy measures.

To measure the degree of resource dependency, I use the share of total natural resource rents in total GDP provided by the Worldbank in their *World Development Indicators (WDI)* as mentioned above.[16]

At this point, it is worth noticing that in the literature, there are several different variables used to measure the degree of resource dependency and that there is also a distinction between a country being resource dependent and being resource abundant. Especially when it comes to measuring the effect of natural resources on economic growth, it seems to be important to take this difference into account. Sachs and Warner (1995) already highlighted that different measures of resource abundance/dependency may lead to different econometric results, some of them being biased. This could be the case if there are omitted factors, such as geography, that lead to slower growth in non-resource sectors and therefore higher shares of natural resources in GDP. Therefore, they control for variables such as initial growth rates and geographical factors in their analysis and find that even with these control variables their results do not change basically. Since the current paper does not look at the direct effect of natural resource rents on growth, but on the composition of government spending, it seems to be plausible to use a measure of resource dependency rather than resource abundance. I argue that those resources that have already been transformed to rents, have a stronger influence on government spending decisions and aspects, such as rent-seeking, compared to resources, only the existence of which is known so far. For that reason, using a measure of abundance, such as the per capita resource reserves does not seem to be appropriate.[17] Moreover, if one looks at incentives of different

---

[14]The PRS Group defines the question of whether the leader is subject to regular electoral competition as the main criterion (PRS, 2014).

[15]For more details, see Marshall et al. (2013).

[16]Total natural resource rents is the sum of all rents from oil, natural gas, coal, minerals and timber. One could also think about excluding the rents from timber, since forest area is renewable to some extent by reforestation unlike subsoil assets. Anyway, since reforestation, especially of primary forest, takes several decades, forest area can be considered as nonrenewable within the time horizon of one generation.

[17]Ramsay (2011) finds in his analysis of the relationship between oil income and democracy that it is mainly rents from oil rather than the wealth of it that cause the negative effect on a country's institutions. Although it

income sources for governments, the degree of resource dependency seems to be a good proxy for the share of windfall rents in total government income. The higher the share of resource rents in total GDP, the smaller the portion of other taxable economic activities.

The data on real GDP per capita as well as geographical and demographical control variables, e.g. settlement structure and age distribution of the population, are taken from the *WDI database*. From the same database, I obtain the information about the structural composition of a country's economy, e.g. the share of the service sector in total GDP[18] and data on net financial aid inflows. Originally, the aid flows are expressed in real US dollars, but I calculate them as real per capita aid relative to real per capita GDP, to capture a country's dependency on development assistance.

Information about the share of each country's population professing the different main religions is taken from the dataset of the *World Religion Project* published by the Correlates of War Project. The data is available for every fifth year, so I use a linear interpolation to fill the missing years.[19] Data on gross government debt is taken from the *World Economic Outlook Databases* by the IMF.

In addition to simple cross-country and panel regressions, I also use instrumental variable regressions to account for potential endogeneity of the autocracy variables as well as the GDP measure. As instruments for the logarithmized real GDP per capita, I use a set of geographical indicators. In particular, these variables are: the absolute latitude of the country and its squared value, whereby I linearly rescale the latitude, such that it theoretically ranges from 0 to 180 (South to North); regional dummies for each country[20]; and the length of a country's coastline relative to its total border length. All the geographical data is taken from the *Worldbank GDN Database 2001* besides the information about the length of the different border types, which stems from the *CIA World Factbook*.

As instruments for the autocracy measures, I use the mortality rate of settlers during the colonial era reported in annualized deaths per 1000 soldiers, as in Acemoglu et al. (2001). The authors show that this measure is a valid instrument for institutional variables that lack exo-

---

is not clear whether this holds true for natural resources in general and for their effect on government spending decisions, this gives another reason to focus on resource rents rather than resource wealth. On the contrary, as Tsui (2011) sums from the literature, it is total national wealth of a certain resource (in his case, oil) that rulers seek, which is especially plausible when they have a long planning horizon. Nevertheless, I assume that current rather than potential future government income (and its source) matters for fiscal policy decisions.

[18]Services include the total value added in the ISIC divisions 50-99.

[19]For more information, see Maoz and Henderson (2013).

[20]The regional dummies are in detail: EAP (East Asia and Pacific), EECA (Eastern Europe and Central Asia), MENA (Middle East and North Africa), SA (South America), NA (North America and Canada), SSA (Sub-Saharan Africa), LAC (Latin America and Caribbean). The default is Western Europe.

geneity.[21]

For the empirical investigation, I limit my sample to the period 1992-2010 due to the break-down of the former Soviet Union at the beginning of the 1990s and the resulting emergence of new resource-rich states. Restrictions of data availability, especially of the institutional and the government spending variables, result in a dataset with 139 countries and a total time period from 1992 until 2010.[22]

3.2 Descriptive Statistics

Before I proceed with the results of my regression analyses, I first present some descriptive statistics about the main variables of interest (see table 1). The dependent variables in the regression analyses are the shares of different spending types in total government spending. The components are: spending for communication and transport infrastructure (INFRA), educational spending (EDUC), defense spending (DEFENSE), spending for social protection (SOCIAL), and healthcare spending (HEALTH). RENTS is the share of total natural resource rents in GDP, DEMACC is the ICRG autocracy indicator and AUTOC is the autocracy measure provided by the PolityIV database.

The different panels in figure 3 show simple correlations of the several government spending components and the degree of resource abundance using average values over the sample period. In each scatter plot, countries are categorized as democratic and autocratic ones using the sample median of the *ICRG* autocracy measure as a threshold.[23] As can be seen, the plots give a first hint that there might be a joint effect of resource abundance and autocracy on

---

[21]The data is by definition only available for former colonies. See Acemoglu et al. (2001) for a detailed description of the data.

[22]List of countries:
Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Belarus, Belgium, Bolivia, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Cameroon, Canada, Chile, China, Colombia, Dem. Rep. Congo, Rep. Congo, Costa Rica, Cote d'Ivoire, Croatia, Cuba, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Finland, France, Gabon, Gambia, Germany, Ghana, Greece, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea South, Kuwait, Latvia, Lebanon, Liberia, Libya, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Mali, Malta, Mexico, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Netherlands, New Caledonia, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russia, Saudi Arabia, Senegal, Serbia, Sierra Leone, Singapore, Slovak Republic, Slovenia, Somalia, South Africa, Spain, Sri Lanka, Sudan, Suriname, Sweden, Switzerland, Syrian Arab Republic, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.
Notice that the actual number of countries entering the regression varies with the particular specifications.

[23]The median value is 1.93.

Table 1: Descriptive Statistics

	Obs.	Mean	Std. Dev.	Min	Max
INFRA	1711	5.32	3.93	0.00	26.54
EDUC	1845	13.00	6.39	0.17	42.83
DEFENSE	1763	8.97	8.68	0.03	78.37
SOCIAL	1837	17.02	14.83	0.00	54.65
HEALTH	1829	7.99	4.74	0.03	31.64
RENTS	2571	10.47	14.85	0.00	78.61
DEMACC	2549	2.13	1.68	0.00	6.00
AUTOC	2491	-3.76	6.43	-10.00	10.00

$N = 139$ countries, $T = 19$ (1992-2010)

the composition of government spending. Whereas for some components, such as defense spending, there does not seem to be a difference between democratic and autocratic countries, for others like education and social spending, the data suggests a distorting effect of autocracy. Additionally, the data reveals a potential positive relationship between resource abundance and the degree of autocracy, a fact that has been highly discussed in the literature.[24] This potential multicollinearity of the resource abundance measure and the autocracy indicator might be severe due to the inclusion of interaction terms into the regressions. To mitigate the multicollinearity issue and to avoid biased $p-$values, I will center both variables by substracting their sample mean from each individual observation when running the regressions. Centering the variables also facilitates the interpretation of the econometric results. Since I use the averages of all variables for the period 1992-2010 to conduct simple cross-country OLS regressions in a first step, table 2 summarizes the descriptive statistics of the averaged values for the main variables of interest.

---

[24]See, among others, Ross (2001).

Table 2: Descriptive Statistics - Variable means

	Obs.	Mean	Std. Dev.	Min	Max
INFRA	110	5.06	32.98	0.15	16.62
EDUC	112	12.97	5.77	1.11	33.13
DEFENSE	109	9.26	9.21	0.09	77.57
SOCIAL	112	15.98	13.85	0.10	50.59
HEALTH	112	7.64	4.09	0.41	18.84
RENTS	137	10.67	14.25	0.00	60.91
DEMACC	139	2.13	1.50	0.00	5.60
AUTOC	133	-3.78	6.08	-10.00	10.00

$N = 139$ countries, $T = 1$ (average over period 1992-2010)

Figure 3: Autocracy, resource rents and composition of government spending
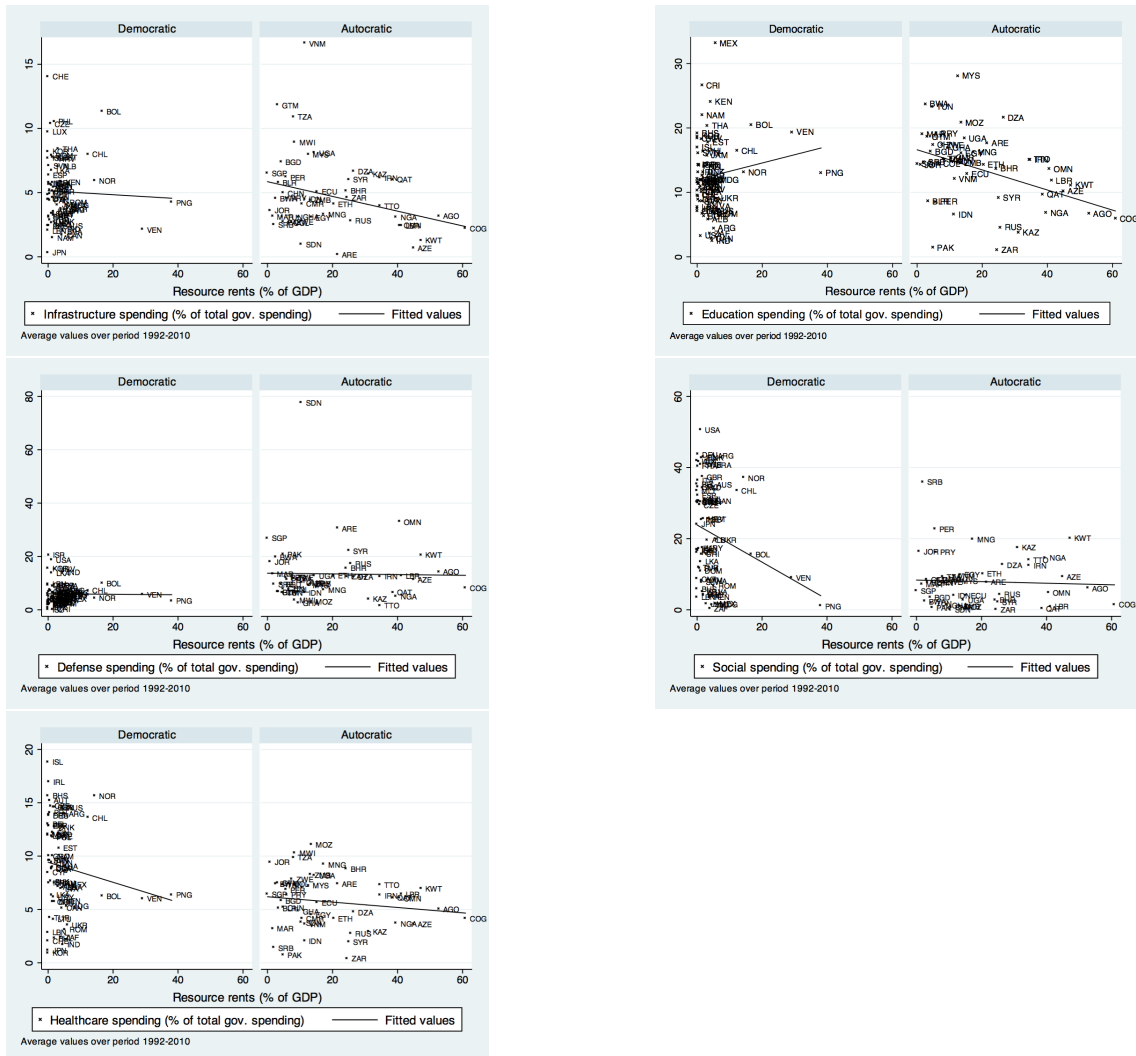
The descriptive statistics that are presented in this chapter give rise to the assumption that there is a joint effect of resource abundance and weak institutions in the form of lower levels

of democracy on the composition of government expenditure. If this relationship holds true, it could serve as an additional explanation of why in some countries natural resource wealth promotes economic development while others become "failed states" and seem to get poorer over time. Especially public spending on education and infrastructure might serve as an investment in future prosperity, while excessive social protection or public employment may hinder growth rather than foster it.[25]

4 Empirical Findings

In this section I analyze the potential interaction effect between the level of resource rents and the degree of autocracy on the composition of government expenditure.

First, I use averages of all variables over the period 1992-2010, to estimate a cross-country model of the form:

$$SHARE_i = \beta_0 + \beta_1 RENTS_i + \beta_2 AUT_i + \beta_3 (RENTS \cdot AUT)_i + \boldsymbol{\beta'} \cdot \boldsymbol{C_i} + \epsilon_i, \tag{1}$$

where SHARE is the share of a particular type of government spending in total government spending, RENTS is the share of natural resource rents in GDP, AUT is either of the two measures for autocracy, and $\mathbf{C}$ is a vector of control variables. Notice that the set of control variables slightly varies across the specifications of the different spending types according to the economic reasoning behind them. To account for this and the fact that the error terms might be correlated across the equations, I will use seemingly unrelated regressions (SUR), which are supposed to be more efficient compared to a set of independent OLS regressions. Moreover, i is the country index and ϵ is the error term. The main focus lies on the estimation results for β_3, the coefficient of the interaction term between the resource abundance measure and the autocracy indicator.

Cross-country SUR regressions

Table 3 shows the results of the cross-country SUR regressions for each of the five spending variables, whereby in the first five columns the ICRG and in the latter ones the PolityIV autocracy measure is used, respectively. In this first step, I introduce only the variables of main interest, without any additional controls.[26] As can be seen, the interaction term between resource dependence and level of autocracy is significant in about half of the equations. Es-

---

[25]See Hausken et al. (2004).

[26]Notice that in this case, where all regressors are the same across the five different specifications, the results are the same as in the case of independent OLS regressions.

pecially in the case of spending on education and social protection, there seems to be a joint effect of the two variables. In resource-dependent countries, education spending seems to be lower with autocratic regimes than with democratic ones, while spending on social protection seems to be higher in autocratic regimes with high resource rents.

Table 3: Results of the cross-country SUR regressions

	ICRG autocracy measure					PolityIV autocracy measure				
	(1) INFRA	(2) EDUC	(3) DEFENSE	(4) SOCIAL	(5) HEALTH	(6) INFRA	(7) EDUC	(8) DEFENSE	(9) SOCIAL	(10) HEALTH
RENTS	-0.0356 (-1.33)	0.00190 (0.03)	-0.0877 (-1.03)	-0.134 (-1.20)	-0.0187 (-0.51)	-0.0352 (-1.36)	-0.0381 (-0.67)	-0.0975 (-1.23)	-0.242** (-2.14)	-0.0528 (-1.48)
AUTOCRACY	-0.0454 (-0.20)	0.300 (0.59)	3.537*** (4.82)	-5.643*** (-5.85)	-1.444*** (-4.52)	-0.00683 (-0.13)	0.236** (2.04)	0.910*** (5.65)	-1.203*** (-5.26)	-0.232*** (-3.21)
RENTS∗AUTOCRACY	-0.00626 (-0.34)	-0.111*** (-2.75)	0.0435 (0.75)	0.173** (2.27)	0.0156 (0.61)	-0.00148 (-0.42)	-0.0171** (-2.21)	0.000159 (0.01)	0.0507*** (3.31)	0.00798 (1.65)
Countries	106	106	106	106	106	103	103	103	103	103
Observ.	106	106	106	106	106	103	103	103	103	103
R^2	0.049	0.097	0.221	0.417	0.269	0.051	0.088	0.267	0.361	0.184

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

In the next step, I control for different factors that may potentially influence the composition of government spending. The log of real GDP per capita (LOGGDP) is included to control for different levels of income, which may, according to Wagner's Law, influence a government's expenditure decisions.[27] The level of GDP per capita may also serve as a proxy for a country's capital stock and therefore the return on investments.

Additionally, I control for the gross government debt relative to the GDP (GOVDEBT), since it is possible that the indebtedness of a government may influence the decisions about government spending away from long-term investments in favor of rather short-term projects. In order to account for the importance of military services due to armed conflicts a country is involved in, I use the ICRG measure for external military conflicts (EXTCONF). It is assumed that a higher degree of military activity leads to more government expenditure related to purposes of defense, since countries engaged in military disputes face higher demands for military services. To take into account a potential influence of a society's demography on public spending decisions, I also include the share of young people (0 - 14 years) (YOUNG) to account for the fact that especially education spending should increase with the share of population at school age. Respectively, the variable OLD captures the share of population older than 65. It seems plausible to assume that an increasing share of retired people raises the need for spending on social protection. The share of the population living in rural areas (RURPOP) enters the regressions, since people in rural areas are less likely to be employed in high-tech sectors and also less likely to enjoy higher education. This might result especially in lower spending on education. In order to make sure that potential differences in government spending are not driven by religious aspects of different regions, I also control for the share of the population professing the Islamic religion (MUSLIMS). I use the share of people belonging to any stream of Islam instead of differentiating between certain streams. It might be that a country's main religion influences the composition of the government spending due to different cultural aspects across religions, such as the role of education or the status of families within the society. The variable AID captures the net inflows of financial aid and development assistance relative to a country's real GDP. I treat values for high-income countries, originally reported as missing, as zero, as well as negative values. Negative values arise when the amount of repayments for old loans exceeds the new inflows in that period.[28] Many official aid programs are conditional on the recipient's government and its commitment to a sustainable fiscal policy, wherefore higher dependency on financial aid might shift public spending away from certain sectors in favor of others.

---

[27]Notice that this variable is very likely to be endogenous, a fact that is addressed in the IV regressions.

[28]I treat negative values as zero, since I am only interested in the effects that a potential dependency on international aid might have on a country's fiscal policy.

Table 4 sums the results of the cross-country SUR regressions including a set of control variables for each equation. Notice that the set of explanatory variables varies among the equations depending on the variable to be explained, since different spending types are supposed to be influenced by different regressors. The coefficients of the interaction term lose their significance in each equation for both measures of autocracy, besides the second one where the share of education spending is the dependent variable. The negative coefficient of the interaction term confirms the first impression that a highly resource dependent and highly autocratic regime tends to spend less on education than a democratic regime with high rents from natural resources. The interaction term in the equation for social spending is still positive with the full subset of covariates but far from significant.

Moreover, most of the control variables have the expected sign. A higher share of young people in the total population seems to lead to higher spending on education, while a higher share of elderly people causes increased spending on social protection. Higher dependency on external aid seems to be correlated with relatively higher spending on infrastructure, social protection, and healthcare, a finding that is consistent with economic reasoning. Anyway, it is not clear whether this effect is causal, since it seems also plausible that aid for developing countries is conditional on a sustainable government spending path. With a similar reasoning on reverse causality, one can question whether the significant coefficients of GDP in many of the equations really stem from causality or rather from correlation.

Table 4: Results of the cross-country SUR regressions with two alternative autocracy measures and further controls

	ICRG autocracy measure					PolityIV autocracy measure				
	(1) INFRA	(2) EDUC	(3) DEFENSE	(4) SOCIAL	(5) HEALTH	(6) INFRA	(7) EDUC	(8) DEFENSE	(9) SOCIAL	(10) HEALTH
RENTS	-0.0682** (-1.98)	-0.163** (-2.25)	-0.0623 (-0.77)	0.0371 (0.36)	-0.0272 (-0.77)	-0.0563 (-1.59)	-0.200*** (-2.68)	-0.0893 (-1.07)	0.0262 (0.25)	-0.0233 (-0.68)
AUTOCRACY	-0.264 (-0.99)	-0.0986 (-0.16)	3.615*** (4.16)	-2.197** (-2.04)	-0.409 (-1.16)	-0.0584 (-1.03)	0.135 (0.91)	0.948*** (4.51)	-0.483* (-1.96)	-0.0654 (-0.91)
RENTS∗AUTOCRACY	0.0101 (0.52)	-0.0937** (-2.31)	-0.0220 (-0.37)	0.0319 (0.44)	-0.0113 (-0.46)	0.00104 (0.26)	-0.0159* (-1.84)	-0.00187 (-0.15)	0.00490 (0.33)	-0.00109 (-0.22)
LOGGDP	0.106 (0.30)	2.964*** (3.73)	1.782** (2.54)	2.894** (2.37)	1.913*** (5.39)	0.112 (0.34)	3.027*** (3.85)	1.149* (1.74)	3.858*** (3.38)	1.767*** (5.24)
GOVDEBT	-0.0233*** (-3.15)	-0.0444*** (-2.85)	0.0513** (2.25)	-0.00538 (-0.20)	-0.0222** (-2.38)	-0.0239*** (-3.21)	-0.0445*** (-2.80)	0.0540** (2.37)	-0.00816 (-0.30)	-0.0223** (-2.47)
RURPOP	0.0121 (0.66)	0.0181 (0.48)		-0.0628 (-1.03)		0.0136 (0.72)	0.00908 (0.23)		-0.0736 (-1.26)	
AID	13.47** (1.99)	5.551 (0.38)		44.35* (1.75)	37.40*** (4.43)	13.50** (1.99)	4.765 (0.32)		56.26** (2.26)	36.73*** (4.56)
SERVICES	-0.0357 (-0.86)	-0.176** (-2.14)				-0.0193 (-0.43)	-0.200** (-2.24)			
YOUNG		0.417*** (4.65)					0.417*** (4.55)			
MUSLIMS		1.924 (1.12)	3.949 (1.53)	1.281 (0.43)			1.012 (0.50)	0.545 (0.18)	1.883 (0.59)	
EXTCONF			2.220*** (2.67)					1.996** (2.37)		
OLD				1.024*** (3.68)	0.0302 (0.32)				0.934*** (3.39)	0.0826 (0.90)
Countries	98	98	98	98	98	95	95	95	95	95
Observ.	98	98	98	98	98	95	95	95	95	95
R^2	0.207	0.330	0.402	0.609	0.488	0.210	0.318	0.410	0.620	0.468

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Potential endogeneity problem

The main shortcoming of the above empirical model is the possibility of some of the regressors being endogenous.

Part of the main motivation for looking at the composition of government spending is that this might influence the social and economic development of a country. If this is the case, it is obvious that different types of public spending can have different effects on economic growth. This leads to potential endogeneity of the GDP measure in the regressions due to reverse causality and raises the need for instrumental variable regressions to mitigate this problem.

As a first instrument for a country's GDP per capita, I use the absolute latitude of a country and its squared value, whereby the data is rescaled such that 0 stands for the South Pole and 180 for the North Pole. I argue that countries located in the northern hemisphere are closer to potential trade partners, since nearly 90 percent of the world's population lives in that part of the world.[29] Anyway, in the very northern part of the northern hemisphere very few people are settled, wherefore I assume a quadratic relationship between latitude and economic prosperity. To take into account that not only the latitude infuences the distance of a country to major markets, I also use regional dummies in my first-stage regressions[30]. The argument behind this is that countries might profit economically from prospering markets located in their geographical region, although one of course observes huge differences between levels of income even within one continent.

My second instrument for a country's GDP is the length of its coastline relative to its total border length. The variable ranges between zero and one, with zero meaning the country is landlocked. I prefer using this continous measure over just using a landlocked dummy, since it contains more detailed information about a country's access to maritime transportation. I assume that countries with a better access to maritime transportation have, all else equal, greater trade potential and therefore higher GDP rates.[31] Both a country's latitude and its coastline are exogenous by nature and can be assumed to not have a direct impact on the composition of government spending.[32] Therefore, I assume that both are valid instruments for real GDP per capita.

---

[29]See http://www.radicalcartography.net/index.html?histpop (17.08.2015).

[30]I distinguish between countries from East Asia and Pacific, Eastern Europe and Central Asia, Middle East and North Africa, South Asia, Western Europe, North America, Sub Saharan Africa and Latin America, according to the *GDN database* of the Worldbank (2001).

[31]According to the International Chamber of Shipping, around 90 % of the world's total traded goods are seaborne. See www.ics-shipping.org/shipping-facts/shipping-and-world-trade (17.08.2015).

[32]At this point one could argue that the borders of a country are not completely exogenous and neither is its coastline, since borders are defined by humans as a result of past settlement processes and in many cases armed conflicts. Nevertheless, it seems plausible to assume that there are no factors that influence both the length of a country's coastline and that country's public spending pattern.

Since I assume that not only GDP is potentially endogenous in my specification, but also the institutional variables, I additionally instrument them in the regressions. It seems plausible to suppose an influence of the public spending pattern on institutional quality. First, better educated citizens are more likely to put political pressure on a regime, no matter whether this is democratic or autocratic. Putting pressure on a regime might also be promoted by a better infrastructure, especially telecommunication infrastructure, since demonstrations and riots need to be organized, which gets easier the more people have access to modern communication systems. Additionally, a strong military has the potential to either suppress or support social tendencies against the regime in power, depending on whose side it takes. Summing up, there are reasons to assume endogeneity also for the institutional variables. To overcome this problem, I not only use instruments for the GDP variable, but also for the institutional measures. In the growth literature, there are several attempts to find appropriate instruments for institutional quality. Mauro (1996) uses the degree of ethnolinguistic fractionalization as an instrument for the quality of institutions, but Acemoglu et al. (2001) argue that this measure itself might be endogenous, which seems plausible if one takes into account that people relocate over time according to the economic development of certain regions.

Another attempt is undertaken by Hall and Jones (1999), who use the distance from the equator as an instrument for institutional quality. Their argumentation is based on similar assumptions as the one in Acemoglu et al. (2001), where the authors use settler mortality rates from the colonial era in their growth regressions. It is assumed that countries where Europeans found better living conditions were more likely to be settled by them, whereas regions with poor living conditions tended to be claimed simply to exploit their natural resources. Countries with a tropical climate, which might be correlated with absolute distance from the equator, might have yielded higher mortality rates in former centuries and been therefore less likely to be settled by Europeans. The main reason for higher mortality rates is not the inhospitable climate itself, but the higher possibility of tropical diseases such as malaria and yellow fever. For that reason, in these countries institutions with European standards were less likely to be established. Since institutional development is thought be be partly predetermined by history, these countries have a higher possibility to exhibit bad institutions nowadays. In my regressions, I will follow Acemoglu and coauthors and use the logarithmized settler mortality rate as an instrument for institutional quality. Notice that this limits the sample to countries that are former colonies.[33] To combine the SUR regressions with an instrumental variable approach, I use 3SLS regressions. The system of equations then looks as follows:

---

[33]In the robustness checks, I will also present the results from regressions using a different instrumental variable.

$$INFRA_i = \beta_0 + \beta_1 RENTS_i + \beta_2 AUT_i + \beta_3 (RENTS \cdot AUT)_i + \beta_4 LOGGDP_i$$
$$+ \beta_5 GOVDEBT_i + \beta_6 RURPOP_i + \beta_7 AID_i + \beta_8 SERVICES_i + \epsilon_{1i} \tag{2}$$

$$EDUC_i = \beta_9 + \beta_{10} RENTS_i + \beta_{11} AUT_i + \beta_{12} (RENTS \cdot AUT)_i + \beta_{13} LOGGDP_i$$
$$+ \beta_{14} GOVDEBT_i + \beta_{15} RURPOP_i + \beta_{16} AID_i + \beta_{17} SERVICES_i$$
$$+ \beta_{18} YOUNG + \beta_{19} MUSLIMS + \epsilon_{2i} \tag{3}$$

$$DEFENSE_i = \beta_{20} + \beta_{21} RENTS_i + \beta_{22} AUT_i + \beta_{23} (RENTS \cdot AUT)_i + \beta_{24} LOGGDP_i$$
$$+ \beta_{25} GOVDEBT_i + \beta_{26} MUSLIMS_i + \beta_{27} EXTCONF + \epsilon_{3i} \tag{4}$$

$$SOCIAL_i = \beta_{28} + \beta_{29} RENTS_i + \beta_{30} AUT_i + \beta_{31} (RENTS \cdot AUT)_i + \beta_{32} LOGGDP_i$$
$$+ \beta_{33} GOVDEBT_i + \beta_{34} RURPOP_i + \beta_{35} AID_i$$
$$+ \beta_{36} MUSLIMS_i + \beta_{37} OLD + \epsilon_{4i} \tag{5}$$

$$HEALTH_i = \beta_{38} + \beta_{39} RENTS_i + \beta_{40} AUT_i + \beta_{41} (RENTS \cdot AUT)_i + \beta_{42} LOGGDP_i$$
$$+ \beta_{43} GOVDEBT_i + \beta_{44} AID_i + \beta_{46} OLD_i + \epsilon_{5i} \tag{6}$$

$$LOGGDP_i = \beta_{47} + \beta_{48} LATITUDE_i + \beta_{49} (LATITUDE_i)^2 + \beta_{50} COAST\_SHARE_i$$
$$+ \beta_{51} REG\_DUMMY_i + \epsilon_{6i} \tag{7}$$

$$AUTOCRACY_i = \beta_{52} + \beta_{53} SETTLER\_MORT_i + \epsilon_{7i} \tag{8}$$

Table 5 shows the results of the 3SLS regressions. As can be seen, the coefficients of the interaction terms are not significant anymore apart from in the equations for education spending. For both the ICRG and the PolityIV autocracy measures, the interaction term with the resource dependency measure is negative and significant. This underlines the findings of the simple cross-country regressions and is in line with the results of Cockx and Francken (2015) that good institutions mitigate the negative effect of resource dependency on education spending. It

shows that their findings still hold qualitatively, even when potential endogeneity of the GDP and the institutional variable is taken into account. The positive influence of a higher income level on government spending for education and healthcare seems to be confirmed by the 3SLS regressions while the structure of the economy, measured by the share of the service sector, does not seem to shift more public spending towards education.

Note that the number of observations drops sharply in the instrumental variable regressions, since the settler mortality rate only exists for former colonies. A Hansen-Sargan test for potential overidentification in the system of equations yields a p-value of 0.13 in the case of the ICRG autocracy variable and 0.08 in the case of the PolityIV variable, which means that in both cases the hypothesis of a valid overidentification restriction cannot be clearly rejected. There does not seem to be a problem with overidentification in the model. The results of the first-stage regressions are not shown explicitly, but the first-stage regression of equation (7) yields an adjusted R^2 of 0.69 and an F statistic of 28.8.[34] The adjusted R^2 for equation (8) is 0.19 (for the ICRG autocracy measure and 0.14 for the PolityIV measure, respectively) and the F statistic is 16.24 (and 10.49 in the case of the PolityIV variable, respectively). The coefficients of the variables are significant and have the expected signs in the first-stage regressions, e.g. there is a positive relationship between settler mortality and autocracy and a quadratic relationship between the latitude measure and the GDP. The coefficients of the coast share variable in the equation (7) are also positive and statistically significant.

---

[34]According to Staiger and Stock (1997), an F statistic of less than 10 in the first-stage regression may serve as an indicator for weak instruments. Hence, there does not seem to be a problem of weak instruments in the case of the LOGGDP variable.

Table 5: Results of the cross-country 3SLS regressions

	ICRG autocracy measure					PolityIV autocracy measure				
	(1) INFRA	(2) EDUC	(3) DEFENSE	(4) SOCIAL	(5) HEALTH	(6) INFRA	(7) EDUC	(8) DEFENSE	(9) SOCIAL	(10) HEALTH
RENTS	0.0077 (0.12)	-0.0813 (-0.38)	-0.1526 (-0.90)	0.1625 (0.82)	-0.0441 (-0.83)	0.06 (0.90)	-0.0759 (-0.36)	-0.1239 (-0.95)	0.1385 (0.89)	0.006 (0.16)
AUTOCRACY	0.0668 (0.10)	0.4791 (0.14)	4.2844 (1.58)	1.8618 (0.44)	1.0986 (1.32)	-0.0028 (-0.03)	0.2102 (0.38)	0.0118 (0.02)	-0.6056 (-0.93)	0.0037 (0.04)
RENTS∗AUTOCRACY	-0.0267 (-0.60)	-0.4023** (-2.53)	-0.162 (-1.01)	-0.0128 (-0.07)	0.0394 (0.79)	-0.0076 (-0.90)	-0.0984*** (-3.23)	-0.0215 (-0.68)	0.0165 (0.44)	0.0041 (0.50)
LOGGDP	-0.2366 (-0.30)	8.1385*** (2.80)	2.676* (1.83)	-1.7038 (-0.66)	1.7310*** (2.91)	-0.7405 (-1.01)	5.2784 (1.64)	0.7733 (0.61)	-0.2362 (-0.08)	0.6294 (1.09)
YOUNG		0.8604* (1.92)					0.9911** (2.13)			
GOVDEBT	-0.0366*** (-3.08)	-0.0090 (-0.21)	0.1657*** (3.92)	-0.1085** (-2.07)	-0.0482*** (-3.40)	-0.0391*** (-3.04)	0.0101 (0.22)	0.1776*** (3.91)	-0.0842* (-1.72)	-0.0419*** (-3.23)
EXTCONF			4.940*** (3.75)					5.0837*** (3.61)		
RURPOP	-0.0098 (-0.41)	0.0172 (0.21)		-0.1006 (-0.99)		-0.0110 (-0.45)	-0.0888 (-1.08)		-0.1051 (-1.14)	
MUSLIMS		2.8785 (0.51)	-0.0847 (-0.02)	-3.2853 (-0.51)			-0.8949 (-0.13)	4.2559 (0.76)	4.5925 (0.58)	
AID	21.181** (2.08)	39.094 (1.19)		25.000 (0.60)	38.747*** (3.54)	20.444 ** (2.02)	1.778 (0.05)		58.812 (1.12)	28.914*** (2.82)
SERVICES	0.0081 (0.12)	-0.3630 (-1.64)				0.0971 (1.06)	-0.3036 (-1.06)			
OLD				3.9591*** (3.74)	0.4744** (1.97)				2.865*** (2.75)	0.6188*** (2.71)
Countries	42	42	42	42	42	40	40	40	40	40
Observ.	42	42	42	42	42	40	40	40	40	40
R^2	0.34	0.18	0.58	0.58	0.53	0.34	0.14	0.53	0.59	0.52

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
The latitude, the squared latitude, the relative length of coastline, and regional dummies are used as instruments for the LOGGDP variable.
The autocracy variables are instrumented by the settler mortality rate (also in the interaction terms).

Panel regressions

So far, the cross-country OLS regressions have provided weak support for the hypothesis of a joint effect of high levels of autocracy and high rents from natural resources on the composition of government spending. It seems that countries highly dependent on natural resource rents tend to spend less on education if they are autocratic rather than democratic, whereas with respect to other components of government spending, there does not seem to be such a joint effect. In the next step, I conduct panel regressions to test whether the results hold if one controls for potential unobserved heterogeneity between the countries and overall time effects. I estimate the model of the form

$$SHARE_{it} = \alpha_i + \beta_1 RENTS_{it} + \beta_2 AUT_{it} + \beta_3 (RENTS * AUT)_{it} + \boldsymbol{\beta'C_{it}} + \delta_t + \epsilon_{it}, \quad (9)$$

where α_i is a country-specific fixed effect, t is the time index, and δ_t are time dummies to capture overall time effects. I use five-year averages of all variables to smooth out short-term fluctuations and potential measurement errors. This leaves me with a total of four periods.[35] The rest of the regression equations is similar to equations (2)-(8) in the cross-country case. Particularly, in each equation I introduce the same control variables as in the cross-country regressions.

First, I conduct panel regressions both with a fixed effects and a random effects estimator and in a second step I will again use an instrumental variable approach to account for the above mentioned endogeneity problem.

Tables 6 and 7 show the results of the panel regressions with the fixed effects and the random effects estimators. Although the results are much less significant compared to the cross-country cases, they deliver additional support to the observation that autocratic regimes highly dependent on rents from natural resources seem to spend relatively less on education and more on social spending. For both autocracy measures and both estimation techniques, the coefficients of the interaction term between resource rents and the degree of autocracy are negative in the equations with education spending and positive in those with social spending. Anyway, they are insignificant in the case of the ICRG autocracy measure and in most cases for the fixed effects estimator.

Table 7 also shows the results of a standard Hausman test[36] comparing each random effects regression with the equivalent fixed effects regression, the latter being known to be consistent

---

[35]Note that due to sample restrictions, the last period consists of only four years.
[36]The STATA option "sigmamore" is used conducting the Hausman test.

even in the case of unobserved and time-constant endogeneity. The null hypothesis that the random effect estimator is consistent, and in that case more efficient than the fixed effects estimator, is rejected in the regressions using defense and health spending as the LHS variables. In the cases of education and social spending being the dependent variables, the null hypothesis cannot be rejected and the equations seem to be consistently estimated with the random effects estimator.

Since these results are likely to be biased due to endogenous covariates, I will proceed with panel regressions using instrumental variables, just as I did before in the cross-country regressions.

Table 6: Results of the panel regressions, fixed effects estimator

	ICRG autocracy measure					PolityIV autocracy measure				
	(1) INFRA	(2) EDUC	(3) DEFENSE	(4) SOCIAL	(5) HEALTH	(6) INFRA	(7) EDUC	(8) DEFENSE	(9) SOCIAL	(10) HEALTH
RENTS	-0.00978 (-0.09)	-0.154 (-1.60)	-0.0897* (-1.71)	-0.115 (-1.31)	-0.111*** (-2.90)	-0.0184 (-0.19)	-0.149 (-1.59)	-0.1000** (-2.13)	-0.114 (-1.47)	-0.124*** (-3.91)
AUTOCRACY	0.137 (0.46)	-0.0693 (-0.20)	-0.167 (-0.42)	0.0266 (0.05)	-0.0347 (-0.13)	-0.224 (-1.48)	0.142 (0.98)	-0.253** (-2.44)	-0.144 (-0.85)	0.0784 (0.89)
RENTS∗AUTOCRACY	0.0221 (0.92)	-0.0108 (-0.49)	-0.0196 (-0.94)	0.0263 (0.97)	-0.0168 (-1.29)	-0.000157 (-0.03)	-0.00354 (-0.95)	-0.0107 (-1.52)	0.0130* (1.92)	-0.00713** (-2.11)
LOGGDP	4.666** (2.44)	1.479 (0.75)	3.008 (1.50)	3.019 (0.99)	-0.867 (-0.64)	4.259** (2.07)	1.041 (0.53)	3.036 (1.65)	4.194 (1.44)	-0.719 (-0.51)
GOVDEBT	-0.0190 (-1.32)	-0.00952 (-1.03)	0.0249*** (3.37)	-0.00426 (-0.38)	-0.00792 (-1.18)	-0.0176 (-1.28)	-0.0122 (-1.41)	0.0247*** (4.11)	-0.00358 (-0.34)	-0.00799 (-1.18)
RURPOP	0.0851 (0.69)	0.193 (1.41)		-0.142 (-0.59)		0.0816 (0.69)	0.158 (1.17)		-0.0238 (-0.10)	
AID	1.725 (0.12)	-4.083 (-0.18)		-2.077 (-0.46)	-3.367 (-1.19)	-1.088 (-0.08)	-2.137 (-0.09)		-2.778 (-0.62)	-2.048 (-0.69)
SERVICES	-0.0812 (-1.17)	0.00672 (0.09)				-0.113 (-1.48)	0.0258 (0.32)			
YOUNG		0.195 (1.24)					0.200 (1.31)			
MUSLIMS		-24.23 (-1.38)	-8.213 (-0.61)	3.372 (0.18)			-26.56 (-1.45)	-0.372 (-0.03)	-2.682 (-0.13)	9.828 (1.12)
EXTCONF			0.193 (0.75)					0.360 (1.21)		
OLD				0.615 (1.58)	0.527* (1.89)				1.221*** (2.67)	0.647* (1.89)
Countries	102	103	102	106	108	99	100	99	103	103
Observ.	311	327	330	347	350	301	317	318	336	334

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Time and country fixed effects are included in the regressions.

Table 7: Results of the panel regressions, random effects estimator

	ICRG autocracy measure					PolityIV autocracy measure				
	(1) INFRA	(2) EDUC	(3) DEFENSE	(4) SOCIAL	(5) HEALTH	(6) INFRA	(7) EDUC	(8) DEFENSE	(9) SOCIAL	(10) HEALTH
RENTS	-0.0673* (-1.70)	-0.137** (-2.23)	-0.0525 (-1.43)	-0.0683 (-1.13)	-0.0593*** (-2.62)	-0.0398 (-0.96)	-0.142** (-2.42)	-0.0385 (-1.19)	-0.0812 (-1.54)	-0.0589*** (-2.61)
AUTOCRACY	0.00290 (0.01)	0.191 (0.54)	0.556 (1.39)	-0.624 (-0.98)	-0.0952 (-0.35)	-0.0488 (-0.55)	0.207* (1.89)	0.112 (0.69)	-0.335** (-2.05)	0.0542 (0.78)
RENTS*AUTOCRACY	0.0136 (0.70)	-0.0213 (-1.11)	-0.0238 (-1.21)	0.0267 (1.08)	-0.00885 (-0.76)	-0.0000769 (-0.02)	-0.00632** (-1.97)	-0.00930 (-1.40)	0.0115** (2.18)	-0.00129 (-0.57)
LOGGDP	0.629* (1.75)	2.008*** (2.68)	0.00657 (0.01)	2.838** (2.56)	1.082*** (3.55)	0.537 (1.42)	2.076*** (2.78)	0.121 (0.21)	3.071*** (2.75)	1.000*** (3.13)
GOVDEBT	-0.0270*** (-3.43)	-0.0184** (-2.47)	0.0224*** (3.42)	-0.00139 (-0.20)	0.00198 (0.50)	-0.0269*** (-3.39)	-0.0209*** (-2.89)	0.0217*** (3.99)	0.00256 (0.37)	0.00196 (0.51)
RURPOP	0.0456** (2.08)	0.0477 (1.21)		-0.0398 (-0.51)		0.0482* (1.95)	0.0440 (1.06)		-0.00977 (-0.12)	
AID	13.90 (1.61)	4.388 (0.35)		-0.340 (-0.12)	3.424 (1.20)	12.02 (1.35)	5.974 (0.49)		0.646 (0.24)	4.461 (1.48)
SERVICES	-0.0406 (-1.12)	-0.0456 (-0.76)				-0.0374 (-0.94)	-0.0434 (-0.68)			
YOUNG		0.330*** (3.63)					0.320*** (3.66)			
MUSLIMS		1.440 (0.69)	10.17*** (3.25)	-2.353 (-0.93)			0.520 (0.26)	10.94*** (3.39)	-0.997 (-0.35)	-1.389 (-1.47)
EXTCONF			0.356 (1.43)					0.443 (1.61)		
OLD				0.988*** (3.81)	0.105 (1.12)				1.066*** (3.95)	0.149 (1.46)
Countries	102	103	102	106	108	99	100	99	103	103
Observ.	311	327	330	347	350	301	317	318	336	334
Hausman χ^2	15.87	17.42	42.63	9.37	42.98	18.42	13.74	44.99	4.09	35.32
Hausman p	(0.1460)	(0.1809)	(0.0000)	(0.5876)	(0.0000)	(0.0723)	(0.3178)	(0.0000)	(0.9432)	(0.0001)

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Time effects are included in the regressions in the form of period dummies.

Table 8 shows the estimates for the panel regressions resulting from equation (9) using the two different autocracy measures and a random effect estimator with instrumental variables. The reasoning behind the instrumantal variable approach is the same as in the cross-country regressions and potential endogeneity cannot be cured by simply using lags of the regressors, so not using instrumental variables would lead to biased estimates.

The instruments for the endogenous variables are the same as in the cross-country regressions, in particular the set of the geographical indicators for the GDP variable and the settler mortality rate for the autocracy measures. Since all the instruments are time-invariant, using a fixed effects estimator is not feasible in the panel regressions.[37]

The results of the panel instrumental variable regressions give additional support to the previous results. The coefficient of the interaction term in the education spending equation is negative and significant for both autocracy measures, while that in the social spending equations is still positive, but insignificant. For the other types of government spending, there does not seem to be a joint effect of resource dependency and autocracy, since the coefficients are insignificant in nearly all cases.

Rather surprising are the positive and significant coefficients of the autocracy variable in the equations with education spending. They suggest that, on average, more autocratic countries have a higher share of education spending in total government spending, which does not seem to be in line with theories from political economy. One possible explanation is the fact that by using the information about settler mortality as an instrument for autocracy, many democratic countries self-select out of the sample and mainly countries with relatively bad institutions stay in. Moreover, different to a fixed effects estimator, the random effects estimator does not uniquely focus on within-variation, so the results do not mean that a country increases its spending on education when it becomes less democratic.

Table 9 sums the coefficients of the main variables of interest from the different regression models. Since the results for any other types of government spending besides that on education and social protection are insignificant throughout most specifications and estimation methods, they are left out of the summary. Special focus lies on the coefficients for the interaction term between resource dependency and autocracy. The interaction term in the education spending regressions is negative and statistically significant in most specifications besides the fixed effects regressions and the random effects regressions using the ICRG autocracy measure.

---

[37]The results of the first-stage regressions are not reported here. Random effects regressions with time dummies yield overall R^2 values of 0.71 ($Wald\ \chi^2 = 742.8$) for the GDP variable regressed on the set of geographical indicators and 0.18 (0.14) for the ICRG (PolityIV) autocracy measure regressed on the settler mortality rate ($Wald\ \chi^2 = 37.7$ and 28.1, respectively.). Again, as in the cross-country case, the number of observations drops sharply due to the same reason as before.

The magnitude of the coefficient ranges between -0.44 and -0.01.[38]

In the case of the regressions for social spending, the results are less clear than for education spending. While the use of the ICRG indicator as a measure of autocracy leads to a significant positive coefficient only in the seemingly unrelated OLS regression, using the PolityIV measure leads to positive and, at least barely, significant coefficients also in the panel regressions. The magnitude ranges between 0.01 and 0.17.

---

[38]Notice that the interpretation of the coefficients' magnitudes is not straightforward in the case of regressions with interaction terms.

Table 8: Results of the panel IV regressions, random effects estimator

	ICRG autocracy measure					PolityIV autocracy measure				
	(1) INFRA	(2) EDUC	(3) DEFENSE	(4) SOCIAL	(5) HEALTH	(6) INFRA	(7) EDUC	(8) DEFENSE	(9) SOCIAL	(10) HEALTH
RENTS	-0.0345 (-0.63)	-0.122 (-0.94)	-0.163* (-1.70)	0.0619 (0.46)	-0.0196 (-0.52)	0.123 (1.34)	-0.182* (-1.76)	-0.0876 (-1.36)	0.0124 (0.13)	-0.0133 (-0.44)
AUTOCRACY	0.906* (1.70)	3.973** (2.07)	2.943 (1.18)	-4.319 (-1.42)	-0.363 (-0.48)	-0.195 (-1.04)	0.863* (1.87)	0.109 (0.40)	-0.731 (-1.48)	0.00879 (0.06)
RENTS*AUTOCRACY	0.00318 (0.06)	-0.262** (-2.38)	-0.00670 (-0.07)	0.128 (1.13)	-0.00723 (-0.18)	-0.0320* (-1.74)	-0.0404** (-2.01)	-0.00465 (-0.24)	0.0375 (1.63)	-0.00200 (-0.24)
LOGGDP	0.601 (0.80)	5.972** (2.30)	0.832 (0.70)	-3.594 (-1.21)	0.756 (1.00)	1.669 (1.35)	3.309 (1.21)	0.744 (1.19)	-1.830 (-0.68)	0.281 (0.40)
GOVDEBT	-0.0537*** (-4.73)	-0.0254 (-0.98)	0.0943*** (4.11)	-0.0209 (-0.70)	-0.00752 (-0.84)	-0.0288* (-1.96)	-0.0201 (-0.98)	0.149*** (6.87)	-0.0280 (-1.15)	-0.0121 (-1.35)
RURPOP	0.0309 (0.83)	-0.000408 (-0.01)		-0.200** (-1.98)		0.114* (1.84)	-0.0181 (-0.24)		-0.143 (-1.60)	
AID	15.12* (1.80)	17.87 (0.64)		15.19 (0.41)	15.04 (1.34)	15.43 (1.19)	-1.540 (-0.06)		24.58 (0.70)	10.79 (0.91)
SERVICES	-0.0426 (-0.88)	-0.150 (-0.96)				-0.0530 (-0.67)	-0.152 (-0.87)			
YOUNG		0.606** (2.38)					0.440 (1.59)			
MUSLIMS		-3.686 (-0.96)	0.803 (0.20)	2.401 (0.43)			-5.858 (-1.18)	2.223 (0.74)	3.487 (0.62)	-1.824 (-1.08)
EXTCONF				2.060*** (3.40)					3.052*** (4.86)	
OLD				2.150*** (2.95)	0.408* (1.86)				2.546*** (3.20)	0.517** (2.16)
Countries	45	45	41	45	46	43	43	39	43	43
Observ.	137	139	127	142	144	129	131	119	134	132
R^2	0.29	0.09	0.57	0.49	0.39	0.10	0.16	0.60	0.50	0.38

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Time effects are included in the regressions in the form of period dummies.
The latitude, the squared latitude, the relative length of coastline and regional dummies are used as instruments for the LOGGDP variable.
The autocracy variables are instrumented by the settler mortality rate (also in the interaction terms).

Table 9: Summarizing results

	ICRG autocracy measure									
	Education spending					Social spending				
	SUR	3SLS	FE	RE	RE.IV	SUR	3SLS	FE	RE	RE.IV
RENTS	0.00	-0.08	-0.15	-0.14**	-0.12	-0.134	0.16	-0.12	-0.07	0.06
	(0.03)	(-0.38)	(-1.60)	(-2.23)	(-0.94)	(-1.20)	(0.82)	(-1.31)	(-1.13)	(0.46)
AUTOCRACY	0.30	0.48	-0.07	0.19	3.97**	-5.64***	1.86	0.03	-0.62	-4.32
	(0.59)	(0.14)	(-0.20)	(0.54)	(2.07)	(-5.85)	(0.44)	(0.05)	(-0.98)	(-1.42)
INTERACT	-0.11***	-0.44**	-0.01	-0.02	-0.26**	0.17**	-0.01	0.03	0.03	0.13
	(-2.75)	(-2.53)	(-0.49)	(-1.11)	(-2.38)	(2.27)	(-0.07)	(0.97)	(1.08)	(1.13)
	PolityIV autocracy measure									
	Education spending					Social spending				
	OLS	3SLS	FE	RE	RE.IV	OLS	3SLS	FE	RE	RE.IV
RENTS	-0.03	-0.08	-0.15	-0.14**	-0.18*	-0.24**	0.14	-0.11	-0.08	0.01
	(-0.67)	(-0.36)	(-1.59)	(-2.42)	(-1.76)	(-2.14)	(0.89)	(-1.47)	(-1.54)	(0.13)
AUTOCRACY	0.24**	0.21	0.14	0.21*	0.86*	-1.20***	-0.61	-0.14	-0.34**	-0.73
	(2.04)	(0.38)	(0.98)	(1.89)	(1.87)	(-5.26)	(-0.93)	(-0.85)	(-2.05)	(-1.48)
INTERACT	-0.02**	-0.10***	-0.00	-0.01**	-0.04**	0.05***	0.02	0.01*	0.01**	0.04
	(-2.21)	(-3.23)	(-0.95)	(-1.97)	(-2.01)	(3.31)	(0.44)	(1.92)	(2.18)	(1.63)

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5 Robustness Checks

The results of the cross-country and panel regressions with instrumental variables give a strong hint of a negative and significant joint effect of resource dependency and autocracy on the share of public spending on education. Since I use the share of the spending types in total government spending instead of their shares in the GDP, the results indicate that this shift away happens in favor of other types of public spending. Although there is weak evidence in the data that resource-rich autocracies spend relatively more on social security, the results are far from clear.

Alternative instrument for institutional variables

One of the main problems in the panel IV regressions is the fact that using the data on settler mortality as an instrument for institutional quality leads to a sample reduction and a selection

effect towards former colonies. Moreover, the historical settler mortality rate is time-invariant and therefore does not allow the institutional variable to change over time in the panel IV regressions. To overcome this problem and to increase the country sample, I use an alternative instrumental variable for the autocracy measures in the following. In their studies on franchise extension in Europe during the 19th and the early 20th century, Aidt and Jensen (2013, 2014) compute a measure that captures the *revolutionary threat* that is placed on a government by institutional changes in other countries. In detail, for each country i in year t they use a distance-weighted sum of major revolutionary events happening in countries other than i in year t. Their idea behind this variable is that an incumbent regime is only willing to distribute more power to the citizens in the presence of the threat of a riot and that the perception of this threat intensifies in periods of revolutionary events in the rest of the world. This reasoning is closely linked to Acemoglu and Robinson (2000), who build a theoretical model which explains the extension of the franchise in Western Europe during the 19th century with the upcoming unrest at that time stemming from economic inequality. In a recent paper about the influence of democratization processes on economic growth, Acemoglu et al. (2014) also make use of the idea of democratization waves when they compute an instrumental variable for their endogenous democracy variable. They argue that regional trends both towards more as well as towards less democracy may generate spillover effects and may therefore be used as a source of exogenous variation in democracy. Although Acemoglu et al. (2014) use a dichotomous measure of democracy and investigate the growth potential of transitions from autocracy to democracy (and the other way around), their reasoning can also be applied to the continuous institutional measures used in the current paper. Following this idea, I use the average degree of autocracy of all other countries in the same geographical region in the previous period[39]. In detail, the instrumental variable IV for country i located in region K in year t is defined as:

$$IV_{it}^K = \frac{1}{|K|-1} \sum_{\substack{j \in K \\ j \neq i}} AUTOC_{jt-1}, \quad K = \{k_1, ..., i, j, k_n\}$$

I do not weight the measure by the bilateral distances between countries i and j, since I argue that actual distance is less important for the flow of information nowadays than it used to be in earlier times. Anyway, I assume that it is mainly waves of democratic change in the same region influencing potential democratization processes in country i. The main argument for this assumption is quite similar to that of Aidt and Jensen (2011, 2013) about cultural and ethnical proximity. I use the lagged value of the average regional autocracy measure to account

---

[39] As described above, one period corresponds to five years. The geographical regions are the same as described earlier.

for the fact that it is likely to take some time until democratization waves from neighboring countries spill over.

Table 10 shows the results of the Panel IV regressions with the alternative instrument for the autocracy measures.[40]

---

[40]The first-stage regression yields an overall R^2 value of 0.29 (0.42) and a $Wald\ \chi^2$ statistic of 63.1 (114.1) for the ICRG (PolityIV) autocracy variable regressed on the computed instrument.

Table 10: Robustness checks: Panel IV regressions with alternative instrumental variable, random effects estimator

	ICRG autocracy measure					PolityIV autocracy measure				
	(1) INFRA	(2) EDUC	(3) DEFENSE	(4) SOCIAL	(5) HEALTH	(6) INFRA	(7) EDUC	(8) DEFENSE	(9) SOCIAL	(10) HEALTH
RENTS	-0.0411 (-0.66)	-0.0851 (-0.87)	-0.0928 (-0.77)	0.0993 (0.53)	-0.00895 (-0.19)	-0.0408 (-0.85)	-0.106* (-1.69)	-0.137** (-2.46)	-0.0250 (-0.30)	-0.0254 (-0.77)
AUTOCRACY	-0.0836 (-0.14)	2.399 (1.56)	2.299 (0.84)	-6.483 (-1.59)	-1.998*** (-2.61)	-0.0443 (-0.42)	0.730** (2.29)	0.952** (2.31)	-1.450*** (-2.58)	-0.385** (-2.19)
RENTS∗AUTOCRACY	-0.00671 (-0.12)	-0.164** (-2.43)	-0.0219 (-0.21)	-0.0846 (-0.50)	-0.00253 (-0.05)	0.000806 (0.11)	-0.0263*** (-2.89)	-0.00367 (-0.40)	0.0197 (1.45)	0.00296 (0.52)
LOGGDP	0.804 (1.17)	3.546*** (3.00)	-0.349 (-0.35)	2.352 (0.80)	1.207** (2.33)	0.550 (1.05)	2.041* (1.80)	-0.515 (-0.72)	4.445** (2.35)	1.702*** (4.21)
GOVDEBT	-0.0232*** (-3.48)	-0.0238* (-1.94)	0.0123 (1.07)	0.0152 (0.88)	0.00586 (1.22)	-0.0234*** (-3.41)	-0.0261** (-2.29)	0.0119* (1.83)	0.0152 (1.19)	0.00615 (1.44)
RURPOP	0.0725** (2.34)	0.0331 (0.80)		0.0248 (0.22)		0.0675** (2.44)	0.0174 (0.37)		0.0529 (0.58)	
AID	6.772 (0.76)	13.83 (0.96)		-13.50 (-0.88)	1.060 (0.26)	5.601 (0.70)	4.451 (0.35)		0.923 (0.13)	6.229** (2.28)
SERVICES	-0.0333 (-0.77)	-0.0260 (-0.34)				-0.0217 (-0.47)	0.0180 (0.21)			
YOUNG		0.298*** (3.16)					0.248** (2.48)			
MUSLIMS		-1.782 (-0.70)	5.078 (0.95)	7.616 (0.98)			-3.769 (-1.22)	0.282 (0.07)	8.515 (1.50)	0.841 (0.50)
EXTCONF			0.590** (2.02)					0.125 (0.37)		
OLD				0.632 (1.61)	-0.183 (-1.46)				0.399 (1.17)	-0.179 (-1.63)
Countries	92	95	95	99	100	89	92	92	96	96
Observ.	247	261	264	278	280	237	251	254	268	267
R^2	0.11	0.14	0.29	0.47	0.28	0.12	0.15	0.29	0.50	0.27

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Time effects are included in the regressions in the form of period dummies.
The latitude, the squared latitude, the relative length of coastline and regional dummies are used as instruments for the LOGGDP variable.
The autocracy variables are instrumented by the lagged average regional autocracy measures (also in the interaction terms).

It can be seen that using the alternative instrumental variable for the autocracy measures underlines the negative and significant effect of the interaction term on the share of education spending, while for the other spending types the results remain insignificant. Moreover, it seems to be confirmed that a higher income per capita results in relatively more education spending and potentially more spending on healthcare. A positive effect of the interaction term on the share of social spending cannot be suggested by the results at this point. The statistically significant negative effect of autocracy on healthcare spending is in line with the results of Cockx and Francken (2014), who find that the level of democratization positively influences the level of public health expenditures.

Additional control variables

In the next step, I will proceed with further robustness checks in order to confirm the findings for education spending and to more deeply check for an effect on social spending. Table 11 shows the results of the robustness checks with the settler mortality rate as an instrument and the additional control covariates. In columns 1-4 three additional control variables are introduced compared to the baseline regression, both for education and social spending. GOV-SPEND is the total government expenditure relative to the country's GDP. I add this variable in order to control for the possibility that the overall level of public spending also influences the composition of it. Indeed, in all regressions for the social spending share, the coefficient of the government spending variable is negative but insignificant. EXTCONF is, as described before, the ICRG variable measuring the degree of a country's involvement in external military conflicts. The results are not clear cut, but give a small hint to a reduction in education spending in times of military conflicts. If one looks at the prior results for the military spending regressions, this shift seems to happen in favor of military expenditures, a fact that seems instantly plausible.

POP is the logarithm of a country's total population. This variable is added to make sure that potential differences in the government spending patterns are not just driven by the size of the population. A bigger country, measured by its number of citizens, on the one hand faces economies of scale in the supply of public goods, which can lead to relatively smaller governments in bigger countries and therefore relatively smaller spending on administration. On the other hand, the possibility of ethnical or cultural conflicts between different groups in a country increases with a growing population size, a fact that might counteract the mentioned economies of scale.[41] Although it is not clear which effect predominates and how the certain

---

[41]See Alesina and Wacziarg (1998).

parts of government spending are influenced, it is nevertheless possible that the population size does change the public spending composition. The results weakly suggest that a larger population leads to relatively more spending on social protection and less spending on education. The positive relationship between the population size and the share of social spending is in line with the findings of Sanz and Velazquez (2007). Moreover, they also find a positive relationship between population and spending for education, a result that cannot be confirmed at this point.

In columns 5-8, the autocracy variables are replaced by the measure for executive constraints from the *PolityIV database*. The score originally ranks from 1 to 7, with higher values meaning that the regime faces more executive constraints leading theoretically to a higher accountability. Again, just like the autocracy measures, the variable is inverted such that a higher value represents a higher political risk. Executive constraints cannot only be imposed by legislatures, but also powerful groups such as a strong military or powerful peers. Therefore, the checks and balances in an autocratic regime do not necessarily need to be lower than in a democracy. This is underlined by rather low pairwise correlations of 0.22 and 0.33 between the executive constraints measure and the PolityIV and ICRG autocracy measure, respectively.[42] Regressions 5 and 6 contain the same set of control variables as the baseline regression, whereas in the last two, the full set of control variables is used, just as in columns 1-4. The interaction term stays negative but insignificant in the equations for the education spending, while it is positive and insignificant in both of the social spending regressions.

---

[42]Both correlations are highly significant.

Table 11: Robustness checks: Panel IV regressions with additional controls, random effects estimator

	ICRG autocracy measure		PolityIV autocracy measure		PolityIV executive cons. measure			
	(1) EDUC	(2) SOCIAL	(3) EDUC	(4) SOCIAL	(5) EDUC	(6) SOCIAL	(7) EDUC	(8) SOCIAL
RENTS	-0.132 (-1.07)	0.106 (0.94)	-0.0907 (-0.78)	0.174* (1.91)	-0.194** (-2.07)	0.124 (1.12)	-0.168 (-1.59)	0.0168 (0.15)
AUTOCRACY	3.522* (1.89)	-2.532 (-1.27)	0.845** (2.53)	-0.413 (-1.17)	2.209* (1.68)	-3.474** (-2.18)	2.652 (1.37)	-2.537 (-1.34)
RENTS∗AUTOCRACY	-0.225** (-2.00)	0.114 (1.05)	-0.0645*** (-2.63)	0.00374 (0.14)	-0.0789 (-1.40)	0.0316 (0.43)	-0.0118 (-0.24)	0.0901 (1.44)
GOVDEBT	-0.0148 (-0.60)	-0.0371 (-1.47)	-0.0267 (-1.08)	-0.0384 (-1.45)	-0.0302 (-1.35)	-0.00752 (-0.27)	-0.00708 (-0.37)	-0.0203 (-0.81)
RURPOP	0.00417 (0.06)	-0.191** (-2.55)	-0.0679 (-1.11)	-0.164** (-2.46)	-0.0206 (-0.33)	-0.169* (-1.94)	0.0622 (0.60)	-0.157 (-1.39)
MUSLIMS	-2.236 (-0.55)	-0.769 (-0.18)	-4.276 (-1.11)	-1.442 (-0.33)	-2.987 (-0.70)	3.428 (0.62)	-3.369 (-0.50)	2.001 (0.29)
SERVICES	-0.122 (-0.80)		-0.0850 (-0.51)		-0.137 (-0.85)		0.00268 (0.02)	
AID	1.190 (0.04)	20.00 (0.63)	-10.06 (-0.38)	31.01 (1.01)	-10.60 (-0.42)	45.60 (1.25)	5.405 (0.18)	28.56 (0.78)
YOUNG	0.547** (2.07)		0.689** (2.35)		0.274 (0.93)		0.0448 (0.16)	
OLD		2.696*** (4.68)		2.897*** (4.98)		2.009** (2.39)		2.009* (1.94)
GOVSPEND	0.00523 (0.05)	-0.176 (-1.56)	-0.0344 (-0.29)	-0.120 (-0.93)			-0.207** (-2.22)	-0.110 (-0.96)
EXTCONF	-1.123* (-1.71)	0.646 (0.95)	-0.973 (-1.39)	0.267 (0.34)			-0.493 (-0.95)	0.759 (1.13)
LOGGDP	4.033 (1.44)	-2.448 (-1.04)	2.716 (1.12)	-1.235 (-0.62)	1.084 (0.41)	-0.351 (-0.12)	0.580 (0.18)	-0.314 (-0.08)
POP	-0.998 (-1.25)	1.329 (1.58)	-1.214 (-1.52)	1.826** (2.19)	-2.027*** (-2.68)	2.001* (1.93)	-2.366* (-1.77)	1.543 (1.10)
Countries	45	45	43	43	43	43	43	43
Observ.	139	142	131	134	131	134	131	134
R^2	0.14	0.57	0.23	0.57	0.26	0.52	0.17	0.51

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Time effects are included in the regressions in the form of period dummies.
The latitude, the squared latitude, the relative length of coastline and regional dummies
are used as instruments for the LOGGDP variable.
The autocracy variables are instrumented by the settler mortality rate (also in the interaction terms).

In table 12, the same specifications are used as in table 11, but in each regression, the lagged regional autocracy measure is used as the instrument instead of the settler mortality. In each regression where education spending is the dependent variable, the coefficient of the interaction term is negative and statistically significant, which underlines the previous findings. In the regressions with social spending as the LHS variable, the coefficient of the interaction term is positive in three out of four cases, but insignificant in all of them. The results in table 12 also give additional support to a positive relationship between population size and social spending on the one hand and a negative relationship between population size and education spending on the other hand.

Dichotomous measure of autocracy

In this paper, I use different measures for autocracy that are well-known in the literature, all of them being continuous. One main aspect taken into account by all of these variables is the degree of government accountability or executive constraints on the regime, respectively. The main problem about measures for institutional quality is that most of them rely heavily on subjective assessments, since institutional threats such as corruption, political repression, or nepotism are hard to quantify. Using continuous variables for autocracy has the advantage, compared to dichotomous ones, that they capture democratization tendencies, even if these are not strong enough to cause the dichotomous measure to switch from autocratic to democratic or vice versa. This is the main reason why I prefer to use continuous variables in this paper. Anyway, as Boix et al. (2013) point out, using a dichotomous measure for democracy may have several advantages, especially when it is coded based on several subindicators, such as political competitiveness and free elections. In their paper, they develop a democracy dummy and code a country as democratic if there are free and fair elections and if at least half of the male population is endowed with suffrage. Their dataset covers 219 countries and contains yearly data on their democracy dummy over the period 1800-2007. The yearly data ensures that not only permanent but also temporary transitions are covered.

As a further robustness check, I conduct the IV panel regressions with the democracy dummy from Boix et al. (2013) alternatively to the previous institutional variables. The dummy has a high positive correlation both with the ICRG measure for democratic accountability (0.71) and the PolityIV democracy variable (0.86) in the sample.[43] Since the dummy is coded for each year, I do not use five-year averages as I did before, but yearly data. This leaves me with a time dimension of 19 years. I invert the original data, such that the dummy takes the value 1 if

---

[43]Both correlations are highly significant at the one-percent level.

country i is autocratic in year t, and 0 otherwise. As the instrument for the autocracy dummy, I use the first lag of its average over all other countries in the same region as the respective country, computed in the same manner as described earlier. By definition, the instrumental variable ranges between zero and one and measures the share of autocracies in a country's region in $t - 1$.

The results are shown in table 13. Although the endogenous autocracy variable is now binary, the first stage of the model can still be estimated consistently with an OLS estimator.[44] The coefficient of the interaction term is negative and highly significant in the regression with education spending as dependant variable and positive and highly significant in the regression for social spending.[45] These results strongly support the previous findings on the significantly negative interaction effect of resource rents and autocracy on the share of education spending in total government spending. Additionally, they give a strong hint of a positive interaction effect on the share of social spending, which was only slightly indicated in the regressions with the continuous autocracy measures.

---

[44]Wooldridge (2002, pp. 621-625).

[45]The first-stage regression yields an overall R^2 value of 0.71 and a $Wald\ \chi^2$ statistic of 1575 for LOGGDP regressed on the geographical variables and year fixed effects. Regressing the autocracy dummy on the lagged share of autocracies in the same region yields an overall R^2 of 0.38 and a $Wald\ \chi^2$ statistic of 69.3 in the first-stage regression.

Table 12: Robustness checks: Panel IV regressions with alternative instrumental variable and additional controls, random effects estimator

	ICRG autocracy measure		PolityIV autocracy measure		PolityIV executive cons. measure			
	(1) EDUC	(2) SOCIAL	(3) EDUC	(4) SOCIAL	(5) EDUC	(6) SOCIAL	(7) EDUC	(8) SOCIAL
RENTS	-0.0686 (-0.79)	0.0997 (0.53)	-0.123** (-2.05)	-0.00918 (-0.11)	-0.115* (-1.69)	0.0895 (0.95)	-0.112* (-1.70)	0.0240 (0.26)
AUTOCRACY	1.706 (1.36)	-6.503* (-1.68)	0.617** (2.37)	-1.281** (-2.44)	1.991* (1.83)	-4.648*** (-2.84)	2.303* (1.75)	-4.326** (-2.25)
RENTS*AUTOCRACY	-0.196*** (-3.17)	-0.0450 (-0.25)	-0.0297*** (-3.46)	0.0214 (1.60)	-0.108*** (-3.46)	0.0325 (0.65)	-0.0942*** (-2.90)	0.0523 (1.09)
GOVDEBT	-0.0203* (-1.66)	0.0157 (0.99)	-0.0247** (-2.22)	0.0155 (1.30)	-0.0218* (-1.78)	0.0241* (1.88)	-0.0200 (-1.63)	0.0210 (1.57)
RURPOP	0.0240 (0.67)	0.00968 (0.09)	-0.000895 (-0.02)	0.0208 (0.26)	0.00658 (0.16)	0.0203 (0.28)	0.0164 (0.34)	0.0172 (0.21)
MUSLIMS	-1.097 (-0.50)	6.508 (0.89)	-2.889 (-1.17)	6.205 (1.23)	-2.744 (-1.02)	6.117 (1.46)	-3.034 (-0.97)	5.234 (1.06)
SERVICES	-0.0719 (-1.00)		-0.0606 (-0.75)		-0.0484 (-0.58)		0.0196 (0.21)	
AID	6.421 (0.47)	-10.29 (-0.64)	4.227 (0.35)	3.605 (0.54)	-2.646 (-0.21)	0.203 (0.03)	2.061 (0.15)	-0.927 (-0.12)
YOUNG	0.265*** (3.02)		0.248*** (2.81)		0.194* (1.95)		0.138 (1.27)	
OLD		0.530 (1.35)		0.428 (1.34)		0.380 (1.23)		0.389 (1.15)
GOVSPEND	-0.0000** (-2.35)	-0.0000 (-0.12)	-0.0000** (-2.40)	-0.0000 (-0.29)			-0.0000** (-1.99)	-0.0000 (-0.07)
EXTCONF	-0.0603 (-0.18)	0.202 (0.37)	-0.244 (-0.72)	0.230 (0.47)			-0.287 (-0.80)	0.307 (0.59)
LOGGDP	2.652** (2.56)	2.833 (1.00)	1.733* (1.80)	4.605*** (2.67)	1.515 (1.47)	4.520*** (2.90)	0.997 (0.83)	4.350** (2.38)
POP	-1.003*** (-2.93)	1.506 (1.39)	-0.990*** (-2.64)	2.024*** (2.91)	-1.107*** (-2.74)	2.068*** (3.30)	-1.099** (-2.30)	2.015*** (2.74)
Countries	95	99	92	96	92	96	92	96
Observ.	261	278	251	268	251	268	251	268
R^2	0.21	0.5	0.24	0.55	0.21	0.52	0.20	0.53

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Time effects are included in the regressions in the form of period dummies.
The latitude, the squared latitude, the relative length of coastline, and regional dummies
are used as instruments for the LOGGDP variable.
The autocracy variables are instrumented by the lagged average regional autocracy measures (also in the interaction terms).

Table 13: Robustness checks: Panel IV regressions with dichotomous autocracy measure, random effects estimator

	Dichotomous autocracy measure	
	(1) EDUC	(2) SOCIAL
RENTS	-0.0334 (-0.67)	-0.166** (-2.55)
AUTOCRACY	5.782** (1.97)	-5.783 (-1.34)
RENTS*AUTOCRACY	-0.165*** (-2.63)	0.272*** (3.23)
LOGGDP	2.666*** (2.66)	3.869*** (2.61)
YOUNG	0.310*** (4.25)	
GOVDEBT	-0.0153*** (-2.98)	0.000655 (0.09)
RURPOP	0.0964** (2.23)	0.00268 (0.04)
MUSLIMS	-2.242 (-0.87)	-0.477 (-0.13)
SERVICES	0.0256 (0.72)	
AID	6.917 (1.16)	0.0961 (0.02)
OLD		0.829*** (3.88)
Countries	94	98
Observ.	1011	1093
R^2	0.19	0.58

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Time effects are included in the regressions in the form of year dummies.

The latitude, the squared latitude, the relative length of coastline, and regional dummies are used as instruments for the LOGGDP variable.

The autocracy dummy is instrumented by the lagged share of autocracies in each country's region also in the interaction terms.

Endogenous resource rents

As a last robustness check, I take into account the possibility of the resource rents variable also being endogenous. So far, I have treated it as exogenous, but one could argue that it is endogenous as well. First, there might be omitted variables in the model, which influence both the composition of government spending and the share of natural resources in a country's GDP. Assume that political events in a resource-abundant country lead to more integration in international trade. This might attract more FDI in the resource sector and lead the government to invest more in promotive infrastructure, hence influencing the structure of government spending.

Another and more plausible source of endogeneity in the resource rents variable is potential reverse causality. Some forms of government spending may have an influence on the share of the resource sector in total GDP. Especially in countries in which state-owned enterprises extract the resources, investments in the resource sector may be part of the government budget. Moreover, government spending on infrastructure potentially attracts more FDI in the resource sector, since resource exploitation requires transport facilities such as railroads and harbors. This may lead to an expansion of the resource sector. Public investment in infrastructure or education may also lead to an expansion of the non-resource sector and hence increase the degree of economic diversification. Both effects potentially influence the share of the resource sector in total GDP. To overcome potential endogeneity of the resource rents variable, I will use initial per capita endowment of oil, gas and natural gas liquids and yearly averages of the world oil and gas prices as instruments for a country's degree of resource dependence.[46] Since the endowment data only contains hydrocarbons, I use both oil and gas rents separately instead of the sum of all natural resources as before. In particular, I use the product of the time constant initial per capita endowment of country i and the average oil price, respectively gas price, in year t as an instrument for the oil and gas rents.[47] The higher a country's initial endowment, the higher is the probability of new resources being discovered. World market energy prices influence the rents both directly and indirectly through their influence on the expected profitability of the exploration of new resource reserves. The reasoning is similar to the method of Tsui (2011), who finds a negative long-term effect of oil wealth on democracy, using an instrumental variable approach to overcome the potential problem of endogeneity in his oil wealth variable. Since the data of oil endowment Tsui uses is not publicly available, I use geological data from the *USGS*

---

[46]Initial population is the population in 1991, the year before the sample period.

[47]For oil, I use the unweighted average of the annual spot prices of Brent and West Texas Intermediate and for gas the price of natural gas futures "contract 4", due to data availability. All prices are published by the *U.S. Energy Information Administration (EIA)*.

World Petroleum Assessment 2000 to compute each country's estimated initial endowment of oil and gas.[48] The report originally contains data about estimated initial endowment of oil, gas, and natural gas liquids for 246 assessment units (AU) grouped into eight regions of the world, except for the United States of America. Oil endowments are measured in million barrels, gas endowments in billion cubic feet, and natural gas liquids endowment in million barrels. To compare the three endowments and to aggregate natural gas and natural gas liquids into one measure, I convert gas and natural gas liquids into million barrels of oil equivalent (mboe).[49] Using a geographic information system (GIS) software, I combine the assessment units with the onshore territory and the exclusive economic zones (EEZ) of all countries in the world.[50] The EEZ are defined as the nautical zones offshore up to 200 nautical miles away from the shore, in which the respective country has the exclusive right to exploit all natural resources.[51] For each AU in the *USGS* data and each country whose economic territory overlaps with the AU, I compute the share of the total AU's area falling into the country's economic territory.[52] By multiplying these shares with the estimated initial hydrocarbon endowments of each AU, I obtain the total estimated initial endowment of oil, gas and natural gas liquids for every country.[53]

Figure 4 shows the GIS map from which the endowment data is obtained. The red areas are the known oil and gas basins and the light blue areas are the EEZ, each belonging to one certain country (light green). Although the estimates of the initial hydrocarbon endowments take into account information about previous resource extraction, they are mainly based on geographical aspects, and therefore the variable can be assumed to be exogenous and a valid instrument for oil and gas rents. Table 14 shows the results of the IV regressions with five-year periods, where oil and gas rents, GDP, and the autocracy variables are treated as endogenous. As before, the GDP variable is instrumented with the geographic variables and the autocracy variables with the average regional autocracy measure of the previous period.

While the coefficient of the interaction term is insignificant in the regressions for social spending with both autocracy variables and both commodity types, it is negative and highly significant in the regressions for education spending in the case of oil as the used commodity. When gas

---

[48]The report and the data are available at `http://pubs.usgs.gov/dds/dds-060/index.html#TOP` (16.12.2015).

[49]I convert gas according to: 1 billion cubic feet of gas = 0.19 mboe and natural gas liquids according to: 1 million barrels of natural gas liquids = 0.8625 mboe. The conversion factors stem from `http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/using-the-statistical-review/conversion-factors.html` (21.12.2015) and `https://www.eia.gov/cfapps/ipdbproject/docs/unitswithpetro.cfm` (21.12.2015).

[50]The data on the countries' territories and the EEZ is obtained from `http://www.marineregions.org/downloads.php` (09.12.2015).

[51]See `http://www.un.org/Depts/los/convention_agreements/texts/unclos/part5.htm` (21.12.2015).

[52]I exclude those territories whose legal status is disputed between two or more countries.

[53]Endowment of the USA is set to missing, due to missing information in the original data.

rents are used instead, it loses its significance but stays negative. The results of the education spending regressions are in line with the previous findings, while those for social spending are not. Anyway, one needs to be aware that any effects of rents from non-hydrocarbon resources are left out of these regressions, since only oil and gas rents are taken into account. Moreover, this reduces the number of countries to oil and gas producing countries and hence the number of observations.

Figure 4: World map with oil and gas basins
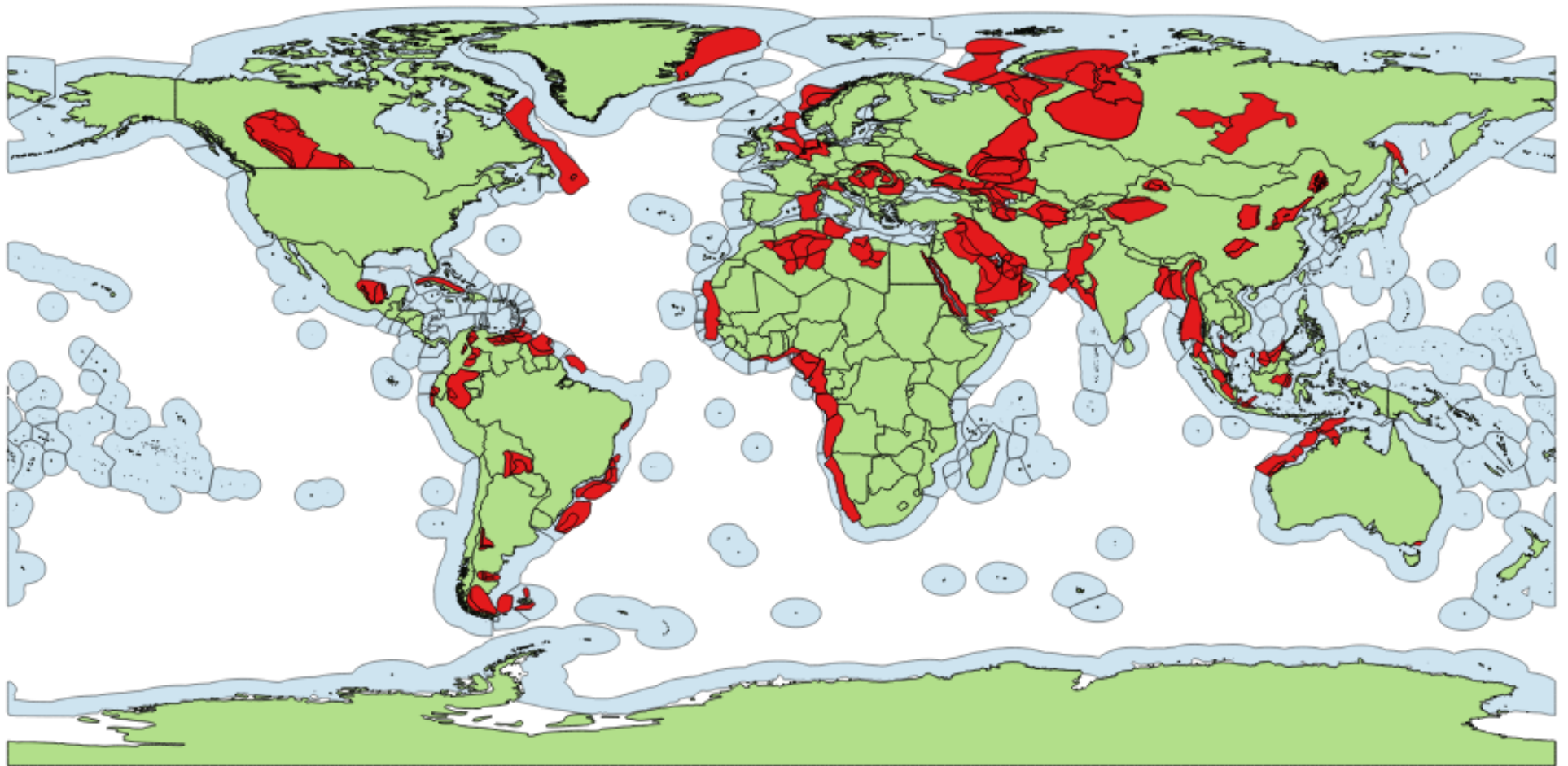
Source: Own illustration.
Legend: Red = oil and gas basins; light green = country territories; light blue: EEZ.

Table 14: Robustness checks: Panel IV regressions with endogenous resource rents, random effects estimator

	ICRG autocracy measure				PolityIV autocracy measure			
	(1) EDUC	(2) SOCIAL	(3) EDUC	(4) SOCIAL	(5) EDUC	(6) SOCIAL	(7) EDUC	(8) SOCIAL
OILRENTS	0.0715	-0.277			0.0152	-0.249		
	(0.40)	(-0.52)			(0.09)	(-0.67)		
GASRENTS			0.253	0.146			0.249	0.0599
			(1.13)	(0.37)			(0.60)	(0.17)
AUTOCRACY	1.120	-4.335	1.401	-2.950	0.453**	-0.825*	0.907**	-1.115**
	(1.21)	(-1.59)	(1.60)	(-1.16)	(2.34)	(-1.68)	(2.34)	(-2.22)
OIL∗AUTOCRACY	-0.203**	-0.101			-0.0484***	-0.0148		
	(-2.55)	(-0.39)			(-2.96)	(-0.39)		
GAS∗AUTOCRACY			-0.511*	-0.398			-0.0482	-0.00772
			(-1.72)	(-1.15)			(-0.90)	(-0.18)
LOGGDP	2.699***	3.046	2.115***	3.517	2.701***	5.295***	1.493	5.011***
	(3.22)	(1.23)	(2.70)	(1.48)	(3.24)	(3.32)	(1.16)	(2.66)
Countries	94	98	94	98	91	95	91	95
Observ.	258	275	258	275	248	265	248	265
R^2	0.17	0.42	0.12	0.54	0.18	0.47	0.06	0.51

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Time effects are included in the regressions in the form of period dummies.

Coefficients of the exogenous variables are not displayed. The exogenous regressors are the same as in table 13.

The latitude, the squared latitude, the relative length of coastline, and regional dummies

are used as instruments for the LOGGDP variable.

The autocracy variables are instrumented by the lagged average regional autocracy measures (also in the interaction terms).

6   Conclusion

This paper contributes to the literature on the *natural resource curse* by empirically investigating the joint effect of resource dependency and an autocratic government on the composition of government spending. It is hypothesized that it is neither resource dependency nor autocratic political structures per se that distort government spending, but the interaction of both. Although there is no clear-cut answer in the literature to the question of the direction in which this distortion goes, existing theories indicate that resource dependency in autocracies may lead to a shift in government spending away from growth promoting sectors in favor of rent distribution. Based on these assumptions, I include the shares of five different spending types in total government spending in my analysis. These types are in particular: spending on infrastructure and telecommunication, education spending, military spending, spending for social protection, and spending for healthcare. Using both panel data and instrumental variable regressions, the analysis provides strong evidence that natural resource dependency in autocratic countries leads to significantly lower spending on education. Taking into account that education spending is an important instrument to build human capital and to promote economic growth, especially in developing countries, this finding may serve as an additional explanation for the negative effects of natural resources in many countries. Concerning the other types of government spending, there does not seem to be a joint effect of resource rents and autocracy, besides very weak evidence for a positive effect on social spending. This positive effect is rather non-robust to different specifications of the regression model. In particular, the empirical analysis does not find any evidence that autocrats in *rentier states* behave differently with respect to military and infrastructure spending.

One has to be aware that especially government spending on military purposes is prone to "cover-up" as is the data on it prone to measurement error. It seems likely that autocrats report less military expenditure than was actually incurred, due to a lack of surveillance. The incentive for underreporting is even higher if the country receives foreign aid payments. If this is the case, then the results for the influence of autocracy on military expenditure are likely to be biased downwards.

References

Acemoglu, D., Johnson, S., and Robinson, J. A. (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *American Economic Review*, 91(5):1369–1401.

Acemoglu, D., Naidu, S., Restrepo, P., and Robinson, J. (2014). Democracy Does Cause Growth. Technical Report w20004, National Bureau of Economic Research, Cambridge, MA.

Acemoglu, D. and Robinson, J. A. (2000). Why Did the West Extend the Franchise? Democracy, Inequality, and Growth in Historical Perspective. *The Quarterly Journal of Economics*, 115(4):1167–1199.

Aidt, T. S. and Jensen, P. S. (2013). Democratization and the size of government: evidence from the long 19th century. *Public Choice*, 157(3-4):511–542.

Aidt, T. S. and Jensen, P. S. (2014). Workers of the world, unite! Franchise extensions and the threat of revolution in Europe, 1820 - 1938. *European Economic Review*, 72:52–75.

Alesina, A. and Dollar, D. (2000). Who Gives Foreign Aid to Whom and Why? *Journal of Economic Growth*, 5(1):33–63.

Alesina, A. and Wacziarg, R. (1998). Openness, country size and government. *Journal of Public Economics*, 69(3):305–321.

Barro, R. J. (1991). Economic Growth in a Cross Section of Countries. *The Quarterly Journal of Economics*, 106(2):407.

Barro, R. J. (2001). Human Capital and Growth. *American Economic Review*, 91(2):12–17.

Bhattacharyya, S. and Collier, P. (2014). Public capital in resource rich economies: is there a curse? *Oxford Economic Papers*, 66(1):1–24.

Boix, C., Miller, M., and Rosato, S. (2013). A Complete Data Set of Political Regimes, 1800-2007. *Comparative Political Studies*, 46(12):1523–1554.

Brunnschweiler, C. N. and Bulte, E. H. (2008). The resource curse revisited and revised: A tale of paradoxes and red herrings. *Journal of Environmental Economics and Management*, 55(3):248–264.

Bulte, E. H., Damania, R., and Deacon, R. T. (2005). Resource intensity, institutions, and development. *World Development*, 33(7):1029–1044.

Campante, F. R. and Chor, D. (2012). Why was the Arab World Poised for Revolution? Schooling, Economic Opportunities, and the Arab Spring. *Journal of Economic Perspectives*, 26(2):167–188.

Cockx, L. and Francken, N. (2014). Extending the concept of the resource curse: Natural resources and public spending on health. *Ecological Economics*, 108:136–149.

Cockx, L., Francken, N., and Instituut voor Ontwikkelingsbeleid en beheer (IOB), U. A. (2015a). *Is there a natural resource curse on education spending?* IOB Working Papers. Number 2015.02 35 pages.

Cockx, L., Francken, N., and Instituut voor Ontwikkelingsbeleid en beheer (IOB), U. A. (2015b). *Natural resource wealth and public social spending in the Middle East and North Africa.* IOB Working Papers. Number 2015.03 29 pages.

Collier, P. and Hoeffler, A. (2005). Resource Rents, Governance and Conflict. *Journal of Conflict Resolution*, 49(4):625–633.

Frankel, J. (2012). The Natural Resource Curse: A Survey. Technical Report RWP12-014, John F. Kennedy School of Government, Harvard University.

Gelb, A. (2010). Economic Diversification in Resource Rich Countries.

Gemmell, N., Kneller, R., and Sanz, I. (2016). Does the composition of government expenditure matter for long-run gdp levels? *Oxford Bulletin of Economics and Statistics*, 78(4):522–547.

Hall, R. E. and Jones, C. I. (1999). Why do some countries produce so much more output per worker than others? *The Quarterly Journal of Economics*, 114(1):83–116.

Hannum, E. and Buchmann, C. (2005). Global Educational Expansion and Socio-Economic Development: An Assessment of Findings from the Social Sciences. *World Development*, 33(3):333–354.

Hausken, K., Martin, C. W., and Pluemper, T. (2004). Government Spending and Taxation in Democracies and Autocracies. *Constitutional Political Economy*, 15(3):239–259.

Herb, M. (2003). Taxation and representation. *Studies in Comparative International Development*, 38(3):3–31.

Herb, M. (2005). No Representation without Taxation? Rents, Development, and Democracy. *Comparative Politics*, 37(3):297.

International Food Policy Research Institute (IFPRI) (2015). Statistics of public expenditure for economic development (SPEED).

Kahneman, D. and Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47(2):263.

Kotera, G. and Okada, K. (2015). How does democratization affect the composition of government expenditure? Technical Report 67085, Munich Personal RePEc Archive, Munich.

Leite, C. A. and Weidmann, J. (1999). Does mother nature corrupt? natural resources, corruption, and economic growth. IMF Working Papers 99/85, International Monetary Fund.

Lipset, S. M. (1959). Some Social Requisites of Democracy: Economic Development and Political Legitimacy. *American Political Science Review*, 53(01):69–105.

Maoz, Z. and Henderson, E. A. (2013). The World Religion Dataset, 1945 - 2010: Logic, Estimates, and Trends. *International Interactions*, 39(3):265–291.

Marshall, M. G., Gurr, T. R., and Jaggers, K. (2013). Political regime characteristics and transitions, 1800-2012. Technical report, Center for Systemic Peace, PolityIV Project.

Mauro, P., Development, I. M. F. P., and Dept, R. (1996). *The effects of corruption on growth, investment, and government expenditure*. IMF working paper. International Monetary Fund.

Mehlum, H., Moene, K., and Torvik, R. (2006). Institutions and the Resource Curse. *The Economic Journal*, 116(508):1–20.

Nijkamp, P. and Poot, J. (2004). Meta-analysis of the effect of fiscal policies on long-run growth. *European Journal of Political Economy*, 20(1):91–124.

Pluemper, T. and Martin, C. W. (2003). Democracy, Government Spending, and Economic Growth: A Political-Economic Explanation of the Barro-Effect. *Public Choice*, 117(1):27–50.

Profeta, P., Puglisi, R., and Scabrosetti, S. (2013). Does democracy affect taxation and government spending? Evidence from developing countries. *Journal of Comparative Economics*, 41(3):684–718.

Ramsay, K. W. (2011). Revisiting the resource curse: Natural disasters, the price of oil, and democracy. *International Organization*, 65(3):507–529.

Ross, M. L. (2001). Does Oil Hinder Democracy? *World Politics*, 53(03):325–361.

Sachs, J. and Warner, A. (1995). Natural Resource Abundance and Economic Growth. Technical Report w5398, National Bureau of Economic Research, Cambridge, MA.

Sala-i Martin, X. and Subramanian, A. (2003). Addressing the Natural Resource Curse: An Illustration from Nigeria. Technical Report w9804, National Bureau of Economic Research, Cambridge, MA.

Sanz, I. and Velazquez, F. J. (2007). The role of ageing in the growth of government and social welfare spending in the OECD. *European Journal of Political Economy*, 23(4):917–931.

Sarr, M. and Wick, K. (2010). Resources, conflict and development choices: public good provision in resource rich economies. *Economics of Governance*, 11(2):183–205.

SOFAZ. SOFAZ Revenue and Expenditure Statement for January-March 2015. Online Report.

Staiger, D. and Stock, J. H. (1997). Instrumental Variables Regression with Weak Instruments. *Econometrica*, 65(3):557.

The PRS Group (2014). Icrg researcher's dataset - table 3b.

Tsui, K. (2011). More Oil, Less Democracy: Evidence from Worldwide Crude Oil Discoveries. *The Economic Journal*, 121(551):89–115.

Ulfelder, J. (2007). Natural-Resource Wealth and the Survival of Autocracy. *Comparative Political Studies*, 40(8):995–1018.

USGS (2000). US Geological Survey World Petroleum Assessment 2000. Technical report, USGS.

van der Ploeg, F. (2008). Challenges and opportunities for resource rich economies. *CEPR Discussion Paper*, 5688.

Wooldridge, J. M. (2002). *Econometric analysis of cross section and panel data*. MIT Press, Cambridge, MA.

Yu, B., Fan, S., and Saurkar, A. (2009). Does Composition of Government Spending Matter to Economic Growth? Beijing, China.