8

The Centre on Conflict, Development and Peacebuilding
CCDP Working Paper

Oil, Gas and Minerals:

The Impact of Resource-Dependence and Governance on Sustainable Development

Gilles Carbonnier, Natascha Wagner and Fritz Brugger

THE GRADUATE INSTITUTE | GENEVA
CENTRE ON CONFLICT, DEVELOPMENT AND PEACEBUILDING

Contents

Preface

It has often been argued that oil, gas and minerals may have a negative impact on development as measured by income per capita. Yet this assertion does not say much about sustainability, which is critical for developing countries whose economic growth derives primarily from the exploitation of exhaustible resources. This Working Paper, written by the CCDP's Deputy Director Gilles Carbonnier together with Fritz Brugger and Natascha Wagner, takes adjusted net savings (ANS) as an indicator of weak sustainability in order to examine the link between resource dependence and sustainable development. It also takes a closer look at specific governance indicators.

Since it is hard to disentangle the direct effect of governance on development in empirical studies, the Working Paper uses the relative size of the youth bulge as instrument. The results highlight a negative relationship between natural resource extraction and ANS but indicate that this is not inevitable. Effective checks on the power of the executive appears to be critical for sustainable outcomes. Moreover, effective legislative chambers, an independent judiciary and broad acceptance of established institutions all have a positive impact on ANS per capita. The results further confirm that armed conflict and armed violence as measured by homicide rate have a negative impact on ANS.

This Working Paper is the result of the CCDP's on-going research project on governance in the extractive industries, with a particular focus on how resource-rich developing countries can escape the resource trap. The project focuses on the complex relationship between sustainable development processes and the extraction of oil, gas and minerals. Specifically, it seeks to distil lessons from an investigation of how, and under what conditions, formerly low-income resource-rich countries have managed to establish systems of governance that enabled them to use the proceeds of their natural wealth in a way that avoided the resource curse. Why have some resource-rich countries managed to join the ranks of upper middle-income emerging economies while others have not?

Preliminary results of this CCDP project suggest that there is a need for the extractive industries and donor agencies to expand their focus from community-development programmes to strengthening checks-and-balance mechanisms. Indeed, this Working Paper suggests a number of possible avenues to make extractive resources a stake for peace rather than for violent rent seeking.

We are grateful to Lundin Petroleum for financial support, and in particular to Christine Batruch (Vice President, Corporate Responsibility) for her continued support and encouragement of our work on this important topic. A further output of this project is the recent special issue of the journal *Global Governance*, Vol. 17:2 (April-June 2011), for which Gilles Carbonnier was also the guest editor.

Keith Krause
CCDP Director

September 2011

1. Introduction

Intuition suggests that states with abundant sub-soil assets in the form of oil, gas and minerals are in a position to draw large revenues from extraction that can in turn spur economic development. In other words, resource abundance should be a blessing. Experiences to date display a mixed record. Industrialized countries like Australia, Canada and the United States succeeded in turning resource extraction into economic growth and development. Developing countries like Botswana, Chile, Malaysia or South Africa have all joined the category of upper-middle income economies, in part thanks to the exploitation of natural resources. But other resource-rich economies such as the Democratic Republic of the Congo and Niger could not emulate these successes. They keep ranking among low-income countries and epitomize the so-called 'resource curse'.

This paper looks at the critical variables that help to explain different outcomes of extraction in terms of sustainable development. The empirical literature so far tends to focus on the impact of resource richness on economic growth and income per capita. While this is an important metric for economic development, it does not say much about sustainability, which is crucial in the case of exhaustible resources like oil and minerals whose production is bound to peak and cease at some point in time. This is why we draw on environmental accounting and take adjusted net savings (ANS) as an indicator of weak sustainability. Consistent with the resource-curse literature, the paper considers a range of governance and institutional indicators to assess the nexus between the extraction of resources, governance and development outcomes. The objective is to enhance our understanding of the interactions between resource dependence, institutions and the quality of governance, armed violence and sustainable development in resource-rich developing countries.

Our dynamic panel data analysis covers 108 developing countries over 24 years, from 1984 to 2007. We rely on the System GMM estimator (Arellano and Bover, 1995) to address the dynamic process between national income, resource extraction, investment and saving. Furthermore, we instrument governance by the relative size of the youth bulge, following Urdal (2004) who provided strong evidence that the size of the youth bulge affects a country's propensity for conflict, consistent with historical research on violence (Muchembled, 2008). Instrumenting the endogenous governance indicators with the time-varying size of the youth bulge allows us to fully exploit the panel dimension of our dataset and leads us to the following results: Governance matters. However, the different governance indicators available cover different aspects and therefore have differential effects on the outcome of interest. Consequently, not all governance indicators prove to have predictive power for ANS. Effective legislative chambers and the acceptance of established institutions have demonstrated a positive impact on sustainable development. Thus, our results emphasize once more that governance indicators have to be carefully designed and implemented to allow one to draw meaningful conclusions. Moreover, we also present evidence that resource-rich countries tend to deplete their resources without re-investment. Using a set of dummy variables to classify resource-richness we find some indication that those countries with moderate resource rents tend to do worse in terms of sustainability.

The paper is structured as follows. Section 2 presents the capital approach to economic development and looks at the case of a few resource-rich developing countries. Section 3 provides the theoretical background on the economics and politics underlying our empirical model presented in section 4, together with the data and indicators. Section 5 discusses the results and section 6 concludes.

2. From Extraction to Development

In theory, extractive revenues should help resource-rich countries to mobilize domestic resources for social and economic development, in particular during price booms. Yet in practice, "one of the surprising features of modern economic growth is that economies abundant in natural resources have tended to grow slower than economies without substantial natural resources" (Sachs and Warner, 1997).

Today, the vast majority of resource-rich economies are developing countries (IMF 2007:62-63) and the relationship between extraction and development is a controversial issue. There is little consensus about the transmission channels from the exploitation of non-renewable natural resources to sustainable development outcomes, and about the prerequisites to escape the resource curse, let alone if the curse argument is a valid one (Papyrakis and Gerlagh, 2004). Recent research shows that extractive booms have been more of a curse than a blessing for several resource-rich countries. This is for instance the case for the Democratic Republic of the Congo, Equatorial Guinea, and Nigeria. The main symptoms involve Dutch disease, rentier-state dynamics, rent-seeking behavior and armed violence (Mehlum *et al.*, 2006; Collier and Goderis, 2008; Carbonnier 2007 and 2011).

2.1 The resource curse

Early contributions to the resource curse literature focused mainly on economic explanations including terms of trade, price volatility, dependency theories, and Dutch disease. Yet, as Ross (1999:307) puts it

> to explain why these hardships lead to persistently slow growth – the resource curse – we must also explain why governments fail to take corrective action. Governments play an exceptionally large role in the resource sectors of almost all developing countries and, at least in theory, have the policy tools to mitigate each of these hardships.

This is why research has come to stress the political dimension of the resource curse, looking in particular at the role of the state. The rentier state theory, for example, holds that mineral rents reduce the necessity of the government to levy domestic taxes, rendering leaders less accountable to citizens and more prone to rent-seeking, corruption and patronage politics (Mahdavy, 1970; Beblawi and Luciani, 1987; Clark, 2007; Yates, 1996; Karl, 1996). This has led to the finding that oil hinders democracy (Ross, 2001) and that presidential democracies are more likely to face a resource curse than parliamentarian democracies (Andersen and Aslaksen, 2008).

There is a consensus on the positive correlation between institutional quality and the development outcome of resource extraction. Yet, authors disagree on whether the quality of institutions prior to windfall revenues is decisive or whether extractive rents deteriorate otherwise good institutions (Mehlum *et al.*, 2006; Robinson *et al.*, 2006; Pessoa, 2008; Sala-i-Martin and Subramanian, 2003; Collier, 2007; Van der Ploeg and Poelhekke, 2010; Brambor, 2008). A recent survey of the resource-curse literature concludes:

> The proposition that oil abundance induces extraordinary corruption, rentseeking, and centralized interventionism and that these processes are necessarily productivity-and growth-restricting is not supported by comparative or historical evidence (...) The extent to which mineral and fuel abundance generate developmental outcomes depends largely on the nature of the state and politics as well as the structure of the ownership in the export sector. (Di John, 2011)

2.2 A capital approach

Most of the resource-curse literature follows Sachs and Warner by assessing development outcome in terms of GDP growth. This focus on growth in output and value added neglects variations in stocks. The exploitation of oil, gas and minerals translates into immediate GDP growth without considering the concomitant depletion of the natural capital base, in particular the reduction of national sub-soil wealth. In addition, mineral resources are non-renewable. The exploitation of oil, gas and minerals in low-income countries offers a time-bound opportunity to mobilize domestic finance for development, since the extractive rent will die off at some point, depending on the abundance of mineral deposits or oil reserves and the pace of extraction (Stevens, 2011). In the long run, the development outcome is closely tied to the allocation of the resource rents between consumption and investment. In fragile states, the rents are all too often misappropriated and invested in patronage politics and political repression rather than in infrastructure, health services and education. This extractive windfall often leads political leaders to overspend on consumption and non-productive assets, as illustrated by lavish presidential palaces and sumptuary monuments built across gas-rich Turkmenistan. These expenditures contribute to GDP growth but certainly not to sustainable development. The rent tends to be perceived as a prize that can be captured through corruption and armed violence (Humphreys *et al.*, 2007).

This paper adopts a capital approach, which is particularly relevant in the context of resource-rich economies. It captures the linkages between resource extraction and sustainability (Hamilton 2004:31) and incorporates natural capital in calculating national income and wealth (Goodwin, 2007). We consider genuine savings as a measure of the development outcome, building on the idea that the total amount of capital in the economy should not be eroded over time. Hartwick (1977) sought to identify conditions under which constant consumption could be maintained indefinitely using the input from a finite stock of non-renewable resources. The 'Hartwick rule' not to erode the overall capital base while exploiting natural resources requires investing the resource rent in productive physical, human and social capital (Solow, 1974; Hartwick, 1977; Perman *et al.* 2003:89). Thus, genuine savings rather than GDP growth allow long-run economic sustainability (World Bank, 2006).

This approach suffers from several limitations (Everett and Wilks, 1999; Thiry and Cassiers, 2010). It rests on the assumption that natural capital can be fully substituted by produced and human capital, which is obviously not a realistic premise. Genuine savings are often referred to as an indicator of "weak sustainability". Ecology scholars, in contrast, advocate for "strong sustainability", i.e. to preserve the entire ecosystem for future generations. In any case, genuine savings as an indicator of weak sustainability is consistent with the UN definition of sustainable development as "development that ensures non-declining per capita national wealth by replacing or conserving the sources of that wealth; that is, stocks of produced, human, social and natural capital." (United Nations *et al.*, 2003:4). The concept of wealth is based on a comprehensive list of assets which includes:

- produced capital like roads, buildings, dams, canals, transmission lines, railways, ports;
- natural capital like oil and minerals, fisheries, forests, ecosystems;
- human capital like knowledge, education, training, skills, physical and mental health; and
- social capital like social cohesion, stock of trust, socially held knowledge that facilitates the social coordination of economic activity[1] (Goodwin, 2007).

[1] The last two forms of capital are also called intangible capital.

Resource extraction corresponds to a decumulation or disinvestment since it reduces the stock of natural capital. Overall wealth can nonetheless grow with compensatory capital accumulation.

Several efforts were made to develop indicators of sustainable development, based on the premise that sustainable development requires non-declining wealth per capita, that is non-declining physical, natural, human and social capital per person (Arrow *et al.*, 2003). Dasgupta *et al.* (2002) and Hamilton (2002) show that assessing the development outcome of extractive activities through such a capital approach yields different results from considering GDP. Several countries with strong GDP growth actually record negative per capita net savings growth. Resource-rich countries that see their non-renewable resource capital base decline through extraction do not only have to define efficient extraction policies, but also strategies to maintain adjusted net savings for future generations. The World Bank has defined and calculated the ANS for 209 countries from 1970-2008 using the following formula (Bolt *et al.*, 2002):

$$ANS_{it} = \underbrace{(GS_{it} - DEPC_{it})}_{\widehat{=}\text{Net Savings}} + EE_{it} - RRD_{it} - CD_{it,} \quad (1)$$

where ANS_{it} is the adjusted net savings of country i at time t. It is composed of gross national savings GS_{it} net of the depreciation of produced capital $DEPC_{it}$, augmented by (non-fixed capital) expenditure on education EE_{it} and reduced by the rents from depletion of natural capital[2] and damages from carbon dioxide emissions CD_{it}.

We consider ANS as a proxy for sustainability, linking investment in physical and human capital with extraction of resources. We aim at elaborating on the principles of environmental accounting or green national accounts that have been found to be significantly correlated with aggregate welfare (Gnègnè, 2009). In contrast to previous studies which analyze ANS as a percentage of GNI, we consider per capita ANS. We take the per capita approach to have a metric that is income free. We opt for this definition because we do not want to risk that our results are merely driven by changes in national income. The World Bank ANS data have recently started to be used more often in the resource curse literature (e.g. Stoever, 2011; Barbier, 2010; Van der Ploeg and Poelhekke, 2010; der Ploeg 2010; Dietz *et al.*, 2007). Previous studies looking at the determinants of net savings use the ANS ratio as dependent variable, that is ANS as percentage of national income. This raises endogeneity issues, especially when putting national income as one of the explanatory variables of the empirical model.

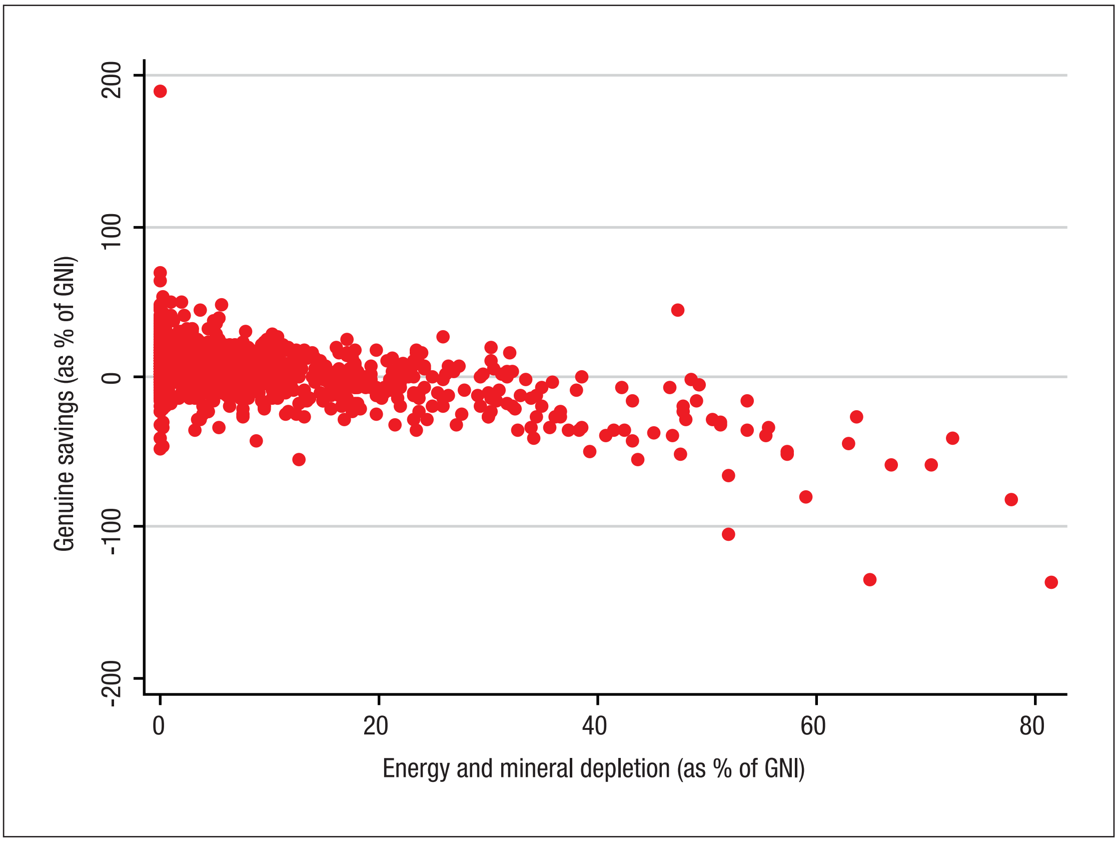
Barbier excludes CO^2 damage from the calculation; it suffers from methodological flaws and data are missing for most countries for the pre-2000 period. We follow Barbier in that we take ANS excluding particulate emission damage. Besides, der Ploeg (2010) shows that the World Bank's genuine saving figures based on market rather than accounting prices are susceptible to downwards bias. However, in many developing countries resource extraction translates into negative saving rates, which indicates – despite a possible margin of downward bias – that resource rents are consumed rather than invested in physical and human capital.

---

2 Natural capital includes gas, coal, forest, oil, metals and minerals such as bauxite, copper, gold, iron ore, lead, nickel, phosphate rock, silver, tin and zinc.

We distinguish in our sample of developing countries between low-income countries (LIC), lower-middle income countries (LMIC) and upper-middle income countries (UMIC). Figure 1 shows a negative relationship between genuine saving as a percentage of GDP and resource dependence, which is supported by several studies (Atkinson and Hamilton, 2003; Neumann, 2004; Dietz *et al.*, 2007). Controlling for country-fixed effects and time-fixed effects, we find a negative and significant correlation of 0.77. This echoes the results of a World Bank study (World Bank, 2006) and is not surprising. However, by construction energy and mineral depletion reduce genuine savings. Extracting oil, gas and minerals might increase GDP but reduces genuine savings *ceteris paribus*. Investment in education can play a critical role in partly offseting this impact (Gylfason, 2001). If we further consider the correlation between the sum of gross saving and education expenditures with resource rents, we find a positive with-in country correlation with a coefficient of 0.26. Yet, even if resource-rich developing countries seem to save and invest in education, investment in human capital is smaller than the depletion of natural capital.

Figure 1: Relationship between genuine savings and depletion of energy and minerals for the sample of LICs, LMICs and UMICs in the period 1984-2007.

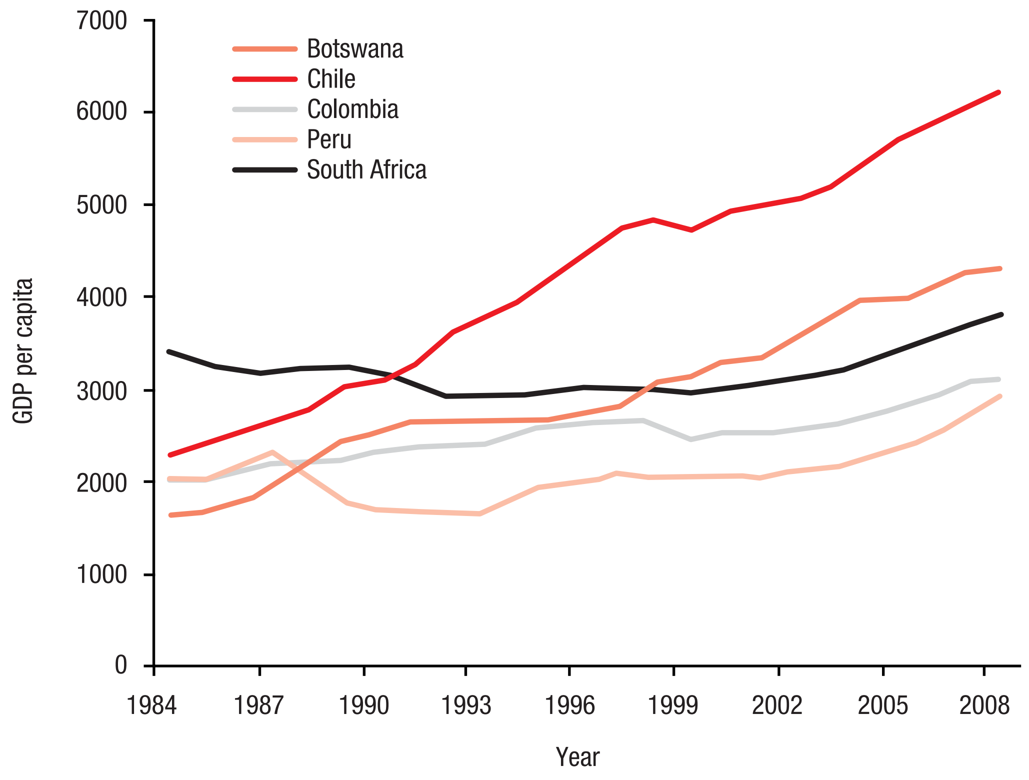


Countries like Nigeria and Angola have displayed strong economic growth over the past decade and recently graduated from low-income to middle-income countries. But negative saving rates compared to GDP may imperil opportunities for, and the living standard of, future generations (World Bank, 2006). Nigeria, for instance, enjoyed a substantially higher GDP per capita than resource-poor countries like Vietnam and Laos in 2007 but ranked lower on the Human Development Index (HDI) scale. Since the HDI includes health and education indicators in addition to income per capita, we should expect lower public expenditure in health and education in Nigeria than in Vietnam and Laos. But 2007 data indicates that Nigeria actually allocates a greater share of public expenditure to public health than Laos and a greater share to education than Vietnam (Carbonnier *et al.*, 2010). Understanding these apparent paradoxes requires looking deeper into the quality of expenditure and public services. The World Bank contends that, according to conservative estimates, Nigeria could have had a stock of produced capital in 2000 five times higher than the actual stock had the country wisely reinvested its oil rents. Moreover, if these investments had taken place, oil would play a much smaller role in the Nigerian economy and it would be more diversified today (World Bank, 2006). This is compounded by the fact that many of those resource-rich countries experienced or still experience high levels of armed violence or armed conflict. Such conflicts are often related to rent-seeking behavior and the attempt to control the extractive resources. High incidences of armed violence are found to severely compromise the skills and assets that are essential to living a productive life and shorten planning and investment horizons (Geneva Declaration, 2010).

2.3 Resource-rich, upper middle-income countries

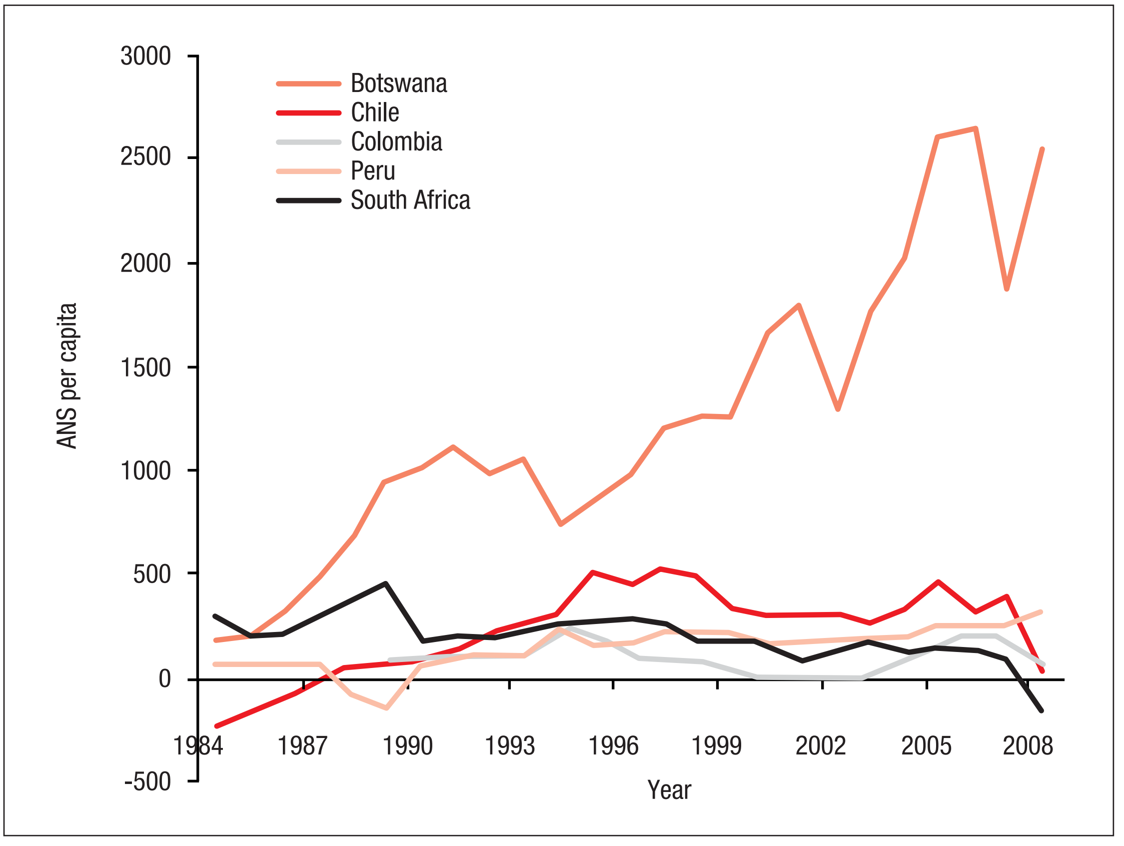
Over the last four decades, some developing countries managed to benefit from their mineral wealth to spur economic and social development. Today for example, Botswana, Chile, Colombia, Peru, and South Africa rank among upper-middle income countries with varying degrees of economic diversification. Figure 2 shows that all five countries registered an increase in per capita GDP over the sample period (1984-2007), although less pronounced in South Africa, with Botswana experiencing the strongest GDP growth of 4.59% over this period. The picture is different when looking at ANS (Figure 3). Botswana shows robust growth in ANS per capita while it remains very low or even turns negative in the other four countries: all countries experience a decline after 2005 and South Africa exits the sample period with a per capita ANS lower than in 1984, raising doubt about the sustainability of the development path.

Figure 2: Evolution of GDP per capita over the period 1984-2008 for five selected countries.



Botswana stands out as an exception, remarkably outperforming its peers. How come it succeeds in spurring a three-fold increase in ANS per capita over the period? Botswana developed an explicit policy of reinvestment of all its resource rents. It elaborated as of the early 1990s an indicator to monitor the policy implementation: the "Sustainable Budget Index" (SBI), which loosely follows the Hartwick-Solow rule (Lange, 2004:259; Lange and Hassan, 2003). The SBI is the ratio of non-investment spending to recurrent (nonmineral) revenue. An SBI value below 1 means that current government consumption is sustainable because it is financed entirely out of revenues other than from minerals and that all the government revenues from minerals are invested rather than consumed. Accordingly, an SBI value greater than 1 means that consumption relies in part on the exploitation of exhaustible resources, which is fiscally unsustainable (Lange and Hassan, 2003). In 2007 the Botswanian government started to work on a more sophisticated formula to address SBI weaknesses such as the lack of clarity on what can be registered as investment and, more importantly perhaps, the quality of investments (Bank of Botswana, 2007). In trying to explain the good performance of Botswana compared to countries like Nigeria, Acemoglu *et al.* (2001) point to the fact that Botswana had already better institutions before diamond mining started in 1967. Botswana's political system, in part inherited from the pre-colonial era, notably placed more effective constraints on the political elite.

Figure 3: Evolution of ANS per capita over the period 1984-2008 for five selected countries



3. Theoretical Background

Our econometric model is based on the neoclassical, long-term growth framework. Saving is the fraction of output that is not consumed and depends on GDP as well as on the exogenous population growth (Solow, 1956 and 1974). In a first attempt to identify the determinants of genuine savings, Dietz *et al.* (2007) provide a brief overview of the major empirical studies and argue that the most significant and robust explanatory variables include GDP per capita and growth. Counter-intuitively, interest rates and terms of trade do not appear to be significant. In our empirical model presented below, we control for GDP per capita and GDP growth and for population growth and take ANS per capita as dependent variable. The variables of interest are extractive resource dependence and a series of institutional and governance indicators that are in turn included in the set of covariates.

The resource-curse literature highlights four critical institutional variables: (i) political constraints on the executive power and effective checks and balances, (ii) the level and type of corruption, (iii) regime types, and (iv) armed violence and conflict. The first widely-cited example of the resource curse is the rapid decline of early modern Spain in the seventeenth century. Castile suffered from Dutch disease and the rentier-state syndrome as a direct result of the extraordinary amount of precious metals it extracted from its Latin American colonies. Drelichman and Voth (2008) show how the silver windfall eroded Spanish institutions at a critical point in time. The country was evolving in the direction of limiting the power of the king in favor of the Cortes, a quasi-parliamentary body with representatives of the main cities of Castile, in which an emerging merchant class was to gain influence. But the revenues from the Latin American silver bonanza, which amounted up to a third of Spain's total revenues, allowed the king to set policies unchecked by any powerful actor outside the monarchy and to embark in costly war enterprises. This turned out to be fatal in Spain's competition with England and Flanders that succeeded in establishing effect checks-and-balance mechanisms on the power of the executive.

The literature assessing the link between governance, institutions and the resource curse tests a range of indicators. Kolstad and Wiig (2009), Rothstein and Teorell (2008) and others analyze institutions and the quality of governance from a political economy perspective, looking at different indicators and causal mechanisms to better understand which institutional variables play a major role in the extraction-development nexus. Rothstein and Teorell argue that impartiality in the exercise of governmental power is key to the quality of governance: "When implementing laws and policies, government officials shall not take anything about the case into consideration that is not beforehand stipulated in the policy or the law." We select specific governance indicators that serve as proxy for impartiality or impartiality enhancing institutions, drawing primarily from the Polcon V database. It provides several measures of institutionalized constraints using a spatial model of political interaction that incorporates information on the number of independent branches of government with veto power, the effectiveness of legislative chambers, the independence of the judiciary, the strength and independence of sub-federal entities and the acceptance of these institutions by the population (Henisz, 2000, 2002 and 2006).

Rothstein and Teorell (2008) distinguish between the content of a policy and its procedural aspects, i.e. the way the policy is implemented, which they refer to as the quality of governance since it determines how far a government behaves in a predictable and consistent fashion. The authors further distinguish between the output-and inputside of political systems. The latter is about autocracy versus democracy. It focuses on how the content of policies is being defined and how access to power is organized and looks at organized interests, political parties, ideologies, etc. On the other hand, governance refers to the output-side of the political system with a focus on procedures. Governance refers to how policy decisions are being made and how power is exercised, with impartiality as the organizing principle. The quality of governance hangs less on the political system *per se* (i.e. democracy or autocracy) than on the output-side of the political system.

Andersen and Aslaksen (2008) find no resource curse in democracies with a parliamentary form of government while the poor performance of resource abundant presidential and non-democratic regimes leads to lower growth, understood as consequence of a less rigid budget constraint in presidential regimes. Collier and Hoeffler (2009) test the impact of democracy in resource rich economies on GDP growth from 1970-2001. They find that while the combination of high natural resource rents and open democratic systems in developing countries has been growth reducing, the existence of solid checks-and-balance mechanisms tends to offset this effect. The problem, they argue, is that political constraints are undersupplied in nascent democracies and further tend to be eroded by extractive resource rents in the medium to long-term. Cabrales and Hauk (2011) further show that weak institutions tend to lead to revolutions associated with resource discoveries. Tsui (2011) finds that the discovery of 100 billion barrels of oil pushes downward a country's democracy level by almost 20 percent, using the Polity IV Index in relation to indicators of oil endowment and discovery, oil quality and cost of exploitation.

The recent literature on resource dependence and political regime has produced mixed results regarding the effect of institutions and institutional quality. Mavrotas *et al.* (2011), for example, demonstrate that both point-and diffuse-type natural resource dependence retard the development of democracy and good governance. Stoever (2011) finds a significant positive relationship between good institutions and sustainability as measured by ANS. Using the unweighted average of the six (composite) indicators combined to the Worldwide Governance Indicators from 1996 to 2007, the quality of governance tends to have a greater influence on non-physical capital, that is [dis-]investment in human capital and natural capital than on physical capital. The precise relationship between resource richness, democracy and growth remains contested. In our model, we test how far the nature of the regime impinges upon genuine savings by including Polity2 (Polity IV) as a measure of autocracy and democracy.

The level of corruption is a direct measure of impartiality whereby corruption can be defined as a violation of the impartiality principle (Kurer, 2005; Rothstein and Teorell, 2008). Barbier (2010) compares the effect of corruption on ANS in African and Asian resource-dependent economies between 1970 and 2003. In the case of African countries, it seems that it is corruption rather than resource dependency *per se* that negatively affects the ability to reinvest resource rents in productive and human capital, at least in the short term. Corruption does influence long-run growth in adjusted net saving rates in both Asian and African countries. Dietz *et al.* (2007) test the impact of institutional quality on ANS in resource-rich countries using indicators for corruption, bureaucratic quality, rule of law and political constraints on the executive. They find that it is primarily the level of corruption that has a robust impact on ANS in interaction with resource dependence, measured as share of exports. In contrast, Boos (2011) finds that bureaucratic quality exerts a greater influence than corruption. In our model, we use the corruption indicator from the Political Risk Index, which provides a combined expert-based measure of a country's rule of law and extent of government corruption.

The civil wars in Angola, the Democratic Republic of the Congo and Sierra Leone served to support the argument that resource-rich countries are more prone to conflict than their resource-poorer counterparts (Le Billon, 2003; Collier and Hoeffler, 2004; Le Billon, 2005; Rosser, 2006). The relationship between resource dependence and armed conflict has been subject to controversies in the academic literature over the past years and there is no consensus on the precise causal mechanisms, let alone on the correlation. Many authors argue that resource dependence tends to prolong armed conflicts (Di John, 2007), and that there is a link between the quality of governance, resource richness and conflict. Teorell (2009) finds some support for the hypothesis that civil war is associated with the lack of impartial institutions. Brunnschweiler and Bulte (2008) argue that there is no evidence of a causal relationship between natural resource dependence and armed conflict, and that resource abundance is actually associated with a reduced probability of civil war. Van der Ploeg and Rohner (2010) draw another conclusion by treating re-source extraction as endogenous on the basis that fighting does affect the extraction pace. Whereas Lujala (2009) emphasizes that the location and type of resource matters, others link resource dependence and ethnic exclusion. Basedau and Richter (2011) argue that only situations of low abundance of oil per capita in combination with either high dependence of natural resources or geographical overlap of ethnic exclusion with oil reserve areas within autocracies provide conditions for the onset of civil war. We include in our model two violence indicators with data on homicides from the Small Arms Survey and on armed conflict from the Uppsala Conflict Data Program.

4. Econometric Specification and Data

We carry out a dynamic panel data analysis looking at 108 countries over 24 years, from 1984 to 2007. Among the 108 countries we have 33 LICs, 41 LMICs and 34 UMICs. LICs make up for 27.25% of the observations meaning that they represent roughly one third of the sample and are not systematically underrepresented. A comprehensive list of countries and the number of observations per country can be found in Table 1. The sample is restricted to developing countries because we aim at analyzing whether there are systematically different development outcomes for resource-rich developing countries versus resource-poor ones.

Table 1: Alphabetical list of the 108 LICs, LMICs and UMICs that are considered in the regression analysis. For each country the maximum number of available observations is also presented.

Country	Obs.	Country	Obs.	Country	Obs.
Albania	16	Gambia, The	20	Pakistan	24
Algeria	19	Georgia	9	Panama	24
Argentina	22	Ghana	21	Papua New Guinea	18
Armenia	5	Guatemala	15	Paraguay	24
Bangladesh	24	Guinea	16	Peru	21
Belarus	16	Guinea-Bissau	13	Philippines	24
Belize	17	Guyana	12	Romania	11
Benin	13	Honduras	24	Russian Federation	11
Bhutan	9	India	24	Rwanda	24
Bolivia	11	Indonesia	21	Senegal	1
Botswana	24	Iran, Islamic Rep.	8	Seychelles	11
Brazil	24	Jamaica	22	Sierra Leone	6
Bulgaria	21	Jordan	24	Solomon Islands	10
Burkina Faso	19	Kenya	24	South Africa	24
Burundi	6	Kyrgyz Republic	11	Sri Lanka	24
Cambodia	6	Lao PDR	7	Vincent and the Grenadines	2
Cameroon	21	Lebanon	1	Sudan	1
Cape Verde	21	Lesotho	24	Suriname	4
Central African Republic	9	Lithuania	14	Swaziland	17
Chad	7	Macedonia, FYR	15	Syrian Arab Republic	3
Chile	19	Madagascar	13	Tajikistan	11
China	24	Malawi	14	Tanzania	15
Colombia	16	Malaysia	24	Thailand	24
Comoros	20	Maldives	9	Togo	13
Costa Rica	24	Mali	20	Tonga	4
Cote d'Ivoire	14	Mauritania	8	Tunisia	24
Djibouti	14	Mauritius	24	Turkey	24
Dominica	4	Mexico	22	Uganda	13
Dominican Republic	24	Moldova	11	Ukraine	12
Ecuador	9	Mongolia	16	Uruguay	24
Egypt, Arab Rep.	20	Morocco	24	Uzbekistan	2
El Salvador	22	Mozambique	6	Vanuatu	12
Eritrea	11	Namibia	21	Venezuela, RB	10
Ethiopia	22	Nepal	24	Vietnam	14
Fiji	20	Nicaragua	14	Zambia	4
Gabon	7	Niger	5	Zimbabwe	20

Our empirical analysis faces several endogeneity issues. We first address shocks that are time-varying but common across countries by including 23 year dummies. Heterogeneity across countries is dealt with by including country fixed effects. Second, since the data generating process is dynamic, current observations of the dependent variable depend on past realizations. Therefore, we include a lagged value of the dependent variable in the set of covariates. Third, some explanatory variables are predetermined and we do not have exogenous instruments for all of them. To tackle the endogeneity of the GDP measures we include only the lagged values of log per capita GDP and GDP growth.

Thus, our basic econometric model looks as follows:

$$ANS_{it} = \beta_1\, ANS_{i,t-1} + \beta_2\, GDP_{i,t-1} + \beta_3\, POP_{it} + \beta_4\, RR_{it} + \beta_5\, GOV_{it} + \lambda_t + \nu_i + \varepsilon_{it,} \qquad (2)$$

where our dependent variable ANS_{it} is the log per capita genuine savings of country i at time t. As per capita ANS is highly skewed we take its log expression. On average log ANS per capita is 4.48, which means that the average country has an ANS per capita of US$ 88.5. The variation of log per capita ANS with a standard deviation of 1.41 is large relative to the mean (Table 2), which indicates large ANS fluctuations across time and countries. By definition, ANS can also be negative as illustrated by the minimum value in our dataset, namely -2.02.

The list of control variables includes the lagged dependent variable, and the lagged level of log per capita GDP and lagged GDP growth as denoted by the matrix $GDP_{i,t-1}$. As already exemplified for the five case studies, per capita GDP is substantially higher than per capita ANS. It ranges between US$ 111.76 and US$ 9,359.59. The variation in per capita GDP is substantially smaller compared to per capita ANS. However, GDP growth varies substantially across countries and over time (Table 2). We further include population growth POP_{it}, an export-based resource-richness measure RR_{it} and a set of governance indicators GOV_{it}.

Table 2: Descriptive statistics

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Log ANS pc	1571	4.483	1.409	-2.017	7.878
Log GDP pc	1571	6.860	1.071	4.716	9.144
GDP pc growth (%)	1571	2.081	4.890	-46.892	37.839
Resource richness	1571	14.333	21.185	0	98.631
Population growth (%)	1571	1.821	1.248	-8.271	11.181
Conflict dummy	1571	0.159	0.366	0	1
Homicide rate (%)	629	8.510	12.186	0	83.968
Effective legislative chambers	1571	0.787	0.410	0	1
Independent judiciary	1542	0.292	0.455	0	1
Legislative and judiciary	1542	1.079	0.706	0	2
Acceptance of insitutions	1258	3.180	1.195	0	6
Corruption	1239	2.670	0.987	0	6
Polity2	1566	2.083	6.423	-10	10
Youth bulge (%)	1571	10.502	9.241	0.136	23.200
Resource Richness Dummy					
Between 5 and 10%	1571	0.111	0.314	0	1
Between 5 and 20%	1571	0.189	0.392	0	1
Cut-off ≥ 20%	1571	0.039	0.195	0	1
Cut-off ≥ 25%	1571	0.026	0.159	0	1

We define resource-richness as the sum of fuel, ores and minerals exports over all merchandise exports. 23% of the observations in our sample correspond to country-time pairs with no such resource exports. In contrast, 39% of the country-time pairs represent observations with an export ratio of at least 10%. In a second step we test for the sensitivity of the results to different specifications of resource dependence with multiple cut-off points related to extractive exports as a share of GDP, building on the specification introduced by Collier and Hoeffler (2004). We identify four different resource-dependence thresholds with extractive exports being between 5 -10% and 5 -20% and above 20% and 25% of GDP, respectively. Descriptive statistics for the different resource richness dummies are presented at the bottom of Table 2. For the range 5 -10%, 11% of the country-time pairs in the sample are classified resource-rich while it is only 2.6% for the highest cut-off point. According to our definition of resource-richness, a country's classification is not time fixed, but dynamic and allows to include country-fixed effects in the empirical model.

As for the governance indicators, we first consider the extent of institutionalized constraints on the executive. The descriptive statistics in table 2 show that 79% of all country-time pairs have effective legislative chambers. However, an independent judiciary can only be found in 29% of the cases. We also consider a variable that takes on the value one if either effective legislative chambers or an independent judiciary exist and the value two if both are present. We further include a variable on the acceptance of established institutions, which varies between 0 and 6 reflecting the degree to which the citizens of the country are willing to accept the established institutions, as well as a corruption index that also ranges from 0 to 6. We also consider the Polity2 variable that ranges from -10 (strong autocracy) to +10 (strong democracy).

For the occurrence of armed violence we have two measures. We use the standard conflict indicator from the UCDP/PRIO Armed Conflict Database (Harbom *et al.*, 2009) that takes on the value one if there are at least 25 battle-related deaths in a given year. In 16% of our observations we witness violence that amounts to an armed conflict. In order to get a finer measure of the intensity of armed violence including urban and gangrelated violence, we examine the homicide rate provided by the Geneva-based Small Arms Survey. However, this indicator is available for a shorter time period and is thus available for 275 country-time pairs and 85 countries only.

In addition to the explanatory variables described, our empirical model includes the already mentioned time-fixed and country-fixed effects. The shocks that affect all countries at the same time are captured by λ_t and the country-fixed effects by ν_i. Despite the lag transformation and the inclusion of the time- and country-fixed effects, estimating the above model in this form by OLS, does not do justice to the dynamic nature of the data. Therefore, we transform equation (2) in its difference form to dispose the country-fixed effects ν_i. The transformed disturbance $\Delta\varepsilon_{it}$ depends on ε_{it} and ε_{it-1}. Consistent estimates of the coefficients $\beta = (\beta_1, \beta_2, \ldots, \beta_5)'$ can be obtained for initial conditions $X_{i1} = (GDP_{i,0}, POP_{i1}, RR_{i1})'$ that are uncorrelated to subsequent disturbances εit for $t = 2, 3, \ldots, T$. Accordingly, the lagged level of $X_{i,t-2}$ is uncorrelated with Δεit and serves as instrument. All lags dating back further than $(t - 2)$ can also serve as instruments. Then, the first-differenced GMM estimator introduced by Arellano and Bond (1991) exploits the following moment condition:

$$E[y_{i,t-s}\Delta\varepsilon_{it}] = E[Z_i'\Delta\varepsilon_i] = 0, \qquad (3)$$

for $t = 3, 4, \ldots, T$ and $s \geq 2$, where $\Delta\varepsilon_i = (\Delta\varepsilon_{i3}, \Delta\varepsilon_{i4}, \ldots, \Delta\varepsilon_{iT})'$ and Z_i is a $(T - 2) \times m$ matrix of initial conditions. We consider the collapsed version of Z_i that restricts the instrument counts. All past observations of log per capita ANS, log per capita GDP, GDP growth and population growth as well as resource-richness are collected in Z_i and help coping with the dynamic data generating process.

Yet, the difference estimator by itself suffers from one major limitation. It performs poorly when the series under study are (close to) random walks or when the variance of the individual effects increases relative to the variance of the transient shocks. As a consequence, past levels have little information about future changes in the variables as these changes represent the stochastic innovations. This means that the first differences instrumented with past levels will not identify the coefficients as the lagged levels are only weakly correlated with the first-differences. To circumvent this problem Arellano and Bover (1995) offer system GMM as solution. *In addition to* instrumenting first differences with lagged levels, levels are instrumented with differences. The system GMM has smaller finite sample bias and greater precision when using persistent series. This implies that a *second* moment condition can be exploited:

$$E[\Delta y_{it-1}(\mu_i + \varepsilon_{it})] = 0, \qquad (4)$$

for $i = 1, 2, ..., N$ and $t = 3, 4, ..., T$. Thus, the system estimator relies on a stacked dataset with twice the observations –the transformed and the untransformed ones– of each individual country i.

Furthermore, we do not instrument governance with its lagged observation but an exogenous instrument. The relative size of the youth bulge serves to identify the quality of governance. While *a priori* the size of the youth cohort does not have a direct impact on per capita ANS, it has been shown that the size of the youth cohort directly influences the propensity of conflict in a country (Barakat and Urdal, 2009; Urdal and Hoelscher, 2009; Urdal, 2004). We extend their rationale and argue that the relative size of the youth bulge can also be used to instrument governance because states with a higher share of young people tend to be more exposed and fragile then the economically developed ones in which the demographics have changed towards are bigger share of the adult population. As shown in equation (2) we include population growth in the set of covariates to account for demographic dynamics and to justify the use of the relative youth bulge as instrument.

5. Results

We start by highlighting some interesting correlations, some of which also motivate our choice of instument, and then discuss the results from our dynamic panel data model.

As discussed in section 2.1, earlier studies on the resource curse that take per capita GDP growth as dependent variable find a negative relationship between income growth and resource richness. Our dataset does not support the resource-curse argument when looking at the relationship between GDP growth and resource-richness: We do not find any significant correlation (an insignificantly small, positive correlation), which holds also for the correlation between log GDP per capita and resource richness. But the correlation between resource-richness and sustainable development as measured by ANS per capita is clearly negative. The correlation between log per capita ANS and log per capita GDP is rather high, namely 72%, which is not surprising since it confirms the strong link between income and capital in a Solow sense (Table 3).

We find a positive link between resource dependence and conflict intensity with a coefficient of 17.5%. Controlling for country-fixed effects the coefficient drops to 6.7%. In our dynamic panel analysis we take the relative size of the youth bulge to instrument the governance indicators. Therefore, we want to verify that the "first-step" correlations show the expected sign. We find a positive correlation between both the conflict dummy and the homicide rate and the youth bulge. This finding supports earlier research by Urdal (2004) that argues that the bigger the relative size of the youth bulge, the higher the propensity for conflict. In addition, we find a negative correlation between the relative size of the youth bulge and all our governance indicators. Obviously, the intensity of the correlation varies. It is highest in absolute terms between the youth bulge and the Polity2 indicator, followed by the measure of the acceptance of established institutions. Thus, in line with our theoretical considerations we find that societies that have a relatively larger share of young people perform relatively worse in terms of governance indicators (Table 3).

Table 3: Correlations matrix adjusted for time fixed effects

	Log ANS pc	Log GDP pc	GDP pc growth	Resource richness	Population growth	Conflict dummy	Homicide rate
Log ANS pc	1						
Log GDP pc	0.720	1					
GDP pc growth (%)	0.208	0.037	1				
Resource richness	-0.076	0.051	0.007	1			
Population growth (%)	-0.243	-0.369	-0.150	0.057	1		
Conflict dummy	-0.119	-0.059	0.003	0.175	0.006	1	
Homicide rate (%)	-0.079	0.087	-0.036	0.142	0.043	0.270	1
Effective legislative chambers	0.094	0.199	0.014	-0.207	-0.058	-0.036	0.059
Independent judiciary	0.118	0.112	0.097	-0.114	0.003	-0.172	-0.223
Legislative and judiciary	0.133	0.182	0.078	-0.187	-0.027	-0.143	-0.133
Acceptance of institutions	0.236	0.127	0.245	-0.109	-0.107	-0.237	-0.330
Corruption	0.193	0.249	0.080	-0.228	0.034	-0.217	-0.037
Polity2	0.217	0.469	-0.016	-0.160	-0.245	-0.084	0.152
Youth bulge (%)	-0.089	-0.155	0.036	0.084	0.284	0.095	0.092
	Effective legisl. chambers	**Ind. judiciary**	**Legislative & judiciary**	**Accept. of instit.**	**Corruption**	**Polity2**	**Youth bulge**
Effective legislative chambers	1						
Independent judiciary	0.292	1					
Legislative and judiciary	0.717	0.876	1				
Acceptance of institutions	0.132	0.699	0.575	1			
Corruption	0.272	0.385	0.418	0.413	1		
Polity2	0.523	0.151	0.374	-0.070	0.215	1	
Youth bulge	-0.045	-0.044	-0.054	-0.109	-0.055	-0.123	1

We present the dynamic panel data results in tables 4-6. In the first two tables we contrast different governance indicators and their explanatory power for genuine savings. In table 6 we present the specification that analyzes the connection between our measures of armed violence and ANS. Across specifications and indicators we only provide two-step estimates of the GMM models which make use of the efficient variance-covariance matrix.[3] At the bottom of each table we present the Arellano-Bond specification tests. They fail to reject our model specification and choice of instruments. It seems that the lagged dependent variables and the relative size of the youth bulge identify the endogenous variables properly. We do not present the Hansen nor the Sargan test because the former is weakened by the fact that we have many time dummies as instruments and, as a result, the latter is not robust.

We start with some general observations that hold across all specifications: First, our lagged dependent variable (lagged log per capita ANS) shows a relatively low level of persistence. Across specifications the coefficient associated with log per capita ANS is significantly lower than 0.5. The intuition one gets from the descriptive statistics and from the five case studies, namely that ANS varies substantially across countries and over time, is confirmed by the dynamic analysis. In turn, the lagged level of log per capita

[3] One- and two-step estimates are qualitatively similar in terms of size and signicance levels. The one-step estimation results are made available by the authors upon request

GDP has a high predictive power for contemporaneous genuine savings. The coefficient is on average twice as big as the coefficient associated with lagged log per capita ANS. Thus, income dynamics appear much more reliable in predicting genuine savings than past levels of ANS. This observation gives us additional confidence for our choice of dependent variable. Contrary to existing studies such as the one by Dietz *et al.* (2007) that employs ANS as a percentage of GNI as dependent variable, we employ a per capita measure of genuine savings. Using the GDP ratio of ANS, it is difficult to disentangle the impact between changes in the capital stock and income flow variables, and the results may be largely driven by income dynamics. Considering per capita GDP as an explanatory variable might further bias the results as the GDP metric appears on both sides of the regression model. This is why we emply per capita ANS to get a capital measure that is free from income scaling. It is true that our dependent variable and the GDP variable are both expressed in per capita terms, however changes in the population size affect both variables in the same manner.

Across specifications GDP growth also has a positive but small impact on genuine savings, supporting again the argument that income dynamics are critical for re-investment in human and social capital. Unfortunately, it does not inform us over the precise dynamics because it appears that the countries that are resource rich have lower per capita ANS.

Across specifications and no matter what specific governance or armed violence indicator is included, we find a negative impact of resource richness on sustainable development as measured by ANS. It is always significant at the 10% level at least, except for the specification in which we consider effective legislative chambers as governance indicator. There, the significance of the coefficient associated with resource richness lies at 10.5%.

Population growth has a negative impact on genuine savings as measured by log per capita ANS. This is not surprising because mechanically when the population growth rate is high the population increases and the per capita measure of ANS decreases. Even if none of the coefficients associated with population growth appears to be significant, we include them in the empirical specification with regard to both our choice of instrument and insights from neo-classical growth theory Solow (1956).

After having identified these common patterns across specifications, we turn to the interpretation of the different governance indicators. We consider them in turn because we aim at accounting for their endogenous nature by instrumenting them. In table 4 we present the Polity2 indicator as in Kaufmann *et al.* (2008), the corruption indicator from the Political Risk Service database, and the acceptance of established institutions. The Polity2 variable and, surprisingly, the corruption indicator, are associated with a positive impact on genuine savings. Yet, none of these relationships shows to be statistically significant. The corruption index is closest to having some explanatory power, in the one-step estimation the *p*-value ranges at 16.2%. However, in the two-step estimation it increases to 24.8%. This comes as a suprise since corruption has repeatedly been found to be significantly negative for development in resource-rich economies, including when looking at genuine savings (Dietz *et al.*, 2007). However, as already pointed to earlier, Dietz *et al.* take another specification of ANS. As for the Polity2 indicator from the Polity IV dataset, it is a measure of institutional democracy versus autocracy (Marshall *et al.*, 2010). Our results tend to indicate that the regime type and the perception of corruption do not matter as much as the existence of effective checks on the otherwise unrestrained power of the executive. Moreover, the people's acceptance of governance institutions may matter more than the level of democracy *per se*, as we shall see below.

Table 4: Dynamic panel data estimates relying on System GMM are presented for three different policy indicators, namely: Polity2, Corruption and Acceptance of established institutions. Two-step estimates are shown. Robust p-values are in parentheses. The lower part of the table shows the number of observations and countries per model and the Arellano-Bond specification tests (p-values). The relative size of the youth bulge is taken as exogenous instrument for the respective governance indicator.

	Polity 2	*Corruption*	*Acceptance of established institutions*
Log ANS pc (Lag)	0.448	0.338	0.329
	(0.000)	(0.000)	(0.006)
Log GDP pc (Lag)	0.740	0.794	1.237
	(0.015)	(0.013)	(0.004)
GDP pc growth (Lag)	0.016	0.015	0.015
	(0.061)	(0.061)	(0.033)
Resource richness	-0.009	-0.009	-0.007
	(0.046)	(0.023)	(0.082)
Population growth	-0.065	-0.098	-0.053
	(0.471)	(0.544)	(0.713)
Governance indicator	0.023	0.165	0.219
	(0.482)	(0.248)	(0.075)
Observations	1575	1243	1258
# of countries	99	76	76
AR(1) test in 1^{st} Δ	(0.000)	(0.000)	(0.000)
AR(2) test in 1^{st} Δ	(0.339)	(0.224)	(0.186)

We consider specific indicators from the Polcon V database in turn. Results are presented in table 5. We start with a dummy variable coding for the existence of effective legislative chambers and it seems that this is exactly what matters for sustainable development.
In our conservative two-step estimate we find that an efficient legislative increases genuine savings by 0.79. An independent judiciary also seems to be highly favorable to sustainable development. While the coefficient associated with an independent judiciary is only significant at a *p*-value of 12.4% in the two-step estimation, the combined index of the existence of an effective legislative and an independent judiciary is significant at the 1% level and has a sizable impact on log per capita ANS (0.43 according to the conservative estimation). The legitimacy of governance institutions among the population seems to matter much since the acceptance of established institutions by the society significantly increases genuine savings (Table 4 Column 3). This result indicates that societies with a high acceptance of existing institutions are more likely to engage in sustainable development policies.

Table 5: Dynamic panel data estimates relying on System GMM are presented for three policy indicators, namely: Effective legislative chambers, Independent judiciary and Effective legislative chambers & independent judiciary. Two-step estimates are shown. Robust p-values are in parentheses. The lower part of the table shows the number of observations and countries per model and the Arellano-Bond specification tests (p-values). The relative size of the youth bulge is taken as exogenous instrument for the respective governance indicator.

	Effective legislative chambers	*Independent judiciary*	*Effective legislative chambers & independent judiciary*
Log ANS pc (Lag)	0.394	0.421	0.393
	(0.000)	(0.000)	(0.000)
Log GDP pc (Lag)	0.884	0.909	0.796
	(0.001)	(0.003)	(0.008)
GDP pc growth (Lag)	0.011	0.012	0.006
	(0.131)	(0.090)	(0.399)
Resource richness	-0.008	-0.008	-0.009
	(0.105)	(0.041)	(0.020)
Population growth	-0.081	-0.132	-0.130
	(0.409)	(0.287)	(0.124)
Governance indicator	0.788	0.403	0.434
	(0.014)	(0.124)	(0.004)
Observations	1571	1542	1542
# of countries	98	98	98
AR(1) test in 1^{st} Δ	(0.000)	(0.000)	(0.000)
AR(2) test in 1^{st} Δ	(0.404)	(0.386)	(0.455)

From governance to violence: In table 6 we present results for the impact of conflict and violence as measured by the homicide rate on genuine savings. Again, we use the relative share of the youth bulge as instrument. For incidences of conflict we find the expected result. Conflicts are associated with a decrease in sustainable development efforts. The result is significant at the 10% level for the one-step estimation procedure. In the two-step procedure the significance level increases to 15.7%. As the conflict dummy itself is a rather crude measure we also tested for a link between genuine savings and the homicide rate. We have however to reduce the sample to the period 2003-2007 for which we have reliable homicide data from the Geneva-based Small Arms Survey. We find a negative coefficient associated with the homicide rate that is significant at the 10% level. One word of caution however. These last results might be driven by systematically missing data. Our sample drops to 275 observations and 85 countries.

Table 6: Dynamic panel data estimates relying on System GMM are presented for two indicators of violence, namely: a conflict dummy and the homicide rate. Two-step estimates are shown. Robust p-values are in parentheses. The lower part of the table shows the number of observations and countries per model and the Arellano-Bond specification tests (p-values). The relative size of the youth bulge is taken as exogenous instrument for the respective governance indicator.

	Conflict dummy	*Homicide rate*
Log ANS pc (Lag)	0.470	0.170
	(0.000)	(0.108)
Log GDP pc (Lag)	0.894	0.875
	(0.002)	(0.001)
GDP pc growth (Lag)	0.012	0.033
	(0.095)	(0.142)
Resource richness	-0.007	-0.009
	(0.090)	(0.078)
Population growth	-0.054	0.073
	(0.567)	(0.719)
Governance indicator	-0.365	-0.024
	(0.157)	(0.095)
Periode	1984-2007	2003-2007
Observations	1670	275
# of countries	108	85
AR(1) test in 1st Δ	(0.000)	(0.049)
AR(2) test in 1st Δ	(0.404)	(0.224)

Finally, we also tested for the sensitivity of our results with respect to different resource-richness thresholds. Thus, instead of using the export-based resource measure we define dummies for resource-richness based on different cut-off points. The empirical specification remains the same and we take only one governance indicator, namely the efficient legislative chambers that proves to have the highest coefficient among the different governance indicators tested earlier. Again, the coefficients associated with the lagged level of log per capita ANS and the GDP measures show the expected sign (Table 7). The governance indicator has a positive and significant impact on genuine savings across specifications. However, the resource-richness dummy leaves room for some confusion. At the upper end of the distribution, when we take cut-off points of 20 and 25%, respectively, we see a positive yet insignificant effect of resource-richness on ANS. Apparently, resource abundant countries do not face the resource curse. What about countries with intermediate ranges of resource dependence? If we consider all countries that have between 5-10% and/or 5-20% of resource revenues over GDP as resource-rich the negative impact on ANS reappears. Both, the lower and the upper cut-off points seem to be valid. But if we chose a cut-off point and interval below 5% we do not find any indication of the resource curse, which means that countries with few extractive resources in overall exports do not suffer. Thus, the results indicate that the resource curse mainly affects those countries with a moderate dependence on resource exports, situated in the 5-20% range.

Table 7: Dynamic panel data estimates relying on System GMM and applying different definitions of resource-richness are presented. The governance indicator taken is Effective legislative chambers. Two-step results are shown. Robust p-values are in parentheses. The lower part of the table shows the number of observations and countries per model and the Arellano-Bond specification tests (p-values). The relative size of the youth bulge is taken as exogenous instrument for the governance indicator.

	5-10%	*5-20%*	*20%*	*25%*
Log ANS pc (Lag)	0.406	0.369	0.38	0.4
	(0.000)	(0.000)	0	0
Log GDP pc (Lag)	0.817	0.878	0.864	0.746
	(0.019)	(0.014)	(0.009)	(0.011)
GDP pc growth (Lag)	0.007	0.010	0.007	0.008
	(0.254)	(0.140)	(0.235)	(0.214)
Resource richness	-0.297	-0.235	0.039	0.098
	(0.119)	(0.048)	(0.949)	(0.824)
Population growth	-0.033	-0.060	-0.06	0.001
	(0.618)	(0.423)	(0.505)	(0.994)
Governance indicator	1.088	1.140	0.965	0.97
	(0.001)	(0.000)	(0.003)	(0.004)
Observations	1571	1571	1571	1571
# of countries	98	98	98	98
AR(1) test in 1^{st} Δ	(0.000)	(0.000)	(0.000)	(0.000)
AR(2) test in 1^{st} Δ	(0.468)	(0.452)	(0.390)	(0.376)

6. Conclusion

There is general agreement that governance matters a great deal for development, especially in resource-rich economies. Yet, it is hard to disentangle the direct effect of governance on development outcomes in empirical studies. In a novel approach we use the relative size of the youth bulge as instrument not only for armed conflict but also for the quality of governance to assess the impact of extractive resource dependence on sustainable development as measured by per capita ANS.

This papers examines the dynamic relationship between resource extraction, institutional quality, armed violence and sustainable development with a panel data covering 108 developing countries over 24 years. While the literature shows mixed outcomes of resource dependance on GDP growth in developing countries, our results highlight a negative relationship between resource extraction and genuine savings. This is not surprising since, *ceteris paribus*, natural resource extraction reduces genuine savings. Yet, as the Bostwana example illustrates and our results indicate, this relationship is not systematic: it can be averted if appropriate governance mechanisms and institutional arrangements are nurtured.

The presence of effective checks and balances seem to be critical to help reverse the negative development outcome of extraction. The presence of effective legislative chambers together with an independent judiciary appears to be the most significant institutional variables, especially when these insitutions enjoy broad acceptance among the population. In our model, effective constraints on the executive appear to be much more significant than indicators of democracy and even corruption when looking both at the relevant *p*-values and coefficient sizes. Our finding is not new. It is indeed consistent with research on the dynamics that presided over the decline of Spain in the sixteenth and seventeenth century in conjunction with the massive mineral exploitation in the Latin American colonies.

Beyond governance, our results confirm that armed conflict has a negative impact on genuine saving. They further hint to the fact that armed violence as measured by the homicide rate negatively affects sustainable development, even if the period under review is too short to draw a firm conclusion. Since the number of armed conflicts has been declining in the aftermath of the Cold War while armed violence has become more pervasive, the relationship between natural resource extraction and armed violence in general requires further research, in particular with detailed country case studies that uncover the specific dynamics at work around extraction sites as well as at the subnational and national levels in conjunction with rent-seeking dynamics.

Our results challenge the policies and programmes of extractive industries and aid agencies in resource-rich countries. Companies tend to invest in community-relation and community-development programmes, often with a view to securing their licence to operate on the ground. While some of these programmes may effectively meet the objective of providing essential services to host communities and improving the overall relations with them, private firms tend to substitute state institutions whose popular acceptance may diminish further as a result. The same applies to non-governmental organizations supported by international aid agencies to deliver basic public services. Our results call for increased focus on strengthening checks-and-balance mechanisms, in particular with regard to the capacity of parliaments to exert effective constraints on the executive and on supporting the emergence of a credible judiciary. Some companies have taken steps in the right direction, for instance by supporting efforts to strengthen the judiciary in oil-rich countries. This type of engagement may be politically sensitive, but appears highly relevant to promote more sustainable development outcomes. In the newly independent Republic of South Sudan for instance, oil plays a dominant role in economic development. Once economic sanctions are lifted, oil companies may support the international community in building effective legislative and judiciary institutions beyond their usual focus on host-community relations. They may also indirectly contribute to reducing the incentives for violent rent seeking by providing credible information on the likely amount of oil reserves and annual export flows, and thus on revenues to be reasonably expected in the coming years. Managing expectations may help rally former enemies around a development vision in which they feel that they can get their fair share in a peaceful context and that aggressive rent seeking would be counterproductive.

Bibliography

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.

Andersen, J. R. J. and Aslaksen, S. (2008). Constitutions and the Resource Curse. *Journal of Development Economics*, 87 (2), 227–246.

Arellano, M. and Bond, S. (1991). Some Tests of Specification of Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *Review of Economic Studies*, 58 (2), 277–297.

____, and Bover, O. (1995). Another Look at the Instrumental Variable Estimation of Error-Components Models. *Journal of Econometrics*, 68 (1), 29–52.

Arrow, K. J., Dasgupta, P. and Mäler, K.-G. (2003). Evaluating Projects and Assessing Sustainable Development in Imperfect Economies. *Environmental & Resource Economics*, 26 (4), 647–685.

Atkinson, G. and Hamilton, K. (2003). Savings, Growth and the Resource Curse Hypothesis. *World Development*, 31 (11), 1793–1807.

Bank of Botswana (2007). *Annual Report*.

Barakat, B. and Urdal, H. (2009). Breaking the Waves? Does Education Mediate the Relationship Between Youth Bulges and Political Violence? *Policy Research Working Paper, World Bank Washington, DC.*

Barbier, E. (2010). Corruption and the Political Economy of Resource-Based Development: A Comparison of Asia and Sub-Saharan Africa. *Environmental & Resource Economics*, 46 (4), 511–537.

Basedau, M. and Richter, T. (2011). *Why Do Some Oil Exporters Experience Civil War But Others Do Not? A Qualitative Comparative Analysis of Net Oil-Exporting Countries.* Giga working paper no 157.

Beblawi, H. and Luciani, G. (eds.) (1987). *The Rentier State: Nation, State and the Integration of the Arab World.* London: Croom Helm.

Bolt, K., Matete, M. and Clemens, M. (2002). Manual for Calculating Adjusted Net Savings. *World Bank Environment Department,* Washington D.C.

Boos, A. (2011). *The Relationship between the Resource Curse and Genuine Saving: Empirical Evidence.* Paper presented at the EAAE PhD Workshop, Nitra, Slovak Republic, April 27-29.

Brambor, T. (2008). *Oil and Institutional Change: Is there a Resource Curse?* Working paper, Stanford University.

Brunnschweiler, C. N. and Bulte, E. (2008). *Natural Resources and Violent Conflict: Resource Abundance, Dependence and the Onset of Civil Wars.* CER-ETH Economics Working Paper Series 08/78, CER-ETH – Center of Economic Research (CER-ETH) at ETH Zurich.

Cabrales, A. and Hauk, E. (2011). The Quality of Political Institutions and the Curse of Natural Resources. *The Economic Journal*, 121 (551), 58–88.

Carbonnier, G. (2007). Des matières premières pour financer le développement: Comment conjurer la malédiction des ressources naturelles? *Annuaire suisse de politique de développement: Financer le développement par la mobilisation des ressources locales*, 26 (2), 83–98.

____. (2011). The Global and Local Governance of Extractive Resources. *Global Governance*, 17 (2), 135–148.

____, Chakraborky, P. and dalla Mulle, E. (2010). *Asian and African Development Trajectories: Revisiting Facts and Figures.* International development policy series, working paper 1, Graduate Institute of International and Development Studies (IHEID), Geneva.

Clark, J. F. (2007). Petro-Politics in the Republic of Congo. *Journal of Democracy*, 8 (3), 62–76.

Collier, P. (2007). *Laws and Codes for the 'Resource Curse'.* Unpublished paper. Oxford University.

____, and Goderis, B. (2008). *Commodity Prices, Growth, and the Natural Resource Curse: Reconciling a Conundrum.* MPRA Paper 17315, University Library of Munich, Germany.

____, and Hoeffler, A. (2004). Greed and Grievance in Civil War. *Oxford Economic Papers*, 56 (4), 563–595.

____, and ____ (2009). Testing the Neocon Agenda: Democracy in Resource-Rich Societies. *European Economic Review*, 53 (3), 293–308.

Dasgupta, S., Laplante, B., Wang, H. and Wheeler, D. (2002). Confronting the Environmental Kuznets Curve. *The Journal of Economic Perspectives*, 16 (1), 147–168.

der Ploeg, F. V. (2010). Why do Many Resource-Rich Countries have Negative Genuine Saving?: Anticipation of Better Times or Rapacious Rent Seeking. *Resource and Energy Economics*, 32 (1), 28–44.

Di John, J. (2007). Oil Abundance and Violent Political Conflict: A Critical Assessment. *The Journal of Development Studies*, 43 (6), 961–986.

____. (2011). Is There Really a Resource Curse? Theory, Evidence and Policy. *Global Governance*, 17 (2), 167–184.

Dietz, S., Neumayer, E. and De Soysa, I. (2007). Corruption, the Resource Curse and Genuine Saving. *Environment and Development Economics*, 12 (01), 33–53.

Drelichman, M. and Voth, H.-J. (2008). Institutions and the Resource Curse in Early Modern Spain. In E. Helpman (ed.), *Institutions and Economic Performance*, Cambridge, Ma: Harvard University Press.

Everett, G. and Wilks, A. (1999). *The World Banks Genuine Savings Indicator: a Useful Measure of Sustainability?* Tech. rep., The Bretton Woods Project, London.

Geneva Declaration (ed.) (2010). *More Violence, Less Development. Examining the Relationship between Armed Violence and MDG Achievement.* Geneva Declaration on Armed Violence and Development.

Gnègnè, Y. (2009). Adjusted Net Saving and Welfare Change. *Ecological Economics*, 68 (4), 1127–1139.

Goodwin, N. (2007). Capital. In C. J. Cleveland (ed.), *Encyclopedia of Earth*, Washington, D.C.

Gylfason, T. (2001). Natural Resources, Education and Economic Development. *European Economic Review*, 45, 847–859.

Hamilton, K. (2002). *Sustainable Per Capita Welfare With Growing Population: Theory and Measurement.* Paper presented at the Second World Congress of Environmental and Resource Economists, 23-27 June, at Monterey.

____. (2004). Accounting for Sustainability. In OECD (ed.), *Measuring Sustainable Development*, Paris: OECD.

Harbom, L., Havard, S. and Havard, M. N. (2009). UCDP/PRIO *Armed Conflict Dataset Codebook*. Codebook, Uppsala Conflict Data Program and International Peace Research Institute, Oslo.

Hartwick, J. M. (1977). Intergenerational Equity and the Investing of Rents from Exhaustible Resources. *The American Economic Review*, 67 (5), 972–974.

Henisz, W. J. (2000). The Institutional Environment for Economic Growth. *Economics and Politics*, 12 (1), 1–31.

(2002). The Institutional Environment for Infrastructure Investment. *Industrial and Corporate Change*, 11 (2), 355–389.

(2006). Polcon 2005 Codebook.

Humphreys, M., Sachs, J. D. and Stieglitz, J. (eds.) (2007). *Escaping the Resource Curse.* New York: Columbia University Press.

IMF (2007). *Guide on Resource Revenue Transparency.* Washington: International Monetary Fund.

Karl, T. (1996). *Paradox of Plenty: Oil Booms and Petro-States.* Berkeley: University of California Press.

Kaufmann, D., Kraay, A. and Mastruzzi, M. (2008). *Governance Matters VII : Aggregate and Individual Governance Indicators 1996-2007.* Policy Research Working Paper Series 4654, The World Bank.

Kolstad, I. and Wiig, A. (2009). Is Transparency the Key to Reducing Corruption in Resource-Rich Countries? *World Development*, 37 (3), 521–532.

Kurer, O. (2005). Corruption: An Alternative Approach to its Definition and Measurement. *Political Studies*, 53, 222–239.

Lange, G.-M. (2004). Wealth, Natural Capital, and Sustainable Development: Contrasting Examples from Botswana and Namibia. *Environmental and Resource Economics*, 29 (3), 257–283.

____, and Hassan, R. (2003). Mineral Accounts: Managing an Exhaustible Resource. In G.-M. Lange, R. Hassan and K. Hamilton (eds.), *Environmental Accounting in Action: Case Studies from Southern Africa*, Edgar Elwin, pp. 25–67.

Le Billon, P. (2003). Buying Peace or Fuelling War: The Role of Corruption in Armed Conflicts. *Journal of International Development*, 15 (4), 413–426.

____. (2005). Corruption, Reconstruction and Oil Governance in Iraq. *Third World Quarterly*, 26 (4), 685–703.

Lujala, P. (2009). Deadly Combat Over Natural Resources – Gems, Petroleum, Drugs, and the Severity of Armed Civil Conflict. *Journal of Conflict Resolution*, 53 (1), 50–71.

Mahdavy, H. (1970). The Patterns and Problems of Economic Development in Rentier States: The Case of Iran. In M. A. Cook (ed.), *Studies in the Economic History of the Middle East*, London: Oxford University Press.

Marshall, M. G., Gurr, T. R. and Jaggers, K. (2010). *Polity IV Project: Dataset Users' Manual.* Polity IV Project, Centre for Systemic Peace, Vienna.

Mavrotas, G., Murshed, S. M. and Torres, S. (2011). Natural Resource Dependence and Economic Performance in the 1970-2000 Period. *Review of Development Economics*, 15 (1), 124–138.

Mehlum, H., Moene, K. and Torvik, R. (2006). Cursed by Resources or Institutions? *The World Economy*, 29 (8), 1117–1131.

Muchembled, R. (2008). *Une Histoire de la Violence – De la fin du Moyen-âge à nos jours.* Paris: Seuil.

Neumann, E. (2004). Does the Resource Curse hold for Growth in Genuine Income as well? *World Development*, 32 (10), 1627–1640.

Papyrakis, E. and Gerlagh, R. (2004). The Resource Curse Hypothesis and its Transmission Channels. *Journal of Comparative Economics*, 32 (1), 181–193.

Perman, R., Ma, Y., McGilvray, J. and Common, M. (eds.) (2003). *Natural Resource and Environmental Economics.* 3rd ed. Essex: Pearson.

Pessoa, A. (2008). *Natural Resources and Institutions: the "Natural Resources Curse"? Revisited.* MPRA Paper 8640, University Library of Munich, Germany.

Robinson, J. A., Torvik, R. and Verdier, T. (2006). Political Foundations of the Resource Curse. *Journal of Development Economics*, 79 (2), 447–468.

Ross, M. L. (1999). The Political Economy of the Resource Curse. *World Politics*, 51 (2), 297–322.

____. (2001). Does Oil hinder Democracy? *World Politics*, 53 (3), 325–361.

Rosser, A. (2006). The Political Economy of the Resource Curse: A Literature Survey. Institute of Development Studies (IDS), Working Paper 268.

Rothstein, B. and Teorell, J. (2008). What is Quality of Government? A Theory of Impartial Government Institutions. *Governance*, 21 (2), 165–190.

Sachs, E. J. D. and Warner, A. M. (1997). *Natural Resource Abundance and Economic Growth.* Tech. rep., Center for International Development and Harvard Institute for International Development.

Sala-i-Martin, X. and Subramanian, A. (2003). *Addressing the Natural Resource Curse: An Illustration from Nigeria.* Economics Working Papers 685, Department of Economics and Business, Universitat Pompeu Fabra.

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *Quarterly Journal of Economics*, 70 (1), 65–94.

____. (1974). Intergenerational Equity and Exhaustible Resources. *The Review of Economic Studies*, 41, pp. 29–45.

Stevens, P. (2011). Contractual Arrangements and Revenue Management: The UK/Scotland and Norwegian Experience. *Global Governance: A Review of Multilateralism and International Organizations*, 17 (2), 149–153.

Stoever, J. (2011). On Comprehensive Wealth, Institutional Quality and Sustainable Development – Quantifying the Effect of Institutional Quality on Sustainability. *Journal of Economic Behavior & Organization.*

Teorell, J. (2009). *The Impact of Quality of Government as Impartiality: Theory and Evidence.* Paper presented at the Annual Meeting of the American Political Science Association, Toronto, Canada, September 2-6.

Thiry, G. and Cassiers, I. (2010). *Alternative Indicators to GDP: Values behind Numbers. Adjusted Net Savings in Question.* Discussion paper 2010-18, Institut de Recherches Économiques et Socials de l'Université Catholique de Louvain.

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

United Nations, European Commission, IMF, OECD and World Bank (2003). *Integrated Environmental and Economic Accounting.* New York.

Urdal, H. (2004). The Devil in the Demographics: The Effect of Youth Bulges on Domestic Armed Conflict, 1950-2000. *Social Development Papers: Conflict Prevention and Reconstruction*, 14.

____, and Hoelscher, K. (2009). Urban Youth Bulges and Social Disorder: An Empirical Study of Asian and Sub-Saharan African Cities. *SSRN eLibrary*.

Van der Ploeg, F. and Poelhekke, S. (2010). The Pungent Smell of 'Red Herrings': Subsoil Assets, Rents, Volatility and the Resource Curse. *Journal of Environmental Economics and Management*, 60 (1), 44–55.

____, and Rohner, D. (2010). *War and Natural Resource Exploitation.* IEW – Working Papers iewwp481, Institute for Empirical Research in Economics – University of Zurich.

World Bank (2006). *Where is the Wealth of Nations? Measuring Capital for the 21st Century.* World Bank, Washington D.C.

Yates, D. (1996). *The Rentier State in Africa: Oil Rent Dependency and Neocolonialism in the Republic of Gabon.* Trenton, NJ: Africa World Press.

About the Authors

Gilles Carbonnier is professor of Development Economics at the Graduate Institute of International and Development Studies in Geneva. He is the deputy director of the Centre on Conflict, Development and Peacebuilding (CCDP) and editor-in-chief of the *International Development Policy* Series. His current research and publication focus on energy and development, the governance of oil and mineral resources, international development cooperation and humanitarian studies. He specializes on issues related to war economies, corporate responsibility and public-private partnerships. Prior to joining the Graduate Institute in 2007, Gilles Carbonnier gained over 18 years of professional experience in multilateral trade negotiations, development aid policy and humanitarian action.
gilles.carbonnier@graduateinstitute.ch

Natascha Wagner is a PhD candidate in development economics at the Graduate Institute of International and Development Studies. Her background is in economics and econometrics with a focus on impact evaluations (such as randomization, difference-in-difference, regression discontinuity design, and instrumental variables). She has worked in Senegal under the auspices of the World Bank and for UNDP (financed by the Gates Foundation). In Côte d'Ivoire, she was the field coordinator for a World Bank funded HIV/AIDS sensitization campaign. She has experience in the collection of administrative data and the set-up and conduction of individual and household surveys. Natascha Wagner's research covers social exclusion in village organizations, HIV/AIDS sensitization, the impact of natural disasters on official aid flows, the economic consequences of polygamy, the determinants and health consequences of female genital mutilation and the impact of vote results on public spending at the district level.
natascha.wagner@graduateinstitute.ch

Fritz Brugger is a PhD candidate at the Graduate Institute of International and Development Studies in Geneva, and head of an innovative weather-indexed micro-insurance program in Kenya. He has an extensive experience in development policy issues as well as development cooperation and has worked in the Caribbean, Africa, Central and South East Asia. Over the past years, his research has centered on the ethical aspects of land distribution and business conduct of transnational companies in developing countries, as well as on corporate social responsibility issues. Fritz Brugger has developed analytical tools to assess the implementation of the UN Global Compact principles in corporate practice, and published various papers on public private partnerships and natural resource management.
fritz.brugger@graduateinstitute.ch

The authors would like to express their gratitude to Lundin Petroleum for their financial support of this research. They also thank Achim Wennmann for his substantive inputs and Leslie-Anne Duvic Paoli for editorial support.

CCDP Working Paper Number 8

Published by the
Centre on Conflict, Development and Peacebuilding (CCDP)
Graduate Institute of International and Development Studies
132, rue de Lausanne
PO Box 136
1211 Geneva 21
Switzerland
E-mail: ccdp@graduateinstitute.ch
Website: http://www.graduateinstitute.ch/ccdp

Design: Latitudesign

Printed in Switzerland

THE GRADUATE INSTITUTE | GENEVA
CENTRE ON CONFLICT,
DEVELOPMENT AND PEACEBUILDING

Graduate Institute of International and Development Studies
132, rue de Lausanne
PO Box 136
1211 Geneva 21
Switzerland
E-mail: ccdp@graduateinstitute.ch
Website: http://www.graduateinstitute.ch/ccdp