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Shining a Light on the Resource Curse: An Empirical Analysis of the Relationship Between Natural Resources, Transparency, and Economic Growth

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Summary. — One of the most common policy prescriptions for overcoming the so-called "resource curse," particularly for extractive industries, has been to call for greater transparency and accountability from governments. However, despite the conceptual attraction of this policy, it has never been empirically proven that resource-rich countries are actually less transparent than other countries, and whether this lack of transparency has had a significant negative effect on economic growth. Using a relatively new index of transparency that has extensive coverage, both across countries and time, the results suggest a strong and robust negative causal association running from (point) resource export revenues to transparency. Furthermore, there is also some evidence that this lack of transparency is associated with a subsequent decrease in economic growth.

Key words — transparency, natural resources, economic growth, Middle East countries

1. INTRODUCTION

The well-known "resource curse" has attracted a large and growing volume of literature over the past decade. The purported explanations for this curse are many and varied, but in general can be classified into two groups—"Dutch disease" models, and "Nigerian disease" models. The *Dutch disease* models focus on issues such as the re-allocation of resources toward the primary commodity sector, at the expense of the manufacturing sector. This affects the domestic economy, but also affects the external sector, as the appreciating exchange rate makes manufacturing exports less competitive (see, e.g., van Wijnbergen, 1984).

The *Nigerian disease* models hypothesize that these resource revenues are effectively wasted by governments, who lack the institutional capacity to use these windfall gains efficiently. As a result, corruption and rent-seeking explanations often feature prominently in these analyzes. An additional feature of many recent papers is the distinction made between the different *types* of natural resources. These are generally divided into "point" resources, such as fuels, ores, and metals, and "diffuse" resources (essentially agriculture). Auty (2001) and Isham *et al.* (2005), for example, argue that these point resources, because they are more geographically specific, make it easier for governments to control them, and rent-seeking behavior is therefore more likely. Diffuse resources, on the other hand, are geographically diverse, and so ownership and control also tend to be more diffuse. [1]

Although there is general (but not universal) agreement that an institutional explanation is at the heart of this problem, the issue of how to actually turn this into some form of policy response has essentially come down to one broad conclusion. In order to ensure that resource revenues become a blessing rather than a curse, the most common course of action recommended is to "shine a light" on the issue. At a theoretical level it is not hard to understand why calls for greater transparency are so strident in this area. As Kolstad and Wiig (2009) outline, there are a number of ways that a lack of transparency can create or exacerbate the problems associated with resource-rich economies. This lack of transparency can: (i) make corruption more attractive, in that it can reduce the probability of discovery; (ii) make it easier to capture rents; (iii) create principle-agent problems (between governments and its citizens, but also between elected officials and the bureaucracy); and (iv) can undermine democracy via these resource rents by reducing the need for domestic taxation (and hence reducing demands for accountability), increasing spending on patronage, and/or increasing spending on the direct oppression of dissenting voices.

In terms of specific global policies, the two most commonly-cited attempts to improve the transparency of resource-related revenues are the Extractive Industries Transparency Initiative (EITI) and "Publish What You Pay" initiatives, ostensibly led by NGOs such as Global Witness and Transparency International. [2] It is clear that these policies assume that it is the abundance of natural resources (generally the "point" resources of fuels, ores and metals) that is driving the lack of transparency, because without the large revenues being earned from these resources there is less reason for the government to hide anything from its citizens.

However, despite the faith that proponents have put into these initiatives, it has never been firmly established in the literature that: (i) countries with an abundance of resource revenues are actually less transparent than other countries in the first place; (ii) whether any lack of transparency observed is a *direct* result of these resource revenues (in that the government specifically tries to restrain access to information in order to have a freer hand in how that money is spent); and (iii) whether this lack of transparency has a statistically and economically significant effect on economic growth. [3] It is these three questions that provide the motivation for this paper. Section 2 discusses the potential relationship between resource

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rents and transparency, and how that can ultimately affect economic growth. Section 3 outlines a relatively new measure of transparency that has extensive coverage both across countries and across time, and offers some descriptive evidence of the link between natural resource abundance and transparency. Section 4 employs a more formal econometric investigation of the three hypotheses outlined above, while Section 5 offers some concluding comments.

2. THEORETICAL RELATIONSHIP BETWEEN TRANSPARENCY AND NATURAL RESOURCES

(a) *Why would an abundance of natural resources affect transparency?*

Transparency, as it relates to the disclosure of information by public officials, is often thought of as a means of promoting accountability from these public officials (whether elected or otherwise). In this sense, transparency is often dealt with as a principal-agent problem with informational asymmetries, where the principal attempts to align the interests of the agent with their own interests by making it possible to discover (and punish) deviations in actions by the agent. However, who the "principal" and "agent" are varies. For example, sometimes the principal is the politician, who is trying to place constraints on the action of the bureaucracy (the agent) (see, e.g., Becker and Stigler, 1974). However, this assumes the politician is benevolent, or at least benign. An alternative views the politician as the problem, and so in these situations, citizens are the principal, trying to impose constraints on the agent (the politician). This is the idea behind many of the models presented in Persson and Tabellini (2000), as well as Robinson *et al.* (2006).

In many of these political economy models, it is argued that where there are appropriate levels of transparency and accountability, resources are a blessing, however where accountability is lacking, resources are a curse, because there is no effective mechanism to monitor the actions of the government. Intuitively, this is appealing, because it allows for the empirical fact that some resource-rich countries (with good institutions) have performed quite well, while others (with poor institutions) have not. However, one potential drawback in some of these models (e.g., Mehlum, Moene, & Torvik, 2006) is that these institutions are exogenous to the abundance of resources. That is, the level of institutions is given, and consequently resources become a curse or a blessing depending on the initial conditions of the institutions. As Robinson *et al.* (2006) note, however, this is often not going to be the case, because the resource revenues themselves can affect the quality of a country's institutions. In the context of this current paper, this could manifest itself in a decrease in the transparency of the government precisely *because* of these resource revenues.

(b) *How could transparency affect economic growth?*

If significant resource rents lead to public officials trying to hide the true extent of these revenues, would this necessarily have a widespread negative effect on the economy overall? The appropriations of these rents linked directly to the natural resource may, for example, be treated as simply a tax on the revenues, with the only difference being that it is the official(s) that receive the tax, rather than the government, and so any deadweight losses to the aggregate economy may ultimately be minimal. However, it is unlikely that this type of behavior would be "ring-fenced" purely to the appropriation or inefficient use of a portion of these revenues. If a lack of transparency is indeed symptomatic of countries with significant resource revenues, it could easily affect the broader economy through a number of mechanisms. For example, if a government has no (or little) commitment to the transparent account of its actions, then this is likely to be true across all of their data dissemination, not just those pertaining to the natural resource. This general lack of regard for gathering and releasing information would make it difficult for private market participants in all sectors of the economy to make efficient and informed investment and consumption decisions. There are also likely to be other indirect effects at work. Indeed, transparency is often thought of not as an end in itself, but as a means to an end, with the end being a more accountable government, and better institutions that arise through the constraints imposed by transparency.

3. MEASURING TRANSPARENCY

The first step in trying to untangle these relationships is, of course, to find an appropriate measure of transparency. Existing measures include an index developed by Islam (2006), who equates transparency with the *timeliness* of when countries send statistical information to the IMF, and Kaufmann and Bellver (2005), who construct an unobserved components model from various data sources.[4] While both have much to recommend them, neither of these indices is suitable for the questions posed above, because neither have a temporal dimension, and so any causal relationship between resource revenues and transparency can only be inferred from using cross-sectional estimation techniques. The Release of Information (*RI*) index developed in an earlier paper (Williams, 2009) does, however, provide a reasonable, if rough, temporal measure of transparency. This index uses the amount of information released by governments to the World Bank's *World Development Indicators* and the IMF's *International Financial Statistics* (2008). The benefit of this approach is that scores can be developed for nearly every (independent) country, and so the index has annual data for 175 countries during 1960–2005.[5] In this paper, it was demonstrated that the amount of information released is not purely a function of income (i.e., rich countries do not produce more information simply because they are rich). Rather, the amount of information released seemed to depend more on the *willingness* of the government to release information.[6]

(a) *Potential problems with using this index as a proxy for transparency*

This index therefore appears to be a reasonable candidate for approximating the transparency of governments, in the sense that their willingness to release information to these databases might be considered a reasonable proxy for their overall attitude to transparency. It is not, however, without its problems.

(i) *Measuring quantity, not quality*

One potential criticism of this index is that this simple "count" measure may ignore the fact that quality is likely to be an equally, if not more, important issue. For example, a government that may wish to hide or obfuscate its true statistics is more likely to "fudge" the figures to say what they want, rather than omit reporting them entirely. As Chart 1 below demonstrates, however, there is a very high correlation between the quantity of information released, and its quality,

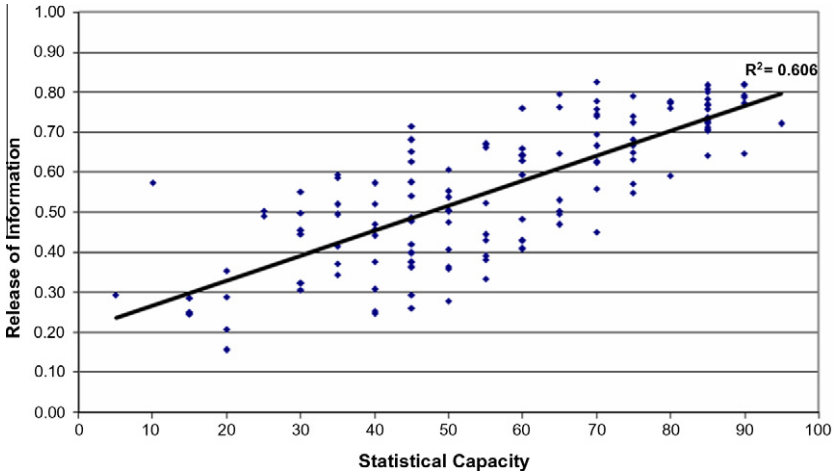

Chart 1. *Release of Information Index and Statistical Capacity Index, 2005. Source: Author's calculations, and World Bank (2004). Measure for Statistical Capacity only includes the two sub-sections "Data Collection," and "Statistical Practice," which are designed to capture the quality of the statistics produced.*

as defined in the World Bank's *Statistical Capacity Indicator* (2008). This indicator scores developing countries on a number of issues relating to their capacity to deliver quantity and quality (with the assumption presumably that the omitted high-income developed countries would have had a score of 100). The measure below is a straight average of the sub-indices "Data Collection," and "Statistical Practice," which are a close approximation to the quality of data produced.[7] The correlation between these two indices of 0.78 suggests that developing countries with poor quality of statistics are also the ones that release the lowest quantity of statistics.

(ii) *Counting the "wrong" information*

It could be argued that a more precise measure of transparency in the context of natural resource revenues would only include information on fiscal transparency (i.e., releasing budgetary revenue, and expenditure information), and the publication of other relevant information, such as contracts, size of reserves, and so on. However, although this would be an interesting avenue to investigate, the issue here is whether the resource rents lead to a much broader problem with transparency across the whole of the government.

(iii) *The timing of the release of information*

A related issue is one of timeliness. The data that ultimately appears in these two databases is not always gathered and released in the year that the information pertains to. There will undoubtedly be lags (of varying degrees) in when this information appears. All this index can say, however, is that data either exists or does not exist for that year, not when the government eventually published it. Given the relatively long time frame at hand here (45 years), this is unlikely to be a major issue. For example, if a government takes a year or more to provide much of its information to the World Bank and IMF, the main issue here is whether they have provided it at all. Moreover, as will be seen in the empirical section, the index is averaged over five year intervals, to at least in part account for any lags.[8]

(iv) *Is information purely a function of income?*

Table 1 highlights the fact that income alone is unlikely to be the defining feature for the release of information by looking at the levels of *per capita* income for four resource-rich Middle East countries, and comparing these to the levels of income for countries with very similar index scores in 2005. In each of these examples, the Middle East countries show a level of *per capita* income many multiples greater than their chosen counterpart. It may be argued that these Middle East countries are "exceptional" cases because their *per capita* incomes are boosted due to their energy exports. But that is not the point. Irrespective of *how* they came to have higher levels of income, the fact remains that they could have chosen to spend far more resources on gathering and, importantly, releasing information if they had so chosen. The fact that they have not, therefore, begs the question of why they have chosen not to. One possibility is that information is deliberately held back from the broader community because the lack of information helps the government to distribute patronage without overt scrutiny.

Table 1. *Comparison of selected countries, release of information scores and GDP per capita, 2005*

	RI score, 2005	GDP *per capita* in 2005 (PPP in 2005 USD)
Qatar	0.39	70715.83
Myanmar	0.40	838.27
Oman	0.49	20350.21
Nepal	0.50	960.44
Saudi Arabia	0.54	21219.71
Kenya	0.54	1375.30
Kuwait	0.57	21574.30
Cote d'Ivoire	0.57	1613.61

(b) *Other factors affecting transparency*

Although the main focus of this analysis relates to natural resources and transparency, natural resources are most unlikely to be the only factors that influence transparency. There are a number of additional factors that could be driving the information released by governments:

(i) In Williams (2009), it was shown that the degree of constraints on the executive branch of government had a strong and positive causal effect on transparency. That is, where the executive faced strong constraints on its actions (such as a strong opposition), levels of transparency were higher. This is particularly important here, as what might be happening is that higher revenues from primary

commodity exports are leading directly to less accountability from the executive, and lower transparency is an inevitable, but not necessarily vital, consequence of this.
(ii) The release of information may be a function of the level of education. This is likely to be important on the supply side (the quality of the data being produced requires high levels of education) and on the demand side (citizens with more education are likely to demand more information from their government). Therefore, it might be expected that there would be a positive relationship between education and information.
(iii) An abundance of natural resources may lead to the government increasing its spending (perhaps to "buy off" interest groups, or perhaps just to increase general welfare spending). It may, therefore, be this "bloated" and relatively inefficient public sector that is causing less information to be released, rather than a deliberate obfuscation in order to hide something.

4. EMPIRICAL ANALYSIS

(a) *Empirical specification*

Because it is highly likely that there are a number of factors influencing the release of information, it is therefore important to take a more rigorous statistical approach to this issue. Based on the theoretical considerations above, the core specification is:

$$RI_{it} = \hat{a}_i RI_{it-1} + \hat{a}_2 NATRES_{it-1} + \hat{a}_i Z_{it-1} + \eta_{t-1} + v_{it-1} \quad (1)$$

where RI is the Release of Information index (proxying transparency), $NATRES$ is the measure of natural resources employed (see below), and Z is a range of additional factors that were hypothesized above to be important possible determinants of transparency. Of most interest, of course, is the coefficient $\hat{a}_2$ which should, according to the discussion above, be negative.

The initial sample size consists of 105 countries (see Table A.1 for a list of these countries). The panel data estimation being employed is based on nine five-year non-overlapping periods during 1960–2004 (all variables are taken as averages over each five year period). Because I am interested in the causal nature of the relationship between transparency and natural resources, all variables (including the dependent variable) have been lagged by one period. Although the choice of a one-period (five year) lag appears somewhat arbitrary, there are both theoretical and empirical reasons for this choice. Firstly, it is likely that it would take some time: (a) for rent-seeking opportunities to be identified; (b) for them to be acted on; and (c) for this to manifest itself in a decrease in transparency. Secondly, in order to ascertain whether a one five-year period was an appropriate length of time, different variations were attempted. The results strongly suggested that any negative effects from point resources towards transparency do occur with a lag, and the period length where that effect was the strongest was 6–10 years. [9] Furthermore, I also isolated specific episodes where either mineral or oil and gas rents (see Appendix for definitions) increased by more than one standard deviation during 1970–2005 (see Table 2 for details). On average, for these 58 episodes, the transparency scores increased markedly in the five years before the jump in rents, and continued to increase (albeit at a slower rate) in the five years immediately after the jump. However, in the period 6–10 years after the jump in rents, for both mineral and oil and gas rents, the index scores actually *decreased*.

Before moving on to some of the results, however, there are specification issues that require attention. The first is that the lagged dependent variable is endogenous to the fixed effects in the error term, which means the results will be biased. [10] There are two possible methods to correct this. The first is to difference the data to remove these fixed effects (or equivalently to include dummy variables for each country). However, this on its own will not overcome the problem of the endogenous lagged dependent variable. Therefore, an additional method is to instrument the lagged dependent variable (and any other potentially endogenous variables) in the regression with prior values of the variable that will be uncorrelated with the fixed effects. First differencing accompanied with using the level of past values as instruments gives rise to the well-known "difference GMM" estimator (Arellano & Bond, 1991). A further step is to first difference the instruments themselves in order to make them exogenous to the fixed effects. The combination of first differencing the variables and instrumenting with lagged levels of these variables, and using the levels of the variables with the first differenced instruments, gives us the "System GMM" estimator, developed by Blundell and Bond (1998). Further, because this type of estimator assumes there is no cross-country correlation in the error term, period dummies are employed to control for this. This estimator also assumes that, while there will be first-order serial correlation in the error term, there should not be second-order correlation. Lastly, the validity of the instruments can be tested for using Sargan/Hansen tests. [11] Because the issue of the endogeneity of both the lagged dependent variable, as well as the other explanatory variables, is a vital issue to consider here, this GMM System estimator will be employed in all regressions below.

Table 2. *Changes in release of information scores before and after significant increases in resource rents*

	Metals and mineral rents (increase of >1 st.dev)		Oil and gas rents (increase of >1 st.dev)			
	Average change (%)	No. of episodes	Average change (%)	No. of episodes	Average change (%)	No. of episodes[a]
% Δ in RI 1–5 years before increase	13.33	25	18.46	33	20.84	7
% Δ in RI 1–5 years after increase	4.94	25	3.72	33	7.83	7
% Δ in RI 6–10 years after increase	−1.79	25	−3.03	33	−5.50	7

Notes: Data on rents is taken from the World Development Indicators (2008). Resources included are: bauxite, copper, lead, nickel, phosphate, tin, zinc, gold, silver, iron ore (for minerals and metals), and oil and gas. Country is counted if it had an increase in rents (as a proportion of GDP) greater than one standard deviation from the sample mean.
Period covered is 1975–95, allowing for lags five years prior and up to 6–10 after. Data on rents only available 1970–2005.
[a] Only includes episodes outside the 1974 and 1979–80 oil shocks: Angola (1985), PNG and Libya (1990), Kuwait and Angola (1992), Iran (1993) and Yemen (1994).

The following three sections are designed to investigate empirically the three questions posed in the introduction: (i) whether countries with an abundance of resource revenues are actually less transparent than other countries in the first place (and whether the *type* of natural resource matters); (ii) whether any lack of transparency observed is a *direct* result of these resource revenues; and (iii) whether the so-called "resource curse" can be at least in part explained by the lack of overall transparency that eventuates from these resource-rich countries.

(b) *Are resource-rich countries less transparent than other countries?*

As outlined in the introduction, an important first step is to ascertain whether countries with an abundance of natural resources are also less transparent. Because there are undoubtedly other factors that contribute to transparency, Table 3 also includes the core explanatory variables (also lagged by one period):

- The log of GDP *per capita* (taken from the PENN Tables 6.2).
- Executive constraints (*XCONST*), taken from the POLITY IV database (Marshall & Jaggers, 2002).
- Gross Secondary Enrolments, taken from the Global Development Growth Network and *World Development Indicators*, as a measure of education.
- Government consumption as a % of GDP, taken from the *World Development Indicators*.
- Primary commodity exports, as a proportion of GDP, as categorized in the *World Development Indicators* (see Appendix), as the proxy for the rents earned on resources.

Column 1 shows that, when entered on its own, (lagged) primary commodity exports do indeed have a significant and negative causal relationship with transparency. Furthermore, the significant effect of executive constraints on transparency that was observed in Williams (2009) remains true here, as observed when the additional core variables are introduced in Column 2. However, for our purpose here, the important thing to note is that the negative effect of resource abundance does not appear to simply work through the channel of executive constraints. In other words, it does not seem to be the case that resource abundant countries are less transparent simply because the executive also happens to have fewer constraints on their actions. Furthermore, the education variable is positive, but insignificant.[12]

The issue of which instruments to use in this GMM System estimation, however, is an important one. One can have "too many instruments," in which case the instruments fail to expunge their endogenous components and essentially revert to the (biased) OLS coefficient estimates. A common sign of this problem is if the Hansen/Sargan test for over-identification approaches the perfect value of 1.00. In Column 2 one can see that the instrument count is 170, and the Hansen and

Table 3. *The effect of natural resources on transparency*

	1	2	3	4	5	6	7
	Dependant variable: release of information (*RI*) index	Dependant variable: release of information (*RI*) index	Dependant variable: release of information (*RI*) index	High-income OECD countries removed	Fuel export Middle East countries removed	Dependant variable: freedom of the press	Dependant variable: civil liberties (Freedom House)[a]
Dependent variable,$_{t-1}$	0.7328	0.6307	0.5718	0.6605	0.4747	0.4730	0.7277
	0.0612***	*0.0889****	*0.1161****	*0.1066****	*0.1186****	*0.1552****	*0.1346****
Log of *per capita* GDP,$_{t-1}$		0.0083	0.0093	0.0092	0.0214	−0.0702	0.1693
		0.0108	*0.0237*	*0.0143*	*0.0224*	*0.1096*	*0.1060*
Executive constraints,$_{t-1}$		0.0072	0.0141	0.0101	0.0132	0.0619	−0.0180
		0.0026***	*0.0037****	*0.0036****	*0.0033****	*0.0489*	*0.0779*
Gross secondary enrolments,$_{t-1}$		0.0369	0.0105	0.0401	0.0153	0.4147	−1.7164
		0.0365	*0.0626*	*0.0554*	*0.0555*	*0.2798*	*0.4577****
Government consumption,$_{t-1}$		−0.0014	−0.0011	−0.0010	−0.0029	−0.0032	−0.0105
		0.0010	*0.0015*	*0.0013*	*0.0011****	*0.0100*	*0.0150*
Primary commodity exports (% GDP),$_{t-1}$	−0.1561	−0.1387	−0.2555	−0.1857	−0.2033	−1.0932	2.4393
	0.0556***	*0.0503****	*0.0868****	*0.0806***	*0.0707****	*0.5401***	*0.9162****
Tests (p-values)							
Hansen test	0.097	1.000	0.412	0.540	0.440	0.439	0.655
Diff-Hansen	0.133	1.000	0.503	0.560	0.564	0.635	0.155
AR1	0.000	0.000	0.000	0.000	0.000	0.004	0.005
AR2	0.934	0.628	0.352	0.703	0.349	0.825	0.918
Instrument count	62	170	50	50	50	42	46
Countries	105	105	105	85	99	100	105
Observations	598	598	598	443	570	330	488

Note: For GMM-SYS, all variables are treated as potentially endogenous. In Columns 1 and 2 all available instruments are employed. In all other columns the instrument count reported is based on the number of "collapsed" instruments, using the *xtabond2* specification from Roodman (2006). Orthogonal deviations, rather than first differences, used in all regressions. Difference-in-Hansen test reports the *p*-values based on the null hypothesis that the instruments in the levels equation are exogenous. For more details, see Roodman (2006). Coefficients based on the two-step estimation, using the Windmeijer correction. Time dummies employed but not reported. Numbers in italics are robust standard errors.

[a] Higher values of Civil Liberties represents fewer Civil Liberties.

* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Difference-Hansen *p*-values are both 1.00. Therefore, in all subsequent regressions, I have followed the advice of Roodman (2006) and "collapsed" the instrument set. Nevertheless, as Column 3 shows, the coefficient on primary commodity exports remains negative and highly significant. [13]

(i) *Are the results sensitive to the sample of countries used?*

In relation to this, the negative coefficient on the primary commodity variable may be due to a couple of factors. Firstly, this result may be occurring because of a "best *versus* the rest" sample bias. That is, the inclusion of high-income OECD countries, who have (on average) high levels of transparency and also (again, on average) low levels of primary commodity exports, may be driving these results. If it turns out that there is little variation within the remaining 85 developing countries, then the link between natural resources and transparency is not particularly robust. As Column 4 shows though, once these high-income OECD countries are removed from the sample, the coefficient on primary commodity exports falls marginally (from −0.26 to −0.19), but is still significant. A second consideration is that the size of the coefficient may be due largely to the inclusion of the oil-rich and (as was observed in Table 1) less than transparent Middle East countries. Again, if this is true, then while that may support the deleterious effects of natural resources on transparency for this small group of countries, it is not true at the broader level. The coefficient, however, remains roughly the same when these six Middle East countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) are removed. [14]

(ii) *Are these results sensitive to the measure of transparency used?*

In order to see whether these results apply only to the specific proxy for transparency used to date, Columns 6 and 7 employ, respectively, the measures of Press Freedom and Civil Liberties, both produced by Freedom House (2008). The measure of Press Freedom, unfortunately, is only available from 1980, and has only three categories: free, partly free, and not free. [15] Despite these limitations, primary commodity exports also exhibit a negative and significant effect on Press Freedom. The same is true for Civil Liberties, which is an indicator broader in scope (aside from looking at freedom of expression, it also incorporates other issues, such as freedom of association, and freedom of religion). Nevertheless, primary commodity exports also have a significant negative effect on civil liberties. [16] Therefore, although these proxies are not perfect substitutes to the Release of Information index, the results support the idea that an abundance of natural resources has a negative effect on transparency. [17]

(iii) *Does the type of resource matter?*

As was discussed previously, there is a line of thought that suggests it is the so-called "point" resources of fuels, ores, and minerals that cause the negative institutional effects for a country, while the "diffuse" exports of food and agricultural raw materials have a more benign or insignificant effect on a country's institutions. Table 4 examines this issue, as well as incorporating alternative proxies for natural resource rents. Column 1 separates the primary commodity exports into four broad categories: fuels, ores, and metals, agricultural raw materials, and food (the precise classifications are from the *World Development Indicators*, and can be found in Table A.2 in the Appendix). From the evidence here, it does appear as though the "point" resources of fuels, ores, and metals have the same negative effect on transparency that Ross (2001) and others have found for a country's institutions more generally. Both have a negative coefficient, and are significant at the 1% level. Food also has a negative coefficient, but is not significant, while agricultural raw material exports actually have a positive (but again insignificant) effect on transparency.

Given the fact that the two point resources have a significant negative effect on transparency, but not the two diffuse categories, Column 2 groups the commodities into these two respective categories. The coefficient on the point resource variable remains highly significant, but the diffuse resource variable is not. [18]

Columns 3 and 4 use alternative measures of resource revenues. The first, point and diffuse resources as a proportion of merchandise exports, tell a similar story—point resources have a significant negative effect on transparency. The second measure is the one used in Table 2 above from the World Bank, and attempts to calculate the rents earned from oil, gas, metals, and minerals (there is no corresponding measure for agriculture). Once again, countries that earn higher point resource rents release less information. [19]

As a first run-through, then, the hypothesis that primary commodity exports have a negative effect on transparency appears to be quite strong. More specifically, however, the evidence does suggest that the type of resource is extremely important. The extractive point resources have a much larger negative effect on transparency than the diffuse-type resources. [20]

(iv) *Employing additional variables*

One of the main contentions of this paper is that the effect of having an abundance of (point) resources has a fairly direct negative effect on transparency. The analysis so far has only looked at this issue with respect to the core variables. However, there are a number of additional factors that may prove to be important in this analysis. At a broad level, there are two issues that deserve further examination. Firstly, whether the negative effects on transparency observed here are specifically due to the point resource revenues, or whether any "windfall"-type revenue which can lead to rent-seeking behavior will cause transparency to suffer. Secondly, although the degree of executive constraints has been included in the analysis, it is not yet clear whether there might be some other political or institutional factors that are being affected, and that in turn is having an effect on transparency.

In order to test the issue of whether any type of windfall gain will have a negative effect on transparency, two additional variables are examined in Table 5. Countries may experience a positive terms of trade shock (irrespective of the type of goods or services they export), which in turn promotes the same sort of rent-seeking behavior associated with point resource exports. Therefore, Column 1 from Table 5 includes the log change in the terms of trade (over each five year period). However, the inclusion of the terms of trade results in both point and diffuse resource export coefficients being negative and significant. The terms of trade variable itself, however, has no discernible effect on transparency. [21]

The second type of windfall gain may come from foreign aid receipts. In theory, an increase in aid revenues could increase the amount of information released by governments, either: (a) because of the information requirements imposed on them from donors, or (b) because the revenues themselves can be used to improve the quality and quantity of information released. However, it is also possible to argue that governments may want to appropriate some of these aid receipts for personal gain and may not want anyone to know about it. Consequently, higher aid revenues may result in less transparency. [22] While the issue here requires more substantial investi-

Table 4. *Alternative resource variables*

Dependent variable: release of information	1	2	3	4
Release of information,$_{t-1}$	0.5334	0.5697	0.5132	0.5337
	0.1016***	*0.1159****	*0.1146****	*0.0976****
Log of *per capita* GDP,$_{t-1}$	0.0061	0.0041	−0.0162	0.0176
	0.0175	*0.0244*	*0.0196*	*0.0186*
Executive constraints,$_{t-1}$	0.0097	0.0124	0.0114	0.0152
	0.0039**	*0.0038****	*0.0038****	0.0032***
Gross secondary enrolments,$_{t-1}$	0.0411	0.0283	0.0936	−0.0154
	0.0677	*0.0658*	*0.0583*	*0.0552*
Government consumption (% GDP),$_{t-1}$	0.0001	−0.0005	−0.0002	−0.0025
	0.0013	*0.0016*	*0.0014*	*0.0012***
Alternative resource variables				
Fuel,$_{t-1}$	−0.2778			
	0.0903***			
Ores and minerals,$_{t-1}$	−0.6578			
	0.2529***			
Agricultural raw materials,$_{t-1}$	0.1914			
	0.1906			
Food,$_{t-1}$	−0.3634			
	0.3748			
Point resources (% GDP),$_{t-1}$		−0.2813		
		0.0974***		
Diffuse resources (% GDP),$_{t-1}$		−0.2266		
		0.2431		
Point resources (% exports),$_{t-1}$			−0.1480	
			0.0353***	
Diffuse resources (% exports),$_{t-1}$			−0.0115	
			0.0598	
Oil, gas, metals and minerals rents,$_{t-1}$				−0.0023
				0.0007***
Tests (p-values)				
Hansen test	0.585	0.559	0.422	0.323
Diff-Hansen	0.618	0.717	0.308	0.295
AR1	0.000	0.000	0.000	0.005
AR2	0.335	0.380	0.231	0.005
Instrument count	71	57	57	46
Countries	105	105	105	92
Observations	598	598	598	450

Note: For GMM-SYS, all variables are treated as potentially endogenous. The instrument count reported is based on the number of "collapsed" instruments, using the *xtabond2* specification from Roodman (2006). All regressions employ orthogonal deviations. Difference-in-Hansen test reports the *p*-values based on the null hypothesis that the instruments in the levels equation are exogenous. For more details, see Roodman (2006). Coefficients based on the two-step estimation, using the Windmeijer correction. Time dummies employed but not reported. Numbers in italics are robust standard errors.

* Significant at 10% level.

** Significant at 5% level.

*** Significant at 1% level.

gation, it does appear as though, for transparency at least, natural resources have a far more deleterious effect than foreign aid does. Although the coefficient for development assistance is negative, it is not a significant factor. The coefficient on point resources, while lower, remains statistically significant. [23]

The other issue requires a more thorough investigation of additional institutional channels that may be at work here. Column 3 examines the possibility that it is internal conflict that is potentially driving the lack of transparency. In Collier and Hoeffler (2004) a significant link was observed between the proportion of natural resource exports for countries, and the incidence of civil war, with the rationale being that having an abundance of these resources can lead to an internal fight for the spoils of these resources. If this is correct, then what might be happening here is that the abundance of natural resources may cause internal conflict, which consequently disrupts the release of information. The lack of information, however, is due more to the disruption of the internal war, rather than the natural resource as such. However, although the incidence of civil war is negatively related to the degree of transparency, it marginally fails to be a significant determinant (*p*-value of 0.17) and the coefficient on point resources is still highly significant. So while civil wars may have some effect on transparency, its importance is of a lower order of magnitude than the natural resource exports. [24]

The other additional institutional variable is a measure of Institutional Quality, taken from the International Country Risk Guide, produced by Political Risk Services (2008). [25] Intuitively, the link here might run from natural resource abundance, onto the quality of the institutions and then (perhaps concurrently) a decrease in transparency. Partial evidence of this might be found, therefore, if the inclusion of the *ICRG*

Table 5. *Incorporating additional variables*

Dependant variable: *RI* index	1	2	3	4
RI_{t-1}	0.5000	0.6858	0.7650	0.5667
	*0.1049***	*0.1210****	*0.1148****	*0.1149****
Log of *per capita* GDP,$_{t-1}$	0.0172	0.0102	0.0277	0.0069
	0.0149	*0.0146*	*0.0204*	*0.0235*
Executive constraints,$_{t-1}$	0.0136	0.0087	0.0073	0.0081
	*0.0031****	*0.0031****	*0.0036***	*0.0037***
Gross secondary enrolments,$_{t-1}$	0.0020	0.0622	−0.0598	−0.0190
	0.0395	*0.0568*	*0.0635*	*0.0615*
Government consumption (% GDP),$_{t-1}$	−0.0021	−0.0008	0.0003	−0.0007
	*0.0011**	*0.0012*	*0.0016*	*0.0014*
Point resources (% GDP),$_{t-1}$	−0.2131	−0.1843	−0.3509	−0.3426
	*0.0569****	*0.0904***	*0.1107****	*0.1096****
Diffuse resources (% GDP),$_{t-1}$	−0.3972	0.1692	0.0315	−0.0071
	*0.1364****	*0.2317*	*0.2382*	*0.1866*
"*Windfall*" *variables*				
Log change, terms of trade,$_{t-1}$	0.0197			
	0.0725			
Official development assistance (% GDP),$_{t-1}$		−0.0001		
		0.0011		
Institutional variables				
Civil War dummy$_{t-1}$			−0.0417	
			0.0306	
Institutional quality (ICRG),$_{t-1}$				0.0044
				*0.0025**
Tests (p-values)				
Hansen test	0.535	0.814	0.463	0.575
Diff-Hansen	0.478	0.483	0.429	0.518
AR1	0.000	0.000	0.005	0.000
AR2	0.425	0.717	0.25	0.442
Instrument count	64	64	62	64
Countries	96	79	100	92
Observations	543	424	447	527

Note: For GMM-SYS, all variables are treated as potentially endogenous. The instrument count reported is based on the number of "collapsed" instruments, using the *xtabond2* specification from Roodman (2006). All regressions employ orthogonal deviations. Difference-in-Hansen test reports the *p*-values based on the null hypothesis that the instruments in the levels equation are exogenous. For more details, see Roodman (2006). Coefficients based on the two-step estimation, using the Windmeijer correction. Time dummies employed but not reported. Numbers in italics are robust standard errors.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

variable led to the coefficient on the point resource variable becoming insignificant. However, the coefficient on Institutional Quality, while positive and marginally significant, does not appear to materially affect the point resource variable (indeed, it actually becomes more negative). Similar results were found if I substituted the individual ICRG measures of Rule of Law, Bureaucratic Quality, and then Corruption, in that point resources remained significant at the 1% level. [26]

Even if one takes the Release of Information index literally, rather than as a proxy for transparency, then it is nonetheless curious that an abundance of point resources should lead to less information being released to the public. As a purely illustrative example of the impact of these point resources on the *RI* index, the average point resources coefficient from Table 4 suggests that every one percentage point increase in the share of point resource exports in GDP leads to a decrease in the *RI* index of 0.24 points. To put it another way, if Nigeria had remained at the level of point resource exports (overwhelmingly oil) that it had in 1965 (3.3% of GDP), rather than the average it has had since 1975 (39.3%), then its *RI* index score would have been some 8.5 points higher (i.e., its average index score would have been around 0.635, as opposed to its actual score of 0.55). This would have put it roughly on the same level as countries such as Iceland, Turkey, or Argentina.

(c) *Could the resource "curse" on economic growth be due to a lack of transparency?*

The next question, therefore, is whether the lack of transparency observed in countries with an abundance of (point) resources is at least in part responsible for the "resource curse" observed in so many previous papers. The rationale behind this is relatively straight forward. Even though the initial reason for the lack of transparency may be due to the revenues earned on these natural resources, the lack of transparency ultimately has a negative effect on many other areas of the economy, both directly through information asymmetries, and indirectly, through institutional factors such as corruption. For example, in Williams (2009), it was demonstrated that the more information a government released, the greater was the investment, which subsequently affected economic growth. It also had a significant causal effect on the depth of financial institutions. In other words, creating an opaque climate through a lack of transparency in order to appropriate

the rents from the natural resources will ultimately affect many sectors of the economy, and so the transmission mechanism runs from an abundance of point resources, through to a lack of transparency, and then (indirectly) onto economic growth. Therefore, the hypothesis to be tested here is whether the highly negative and significant effects on economic growth commonly attributed to the resource revenues occur only because the analyses suffer from omitted variable bias (i.e., transparency).

From an empirical standpoint, evidence of this might be seen if the significant negative effect of natural resource exports on growth seen in many previous studies disappears (or at least substantially falls) once the transparency variable is included. I have also included a number of the same variables from the previous analysis, again with the aim of looking at how the various transmission mechanisms may be operating between them. Using the same sample period as before, the core regression is based on a fairly standard growth equation:

$$Growth_{it} = \hat{a}_1(Log)GDPPC_{it} + \hat{a}_2 POPG_{it} + \hat{a}_3 OPEN_{it} + \hat{a}_4 SEC_{it} + \hat{a}_5 XCONST_{it} + \hat{a}_6 GOVC_{it} + \hat{a}_7 + \hat{a}_7 POINT_{it} + \hat{a}_8 DIFFUSE \quad (2)$$

where *Growth* is the average annual *per capita* economic growth (using the chain measure of real GDP *per capita* from the PENN Tables, 6.2); (*Log*) *GDPPC* is the log of initial *per capita* (again from the PENN Tables); *POPG* is the Population growth (measured as the log change in population over each period, with the population variable taken from the *World Development Indicators, 2008*); *OPEN* is the Imports + Exports as a % of GDP, taken from the PENN Tables; *SEC* is the Gross Secondary Enrolments (as before); *XCONST* is the Executive Constraints (as before); *GOVC* is the Government Consumption (as before); *POINT:* Point exports as a % of GDP (as before); *DIFFUSE* is the Diffuse exports as a % of GDP (as before); *ICRG:* Institutional Quality (as before); and *RI* is the Release of Information index (as before).

Initially, all variables use contemporaneous values, as opposed to the lagged values used above, and the estimation procedure is again the GMM System estimator, using orthogonal deviations and a collapsed instrument set. Given the inclusion of the Institutional Quality variable in this growth analysis, the sample size is somewhat smaller than before (92 countries *vs.* 105). As Column 1 in Table 6 demonstrates, there is actually little evidence of a "resource curse" at all when using current values. The coefficient on the diffuse resource variable is positive (albeit not significantly so), while the point resource variable has a negative coefficient, but again not significantly so. However, the rather benign effect of current resource

Table 6. *Economic growth regressions*

Dep. variable: *per capita* GDP growth	1 Current PX	2 Lagged PX	3 Lagged PX	4 Lagged PX	5 Lagged PX
Initial log of *per capita* GDP	0.9359	0.3325	−0.3174	−1.0974	−0.4563
	1.2188	*1.2092*	*1.3718*	*1.0008*	*1.0677*
Population growth (log change)	−2.0468	−1.0923	−1.0083	−1.5649	−1.6367
	0.3757***	*0.7446*	*0.6457*	*0.5797****	*0.5033****
Trade openness (% GDP)	4.7561	4.7399	3.7308	2.5627	3.0851
	1.6959***	*2.2722***	*2.0203**	*1.4985**	*2.0671*
Gross secondary enrolments	1.6434	1.7999	0.8593	1.3123	1.4262
	2.6973	*2.8097*	*2.8144*	*2.4535*	*2.0981*
Executive constraints	−0.3592	−0.1821	−0.2515	−0.6080	−0.6303
	0.2156*	*0.2755*	*0.2065*	*0.2310****	*0.2062****
Government consumption (% GDP)	−0.2178	−0.1917	−0.1542	−0.1368	−0.1532
	0.0656***	*0.1001**	*0.0864**	*0.0758**	*0.0789**
Point resources (% GDP)	−1.4175	−17.6737	−15.0189	−4.3737	−5.1080
	4.6560	*8.0101***	*6.8818***	*6.3576*	*6.4600*
Diffuse resources (% GDP)	10.3585	15.0007	25.5488	10.6892	2.3312
	16.1657	*13.0304*	*13.0319***	*10.2312*	*11.5065*
Institutional quality (ICRG)			6.2973	5.4095	
			2.5891**	*2.6988***	
RI				9.4865	12.4845
				4.0783**	*3.8056****
Tests (p-values)					
Hansen test	0.156	0.170	0.372	0.335	0.431
Diff-Hansen	0.609	0.248	0.263	0.913	0.981
AR1	0.000	0.000	0.000	0.000	0.000
AR2	0.600	0.727	0.725	0.785	0.894
Instrument count	64	64	71	78	71
Countries	92	92	92	92	92
Observations	538	538	538	538	538

Note: For GMM-SYS, all variables are treated as potentially endogenous. The instrument count reported is based on the number of "collapsed" instruments, using the *xtabond2* specification from Roodman (2006). All regressions employ orthogonal deviations. Difference-in-Hansen test reports the *p*-values based on the null hypothesis that the instruments in the levels equation are exogenous. For more details, see Roodman (2006). Coefficients based on the two-step estimation, using the Windmeijer correction. Time dummies employed but not reported. Numbers in italics are robust standard errors.

* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

exports on current growth is perhaps a slightly misleading one. The most common methodology in papers on this issue is cross-sectional analysis, and in the majority of these papers the resource variable is taken from the start of the sample period (e.g., in their seminal paper on this issue, Sachs and Warner (1997) use primary commodity exports in 1970 regressed on growth from 1970 to 1990). In other words, the large negative coefficients previously observed occur with a lag. Therefore, in Column 2 I take one-period lags of both resource export variables. Although the coefficient on the diffuse resource variable remains positive but statistically insignificant, the coefficient on point resources goes from −1.42 in Column 1 to −17.67 in Column 2, and is now significant at the 5% level. In other words, it appears as though the "curse," with respect to point resources, takes at least five years to have a negative effect on economic growth. [27]

Column 3 introduces the institutional quality variable and, although the coefficient on this is indeed positive and significant, as has been found in numerous previous studies, it does not seem to explain the "curse" of resources. The coefficient on the point resource variable only falls by around 15%, and remains statistically significant. This is very much in line with previous studies on the link between institutions and natural resources (see in particular Sachs & Warner (1997), Mehlum *et al.* (2006) and Kolstad & Wiig, 2009). In both the theoretical model of Mehlum *et al.* (2006), and their subsequent empirical analysis, they assume that institutions and natural resources are exogenous (i.e., institutions are "given" and natural resources help or hinder the economy, depending on these given institutional conditions). The contention here is that this specific aspect of the institutional landscape (transparency) is actually endogenous to resource abundance.

To that end, Column 4 introduces the Release of Information index into the analysis, and it does appear to have a large effect on the point resource coefficient. Specifically, the coefficient falls by over 70% to −4.38, and is now insignificant. The coefficient on the *RI* index, however, is both positive and significant. This suggests that, although controlling for transparency does not completely eliminate the negative effect of point resources on growth (the coefficient is still negative), it ceases to be a significant cause of lower growth. Given the previous results in this paper, this is suggestive of the fact that at least one of the major causes of the resource curse may be due to the effect these resources have on the transparency of the government. [28] It also suggests that the transmission mechanism from point resources through transparency and onto growth is not exclusively through any improvement (or deterioration) in the quality of the countries' institutions. [29]

Table 7 summarizes the results from running a number of additional regressions to test both the sensitivity and the robustness of this result. Firstly, to see whether this result was specific only to the proxy used here for resource rents, I also ran regressions using point and diffuse exports as a percentage of merchandise exports, as well as the measure for oil, gas, and mineral rents used in the previous section. Using the former measure of resource rents, the inclusion of the *RI* index (along with the other explanatory variables and Institutional Quality) led to a fall in the point resource variable of 82% and, using the latter measure, a fall of 63%. In both cases the resource variable ceased to be significant once the *RI* index was included. Secondly, I separately added a number of additional variables to the growth regression: investment, the incidence of civil war, official development assistance, and a proxy for financial development (the log of financial deposits as a percentage of GDP). Again, the inclusion of the *RI* index led to a substantial decrease in the coefficient on point resources in each regression.

Table 7. *Effect of release of information variable on point resources with additional variables*

	Coefficient on POINT before *RI* added [a]	Coefficient on POINT after *RI* added	% Change
Alternative variables			
Point (% exports)	−4.383	−0.771	−82.4
Oil, gas, mineral rents	−0.119	−0.045	−62.6
Additional variables			
Investment	−9.809	−2.924	−70.2
Civil war	−8.658	−2.341	−73.0
ODA	−7.684	−2.808	−63.5
Financial deposits	−11.848	−6.905	−41.7

[a] Other explanatory variables included in each regression but not reported here: Initial GDP *per capita*, population growth, trade openness, secondary schooling, executive constraints, government consumption spending, diffuse resource exports, Institutional Quality.

5. CONCLUDING COMMENTS

The answer to the first question posed at the start of this paper, on whether resource-rich countries are less transparent, appears to be that indeed they are, particularly with respect to point resources. Moreover (in answer to the second question), this lack of transparency appears to be a fairly direct result of these resource revenues. If one accepts the efficacy of the Release of Information index as a proxy for transparency, then this causal relationship running from point resources to transparency was robust to a number of different sample sizes and the inclusion of a range of additional and alternative variables.

The final question posed was whether this transmission mechanism could (at least in part) go some way toward explaining the negative relationship observed between natural resources and economic growth. Again, the answer appears to be that it does play a role. For example, across a number of different specifications, point resources ceased to be a significant "curse" once the *RI* index was included in the regression. This does not, of course, explain the curse in its entirety, nor will the effect be of the same magnitude across each country. Nevertheless, it does appear as though it is the lack of transparency arising from the point resource export revenues, rather than the revenues *per se*, that is one of the primary reasons for the subsequent poor growth record for these countries. Finally, from a policy perspective, these results do suggest that, even if the existing policy response of trying to improve transparency is probably difficult in practice to achieve, it may at least be on the right track.

NOTES

1. It is not the intention here to give a detailed review of the entire "resource curse" literature. For a theoretical treatment on the "Nigerian disease" resource curse, see Mehlum *et al.* (2006) and Robinson, Torvik, and Verdier, 2006. Among the large empirical literature on this issue, see Sachs and Warner (1997), Ross (2001), Leite and Weidmann (1999), Sala-i-Martin and Subramanian (2003), and references contained within.

2. On the issue of the policy prescriptions on transparency and natural resources, see Stiglitz, 2005, Iimi, 2006, Shaxson, 2007, Palley, 2003, and others, as well as the websites for Transparency International, 2008 (www.transparency.org), *or Global Witness*, 2009 *(www.globalwitness.org)*.

3. Kolstad and Wiig (2009) did perform a rudimentary empirical analysis of the effect of transparency on resource-rich countries, using the Freedom of the Press indicator (see below for details on this indicator), however, this covered a relatively small number of countries, and used a simple cross-sectional OLS estimation that could not account for likely endogeneity issues.

4. The construction of this index is similar to the approach taken in the well-known Governance Indicators dataset from the World Bank.

5. For the exact methodology of the construction of this index, see Williams (2009). The index in this initial paper only went up to the year 2000, however, I have subsequently updated the index to 2005, using data contained within the 2008 versions of the *WDI* and *IFS*. For more information and access to the data, visit: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

6. For example, evidence from five transition countries (Poland, Bulgaria, Albania, Hungary, and Romania) showed the amount of information released by their governments rose strikingly from the beginning of the 1990s, just at the time they began to enjoy greater political (and economic) freedoms. The fact that it was the political, and not economic, situation that was driving this could be seen from the fact that these increases occurred at the same time as *per capita* levels of GDP were significantly *falling*.

7. These measures include issues such as whether countries follow the IMF's accounting standards, how often they undertake a census, and the completeness of their vital registration system. For more details see World Bank (2004) *Measuring Results: Improving National Statistics in IDA Countries (Washington: World Bank)*.

8. Moreover, the correlation between the index produced by Islam, which specifically looks at the issue of timeliness, and the index used here, is 0.77 (across 161 countries) which suggests those that produce the most amount of data are also those that produce it in the most timely manner.

9. These included: five-year periods using current values; three year periods with both current values as well as one lag, and seven year periods with again both current and lagged values. There was no significant impact of either point or diffuse resources when any of the current values were used, nor was there any significant effect after a period of three years. When using seven year lagged variables, the coefficient on point resources was marginally significant (p-value = 0.07) and negative, however, the regression also failed both the Hansen and AR2 tests. As will be seen shortly, however, using five year periods with one lag resulted in a highly significant negative coefficient. These results are available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

10. Specifically, biased upwards using OLS, and biased downwards if using a Within Groups estimator. See Nickell (1981) or Bond (2002) for a detailed explanation of these biases.

11. The "Difference-in-Hansen" test reported in the tables below is an additional test for whether the changes in the instrumenting variables are uncorrelated with the fixed effects, which is an assumption for the "GMM-Sytem" estimator.

12. It may of course be that using gross secondary enrolments is a bad proxy here for the quality of the bureaucracy or even, more broadly, the level of education for the country. For example, gross secondary enrolments, even with a one period lag, is perhaps unlikely to reflect the (current) quality of older public servants. In order to deal with this, I tried a number of alternatives, such as lagging this variable by an additional period, and employing other education variables, such as years of secondary schooling from the Barro-Lee dataset (Barro & Lee, 2000), and public education spending (as a % of GNI). The education variable was never significant, whereas the resource variable was always negative, and highly significant. This remained true even if I used a more direct measure of the bureaucracy from ICRG (Bureaucratic Quality). These results are available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

13. A second consideration is whether to first difference the variables (as is most common), or whether to use orthogonal deviations. Rather than taking the first difference, this method subtracts off the average of all *future* available observations of a variable. This may be an important consideration in panels with "gaps" (as this one has), because the use of orthogonal deviations makes the gaps irrelevant. Because of the gaps in this dataset, therefore, I have employed orthogonal deviations in all regressions. Although not reported, the results are very similar to using first differences anyway. For example, in the core specification of Column 3, with the collapsed instrument set, using first differences results in a coefficient on the primary commodity variable of −0.286, compared to the coefficient using orthogonal deviations of −0.256. These results are available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

14. Although not shown here, I also tested two other samples: (i) to see whether the relationship was due to these countries' religion (Islam), rather than their natural resources, I used a sample that excluded all countries (24) with a majority Muslim population. The coefficient on the natural resource variable, however, remained negative and highly significant; (ii) I removed the top five natural resource exporters from Africa (Gabon, Zambia, Cote d'Ivoire, Nigeria and the Republic of Congo). Again, the coefficient on the resource variable was negative (−0.33) and significant. Removing the top 10 African exporters produced virtually identical results. These results are available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

15. Scores (out of 100) are also available after 1994, however, to keep a degree of comparability, the same methodology is used for all periods: countries classified as free, partly free and not free are assigned a score of 3, 2, or 1 respectively. As with the other variables, these scores are averages over each available five year period.

16. Note that I have left this index unscaled, and in this index higher scores reflect fewer civil liberties. Therefore, the positive coefficient on the primary commodity variable indicates that countries with greater primary commodities have fewer civil liberties.

17. There is also the possibility that the RI index is perhaps not measuring transparency as such, but simply reflects a more benign indifference to public services overall, of which statistical collection is but one manifestation. If true, this does not necessarily make the results to date unimportant (irrespective of the reason for the lack of information, this will still likely have a negative impact on the broader economy). But it is important with respect to intent, because benign neglect is different to wilfull, obfuscation. Admittedly, this is a difficult issue to test empirically. Nevertheless, I ran regressions using, respectively, the "General Public Services" category of government expenditure, of which spending on statistical services is a component (taken from the IMF's *Government Financial Statistics*, 2009, database), and Public Investment (both as a proportion of GDP) as the dependent variable. If the resource exporters are producing less information due to general indifference (reflected through fewer resources devoted to consumption or capital public spending), then the coefficient on the point resource variable should also be negative. However, the coefficient is actually positive when regressed on General Public Services and, while negative for Public Investment, is not significantly so. These results are available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

18. This remained true even when using the two alternative samples from Columns 4 and 5 of Table 2. I also used the cross-sectional dataset from the original Sachs and Warner paper, with the inclusion of the RI index variable as the dependent variable (as well as including the *XCONST* variable, which was not used in that paper, and RI60 for initial information). Using the variables from the dataset that closely match those used here (*sec70* for secondary enrolments, *lgdpea70* for *per capita* income, *gvxdxe* for government consumption and *sxp* for primary commodity exports in 1970), the coefficient on *sxp* was −0.32, and was significant at the 5% level, despite only having a sample of 68 countries. These results are available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

19. On the surface, this variable would appear to be a more precise candidate for measuring rents from these point resources. However, it has some significant methodological issues. The main problem is that, in order to estimate these rents, the costs of production have to be calculated. These costs are often only estimates, with some countries' estimates being based on nothing more than the costs of neighbouring countries. These limitations, plus the fact that regressions using this variable almost always failed the AR(2) test, and that it is available for fewer periods, means the "point" and "diffuse" commodities as a proportion of GDP will be used for the majority of the analysis here.

20. Nor does it appear that there is much reverse causality at work here. When switching the regression around so that the resource variable (either point or diffuse) is the dependent variable, the coefficient on RI, while negative, is never significant. These results are available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

21. This remains true even if both natural resource variables are removed from the regression. I also used the positive terms of trade "shock" variable constructed by Dehn (2000), in order to see whether there was a demonstrable effect on transparency when a country experienced a substantial (relative to GDP) "windfall" gain in their terms of trade (see Dehn, 2000 for more information on the derivation of this variable).There was no difference in the results, with the shock variable being insignificant, and the point resource variable remaining negative and significant. These results are available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

22. This follows the "curse of aid" line of thinking from Djankov *et al.* (2008). Furthermore, in a recent paper, Cagé (2009), using the same Release of Information indicator used here, highlighted the negative influence that information asymmetries have on the effectiveness of aid on economic growth.

23. This remains true even if I divide the aid variable into its bilateral and multilateral components.

24. Again, removing the natural resource variables does not significantly affect the coefficient on the civil war variable. These results are available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

25. This measure of institutional quality only includes corruption, rule of law and bureaucratic quality. The original measure of Institutional Quality developed by Knack and Keefer (1995) also included Expropriation of Assets, and Repudiation of Contracts. However, ICRG have subsequently discontinued these two series. Furthermore, because the ICRG measure of institutional quality only has data going back to the early 1980s, I have followed Roodman (2004) and used the country values from 1980-84 for periods prior to this.

26. I also experimented with a number of other additional and alternative variables, such as replacing the Executive Constraints variable with the more general POLITY variable, and the measure of Political Rights from Freedom House, and the point resource coefficient was always negative, and always significant. Furthermore, other additional explanatory variables were also examined: the log of population, overall trade openness, manufacturing exports, and investment. Of these four variables, only population had a (positive) significant effect on the release of information (that is, there is some evidence that there are economies of scale in the production and release of information). However, none of these had a significant effect on the point resource variable. These results are available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

27. If I use the original sample of 105 countries, the coefficient on point resources lagged one period is −24.28, and is significant at the 1% level. These results are available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

28. I also repeated this analysis with the two alternative samples that removed the high-income OECD countries and the energy-rich Middle East countries. With respect to the sample without the high-income OECD countries, the results are quite similar to before. The coefficient on point resources falls by over 85% and is again no longer significant. The removal of the six Middle East countries, while similar, suggests a smaller impact of transparency. The coefficient falls by around 15% and is not significant (whereas the coefficient on transparency is quite large, and is significant). These results are available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

29. Breaking the Institutional Quality variable down into its constituent parts (Corruption, Rule of Law, and Bureaucratic Quality) did little to change the results presented here. The introduction of the RI variable led to a fall in the coefficient on point resources of 63%, 77%, and 70% for regressions with the Rule of Law, Corruption and Bureaucratic Quality respectively, and ceased to be a significant determinant of growth in each. These results are available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm.

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APPENDIX

See Tables A.1, A.2, and A.3.

Table A.1. *List of countries used in "core" regressions (105)*

Algeria	Ethiopia	Madagascar	Romania
Argentina	Fiji	Malawi	Saudi Arabia
Australia	Finland	Malaysia	Senegal
Austria	France	Mali	Sierra Leone
Bahrain	Gabon	Mauritius	Slovenia
Bangladesh	Germany	Mexico	South Africa
Benin	Ghana	Moldova	Spain
Bolivia	Greece	Morocco	Sri Lanka
Brazil	Guatemala	Mozambique	Sudan
Burkina Faso	Honduras	Nepal	Sweden
Cameroon	Hungary	Netherlands	Switzerland
Canada	India	New Zealand	Syrian Arab Republic
Central African Republic	Indonesia	Nicaragua	Thailand
Chad	Iran, Islamic Rep.	Niger	Togo
Chile	Ireland	Nigeria	Trinidad and Tobago
China	Israel	Norway	Tunisia
Colombia	Italy	Oman	Turkey
Congo, Dem. Rep.	Jamaica	Pakistan	Uganda
Congo, Rep.	Japan	Panama	United Arab Emirates
Costa Rica	Jordan	Papua New Guinea	United Kingdom
Cote d'Ivoire	Kenya	Paraguay	United States
Czech Republic	Korea, Rep.	Peru	Uruguay
Denmark	Kuwait	Philippines	Venezuela
Dominican Republic	Latvia	Poland	Zambia
Ecuador	Liberia	Portugal	Zimbabwe
Egypt, Arab Rep.	Lithuania	Qatar	
El Salvador	Macedonia, FYR		

Table A.2. *List of variables used, and sources*

Variable	Source
Primary commodity exports (% GDP, % merchandise exports)	*World Development Indicators* (*WDI*)
Fuel	Fuels comprise SITC section 3 (mineral fuels). *Source*: *World Development Indicators* (*WDI*)
Ores and minerals	Ores and metals comprise the commodities in SITC sections 27 (crude fertilizer, minerals nes); 28 (metalliferous ores, scrap); and 68 (non-ferrous metals). *Source*: *World Development Indicators* (*WDI*)
Agricultural raw materials	Agricultural raw materials comprise SITC section 2 (crude materials except fuels) excluding divisions 22, 27 (crude fertilizers and minerals excluding coal, petroleum, and precious stones), and 28 (metalliferous ores and scrap). *Source*: *World Development Indicators* (*WDI*)
Food	Food comprises the commodities in SITC sections 0 (food and live animals), 1 (beverages and tobacco), and 4 (animal and vegetable oils and fats) and SITC division 22 (oil seeds, oil nuts, and oil kernels). *Source*: *World Development Indicators* (*WDI*)
Metals, minerals, oil and gas rents (% GDP)	Rents were measured as the market value of extracted material minus the average extraction cost. This is an approximation of the Net Price valuation method (which uses marginal extraction cost) which in turn is an approximation of the more exact User Cost method. Resources included are: bauxite, copper, lead, nickel, phosphate, tin, zinc, gold, silver, iron ore, oil and gas. *Source*: *WDI* (*2008*)
Release of information index	Author's calculations, available at: http://web.biz.uwa.edu.au/staff/awilliam/default.htm
Civil liberties, political rights	Freedom House. Data can be accessed at: http://www.freedomhouse.org/template.cfm?page=1
Log of *per capita* GDP (initial and average)	RGDPCH (PENN 6.2). Heston et al. (2005). Accessed from http://pwt.econ.upenn.edu/php_site/pwt_index.php
Per capita growth	Average annual percent change in RGDPCH (as above)
Executive constraints, POLITY	XCONST, from POLITY IV dataset (Marshall & Jaggers, 2002). Can be accessed at: http://www.cidcm.umd.edu/inscr/polity/
Gross secondary enrolments	Global Development Growth Network database (2006). Accessed at: http://www.nyu.edu/fas/institute/dri/globaldevelopmentnetworkgrowthdatabase.html, with additional data from the *WDI*
Government consumption (% GDP)	*World Development Indicators* (*WDI*)
Institutional quality (ICRG)	Sum of Corruption, Rule of Law and Bureaucratic Quality indices, taken from Political Risk Services (2008)
Trade openness	Imports plus exports as a% of GDP, taken from PENN 6.2, as above
Population growth	Log change in population over each five year period, with the population variable taken from the *World Development Indicators, 2008*
Civil War dummy	Collier and Hoeffler (2004)
Press Freedom	Freedom House. Data can be accessed at: http://www.freedomhouse.org/template.cfm?page=1
Investment	PENN 6.2, as above
Official Development Assistance (% GDP)	Roodman (2004)
Log change in Terms of trade	Global Development Growth Network database (2006)

Table A.3. *Descriptive statistics*

Variable	Mean	Std.Dev.	Min	Max
Release of information index	0.64	0.12	0.33	0.90
Log of *per capita* GDP, initial year	8.58	1.07	5.81	10.77
Primary commodity exports (proportion of GDP)	0.14	0.13	0.00	0.68
Agriculture raw materials exports (proportion of GDP)	0.01	0.02	0.00	0.20
Food exports (proportion of GDP)	0.05	0.05	0.00	0.31
Minerals, ores and metals exports (proportion of GDP)	0.02	0.06	0.00	0.52
Fuels exports (proportion of GDP)	0.05	0.11	0.00	0.65
Point resource exports(proportion of GDP)	0.07	0.13	0.00	0.67
Diffuse resource exports (proportion of GDP)	0.07	0.06	0.00	0.37
Minerals, metals, oil and gas rents (% GDP)	7.37	14.24	0.00	77.70
Executive constraints	4.62	2.29	1.00	7.00
Gross secondary enrolments	0.55	0.33	0.01	1.61
Government consumption (% GDP)	15.26	5.71	4.01	48.06
(Log) population	16.37	1.46	13.03	20.97
Log change in terms of trade	−0.02	0.18	−1.00	0.89
Manufacturing exports (proportion of GDP)	0.09	0.10	0.00	0.80
Imports + Exports, % GDP (log)	3.93	0.59	1.66	5.33
Civil War dummy	0.04	0.21	0.00	1.00
Press freedom	2.19	0.77	1.00	3.00
Institutional quality (ICRG)	9.23	3.88	1	16
Investment	17.62	8.46	2.80	42.42
(Log) liquid liabilities, % GDP	−1.03	0.81	−12.87	0.64
Population growth	1.45	1.01	−6.45	7.26
Official development assistance	4.66	6.51	−0.059	53.51
Per capita growth	1.84	2.91	−11.71	15.32
Civil liberties	3.45	1.74	1	7
Political rights	3.32	2.05	1	7
Financial deposits (log)	3.14	1.38	−10.09	5.19