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# **Natural Resources, Democracy, and Labour-Market Outcomes in the Public Sector**

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## **ABSTRACT**

Governments in resource-rich countries may use a sizable share of the revenue from their underground wealth to buy support through public employment. This occurs in both democratic governments (which need to be re-elected) and autocratic governments (which have to prevent riots and regime change). Using the Worldwide Bureaucracy Indicators dataset provided by the World Bank, we analyse the effect of natural resources on public employment in developing countries from 2000 to 2018. We find that resource rents may have an effect on public sector characteristics. However, uncovering the heterogeneous effects of different types of natural resources, we find that oil and gas wealth may increase public employment in countries that are not fully democratic, while forest wealth has a positive impact for all values of democracy. At the same time, the public sector wage premium is positively affected by oil and forest in non-democratic countries and by gas when the level of democracy is very high.

**Keywords:** natural resources, public sector, rentier states, patronage employment.

**JEL codes:** P16, N5, C23, O57

## 1. Introduction

The analysis of state capacity, defined as the institutional capability of the state to carry out various policies that deliver benefits and services to households and firms (Besley and Persson, 2011), has emerged as a major issue relating governance, institutions, and long-term economic development. The focus has been on two dimensions: fiscal capacity and legal capacity, defined respectively as the capability to raise revenues from taxes and to enforce contracts and property rights.

More recently, Ricciuti et al. (2019) have looked at fiscal aspects, focusing on the financial planning side – the capability of states to design, implement, and monitor their budgets. Strengthening such ability is strategically important for economic development, since achieving greater efficiency in public financial management can lead to more efficient public goods provision. In doing this, the state needs a well-functioning bureaucracy.

Natural resources such as minerals, oil, and gas are a source of rents for the state. However, large endowments of natural resources may reduce economic growth and are associated with non-democratic regimes, leading to the so-called ‘resources curse’. Besides explanations based on capital inflows and real exchange rate appreciation, that is, the so-called ‘Dutch Disease’ (Kremers, 1986), and on the macroeconomic volatility generated by natural resource prices (van der Ploeg and Poelhekke, 2009), a major cause for this perverse outcome is traceable in the public sector: politicians may use rents from natural resources as a tool to remain in power (Robinson et al. 2006, Caselli and Cunningham 2009). For example, a job in the public sector may be offered in exchange for a vote, or simply as acceptance of the status quo in a non-democratic regime. In addition, so-called white elephant projects (expensive, below capacity, and therefore unsustainable over time) are another example of a waste of public money accrued from extractive resources. Overall, an excessive expansion of the public sector may generate substantial inefficiencies.<sup>1</sup>

A case in point is Venezuela. *Petróleos de Venezuela S.A. (PDVSA)*, the state-owned enterprise, tripled its payroll during the presidency of Hugo Chávez.<sup>2</sup> Between 2002 and 2012, incapacitating injuries to employees rose from 1.8 per million-man hours to 6.2. It also underwent politicisation. In 2002, many of the employees of PDVSA went on strike against the policies of Chávez, who, in response, fired over 19,000 workers from the company. *Intevep*, the research and development subsidiary, lost 80% of its workers, damaging PDVSA’s ability to innovate and

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<sup>1</sup> For comprehensive reviews on the resource curse and its causes and consequences, see van der Ploeg (2011) and Ross (2015).

<sup>2</sup> Enrique Krauze (March 8, 2018). "Hell of a Fiesta". New York Review of Books.

compete.<sup>3</sup> In 2006, Rafael Ramírez, the energy minister, gave PDVSA workers a choice: support President Hugo Chávez, or lose their jobs.<sup>4</sup> PDVSA continued to hire only the president's supporters, and its revenue is used to fund political projects.<sup>5</sup>

While a large literature has investigated how natural-resource rents affect government expenditure and political outcomes, comparatively less attention has been paid to the public-sector labour market. Yet public employment represents a potentially important channel for distributing resource rents. Recent research has begun to examine the relationship between resource wealth and public employment more directly, suggesting that the way rents are distributed through public jobs may vary with countries' political and social characteristics (Ali and Elbadawi 2016, Al Yussef et al. 2024, Al Yussef 2024). However, the role of political accountability in shaping this relationship remains comparatively underexplored.

Against this background, this paper assesses whether and how natural-resource wealth is associated with a larger share of public employment and a higher public-sector wage premium. Our hypothesis is that, in resource-rich economies, the public sector may be used as a tool to increase political support, as resource rents provide governments with additional resources that can be redistributed through public employment and remuneration. Resource-poor countries, by contrast, face greater constraints in using this channel of redistribution. We further investigate whether this relationship varies with the level of democracy. Our expectation is that the political use of public employment may also occur in non-democratic countries, where public jobs can be used to give benefits to the population to avoid turmoil in exchange for the lack of democracy.

The paper contributes to the literature in three respects. First, we consider two dimensions of the public-sector labour market: the share of workers employed in the public sector and the public-sector wage premium. This provides a broader picture of how resource wealth may affect the public sector. Second, we investigate whether democracy conditions the relationship between natural resources and public-sector outcomes. In doing so, we complement recent research showing that other country characteristics, such as fractionalization, may shape how resource rents are distributed through public employment and wages (Al Yussef, 2024). Third, rather than considering natural resources only in the aggregate, we distinguish among different types of resource wealth. This allows us to uncover potential heterogeneity across agricultural, forest, mineral, coal, oil, and gas resources that may be hidden by aggregate measures.

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<sup>3</sup> "Brain Haemorrhage; Venezuela's Oil Diaspora." *The Economist*, July 19, 2014.

<sup>4</sup> "Storm over Venezuela oil speech", BBC News, November 4, 2006.

<sup>5</sup> "Venezuela's oil industry: Up in smoke". *The Economist*, August 27, 2012.

We examine these relationships using panel regressions on a sample of developing countries from 2000 to 2018. Overall, our results suggest that considering natural resources only in the aggregate may conceal important differences in how specific types of resource wealth are associated with public-sector labour market outcomes and how these relationships vary with political institutions. In particular, we find that oil and gas wealth may increase public employment in countries that are not fully democratic, while forest wealth has a positive association with public employment across all levels of democracy. At the same time, the public sector wage premium is positively affected by oil and forest in non-democratic countries, and by gas when the level of democracy is very high.

The paper is organised as follows: Section 2 reviews the theoretical and empirical literature related to patronage, public employment, and natural resources. Section 3 describes the empirical strategy and data. Section 4 shows the results. Section 5 concludes.

## **2. Literature review**

In this section we review the three streams of the literature that are relevant to our analysis. First, we look at the theory behind the use of resource rents for politically motivated expenditures. Second, we examine the empirical evidence for these theoretical models. Third, we consider the literature on public employment and public-sector labour markets in developing countries, focusing on the different economic and political explanations for the size and remuneration of the public sector.

Our major theoretical reference point is Robinson et al. (2006), who studied an incumbent politician seeking to secure re-election through patronage, i.e., the allocation of state resources and positions to clients to buy their votes and support.<sup>6</sup> They find that politicians tend to over-extract natural resources relative to the efficient extraction path because they discount the future too much. At the same time, resource booms improve the efficiency of the extraction path; however, by raising the value of being in power and by providing politicians with more resources that they can use to influence election outcomes, resource booms increase misallocation in the rest of the economy. The overall impact depends on institutions: countries with institutions that promote accountability and state competence will tend to benefit from resource booms since these institutions mitigate the perverse political incentives that such booms create. Countries without such institutions, however, may suffer from a resource curse. Therefore, the patronage model emphasises institutions of public

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<sup>6</sup> Caselli and Cunningham (2009) similarly emphasize how resource windfalls affect political leaders' incentives. In their framework, an increase in resource revenues raises the value of remaining in power and may induce leaders to redirect resources from productive activities towards expenditure aimed at political survival, including patronage.

sector accountability.<sup>7</sup> These results also hold for an autocrat, whose political survival depends on the support of a ‘winning coalition’, which may be captured by patronage in public employment.

Arezki et al. (2011) and Okada and Samreth (2021), using a panel of countries, find that an increase in resource windfalls causes more government spending, and its impact is larger in autocratic countries. Caselli and Michaels (2013), using data on Brazilian municipalities, show that resource windfalls increase municipal revenues and spending on public goods and services. A few studies have examined the relationship between natural resources and military expenditure. Cotet and Tsui (2013) show that oil discoveries increase military expenditure in non-democratic countries. Ali and Abdellatif (2015) investigate this relationship using data on the Middle East and North Africa countries and show that oil and forest rents increase military expenditure, whereas coal and natural gas rents decrease it. Some studies investigate the effects of natural resource abundance on government expenditure for education and health. Gylfason (2001) shows that natural resource abundance has negative impacts on educational inputs, outcomes, and participation. Cockx and Francken (2014, 2016) find evidence that natural resource abundance significantly decreases public health and public education spending. Okada and Samreth (2021) find a positive effect of oil discoveries on defence and general public services, whereas they decrease expenditure on public order and safety, and economic affairs. Moreover, they find no significant impact on social spending. Finally, on the design of fiscal institutions, Bhattacharyya et al. (2017) find that resource discoveries lead to expenditure centralisation.

A separate literature has investigated the determinants and economic role of public employment in developing countries. Two broad interpretations have been proposed to explain why public employment may be relatively large in these economies. The first one emphasises rent-seeking, redistribution, and political incentives. Gelb et al. (1991) argue that excessive public employment may result from pressure for high-wage employment. Public employment can therefore operate as a redistributive device, but it may also reflect the demands of politically influential groups or the incentives of governments to distribute benefits through public jobs. Related works highlight how weak political accountability can contribute to public-sector overemployment. Ragauskas and Valeškaitė (2020), for example, find that stronger political competition is associated with lower levels of nepotism and state exploitation.

A second interpretation stresses the insurance role of public employment. Rodrik (2000) argues that relatively secure government jobs may provide partial insurance against external risks, especially in developing economies where formal social protection mechanisms are limited. From this perspective, a large public sector need not arise exclusively from rent-seeking or patronage but

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<sup>7</sup> A competing model, emphasizing the quality of institutions in the private sector, is provided by Mehlum et al. (2006).

may also represent a response to economic insecurity: citizens will have a higher demand for social insurance as long as the external risk faced by the domestic economy, proxied by the level of trade openness, increases. This hypothesis has been challenged by Gözgor et al. (2019), who, using the Worldwide Bureaucracy Indicators, the same dataset employed in our study, find that greater globalisation is associated with lower public employment.

A relatively large literature has addressed the issue of wage premia between the public and the private sector. Most of the studies analyse individual data in developed countries (Ehrenberg & Schwarz, 1986; Moulton, 1990; Gregory & Borland, 1999; Dickson et al., 2014) and find heterogeneity of the wage premium across the wage distribution, consistent with wage compression in the public sector, where there are higher wage premia for lower-skilled workers. In this review, we give more weight to the contributions concerning developing countries. Lindauer and Sabot (1983) provide the first contribution on the public-sector wage premium in developing countries. They used OLS and a simple Mincer wage equation to estimate wage differences between public- and private-sector workers in urban Tanzania. However, the OLS method may not be appropriate since employees may non-randomly self-select into the public or private sector, possibly because of comparative advantage or non-wage characteristics of jobs in each sector (e.g., security in the public sector). Terrell (1993) employed the Heckman selection model to address possible selection bias for Haiti, and Tansel (2005) went further by using an IV approach to study Turkey. Panizza and Qiang (2005) compare public and private formal-sector wages for 13 Latin American countries. They find wage premiums for women in 10 countries, but premiums for men in about half of the countries. Panizza and Qiang (2005) use OLS by noting that any instrumental variable available in the comparable cross-country data is likely to be weak and may lead to more bias than OLS.

As in Tansel et al. (2018), panel data and fixed-effects estimates, by comparing wages for the same workers when they change sectors, can control for unobserved time-invariant differences in the employees in the public and private sectors. They find public sector earnings penalties for men but premiums for women. Mizala et al. (2011) use matching methods to estimate public-sector earnings premiums for 7 countries in Latin America, matching observations on education, experience, gender, marital status, and region. They find that low-wage workers earn a wage premium while the most skilled workers earn a wage penalty. However, there is an efficiency cost to the use of matching, and it is not clear whether it yields estimates with a lower mean squared error than OLS.

Gindling et al. (2020) is the closest paper to ours. They examine the public-sector wage premium for up to 68 countries. Compared to all private-sector paid employees, including informal sector employees, the public sector generally pays a wage premium. However, in most countries, it disappears when the public sector is compared to only formal sector private employees. Moreover,

there is wage compression in the public sector. Finally, the wage premium is weakly associated with countries' level of development.

A small but growing literature has begun to investigate public employment as a channel through which natural-resource rents may affect the economy. Cologni and Manera (2013) show that shocks to oil revenues can generate sectoral reallocations and that the expansion of government employment can account for an important part of the contraction of the private sector following positive oil-revenue shocks. More recently, Al Yussef, Hens and Holm (2024) argue that when policymakers place a higher value than the population on public employment or the provision of government goods, resource rents may lead to an excessive expansion of public employment. This can erode the benefits of resource wealth by reducing leisure, private production, and consumption, particularly when policymakers attach excessive importance to employment relative to citizens' preferences for leisure.

Particularly close to our analysis is a paper by Al Yussef (2024) on resource rents, ethnic fractionalization, and redistributive public-sector employment. The author shows that the relationship between resource abundance and public employment depends on ethnic fractionalization: when fractionalization is low, greater resource abundance is associated with higher public employment and lower public-sector remuneration; when fractionalization is high, resource rents are instead associated with fewer public-sector jobs but higher remuneration for a smaller group of beneficiaries.

Our analysis complements this emerging literature by focusing on the role of democratic institutions. We investigate whether the level of democracy conditions the relationship between natural-resource wealth and both public employment and the public-sector wage premium. In addition, we distinguish between different types of natural resources, allowing us to assess whether the relationship between resource wealth and public-sector labour market outcomes varies according to the nature of the resource endowment.

### **3. Empirical strategy and data**

Our empirical analysis is based on data from the recent Worldwide Bureaucracy Indicators dataset (WWBI), provided by the World Bank (World Bank, 2018b). The WWBI provides internationally comparable measures of public-sector employment and remuneration, contributing to a better understanding of the personnel dimensions of state capability, the footprint of the public sector on the overall labour market, and the fiscal implications of the government wage bill. It covers 202 countries and territories between 2000 and 2018. The WWBI dataset encompasses three categories of variables: the characteristics of public employment, wages, and the wage bill. The characteristics of public employment include the number of public employees, their age, gender

distributions, and academic qualifications. The wage variables capture the competitiveness of public-sector wages as compared to private-sector wages; wage compression and relative wages across different occupations; and the gender pay gap in the public and private sectors. Finally, the wage bill measures the affordability of the public sector. In this paper, we focus on two main outcomes: public-sector employment as a share of paid employment and the public-sector wage premium relative to private-sector workers. The latter captures the relative remuneration of public-sector employees compared with workers in the private sector.

Our main measure of resource rents is the share of natural capital wealth over total wealth, from the Wealth Accounting dataset (World Bank, 2018a). It measures the present value of natural resource rents, aggregating hydrocarbons, minerals, forests, and agricultural commodities. Because it captures the expected size of the rents accruing from natural resources at a certain point in time, this variable is in line with the intuition that higher expected income from natural resources may increase the value of incumbency and provide ruling groups with more funds that can be used to retain power (e.g., to influence the outcome of elections), thus increasing the public sector.

Resource rent estimation is based on the difference between the price of a commodity and the average cost of producing it, estimating the world price of units of specific commodities and subtracting estimates of average unit costs of extraction or harvesting costs (including a normal return on capital). The unit rents are then multiplied by the quantities countries extract or harvest to determine the rents for each commodity as a share of gross domestic product (GDP). Such measures are based on estimates and, therefore, are subject to measurement error. However, as long as the noise approximates classic errors in variables case, this is a source of attenuation bias. Therefore, it stacks the odds against our results, implying that estimates of the effects of natural resource rents may be conservative. Assuming that both the identity of a country's commodities and world prices are largely exogenous to state institutions, this measure avoids identification problems related to the estimation of the effects of natural resources.

In addition to aggregate natural-resource wealth, we distinguish between point-source and diffuse resources and separately consider agricultural, forest, mineral, coal, oil, and gas wealth. This disaggregation allows us to investigate whether aggregate measures conceal heterogeneous relationships across different types of natural resources.

Figure 1 shows the unconditional relationship between natural-resource wealth and our two public-sector outcomes: public employment and the public-sector wage premium. As shown, the level of natural resources is positively correlated with the share of public employment and with public-sector wage premium.

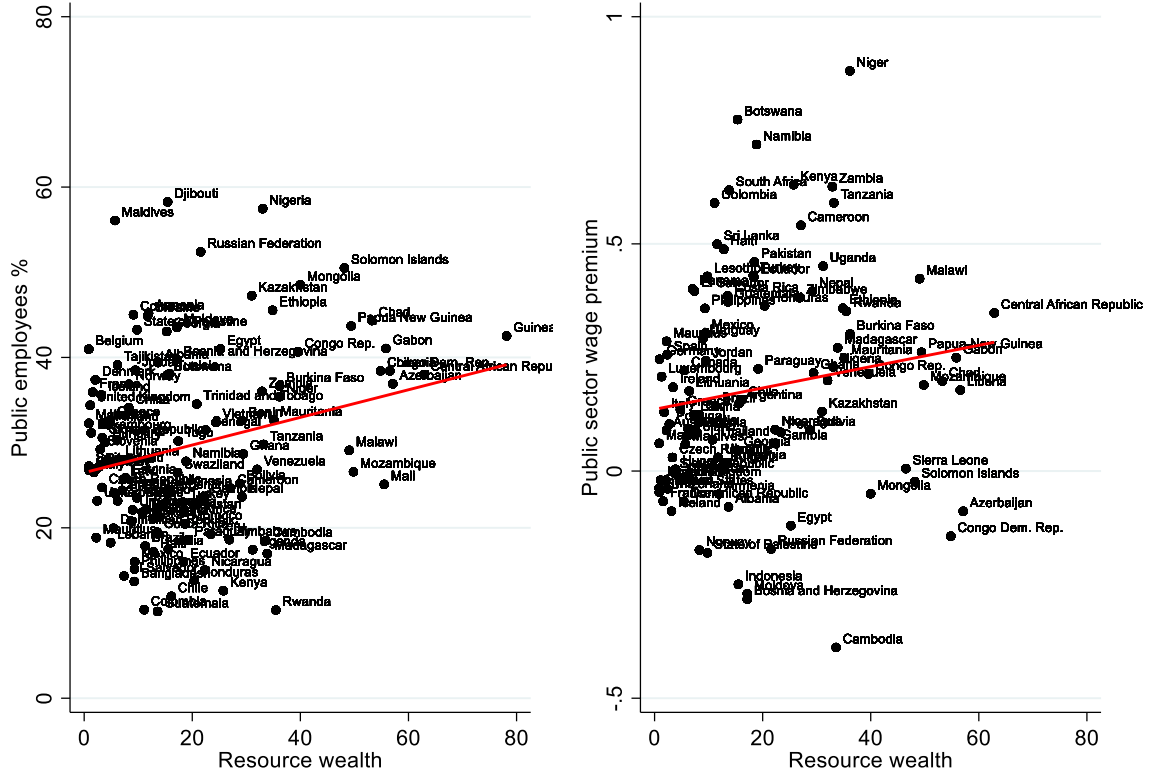


Fig. 1 Relationship between resource wealth and public sector characteristics.

To investigate these relationships more systematically, we use five-year averages of our variables, and we estimate the following model:

$$PEC_{it} = \alpha + \beta RR_{it-1} + \gamma dem_{it-5} + \delta RR_{it-1} * dem_{it-5} + \zeta X_{it-1} + \eta_i + \varepsilon_t + \mu_{it}$$

where  $PEC_{it}$  captures public employment characteristics of country  $i$  averaged over the years  $t-4$  to  $t$ , as described below.  $RR_{it-1}$  is our measure of resource rents averaged over the years  $t-5$  to  $t-1$ , and  $dem_{it-5}$  is the level of democracy in the country evaluated by *Polity2* variable, provided by the Polity IV dataset (Marshall et al., 2014). To reduce simultaneity between political institutions and current public-sector outcomes, we average the *Polity2* score over the period  $t-10$  to  $t-6$ , and we scale these averages such that our measure ranges from 0 to 1, with higher values implying better democratic institutions.  $RR_{it-1} * dem_{it-5}$  is the interaction between resource rents and democracy, which allows us to assess whether the association between natural-resource wealth and public-sector outcomes varies with the level of democracy. The vector  $X$  is a set of time-varying controls, averaged over the years  $t-5$  to  $t-1$ . All regressions include country and year fixed effects ( $\eta_i$  and  $\varepsilon_t$  respectively). Standard errors are clustered at the country level to allow for unknown forms of heteroskedasticity and serial correlation.

The set of control variables includes the logarithm of GDP per capita (*GDP*), a measure of the level of education in the country given by the secondary school completion rate (*Education*) from World Bank (2018c), *Openness*, that is the sum of exports and imports of goods and services measured as a share of gross domestic product (World Bank, 2018c), *population ages 15-64* (World Bank, 2018c).

Table 1 presents descriptive statistics. Public-sector employment accounts for about 11 percent of total employment on average, although there is substantial cross-country variation, ranging from less than 2 percent to more than 42 percent. The average public-sector wage premium is close to zero, but it also displays considerable heterogeneity across countries, with values ranging from -0.43 to 0.51. Resource dependence is similarly heterogeneous, with an average of about 36 percent and values ranging from 7 to 85 percent. Among individual resources, agricultural and forest wealth represent the largest components on average, while oil, gas, coal, and mineral wealth are more concentrated in a smaller number of countries. Finally, the average democracy score is relatively high, although the sample exhibits substantial variation in political institutions.

Table 1 – Descriptive statistics

| Variable                                                | Mean  | Std. Dev. | Min   | Max    |
|---------------------------------------------------------|-------|-----------|-------|--------|
| Public sector employment as a share of total employment | 10.94 | 10.16     | 1.86  | 42.65  |
| Public sector wage premium                              | 0.02  | 0.20      | -0.43 | 0.51   |
| Resource dependence                                     | 35.66 | 18.18     | 7.22  | 84.53  |
| Agricultural capital                                    | 23.03 | 12.83     | 5.06  | 57.21  |
| Forests                                                 | 3.22  | 4.59      | 0.01  | 22.07  |
| Minerals                                                | 2.20  | 3.87      | 0.00  | 23.73  |
| Coal                                                    | 0.31  | 1.32      | 0.00  | 11.77  |
| Oil                                                     | 1.83  | 5.04      | 0.00  | 25.93  |
| Gas                                                     | 0.37  | 0.72      | 0.00  | 3.22   |
| Polity2                                                 | 0.78  | 0.25      | 0.09  | 1.00   |
| GDPpc (log)                                             | 7.19  | 0.76      | 5.80  | 8.36   |
| Education                                               | 57.41 | 24.14     | 10.73 | 97.70  |
| Openness                                                | 75.77 | 26.97     | 20.72 | 146.81 |
| Population 15-64 (log)                                  | 16.82 | 1.13      | 14.44 | 19.10  |
| Civil War                                               | 3.29  | 0.67      | 1.92  | 4.00   |

#### 4. Results

This section presents the results. We begin by assessing evidence on whether our measure of resource rents, the share of natural capital wealth over total wealth, has an impact on public sector employment as a share of paid work. Then we investigate different types of natural resources.

Table 2 shows that the coefficient of resource wealth is positive and significant at conventional levels. However, neither the coefficient of Democracy nor that of the interaction term is significant. Thus, although aggregate resource wealth is positively associated with public-sector employment, there is no evidence in this specification that this relationship systematically varies with the level of democracy.

This measure of resource rents may cover the heterogeneous effects of different types of natural resources. In columns 2-4, we consider point-source resources and diffuse resources. Point-source resources are extracted from a relatively narrow geographical base and are therefore easier for political elites to control and appropriate, whereas diffuse resources are extracted from a broader geographical base and are less easily controlled (Isham et al. 2005, Bhattacharyya and Collier 2014). As in Masi et al. (2024), we classify oil, minerals, gas, and coal as point-source resources, while agricultural and forest resources are classified as diffuse resources. The results suggest that the positive relationship is mainly driven by point-source resources, whereas diffuse resources are not significantly associated with public employment. However, the interaction terms with democracy remain statistically insignificant.

Figure 2 shows the marginal effects of natural resource rents at different levels of democracy, calculated from the estimates reported in column 4, where point-source and diffuse resources are included simultaneously to avoid potential omitted-variable bias. The marginal effect of aggregate resource wealth is not statistically significant across the democracy distribution. By contrast, point-source resources are positively and significantly associated with public employment at low levels of democracy, but the effect loses statistical significance once the democracy index exceeds approximately 0.4. Diffuse resources display a much weaker pattern, with a statistically significant marginal effect only around a democracy level of 0.4. Overall, the figure suggests that the relationship between natural resources and public employment is more pronounced for point-source resources in less democratic countries.

Table 2 - Public sector employment, as a share of paid employment

| VARIABLES                     | (1)                    | (2)                       | (3)                  | (4)                                   |
|-------------------------------|------------------------|---------------------------|----------------------|---------------------------------------|
|                               | Resource<br>dependence | Point Source<br>Resources | Diffuse<br>Resources | Point Source and<br>Diffuse Resources |
| Democracy                     | 4.482<br>(5.845)       | -1.062<br>(4.333)         | -0.601<br>(5.445)    | 0.608<br>(5.445)                      |
| Resource wealth               | 0.213*<br>(0.119)      |                           |                      |                                       |
| Resource wealth * Democracy   | -0.244<br>(0.233)      |                           |                      |                                       |
| Point Source Resources        |                        | 0.157<br>(0.146)          |                      | 0.278*<br>(0.150)                     |
| Point source res. * Democracy |                        | -0.096<br>(0.369)         |                      | -0.181<br>(0.362)                     |
| Diffuse Resources             |                        |                           | 0.137<br>(0.230)     | 0.279<br>(0.204)                      |
| Diffuse res. * Democracy      |                        |                           | -0.018<br>(0.390)    | -0.073<br>(0.358)                     |
| GDP pc (log)                  | -8.571***<br>(3.265)   | -9.690***<br>(3.192)      | -8.457**<br>(3.329)  | -8.363**<br>(3.333)                   |
| Education                     | 0.118**<br>(0.059)     | 0.121**<br>(0.058)        | 0.117**<br>(0.057)   | 0.134**<br>(0.058)                    |
| Openness                      | -0.021<br>(0.021)      | -0.025<br>(0.023)         | -0.022<br>(0.021)    | -0.026<br>(0.022)                     |
| Population ages 15-64         | 7.242<br>(5.593)       | 5.259<br>(5.742)          | 7.615<br>(5.803)     | 6.390<br>(5.802)                      |
| Constant                      | -22.863<br>(87.435)    | 22.790<br>(89.794)        | -26.215<br>(93.028)  | -10.656<br>(93.013)                   |
| Observations                  | 1,319                  | 1,319                     | 1,319                | 1,319                                 |
| R-squared                     | 0.334                  | 0.331                     | 0.330                | 0.340                                 |
| Number of countries           | 106                    | 106                       | 106                  | 106                                   |
| Year FE                       | YES                    | YES                       | YES                  | YES                                   |
| Country FE                    | YES                    | YES                       | YES                  | YES                                   |

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

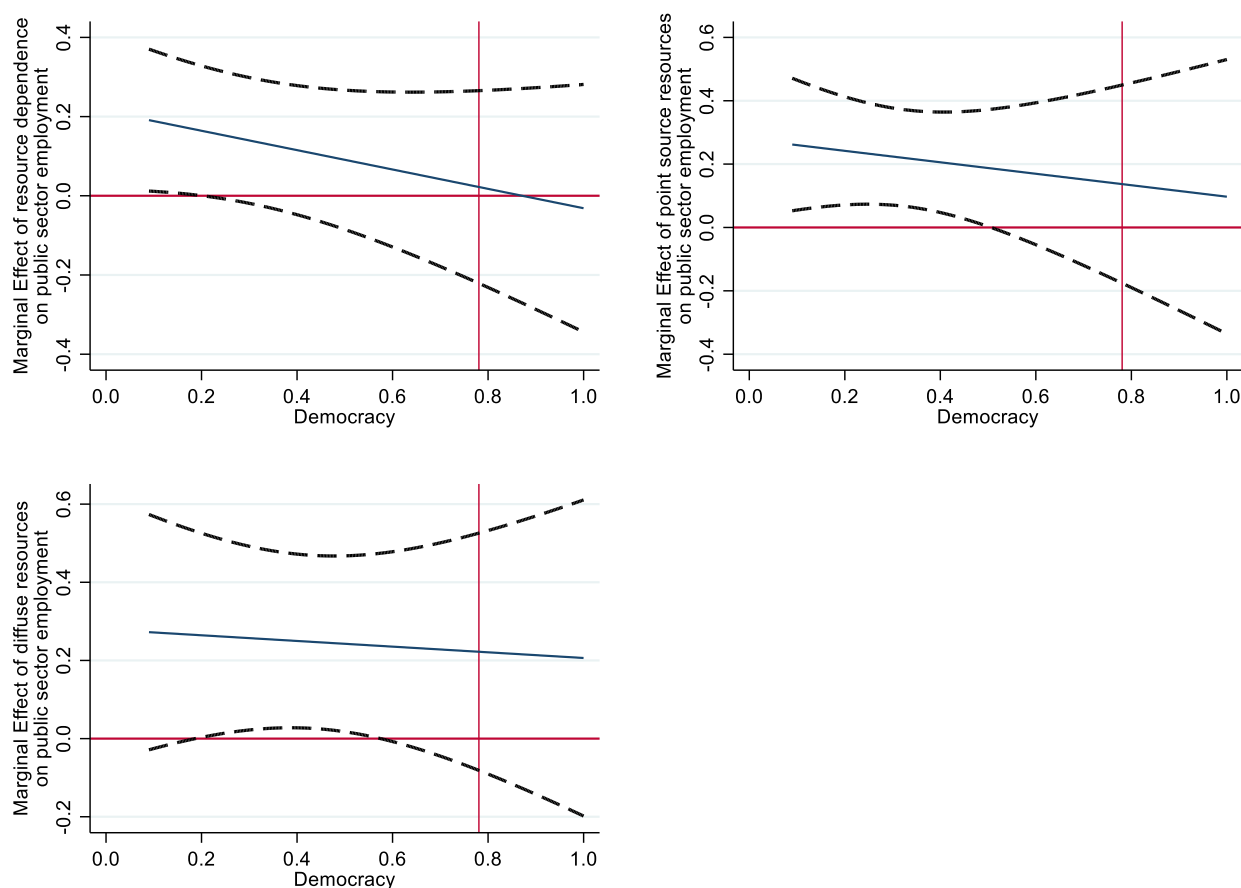


Fig. 2 Marginal effects of natural resources on public sector employment

To investigate whether aggregation conceals heterogeneous patterns across specific natural resources, Table 3 considers agriculture, forest, mineral, coal, oil, and gas. We find that the effect on public employment depends on the specific natural endowment. In fact, oil and gas wealth may increase the share of public employees (columns 6 and 7). However, the interaction term is negative, suggesting that the effect of such resource rents is offset when the level of democracy increases. Figure 3 reports the corresponding marginal effects (from column 7) and confirms that oil and gas have a positive impact on public employment, which decreases as the level of democracy increases. Thus, non-democratic countries have even higher incentives to increase the public sector. Public work is probably used as a means to give benefits to the population to avoid turmoil in exchange for the lack of democracy. Forest wealth has a positive effect that persists in each level of democracy. Such an effect seems to be absent for other natural resources.

Table 3 - Public sector employment, as a share of paid employment: different resources

| VARIABLES                          | (1)<br>Agricultural<br>wealth | (2)<br>Forest<br>wealth | (3)<br>Mineral<br>wealth | (4)<br>Coal<br>wealth | (5)<br>Oil<br>wealth | (6)<br>Gas<br>wealth | (7)<br>All<br>Resources |
|------------------------------------|-------------------------------|-------------------------|--------------------------|-----------------------|----------------------|----------------------|-------------------------|
| Democracy                          | -1.137<br>(6.263)             | -0.081<br>(4.352)       | -2.933<br>(3.504)        | -1.376<br>(3.990)     | 0.256<br>(4.658)     | -0.423<br>(4.063)    | -1.846<br>(5.579)       |
| Agricultural wealth                | 0.029<br>(0.365)              |                         |                          |                       |                      |                      | -0.128<br>(0.431)       |
| Agricultural wealth *<br>Democracy | 0.002<br>(0.572)              |                         |                          |                       |                      |                      | 0.109<br>(0.677)        |
| Forest wealth                      |                               | 0.932*<br>(0.499)       |                          |                       |                      |                      | 1.417**<br>(0.605)      |
| Forest wealth *<br>Democracy       |                               | 0.092<br>(0.698)        |                          |                       |                      |                      | 0.277<br>(0.952)        |
| Mineral wealth                     |                               |                         | 0.029<br>(0.218)         |                       |                      |                      | -0.156<br>(0.262)       |
| Mineral wealth *<br>Democracy      |                               |                         | 0.393<br>(0.486)         |                       |                      |                      | 0.738<br>(0.477)        |
| Coal wealth                        |                               |                         |                          | 0.419<br>(4.334)      |                      |                      | -0.933<br>(4.055)       |
| Coal wealth *<br>Democracy         |                               |                         |                          | -1.260<br>(4.379)     |                      |                      | -0.258<br>(4.110)       |
| Oil wealth                         |                               |                         |                          |                       | 0.308<br>(0.191)     |                      | 0.601***<br>(0.200)     |
| Oil wealth *<br>Democracy          |                               |                         |                          |                       | -0.480<br>(0.332)    |                      | -0.474<br>(0.305)       |
| Gas wealth                         |                               |                         |                          |                       |                      | 2.802**<br>(1.090)   | 2.400**<br>(0.923)      |
| Gas wealth *<br>Democracy          |                               |                         |                          |                       |                      | -3.118*<br>(1.656)   | -2.683**<br>(1.258)     |
| GDP pc (log)                       | -9.143***<br>(3.311)          | -8.030**<br>(3.189)     | -9.769***<br>(3.129)     | -8.712***<br>(3.319)  | 9.462***<br>(3.170)  | 9.675***<br>(3.200)  | -8.493**<br>(3.455)     |
| Education                          | 0.114**<br>(0.056)            | 0.126**<br>(0.057)      | 0.123**<br>(0.057)       | 0.110*<br>(0.056)     | 0.112**<br>(0.055)   | 0.117**<br>(0.055)   | 0.151***<br>(0.055)     |
| Openness                           | -0.022<br>(0.022)             | -0.021<br>(0.022)       | -0.026<br>(0.022)        | -0.023<br>(0.022)     | -0.023<br>(0.022)    | -0.025<br>(0.023)    | -0.031<br>(0.022)       |
| Population ages 15-<br>64          | 6.733<br>(5.715)              | 8.612<br>(6.028)        | 5.400<br>(5.519)         | 6.720<br>(5.792)      | 6.049<br>(5.801)     | 5.829<br>(5.812)     | 6.216<br>(5.796)        |
| Constant                           | -4.849<br>(92.580)            | -47.368<br>(95.236)     | 22.628<br>(86.010)       | -7.358<br>(90.447)    | 7.896<br>(91.030)    | 13.393<br>(91.964)   | -6.489<br>(96.636)      |
| Observations                       | 1,319                         | 1,319                   | 1,319                    | 1,319                 | 1,319                | 1,319                | 1,319                   |
| R-squared                          | 0.327                         | 0.346                   | 0.339                    | 0.339                 | 0.331                | 0.333                | 0.398                   |
| Number of countries                | 106                           | 106                     | 106                      | 106                   | 106                  | 106                  | 106                     |
| Year FE                            | YES                           | YES                     | YES                      | YES                   | YES                  | YES                  | YES                     |
| Country FE                         | YES                           | YES                     | YES                      | YES                   | YES                  | YES                  | YES                     |

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

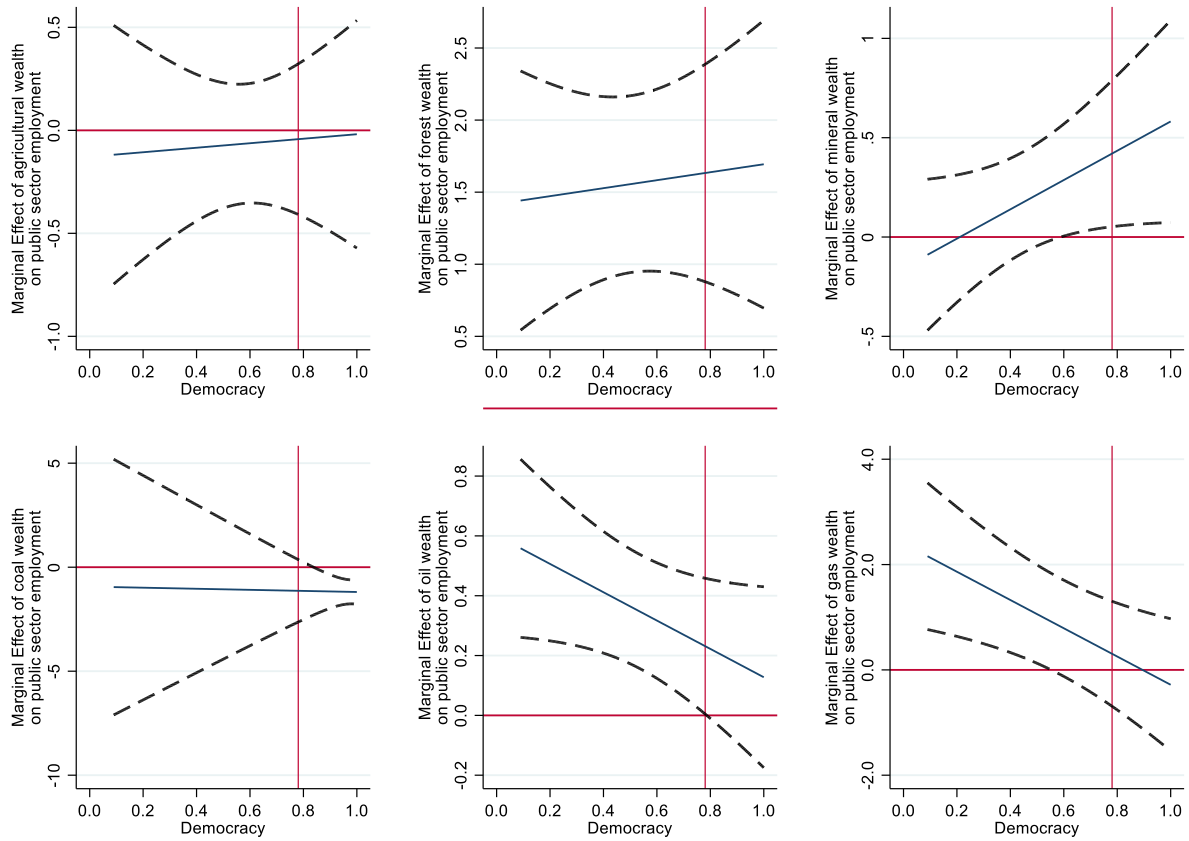


Fig. 3 Marginal effects of natural resources on public sector employment: different resources

We next turn to the public-sector wage premium. In table 4, we repeat the previous analysis using the wage premium relative to private-sector employees as the dependent variable, and in Figure 4 we show the corresponding marginal effects. In column 1, we again consider all types of natural resources, and find that the coefficient is still positive and significant, while the interaction term is negative and significant. Unlike the results for public employment, the relationship between aggregate resource wealth and the public-sector wage premium clearly varies with political institutions: the positive association weakens as democracy increases.

A similar pattern emerges for point-source resources. Their coefficient is positive, while the interaction with democracy becomes negative and statistically significant when point-source and diffuse resources are entered jointly. Diffuse resources, by contrast, show no statistically significant relationship with the wage premium.

Table 4 - Public sector wage premium (compared to all private employees)

| VARIABLES                        | (1)<br>Resource<br>dependence | (2)<br>Point Source<br>Resources | (3)<br>Diffuse<br>Resources | (4)<br>Point Source and Diffuse<br>Resources |
|----------------------------------|-------------------------------|----------------------------------|-----------------------------|----------------------------------------------|
| Democracy                        | 0.530**<br>(0.241)            | -0.002<br>(0.172)                | 0.098<br>(0.236)            | 0.366*<br>(0.211)                            |
| Resource wealth                  | 0.017*<br>(0.008)             |                                  |                             |                                              |
| Resource wealth *<br>Democracy   | -0.025***<br>(0.009)          |                                  |                             |                                              |
| Point Source Resources           |                               | 0.016**<br>(0.008)               |                             | 0.023**<br>(0.010)                           |
| Point source res. *<br>Democracy |                               | -0.018<br>(0.013)                |                             | -0.029**<br>(0.013)                          |
| Diffuse Resources                |                               |                                  | 0.004<br>(0.011)            | 0.015<br>(0.010)                             |
| Diffuse res. * Democracy         |                               |                                  | -0.012<br>(0.020)           | -0.023<br>(0.015)                            |
| GDP pc (log)                     | -0.013<br>(0.122)             | -0.072<br>(0.128)                | -0.081<br>(0.125)           | -0.052<br>(0.126)                            |
| Education                        | 0.002<br>(0.002)              | 0.003*<br>(0.002)                | 0.002<br>(0.002)            | 0.003*<br>(0.002)                            |
| Openness                         | -0.000<br>(0.001)             | -0.001<br>(0.001)                | -0.000<br>(0.001)           | -0.000<br>(0.001)                            |
| Population ages 15-64            | 0.332**<br>(0.146)            | 0.165<br>(0.158)                 | 0.297**<br>(0.134)          | 0.249*<br>(0.135)                            |
| Constant                         | -5.614**<br>(2.726)           | -2.065<br>(3.074)                | -4.096*<br>(2.451)          | -3.861<br>(2.536)                            |
| Observations                     | 1,098                         | 1,098                            | 1,098                       | 1,098                                        |
| R-squared                        | 0.195                         | 0.162                            | 0.137                       | 0.197                                        |
| Number of country_id             | 92                            | 92                               | 92                          | 92                                           |
| Year FE                          | YES                           | YES                              | YES                         | YES                                          |
| Country FE                       | YES                           | YES                              | YES                         | YES                                          |

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

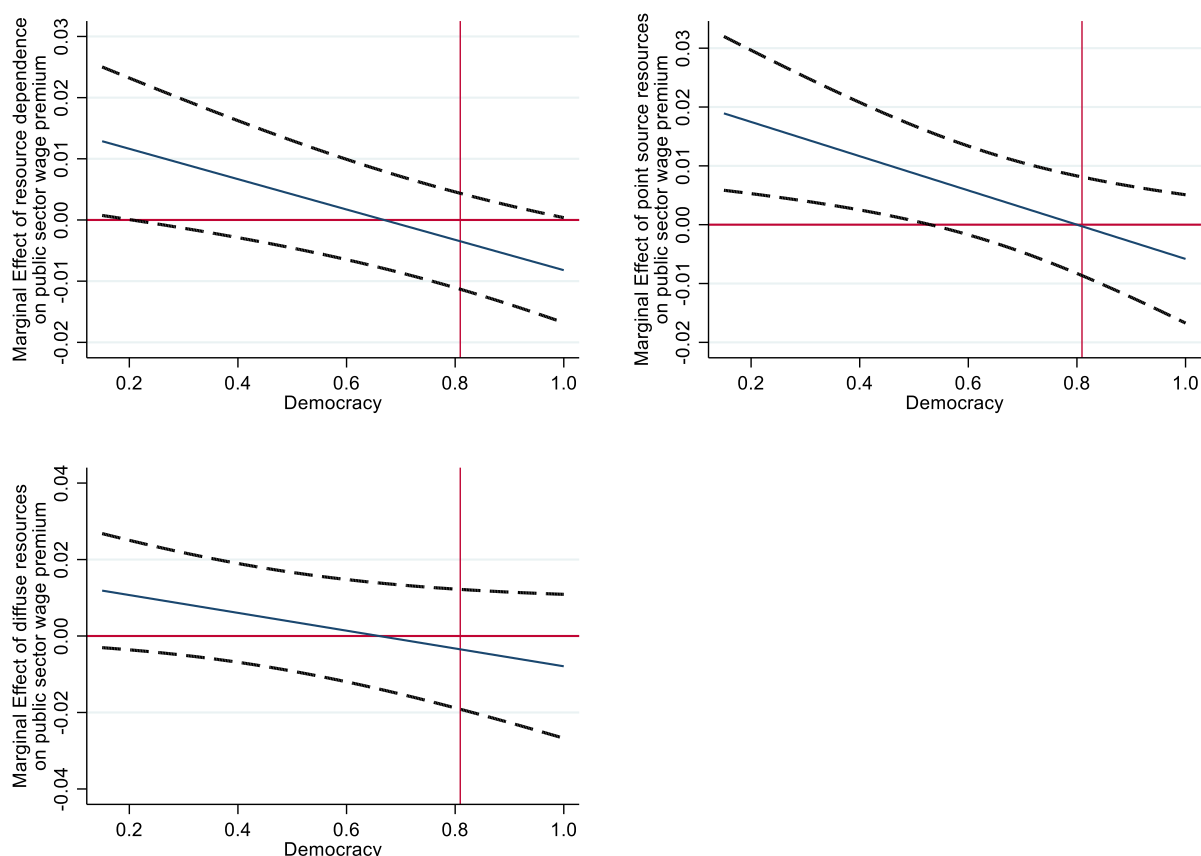


Fig. 4 Marginal effects of natural resources on public sector wage premium.

Table 5 disaggregates resource wealth into its individual components. Once again, the results reveal substantial heterogeneity. Forest wealth is positively associated with the public-sector wage premium. Figure 5 shows that the forest-related wage premium declines and becomes insignificant as democratic institutions become stronger. Oil wealth presents a similar pattern, with a positive public-sector wage premium that declines as democracy increases. Gas wealth displays the opposite pattern. Its coefficient is negative, while the interaction with democracy is positive and statistically significant. Hence, the association between gas wealth and the public-sector wage premium increases with democracy and becomes positive and statistically significant when the democracy index reaches approximately 0.6. Coal wealth is associated with a significant negative public-sector wage differential, although the negative gap relative to the private sector decreases as democracy increases. Finally, the marginal effects of mineral and agricultural wealth are not statistically significant.

Taken together, the results indicate that the relationship between natural-resource wealth and the public-sector labour market cannot be adequately analysed using aggregate measures alone. Different resources are associated with different combinations of public employment and relative public-sector remuneration, and democracy conditions some of these relationships more strongly than

others. In particular, the moderating role of democracy is especially evident for oil and gas wealth in the case of public employment and for oil and forest wealth in the case of the public-sector wage premium. These results are largely confirmed using the instrumental variable approach presented by Bhattacharyya and Hodler (2010).<sup>8</sup>

Table 5 - Public sector wage premium (compared to all private employees): different resources

| VARIABLES                       | (1)<br>Agricultural<br>wealth | (2)<br>Forest<br>wealth | (3)<br>Mineral<br>wealth | (4)<br>Coal<br>wealth | (5)<br>Oil<br>wealth | (6)<br>Gas<br>wealth | (7)<br>All<br>Resources |
|---------------------------------|-------------------------------|-------------------------|--------------------------|-----------------------|----------------------|----------------------|-------------------------|
| Democracy                       | -0.118<br>(0.280)             | 0.180*<br>(0.101)       | -0.063<br>(0.164)        | -0.126<br>(0.147)     | -0.047<br>(0.174)    | -0.093<br>(0.151)    | -0.009<br>(0.198)       |
| Agricultural wealth             | -0.008<br>(0.017)             |                         |                          |                       |                      |                      | -0.015<br>(0.012)       |
| Agricultural wealth * Democracy | 0.005<br>(0.024)              |                         |                          |                       |                      |                      | 0.017<br>(0.016)        |
| Forest wealth                   |                               | 0.043***<br>(0.014)     |                          |                       |                      |                      | 0.071***<br>(0.016)     |
| Forest wealth * Democracy       |                               | -0.114***<br>(0.024)    |                          |                       |                      |                      | 0.104***<br>(0.026)     |
| Mineral wealth                  |                               |                         | 0.026**<br>(0.012)       |                       |                      |                      | 0.015<br>(0.009)        |
| Mineral wealth * Democracy      |                               |                         | -0.029<br>(0.020)        |                       |                      |                      | -0.014<br>(0.011)       |
| Coal wealth                     |                               |                         |                          | -0.233**<br>(0.095)   |                      |                      | 0.280***<br>(0.079)     |
| Coal wealth * Democracy         |                               |                         |                          | 0.203**<br>(0.092)    |                      |                      | 0.249***<br>(0.079)     |
| Oil wealth                      |                               |                         |                          |                       | 0.011<br>(0.010)     |                      | 0.020**<br>(0.009)      |
| Oil wealth * Democracy          |                               |                         |                          |                       | -0.005<br>(0.022)    |                      | -0.025<br>(0.016)       |
| Gas wealth                      |                               |                         |                          |                       |                      | -0.077**<br>(0.031)  | -0.065**<br>(0.031)     |
| Gas wealth * Democracy          |                               |                         |                          |                       |                      | 0.146***<br>(0.043)  | 0.140***<br>(0.042)     |
| Observations                    | 1,098                         | 1,098                   | 1,098                    | 1,098                 | 1,098                | 1,098                | 1,098                   |
| R-squared                       | 0.130                         | 0.234                   | 0.158                    | 0.202                 | 0.144                | 0.147                | 0.394                   |
| Number of countries             | 92                            | 92                      | 92                       | 92                    | 92                   | 92                   | 92                      |
| Year FE                         | YES                           | YES                     | YES                      | YES                   | YES                  | YES                  | YES                     |
| Country FE                      | YES                           | YES                     | YES                      | YES                   | YES                  | YES                  | YES                     |

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

<sup>8</sup> We use the twice lagged democracy measure  $dem_{i,t-10}$  and the interaction terms  $RR_{i,t-1} * dem_{i,t-10}$  as instruments. Results are available upon request.

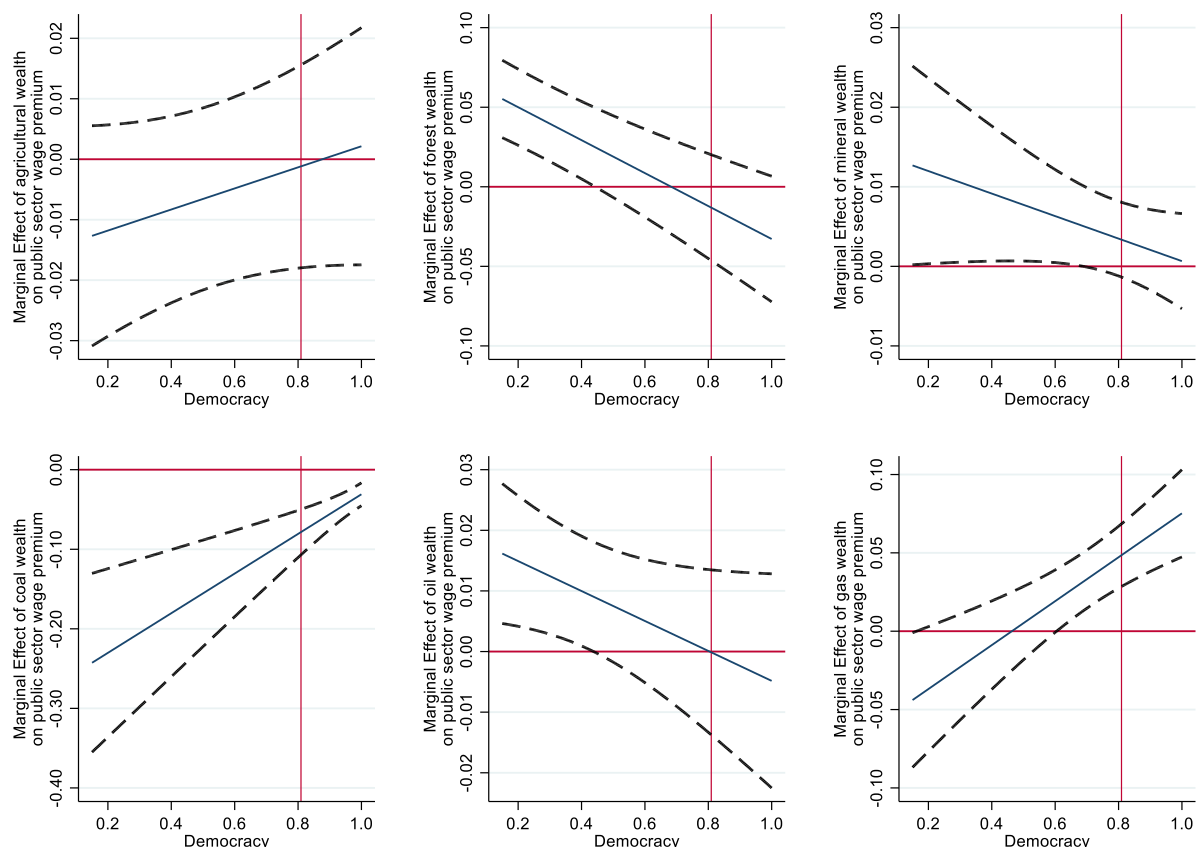


Fig. 5 Marginal effects of natural resources on public sector wage premium: different resources

## 5. Conclusions

This paper assesses whether the public sector is different in terms of size in resource-rich countries with respect to resource-poor countries. According to the patronage hypothesis, resource-rich economies use public employment as a tool to increase political support. This may also happen in non-democratic countries as a means to give benefits to the population to avoid turmoil in exchange for the lack of democracy.

Using panel data for the period 2000–2018, we focus on two dimensions: the share of public-sector employment and the public-sector wage premium relative to private-sector workers. Our analysis complements the existing literature on the political economy of natural resources by considering public employment and remuneration as potential channels through which resource wealth may shape the public sector. Our results suggest that aggregate measures of natural-resource wealth conceal substantial heterogeneity across resource types: while aggregate measures of resource rents may not have an impact on public sector characteristics, oil and gas wealth may increase public employment in countries that are not fully democratic, while forest wealth has a positive impact for

all values of democracy. At the same time, the public sector wage premium is positively affected by oil and forest in non-democratic countries and by gas when the level of democracy is very high. Overall, these findings suggest that both the type of natural resource and the institutional environment matter for understanding how resource wealth is associated with public-sector labour market outcomes.

Our results shed light on an important aspect of the public sector in developing countries. Further research may deal with the endogeneity problem, by exploiting exogenous variation generated by natural-resource discoveries or international commodity-price shocks.

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