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The curse reversed: resource dependence and recessions in the United States

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Abstract

The relationship between natural resources and economic development is one of the most perplexing questions in economics, with many seemingly contradictory results. In this paper, I offer a new explanation for why resources appear to be beneficial in some circumstances but detrimental in others by showing that the so-called ‘resource curse' is not constant across time and is in fact linked with the business cycle in the United States. I show that while resources are generally associated with slower growth, this relationship flips during recessionary periods. Additionally, while the overall negative relationship between resources and growth can be explained by commodity prices and `resource drag', the positive relationship which appears during periods with many quarters of negative growth is robust and even spills over onto non-resource sectors.

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1. Introduction

The relationship between natural resource deposits and economic development is one of the most perplexing questions in all of economics, with many seemingly contradictory results. A quarter century after Sachs and Warner's seminal series of papers establishing the 'curse of natural resources' (Sachs and Warner (1995), Sachs and Warner (1999), Sachs and Warner (2001)), there is still much debate over whether having abundant resources is helpful or harmful for growth. For example, Allcott and Keniston (2018) show that areas exogenously endowed with more oil had higher wages in the long run, while Jacobsen, Parker, and Winikoff (2021) show the long-run effects of the 1970's oil booms on life-time earnings is negative and Bahar and Santos (2018) use data on the discovery of oil and gas fields to show that countries with a larger share of natural resources in their exports suffer from a lack of diversification in their non-resource exports. Betz et al. (2015) find no evidence of a resource curse within the coal mining industry, while Glaeser, Kerr, and Kerr (2015) find that being located close to historical coal mines is associated with decreased levels of entrepeneurship. Aragón and Rud (2013) find that demand for minerals from a local mine in Peru spilled over into other unskilled sectors, while Hornbeck and Keskin (2015) find no evidence of spillovers from agricultural booms due to a windfall in groundwater access.

Certainly we should expect different types of resources to impact different economies in different ways, but the dichotomy of results remains curious. Smith (2015), Lashitew and Werker (2020) and Brunnschweiler and Bulte (2008) all argue that the distinction between resource abundance and resource dependence is behind this oddity. They claim that resource abundance is good for development, but resource dependence, where a large portion of a region's GDP or total exports is devoted to the resource sector, is associated with lower long-run growth and that measures of resource dependence are endogenous to institutional quality. Alternatively, James (2019) argues that even resource abundance could be considered endogenous, and demonstrates that the correlation between institutional quality and GDP fully explains the negative relationship between resource-dependence and institutions. Other papers, including Papyrakis and Gerlagh (2007) and James and Aadland (2011) sidestep the issue of endogenous institutional quality by examining the curse across U.S. states and counties, where institutions are relatively homogeneous, both finding evidence of a resource curse.

While studies have examined the curse across resource sectors and various levels of geographic aggregation, relatively few have looked at how the curse evolves over time. Exceptions include James and Aadland (2011), who look at iteratively longer periods in the U.S. and find the curse appears to show up in each, and James

(2015), which finds that resource-dependence is associated with positive levels of growth across countries during periods of rising resource prices. In this paper, I offer a new explanation for why resources appear to be beneficial in some circumstances but detrimental in others by showing that the so-called 'resource curse' evolves with the business cycle in the United States. I find that resource dependence is associated with higher growth during recessionary periods, with this result being most pronounced in the oil and agricultural sectors, but also appearing in the mining and forestry sectors. Finally, I use a panel with many periods and an interaction term that allows the relationship between resources and growth to depend flexibly on the state of the overall U.S. economy. This model demonstrates that while the overall negative relationship between resources and growth can be explained by commodity prices and 'resource drag', the positive relationship which appears during periods with many quarters of negative growth is robust and even spills over onto non-resource sectors.

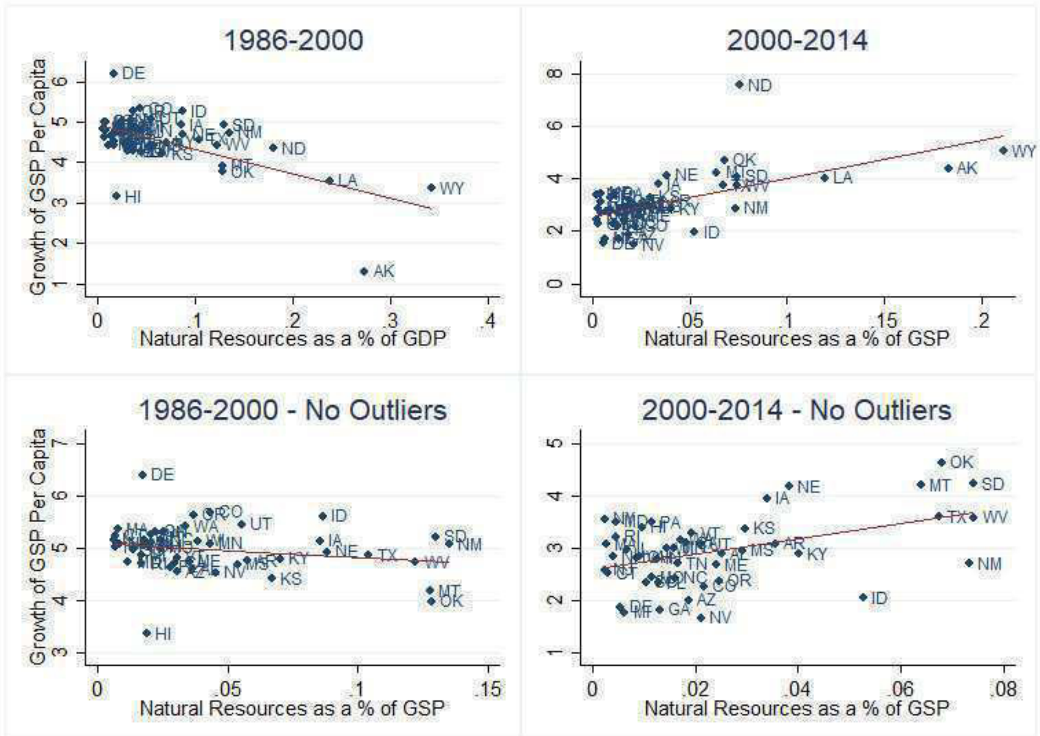
2. The Curse Reversed

The top left portion of Figure 1 displays a replication of Figure 2 from Papyrakis and Gerlagh (2007), plotting the negative relationship between the percentage share of natural resources in state GSP (Gross State Product) in 1986 and the growth for that state over the period from 1986-2000 using data from the Bureau of Economic Analysis (BEA). This data contains yearly estimates of GSP by sector, making it possible to calculate the share of each sector in overall GSP. Next to this graph is a similar version, only looking at the period from 2000-2014. Here, the relationship reverses, as documented in Jaimes and Gerlagh (2020). The bottom half of Figure 1 drops the outliers of Alaska, Wyoming, Louisiana and North Dakota, showing that now the earlier sample is no longer statistically significant (p-value = .172), but the later sample with the positive result remains significant at .01, with a clear upward trend throughout the distribution.

In the appendix, I demonstrate that this reversal appears at various levels of geographic aggregation and that the positive relationship in this later period is in fact far more robust than the earlier negative finding[1]. Jaimes and Gerlagh (2020) cite the shale revolution and high commodity prices as the cause of the positive relationship in this period, but it is worth noting that while the earlier sample was one of prolonged economic growth, the latter included the Great Recession

[1] I use the Manual Row Deletion Analysis (MRDA) method from Kaffine and Davis (2017) to demonstrate that while the result from the earlier period is sensitive to influential observations, the later reversal is not. I also show that the later result is robust to the inclusion of a host of socioeconomic, demographic, political and housing controls.

Figure 1 — Resource Dependence and Economic Growth - 1986-2000 vs. 2000-2014



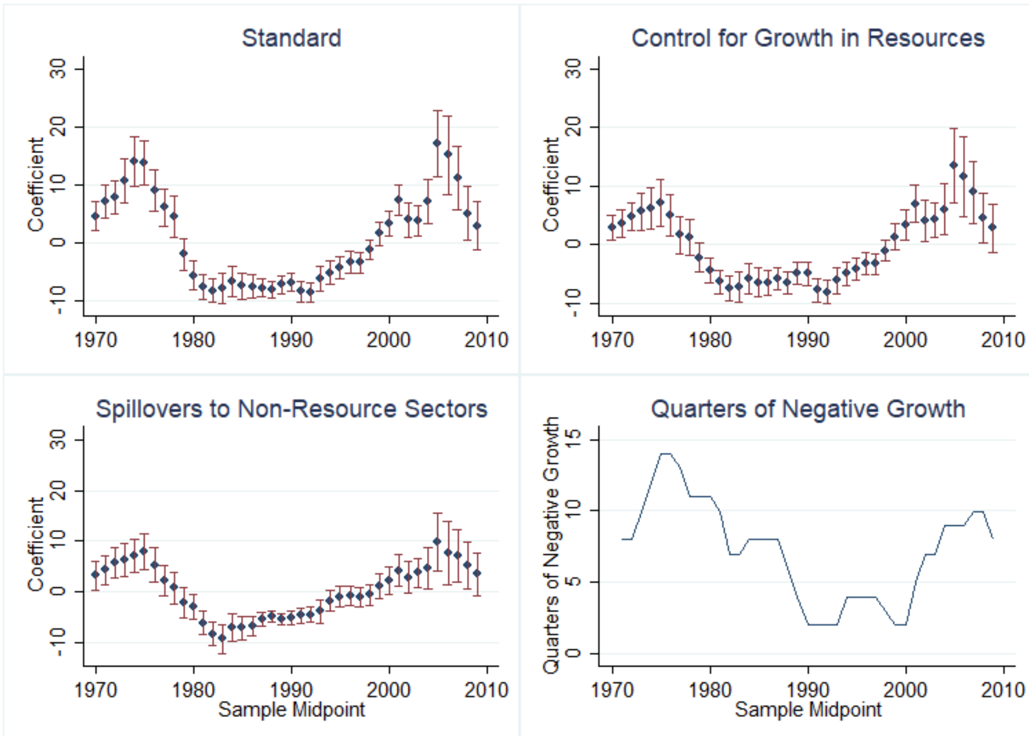
Note: This figure uses data from the Bureau of Economic Analysis to display the relationship between resource dependence and economic growth. In all four graphs, growth in per capita GSP is on the y-axis, with resource dependence, measured as the % share of state GSP devoted to the resource sector at the start of the period on the x-axis. The graphs of the left include the period from 1986-2000 while the graphs on the right are from 2000-2014. The top two graphs include all 50 states while the bottom graphs drop the outliers Wyoming, Alaska, Louisiana and North Dakota

as well as the smaller recession associated with the dot com bubble burst of 2001. This raises the question of whether resources are associated with higher growth in other recessionary periods as well.

To investigate this possibility, Figure 2 displays parameter estimates from different versions of iterative regressions of state GSP growth on resource dependence, with initial state GSP used as a control. Estimates for every 14-year period with starting years from 1963-2002[2] are included. For ease of inference, each parameter estimate appears at the midpoint of the sample over which it was run. For example, the first point, which appears at 1970, shows the estimate for the period from 1963-77, the second point at 1971 shows the estimate for 1964-78, and so on.

[2] In order to alleviate concerns that the choice of 14-year periods is important, Appendix Figure 7 demonstrates that the trends are similar when using 10, 15, and 20 year periods.

Figure 2 — Parameter Estimates and Quarters of Negative U.S. Growth



Note: The left side of this figure plots parameter estimates of specifications where growth in state GSP in regressed on resource dependence in iterative 14-year periods, with initial state income per capita used as a control. Each estimate is plotted at the midpoint of the sample over which it is run, meaning that the estimate on 1970 is the parameter estimate for the 1963-1977 period, and so on. The positive estimates in the earlier and later years imply that resource dependence was associated with higher levels of economic growth in these periods. The right side of this figure displays counts of the number of quarters of negative growth the overall U.S. economy experienced for the same 14-year periods.

The top left graph displays estimates for a simple model which predicts growth as a function of resource-dependence. The relationship evolves cyclically, with peaks in the 70s and 2000s when the U.S. economy was performing poorly and a trough that lasts roughly from 1980 to the late 90s, a period where the overall economy was growing rapidly. For reference, the bottom right graph displays the number of quarters of negative growth for the overall U.S. economy in each corresponding period.

The top right graph tests for a concern raised in James and James (2011) and Davis (2011), that a slow-growing resource sector explains this phenomena, by also including the growth rate of the resource sector as a control. Similar to the findings of Davis (2011), the magnitude of many of the coefficients is reduced by including this control, though the overall cyclical pattern remains the same. The bottom left graph replaces overall GSP growth on the left-hand side with growth in non-resource sectors, in order to test for whether the effects of resource-dependence spilled over onto other sectors, as in James (2015). Once again, the coefficients are smaller in magnitude than in the top left, but still display cyclicality that coincides with the state of the overall US economy.

Figure 3 recreates the top left portion of Figure 2 separately for each type of resource in the BEA data. One concern is that the evolution of the coefficient estimates follows a similar pattern as oil prices with peaks in the 70s and early 2000s so it could be that these reversals are driven entirely by oil-producing states benefitting from high prices, but there appears to be a degree of this counter-cyclicality among each of the resource sectors. A related concern is that perhaps oil prices are in fact fully driving the effect and that the other resource sectors are highly correlated with oil production. Appendix Figure 8 addresses this by re-estimating each specification while including the share of state GSP devoted to oil production as a control. The same trends still emerge, however, with larger coefficients early followed by a dip which runs into the eighties before coefficients rise in the 2000s. In the next section, I test the hypothesis that the relationship between resources and growth in the United States depends on the strength of the economy empirically.

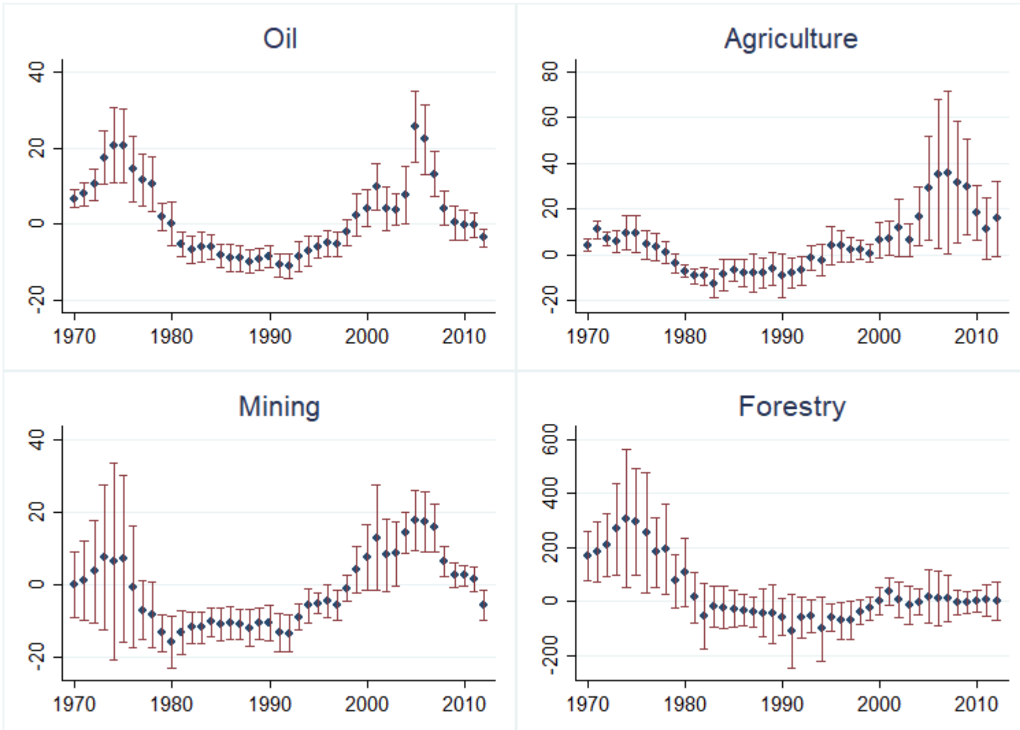
3. Empirical Model

I now combine the data from each of the 40 separate periods above into one complete panel and run specifications of the following general form:

$$G_{ip} = \beta_0 + \beta_1 ln(Y_{ip}^0) + \beta_2 R_{ip} + \beta_3 R_{ip} * Q_p + \beta_4 Z_{ip} + \delta_p + \gamma_i + \epsilon_i \qquad (1)$$

where now G_{ip} is the growth rate for state i in period p, and the model includes every 14-year period from 1963-2016. So $p = 1$ corresponds to 1963-1977, $p = 2$ is 1964-1968, and $p = 40$ is 2002-2016, with δ_p and γ_i included as period and state fixed effects, respectively. Y_{ip}^0 represents the inital GSP per capita for state i in period p and R_{ip} is the resource dependence of state i at the beginning of period p. Q_p measures the number quarters of negative growth during period p for the U.S. economy. The interaction term $R_{ip} * Q_p$, therefore estimates whether resource dependent states perform better than others when the U.S. economy overall is struggling. Z_{ip} include average and ending commodity prices for oil, agricultural products and lumber, as well as a control for the growth rate of the resource sector during the period. Results from running this specification across all 40 periods for

Figure 3 — Evolution of Parameter Estimates by Resource Type



Note: This figure plots parameter estimates of specifications where growth in state GSP in regressed on resource dependence for each separate resource sector in iterative 14-year periods, with initial state income per capita used as a control. All four sectors display a shape similar to Figure 2, where estimates are positive early in the sample before becoming negative in the early 80s and 90s before becoming positive again in the 2000s.

which data is available are reported in Table 1.

In column 1 of Table 1, the coefficient on the natural resources variable is negative and significant, which is unsurprising as the majority of parameter estimates in Figure 2 were negative and significant. In column 2, the resource-economy interaction is included and now the resource coefficient is more negative and significant, suggesting that it was biased toward zero when no control was included for the strength of the overall economy. Additionally, the interaction term is positive and significant at .001, indicating that while resource dependence is generally associated with lower levels of growth, this impact is lessened in periods where there are many quarters of negative growth for the country as a whole. In column 3, I include controls for the average and ending commodity prices for oil, agricultural products and lumber. The resource variables is still negative and economically meaningful, but has lost significance. The resource-economy interaction, however, is still positive and significant at 1%.

Column 4 includes a control for the growth rate in the resource sector, to test whether 'resource drag' is driving the previous results. the resources variable is now close to zero and insignificant, while the resource-economy interaction term remains positive and significant at 1%. Taken together, columns 3 and 4 suggest that while the overall negative relationship between resources and growth can largely be explained by commodity prices and growth in the resource sector, the positive effect of resources during periods with many quarters of negative growth remains. Column 5 replaces total state GSP growth on the left-hand side with growth in non-resource sectors only to look for spillovers from the resource sector onto other industries. In this specification, the level of resource-dependence does not appear to have any impact, but the resource-economy interaction again remains positive and significant. During periods with many quarters of negative growth, states with robust resource sectors appear to outperform others.

4. Conclusion

In this paper, I offer a new explanation for why resources appear to be beneficial in some circumstances but detrimental in others by showing that the so-called 'resource curse' is not constant over time and is in fact linked with the business cycle in the United States. During periods with many quarters of negative growth, the resource curse weakens and can even reverse. I find all four natural resource sectors (agriculture, forestry and fishing, mining, and oil and gas production) appear to contribute to this phenomenon. While the negative relationship between resources and growth can be explained by commodity prices and 'resource drag', the positive relationship which appears during periods with many quarters of negative growth is robust and even spills over onto non-resource sectors. One plausible explanation for this phenomenon is that many items produced in the resource sector are everyday items like food and gasoline, which people still need during hard economic times, granting regions which produce these items some level of protection from the brunt of recessions[3].

[3]For example, Appendix Figure 9 displays per capital consumption spending data from the Bureau of Economic Analysis on various types of goods. While spending on household furnishing, recreational goods and motor vehicles all notably decline during the Great Recession, spending on food and beverages appears unaffected.

Table 1 — Resource-Economy Interaction Model - 1963-2016

	(1) G	(2) G	(3) G	(4) G	(5) GNR
Initial Income	-6.445***	-6.201***	-5.783***	-5.585***	-5.241***
	(0.340)	(0.377)	(0.510)	(0.514)	(0.663)
Natural Resources	-8.243**	-12.66***	-7.750	-1.960	-0.131
	(2.434)	(2.675)	(9.668)	(8.747)	(12.20)
Resource-Economy Interaction		0.779***	0.524**	0.389**	0.744**
		(0.138)	(0.155)	(0.134)	(0.213)
Growth in Resource-Sector				0.0690***	0.0664**
				(0.0196)	(0.0207)
Resource-Commodity Controls	No	No	Yes	Yes	Yes
Observations	2000	2000	2000	2000	2000

Note: This table displays parameters estimates of the effect of resource dependence on economic growth using data from the Bureau of Economic Analysis using a panel of 14-year periods from 1963-2016. Column 1 regresses growth on initial income per capita and resource dependence. Column 2 adds an interaction term which multiplies the resource dependence of a state by the number of quarters of negative growth for the U.S. economy. Column three adds controls for average and ending prices in oil, agricultural products and lumber, using indices from the Federal Reserve Economic Data (FRED). Column 4 adds the growth rate in the resource sector as an additional control. Column 5 replaces state GSP growth on the left hand side with growth in non-resource sectors. State and period fixed-effects are used in each specification, standard errors clustered at the state level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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