

ADDRESSING GREEN ENERGY'S “RESOURCE CURSE”

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Policy changes that encourage non-fossil fuel energy mean increased reliance on batteries and other technologies that must develop rapidly. This article focuses on batteries, noting that key inputs come from corrupt countries, so little of the benefits of exports flow to citizens, and many key finished mineral products come from China. The United States thereby becomes more reliant on autocratic regimes. Using cobalt as an example, this article looks at the nature of its production, the inability of the United States to shoulder its share of the environmental burden of mineral extraction and refining, and looks to previous examples of countries “cursed” with valuable resources desired by wealthy countries. It also hints as to how the “resource curse” problem may be addressed based on the mineral extraction history of the United States.

Governments around the world are setting ambitious targets for electrifying transportation, residences, and commercial buildings¹ by sources that emit less carbon. The United Kingdom seeks to end the sale of new internal combustion passenger cars by 2030,² California and

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1. The UK government is pressing for “heat decarbonization” of buildings using heat pumps and other heat sources. Gov.UK, *Heat in Buildings: What We Are Doing Next*, <https://www.gov.uk/government/groups/heat-in-buildings#what-we-are-doing-next>.

2. Roger Harrabin, *Ban on New Petrol and Diesel Cars in UK from 2030 Under PM's Green Plan*, BBC (Nov. 18, 2020), <https://www.bbc.com/news/science-environment-54981425>.

Canada plan the same by 2035,³ and France by 2040.⁴ The United Kingdom will ban new natural gas heating units for homes starting in 2035 and subsidize the installation of heat pumps in their place.⁵ The sales of electric vehicles (EVs) and the expansion of solar and wind power have achieved impressive levels in percentage terms.⁶ However, their levels of penetration into the transportation and home/business energy markets are not yet at levels which create confidence that those targets will be achieved in a timely fashion.⁷ Moreover, the reliance of many green energy technologies on minerals mined in autocratic and corrupt jurisdictions creates disturbing issues about where the costs of environmental policies will be most felt.

While there are many technical and fiscal challenges to the planned expansion of green energy into transportation and residential and commercial building operation, one of the largest obstacles arises from the reliance of EV and green energy technology on cobalt and other relatively scarce minerals. Cobalt plays a critical role in the design of battery storage, a key component in EV technology and in addressing green energy's reliance on intermittent power sources such as solar and wind.⁸ The essence of the problem is that a critical

3. California Air Resources Board, California Moves to Accelerate to 100% New Zero-Emission Vehicle Sales by 2035 (Aug. 25, 2022), <https://ww2.arb.ca.gov/news/california-moves-accelerate-100-new-zero-emission-vehicle-sales-2035>; David Booth, *Canada Moves to End Sale of New Gas-Powered Cars by 2035*, FIN. POST (June 9, 2021), <https://financialpost.com/commodities/energy/canada-moves-to-ban-internal-combustion-engines-by-2035>.

4. Amy Held, *France Plans to Ban Sale of Diesel and Gas Vehicles by 2040*, NPR (July 6, 2017, 6:25 PM), <https://www.npr.org/sections/thetwo-way/2017/07/06/535799765/france-plans-to-ban-sale-of-diesel-and-gas-vehicles-by-2040>.

5. *£5,000 Grants Unveiled to Support Home Heat Pump Installation*, THE GUARDIAN (Oct. 18, 2021, 5:00 PM), <https://www.theguardian.com/environment/2021/oct/18/5000-grants-unveiled-to-support-home-heat-pump-installation>. Similarly, California is limiting the use of natural gas in appliances and heating systems in homes and buildings. *New California Rules Move State Away from Natural Gas in New Buildings*, REUTERS (Aug. 11, 2021, 7:28 PM), <https://www.reuters.com/legal/litigation/new-california-rules-move-state-away-natural-gas-new-buildings-2021-08-11/>.

6. Pippa Stevens, *The U.S. Solar Industry Posted Record Growth in 2020 Despite COVID, Report Finds*, CNBC (Mar. 16, 2021, 12:01 AM), <https://www.cnbc.com/2021/03/16/the-us-solar-industry-posted-record-growth-in-2020-despite-covid-19-new-report-finds.html>.

7. There are also doubts about whether EVs can live up to the claims of their benefits, but we do not address those issues here. For example, in the United States, the impact of EVs on emission reduction may be less than hoped for as EVs are driven about half as much as gasoline-powered cars. They are not complete substitutes for gas-powered cars. See Fiona Burlig et al., *Low Energy: Estimating Electric Vehicle Electricity Use* 3 (Nat'l Bureau of Econ. Rsch., Working Paper No. 28451, 2021), https://www.nber.org/system/files/working_papers/w28451/w28451.pdf.

8. Davide Castelvecchi, *Electric Cars and Batteries: How Will the World Produce Enough?* NATURE, Aug. 17, 2021, <https://www.nature.com/articles/d41586-021-02222-1>. Many important

component of green technology is primarily sourced from regions with autocratic/kleptocratic governments and, unsurprisingly, places where abuses, such as forced child labor under unsafe conditions, are common.⁹ In this Article, we use cobalt to illustrate the broader issue; however, its problematic role is far from unique.¹⁰

In this Article, we focus on the subset of problems derived from this reliance which fall into what natural resource economists term "the resource curse," the puzzling and persistent negative correlation observed between natural resource wealth and national economic success for many, but not all, natural-resource-rich countries.¹¹ Section

minerals are produced primarily or entirely outside the United States: 100 percent of arsenic, asbestos, cesium, fluor spar, gallium, graphite, indium, manganese, mica, niobium, (some) rare earths, rubidium, scandium, strontium, and tantalum are produced only outside the United States. See *Mineral Commodity Summaries 2021*, U.S. GEOLOGICAL SURV. 7 (2021), <https://pubs.usgs.gov/periodicals/mcs2021/mcs2021.pdf>.

9. Much of the discussion that follows detail these problems. The International Labor Organization (ILO) claims that 152 million children are exploited for labor, mostly in Africa and Asia. See Press Release, Int'l Lab. Org., *2021: International Year for the Elimination of Child Labour* (Jan. 15, 2021), https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_766351/lang-en/index.htm.

10. Other examples of problematic minerals used in green technology include the following. See U.S. GEOLOGICAL SURV., *supra* note 108. Gallium is used in electronic circuits and light-emitting diodes (LEDs) and has defense applications. *Id.* at 62. Graphite is used in electrodes, batteries, and solar panels. *Id.* at 72–73. Indium is a "technology-critical element" used in flat panel displays. *Id.* at 78. Manganese is used as an alloy in stainless steel and batteries. *Id.* at 104–05. Mica is common in construction materials, vehicles, and electronics. *Id.* at 108–09. Niobium is used in superconducting materials such as the magnets in MRI scanners. *Id.* at 114–15. Rare earths are a group of different minerals lumped together used in many processes. *Id.* at 132–33. Rubidium is used in biomedical research, electronics, and specialty glass. *Id.* at 136–37. Scandium is an alloy used in aluminum for weaponry and many other products. *Id.* at 144–45. Strontium, which is primarily from China, is used in drilling fluids. *Id.* at 158–59. Tantalum is used in electronics such as smart phones and gas turbines. *Id.* at 164–65. Another longer list covers minerals, including zinc, silver, platinum, and cobalt, in which more than 75 percent of the volume comes from other countries. *Id.* at various pages. Everything has substitutes, but, as the Geological Survey notes when discussing rare earth minerals, the substitutes "generally are less effective." *Id.* at 133.

11. Professor Richard Auty is credited with first labeling the negative correlation between resource riches and national prosperity as the "resource curse." RICHARD AUTY, *SUSTAINING DEVELOPMENT IN MINERAL ECONOMIES: THE RESOURCE CURSE* THESIS 1 (1993). Auty's analysis was supported by empirical work on oil and minerals led by economists Jeffrey Sachs and Andrew Warner. Controlling for other attributes of an economy, they showed that reliance on oil and minerals is related to low rates of growth. Jeffrey Sachs & Andrew Warner, *Natural Resource Abundance and Economic Growth* 1 (Nat'l Bureau for Econ. Rsch., Working Paper No. 5398, 1995). Later work confirmed that, controlling for other geographical and climate variables, many resource-poor countries enjoyed higher rates of growth than their resource-rich counterparts. Jeffrey Sachs & Andrew Warner, *The Curse of Natural Resources*, 45 EUR. ECON. REV. 827, 827 (2001). See also Xavier Sala-I-Martin & Arvind Subramanian, *Addressing the Natural Resource Curse: An Illustration from Nigeria* (Int'l Monetary Fund, Working Paper WP/03/139, 2003); Benjamin Smith, *Oil Wealth and Regime Survival in the Developing World, 1960–1999*, 48 AM. J.

I describes the challenges posed by the resource curse for green energy policies and utilizes the history of the resource curse as experienced by the development of oil resources in recent decades. Section II draws on examples of institutional solutions to the resource curse based on nineteenth century mineral booms in the United States that suggest possible answers. Section III concludes by examining the challenges the resource curse poses for green energy policies and points toward possible methods for addressing those challenges.

I. ELECTRIFICATION'S RESOURCE CURSE

Changing the production of electricity, which is dominated by fossil fuels, to primary reliance on renewable sources, is a complex and costly process. Globally, as of 2020, the majority of electricity was produced by fossil fuels.¹² The U.S. Energy Information Administration (EIA) projects that electricity generation will rise in the coming decades in developed countries, and will do so even more in developing countries. Between 2020 and 2050, electricity generation may double in the developing world.¹³ The EIA projects a rise in electricity produced by solar and wind (and a gradual decline in coal and natural gas) to meet the ever-rising demand for electricity required by the combination of the shift away from fossil fuels and economic growth in developing countries.¹⁴ In particular, because solar and wind are intermittent power sources, they require batteries to store energy, especially for electric vehicles. The production of batteries must therefore rise significantly.¹⁵ What we address here are the issues that arise from our increasing reliance on batteries.

POL. SCI. 232 (2004); PAUL COLLIER, *THE BOTTOM BILLION* (2007); Macartan Humphreys, *Natural Resources, Conflicts, and Conflict Resolution*, 49 J. CONFLICT RESOL. 508 (2005); and James Fearon & David Laitin, *Ethnicity, Insurgency and Civil War*, 97 AM. POL. SCI. REV. 75 (2003). Resource wealth has also been linked to an increased likelihood of internal domestic violence as factions fight for control of assets.

12. *International Electricity*, U.S. ENERGY INFO. ADMIN., <https://www.eia.gov/international/data/world/electricity/electricity-generation> (last visited Sept. 3, 2022).

13. *International Energy Outlook 2021, Figure 22*, U.S. ENERGY INFO. ADMIN., <https://www.eia.gov/outlooks/ieo/electricity/sub-topic-01.php> (last visited Sept. 3, 2022).

14. *Id.* at Figure 24.

15. Industry consultant AlixPartners estimates that battery production for EVs must triple from 2021 to 2025. See Phil LeBeau, *Tesla Co-Founder Says EV Sales Are about to Take Off, But Questions Whether Production Can Keep Up*, CNBC (Jan. 22, 2022), <https://www.cnbc.com/2022/01/12/tesla-co-founder-says-ev-sales-are-about-to-take-off-but-questions-whether-production-can-keep-up.html>.

A. *Batteries and Cobalt*

Green energy policies are popular in most developed countries,¹⁶ even those with major oil companies.¹⁷ The enthusiasm is easy to understand, as these technologies promise that energy from abundant sunshine and wind (and sometimes tidal forces, geothermal resources, or other sources) will reduce the burning of carbon-emitting fossil fuels. Unsurprisingly, both politicians and activists have embraced it across the western world; political parties expressly labeling themselves as “green” are playing an increasingly significant role in European politics¹⁸ In the 2021 election in Germany, the Green Party won 14.8 percent of the vote and is now playing¹⁹ In Scotland, itself a major oil producer, the Green Party governs in coalition with the Scottish National Party.²⁰ In Austria, that country’s Green Party rules in coalition with a “center-right” party.²¹ The Greens’ rising political influence is yielding the adoption of ambitious targets for increasing electrification, to be met primarily by expansion of wind and solar

16. Almost no one claims not to care about the environment, so many polls are not substantive. The question is the depth of concern. Some of the most sophisticated survey work is done by the Pew Research Center. They show that more than 70 percent of people in advanced economies are concerned about climate change and say they are personally willing to incur costs to help reduce the effects of climate change. See JAMES BELL ET AL., IN RESPONSE TO CLIMATE CHANGE, CITIZENS IN ADVANCED ECONOMIES ARE WILLING TO ALTER HOW THEY LIVE AND WORK (2021).

17. Shell stated a commitment to achieve net-zero emissions in February 2021. See *What Sustainability Means at Shell*, SHELL, <https://www.shell.com/sustainability/our-approach/sustainability-at-shell.html>. (last visited Sept. 3, 2022). BP promises to help lower “economy-wide net zero greenhouse gas (GHG) emission” by 2050. See *bp climate policy positions*, BRITISH PETROLEUM, <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/sustainability/group-reports/bp-climate-policy-positions.pdf> (last visited Sept. 3, 2022). ExxonMobil also promises to reduce greenhouse gas emissions. See *Energy & Carbon Summary*, EXXONMOBIL, <https://corporate.exxonmobil.com/Sustainability/Energy-and-Carbon-Summary> (last visited Sept. 3, 2022). Chevron has initiatives to help produce “a lower carbon future.” See *Designing for a Lower Carbon Future*, CHEVRON, <https://www.chevron.com/stories/designing-for-a-lower-carbon-future> (last visited Sept. 3, 2022).

18. In European countries, Green candidates are common and have gradually risen in the electoral system. In Sweden, until recently, the Green party was part of the ruling coalition. See *Swedish Green Party Quits Ruling Minority Coalition Over Budget Defeat*, CNBC (Nov. 11, 2021, 11:11 AM), <https://www.cnn.com/2021/11/24/swedish-green-party-quits-ruling-minority-coalition-over-budget-defeat.html>.

19. *German Greens Leadership Steel Party for Government*, AP NEWS (Oct. 2, 2021), <https://apnews.com/article/europe-elections-environment-and-nature-environment-germany-ded434c1ae4e5ddb9e7b8bc1c0cf1eb9>.

20. See *Climate Assembly Aims Delivered by Greens*, SCOTTISH GREENS (Dec. 16, 2021), <https://greens.scot/news/climate-assembly-aims-delivered-by-greens> (noting that the Scottish Green party has been active in Scottish governance).

21. Matthew Karnitschnig, *Austria’s Democratic Deficit Disorder*, POLITICO (Jan. 12, 2022), <https://www.politico.eu/article/austrias-freudian-slip/>.

power production.²²

These policies have costs that are less frequently discussed than their goals.²³ For example, expanding renewable electricity generation requires significant expansions of electrical grids that often annoy those whose property or neighboring area must host transmission lines;²⁴ states may oppose transmission lines that take electricity across their territory to other jurisdictions, thereby holding up the process and costing large sums in local fights;²⁵ wind turbines and solar installations can upset neighbors;²⁶ and large scale solar and wind installations may damage habitats for endangered species.²⁷ However, as these problems are not unique to renewable energy projects, existing legal and political processes are adequate to address these issues.

Green energy has a unique problem because of its energy storage requirements. Shifting cars and trucks from gasoline and diesel to

22. The European Commission's goal, adopted in 2021, is to cut greenhouse gas emissions by 55 percent by 2030. European Commission, CLIMATE PLAN, https://climate.ec.europa.eu/eu-action/european-green-deal/2030-climate-target-plan_en. Individual nations also have goals. Germany's goal is to reduce emissions by an average of 6% per year through 2030. However, in 2021, emissions rose 4.5%. See Angela Cullen, *Germany's Carbon Emission Rise in Setback for Climate Goals*, BLOOMBERG, Mar. 15, 2022, <https://www.bloomberg.com/news/articles/2022-03-15/germany-s-carbon-emissions-rise-in-setback-for-climate-goals>

23. The ambition of the goals also raises questions about their attainability. Carbon-based fuels are presumed to be on the way out, but demand and prices for coal, oil, and gas have remained high at least as of 2021. Investments in renewables, which must be huge, are modest. See Christopher Matthews et al., *Behind the Energy Crisis: Fossil Fuel Investment Drops, and Renewables Aren't Ready*, WALL ST. J. (Oct. 17, 2021, 3:09 PM), <https://www.wsj.com/articles/energy-crisis-fossil-fuel-investment-renewables-gas-oil-prices-coal-wind-solar-hydro-power-grid-11634497531>.

24. Andrew P. Morriss et al., *Involuntary Co-Tenants: Eminent Domain and Energy and Communications Infrastructure Growth*, 3 LSU J. Energy L. & Res. 29, 45–50 (2014).

25. Transmitting renewable power from Quebec across Maine has been a long, costly battle. See Brooks Hays, *Maine's North Woods Offer Glimpse of Future Fights for Green Energy*, United Press Int'l (Oct. 22, 2021, 3:01 AM), https://www.upi.com/Science_News/2021/10/22/maine-cmp-corridor-energy-climate/8381634736567/; Ethan Howland, *Avangrid, NextEra Duke It Out Over a 145-mile Transmission Line in the Maine Woods*, Utility Dive (Oct. 26, 2021), <https://www.utilitydive.com/news/avangrid-nextera-necec-transmission-maine-ballot/608877/>.

26. Kevin Hardy & Donnelle Eller, *6 Common Complaints Against Iowa Wind Turbines*, Des Moines Reg. (Apr. 21, 2017, 3:43 PM), <https://www.desmoinesregister.com/story/money/business/2017/04/21/6-common-complaints-against-iowa-wind-turbines/100706178/>; Sarah Malin Nir, *He Set Up a Big Solar Farm. His Neighbors Hated It.*, N.Y. Times (Mar. 18, 2021), <https://www.nytimes.com/2020/03/18/nyregion/solar-energy-farms-ny.html>.

27. See, e.g., Anogha Srikanth, *Largest Solar Farm in the US Would Threaten This Endangered Species*, The Hill (Jan. 9, 2020), <https://thehill.com/changing-america/sustainability/environment/477567-building-the-largest-solar-farm-in-the-us-would> (discussing the harm that a solar project may cause to the endangered Mojave desert tortoise).

electricity, homes from natural gas and other non-renewables to electricity, and electricity generation from burning fossil fuels to intermittent sources such as solar and wind all require local energy storage to smooth the intermittent availability and to enable dispersed (and mobile) locations to have electricity available when needed. This requires physical capital (in particular, batteries) manufactured using inputs currently mined in environmentally damaging ways in locations lacking basic governance institutions and with methods that involve significant human rights violations. The impacts of this resource mining on the source jurisdictions often prevents those jurisdictions from expending the resources necessary to develop institutions to secure human rights and ensure stable governance. also often impede their development of institutions that both human rights and protect rights. This is green energy's 'resource curse.' As discussed in the next section, oil production has, for decades, been categorized as inflicting producing nations with a 'curse' arising from the valued asset.

This is not a trivial problem. Electrification of transportation and home energy use will both significantly increase demand for electricity and shift a massive amount of that larger demand to intermittent sources. For example, EV battery production, which requires cobalt²⁸ and other minerals, must grow with EV sales.²⁹ The demand for battery

28. Reliance on cobalt and other scarce minerals is well known to be a problem, so research is ongoing for alternatives, but alternative compositions of effective batteries pose serious technical challenges. See Youngjin Kim, Won Mo Seong and Arumugam Manthiram, *Cobalt-Free, High-Nickel Layered Cathodes for Lithium-Ion Batteries: Progress, Challenges and Perspectives*, 34 ENERGY STORAGE MATERIALS 250, 250–59 (2021).

29. For example, one Biden administration policy is "to accelerate and deploy electric vehicles and charging stations" by grants and administrative rules. See Press Release, The White House, Biden Administration Advances Electric Vehicle Charging Infrastructure (Apr. 22, 2021), <https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-biden-administration-advances-electric-vehicle-charging-infrastructure/>. There is now greater charging convenience, increasing selection among EV models, and financial benefits to purchasing one, as most vehicles qualify for a \$7,500 federal tax credit. See *Federal Tax Credits for New All-Electric and Plug-in Hybrid Vehicles*, U.S. DEPT OF ENERGY, <https://www.fueleconomy.gov/feg/taxevb.shtml> (last visited Sept. 4, 2022). For a person in the 37 percent marginal tax bracket, \$7,500 is the equivalent to federal income taxes paid on about \$20,000 income — and improved performance. Lucid Motors stock was well received when the company went public in 2021. See Matt Grossman, *Lucid Motors Shares Rise 11% in First Trading Day After SPAC Merger*, WALL ST. J. (July 26, 2021, 4:45 PM), <https://www.wsj.com/articles/lucid-motors-shares-climb-in-first-trading-day-after-spac-merger-11627320990>. One reason Lucid may be well received is due to longer range than Tesla vehicles. See Aaron Spray, *Here's Why Lucid Air Could Be The Best EV*, HOTCARS.COM (Apr. 24, 2021), <https://www.hotcars.com/why-lucid-air-could-be-best-ev-why-tesla-model-s-is-better/>. EV sales are expected to increase. Growth in China and worldwide will continue. The government of China requires that 40 percent of car sales will be EVs by 2030. Nancy Stauffer, *China's Transition to Electric Vehicles*, MIT ENERGY INITIATIVE (Nov. 25, 2020), <https://energy.mit.edu/news/chinas-transition-to-electric-vehicles/>.

capacity may grow tenfold in a decade, mostly for transportation purposes.³⁰ Unless a new technology for battery storage in EVs is developed that does not depend on cobalt (or other similarly problematic mineral inputs), meeting even a portion of the official targets for EVs will require a considerable expansion of cobalt mining. Thus, despite efforts to reduce the amount of cobalt required for EV batteries, world demand is forecast to rise from 141,000 tonnes in 2020 to 270,000 tonnes in 2030, an almost 100% increase.³¹ Unless new sources are found, that material will come primarily from the Democratic Republic of the Congo (DRC) and the finished product from China. Expanding renewable energy use in homes through local storage will also bring about increased battery use, thus increasing demand for raw and finished cobalt.³² Again, meeting the official

The EU claims it will push for 30 million zero emission vehicles by 2030 (a dubious goal given only 1.8 million existed going into 2020, but a push is on). See Kate Abnett, *EU to Target 30 Million Electric Cars by 2030—Draft*, REUTERS (Dec. 4, 2020), <https://www.reuters.com/article/us-climate-change-eu-transport/eu-to-target-30-million-electric-cars-by-2030-draft-idUSKBN28E2KM>. Even before these new encouragements, electric vehicle (EV) production has increased rapidly, with over 3.24 million sold in 2020. More than 80 percent of global sales were in China and Europe; about 10 percent were in the United States. See Roland Irle, *Global EV Sales for 2021*, EV-VOLUMES.COM, <https://www.ev-volumes.com/news/global-ev-sales-for-2021->

[h1/#:~:text=By%20the%20end%20of%202021,BEVs%20and%201%2F3%20PHEV](https://www.ev-volumes.com/news/global-ev-sales-for-2021-h1/#:~:text=By%20the%20end%20of%202021,BEVs%20and%201%2F3%20PHEV) (last visited Sept. 17, 2022). China and the EU are expected to continue to dominate EV sales, claiming at least 80 percent of the market. China dominates lithium-ion battery production, which is expected to triple between 2020 and 2025. See Alice Yu & Mitzi Sumangli, *Top Electric Vehicle Markets Dominate Lithium-Ion Battery Capacity Growth*, S&P GLOB. MKT. INTEL. (Feb. 16, 2021), <https://www.spglobal.com/marketintelligence/en/news-insights/blog/top-electric-vehicle-markets-dominate-lithium-ion-battery-capacity-growth>. Batteries account for roughly a quarter of the cost of producing EVs. Mike Colias, *Ford Plans to Manufacture Its Own Batteries for Electric Vehicles*, WALL ST. J. (Apr. 27, 2021, 12:47 PM), <https://www.wsj.com/articles/ford-plans-to-manufacture-its-own-batteries-for-electric-vehicles-11619542051>.

30. Martin Placek, *Projected Global Battery Demand from 2020 to 2030 by Application*, STATISTA (July 23, 2021), <https://www.statista.com/statistics/1103218/global-battery-demand-forecast/>.

31. Pratima Desai & Mai Nguyen, *Shortages Flagged for EV Materials Lithium and Cobalt*, REUTERS (July 1, 2021), <https://www.reuters.com/business/energy/shortages-flagged-ev-materials-lithium-cobalt-2021-07-01/>.

32. Batteries for commercial buildings and residences must become more common so intermittent power from wind and solar sources can be stored. Tesla sells the Powerwall battery for home installation to store energy, including from home solar panels. Tesla has been selling about 100,000 units a year as of 2021. Aria Alamalhoda, *Tesla Has Installed 200,000 Powerwalls Around the World so Far*, TECHCRUNCH.COM (May 26, 2021, 5:01 PM), <https://techcrunch.com/2021/05/26/tesla-has-installed-200000-powerwalls-around-the-world-so-far/>. Other vendors are entering the market. See, e.g., Chris Davies, *Kohler Power Reserve Takes on Tesla Powerwall with Modular Home Battery*, SLASHGEAR (Jan. 3, 2022, 7:00 AM), <https://www.slashgear.com/kohler-power-reserve-takes-on-tesla-powerwall-with-modular-home-battery-03704945/>.

targets already in place will require expanding production; in many ways we are starting near zero compared to what is needed³³ and investment in domestic cobalt production faces great difficulties.³⁴ While there are substitutes for cobalt such as manganese, China currently controls about 90 percent of manganese production, so that substitution would not eliminate the problem of being dependent on foreign imports from countries without good governance.³⁵

In response to increased demand from green energy expansion as well as other modern technologies (cell phones and computers are other technologies relying on cobalt), refined output has risen steadily in the past decade, especially in the DRC.³⁶ Increased demand has raised world cobalt prices, spurring more mining, again, largely in the DRC.³⁷ Estimates vary, but as much as 80 percent of cobalt comes from the DRC.³⁸ The problem is not limited to the DRC, however. Even some of the minor cobalt producers lack good governance, including Russia, the Philippines, and Cuba.³⁹

The major producer of cobalt is the DRC, which is deeply corrupt. Transparency International ranks the DRC as similar to North Korea as one of the most corrupt countries in the world.⁴⁰ As an example, a

33. Despite having been around for years, rooftop solar panels have only a one percent installation rate in Florida, a location well-suited for solar panels. *Net Metering Issue a Hot Solar Topic in California Now Spreads to Florida*, DIGIT. J. (Jan. 13, 2022), <https://www.digitaljournal.com/pr/net-metering-issue-a-hot-solar-topic-in-california-now-spreads-to-florida-where-rooftop-solar-only-measures-1-penetration-among-homeowner-rate-payers-solar-integrated-roofing-corp-otc-pink-sirc>.

34. Financial support for mining activities in the United States is difficult, presumably because lenders know regulations may keep operations from being launched. See Vipal Monga & Jacquie McNish, *Battery Metals Are Hot, but These Miners Can't Get Investors*, WALL ST. J. (Apr. 23, 2021, 7:00 AM), <https://www.wsj.com/articles/battery-metals-are-hot-but-these-miners-cant-get-investors-11619175601>. Further discussion of the mine can be seen at the company website: <https://www.firstcobalt.com/projects/iron-creek/>.

35. Chuin-Wei Yap, *China Hones Control Over Manganese, a Rising Star in Battery Metals*, WALL ST. J. (May 21, 2021, 8:30 AM), <https://www.wsj.com/articles/china-hones-control-over-manganese-a-rising-star-in-battery-metals-11621597490>.

36. Melissa Garside, *Major Countries in Worldwide Cobalt Mine Production from 2010 to 2020*, STATISTA (Mar. 24, 2022), <https://www.statista.com/statistics/264928/cobalt-mine-production-by-country/>.

37. Like other minerals, the price of cobalt jumps around. In 2021 it was about double what it averaged in the 2012–2017 period. See *Cobalt*, TRADING ECON., <https://tradingeconomics.com/commodity/cobalt> (last visited Nov. 11, 2021).

38. Its lowest cost source is also the place where it is most abundant, the DRC. For an overview, see Gary A. Campbell, *The Cobalt Market Revisited*, 22 MINERAL ECON. 21, 21–28 (2020). The DRC's market share has grown rapidly. Garside, *supra* note 36.

39. *Profiling the World's Eight Largest Cobalt-Producing Countries*, NS ENERGY (Feb. 22, 2021), <https://www.nsenergybusiness.com/features/top-cobalt-producing-countries/>.

40. See 2020 *Corruption Perceptions Index*, TRANSPARENCY INT'L,

friend of the former president of the DRC is accused by the U.K.'s Serious Fraud Office of orchestrating payments of \$360 million in bribes to the president between 2002 and 2011 that resulted in under-market prices for sales of minerals that cost the country more than a billion dollars in lost revenue.⁴¹ Scolding and lecturing the DRC government or imposing economic sanctions—which will be difficult to implement—is unlikely to convince that government to stop cobalt miners from exploiting child labor.⁴² Restricting the use of cobalt from the DRC is literally impossible if governments are to meet existing green energy targets.

The ethical problems that arise from the DRC's cobalt are exacerbated because 15-30 percent of its production comes from so-called “artisanal” mines.⁴³ In mining, “artisanal” generally means a

<https://www.transparency.org/en/cpi/2020/index/cod> (last visited Sept. 7, 2022). There are two Congos: the Democratic Republic of the Congo (DRC) and Congo; both are at the bottom of the corruption chart. The former is the larger of the two and the source of most cobalt. Joseph Kabila was president for 18 years, leaving office in 2019. The current government has accused him of large-scale theft. See Thomas Fessy, *Congo Investigation a Chance to Fight Corruption*, HUMAN RIGHTS WATCH (Dec. 1, 2021, 5:59 PM), <https://www.hrw.org/news/2021/12/02/congo-investigation-chance-fight-corruption>. As the Transparency International ranking of the country has not improved since the departure of Kabila, it is unclear that there has been substantive change.

41. Emily Tian, *UK Fraud Watchdog Digs into Alleged Mine Bribes in DR Congo*, ORGANIZED CRIME AND CORRUPTION REPORTING PROJECT (July 23, 2021), <https://www.occrp.org/en/daily/14897-uk-fraud-watchdog-digs-into-alleged-mine-bribes-in-dr-congo>. On a smaller scale, the ex-Minister of Public Health was accused of stealing \$4.3 million that was to be used to help fight Ebola. See Imelda Cengic, *DR Congo: Ex Minister Accused of Embezzling Ebola Funds*, ORGANIZED CRIME AND CORRUPTION REPORTING PROJECT (Sept. 16, 2019), <https://www.occrp.org/en/daily/10678-dr-congo-ex-minister-accused-of-embezzling-ebola-funds>.

42. The International Labour Organization (ILO) estimates that in 2017 about 20 percent of the children in Africa were in slavery or forced labor. See *Regional Brief for Africa*, ILO, https://www.ilo.org/wcmsp5/groups/public/@ed_norm/@ipecc/documents/publication/wcms_597869.pdf (last visited Sept. 7, 2022). Several years ago, there was great concern about human rights abuses arising from “blood minerals” or “conflict minerals” from Congo. See Alberto Rojas Blanco & Raquel Villacija, *Blood and Minerals: Who Profits from Conflict in DRC?*, AL JAZEERA (Jan. 19, 2016), <https://www.aljazeera.com/features/2016/1/19/blood-and-minerals-who-profits-from-conflict-in-drc>. In response, section 1502 of the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act discouraged electronics makers from sourcing conflict minerals (tin, tantalum, and tungsten) from the DRC. Pub. L. No. 111-203, § 1502, 124 Stat. 1376 (2010). There is evidence the law did not have desirable results as infant mortality in the mineral producing area rose significantly. See Dominic P. Parker & Jeremy D. Foltz, *Unintended Consequences of Sanctions for Human Rights: Conflict Minerals and Infant Mortality*, 59 J. L. & ECON. 731, 733–35 (2016).

43. *Making Mining Safe and Fair: Artisanal Cobalt Extraction in the Democratic Republic of the Congo*, WORLD ECON. FORUM (Sept. 15, 2020), <https://www.weforum.org/whitepapers/making-mining-safe-and-fair-artisanal-cobalt-extraction-in-the-democratic-republic-of-the-congo>. There are “between 150,000 and 200,000 artisanal

small mine worked through hand digging, hauling and sorting—back-breaking labor. Children frequently provide the labor in artisanal mines;⁴⁴ UNICEF estimates 40,000 children are involved.⁴⁵ The U.S. Department of State, with diplomatic understatement, reports that the DRC “does not fully meet the minimum standards for the elimination of trafficking [which includes child labor] and is not making significant efforts to do so.”⁴⁶ Artisanal cobalt mining means that “[c]hildren from 6 years-old spend the entire day in the cobalt mines of Congo bent over, digging with a small shovel or bare hands to gather cobalt-containing heterogenite stones.”⁴⁷ Among other things, exposure to cobalt mining dust means these children may suffer from “exposure-related oxidative DNA damage.”⁴⁸

miners in Lualaba alone.” *Id.* Similarly, a substantial amount of gold comes from artisanal mines and is controlled by organized crime. See Julett Sleinan, *Criminals in Central Africa Profit from New Surge in Gold Prices*, ORGANIZED CRIME AND CORRUPTION PROJECT (July 2, 2021), <https://www.occrp.org/en/daily/14747-report-criminals-in-central-africa-profit-from-new-surge-in-gold-prices>.

44. The income from children’s labor is important in a country where per capita annual income is only about \$600. See *GDP per Capita (Current US \$)-Congo, Dem. Rep.*, THE WORLD BANK, <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=CD> (last visited Sept. 7, 2022). Besides the humanitarian issues involved in child labor, there is evidence it results in lower levels of educational achievement compared to similar areas where there is no mining. Pelle Ahlerup et al., *Gold Mining and Education: A Long-run Resource Curse in Africa?*, 56 J. DEV. STUDIES 1745, 1752 (2020).

45. TRANSPARENCY INT’L, *supra* note 40. That estimate is before the demand for cobalt jumped significantly.

46. *2019 Trafficking in Persons Report: Democratic Republic of the Congo*, U.S. DEPT. OF STATE, [HTTPS://WWW.STATE.GOV/REPORTS/2019-TRAFFICKING-IN-PERSONS-REPORT-2/DEMOCRATIC-REPUBLIC-OF-THE-CONGO/](https://www.state.gov/reports/2019-trafficking-in-persons-report-2/democratic-republic-of-the-congo/) (last visited Nov. 1, 2021). For a report with many photos, see Nima Elbagir et al., *Dirty Energy*, CNN (May 2018), <https://edition.cnn.com/interactive/2018/05/africa/congo-cobalt-dirty-energy-intl/>.

47. James Melville, *Modern Day Cobalt Slavery in Congo*, BYLINE TIMES (June 19, 2020), <https://bylinetimes.com/2020/06/19/from-stone-to-phone-modern-day-cobalt-slavery-in-congo/>. See also Amy Joi O’Donoghue, *Are Children ‘Dying like Dogs’ in Effort to Build Better Batteries?*, DESERET NEWS (May 23, 2021), <https://www.deseret.com/utah/2021/5/23/22441889/our-children-are-dying-like-dogs-congo-slave-labor-cobalt-lawsuit-apple-tesla-human-rights-dell>.

48. Celestin Banza Lubaba Nkulu et al., *Sustainability of Artisanal Mining of Cobalt in DR Congo*, 1 NATURE SUSTAINABILITY 494, 495 (2018). The authors explain that high exposure levels also exist for uranium and other minerals mined in the same areas as cobalt. Firms know this. Elon Musk has called out Apple for using much more cobalt in its batteries than used in Tesla batteries. He noted the human rights issues. See Chris Ciaccia, *Elon Musk Blasts Apple Twice During Tesla Earnings Call*, DAILY MAIL (July 28, 2021, 4:00 PM), <https://www.dailymail.co.uk/sciencetech/article-9830961/Elon-Musk-blasts-Apple-twice-Tesla-earnings-use-cobalt-does-business.html>. While such pressure may have an impact on wealthy consumers in a few countries, we doubt it will have much impact on sales of battery-using products in most of the world. Lithium battery makers are glad to explain that. See *I/ Lead-Acid: A Polluting and Outdated Technology*, OLENERGIES, <https://www.olenegies.com/en/what-is-lithium/stop-lead-acid-and-conflicts-cobalt-mining/> (last visited Sept. 7, 2022).

Because of the DRC's dominant market share, more cobalt comes from such artisanal mines there than comes *in total* from any other country. This problem cannot be solved by Western cobalt-consuming nations banding together to insist on improved working conditions in the DRC's mines, as Chinese firms dominate the refined cobalt market and its government has taken steps to retain that position, and so is unlikely to pay attention to efforts to change the DRC industry.⁴⁹ China produces more batteries and battery chemicals than all other countries combined and that domination is predicted to grow.⁵⁰ Moreover, China produces about half of the EVs in the world and intends to stay in the lead—another reason China is unlikely to cooperate in reforming the cobalt industry.⁵¹ The U.S. government is aware that cobalt, commonly used in the lithium-ion batteries that dominate the market for EV and home power storage batteries, comes from less than desirable market sources.⁵² While the Biden Administration expresses concern about

49. See Luiza Savage, *How America Got Outmaneuvered in a Critical Mining Race*, POLITICO (Dec. 2, 2020, 4:30 AM), <https://www.politico.com/news/2020/12/02/china-cobalt-mining-441967> (China owns about half the cobalt production in the DRC). Chinese control of DRC cobalt is increasing as loan payments are forgiven in exchange for more cobalt; see also *What China's Increasing Control over Cobalt Resources in the DRC Means for the West—Report*, MINING.COM (Jan. 17, 2021, 12:56 PM), <https://www.mining.com/what-chinas-increasing-control-over-cobalt-resources-in-the-drc-means-for-the-west-report/>.

50. See Stephen Wilmot, *The Real Brake on America's Electric-Vehicle Revolution*, WALL ST. J. (Jan. 28, 2022, 5:30 AM), <https://www.wsj.com/articles/the-real-brake-on-americas-electric-vehicle-revolution-11643365805>; see also Jacky Wong, *EV Makers' Next Headache: Scarce Battery Chemicals, Made in China*, WALL ST. J. (Jan. 21, 2022, 7:29 AM), <https://www.wsj.com/articles/ev-makers-next-headache-scarce-battery-chemicals-made-in-china-11642768194>.

51. Mathilde Carlier, *Electric Vehicles Production Forecast - Selected Countries 2023*, STATISTA (Jun. 7, 2022), <https://www.statista.com/statistics/270537/forecast-for-electric-car-production-in-selected-countries/>. Data is difficult to find on government subsidies in China, but some Chinese auto makers, such as China FAW Group, are state-owned companies. See Shunsuke Tabeta, *China Leans on Auto Subsidies to Jump-Start Post-Virus Economy*, NIKKEI ASIA (Apr. 7, 2020, 2:22 PM), <https://asia.nikkei.com/Economy/China-leans-on-auto-subsidies-to-jump-start-post-virus-economy>. Buyers in China can afford domestic EVs such as the best seller, Hong Guang Mini. Yang Jie, *Elon Musk-Backed EV Battery Technology Rises to Dominance in China*, WALL ST. J. (Jan. 15, 2022, 8:13 AM), <https://www.wsj.com/articles/elon-musk-backed-ev-battery-technology-rises-to-dominance-in-china-11642166025>. There is no reason to believe the government of China will do anything substantive to reduce child labor exploitation in the DRC. If EV producers in Germany and the United States avoid DRC cobalt, it simply reduces the cost of an input in Chinese vehicles, giving those producers a little benefit. Chinese policy is to push EV production not only for revenue purposes but to help with air pollution problems in its cities. Nancy Stauffer, *China's Transition to Electric Vehicles*, MIT ENERGY INITIATIVE (Nov. 25, 2020), <https://energy.mit.edu/news/chinas-transition-to-electric-vehicles/>. Cities in China have bad air quality, often only bested by cities in India. See IQAir, *World's Most Polluted Cities 2020 (PM2.5)*, available at <https://www.iqair.com/us/world-most-polluted-cities> (last visited Sept. 7, 2022). That problem is addressed in part by the push for EVs in China—which also presents new trade possibilities.

52. *Reducing Reliance on Cobalt for Lithium-ion Batteries*, OFFICE OF ENERGY EFFICIENCY

critical minerals,⁵³ given the lack of mining and smelting in the United States and the European Union, and the many years it would take to launch such projects even if all environmental review processes were swept aside, current policy must live within the existing supply chain.

Cobalt is critical because, given current prices and technology, cobalt-based batteries are superior to competitively priced batteries made without it.⁵⁴ Producers selling in premium markets, such as Tesla, can use more costly non-cobalt containing batteries, but for much of the world, cobalt will remain attractive.⁵⁵ In 2006, only about 20 percent of cobalt was used in lithium-ion batteries, but by 2020, about 60 percent of all cobalt (and about three times as much cobalt in total was produced in 2020 compared to 2006) went to batteries.⁵⁶ This issue will

& RENEWABLE ENERGY (Apr. 6, 2021), <https://www.energy.gov/eere/vehicles/articles/reducing-reliance-cobalt-lithium-ion-batteries>.

53. See The White House, *Securing a Made in America Supply Chain for Critical Minerals*, Feb. 22, 2022, <https://www.bloomberg.com/news/articles/2022-03-15/germany-s-carbon-emissions-rise-in-setback-for-climate-goals>.

54. There are substitutes, of course, as batteries can be made without cobalt. Daniel Oberhaus, *This Cobalt-Free Battery Is Good for the Planet—and It Actually Works*, WIRED (Aug. 17, 2020, 8:00 AM), <https://www.wired.com/story/this-cobalt-free-battery-is-good-for-the-planet-and-it-actually-works/>. But substitutes may not be as good, or may be costlier. Lead is not as efficient as newer kinds of batteries for EV use and lead is itself toxic. Elon Musk says he would like to eliminate cobalt from batteries, but it is not simple when good performance is an issue. Cutting cobalt has efficiency and safety issues. Angela Chen, *Elon Musk Wants Cobalt out of His Batteries—Here's Why That's a Challenge*, THE VERGE (Jun. 21, 2018, 1:41 PM) <https://www.theverge.com/2018/6/21/17488626/elon-musk-cobalt-electric-vehicle-battery-science>. For a short discussion of various kinds of lithium-ion batteries, see Justin Forbes, *Lithium-ion Battery Materials and Why Their Chemistry Matters*, FLUX POWER (Nov. 27, 2019), <https://www.fluxpower.com/blog/lithium-ion-battery-materials-and-why-their-chemistry-matters>. See also John Blyler, *Lead-Acid vs. Lithium Ion Batteries: Which Will Win?* DESIGNNEWS (Jul. 8, 2020), <https://www.designnews.com/electronics/lead-acid-vs-lithium-ion-batteries-which-will-win>. Some firms are sensitive to this issue, not wanting to face opprobrium for exploiting child labor. For example, BMW announced it will not buy batteries using cobalt from the DRC. Henry Sanderson, *Cobalt Price Jump Underscores Reliance on Metal for Electric Vehicle Batteries*, FIN. TIMES (Apr. 30, 2021), <https://www.ft.com/content/c337958a-3f1b-41c5-b229-11556baa4164>. That means little, as BMW is a minor player in the EV market. More importantly, BMW buying non-DRC cobalt just moves sales to another country, it does nothing to reduce the market for cobalt, so a single small EV producer changing suppliers does not solve the problem.

55. See Safet Satara, *Elon Musk Said That Tesla Can Already Do Without Cobalt in Its Batteries and It Is True*, TORQUE NEWS (Oct. 5, 2021), <https://www.torquenews.com/15553/elon-musk-said-tesla-can-already-do-without-cobalt-its-batteries-and-it-true> (noting that Elon Musk has claimed Tesla will be able to use no cobalt in their next generation electric vehicles, but that cobalt remains stably priced and important in electric vehicles).

56. See *supra* note 28. As rich-country producers shy away from cobalt in batteries, cobalt prices will be held down, making it even more desirable as an input in batteries used in other countries less concerned about where inputs come from or what human rights issues may be involved. Jo Olson, *What's Up with the Cobalt Used in EV Batteries?*, FRESH ENERGY (Apr. 22,

escalate as EV production, and other needs for batteries related to non-carbon production of electricity, are expected to rise rapidly. Battery recycling can play a role in reducing the need for newly mined minerals, but that industry is nascent.⁵⁷

B. Resource Curses

Sitting on a cobalt mine or pool of oil would seem a sure way to national wealth, but the economic development literature provides evidence that many (but not all) countries with valuable natural resources suffer from low growth rates, low income, and poor quality of life. Controlling for other attributes of an economy, economists Jeffrey Sachs and Andrew Warner pioneered research in the field by showing that economic reliance on oil and minerals is related to low rates of growth.⁵⁸ Later work showed that controlling for other geographical and climate variables, resource-poor countries enjoyed higher rates of growth than their resource-rich counterparts.⁵⁹ Resource wealth has also been shown to increase the likelihood of domestic violence as factions fight for control of assets.⁶⁰ Examples of resource-rich, but underdeveloped, autocratic nations are plentiful, including Equatorial Guinea (oil), Venezuela (oil), and Myanmar (rubies and other precious stones). In contrast, there are prominent examples of resource-poor countries which have been successful economically and which have more democratic political systems, e.g. Japan and Singapore.⁶¹

2021), <https://fresh-energy.org/whats-up-with-the-cobalt-used-in-ev-batteries>. Numerous EVs are sold in China for a fraction of EV prices in the U.S. See River Davis, *China's \$4,230 Electric Cars Tap Huge Market Tesla Can't Reach*, BLOOMBERG BUSINESSWEEK (Mar. 10, 2021), <https://www.bloomberg.com/news/articles/2021-03-10/cheap-electric-vehicles-in-china-bring-green-transportation-to-the-masses>. Such vehicles are likely to dominate the EV market in much of the world where few consumers can afford costly EU or U.S. EVs, but the growing middle class can afford a Chinese EV.

57. Patrick McGee and Henry Sanderson, *Electric Vehicles: Recycled Batteries and the Search for a Circular Economy*, FINANCIAL TIMES, Aug. 1, 2021, <https://www.ft.com/content/e88e00e3-0a0c-469a-986b-1ffda60b6aee>.

58. Jeffrey Sachs & Andrew Warner, *Natural Resource Abundance and Economic Growth*, in LEADING ISSUES IN ECONOMIC DEVELOPMENT (G. Meier & J. Rauch, eds., 1995); Jeffrey Sachs & Andrew Warner, *The Curse of Natural Resources*, 45 EURO. ECON. REV. 827 (2001).

59. Other studies in agreement, especially focusing on oil, include Xavier Sala-I-Martin & Arvind Subramanian, *Addressing the Natural Resource Curse: An Illustration from Nigeria*, 22 J. AFR. ECON. 4 (2013); Benjamin Smith, *Oil Wealth and Regime Survival in the Developing World, 1960–1999*, 48 AM. J. POL. SCI. 232 (2004).

60. COLLIER, *supra* note 11; Macartan Humphreys, *Natural Resources, Conflicts, and Conflict Resolution*, 49 J. CONFLICT RESOL. 508 (2005); James Fearon & David Laitin, *Ethnicity, Insurgency and Civil War*, 97 AM. POL. SCI. REV. 75 (2003).

61. In the early 1960s, Singapore's GDP was about \$500 per capita. Today it is higher than it

Correlation is not, of course, causation. Prof. Røed Larsen of the Norwegian Business School notes that oil has been good for that nation.⁶² There are examples that both illustrate and contradict the resource curse hypothesis. While the DRC, rich in diamonds, cobalt and other resources, has been a sad story for a long time, Botswana, also diamond rich, has done better than most resource-rich African nations both economically and with respect to governance.⁶³ Some empirical work has been critical of the resource curse findings,⁶⁴ including one statistical study finding that resource wealth is beneficial in East Asia and Latin America.⁶⁵ Taking the literature as a whole, however, it would be fair to say that more often than not, oil and mineral wealth have been associated with less economic development and less personal freedom.

While there is broad agreement that this correlation exists, there is no consensus explanation for why it exists. Most analyses suggest it is related to the quality of governance and property rights institutions, an analysis which has a "chicken-and-egg" flavor to it.⁶⁶ Other studies

is in the United States. See Singapore GDP 1960–2022, MACROTRENDS, <https://www.macrotrends.net/countries/SGP/singapore/gdp-gross-domestic-product> (last visited Sept. 5, 2022).

62. Erling R. Larsen, *Are Rich Countries Immune to the Resource Curse? Evidence from Norway's Management of Its Oil Riches* (Statistics Norway, Discussion Paper No. 377, 2004).

63. PIERRE ENGELBERT, STATE LEGITIMACY AND DEVELOPMENT IN AFRICA (2002); Atsushi Iimi, *Escaping from the Resource Curse: Evidence from Botswana and the Rest of the World*, 54 INT'L MONETARY FUND STAFF PAPERS 4 (2007); James Robinson, *Botswana as a Role Model for Country Success*, in ACHIEVING DEVELOPMENT SUCCESS: STRATEGIES AND LESSONS FROM THE DEVELOPING WORLD (Augustin Fosu, ed., 2013). The DRC's dreadful governance has a long history well documented in ADAM HOCHSCHILD, KING LEOPOLD'S GHOST: A STORY OF GREED, TERROR, AND HEROISM IN COLONIAL AFRICA (1999). The horrors that Belgian governance in the DRC wrought is the basis of JOSEPH CONRAD'S HEART OF DARKNESS (1899).

64. Graham Davis, *Learning to Love the Dutch Disease: Evidence from the Mineral Economics*, 23 WORLD DEV. 1765 (1995); Michael Herb, *No Representation without Taxation? Rents, Development and Democracy*, 37 COMP. POL. 297 (2005).

65. Michael Alexeev & Robert Conrad, *The Elusive Curse of Oil*, 91 REV. ECON. & STAT. 586 (2009). Unlike Venezuela, which has been run into the ground despite massive oil reserves and revenue, Chile adopted productive policies and ran government surpluses in boom years of copper sales. See Jeffrey Frankel, *A Solution to Fiscal Procyclicality: The Structural Budget Institutions Pioneered by Chile* (Nat'l Bureau of Econ. Rsch., Working Paper No. 16945, 2011).

66. Paul Collier, *Laws and Codes for the Resource Curse*, 11 YALE HUM. RTS. & DEV. L. J. 9 (2008); Daron Acemoglu & James Robinson, *The Role of Institutions in Growth and Development*, in LEADERSHIP AND GROWTH (David Brady & Michael Spence, eds., 2010). See also DARON ACEMOGLU ET AL., WHY NATIONS FAIL: THE ORIGINS OF POWER, PROSPERITY, AND POVERTY (2012). One paper, looking over several decades, finds that natural resource exports are correlated to greater corruption but reports no correlation to basic law and order. Matthias Busse & Steffen Groning, *The Resource Curse Revisited: Governance and Natural Resources*, 154 PUB. CHOICE 1–2 (2013). Mauritius has done well economically; the quality of its institutions appears to have stimulated investment and development in the absence of major

have tried to measure the rule of law, finding that weak institutions mean a lack of constraints on plundering by the ruling class.⁶⁷ Again, this does not show how to resolve the problem. In many nations, the generation of wealth from resources does not help to create better institutions.⁶⁸ Some analyses suggest that natural resources increase costly internal struggles for control.⁶⁹ For example, Auty argues that growth in a country requires reinvestment of rents⁷⁰ in markets, not politics.⁷¹ In resource-rich countries, rents from resources are often used in political contests for control and are controlled by the ruling class, rather than being invested in wealth-creating activities that boost the wider economy over time.⁷² Not surprisingly, resource-rich countries often suffer under authoritarian governments⁷³ and from internal conflict.⁷⁴ Economies that relied on extraction and exports from oil, minerals or plantation crops were more likely to develop slavery, dictatorships and state control⁷⁵ and suffer from greater levels

resources. Jeffrey Frankel, *Mauritius: African Success Story*, in AFRICAN SUCCESSES PROJECT (Sebastian Edwards et al. eds., 2016).

67. Daron Acemoglu et al., *Institutional Causes, Macroeconomic Symptoms: Volatility, Crises and Growth*, 50 J. MONETARY ECON. 49 (2003); Dani Rodrik et al., *Institutions Rule: The Primacy of Institutions over Geography and Integration in Economic Development*, 9 J. ECON. GROWTH 131 (2004). There is some evidence that former English colonies developed better institutions than former Spanish or Portuguese colonies. James Feyrer & Bruce Sacerdote, *Colonialism and Modern Income: Islands as Natural Experiments*, 91 REV. ECON. & STAT. 245 (2009).

68. Brendan McSherry, *The Political Economy of Oil in Equatorial Guinea*, 8 AFR. STUD. Q. 23 (2006); Gilbert Metcalf & Catherine Wolfram, *Cursed Resources? Political Conditions and Oil Market Outcomes* (Nat'l Bureau of Econ. Rsch. Working Paper No. 16614, 2010).

69. Roland Hodler, *The Curse of Natural Resources in Fractionalized Countries*, 50 EURO. ECON. REV. 1367 (2006).

70. Rents are an economic term of art meaning profits greater than are needed to sustain a particular activity. Rents create opportunities for political exploitation because a certain level of income can be extracted and not destroy the activity generating the income. *See generally*, JAMES BUCHANAN ET AL., TOWARD A THEORY OF THE RENT-SEEKING SOCIETY (1980).

71. RICHARD AUTY, SUSTAINABLE DEVELOPMENT IN MINERAL ECONOMIES (1999); RICHARD AUTY, RESOURCE ABUNDANCE AND ECONOMIC DEVELOPMENT (2004). *See also* Kevin Murphy et al., *Why Is Rent-Seeking So Costly to Growth?*, 83 AM. ECON. REV. 409 (1993).

72. Some call the rents from resources “lootable.” Halvor Mehlum et al., *Institutions and the Resource Curse*, 116 ECON. J. 1 (2006). This appears to be so even within countries, with the resource rich areas doing less well than other areas in the same country. *See* Osmel Manzano & Juan Guierrez, *The Subnational Resource Curse: Theory and Evidence*, 6 EXTRACTIVE INDUS. & SOC'Y 261 (Apr. 2019).

73. Michael Ross, *Does Oil Hinder Democracy?*, 53 WORLD POL. 325 (2001).

74. Michael Ross, *A Closer Look at Oil, Diamonds, and Civil War*, 9 ANN. REV. POL. SCI. 265 (2006).

75. Class structure and authoritarianism tend to dominate in extractive-export driven economies compared to small scale producers in open economies, as was the case with the American South compared to the American Northeast, which has more individualism,

of corruption.⁷⁶

Natural resource wealth also appears to be connected to other problems. The level of inequality is higher⁷⁷ and labor allocation may be less efficient⁷⁸ in resource-rich countries. The income from natural resource development may cause "Dutch Disease," the ill-effects of a spike in a country's income, generally caused by discovery of new natural resources and named for the impact of natural gas revenue in the Netherlands in 1959.⁷⁹ Where this exists, the economic effect of a boom (or bust) in revenue from an exported commodity can increase (or decrease) the value of a nation's currency through exchange rate effects, distorting the economy.⁸⁰ A boom in government revenue from export fees or royalties from sales can also cause distortions.⁸¹ If governments fail to adjust to the cyclical consequences of fluctuations in commodity prices, they are unprepared for the collapse of revenues when prices drop.⁸² Further, during the boom revenue from the price hikes may be spent on low value projects that have small benefit and impose continued costs over time.⁸³ Boom and bust, rather than a

democracy, and less inequality. The effects of the defective institutions can be difficult to overcome. Stanley Engerman & Kenneth Sokoloff, *Institutions, Factor Endowments, and Paths of Development in the New World*, 14 J. ECON. PERSP. 217 (2000); STANLEY ENGERMAN & KENNETH SOKOLOFF, *ECONOMIC DEVELOPMENT IN THE AMERICAS SINCE 1500: ENDOWMENTS AND INSTITUTIONS* (2012).

76. Carlos Leite & Jens Weidman, *Does Mother Nature Corrupt?* (Int'l Monetary Fund Working Paper No. 99/85, 1999); Eleanor O'Higgins, *Corruption, Underdevelopment, and Extractive Resource Industries*, 16 BUS. ETHICS Q. 2 (2006).

77. Gobind Nankani, *DEVELOPMENT PROBLEMS OF MINERAL EXPORTING COUNTRIES* (1979).

78. Thorvaldur Gylfason, *Nature, Power, and Growth*, 48 SCOT. J. POL. ECON. 558 (2001).

79. Jeroen Kremers, *The Dutch Disease in the Netherlands*, in *NATURAL RESOURCES AND THE MACROECONOMY* (J. Peter Neary & Sweder van Wijnbergen, eds., 1986); Christine Ebrahimzadeh, *Dutch Disease: Wealth Managed Unwisely*, *FINANCE & DEVELOPMENT* (2020), available at <https://www.imf.org/external/pubs/ft/fandd/basics/dutch.htm> (Dutch non-oil exports became less competitive as the guilder strengthened). How Norway evaded the problem is discussed in Erling Larsen, *Escaping the Resource Curse and the Dutch Disease?*, 65 AM. J. ECON. & SOCIO. 3 (2006).

80. See, e.g., Jeffrey Frankel, *On the Rand: Determinants of the South African Exchange Rate*, 75 SO. AFR. J. ECON. 425, 426 (2007).

81. Oil-rich countries have less economic stability and financial system efficiency than similar countries without oil. Muhammad Umar et al., *The Impact of Resource Curse on Banking Efficiency*, 72 RES. POL'Y 102080 1–2 (August 2021).

82. Democratic regimes tend to manage windfalls by taking the opportunity to reduce external debt. Autocracies fail to take advantage of the opportunity to reduce national debt burdens. See Rebah Arezki & Marlis Bruckner, *Commodity Windfalls, Democracy and External Debt*, 122 ECON. J. 848, 848–49 (2012).

83. Alan Gelb, *Adjustment to Windfall Gains*, in *NAT. RES. AND THE MACROECONOMY* 13, 13–45 (J. Peter Neary & Sweder van Wijnbergen eds., 1986).

careful management of added revenues during boom times, then contributes to economic and political instability.⁸⁴ Coping with Dutch Disease requires considerable political resources, something often in short supply in places like the DRC.⁸⁵

The resource curse may not afflict every country, but it seems to have struck the DRC with a vengeance. Congolese civil society institutions are weak, the Congolese state is dysfunctional and corrupt, and prospects for persuading those profiting from the current state of affairs to change their ways seem dismal. (The long-suffering Congolese experienced one of the worst forms of colonialism under Belgian rule.)⁸⁶ What then can be done to address the green resource curse?

C. *Potential Solutions to the Resource Curse*

The economics literature suggests that when a nation experiences a resource curse, it is likely to exacerbate political conflict, stunt development of political institutions that protect rights, impede development of non-resource sectors, and add substantial economic stress.⁸⁷ While the policy literature has relatively few clear suggestions for addressing the resource curse, much of it argues that some steps can be taken.

Many proposed means of addressing the resource curse focus on controlling the revenues from the extractive industry that produces an influx of revenues: marketing boards to help stabilize prices of resources being sold; taxes on commodities to generate government revenue during boom times; government stockpiles to hold commodities in reserve to sell over time; seller cartels such as OPEC to attempt to stabilize revenue over time; setting long-term price

84. The fault is not entirely with governments that behave in a less-than-sensible manner. Markets also fail to account for such swings, so capital flows are often boom and bust. See Graciela Kaminsky et al., *When It Rains, It Pours: Procyclical Capital Flows and Macroeconomic Policies*, (Nat'l Bureau of Econ. Rsch., Working Paper No. 10780, 2004), <https://www.nber.org/papers/w10780>.

85. See Andrew P. Morriss, *The Consequences of Ignorance in Regulatory Design: The Ethical Duty to Be a Realist*, 19 GEO. J. L. & PUB. POL'Y 717, 720 (2021).

86. See HOCHSCHILD, *supra* note 63, for a comprehensive account of the ills of Belgian colonialism in Congo.

87. See, e.g., Paul Collier, *Doing Well out of War: An Economic Perspective*, in GREED AND GRIEVANCE: ECONOMIC AGENDAS IN CIVIL WARS 91, 91 (Mats Berdal & David Malone, eds., 2000); *Rebellion as a Quasi-Criminal Activity*, 44 J. CONFLICT RESOL. 839, 840 (2000); Paul Collier & Anke Hoeffler, *On Economic Causes of Civil War*, 50 OXFORD ECON. PAPERS 563, 569 (1998); Indra de Soysa, *The Resource Curse: Are Civil Wars Driven by Rapacity or Paucity?* in GREED AND GRIEVANCE, *supra*, at 113.

contracts with buyers to stabilize revenue; hedging in commodity markets; government saving during boom times to have revenue to spend during bust, investing revenues in sovereign wealth funds; and distribution of earnings to citizens.⁸⁸ Some NGOs, such as the National Democratic Institute for International Affairs (NDI) which is chaired by former Secretary of State Madeleine Albright, promote such solutions.⁸⁹ While some governments express a desire to cooperate with NDI, the record of success is thin as reporting creative numbers shines little light on how funds were actually used.⁹⁰ In part this is because such measures are easily avoided: if some multinational mining companies insist on integrity in accounting where they operate, then corrupt governments are more likely to sign contracts with state-owned enterprises not burdened by measures such as the U.S. Foreign Corrupt Practices Act.⁹¹ As China is the leading investor in African oil and mineral development (and a larger investor in Africa than the United States) and Chinese investment is unburdened by such considerations, the more western companies seek to force change, the more likely DRC mining concerns will simply sell to Chinese buyers unconcerned with such niceties.⁹²

There are a few examples of such rules working well, such as the Alaska Permanent Fund, the Norwegian sovereign wealth fund, and the sovereign wealth funds of some Persian Gulf countries.⁹³

88. See INTERNATIONAL MONETARY FUND, FISCAL POLICY FORMULATION AND IMPLEMENTATION IN OIL-PRODUCING COUNTRIES (Jeffrey Davis, Rolando Ossowski & Annalisa Fedelino, eds., 2003) (detailing the policies summarized here); see also Jeffrey Sachs, *How to Handle the Macroeconomics of Oil Wealth*, in ESCAPING THE RESOURCE CURSE 173 (Macartan Humphreys, Jeffrey Sachs, & Joseph Stiglitz, eds., 2007).

89. NDI's Extractive Industries Transparency Initiative (EITI) focuses on good governance for revenues from mineral exploitation. See EITI, PROGRESS REPORT: EXTRACTIVES TRANSPARENCY IN A YEAR OF CHANGE (2021).

90. PwC audited the Nigerian National Petroleum Corp. to account for \$20 billion but could not vouch for the accuracy of the results. See Bassey Udo, 'Missing' \$20 Billion Oil Money: Our Audit Report Not Reliable—PricewaterhouseCoopers, PREMIUM TIMES (Apr. 28, 2015), <http://www.premiumtimesng.com/news/headlines/182172-missing-20billion-oil-money-our-audit-report-not-reliable-pricewaterhousecoopers.html>.

91. See 15 U.S.C. §§ 78m(b), (d)(1), (g)–(h), 78dd-1–3, 78ff.

92. See generally Christopher Alessi & Beina Xu, *China in Africa*, COUNCIL ON FOREIGN RELATIONS (Apr. 27, 2015), <https://china.usc.edu/council-foreign-relations-cfr-backgrounders-china-africa-april-27-2015>; Yike Fu, *The Quiet China-Africa Revolution: Chinese Investment*, THE DIPLOMAT (Nov. 22, 2021), <https://thediplomat.com/2021/11/the-quiet-china-africa-revolution-chinese-investment/>.

93. Macartan Humphreys & M. Sandhu, *The Political Economy of Natural Resource Funds*, in ESCAPING THE RESOURCE CURSE 194, 198–99 (Macartan Humphreys, Jeffrey Sachs & Joseph Stiglitz, eds., 2007) (discussing the limited success of such funds). While some sovereign wealth funds are huge, that does not mean that the revenues are used as well as they could be. In all

Botswana's Pula Fund from diamond earnings may be one of the best examples of a developing country avoiding the resource curse in handling natural resource-export-generated wealth.⁹⁴ Unfortunately, the implementation of these ideas have often failed in practice. For example, in 2000 the World Bank pressed Chad, ranked one of the most corrupt nations by Transparency International (and as the most corrupt nation in the world in 2005)⁹⁵ to take steps to avoid the resource curse problem as a condition for funding for an oil pipeline. The solution agreed (or, perhaps, imposed) was for ExxonMobil to deposit the oil revenues due Chad in an escrow account at Citibank. An independent committee would oversee spending from that account to ensure that most oil money went for poverty-reduction measures. However, when oil revenue began to arrive in 2005, Chad reneged.⁹⁶ Nigeria committed to a similar program, effected through legislation in 2007, but in practice little changed.⁹⁷ Similar corruption has been endemic in other oil-producing countries, such as Angola, Guinea, and Venezuela.⁹⁸ Alaska, Norway, and Botswana have largely escaped the curse because they constructed institutions that prevented it from taking root.

Elsewhere, the problem with this type of "solution" is that, unless governments can bind themselves and their successors, plans intended to block harmful (or merely wasteful or useless) uses of public revenue are not enforceable. Moreover, these solutions presuppose effective governance is sufficiently present that the institutions the solutions require can be created and protected from corruption. Since transparency programs depend on reasonably honest politics in the resource-rich countries, they ignore the fundamental problems underlying the resource curse. If angels rather than corruptible mortals

cases, except the Alaska Permanent Fund, which is in the state constitution, governments can renege on promises regarding wealth funds.

94. While apparently not subject to looting by national leaders, the fund has not been used to stimulate development in other parts of the economy. Scott Pegg, *Is there a Dutch Disease in Botswana?*, 35 RES. POL. 14, 17 (2010).

95. See TRANSPARENCY INT'L, CORRUPTION PERCEPTIONS INDEX (2005), <https://www.transparency.org/en/cpi/2005> (showing Chad tied for last out of 159 nations).

96. Jeffrey Frankel, *The Natural Resource Curse* (Nat'l Bureau for Econ. Rsch., Working Paper No. 15836 at 33, 2010).

97. See Uwafiokun Idemudia, *The Resource Curse and the Decentralization of Oil Revenue: The Case of Nigeria*, 35 J. CLEANER PROD. 183, 185, 191 (2012) (noting that these "agencies and laws are managed and implemented by government officials that benefit from corruption . . .").

98. Nicholas Shaxson, *Oil, Corruption and the Resource Curse*, INT'L AFFAIRS 1123, 1123 (2007); John Hammond, *The Resource Curse and Oil Revenues in Angola and Venezuela*, SCI. & SOC'Y 348, 348 (2011).

ran governments, there would be less corruption.⁹⁹ However, no amount of "technical expertise" will change the temptations created by power and wealth for fallible humans.¹⁰⁰ Advocating integrity is insufficient; scolding autocratic/kleptocratic governments for not behaving more like the Norwegian government is unlikely to be effective.

There is a prominent example of a country which – under conditions remarkably similar to those in places like the DRC today – overcame the resource curse. While the United States is no longer a major exporter of most minerals,¹⁰¹ historically natural resources played a significant role in U.S. economic development under conditions that are close to those in many developing economies today.¹⁰² Indeed, during most of the nineteenth century, the United States *was* a developing country. Compared to the industrial powers such as Britain (during the entire century) and Germany (in the later years), the United States had a weaker central government, was more dependent on the commodity trade, was more dependent on capital imports, and lagged in higher education. Most importantly, while the nineteenth century United States had some relatively strong institutions (e.g. courts) in the more developed regions, corruption was a major issue for the United States in the nineteenth century, particularly in the frontier areas where mineral rushes occurred and which were far away from most organized government resources. For example, when the United States acquired California, it did not have an organized civil government until September 1850 and armed

99. "If men were angels, no government would be necessary. If angels were to govern men, neither external nor internal controls on government would be necessary." THE FEDERALIST NO. 51 (James Madison).

100. Bruce Bueno de Mesquita and Hilton L. Root suggest a framework for aid to maximize its impact on improving general welfare even in autocratic regimes. See Bruce Bueno de Mesquita & Hilton L. Root, *The Political Roots of Poverty: The Economic Logic of Autocracy*, 68 NAT'L INT. 27 (2002). They stress the need to strengthen the private sector: "The hallmark of a good aid policy is one that strives to build a transmission belt from public to private investment flows." *Id.* at 36. Of course, the problem with resource curse states such as Congo is that the mineral wealth effectively makes the autocrats relatively independent of the economy of the country and donor aid in acquiring resources.

101. While the United States has cobalt deposits, little is produced. See U.S. GEOLOGICAL SURV., MINERAL COMMODITY SUMMARIES (2020), <https://pubs.usgs.gov/periodicals/mcs2020/mcs2020-cobalt.pdf>.; cf. Bryce Crocker, *Jervois Mining Releases BFS for Idaho Cobalt Operations*, JUNIOR MINING NETWORK (Sept. 19, 2020), <https://www.juniorminingnetwork.com/junior-miner-news/press-releases/2313-tsx-venture/jrv/84856-jervois-releases-bfs-for-idaho-cobalt-operations.html> (engaging in an extensive discussion of cobalt mine being developed in Idaho).

102. See Paul David & Gavin Wright, *Increasing Returns and the Genesis of American Resource Abundance*, 6 INDUS. & CORP. CHANGE 203, 203 (1997).

vigilance committees took power in San Francisco in both 1851 and 1856.¹⁰³ The parallels between these regions and places like the cobalt mining areas of Congo are thus closer than one would expect if based only on considering New York or Massachusetts in the same period. In the next section, we sketch the parallels between the nineteenth century United States and natural resource economies of the late twentieth and early twenty-first centuries.

II. LEARNING FROM 19TH CENTURY AMERICAN MINERAL BOOMS

There are historical precedents for coping with the problems that mineral booms like the current intense demand for cobalt can produce today. The nineteenth century American economy – which was a developing economy on the fringes of the world economy at the start of that century, although it grew into an important industrial center by the end of it – bears a strong resemblance to the conditions in many of those of today’s natural resource states that suffer from the resource curse. Like the DRC and other modern resource-curse states, the nineteenth century United States was blessed (or cursed) with mineral resources in high demand. That demand spurred extensive exploration and resource development. As economic historians Paul David and Gavin Wright summarized,

between 1850 and 1950, the United States exploited its resource potential to a far greater extent than other countries of the world. The abundance of American natural resources did not derive exclusively from geological endowment ... but reflected the intensity of search, technologies of extraction, refining, and utilization; market development and transportation costs; and legal, institutional and political structures affecting all of these.¹⁰⁴

Somehow nineteenth-century America avoided the resource curse, despite lacking the homogenous culture of Norway, the thoughtful leadership of Botswana, and well-regarded sovereign wealth funds of the Persian Gulf nations. If we can locate what Peruvian development economist Hernando de Soto termed “the missing lessons of U.S. history,”¹⁰⁵ we can identify institutions that enabled the United States to succeed under similar circumstances to

103. Andrew P. Morriss, *Miners, Vigilantes & Cattlemen: Overcoming Free Rider Problems in the Private Provision of Law*, 33 LAND & WATER L. REV. 581, 627–635 (1998).

104. David & Wright, *supra* note 102102102, at 203–04.

105. HERNANDO DE SOTO, *THE MYSTERY OF CAPITAL*, 105–06 (2000) (describing how experts in developed countries could not explain how they solved the problem of developing formal property systems).

the resource curse economies today. Those institutions can help solve green energy's resource curse problem today.

A. *Similarities*

For much of the first part of the nineteenth century, the United States was a small, weak agricultural economy on the periphery of the world economy.¹⁰⁶ For example, in 1820 the GDP of the United States was estimated to be just one-third of that of the UK or France.¹⁰⁷ Indeed, to speak of a "U.S. economy" is something of a misnomer in the early nineteenth century, for it then was a collection of "small and scattered" markets rather than a single economy.¹⁰⁸ Even as markets became more integrated as transportation costs fell, agricultural exports had economic "supremacy" as Europeans needed American food due to their many wars.¹⁰⁹ Moreover, for much of the early nineteenth century, most production not located near waterways (the main means of transportation) was accomplished without much financial infrastructure, skilled labor, or management.¹¹⁰ Although

106. In 1839, per capita GDP in the United States is estimated to have been only between \$75 and \$95. Robert Gallman, *Estimates of American National Product Made Before the Civil War*, 9 ECON. DEV. & CULT. CHANGE 397, 399–400 (1961). The large majority of national income was from agriculture. *Id.* at 404. In 1860, income per worker in most of the country averaged \$100. See Robert Gallman, *Southern Ante-Bellum Income Reconsidered*, 12 EXPLOR. ECON. HIST. 89, 98 (1975). Caribbean islands were often wealthier than the northern colonies. Despite the diseases that imposed a heavy toll on Europeans, the West Indies were generally more attractive for economic activity in the eighteenth century than was continental America. Jamaica's "wealth and strategic importance in the Caribbean made it ... the most valuable colony." T.G. Burnard, *'Prodigious Riches': The Wealth of Jamaica before the American Revolution*, 54 ECON. HIST. REV. 506, 506 (2001). Jamaica was "the most valuable colony in British America in 1774-75"; among whites, "individual wealth and income [exceeded] by a significant margin those of Whites in mainland British America" *Id.* at 508. Similarly, built on the lucrative sugar trade, Bridgetown, Barbados in 1742 had a population equal to New York and Boston. It rivaled the now more famous locales for trade revenue. S.D. Smith, *Gedney Clarke of Salem and Barbados: Transatlantic Super-Merchant*, 76 N.E. QUART. 499, 501 (2003). In the seventeenth century, per capita Barbados output was "one- to two-thirds higher than in England and Wales," David Elitis, *The Total Product of Barbados, 1664-1701*, 55 J. ECON. HIST. 321 (2009); see also Richard Dunn, *The Barbados Census of 1680: Profile of the Richest Colony in English America*, 26 WM. & MARY QUART. 3, 11 (1969).

107. ANGUS MADDISON, *CONTOURS OF THE WORLD ECONOMY, 1-2030 AD*, 379 table A-4 (2007).

108. DOUGLASS NORTH, *THE ECONOMIC GROWTH OF THE UNITED STATES 1790-1860*, 22 (1966).

109. FRANK TAUSSIG, *THE TARIFF HISTORY OF THE UNITED STATES* 11, 11 (1931).

110. Thomas C. Cochran, *Business Organization and the Development of an Industrial Discipline*, in *THE GROWTH OF THE AMERICAN ECONOMY* 303, 303 (Harold F. Williamson, ed., 2d ed., 1951) ("Business in this country consisted mainly of shipping, brokerage, wholesaling and retailing. There were but three banks in the United States of 1790, three bridge companies, a handful of insurance associations, and a dozen canal companies. Of several manufacturing

protectionist tariffs were quickly adopted after the Revolutionary War to promote domestic industry, imports from Britain continued to dominate the U.S. market well into the century except during the Jeffersonian Embargo and War of 1812.¹¹¹ While the U.S. manufacturing sector grew substantially during the middle of the nineteenth century, it grew primarily through domestic sales rather than exports.¹¹² As a result, from the point of view of the rest of the world, the American economy remained heavily dependent on commodity sales for most of the nineteenth century.¹¹³

enterprises attempted on a factory basis, only one had succeeded. There was no labor force skilled in handling machinery, nor any executives experienced in managing complex business structures.”). Transportation infrastructure was primitive. In 1816, moving a ton of freight from Europe to America cost the equivalent of \$9. The cost was the same to move 30 miles overland within the country. See J. Kensey, J. Gilpin & R. Goldsborough, *Chesapeake and Delaware Canal*, AMERICAN STATE PAPERS, II, Miscellaneous, Washington, DC, 1834, 285–291. Cited in Karl Raitz & Nancy O’Malley, *Local-Scale Turnpike Roads in Nineteenth-Century Kentucky*, 33 J. HIST. GEOG. 1 (2007). The situation in Canada was the same.

111. Stanley Engerman & Kenneth Sokoloff, ECONOMIC DEVELOPMENT, *supra* note 75, at 372 (“The development of manufacturing down to the start of the War of 1812 was . . . limited. The United States still depended upon imports from Britain for much of its manufactured goods.”); GEORGE TAYLOR, THE TRANSPORTATION REVOLUTION, 1815-1860 133 (1951) (“Little wonder that under such conditions [high land transportation costs] foreign trade flourished while domestic commerce developed only very slowly.”). The textile industry, which grew up behind protectionist walls, was primarily aimed at the lower quality segment of the market. See PETER TEMIN, THE JACKSONIAN ECONOMY 113 (1969). Peace in 1815 allowed English goods back into the American market, creating hard times for the American manufacturing sector that had grown up during the Embargo and war. NORTH, *supra* note 108, 108at 177 (The biggest external change in 1815 was “a world at peace, with all that it implied in terms of reimposed navigation laws and the comparative advantage of Britain in the production of finished goods, particularly textiles.”); TAYLOR, *supra*, at 334 (noting increase in demand for and supply of British goods after war). Not surprisingly, manufacturers again sought tariff protection and succeeded in getting it. From a pre-war low of twenty percent or less, tariff barriers grew, until by 1830 most imports that competed with American-made goods were taxed between 33% and 50%. *Id.* at 360. Manufactured imports continued to be a major part of imports through the period under study here. *Id.* at 182.

112. Curtis Nettels, *Costs of Production*, 3. J. ECON. HIST. 1, 2–3 (1943) (explaining how mechanization was stimulated by the Civil War due to the manpower shortage and the need to manufacture arms and other necessary goods). See also 1975 U.S. Dep’t of Com. Bicentennial Edition, HISTOR. STAT. OF THE U. S. COLONIAL TIMES TO 1970 (1975) at 884–86 (showing that net merchandise exports were negative in every year but fourteen between 1790 to 1875 and imports of finished goods exceeded exports of finished goods from 1869-1900 (the years for which data are available) in all but one year).

113. See Robert Lipsey, *U.S. Foreign Trade and Balance of Payments, 1800-1913*, 686 (Stanley Engerman et al. eds., 2008). See also HISTOR. STAT. OF THE U. S. COLONIAL TIMES TO 1970, *supra* note 112, at Table U 213-224 (showing outside of the five years of the Civil War, the value of U.S. exports of raw materials and food products exceeded the value of U.S. exports of semi- or finished manufactured goods by a factor of 4 to 8). Cotton provided over half the value of exports and was “the most important proximate cause of expansion” up through 1843. NORTH, *supra* note 108, at 67–68. See also TEMIN, *supra* note 111, at 91 (“Cotton was the single most important commercial commodity to the antebellum economy. It was the largest single crop, accounting for

Governance was as weak in western (which includes much of what we would today call the "midwest") American regions where many of the mineral booms occurred as it is today in the DRC. Until the 1860s at the earliest (a time when the federal government was focused on the Civil War and then the beginnings of Reconstruction) and more properly the General Mining Law of 1872, there was little or no federal government involvement in natural resource issues other than efforts by the Army to control lead mining in the 1840s and 1850s. As a result, most natural resource governance questions were addressed through state and territorial governments, many of which suffered from the same types of corruption problems that plague modern resource curse states. Indeed, at both the state and federal level, from at least the Jacksonian era on, corruption in the legislative and executive branches of governments was widespread and institutionalized.¹¹⁴ Corruption also plagued the judiciary in mineral rich areas. For example, in Nevada the territorial court was renowned for its corruption, with one judge receiving \$25,000 for stepping aside in a case, and another charging \$10,000 for a favorable decision.¹¹⁵ Judicial corruption was such an issue that one analysis concluded that "[w]hile it would be considerably too much to say that Nevadans wanted statehood just to

about 20 percent of the value of all crops, and the largest single export, accounting for roughly half of the value of United States exports in the 1830's.").

114. *Compare* Peri Arnold, DEMOCRACY AND CORRUPTION IN THE 19TH CENTURY UNITED STATES: PARTIES, "SPOILS", AND POLITICAL PARTICIPATION at 5 ("The post-Jackson party system was sustained by its ability to distribute patronage appointments to loyalists, its ability to direct government purchasing to supporters, and the power to reward favored constituencies through distributive public policies. In effect, an organized system of corruption was the foundation for democratic political organization and participation in the United States.") *with Id.* at 14 ("The conventional definition of political corruption is that it is a misuse of public trust to benefit private individuals. In 19th century America, however, corruption took on a more complex function. In the U.S. it entailed the appropriation of governmental resources for the sustenance of mass political parties that, in turn, used those resources to expand political participation and serve some public functions, along with substantial private enrichment. Additionally, 19th century American politics formally tied corruption to democracy. Leading politicians such as Presidents Andrew Jackson and Martin Van Buren crafted an argument that government itself was the province of popular politics and sentiment and that its offices and its patronage ought to be distributed to the citizenry for their benefit. Thus, political parties were given a conception of democratic governance which, paradoxically, legitimated corruption."). We are skeptical of this interpretation.

115. WILLIAM S. GREEVER, *BONANZA WEST: THE STORY OF WESTERN MINING* 102–03 (1963) (explaining how delivering the bribe proved a challenge: "the parties providing the bribe were hard put to locate [the \$10,000] for the banks had closed, but they finally managed to secure it all by one in the morning and knocked at the Judge's hotel room. [The Judge's wife] answered, holding out her nightgown like an apron to receive the money. When dumped in, the coins were so heavy that they pulled her gown completely off and left her standing naked among the scattered gold pieces.").

escape the territorial court, certainly after [statehood] the fierce excitement of the mining suits greatly abated.”¹¹⁶

Nineteenth century mineral rushes produced economic dislocations and the same sort of dramatic price changes seen today in developing resource economies. For example, during the California gold rush farmers abandoned crops to head to the mines, ships were abandoned in San Francisco harbor, and so on.¹¹⁷ The rush to grab resources led to waste and environmental issues.¹¹⁸ Lack of knowledge and sophistication meant courts and government officials struggled to adapt to new types of property rights claims. The legal system’s confusion over mineral geology led to the wildly inefficient “apex” rule in hard rock mining, which produced years of litigation over competing claims.¹¹⁹ Oil geology was similarly opaque and resulted in wasteful and inappropriate application of the rule of capture to oil as that resource became increasingly valuable in the late nineteenth century.¹²⁰

Further, just like resource-curse states today, in the nineteenth century the United States was a net importer of capital. Net foreign investment grew from just under \$0.2 billion in 1843 to \$2.7 billion in 1897.¹²¹ Capital imports grew from an average of \$82.2 million in the first decade of the century to an average of \$3,071.4 million in the last decade.¹²² A considerable portion of that investment went into infrastructure that played important roles in developing natural resources.¹²³ Similarly, Americans needed foreign expertise to develop

116. See Andrew P. Morriss, *Miners, Vigilantes & Cattlemen: Overcoming Free Rider Problems in the Private Provision of Law*, 33 LAND & WATER L. REV. 581, 581, n.193 (1998) (quoting a commentator who stated as such).

117. J.S. HOLLIDAY, *THE WORLD RUSHED IN: THE CALIFORNIA GOLD RUSH EXPERIENCE* 35 (1981).

118. See generally ROBERT L. KELLEY, *GOLD VS. GRAIN: THE HYDRAULIC MINING CONTROVERSY IN CALIFORNIA’S SACRAMENTO VALLEY* (1959).

119. See, e.g., Warren D. Smith, 39 MINING & ENG’G WORLD 159 (July 26, 1913) (Our mining laws appear to benefit the lawyers more than the people in general, or anyone else. ... [E]xtraneous rights benefit lawyers only.”); CURTIS A. LINDLEY, *A TREATISE ON THE AMERICAN LAW RELATING TO MINES AND MINERAL LANDS* 711 (3d ed. 1914) (“It is hardly profitable to pursue this discussion further. Enough has been said to show the absurdity of the law, when applied to geological conditions which were not in contemplating of the lawmakers when the laws were enacted.”).

120. See, e.g., Gary D. Libecap & Steven Wiggins, *Contractual Responses to the Common Pool: Prorating of Crude Oil Production*, 74 AM. ECON. REV. 87, 88 (1984) (discussing wastes associated with the rule of capture in oil recovery).

121. HISTOR. STAT. OF THE U. S. COLONIAL TIMES TO 1970, *supra* note 112, table U26–39, at 869.

122. HISTOR. STAT. OF THE U. S. COLONIAL TIMES TO 1970, *supra* note 112, table U40, at 869.

123. For example, there was massive capital investment in railroads during the 1840s-1850s:

many natural resources. For example, Cornish, Chilean, and other foreign miners played key roles in developing many natural resource finds.¹²⁴

In short, nineteenth-century America struggled with natural resource problems that look remarkably like modern resource-curse nations' problems. Americans did so without the technical expertise, good government advice, or assistance from NGOs available to today's resource-curse states.¹²⁵ Despite these handicaps, nineteenth-century Americans managed to avoid most of the natural resource curse's ill effects and to use their nation's natural resource wealth to help power economic development.¹²⁶ In other words, nineteenth century Americans did not escape the resource curse because of the quality of their judiciary, their legislature, or their executive branches but despite these institutions' failings, suggesting that "the missing lessons of U.S. history" are fertile territory for searching for effective institutional solutions to the resource curse.

B. *The American mineral booms*

The first resource boom in the United States was for lead deposits in the Midwest, then a relatively remote region. Lead was needed for bullets for the military, so a domestic supply was treated as a national security issue. Lead mining took place under a legal regime similar to that in most of the world today, with the federal government asserting ownership of the resource and requiring miners to pay it a share of the lead mined. The next booms began with the California gold rush and continued through the other western mineral rushes. These led to development of new legal regimes through a process of customary law.

Lead

Before independence, the British crown claimed a fifth of gold and

\$370,000,000 between 1840 and 1850 and another \$600,000,000 in the next seven years. TAYLOR, *supra* note 111111, at 346.

124. BAYARD TAYLOR, *ELDORADO OR ADVENTURES ON THE PATH OF EMPIRE*, 77 (1850).

125. There are many problems with how NGOs operate in developing countries. *See, e.g.*, Nicola Banks, et al., *NGOs, States, and Donors Revisited: Still Too Close for Comfort?*, 66 *WORLD DEV.* 707 (2015) (describing problems). The United States may have thus benefited from their absence during its development period.

126. Competition for control of resources was not equal. Native Americans were driven from lands often because they possessed desired resources. Asians and other minorities were often blocked from competing in such markets. Andrew P. Morriss, *Miners, Vigilantes & Cattlemen: Overcoming Free Rider Problems in the Private Provision of Law*, 33 *Land & Water L. Rev.* 581, 591 n.29 (1998).

silver and a fifteenth of copper found on land it granted to colonists.¹²⁷ As there was little gold or silver found in the North American colonies before independence,¹²⁸ the claim proved a mostly theoretical one.¹²⁹ Nonetheless, the new nation's first approach to mineral rights derived from this British practice, with the federal government under the Articles of Confederation claiming "a third part of all gold, silver, lead, and copper mines, to be sold, or otherwise disposed of as Congress shall hereafter direct" from lands sold at auction and a third of all gold, silver, lead, and copper mines.¹³⁰ This reservation was "without effect" and was omitted from land laws passed in 1796, 1800, and 1804, "possibly because no worthwhile mineral strikes had been made on the lands immediately affected."¹³¹

When the Constitution superseded the Confederation, it placed the power to dispose of public lands in Congress's hands. Mineral resources were an important concern almost from the beginning, particularly lead, which was seen as a critical military resource.¹³² Thus after the Louisiana Purchase, Meriwether Lewis (of Lewis and Clark fame) was sent to survey the lead regions of the Louisiana Purchase by President Thomas Jefferson, who "was keenly interested in the possibility of securing a supply of lead for the United States at large from the Louisiana country."¹³³ The positive response from Lewis' survey on the potential of the new land was followed by appointment of a commission in 1805 to report on the title to the lead lands.¹³⁴ This was followed by the 1807 Public Lands Act,¹³⁵ which took all land with lead deposits out of federal land disposal programs, to secure for the federal government both lead and revenue sources from the new

127. See ROBERT C. NESBIT, *WISCONSIN: A HISTORY* 107 (William F. Thompson, 2d ed. 1989) ("It had been customary for the sovereign, in land grants, to make reservations relating to minerals, particularly the precious metals, gold and silver, on the assumption that their presence and discovery on the land was strictly fortuitous."); Robert W. Swenson, *Sources and Evolution of American Mining Law*, in *AM. L. OF MINING* 6-7 (THE FOUND. FOR NAT. RES. & ENERGY L., ed. 1983).

128. See NESBIT, *supra* note 127, at 107 (explaining that there were initially other enterprises in the lead-mining region)

129. Swenson, *supra* note 127, at 7 ("It seems, therefore, that the early colonial charter reservations were never regarded as having much significance....").

130. NESBIT, *supra* note 127, at 107; Swenson, *supra* note 127, at 7; The Western Territory, Ordinance for Ascertaining the Mode of Disposing of Lands (May 20, 1785).

131. NESBIT, *supra* note 127, at 107.

132. WISC. HIST. SOC'Y, *Lead Mining in Southern Wisconsin: The Birth of the Badgers*, <https://www.wisconsinhistory.org/Records/Article/CS408>.

133. JOSEPH SCHAFFER, *THE WISCONSIN LEAD REGION* 24 (1932).

134. *Id.* at 25.

135. 9th Cong., Ch. 46-47, §§ 2-4, 2 Stat. 445 (1807).

territories.¹³⁶ These lands were available for lease in the area that became Missouri, Wisconsin, and Illinois, where substantial lead deposits were mined in the 1810s and 1820s.¹³⁷ Discoveries of lead deposits received a three year lease subject to paying a royalty of one tenth of the ore mined.¹³⁸

However, those attracted to the potential riches offered by lead mining paid little attention to this formal system. Largely ignoring the federal leasing system, lead miners established their own customary rules to govern lead mines on federal land. These customary rules allowed the discoverer of a deposit the land within a twenty-five-foot radius of the discovery and everyone else twelve square feet of ground, with claims good while worked.¹³⁹ Enforcement of the federal law in the face of these activities was almost impossible, particularly given the techniques used in nineteenth-century lead mining, which resemble those used today in "artisanal" cobalt mining.

Lead miners were motivated by hopes of a large find, with "a constant scene of bustling and discovery" and "the constant hope of falling suddenly upon a great body of ore" giving "a perpetual relish" to the miners efforts.¹⁴⁰ New discoveries meant abandoning existing claims in hopes of richer finds.¹⁴¹ In addition, the short term of the leases available discouraged "men of respectability and sufficient capital to carry on mining in a systematic manner" from participating in the mines.¹⁴² Given the short term and primitive nature of most mining operations, enforcement of the leasing law was difficult. Further hampering enforcement efforts, "the great defect" of the 1807 law was "that a specific agent was not at the same time authorized to be appointed for the general superintendence, inspection, and management of the mines" and revenue from the mines was minimal.¹⁴³ The first legal response to valuable mineral deposits was thus remarkably similar to that in modern resource curse states: a formal

136. Nesbit, *supra* note 127127127, at 107.

137. HENRY R. SCHOOLCRAFT, A VIEW OF THE LEAD MINES OF MISSOURI 46-47 (1972 Reprint ed. 1819) (describing lead mines in Missouri in 1816-1818 as producing over \$352,000 in eighteen months based on local reports).

138. WALTER RENTON INGALLS, LEAD AND ZINC IN THE UNITED STATES 102 (1908).

139. *Id.* at 103.

140. SCHOOLCRAFT, *supra* note 137137, at 64.

141. SCHOOLCRAFT, *supra* note 137137, at 64, 137.

142. SCHOOLCRAFT, *supra* note 137137, 137 at 115.

143. SCHOOLCRAFT, *supra* note 137137, 137 at 114-15 (reporting "no revenue"). But see INGALLS, *supra* note 138, at 105 (suggesting that some revenue was obtained at great expense, making the government's net revenue small). 137138

government claim to ownership, which faltered because of the inability of that government to project its authority into the region where the resources were found and a somewhat anarchic local development of a customary regime for dividing up the resource.¹⁴⁴

One major effort to enforce the leasing scheme did prove somewhat successful. Lead mining was primarily concentrated around Potosi, Missouri in the 1820s, with about 2,000 men in the area engaged in lead mining at least some of the time (many mixed mining with farming).¹⁴⁵ A rise in lead prices in 1825 brought about “a considerable increase” in production in Missouri.¹⁴⁶ This coincided with the 1824 arrival of Lieutenant Martin Thomas as superintendent of mines for Missouri and the West. Lt. Thomas began a more vigorous assertion of federal rights than his predecessors¹⁴⁷ and achieved some success in collecting federal royalties. Because refined lead was shipped out (it had a significant cost advantage over shipping out unrefined ore), Thomas focused his enforcement efforts on lead smelters, collecting the royalty there.¹⁴⁸ A later account noted that Thomas ran the region like a “benign dictator,” restricting the use of timber for purposes other than smelting, forbidding farming and gardening, and being “hostile” to anyone wanting to speculate in land purchase or mineral claims.¹⁴⁹ However, even Lt. Thomas’s “energetic” enforcement of the leasing program could not stop the rising number of trespassers on federal land mining lead.¹⁵⁰ Moreover, production remained below its potential due to the primitive techniques used.¹⁵¹

Capt. Thomas Legate, who followed Thomas as superintendent, attempted to bring miners into the formal system by cutting the royalty

144. For developing country examples of such regimes, see, e.g., Robyn d’Avignon, *Primitive Techniques: From ‘Customary’ to ‘Artisanal’ Mining in French West Africa*, 59(2) J. AFR. HIST. 179 (2018) (noting French recognition of “customary” rights to mine gold and rock salt in French West Africa and difficulties implementing the formal legal rules both during colonialism and after independence); Heather Huntington & Kate Marple-Cantrell, *Customary Governance of Artisanal and Small-Scale Mining in Guinea: Social and Environmental Practices and Outcomes*, 102 LAND USE POL’Y 105229 (2021) (describing how “Artisanal and small-scale mining (ASM) in Guinea’s Forecariah and Kindia regions continues to be managed and administered by customary governance structures and deeply rooted informal land tenure regimes.”).

145. INGALLS, *supra* note 138, at 103.

146. INGALLS, *supra* note 138, at 104.

147. INGALLS, *supra* note 138, at 103 (commenting that Lt. Thomas “appears to have entered energetically upon the discharge of his duties.”).

148. NESBIT, *supra* note 127, at 111.

149. NESBIT, *supra* note 127, 127.

150. INGALLS, *supra* note 138, at 105.

151. *Id.* at 105.

to six percent, but “this only confirmed the opposition of the miners to a system which they now characterized as oppressive and un-American.”¹⁵² When the market recovered and lead production resumed in earnest in 1835, only about a fifth of the lead raised in the district paid royalties.¹⁵³ “More and more people began to treat the land as if it was open for squatters to take possession and await survey and sale, and Congress passed the first of a series of general preemption acts in 1830 confirming them in this view.”¹⁵⁴ Contributing to the problems was the active involvement in land speculation of both Capt. Legate and John Sheldon, the registrar of the land office. Legate and Sheldon reserved relatively little land for the mineral leasing program, instead allowing their associates to cheaply purchase mineral lands as farming land.¹⁵⁵

The lead leasing system was “ineffective in practice, few miners taking the trouble to procure leases, there being no special agent to oversee them.”¹⁵⁶ As a result, miners had no secure title.¹⁵⁷ Miners at existing sites, such as those near Potosi, Missouri, ignored federal requirements, making the application of the new regime unsuccessful. The miners “were defiant about leasing or paying a royalty” and had a powerful ally in Missouri Sen. Thomas Hart Benton, who “kept up a tirade against [the leasing program] until he won his point in 1827 and the Missouri lead lands were put up for sale.”¹⁵⁸ For new areas, the law failed in part because it relied on Land Office surveyors’ reports to determine whether particular parcels were “mineral” lands or not. As one historian noted in an understated way, “because of defective surveys the results were necessarily imperfect.”¹⁵⁹

Meanwhile, lead discoveries in the Fever River mining district in

152. NESBIT, *supra* note 127127, at 112.

153. *Id.*127

154. *Id.* 127

155. *Id.*127 at 113 (explaining that while these activities eventually led to their removal from their official positions, even their removal did not end their profitable involvement in the industry. When Legate was removed from his position, he resigned his commission and remained in the Galena region to oversee his holdings.127 Sheldon was also removed after a Congressional investigation reported that he had “made himself master . . . of the vast mineral domain in his district, and disposed of it as if it were indeed his own, uniform only in helping himself and his friends.”).127 See also SCHAFFER, *supra* note 133133, at 114 (describing Sheldon’s removal).

156. INGALLS, *supra* note 138, at 103.

157. NESBIT, *supra* note 127127, at 111–12 (Under the leasing system, “[t]he miners were expected to accept the role of tenants at will of the federal government and their function was to raise lead.”).

158. *Id.* 127at 107–08.

159. INGALLS, *supra* note 138, at 102.

Wisconsin led to a new effort to make leasing work. The Army Bureau of Ordinance, which was to receive the government's royalty in lead for its own use, advertised for lessees to develop the region. The requirements included a \$10,000 bond, a work force of at least 20 men, and a 10 percent royalty on finished product. In return, the lessee received a 320 acre tract, with the use of its stone and timber for the mining.¹⁶⁰ Two men responded in 1822 and made attempts; only one lasted even a year.¹⁶¹ Once again, illegal miners flocked to the area, and population soared from 200 in 1825 to 1,000 in 1826 and to 10,000 in 1828.¹⁶² The transfer of the leasing system to a new region failed without the participation of anyone like Lt. Thomas, showing its dependence on the rare non-corrupt administrator.¹⁶³

One major problem for the lead leasing program was that the leases provided inferior property rights to those otherwise obtainable through extra-legal means. Schafer, in a thorough study of the Wisconsin lead region, concluded that the extra-legal efforts to obtain title resulted from the more favorable terms granted to farmland.

Some of the land sold as agricultural land proved rich in lead; many of the reserved mineral lands had already proven valueless for mining. Speculators pressed in to absorb the dwindling supplies of timber in order to sell them at a high price to either miners or farmers. Under these circumstances the miners who paid rent on leased land were at a disadvantage against "farmers" who had obtained land free of rent which the government had sold them at \$1.25 per acre. And if miners and smelters were to safeguard their future, the timber adjunct to their business must be secured without delay. They petitioned the government to permit them to buy the lands they held under lease, but their appeal fell upon deaf ears, Congress still being obsessed with the notion that the government held in its mineral lands vast potential wealth.¹⁶⁴

160. NESBIT, *supra* note 127127, at 108.

161. NESBIT, *supra* note 127127, 127at 109.

162. SCHAFFER, *supra* note 133133, at 41. *See also* H. RUSSELL AUSTIN, *THE WISCONSIN STORY: THE BUILDING OF A VANGUARD STATE* 81 (1948) (explaining how the lead deposits lured a considerable population to the area, with 16,615 of the 22,214 whites in the area that ultimately became Iowa, Minnesota, Wisconsin, and parts of North and South Dakota in the lead districts in 1836).

163. NESBIT, *supra* note 127127, at 111 (explaining that the leasing system's collapse in Wisconsin was complete when the price of lead fell dramatically in 1829). When it took 5,000 pounds of ore to buy a barrel of flour in the Fever River region, farmers invaded the "mineral" lands to use them for agricultural purposes. The arrival of "\$3 ore and \$15 flour" ended this, however, by making many miners more interested in farming than mining. *Id.*

164. SCHAFFER, *supra* note 133133, at 120–21.

In response to the problems with the leasing program, Congress began to consider the outright sale of lead mines, beginning with the mines in Missouri. When the deposits were discovered in Wisconsin in 1827, Thomas recommended sale of the lead lands in Missouri. A Congressional investigation in 1828 agreed that sales would be appropriate.¹⁶⁵ Not until 1847, however, did Congress finally authorize the sale of lead lands.¹⁶⁶ In the meantime, the leasing program became a "dead letter" after 1834 as illegal entries increased and many miners and smelters in Wisconsin and Missouri simply refused to pay the royalty.¹⁶⁷ Mineral lands were routinely sold as agricultural lands based on false sworn statements that the lands did not contain mineral deposits.¹⁶⁸ In particular, in Wisconsin, while the leasing program was used by a few operators, "unlicensed plants could be numbered by the score."¹⁶⁹

Ingalls' 1908 account of the leasing program concludes by examining the causes of the adoption and failure of the program. He argued the leasing approach was the "natural" one, given the widespread claims of national governments elsewhere to mineral rights.

At the time of the adoption of the [leasing] policy the Republic was not yet 20 years old. It had no mining industry of consequence, and as a nation was inexperienced in the exploitation of mineral resources. In many of the old countries minerals were reserved by the crown which bestowed mining rights in consideration of royalties upon the produce. It was natural, therefore, that the United States upon acquiring an immense territory of little explored, practically unsettled land as the property of the nation should have aimed to secure for the direct benefit of the whole people a fair portion of its mineral yield. This policy was sound in theory, and was amply sanctioned by precedent in foreign countries.¹⁷⁰

Nonetheless, Ingalls found the failure of the leasing program unsurprising, given American conditions.

[T]he people who had but lately thrown off the yoke of Great Britain looked unkindly upon Government interference, and indeed upon anything that savored of landlordism. About the time when the

165. INGALLS, *supra* note 138, at 105.

166. INGALLS, *supra* note 138, at 105.

167. INGALLS, *supra* note 138, at 105.

168. NESBIT, *supra* note 127127, at 113.

169. INGALLS, *supra* note 138, at 125.

170. INGALLS, *supra* note 138, at 125.

Wisconsin lead region was being developed the country was experiencing a change from the old-fashioned Republicanism of Monroe and John Quincy Adams to the aggressive democracy of Andrew Jackson. The authority of the Government was exercised more and more feebly and more and more by unworthy men. There were many scandals and injustices in connection with the mining leases, and to the pioneers who were carving out the frontier, mining almost with rifle in hand, the system of taxing their single industry for the benefit of the rest of the people was utterly repugnant.¹⁷¹

As the lead mine policy evolved from leases to land sales, Congress was grappling with other land disposal issues. After the Revolution, the federal government took title to extensive land holdings in the west, taking not only the British claims but land originally claimed by many of the thirteen original states as well.¹⁷² Federal territory expanded as the country expanded its legal boundaries (through the Louisiana Purchase and acquisition of Florida from Spain) and its effective boundaries (through the eventual compliance by the British with the treaties demarcating the boundaries between Canada and the United States).¹⁷³ The land holdings presented the government with a dilemma. On the one hand, populating these areas was critical for retaining them within the United States. The cheaper the land and other resources in these regions were, the sooner Americans would settle. On the other hand, federal lands offered the national government an important potential source of revenue.

Many Americans were unwilling to wait until the government declared a particular area open to settlement or to pay for the land, leading to a series of preemption acts, as political pressure forced the government to recognize the land claims of groups of squatters.¹⁷⁴ By 1830 much federal land was effectively opened to preemption claims.¹⁷⁵ In 1862 the revenue efforts were abandoned, and homesteading became the dominant method of opening new lands to settlement.¹⁷⁶

171. INGALLS, *supra* note 138, at 125–26.

172. See PUBLIC LANDS FOUNDATION, AMERICA'S PUBLIC LANDS: ORIGIN, HISTORY, FUTURE 16 (2014) (listing various land acquisitions from 1781 to 1867).

173. *Id.*

174. RAY ALLEN BILLINGTON & MARTIN RIDGE, WESTWARD EXPANSION: A HISTORY OF THE AMERICAN FRONTIER 41–42 (6th ed. 2001).

175. Mark T. Kanazawa, *Possession is Nine Points of the Law: The Political Economy of Early Public Land Disposal*, 33 EXPLS. ECON. HIST. 227, 240–41 (1996).

176. Gary M. Anderson & Dolores T. Martin, *The Public Domain and Nineteenth Century Transfer Policy*, 6 CATO J. 905, 908 (1987).

As this process unfolded, Congress made several efforts to preserve mineral deposits in lands to be disposed through homesteading. In 1846, for example, Congress "required the lead mines in Illinois, Arkansas, Missouri, and Iowa, to be offered, interdicting pre-emption until after the offering, and then at a minimum of \$2.50 per acre, but if not taken at private entry within a year of the public sale to be subject to sale as other lands."¹⁷⁷ Similarly, in 1846 when Isle Royal in Minnesota was opened to settlement, the Attorney General ruled that "salines, gold, silver, lead, and copper mines" were reserved for "future disposal of Congress."¹⁷⁸ Statutes in the late 1840s organizing territories around Lake Superior provided for the sale of mineral rights.¹⁷⁹

On the eve of the California Gold Rush, federal land policy was firmly headed in the direction of surface land disposal through free access. Mineral rights were still treated differently, in formal law if not in practice. Why? One possible explanation is the additional revenue from mineral rights sales over that available from land sales simply resulted in a different cost-benefit calculation by Congress. Existing states benefited from increases in federal revenues, giving them a reason to oppose free access to federal resources. However, eastern states' congressional delegations also had an interest in providing free land in the west because many easterners had relatives who had moved west. Given the high transactions costs involved in selling federal land, allowing free access to the lower valued land, but not the higher valued mineral rights, was a logical response. A second possible explanation lies in the long historical roots of reservation of mineral rights to the sovereign. Whatever the reason for the effort to establish control, efforts to retain the mineral rights in public hands did not succeed.

Western Gold

Beginning with the California Gold Rush of 1848-49, prospectors discovered substantial mineral deposits throughout the western United States for several decades. Although details differed, in general the rushes occurred in areas far from organized government and included rapid and substantial population increases. In many instances, miners organized their own customary legal institutions as a substitute for

177. DEP'T OF THE INTERIOR, GENERAL LAND OFFICE, REPORT OF THE COMMISSIONER OF THE GENERAL LAND OFFICE 385 (1866).

178. *Id.* 177

179. *Id.*

formal legal system.¹⁸⁰ These customary regimes allocated property rights and settled disputes until the formal legal system became established.¹⁸¹ The formal legal rules often incorporated some of the key principles from these customary legal systems. The best-known examples of reliance on customary legal regimes come from the California Gold Rush,¹⁸² which served as a model for many other western mining rushes.¹⁸³

California in early 1848 was a remote and isolated territory.¹⁸⁴ Through the early 1840s, the major industry in what was then the Mexican province of Alta California was a hide and tallow trade, conducted by the few thousand inhabitants of an area far from Mexico City and isolated by the vast interior of North America from the United States.¹⁸⁵ With the discovery of gold just a few days before Mexico and the United States signed the treaty ceding both California and the Southwest to the United States,¹⁸⁶ California began a transformation. In 1848, the population grew from 14,000 to 20,000;¹⁸⁷ by the end of 1849, 89,000 gold seekers had arrived in California.¹⁸⁸ The population grew to over 220,000 by the end of 1852.¹⁸⁹ Not surprisingly, the U.S. legal system was ill-prepared to cope with the issues raised by a major gold find.

Even if there had been a formal government body quickly established in California prepared to address property issues, it would have struggled with adjudicating the many conflicting claims. Land titles in California were poorly delineated, in part because Mexican law provided for “floating” land grants, under which grant recipients were able to designate the precise boundaries well after receiving the grant,

180. See Morriss, *supra* note 116, at 591–616 (1998) (explaining the system of customary law used by miners living in the West at this time).

181. *Id.* at 599–616.

182. See, e.g., JOHN UMBECK, A THEORY OF PROPERTY RIGHTS (1981); CHARLES R. SHINN, LAND LAWS OF MINING DISTRICTS (1884); CHARLES R. SHINN, MINING CAMPS: A STUDY IN AMERICAN FRONTIER GOVERNMENT (1885); THE DIARY OF A FORTY-NINER (Chauncy L. Canfield, ed. 1906); THE SHIRLEY LETTERS FROM THE CALIFORNIA MINES 1851-52 (Carl. I. Wheat, ed., 1970).

183. RODMAN W. PAUL, THE FAR WEST AND THE GREAT PLAINS IN TRANSITION 1859-1900 228 (1988).

184. See HOLLIDAY, *supra* note 117, at 42–43 (1981).

185. *Id.* at 26.

186. BAYARD TAYLOR, EL DORADO OR ADVENTURES ON THE PATH OF EMPIRE (1850).

187. DOYCE B. NUNIS, JR., FROM MEXICAN DAYS TO THE GOLD RUSH: MEMOIRS OF JAMES WILSON MARSHALL AND EDWARD GOULD BUFFUM WHO GREW UP WITH CALIFORNIA xlviii (1993).

188. HOLLIDAY, *supra* note 117, at 292.

189. T. H. WATKINS, GOLD AND SILVER IN THE WEST 40 (1971).

making property claims often have ill-defined borders.¹⁹⁰ Moreover, the vague terms and slow pace of the formal transfer of California to American jurisdiction, combined with difficulties caused by several corrupt Mexican governorships preceding the transfer, and the challenges of translating Spanish-language, civil law materials into an English-language, common law system, served to increase the uncertainty about the validity of many Mexican land grants.¹⁹¹ As a result, the ownership of much land in California remained uncertain and the subject of litigation well into the 1870s and 1880s.¹⁹²

Developing legal institutions for mining on the scale that occurred in California would have been challenging under any circumstances. The task was not made easier by the U.S. military governor's proclamation after the discovery of gold that Mexican mining laws were "abolished" coupled with his failure to provide an alternative system.¹⁹³ Further, California's rapid growth meant that newcomers quickly outnumbered existing residents and overwhelmed those existing institutions that had survived the cession to the United States.¹⁹⁴ To compound the difficulties, many of those pouring into California from around the world had little interest in building institutions. Most believed they had come to the remote region to get rich quickly in the gold fields, planning to return home within a few years at most.¹⁹⁵ Moreover, the circumstances of California's accession to the United States left much concerning its legal system unclear during 1846-1850.¹⁹⁶ The delay in filling the vacuum left by the abrogation of Mexican institutions had practical and political causes. The former was that the only representatives of American authority in the new territory were a few thousand soldiers, who were of little use as the military authorities declined to undertake civil administration.¹⁹⁷

190. See Andrew P. Morriss, *The Reception of Mexican Land Law in the United States*, in *LAW IN THE WESTERN UNITED STATES* 313-16 (Gordon Morris Bakken, ed., 2000).

191. *190Id.*

192. *Id.*

193. UMBECK, *supra* note 182182, at 69.

194. HOLLIDAY, *supra* note 117, at 300.

195. Morriss, *supra* note 116, at 597.

196. Briefly, John C. Fremont declared the California Republic on June 15, 1846, and U.S. troops took possession of the territory on July 7, 1846. The United States and Mexico signed the Treaty of Guadeloupe Hidalgo on February 2, 1848, officially declaring California to be U.S. territory. No civilian government was organized for California under U.S. law until the constitution written at a convention called by the military governor in 1849, which was accepted by Congress in 1850. Swenson, *supra* note 127127, at 20-21.

197. NUNIS, *supra* note 187187 at lii ("Unfortunately, the military government proved unequal to the task of establishing, let alone enforcing, law and order. It simply did not have the

The latter was that sectional differences over the question of whether new territories would be slave or free delayed Congressional action on organizing the newly acquired territories.¹⁹⁸

Congress considered ownership of mineral resources in the new territory during the debate over California statehood. In a proposed amendment to the bill to admit California into the Union (and to establish the territories of Utah and New Mexico), Louisiana Sen. Pierre Soulé proposed that California be required to “relinquish all title to claim or tax, dispose of, or in any way interfere with the primary disposal by the United States of the public domain within her limits,” that the new state promise not to:

interpose her authority and power so as to obstruct or impede any control which the United States may deem advisable to exercise over such districts in the mining regions (either now discovered or to be discovered hereafter) as may not be included in any lawful grant made to private individuals, or to corporations, prior to the cession of California to the United States,” and that the southern boundary of the new state be fixed at the Missouri compromise line.¹⁹⁹

The amendment failed 19-36 on a largely sectional vote.²⁰⁰ All nineteen supporters were southerners; only one opponent was from outside the north, Midwest, and border states. The same amendment was offered again at the third reading of the statehood bill and failed

manpower.”).

198. See Ronald C. Woolsey, *A Southern Dilemma: Slavery Expansion and the California Statehood Issue in 1850—A Reconsideration*, 65 S. CAL. Q. 123, 123–24 (1983) (explaining that the debate around California statehood embodied a larger debate from pro-slavery and anti-slavery leaders).

199. CONG. GLOBE, 31st Cong., 1st Sess. 1849 at 428–29 (1850).

200. *Id.* at 429. Voting in favor of the Amendment in addition to Soulé were senators David Atchison (D. Mo.), Robert Barnwell Smith (D. S.C.); John Berrien (Whig, Ga.), Andrew Butler (D. S.C.); Jeremiah Clemens (D. Ala.), Jefferson Davis (D. Miss.), William Dawson (Whig, Ga.), Solomon Downs (D. La.); Henry Foote (D. Miss.); Samuel Houston (D. Tex.); Robert Hunter (D. Va.), William King (D. Ala.), James Mason (D. Va.), Jackson Morton (Whig, Fla.), Thomas Rusk (D. Tex.), William Sebastian (D. Ark.), Hopkins Turney (D. Tenn.), and David Yulee (D. Fla.). Voting against were senators George Badger (Whig, NC), Roger Baldwin (Whig, CT), John Bell (Whig, TN), Thomas Benton (D. Mo.), Jesse Bright (D. Ind.), Lewis Cass (D. Mich.), Salmon P. Chase (Free Soil, OH), John Clarke (Whig, R.I.), Henry Clay (Whig, Ky.), James Cooper (Whig, Pa.), Thomas Corwin (Whig, Ohio), John Davis (Whig, Mass.), William Dayton (Whig, NJ), Daniel Dickinson (D. NY), Henry Dodge (D. Wisc.), Stephen Douglas (D. Ill.), Alpheus Felch (D. Mich.), Albert Greene (Whig, RI), John Hale (Free Soil, NH), Hannibal Hamlin (D. Me.), George Jones (D. Iowa), Jacob Miller (Whig, NJ), Moses Norris (D. NH), James Pearce (Whig, Md.), Samuel Phelps (Whig, Vt.), Thomas Pratt (Whig, Md.), William Seward (Whig, NY), James Shields (D. Ill.), Truman Smith (Whig, Conn.), Daniel Sturgeon (D. Pa.), Joseph Underwood (Whig, Ky.), William Upham (Whig, Vt.), John Wales (Whig, Del.), Isaac Walker (D. Wisc.), Daniel Webster (Whig, Mass.), James Whitcomb (D. Ind.). Party identifications from the Bibliographical Directory of the United States Congress, available at <http://bioguide.congress.gov> (last visited July 8, 2006).

on a similarly sectional 20-30 vote.²⁰¹ The same provision was defeated yet again, 76-131, also along sectional lines in the House.²⁰² Whatever the ultimate cause, Congressional inaction meant "a complete absence of federal legislation on mining between the years of 1848 and 1866."²⁰³

As a result, California developed a mining law that mixed customary law created by the miners and common law created by the state to provide a means of allocating valuable property rights during the gold rush.²⁰⁴ The miners' short time horizon gave them an incentive to keep transaction costs low, while the high value of the resources they were allocating gave them an incentive to make their rights secure. Initially left to their own devices, the miners chose contract over violence as the means of settling claims and initiated a system of mining law built around self-initiated free access to resources on public land.²⁰⁵ The result was a system of customary law that spread across the American west with the "old Californians," who participated in later mineral rushes.²⁰⁶ Miners' customary law had relatively few principles: self-initiated, free access to minerals on public land; a tort-based criminal law; and flexible provisions on claim size which adapted to technological changes in mining.²⁰⁷ This system proved remarkably effective at managing conflict among a population of armed men far from most civilizing influences.²⁰⁸

The rapid development of the California gold fields helped entrench customary mining law there.²⁰⁹ This was fortunate, as a Congress that could not even resolve the basic organizational questions concerning governing the new territory was in no position to tackle

201. CONG. GLOBE, 31st Cong., 1st Sess. 1849 at 553-54 (1850). Senators Badger (Whig, NC), Bell (Whig, Tenn.), and Pratt (Whig, Md.) switched their votes to support the amendment this time. Senators James Bradbury (D. Me.), Augustus Dodge (D. Iowa), Presley Spruance (Whig, Del.), and Robert Winthrop (Whig, Mass.) (Webster's replacement) who had not voted on June 28, voted no this time. Senator Houston (D. Tex.) did not vote on August 12 but had voted in favor on June 28; Senators Bell, Clay, Corwin, Dayton, Jones, Pearce, Phelps, and Webster (who had resigned) did not vote in August but had voted against the amendment in June.

202. CONG. GLOBE, 31st Cong., 1st Sess. 1849 at 1419-20 (1850). The disagreement between North and South over these amendments seems likely to have been the attempt by the South to create a portion of California that would become a slave state rather than concern about federal claims on mineral resources.

203. Swenson, *supra* note 127, at 21.

204. Swenson, *supra* note 127, at 23-24 (discussing the roles of common law and customary law).

205. See UMBECK, *supra* note 182.

206. Paul, *supra* note 183, at 28.

207. Morriss, *supra* note 190, at 601.

208. *Id.* at 597-98.

209. Morriss, *supra* note 116, at 594.

more complex issues. By the time Congress was able to address California's legal status, the region had written its own constitution and sent a delegation to Washington to seek admission as a state after electing a state government and appointing two senators in November 1849.²¹⁰ In short, the survival of free access and self-initiation appears to have been the result of the combination of California's rapid development and the federal Congress's paralysis.²¹¹

Unlike the federal government, California did not wait to put its stamp on mining law. It adopted provisions recognizing customary claims and attempted to limit the activities of foreign miners (through exclusionary taxes aimed at Chinese miners, for example).²¹² Californian politicians appear to have understood that the prosperity created by mining created wealth worth more than the rents available from attempting to tax the mines, or at least they recognized that existing claims created a powerful interest group unwilling to concede direct payments to the state. California's aggressive legitimation of miners' property rights helped secure them against expropriation by the national government. The discovery of mineral resources elsewhere in the west also boosted mining interests' ability to influence Congress. The vast silver deposits in Nevada (the Comstock Lode), for example, caused a boom that led that territory to statehood in 1864.²¹³

The California and later western gold and silver rushes produced enormous wealth. Naturally, this wealth, extracted in large measure from nominally public lands, attracted attention in Washington, D.C. From 1848 through the mid-1860s, Congress regularly debated different approaches to mining on public lands, including proposals to require sales of gold to the government at fixed rates, taxes on production, military seizure of the gold fields, and leasing arrangements.²¹⁴ Congress finally passed a federal mining statute in

210. Congress acquiesced in the Californians' proposals, and California became the thirty-first state on September 9, 1850.

211. It is possible that had Congress realized the extent of the resources at stake, it might have been able to overcome the sectional differences through creative sharing of the economic rents from mining. However, events overtook the political process, and the new Californians quickly seized the policy initiative and entrenched rules that kept the wealth in Californian hands rather than sharing it with Washington, D.C.

212. Morriss, *supra* note 116, at 591, n. 29.

213. *Id.* at 618.

214. HOLLIDAY, *supra* note 117, at 400. An important reason was that California's 1850 entry as a state gave mining interests a presence in the Congress, limiting the ability of the rest of the states to redistribute California's mineral wealth. In this endeavor, California was aided by strong connections between important figures in California and powerful politicians in Washington. For example, long-serving Missouri Senator Thomas Hart Benton's son-in-law was California Senator

1866, seventeen years after the discovery of gold at Sutter's Mill began the California gold rush, although it would be another six years before Congress passed a comprehensive statute governing mineral resources on federal land. The Mining Law of 1866, which gave explicit federal approval to free access to lode deposits on federal land,²¹⁵ "was drafted primarily by [Nevada] Senator [William] Stewart, who made his career as a mining lawyer on the Comstock Lode and represented the interests of the lode miners."²¹⁶ Stewart had served as attorney general of California from 1850 until he moved to Nevada in 1860.²¹⁷ The law provided that "the mineral lands of the public domain, both surveyed and unsurveyed," are "to be free and open to exploration and occupation by all citizens of the United States, and those declaring their intention to become citizens, subject to such regulations as may be prescribed by law," and "subject also to the local customs or rules of miners in the several mining districts, so far as the same may not be in conflict with the laws of the United States."²¹⁸ The 1866 law was followed by the Placer Act in 1870,²¹⁹ which provided free access to placer deposits.

The two statutes were then consolidated into the General Mining Law of 1872, which "corrected some of the deficiencies" in the two earlier statutes and "codified and defined the tenure system under which mining was to be conducted on public lands."²²⁰ It essentially employed the mining camp rules of priority, possession and development as keys to claims.²²¹ The 1872 act ratified two key principles derived from the customary mining law that applied to mining on public lands from 1848 to the late 1860s and have remained at the heart of American mining law ever since: (1) self-initiated free access to mineral resources on the public domain and (2) fee simple

John C. Fremont. Biographical Directory of the United States Congress, 1774-Present, "Thomas Hart Benton," <http://bioguide.congress.gov/scripts/biodisplay.pl?index=B000398>.

215. An Act granting the Right of Way to Ditch and Canal Owners over the Public Lands and for other Purposes, 14 Stat. 251 (1866); Stephen D. Alfers et al., *Coping with Mining Law Reform*, 37 ROCKY MTN. MINERAL LAW INSTITUTE 12-13 (1991) ("The chief significance of the 1866 law was that it was the first congressional declaration that the mineral lands of the United States were to be free and open to exploration and occupation for mining.")

216. Alfers et al., *supra* note 215, at 12-13.

217. Stewart, William Morris, 1827-1909, Biographical Directory of the U.S. Cong., <http://bioguide.congress.gov/scripts/biodisplay.pl?index=S000922> (last visited July 10, 2006).

218. 14 Stat. 251 (1866).

219. Act of July 9, 1870, ch. 235, 16 Stat. 217 (1870). Placer mining is, as opposed to hard rock mining, the sifting of metals out of waterways.

220. Alfers et al., *supra* note 215, at 12-14.

221. *Id.*

title to the resources for the claimant.²²²

In practice, the General Mining Law of 1872 offered prospective prospectors a deal: find a valuable resource on federal land, invest effort into developing the resource, and the resource (and the land containing it) becomes yours (after payment of a small fee), with fee simple title and no requirement to pay royalties on the mineral resources removed.²²³ The deal was attractive: from 1867 to 2000, 3.3 million acres of public land became private land under the Mining Law's provisions.²²⁴ Although the first reliable numbers came well after the boom, they showed that in 1870, mining in California brought in over \$20 million in capital, paid almost \$4 million in wages, and produced over \$8 million in annual output, respectively approximately 10, 5, and 5 percent of the 1870 totals in U.S. mining.²²⁵

The establishment of free access and fee simple title as the primary underpinnings of American mining law grew out of a combination of the experience with alternatives which weakened the appeal of those alternatives. Frontier conditions allowed the establishment of property rights based on customary law. The rapid establishment of mineral claims meant claim holders were a powerful interest group with

222. We discuss the General Mining Law's provisions in greater detail in Andrew P. Morriss et al., *Homesteading Rock: A Defense of Free Access Under the General Mining Law of 1872*, 34 ENVIRONMENTAL LAW 745 (2004). See also Andrew P. Morriss et al., *Hard Rock Homesteads: Free Access & the General Mining Law of 1872*, 24 J. ENERGY & NAT. RES. L. 255 (2006). Why would Congress ratify such a vast giveaway of public resources? There appear to be two answers. First, by the time Congress acted, many mineral interests in the West were well-established, wealthy, and able to protect themselves politically. Western politicians included not only California and Nevada's congressional delegations but also the territorial delegates from mineral rich territories such as Montana, Idaho, Colorado, and Dakota. Second, Radical Republicans dominated the three Congresses which adopted these three statutes, although their dominance was beginning to lessen in the 1870s. (In 1866 the Senate had 39 Republicans out of 54 members and the House 136 of 193. In 1870, the Senate had 62 Republicans out of 74 members and the House 171 out of 243. In 1872, the Senate had 56 Republicans out of 74 members and the House 136 out of 253.) California interests were prominently represented in Radical circles; John C. Fremont, for example, was a prominent Radical. Fremont briefly served as a candidate for the Radicals in the 1864 presidential election before withdrawing. Tom Chaffin, *PATHFINDER: JOHN C. FREEMONT AND THE COURSE OF AMERICAN EMPIRE* (2002). As a general in the Civil War, he issued a proclamation freeing slaves in Missouri in 1861, which was later rescinded by President Lincoln. *Id.*

223. See Morriss et al., *supra* note 222.

224. MARC HUMPHRIES & CAROL HARDY VINCENT, CONG. RSCH. SERV., *MINING ON FEDERAL LANDS*, (2001). This amounts to only 1.5% of all federal land privatized under all land disposal laws, however. Morriss et al., *supra* note 222.

225. The U.S. totals include all forms of mining, and so the percentages understate the contribution to total gold mining. Pennsylvania's coal mines were the major other source of mining wealth. The total land is equal to about half the size of the Houston metro area. Morriss, *supra* note 126, at 616.

representation in Congress through California and Nevada's statehood. The initial success of the western mineral rights holders in gaining recognition of their property rights did not mean that other interests would abandon efforts to obtain a share of the wealth.

Summary

One nation often cannot simply copy the legal institutions or experience of another that has enjoyed economic success that may be attributed, at least in part, to the legal regime that creates incentives for people to exploit economic opportunities, from mineral or other sources of wealth. Thus, the wholesale adoption of American law is not a viable option for the DRC. However, various jurisdictions have adopted some rules of law that encouraged development. For example, the Cayman Islands were a poor, mosquito-infested backwater in 1960 when they adapted laws from other jurisdictions that encouraged development of off-shore financial institutions which led to rapid economic success.²²⁶ Moreover, legal ideas 'borrowed' from other jurisdictions can be useful, even when used in a quite different context.²²⁷

A straightforward process would be for the DRC to adopt the mining laws from the United States, as well as institutions that protect property rights and encourages development of mineral assets. When ordinary people have the right to protect assets, they will work to keep them and pressure political leaders to protect their rights. When valuable assets, such as cobalt, are exploited, the government can tax the output when it leaves the country so that financial benefits may be spread more widely (as seen in Alaska). The government need not directly control production. Leave it to the mineral owners and the parties they work with to exploit assets. When substantial assets exist, multiple firms will provide information to owners about alternative arrangements that are possible. In the United States we see that with mineral rights when "booms" occur and multiple companies present options to landowners regarding mineral exploitation and payment. The lead experience in the United States showed that government

226. See Tony Freyer & Andrew P. Morriss, *Creating Cayman as an Offshore Financial Center: Structure and Strategy since 1960*, 45 ARIZ. ST. L. J. 1297 (2013); Andrew P. Morriss, *IFCs: Providing the Rule of Law*, IFC REV. (Feb. 2020).

227. Comparatist Alan Watson argues that such "legal transplants" will evolve in their new "host". See Alan Watson, *Legal Transplants: An Approach to Comparative Law* (2d ed., 1993) (A successful legal transplant – like that of a human organ – will grow in its new body and become part of that body just as the rule or institution would have continued to develop in its parent system. Subsequent development in the host system should not be confused with rejection.”).

exploitation of the mineral was fraught with problems that were dissipated when mineral rights became property of people on the ground. Such a straightforward transfer of laws and institutions is unlikely, however. The DRC's conditions, including the toxic legacy of colonialism, make such a simplistic approach doomed to fail. In the next section, we examine the consequences of the challenges in solving the resource curse to make green energy solutions more palatable in practice.

III. ADDRESSING GREEN ENERGY'S RESOURCE CHALLENGES

Many plans to change natural resource institutions have been offered to prevent the array of problems identified with the natural resource curse. Whether it is payment of royalties into a trust fund or publication of royalty details, however, such programs ultimately depend on the existence of other institutions (particularly courts and legal systems) to enforce accountability. When those institutions are absent, reforms are, unsurprisingly, ineffective. Moreover, when sovereigns have control of natural resources – as they do in a *de facto* sense in virtually all jurisdictions because of the high capital costs of resource extraction today – there are no good ways to avoid the danger that a sovereign will later renege on the deal, a temptation that is hard to resist once the rents become high enough. In the few cases where centralized solutions have succeeded for a time, these solutions have often proven not to be sustainable. For example, Venezuela created a widely praised state oil company that proved technically adept and non-corrupt – until Hugo Chavez and his successor found the lure of the oil money irresistible and changed it from a model of competence to a deteriorating bucket of money.²²⁸

The nineteenth century American examples illustrate the difficulties. Lead mining showed the need for a viable enforcement mechanism, which together with lead's requirement of central processing, made a simple royalty scheme just barely possible. However, only when honest military officers could be found to manage collection of government royalties at smelters was this effective. Sadly, honest collectors turned out to be difficult to find. Like lead, cobalt (and many other relevant minerals and rare earths) requires considerable processing. The entire DRC government need not be reformed to develop pockets of honest governance around processing

228. See, e.g., JAVIER CORRALES & MICHAEL PENFOLD, *DRAGON IN THE TROPICS: HUGO CHAVEZ AND THE POLITICAL ECONOMY OF REVOLUTION IN VENEZUELA* (2011).

sites, perhaps with the participation of NGOs or an international body like the African Union. While there remains the problem of the presence in the global market of China, a buyer relatively unconstrained by concerns for whether children are being used in artisanal mines, even China has shown willingness to “play by the rules” in a number of instances.²²⁹

The western mineral rushes temporarily solved many of the problems by awarding property rights to the finder of resources on public land. But murky private land rights in California and technically opaque formal laws yielded both extended litigation and judicial corruption, undermining the initial success of the property rights system as mining matured. And once mistakes such as the apex rule became embedded in the legal system, fixing them proved difficult. It is all well-and-good to conclude that “property rights matter,” but it is hard to find ways that do not encourage investing in reallocating them when they are as valuable as natural resources generally are. Again, the problem can be made more manageable by focusing reform efforts on the specific locations where the resources exist rather than trying to reform the entire Congolese legal system.

One response is that natural resource states face a chicken-and-the-egg problem. The solution is non-obvious and, perhaps, as non-existent as the answer to the old puzzle of whether the chicken or egg came first. Without effective governance institutions, enforcing transparency requirements, property rights, or methods of sharing royalties are not practical. Without the fiscal resources provided by developing natural resources like cobalt, funding the creation of effective governance mechanisms seems impossible. And, in the meantime, developing good governance while money is pouring into countries lacking effective institutions seems virtually impossible.

Another response might be to hope for a technological breakthrough that eliminates the need for massive quantities of cobalt to build an EV industry (and make cell phones, computers, and other technologies on which we have come to depend). That may well happen, or it may not – the next revolution in battery storage technology may require less cobalt but more of some other mineral mostly produced by children in failing states. It seems sufficiently likely

229. The record on this is mixed, Bringing China into the World Trade Organization imposed discipline in some instances to play by generally accepted international norms. See Petros Mavroidis and Andre Sapir, *China and the WTO: An Uneasy Relationship*, VOXEU, Apr. 29, 2021, <https://cepr.org/voxeu/columns/china-and-wto-uneasy-relationship>. Despite limited success, China is no longer the isolated regime of decades past.

that we will continue to be dependent on foreign producers of key mineral resources for some time to come that we need to address the problem that cobalt illustrated in this Article.

The central problem of natural resource states is that controlling pools of valuable resources induces destructive competition. In some ways, this is little different than controlling permits for land development, the issuance of patents, or the right to exchange currency at a favorable rate. The key difference between control of natural resources and other types of rent seeking is that the former is often capable of being controlled with relatively little need for a surrounding civil society while the latter generally involve corrupting institutions within a civil society. This encourages particularly brutal forms of rent seeking. It does little good to oversee land-use permits for Kinshasa, DRC, if no one wants to build buildings in Kinshasa. It does a great deal of good to control access to natural resources in the DRC, regardless of whether anyone wants to spend any time in the DRC. Indeed, this was precisely the circumstance in California in 1848-49 – few of the miners believed California had any future except as a source of gold as it was just too far away from ‘civilization’ (whether Mexico City or the eastern United States).²³⁰ Had there been someone capable of exerting control over the natural resources, there’s no reason to believe that a better outcome would have occurred then than does today in the DRC.

Part of the challenge is sometimes thought to be to convince those in a position to engage in rent-seeking that their gains will be greater from a “fair competition” for resources and the resulting economic activity than from grabbing the resources and looting the treasury. However, this may not actually be true; it may be completely rational for elites to loot their nations’ natural resources and gamble on holding on to power long enough to enjoy their ill-gotten gains. For example, we find it difficult to imagine how the family of Equatorial Guinea’s president, Teodoro Obiang, could prosper materially more than they currently do by using that country’s oil wealth as their personal wealth.²³¹ In theory, this could be addressed through financial controls on buyers subject to non-curse-afflicted governments elsewhere. But so long as there are substantial buyers uninterested in solving other

230. See HOLLIDAY, *supra* note 117, at 297 (“[m]iners shared an indifference toward California and its future.”).

231. Esward Mcallister, *Equatorial Guinea President to Run Again to Extend 43-Year Rule*, *Reuters*, Sept. 24, 2022, <https://www.reuters.com/world/africa/equatorial-guinea-president-run-again-extend-43-year-rule-2022-09-23/>.

nations' resource curses and governance problems, this strategy will not work. China's willingness to tolerate, and engage in, unsavory behavior in African resource states suggests that controls on western buyers will fail. Perhaps we should throw up our hands and accept that creating an electrified future for transportation is like the proverbial revolutionary omelet and it is going to take breaking some eggs to make it.

This does not seem acceptable to us. The story of mineral resources in the nineteenth century American west suggests three areas which merit exploration in finding a way out of green energy's resource curse. First, a key lesson from the California experience in particular is that finding ways to quickly recognize the informal property rights on the ground and grant them formal legal status (bring them under the 'bell jar' of the formal legal system, in de Soto's metaphor)²³² is critical to getting those rights treated as real constraints on an exploitative state's power. While the gold rush literature sometimes waxes eloquently about the innate respect for property rights of the '49ers (often pointing to Anglo-Saxon traditions and Germanic folk moots as predecessors despite the multicultural nature of the mining community in the gold rush), the tradition of rulers grabbing their subjects' resources was at least as strong. What gave the early U.S. gold rush miners the chance to get their rights established was the paralysis at the federal level which prevented the resource-grabbers from being able to preempt the on-the-ground appropriation. Unfortunately, many outside schemes to address resource curse issues focus on strengthening national institutions which end up captured rather than focusing on documenting rights claims on the ground. Reversing that priority may help.

Second, the resource curse exists because of the value of the resources to be grabbed. The demand for cobalt is largely a function of the strategy of electrifying vehicles to curtail greenhouse gas emissions. However, there seems to be little consideration of the impact on developing countries most afflicted by the green energy resource curse of adopting such strategies. Explicitly considering how green energy initiatives will affect the resource curse would at least force policymakers to acknowledge the tradeoffs they are making. Doing so might shift the policy debate to finding reductions in other areas which are less destructive for the DRC's children, particularly as gasoline and diesel motor vehicles represent a relatively small proportion of such

232. Hernando de Soto, *The Mystery of Capital* 66–67 (2000).

emissions, making the gains from the massive shift necessary to move from gasoline and diesel to EVs relatively small.²³³ Being clear about the costs of policies is thus useful.

Finally, the concentration of cobalt reserves in the DRC is not simply a matter of geographical luck. We find cobalt and other key minerals in places like the DRC in part because no one is looking for them closer to home. Mining in the United States is a relatively small industry today due to the understandable reluctance of many Americans to have mines in their metaphorical backyards.²³⁴ But the tradeoff from not looking for and exploiting cobalt and other mineral deposits in the United States when found is not that no one will mine these resources but that they will be dug from the ground by children and other vulnerable people in places with poor governance. This is as much a cost of the EV strategy as the increased transmission grid infrastructure needed to bring renewable energy to where EVs will charge or the cost of building charging networks in residential areas that lack off-street parking. Virtually every policy involves tradeoffs – explicitly acknowledging and addressing them is a key to better policymaking.

233. See Alan Reynolds, *Blaming U.S. passenger vehicles for climate change is ignorant but lucrative*, Cato at Liberty (Sept. 10, 2021) available at <https://www.cato.org/blog/blaming-us-passenger-vehicles-climate-change-ignorant-lucrative-1> (calculating that U.S. passenger vehicles are responsible for only 16.4% of U.S. greenhouse gas emissions and less than 2.5% of global emissions).

234. On U.S. NIMBYism about mining, see, e.g., Joe Fowler, et al., *On mining decision, NIMBY wins over rule of law*, STAR TRIBUNE (Feb. 3, 2022) available at <https://www.startribune.com/editorial-counterpoint-on-mining-decision-nimby-wins-over-rule-of-law-climate/600142801/>; Sean Brodrick, *NIMBY Accelerates the Coming Lithium Supply/Demand Squeeze*, Wealth Wave (July 24, 2021), available at <https://weissratings.com/en/wealth-wave/nimby-accelerates-coming-lithium-supplydemand-squeeze/>. The majority of metals, in some cases 100 percent, are imported. See U.S. GEOLOGICAL SURV., *supra* note 8. Of course, the United States does not have large reserves of all minerals, but even when there are, the difficulties in obtaining mining permits make it simpler to import.