

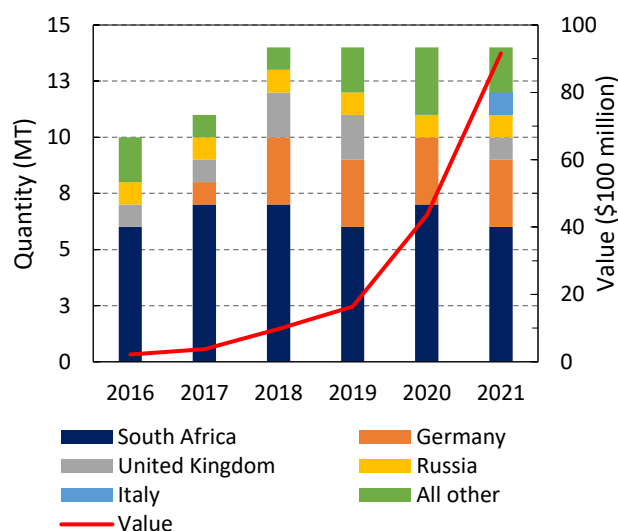
A Small Colossus: Rhodium and Russia

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Rhodium metal is critical to the U.S. economy and national security. When the war in Ukraine began in February 2022 and discussions about sanctions against Russia started, many reports highlighted the Western world's reliance on rhodium and Russia's position as one of the largest suppliers of the metal. This executive briefing describes rhodium, its uses, and Russia's role in the rhodium market.

Rhodium: Rhodium is a platinum group metal (PGM), one of a collection of rare and precious metals used in small amounts by various industries.¹ Platinum-rhodium alloys are used to manufacture nitric oxide, a primary input used to produce explosives, fertilizers, and nitric acid. In the petrochemical industry, catalysts containing rhodium are used to produce value-added chemicals from petroleum feedstocks. Rhodium is also used as a catalyst in the production of consumer-oriented chemicals like menthol, the minty flavor ubiquitous in gum. Due to its hardness, rhodium is sometimes used in jewelry to improve scratch and corrosion resistance. Despite its various uses, about 80 percent of rhodium demand is driven by the automotive industry, where it is used in catalytic converters. In catalytic converters, rhodium is critical for reducing NO_x emissions, pollution that leads to smog and respiratory health issues.²

Figure 1: U.S. imports of rhodium, quantity (metric tons) and value (dollars), 2016-21



Source: USITC/Census DataWeb, HTS subheadings 7110.31 and 7110.39, accessed August 4, 2022.

Scarcity, Supply, and Russia: Like other PGMs, rhodium is rare and only extracted in certain regions.³ Rhodium is largely discussed as part of the larger group of PGMs, so data specific to rhodium production and consumption is difficult to isolate.⁴ It is typically a byproduct of other metal mining or from recycling operations, and there is currently no production of primary rhodium in the United States. The principal sources of non-recycled rhodium are, in order of capacity, South Africa and Russia. South Africa has historically provided the majority of U.S. rhodium imports, with the remaining balance coming from Europe, including Russia (figure 1). Despite Russia accounting for only 7 percent of U.S. rhodium imports, the United States is consistently the top export destination for Russian rhodium, and exports of rhodium from Russia to the U.S. exceeded \$660 million dollars in 2021.⁵

¹ Precious metals have a perceived scarcity and high economic value. Platinum, iridium, osmium, palladium, and ruthenium are other PGMs.

² Other PGMs, palladium and platinum, are responsible for mitigating other pollutants in vehicle exhaust.

³ Of the three PGMs used in catalytic converters, rhodium is the least abundant.

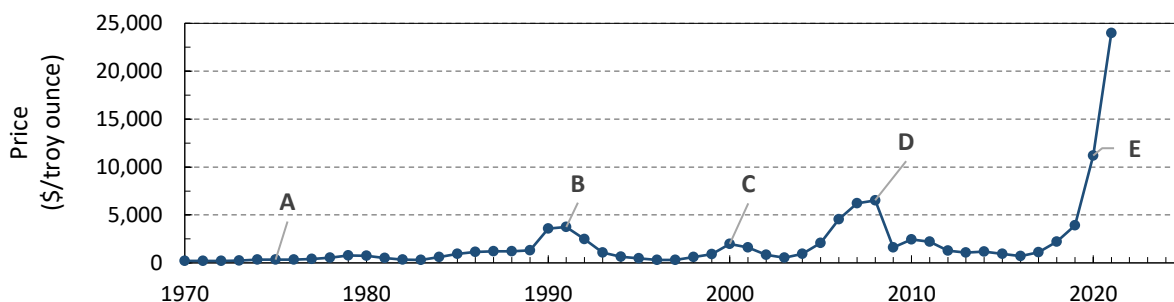
⁴ Estimates from 2012 indicate that 90 percent of known PGM deposits are in three regions—72 percent in South Africa (Bushveld Complex), 10 percent in Russia (Noril'sk-Talnakh area), and 8 percent in Zimbabwe (Great Dyke).

⁵ Russia stopped reporting trade statistics in April 2022. Official export statistics from Russia under HS headings 7110.31 and 7110.39 as reported by national statistical authorities in the Global Trade Atlas database, accessed August 8, 2022.

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The global price of rhodium has undergone several periods of temporary increases due to supply disruptions. Before 1978, three years after introduction of the catalytic converter, the price never exceeded \$500 per troy ounce (figure 2).⁶ Prices remained stable until the early 1990s, when refinery issues in South Africa contributed to supply disruptions. Then a set of shocks in the 2000s involving PGM speculation and the rise in demand in the Asian auto market caused respective price increases. The following decade saw relatively consistent and lower rhodium prices, which increased spectacularly starting in 2020. The average annual price peaked at \$24,000 per troy ounce in 2021 and has since fallen to about \$15,000 per troy ounce in August 2022, which is still well above any previous spike.

Figure 2: Price of rhodium in dollars per troy ounce, 1970–2021



Source: Compiled from USGS, “Metal Prices in the United States Through 2010,” March 5, 2013; USGS, “Platinum Group Metals,” January 2016; USGS “Platinum-Group Metals,” January 2022.

Notes: (A) widespread introduction of catalytic converters; (B) South African refinery issues; (C) speculation over Russian palladium reserves; (D) increased demand in Asian auto markets; (E) COVID-19 pandemic.

Various factors contributed to rhodium’s recent market behavior, including supply chain disruptions caused by the COVID-19 pandemic. Additionally, in early 2020, major South African producer Anglo American Platinum (“Amplats”) experienced an explosion at its facility, which forced the plant to close. In Q4 2020 it closed another part of its Waterval smelter complex for a full rebuild. Thus, 2021 began with an overall rhodium supply deficit of about 107,000 troy ounces, or about 11 percent of global demand.

Outlook: Rhodium prices have remained high throughout 2022 due to sequential shocks to the global supply chain. Some of the price hike may be attributable to speculation over anticipated tighter supplies, in addition to logistics issues. Russia’s invasion of Ukraine has disrupted multiple critical material supply chains, including another PGM, palladium.⁷ Like palladium, rhodium is transported by air and many airspaces, including those in the United States, have been closed to Russian aircraft since the start of the war. Despite Russia not being the largest rhodium source, speculation of Russian PGM shortages in the past led to a 20 percent increase in the price of rhodium from 1999 to 2000. Thus, it is likely the war will contribute to elevated prices in the immediate future. In the longer-term, however, demand for rhodium may decrease. Electric vehicles do not require catalytic converters, meaning the rise of that market segment will eventually decrease demand for rhodium and the other applicable PGMs.

Source: DeCarlo and Goodman, “[Russia, Palladium, and Semiconductors](#),” May 2022; Loferski, “[Platinum-Group Metals](#),” 2012; MetalsDaily, “[Live PGM Pricing](#),” accessed August 4, 2022; National Research Council, “[The Role of the Chemical Sciences](#),” 2012; PRNewswire, “[The U.S. is Desperately Short](#),” February 27, 2020; Reuters, “[Russia Suspends Publication](#),” April 21, 2022; Schwarcz, “[The Right Chemistry](#),” September 10, 2021; Troutner, “[Rhodium is Earth’s Rarest](#),” December 14, 2021; USGS, “[Platinum Group Elements](#),” December 19, 2017; USGS, “[Platinum-Group Metals](#),” January 2022; USGS, “[U.S. Geological Survey Releases 2022](#),” February 22, 2022; Warwick, “[Amplats’ ACP Unit B Closure](#),” November 9, 2020; Warwick, “[Palladium Spot Price Jumps](#),” March 3, 2022.

⁶ Palladium is often traded in troy ounces, where 1 kilogram equals 31.1507 troy ounces.

⁷ No U.S. sanctions on Russian rhodium have been enacted as of October 2022.

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