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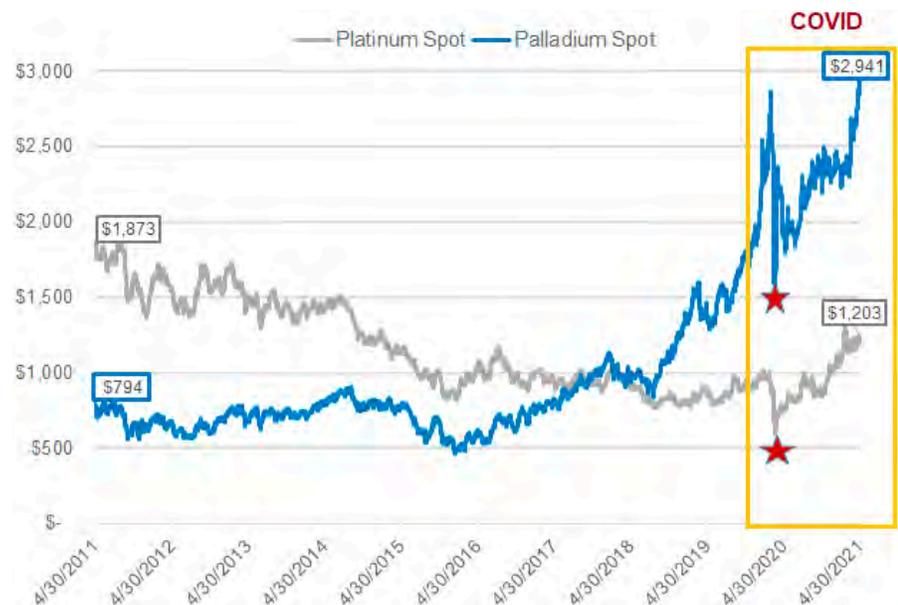
### Palladium is “Up and to the Right”

#### Palladium Price Nears \$3,000

With palladium trading near record highs, we revisit the drivers behind palladium’s pricing. Palladium and platinum have both enjoyed a robust recovery since hitting COVID-19 pandemic lows in early March 2020 (red stars, Figure 1).

Although the one-year price trends look relatively similar for the two PGM (platinum group metals) (Figure 1, yellow box), a look back over the past 10 years reveals a different, more divergent performance pattern — and highlights that palladium (blue line) and platinum (gray line) markets have faced significant differences in their fundamentals. We believe that palladium has regained its pre-pandemic momentum and discuss the case for continued strength in already-high palladium prices. Although apples to oranges, it is worth noting that palladium has managed to outperform the S&P 500 Total Return Index for the 1, 3, and 5 year periods ending April 30, 2021, and has provided comparable returns for the 10 year period (Figure 2).<sup>1</sup>

**Figure 1. Palladium’s Long-Term Trajectory has Been on the Rise Since 2015**



Source: Bloomberg. Data as of 4/30/2021. Palladium spot is measured by Bloomberg XPD Currency and Platinum is measured by the Bloomberg XPT Currency.

**Figure 2. Average Annual Total Returns, 10-Year Periods Ended 4/30/2021**

Investment	1 YR	3 YR	5 YR	10 YR
Palladium Spot	49.25%	44.89%	36.41%	13.99%
Platinum Spot	54.85%	9.98%	2.26%	-4.33%
S&P 500 TR Index (SPXT Index) <sup>1</sup>	45.98%	18.67%	17.42%	14.17%

# Special Report

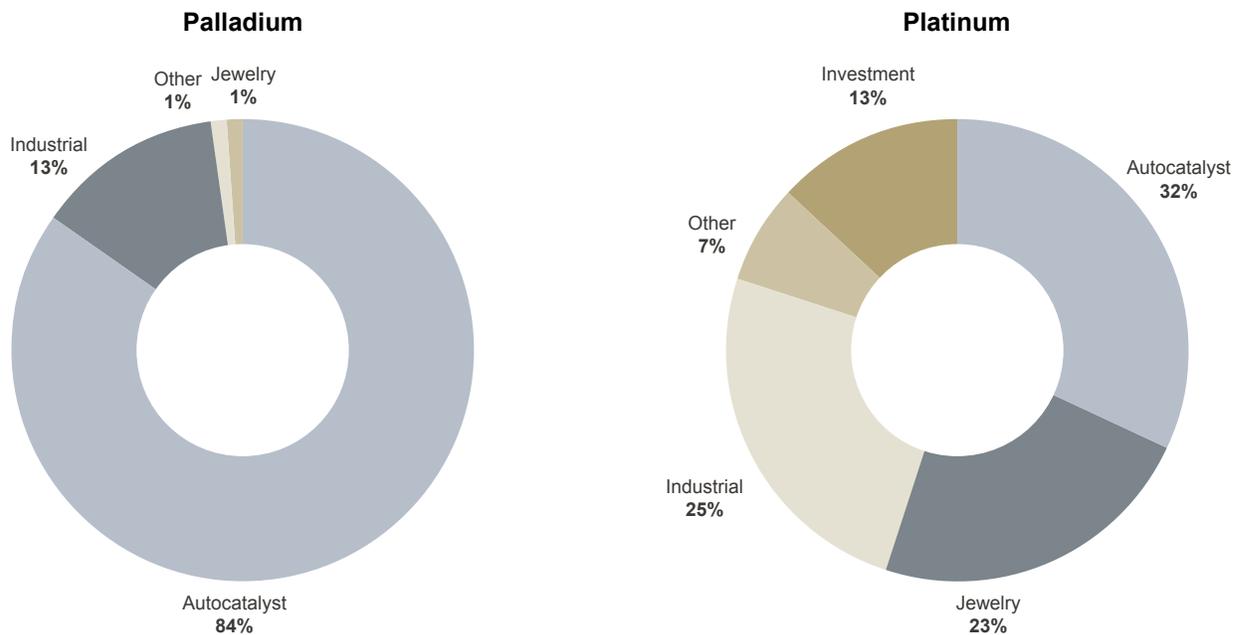
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## Automotive Demand is Back in the Driver's Seat

Palladium demand is highly concentrated in automotive uses, with about 84% of yearly demand coming from auto production. While palladium's "sister metal" platinum is used in a range of industrial applications and has investment demand and jewelry production, palladium use is far more focused on the auto sector and autocatalysts.

### Figure 3. Palladium vs. Platinum Uses

The primary driver of demand for Palladium (Pd) and Platinum (Pt) is the automotive industry. Both metals are critical elements in manufacturing catalytic converters, which help reduce toxic emissions from vehicle exhaust. Rising car production (especially in emerging economies) and tightening emissions standards worldwide have fueled steady growth in the use of catalytic converters.



Source: PGM Market Report February 2021.

In 2020, the COVID-19 pandemic negatively impacted auto production, pushing overall manufacturing down about 15% for the year. Global auto demand, however, is expected to make a significant rebound in 2021. The latest forecasts have auto production up about 9% for 2021, and we see that growth reflected in higher palladium prices.<sup>2</sup>

As the post-COVID auto rebound takes hold, the big-picture trends for palladium are gaining momentum. As long as auto demand is stable, palladium demand is likely to remain robust. The global push for cleaner emissions standards is driving palladium loadings ever higher on European and U.S. gasoline vehicles. Stricter environmental regulations in Europe, North America and China are the key factors, and we expect the pressure for emissions progress to continue.

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## Palladium Sourcing Problems Persist

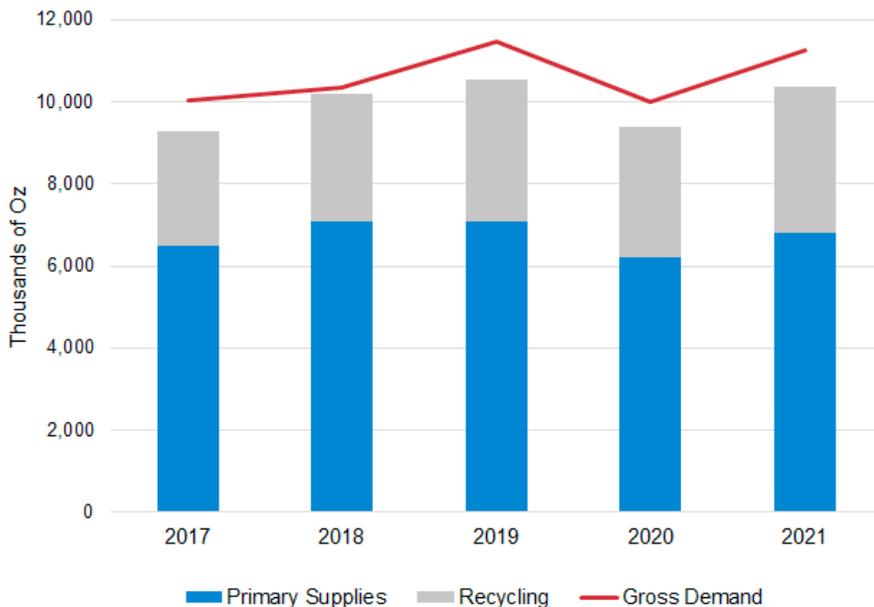
A primary driver of higher palladium prices remains the structural deficit in which demand continues to greatly exceed combined primary and secondary supplies, despite record recoveries of palladium from automotive scrap and sharply higher output in South Africa. 2021 is likely to be the 10<sup>th</sup> consecutive year that palladium supply is in a deficit. Sourcing has become a critical issue for automakers, and at one point, we even saw a trend where thieves were stealing car mufflers to sell the metals back into the recycling market. On the other hand, one valuable source of palladium has been the return of more than 2.5 million ounces of palladium from investors cashing in palladium ETF gains between 2015 and 2020.<sup>3</sup>

Palladium, like platinum, is rare to find and difficult to mine. About 75% of palladium is mined in South Africa and Russia, forecasted in 2021 to be split about equally between the two countries.<sup>3</sup> There was a significant interruption to mining activity because of the COVID pandemic, especially in South Africa, but analysts expect a recovery in 2021. Also, high prices should support robust supply in the palladium recycling market (sourced primarily from palladium recovered from spent autocatalysts). Still, the yearly deficit is a source of pressure, and the above-ground global stock of palladium is incredibly low.

“Most automotive palladium demand is for light-duty gasoline applications that require palladium-rhodium three-way catalysts — the dominant emissions control technology for the past two decades.”<sup>3</sup>



**Figure 4. Palladium Supply Continues to Fall Short of Demand**



Source: Johnson Matthey PGM Market Report May 2021.

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## Marginal Impact from Platinum Substitution

Over the last two decades, the auto sector substituted away from platinum toward palladium. At present, the volume of palladium going into autos is much higher. Annually, about ~9.5 million ounces (Moz) of palladium are used in autos, compared to ~2.9 Moz of platinum.

With palladium prices shooting higher and sourcing struggles ongoing, automakers are slowly shifting back to platinum. Analysts are projecting about 1.5 Moz of current annual palladium usage will revert to platinum by 2025. Still, that's a slow process and a marginal amount compared to the total volume of palladium (which still faces higher future loadings to meet clean-air emissions targets).

## Palladium's Industrial Use is on the Rise<sup>3</sup>

While industrial applications account for less than 15% of total palladium demand, the Chinese chemicals industry has been a vital source of growing use. As China modernizes its industrial infrastructure, it needs to increase the production of chemicals essential for industrial processes. Palladium catalysts, for example, are widely used in China to produce mono-ethylene glycol (MEG) from domestically produced coal (MEG is traditionally made using ethylene oxide and does not require a PGM catalyst).

China also uses palladium catalysts in many of its new propylene oxide plants using the HPPO (hydrogen peroxide to propylene oxide) process. Propylene oxide is used in the synthesis of the insulation material polyurethane. The COVID-19 pandemic fueled the growth in home deliveries of fresh, chilled food, while cold chain capabilities have been critically important for COVID-19 vaccine distribution.

## The Inflation Question

As the prospect of inflation starts to filter back into the economy, some investors are concerned about the possibility of a commodity "supercycle" and what that means for palladium pricing. We believe that the impact of broader inflation is not as relevant to palladium prices. Palladium is less used for investment demand and general store of value than gold, silver and even platinum. Instead, the fundamentals — especially auto demand — will continue to be the driving force behind palladium prices.

## "Up and to the Right": Expecting Trends to Continue

Overall, we see continued support for palladium prices, even at the higher levels they've touched post-COVID. Supply and demand fundamentals have once again come into focus. Robust palladium demand from the automotive sector is expected to continue while supply response remains persistently problematic. In our view, the longer-term fundamental trends remain firmly supportive for palladium.

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<sup>1</sup> S&P 500® Index represents 505 stocks issued by the 500 largest U.S. companies and is viewed as a leading indicator of U.S. equities. The SPXT Index represents total return with dividends reinvested.

<sup>2</sup> Source: [Automotive Powertrain Forecast 2020 - 2030](#).

<sup>3</sup> Johnson Matthey PGM Market Report May 2021.

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