

PLATINUM PERSPECTIVES

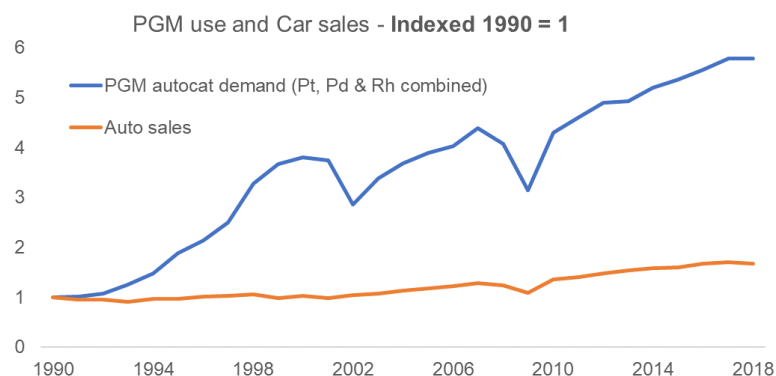
Tighter emissions standards and substitution will drive platinum demand growth despite weaker auto sales

Global light vehicle sales in 2019 are 4.2% lower* than in 2018; which some see as a reason for rising PGM prices to pull back. Historically, **tightened emissions standards rather than increased vehicle sales cause PGM demand growth** (chart below left). Between 1990 and 2018 annual car sales rose from c.54 m to c.94 m but PGM use in autocatalysis was up from 2.2 moz per annum to 12.6 moz per annum. China 6 caused autocatalyst loadings growth in an analogous way this year. (Figure 3, Page 2)

Flawed emissions control of European diesel cars contributed to the c.40% fall in diesel car annual sales in that market (8.5m to 5.3m) but resulted in platinum use in autocatalysts falling only c.20%. This was due to platinum loadings increasing to meet lower emissions limits in cars and trucks (chart below right).

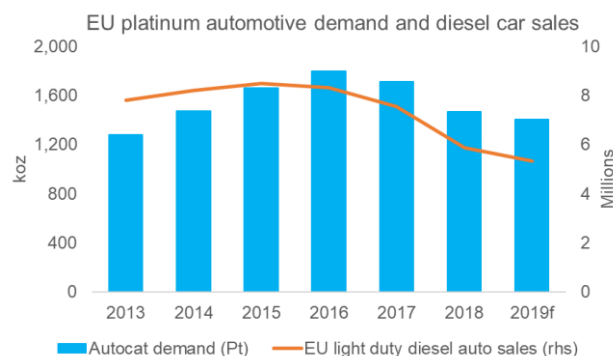
Global light vehicle annual sales of 90.5m (at end-Sep*) compare to 94.4m vehicles sold last year. Although vehicle sales in China fell by 8.7% to 25.3m/y, sales in Europe are up 2.4% to 16.5m/y (Figure 2, Page 2) with a slowing decline in diesel share and a higher portion of diesel in Germany, the largest EU market (up 2% to 34% in the first 9m of 2019).**

Total PGM autocatalyst demand growth well above global auto sales growth over 28 years (5.8 times v 1.7 times)



Source: OICA, LMC Automotive, Johnson Matthey. Indexed chart with 1990 = 1

Higher car & truck loadings partly offset diesel car sales loss (From 2016: sales -36%, Pt auto -22%)



Source: Johnson Matthey, OICA, LMC Automotive, WPIC Research

The high price, sustained demand growth and limited supply growth of palladium makes **material platinum demand growth due to substitution almost certain**. Resolving divergent views on the 'when' of this substitution is being helped by several detailed examples of the 'how'. Initial concerns focused on reduced washcoat stability in high temperature gasoline engines. This is said to cause platinum particles to agglomerate more than palladium ones (losing surface area and catalytic efficiency through sintering). This is now shown to be less relevant as substitution can occur first in large, low temperature gasoline V6 and V8 engines in the US, in lower temperature underfloor catalyst bricks in gasoline cars and in palladium-containing diesel autocatalysts. This substitution is sufficient for meaningful platinum demand growth. If platinum replaces only 10% of palladium in these use areas its demand growth will be over 400 koz per annum.

Many investors may have been unaware of palladium use in diesel catalysts when considering substitution by platinum. This substitution has much lower emissions control risk; significantly shortening implementation lead time.

*Seasonally adjusted annual rates, **Source: LMC Automotive

German diesel car market share recovering. (9m to Sep 2019 (34%))



Source: LMC Automotive, WPIC Research

Light duty diesel autocatalysts now contain between 25% (EU) and 50% (US) palladium on average. Johnson Matthey, May 2019

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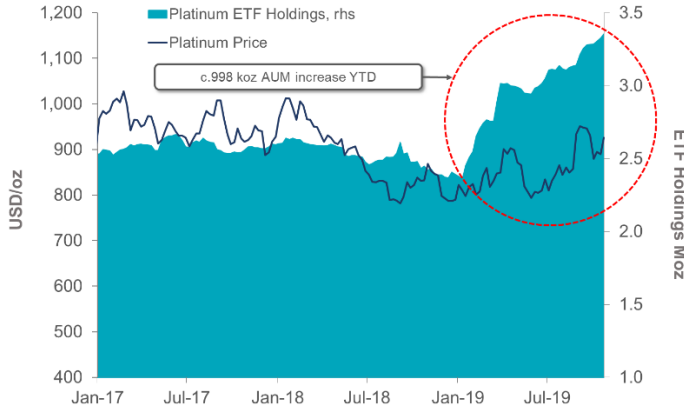
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Platinum's attraction as an investment asset arises from:

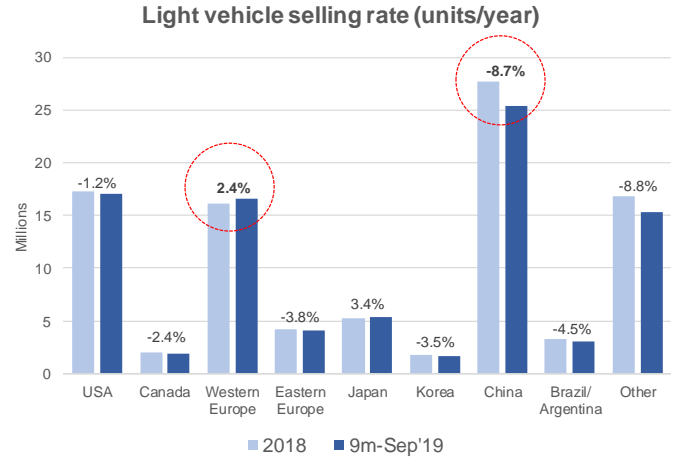
- Supply is relatively constrained with limited investment in new platinum group metal (PGM) mines
- Platinum price is at all-time lows relative to gold and to palladium
- Total PGM demand growth should continue due to increasingly restrictive emissions rules
- Market balance mismatches between palladium and platinum argues for substitution
- Investment demand has surged as institutions begin to factor low price and positive fundamental outlook

Figure 1: Platinum ETF holdings up 998 koz year-to-date



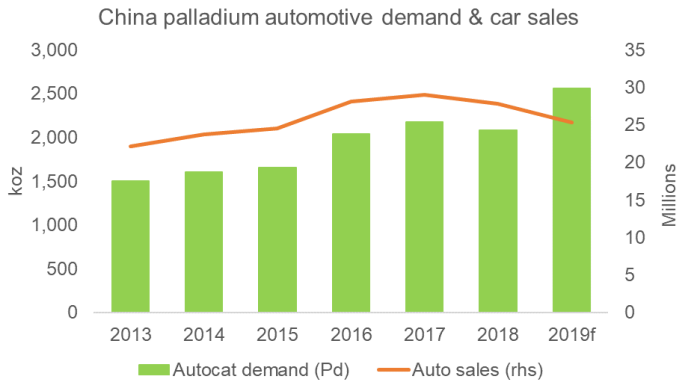
Source: Bloomberg, WPIC Research, as at 31 October 2019

Figure 2: Global light vehicle annualised sales rates in 2018 and 9m to September 2019. World down 4.2% to 90.5m/y



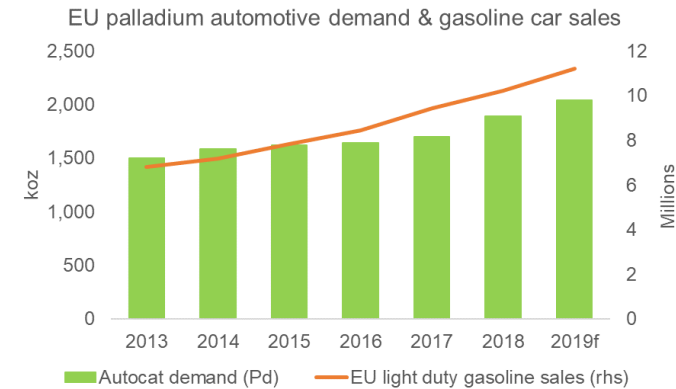
Source: LMC Automotive, WPIC Research

Figure 3: Palladium autocatalyst demand in China is growing despite lower vehicle sales (mostly gasoline)



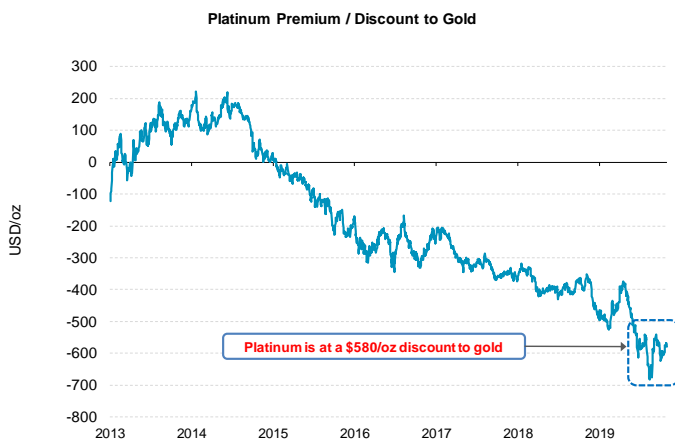
Source: Johnson Matthey, OICA, WPIC Research

Figure 4: Palladium autocatalyst demand in Europe is growing on lost diesel sales and lower emissions



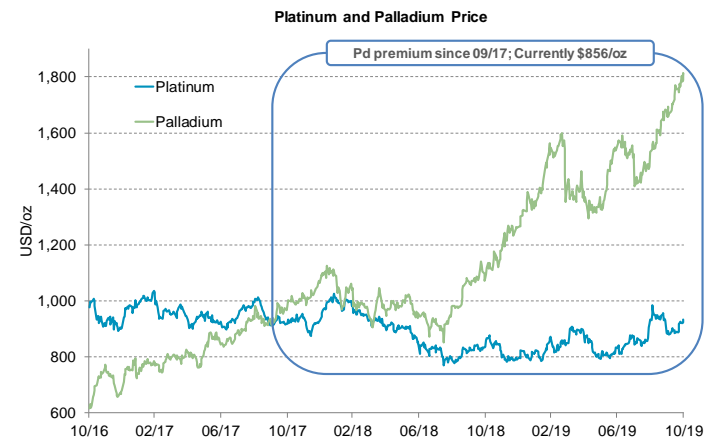
Source: Johnson Matthey, OICA, WPIC Research

Figure 5: Platinum's deep discount to gold remains historically extraordinary



Source: Bloomberg, WPIC Research, as at 31 October 2019

Figure 6: Palladium's price premium to platinum reflects a tight market and highlights the incentive for substitution



Source: Bloomberg, WPIC research, as at 31 October 2019

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