

Where will diesel car platinum loadings go?

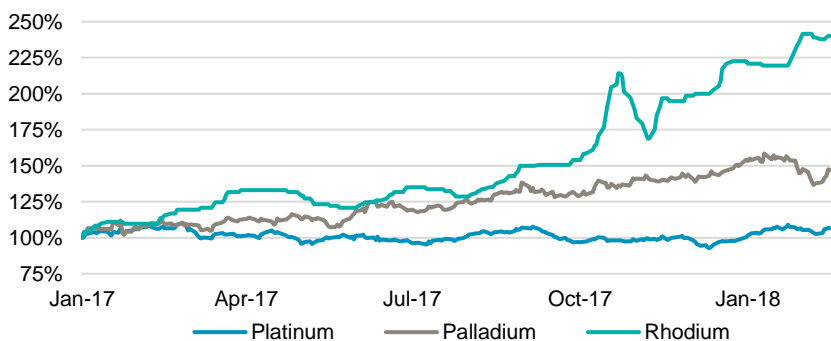
We believe automakers' emission strategies to avoid non-compliance make falling loadings (i.e. "thrifting") less likely than in the past; and consequently there is upside, rather than downside, to platinum loadings.

Market assumption: Even if the declining share of diesel cars on the road in Europe 'levels off'; platinum demand from vehicles will fall as **platinum loadings decline** in line with efficiency improvements achieved in the past (thrifting).

Our view: Previously, when new emissions limits were introduced, Euro 4 and Euro 5 for example, many automakers 'over-engineered' emissions systems with higher metal loadings to avoid the risk of exceeding the regulatory laboratory test emissions levels. Over time, automakers would then reduce or 'thrift' metal, always ensuring that in-lab type-approval emissions testing was achieved using the lowest possible platinum group metal loadings. Thrifting teams were incentivised to just 'pass' the in-lab test with the lowest cost system.

In its Platinum Group Metals market report published on 14 February 2018 Johnson Matthey (JM) expects platinum loadings on European diesel cars to decline. This is despite the current adverse sentiment towards automakers and anecdotal evidence that thrifting teams have been disbanded to avoid the risk of non-compliance or having model operating conditions too close to regulatory emissions limits. **The vast bulk of diesel cars made over the last few years substantially exceed new legal NO_x levels on the road. We believe automakers will try to rebuild their credibility and reputation with consumers and regulators, consequently higher platinum loadings are likely.** The 20% saving in platinum from moving to SCR from LNT technology is unlikely to offset the higher loadings needed to address NO_x and the risk of non-compliance.

Palladium and rhodium prices up c50% - 250%



Source: Bloomberg

Market assumption: Improved NO_x performance for diesels is needed but will be achieved through higher rhodium, rather than higher platinum loadings.

Our view: We have reported previously that automaker low-NO_x strategies will include higher PGM loadings. Under current EU regulation, some automakers need to reduce on-the-road NO_x levels by a factor of 10x, from over 800mg/km to below 80mg/km. Some fabricators, including JM, suggest rhodium has and will continue to assist in reducing NO_x. We believe **rhodium's recent rapid price increase supports the selection of platinum for NO_x reduction.** Fabricators cannot share loading strategies of their automaker customers; making it difficult to verify this trend (and confirm increased platinum loadings).

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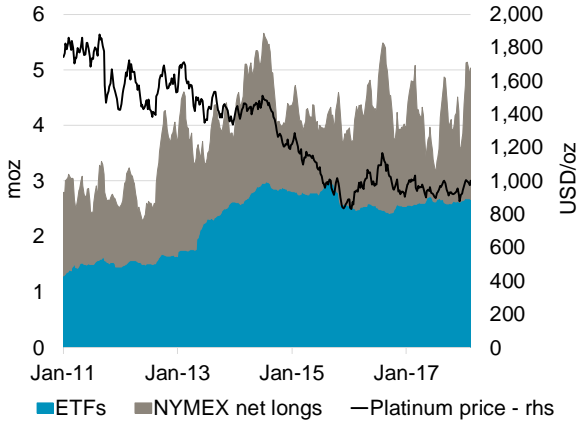
February 2018

Platinum in six charts – February 2018

We believe there are many reasons supporting consideration of platinum as an investment asset:

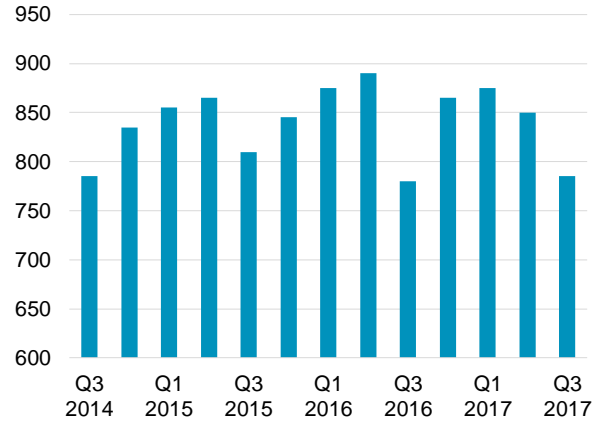
- Supply demand fundamentals are robust and ETF holdings are stable, despite price volatility
- Risks of supply declines are underestimated - cost pressure and falling mining investment continue
- Downside risks to platinum automotive demand are overestimated
- Futures positioning follows sentiment with high correlation to price
- Platinum is undervalued against its past, its production cost, against gold and against palladium

Figure 1: ETF holdings stable despite price volatility; correlation between futures positioning and price



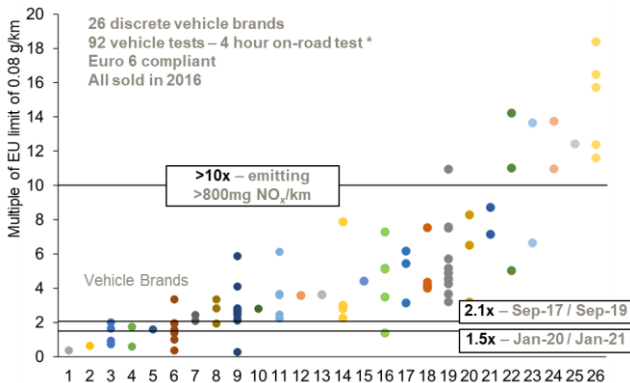
Source: Bloomberg, ETF providers, WPIC Research

Figure 4: Automotive demand starting to be impacted by European diesel share falls plus usual Q3 weakness (koz)



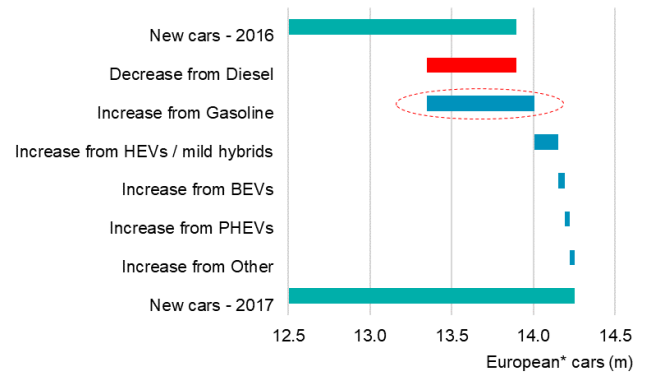
Source: WPIC Platinum Quarterly Q3 2017, SFA (Oxford)

Figure 2: Automakers' NOx emissions vs standards



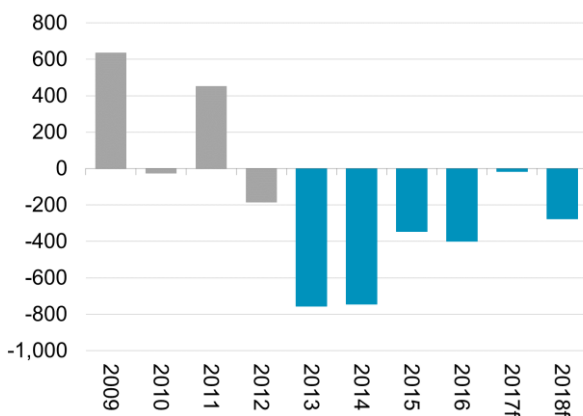
Source: Emissions Analytics

Figure 5: Diesel vehicles lost continue to be replaced by gasoline more than hybrid or battery vehicles



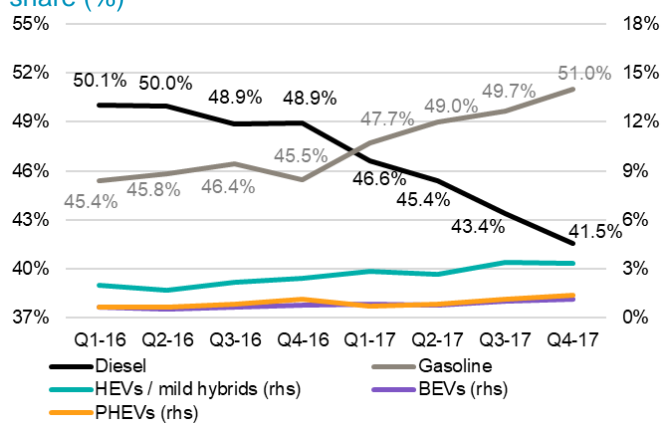
Source: LMC, ACEA, WPIC research

Figure 3: Platinum supply demand balance (koz)



Source: Johnson Matthey (2009-12), SFA (Oxford) (2013-18)

Figure 6: European* passenger powertrain market share (%)



Source: LMC, ACEA, WPIC research

* Europe includes passenger vehicles in Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, UK, Norway and Switzerland (based on the availability of both diesel market share data and Alternative Fuel Vehicle data). HEVs – Hybrid Electric Vehicles; BEVs – Battery Electric Vehicles; PHEVs – Plug-in Hybrid Electric Vehicles

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