PGM basket case

Implications for market development strategies

Richard Stewart
EVP Business Development

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Palladium supply forecast

- Primary supply expected to remain flat to marginally increase with declining South African Production offset by increased Russian Production and net increase in North America due to Blitz ramping up at Stillwater.
- Secondary supply expected to continue to grow as life cycle of increased gasoline cars begins to impact recycling numbers.

Source: Johnson Matthey, SFA Oxford, WPIC, company estimates

Palladium supply constant, driven primarily by regions where basket prices are not platinum dependent.
Palladium demand remains an auto story

- Palladium continues to have a much higher exposure to auto demand growth, given its primary use in gasoline autocatalysts
  - gross autocatalyst demand accounted for 85% of industrial palladium demand in 2018
  - other industrial demand components accounted for ~15% of total demand, however anticipating demand destruction in selected industrial applications

Sources include: Johnson Matthey, SFA Oxford, WPIC, company information

Sustained growth in demand over the last decade
Despite the recent increase in the ZAR PGM basket, we continue to see declining production from South Africa (CAGR* of approximately -1%)

Increased ZAR PGM prices may have delayed selected shaft closures, however current investment climate and market outlook for platinum is not conducive to the commitment of large capital investments for growth

Secondary supply (from autocatalysts) to continue to grow but will plateau at approximately 1.6 Moz per annum.

Sources: Johnson Matthey, SFA Oxford, Company filings, Internal company estimates

*Compound annual growth rate

Supply declines driven by lack of investment in South Africa
Platinum demand forecast

- Gross platinum demand remains industrial biased
- Forecast demand to remain flat at ~7.5 Moz per annum
  - Decline in fleet light duty (LDD) offset by increased loadings and heavy duty diesel (HDD) growth
  - Decline in European diesel market share offset by increased demand out of China and India driven by increasing legislation
  - Chinese jewellery demand remaining largely flat

Sources include: Johnson Matthey, SFA Oxford, WPIC, company information

Platinum demand
The PGM market balance

A market that is not in balance with primary supply ratios
Why does this keep us awake?

• If global demand mix does not match global supply mix, we will be faced with:
  – demand destruction of palladium
  – an over supplied platinum market as a result of over supply

• Primary supply will continue to be mined as a fixed basket at a ratio of roughly 4:5 Pt:Pd globally

• Auto’s manufacturers short term thinking is evidently not driven by PGM costs or supply balance:
  – PGM costs remain relatively small in the total cost of automobiles
  – Reputational impact post “Diesel gate” is significantly higher than catalyst cost considerations
  – Risk of change appears greater than cost of maintaining status quo
  – What happens when PGM mix is no longer a price issue but a physical security of supply issue?

• If we do not get the balance right, it could result in a permanent shift in the PGM market dynamics

Global demand to match global supply to keep market balanced and avoid demand destruction
What drives the PGM basket balance?

<table>
<thead>
<tr>
<th>Lever/driver</th>
<th>Measure</th>
<th>Base Case</th>
<th>Downside</th>
<th>Upside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jewellery</td>
<td>China net demand in 2025</td>
<td>1moz</td>
<td>850k oz (10 year low)</td>
<td>1.75 moz (additional 750k oz over 4 years)</td>
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<td>BEV penetration</td>
<td>2025 penetration</td>
<td>6%</td>
<td>5%</td>
<td>15%</td>
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<tr>
<td>European diesel share</td>
<td>Share of LDV market in 2025</td>
<td>28%</td>
<td>20%</td>
<td>40%</td>
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<tr>
<td>Autocat recycling</td>
<td>Recovery rates</td>
<td>50%</td>
<td>35%</td>
<td>60%</td>
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<tr>
<td>Substitution</td>
<td>Pt substitutes Pd in gasoline LDVs</td>
<td>Status Quo</td>
<td>0.1g Pt:Pd substitution per annum</td>
<td></td>
</tr>
</tbody>
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Effects of the above sensitivities on the supply and demand balance were modelled.
Investment

- Material Investment demand driven by institutional investors
- Investment sentiment will be based on industrial demand outlook
- Can act as a supply / demand shock absorber

Sources: China Customs, Bloomberg, Citi Research

Important part of the PGM eco-system, but unlikely to materially impact on Market Balance
Jewellery evolution

- Possible three phase China jewellery story
- Phase 1: Demand growth through aggressive marketing and positioning as premium product
- Phase 2: Growth stability with typical price elasticity trends
- Phase 3: Demand decline
  - Slowing GDP growth
  - Slowing personal income growth in China and tightening household liquidity
  - Growing number of products and services competing for a shrinking share of wallet (travel, electronics, branded/luxury fashion, cars, etc.)
  - Clampdown on “gifting”

Source: Metals Focus, Refinitiv GFMS, ICE Benchmark Administration, World Gold Council, PGI, macrotrends.net
Jewellery sensitivity

- Future demand is likely to be more difficult and expensive to create than in the past
- The creation of platinum jewellery demand does not assist in “managing the basket” demand
- However, the potential impact on the platinum market balance is significant and cannot be ignored

At 30% of gross global demand, the jewellery market cannot be ignored
Powertrain mix

Battery electric vehicles (BEVs) penetration

Platinum balance

Palladium balance

European diesel share

Platinum balance

Palladium balance

Market balance not that sensitive to power train mix over the medium term
Secondary supply

- Secondary Supply has ability to significantly impact the market balance, however is not without challenges
  - Substrate material (in particular high carbon materials) reducing throughput rates and recoveries
  - Capital intensive infrastructure (refineries) is seldom supported on recycling alone and hence recycling relies on spare capacity
  - Fragmented and often informal collection industry limits ability to formalize
  - Recycling volumes not driven by PGM prices alone
Substitution – moving the needle

Pull factors
• Security of supply and volatility
• Larger platinum market with capacity for additional demand
• Sustained price differential

Push factors
• Impact of “Diesel gate”
• Technical certainty
• Capital implications for fabricators
• Regulatory & licensing timelines

“...it is very early days for platinum substitution back into gasoline catalysts. The problem is that it is very expensive and time-consuming to change catalyst designs, so original equipment manufacturers need to be very sure that by the time they have done it was still worth doing. So, they will want to see the price of palladium above that of platinum for some time.

Peter Duncan
Johnson Matthey, Oct 2017
Summary and conclusions

- The PGM market is a basket case
  - To ensure a sustainable market requires balancing of the basket in line with global supply
  - Considering market forces, over the next few years the industry is at real risk of permanently resetting the PGM market dynamics through demand destruction in palladium and an oversupply of platinum

- The world is undergoing change
  - The market development solutions that created yesterday’s demand are not going to be the same solutions for tomorrow
  - Requires a dynamic structure with the ability to adapt to the changing demand environment
  - Market development needs to consider and be supported by the entire PGM value chain

- Market development must consider the biggest levers that can be pulled…..presently that would appear to be substitution
Questions?