

HERAEUS PRECIOUS APPRAISAL

Heraeus

Ed. 1
13th January 2020



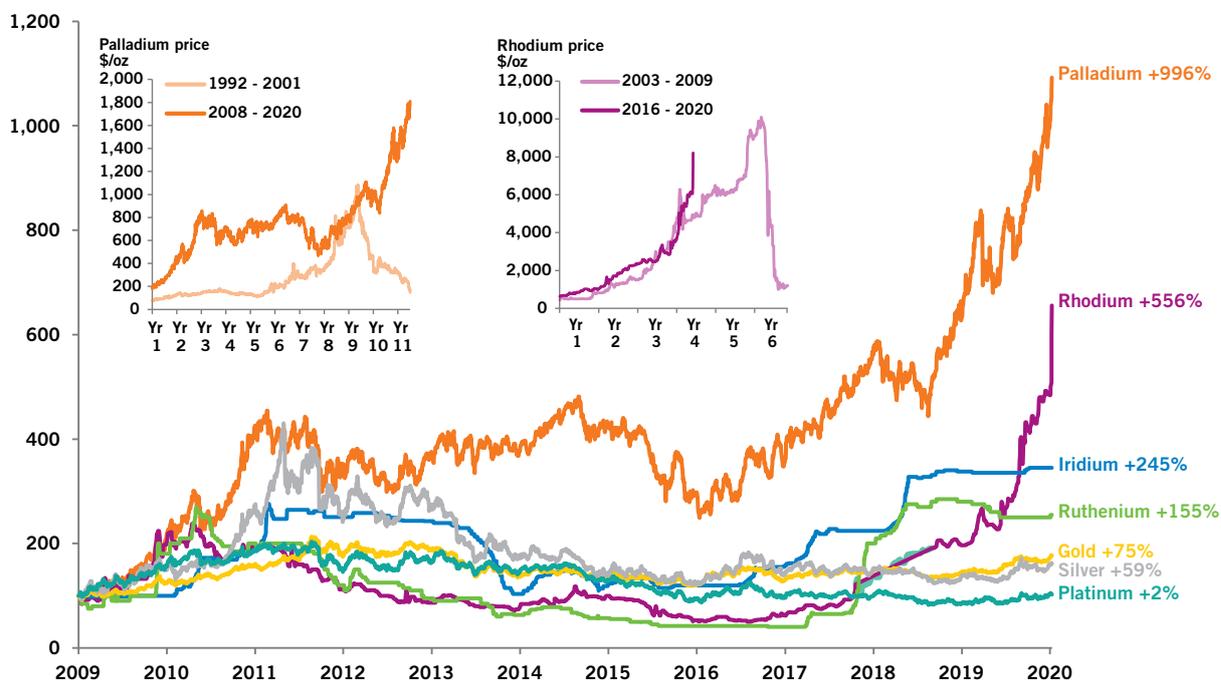
MARKET SPOTLIGHT

Pd & Rh prices jump higher, but what goes up, must come down (eventually)

The price of palladium has increased by 996% since the beginning of 2009, and is up over 1,000% from the lowest price in late 2008. The rhodium price has risen less than palladium starting in 2009, but rhodium has risen 1,212% from its low in 2016. The palladium and rhodium prices rose by 49% and 151% respectively last year.

These sharp price gains are set against a backdrop of falling car sales. US light-vehicle sales fell a little over 1% to 17 million units in 2019. In China, the largest auto market, sales fell by 3.6% year-on-year in December and were down 7.5% for the year as a whole (source: CAAM) for a second consecutive annual decline. CAAM now predicts a 2% decrease in vehicle sales to 25.3 million units this year.

Prices indexed to 100 1 Jan 2009



Source: SFA (Oxford), Heraeus, Bloomberg

Palladium and rhodium demand has been boosted by tightening emissions legislation. In 2019, several Chinese regions brought forward implementation of China 6a and in some cases automakers jumped straight to China 6b which lifted rhodium requirements. Palladium and rhodium also benefitted from the increased demand from higher loadings in gasoline vehicles' autocatalysts in Europe and the US. This year, India brings in Bharat 6 in April, China 6 is rolled out nationwide in July, and the US and Europe tighten their legislation further.

Prices could keep rising for some time yet as tighter emissions legislation offsets falling auto sales. Larger price rallies have been seen in percentage terms in the past. For palladium, the rally from 1992 that ended in January 2001 saw the price escalate by 1,321%. When the rhodium price peaked in 2008, it had rallied 2,195% from its low in 2003. The trouble is that subsequently prices collapsed back to near the level from which the rallies started.



PRECIOUS METALS REVIEW

79 Au Gold

| | Close | Weekly change | High | Date | Low | Date |
|-------|---------|---------------|-------|------------|-------|------------|
| \$/oz | \$1,560 | 0.77% | 1,611 | 08/01/2020 | 1,540 | 09/01/2020 |
| €/oz | \$1,403 | 1.25% | 1,444 | 08/01/2020 | 1,386 | 09/01/2020 |

US investors favoured gold ETFs over coins in 2019. Gold-backed ETF holdings grew 14% in 2019, with an additional 10.3 moz of net inflows. Of that, the largest contribution was 6.8 moz into US ETFs (+18%) while the US Mint reported the worst year on record for gold coin sales. Gold American Eagle coin sales were 152 koz in 2019, a 36% decline from the previous year, with investors deterred by the high price. After a weak first half, the gold price rallied 16% (+ \$216) over the course of the year. This was mirrored by a rebound in ETF holdings in the second half which reached all-time highs of 85.3 moz in Q4. European investment was the second-largest contribution with ETF holdings growing by

3.1 moz (9%). Swiss ETFs increased by 1.4 moz, German ETFs added 1.1 moz and ETFs in the UK gained 0.6 moz. Speculative gold futures positions on NYMEX also reached a record net long at the end of last year, totalling 32.79 moz.

Gold jumped as geopolitical conflict escalated. The gold price rose initially on 3 January with a flow into safe-haven assets after the US assassination of an Iranian general, and was pushed higher by news later in the week of retaliation. The price corrected back to \$1,560/oz last week, however, after Trump signalled that Iran appeared to be standing down.

47 Ag Silver

| | Close | Weekly change | High | Date | Low | Date |
|-------|-------|---------------|-------|------------|-------|------------|
| \$/oz | 18.13 | 0.15% | 18.86 | 08/01/2020 | 17.80 | 09/01/2020 |
| €/oz | 16.30 | 0.62% | 16.90 | 08/01/2020 | 16.03 | 09/01/2020 |

Silver's time to shine. The global photovoltaic market is forecast to install an additional 142 GW of new solar panels this year, up 14% year-on-year (source: IHS Markit). This equates to in excess of 100 moz of silver. Solar installations in India are expected to exceed 10 GW this year as the duty on imported modules is reduced, but could still leave it short of its 2022 100 GW target. Annual capacity additions have nearly doubled each year since 2014, but last year saw just 6.5 GW of installations, a 30% decline from 2018. India's duty on solar cell and module imports (which has already fallen

20%) will decrease further to 15% by July 2020, so installations that had been previously held up by high costs are expected to go ahead. India's photovoltaic silver demand is estimated to grow to around 8 moz this year.

Silver's price movements mirrored those of gold as safe-haven buying boosted the price. However, this failed to reduce the ratio to gold which has edged up to 86. This has likely set the tone for the year and silver will continue to follow gold.

78 Pt Platinum

| | Close | Weekly change | High | Date | Low | Date |
|-------|-------|---------------|------|------------|-----|------------|
| \$/oz | 982 | -0.35% | 989 | 06/01/2020 | 948 | 09/01/2020 |
| €/oz | 883 | 0.12% | 885 | 10/01/2020 | 853 | 09/01/2020 |

UK diesel demand continued its demise in 2019. Automotive platinum demand in Western Europe is expected to decline to ~1 moz this year, pushing the market into greater surplus. The UK is the second-largest car market in Western Europe (for now), which collectively is the largest diesel market in the world. UK car registrations fell by 2.4% to 2.3 million units in 2019 compared to a year earlier, with the market share of diesel cars falling by 21.8% to 583,488 units (source: SMMT).

December marked the 33rd month of declining diesel sales in the UK. Registrations of battery electric vehicles (BEVs) hit another record high, however, at 37,850 units (+144%). A further 23 new models are set to reach the showrooms this year. It is anticipated that new EU emissions standards which took effect on 1 January will further incentivise BEV sales this year due to their eligibility for 'supercredits'.



PRECIOUS METALS REVIEW

⁴⁶ Pd **Palladium**

| | Close | Weekly change | High | Date | Low | Date |
|-------|-------|---------------|-------|------------|-------|------------|
| \$/oz | 2,116 | 6.66% | 2,149 | 09/01/2020 | 2,014 | 06/01/2020 |
| €/oz | 1,905 | 7.32% | 1,936 | 09/01/2020 | 1,801 | 06/01/2020 |

The palladium price rallied \$200 in the first few days of 2020 (+10%), reaching another record high of \$2,149/oz. It is now trading at a premium of roughly \$556/oz to gold and \$1,134/oz to platinum. However, while auto sales have struggled, higher loadings of palladium in autocatalysts are offsetting weak consumer demand; palladium demand is forecast to grow modestly in 2020. Lease rates have started to increase again and when market liquidity is tight, price volatility rises.

China, the world's largest car market, reported another year of shrinking sales. Sales of passenger vehicles in China fell by 3.4% in December to 2.14 million units, taking total sales for 2019 to 20.7 million units, a 7.4% decrease from the year before (source: China Passenger Car Association). December marked the 18th year-on-year monthly decline in 19 months. China's auto industry has been hit particularly hard as the economy slowed

and consumers were deterred from making high-value purchases. Sales are estimated to slide by a further 2% this year according to the China Association of Automotive Manufacturers (CAAM).

The US auto market was stronger than expected last year. US automakers hit the 17 million sales mark for the fifth year in a row last year, although sales still fell (-1.3%) year-on-year (source: MarkLines). The initial forecast for 2019 was 16.7-16.9 million units, but easily available credit, low unemployment rates and healthy GDP have helped sales exceed expectations. Since its record high of 17.5 million units in 2015, US light-vehicle sales have remained buoyantly above 17 million units. Autocatalyst demand for palladium in North America is estimated to grow modestly in 2020, accounting for almost a quarter of auto demand for the metal.

⁴⁵ Rh ⁴⁴ Ru ⁷⁷ Ir **Rhodium, Ruthenium, Iridium**

| | Rhodium | Ruthenium | Iridium |
|----------------|------------|-----------|------------|
| Reporting week | \$7,950/oz | \$255/oz | \$1,500/oz |
| Previous week | \$6,350/oz | \$255/oz | \$1,500/oz |

The rhodium price soared in the first 10 days of 2020, with gains in excess of \$2,000/oz (+ 33.6%). Rhodium is a less liquid market so in times of high demand the price can move rapidly, but such large jumps in the price suggest there is some panic buying. If that is the case then the price could cool off for a while once the buyers with the most urgent requirements have acquired the metal they need.

Western Digital's new high-capacity hard disk drives (HDDs) will be commercially available this year, expanding the manufacturer's range of existing ruthenium-based drives. The new 18 TB and 20 TB models use microwave-assisted magnetic recording

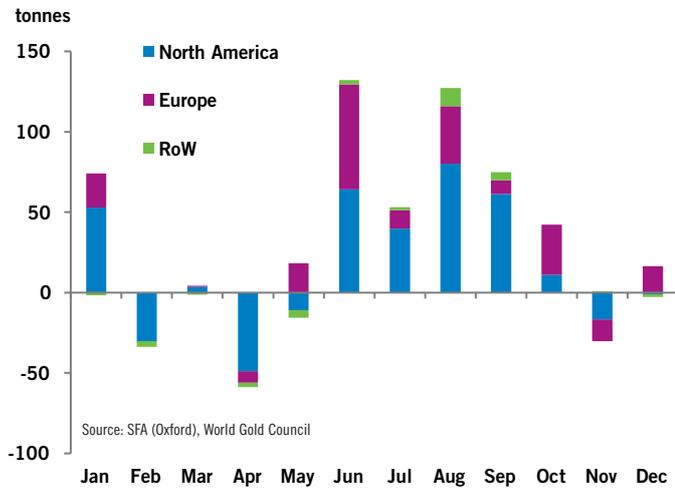
(MAMR), which uses ruthenium in order to increase disk recording capacity. Western Digital began shipping samples earlier this year. It is anticipated that commercialisation of MAMR in this way will help to recover demand for ruthenium in HDDs. However, other manufacturers which endorse alternative drive technologies (which do not use ruthenium) will be an obstacle. Nevertheless, Western Digital still holds a significant share of the HDD market at 37%. Ruthenium demand for HDDs is estimated to increase by more than 10% (around 10 koz) over the next three years.

The ruthenium price gained \$5 in the first week of 2020, increasing for the first time in 16 months.

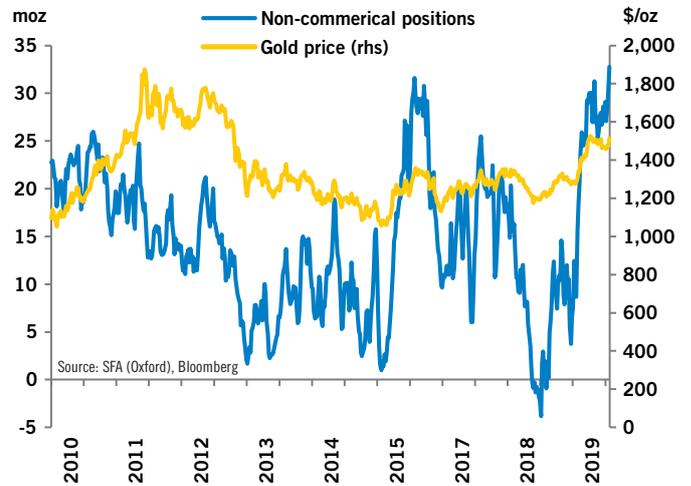


TRENDS AND INVESTMENTS

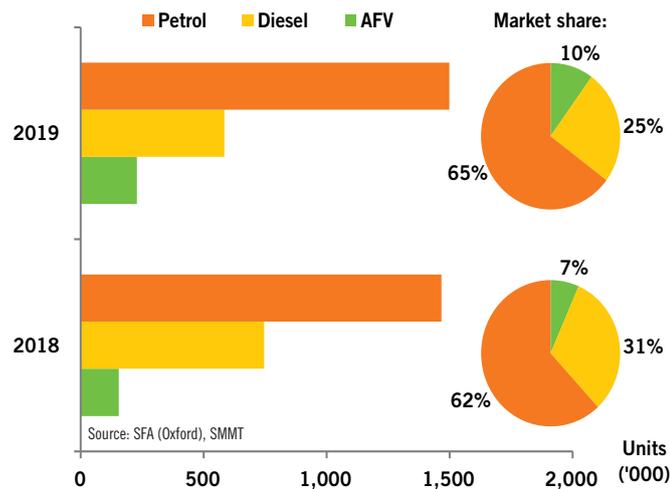
Gold ETF flows 2019



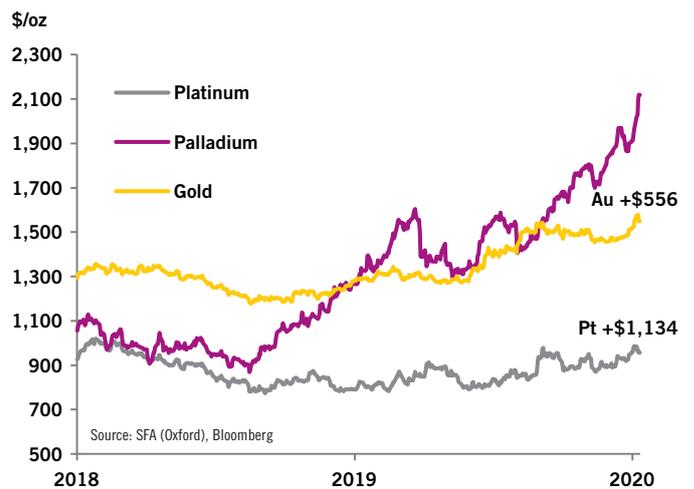
Speculative gold futures positions



UK diesel demand



Palladium premium over platinum & gold



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