

# PLATINUM QUARTERLY

## Q2 2019

6th September 2019

See page 3 for contents

### FOREWORD

This edition of *Platinum Quarterly* considers platinum supply and demand developments for the second quarter of 2019 and provides an updated outlook for 2019. We also provide our views on issues and trends relevant to investors considering exposure to platinum as an investment asset and update you on how our product partnerships continue to meet investors' needs.

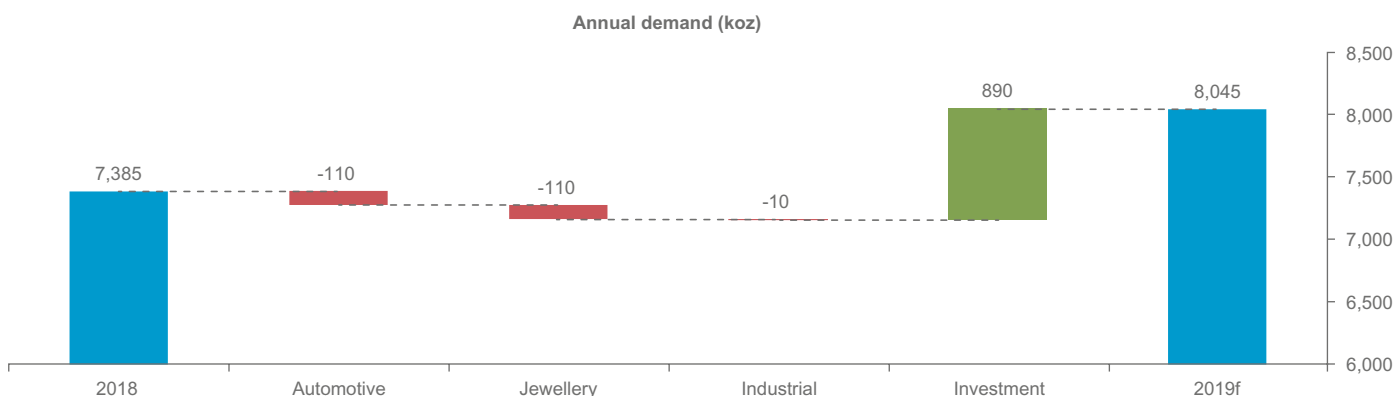
#### Platinum supply and demand – 2019

The revised 2019 forecast has a slightly reduced 345 koz surplus compared to the prior estimate of 375 koz. A strong increase in investment demand more than offsets lower automotive and jewellery demand compared to 2018.

Total demand in 2019 is forecast to rise 9% compared to 2018. Unprecedented investment demand in H1'19 of 855 koz (720 koz from increased ETF holdings and 135 koz from bar and coin purchases) supports a conservative investment demand forecast for 2019 of 905 koz. This more than offsets expected demand decreases in the automotive and jewellery segments of 4% and 5% respectively.

Total supply is forecast to increase by 4% over 2018 with increases in both mining supply and recycling. Refined production is forecast to grow by 5%, as some mining projects ramp up, but mostly due to the refining of metal built up in the processing pipeline in 2018. Recycling is forecast to grow by 3% as an increase in platinum recovered from autocatalysts more than offsets a decrease in jewellery recycling due to the low platinum price.

Although automotive and jewellery demand was weaker in Q2'19 the forecast 2019 surplus is more likely to reduce further than to increase in H2'19 due to downside supply risk and upside demand risk. There remains potential for mine supply disruptions in South Africa due to the risk of power outages and industrial action related to wage negotiations underway at present. Diesel sales may increase in 2019 as all diesel cars sold in Europe after 1 September 2019 will emit NOx below 168 mg/km and consumers can access independent tests to confirm this. Any evidence in 2019 of platinum use in gasoline cars could see the significant positive impact on platinum autocatalyst demand factored into supply-demand analysis. The substantial increase in investment demand by institutions in H1'19 is likely medium to long term in nature, tightening the market and increasing price response to changes in demand. Recent price increases may stimulate increased investor interest in the remainder of 2019.

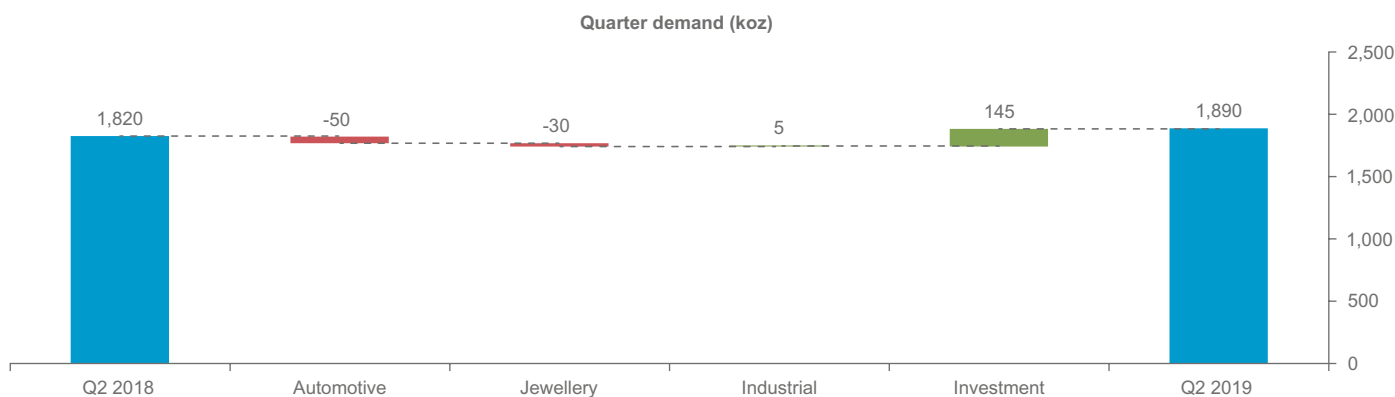


#### Supply – lower Q2 2019 but higher full year 2019 due to the release of refined platinum from pipeline stocks

Total supply and mine supply in Q2'19 were lower year-on-year by 1% and 2% respectively and due mainly to pipeline movements in Russia and South Africa. For 2019, refined output from South Africa, excluding stock releases, is estimated to fall slightly (-5 koz year-on-year), as the ramp-up in new projects is more than offset by the expected reduction in yield from mature, high-cost operations. Refined production in 2019, inclusive of one-off stock releases, is expected to grow 5%, but we expect 2020 refined production to be similar to that in 2018 and considerably below the 2019 level. Supply from recycling is forecast to grow 3% in 2019, lifting total supply 4% over 2018. Potential power disruption and industrial action represent risks that could materially reduce refined platinum mining supply in 2019.

## Demand – Q2 2019 and full year 2019 up as investment demand more than offsets lower jewellery and autocatalyst demand

Q2'19 total demand increased by 4% year-on-year mainly due to ETFs moving from net selling to net buying. This more than compensated for lower autocatalyst and jewellery demand. In 2019, expected annual demand growth of 9% is driven by a similar trend with strong investment demand more than offsetting forecast declines in automotive and jewellery demand.



The *Platinum Quarterly* data and report (starting on page 4) are, as always, prepared independently for WPIC by SFA (Oxford).

## The platinum investment case – strong investment demand and demand growth potential in diesel, gasoline and fuel cell automotive applications

Continued strong institutional investment demand in 2019 may reflect recognition by seasoned and new platinum investors of platinum's undervaluation and resurgent demand growth potential. The material increases in ETF holdings seen in 2019 have not occurred since 2014 and are the highest seen in a six-month period since physically-backed platinum ETFs were launched in 2007.

Looking forward, we see the following platinum demand growth drivers:

- **Increased investment demand:** In 2019 we expect platinum to benefit further from the growing pool of investors considering precious metals. The growth in global debt attracting negative interest rates has added to the long-standing attraction of precious metals to diversify equity investments. Negative yielding debt has grown from \$8 trillion to \$17 trillion<sup>1</sup> this year and gold ETFs have increased from \$91 billion to \$120 billion over the same period. Since 2014 the WPIC has taken platinum's investment case to a wider pool of investors making platinum's consideration as a precious metal more likely. Our partnerships have increased the availability of retail platinum investment products with new products and partners enhancing likelihood of higher retail investment demand. Institutional investment demand has had an unprecedented start this year with ETF buying of 720 koz in H1'19. An additional 66 koz of ETF buying in July and August has extended this positive trend into H2'19.
- **Increased diesel automotive demand:** We expect further stabilisation in the diesel share of Western European car sales. From 1 September 2019, all cars sold must comply with Euro 6 d Temp emissions requirements (RDE) (all new models only from September 2017) which includes on-road emissions testing. This finally addresses the legacy of Dieselgate on all new car sales. Independent on-road testing has shown that NO<sub>x</sub> levels are significantly below the 168 mg/km required; some as low as 21 mg/km. To avoid massive fleet CO<sub>2</sub> fines automakers are expected to promote diesel cars, something they have avoided since 2015, and is likely to increase diesel sales and platinum demand. Recently, some automakers have highlighted that lower CO<sub>2</sub> emitting diesel vehicles have a vital role to play in meeting European fleet CO<sub>2</sub> emissions targets.

1. Bloomberg Barclays Global Aggregate Negative Yielding Debt Market Value USD

- **Increased gasoline automotive demand:** The palladium price exceeded that of platinum in September 2017 and in 2019 has traded, on average, \$595/oz higher than platinum. This is well beyond the level autocatalyst manufacturers suggested as the point of substitution on cost grounds. Johnson Matthey expects palladium's eighth consecutive deficit in 2019 to be over 800 koz with significant palladium demand growth expected as China implements China 6, which is more stringent than US and EU (RDE) regulations. Because over 80% of palladium is produced as a by-product, to nickel in Russia and platinum in South Africa, short-term palladium supply growth is not possible. A very limited amount of palladium substitution by platinum would be material for platinum demand.
- **Emergence of demand from fuel cell electric vehicles:** There is increasing acceptance that fuel cell electric vehicles will sit alongside battery electric vehicles as part of a multi-drivetrain solution to achieve zero on-road emissions. News flow related to heavy duty and non-road fuel cell vehicle applications, including trains, has increased significantly during 2019. Platinum's demand growth from fuel cells will be driven in the near term by heavy duty applications.

### WPIC initiatives highlights

There are material product partnership developments in two of our key target markets, China and North America.

In China our Shanghai office and presence have helped us to increase significantly the awareness of platinum as an investment asset. This has enhanced our ability to attract and work with partners to increase further the number and availability of platinum investment products for investors. Our engagement with the Bank of China has led to the Agricultural Bank of China also using our insights to promote their platinum investment offerings. Two new partners, Shenzhen Jin Zheng Long and Dalian Qian Hai Jin, are now producing retail platinum bars in China. In the US we are pleased to note good progress with two new partnerships with A-Mark Precious Metals and Sunshine Minting Inc.

The heightened global prominence of addressing climate change has elevated the importance of reducing CO<sub>2</sub> emissions from vehicles; making clean diesel and fuel cell electric vehicles more likely to provide short- and medium-term solutions in this regard. The surge in global debt with negative yields has increased the attractiveness of precious metals, including platinum, and has built on platinum's demand growth potential to significantly enhance platinum's investment case.

**Paul Wilson, CEO**

---

### Contents

Foreword	<b>P1</b>	Expanded Tables	<b>P13</b>
Summary Table	<b>P4</b>	Glossary of Terms	<b>P17</b>
Second Quarter 2019 Review	<b>P5</b>	Copyright and Disclaimer	<b>P19</b>
2019 Forecast	<b>P8</b>		

# PLATINUM QUARTERLY Q2 2019

**Table 1: Supply, demand and above ground stocks summary**

	2017	2018	2019f	2018/2017 Growth %	2019f/2018 Growth %	Q1 2019	Q2 2019
<b>Platinum Supply-demand Balance (koz)</b>							
<b>SUPPLY</b>							
<b>Refined Production</b>	<b>6,125</b>	<b>6,115</b>	<b>6,430</b>	<b>0%</b>	<b>5%</b>	<b>1,515</b>	<b>1,610</b>
South Africa	4,380	4,460	4,655	2%	4%	1,070	1,160
Zimbabwe	480	465	470	-3%	1%	110	115
North America	365	355	395	-3%	11%	85	105
Russia	720	665	725	-8%	9%	205	185
Other	180	170	185	-6%	9%	45	45
<b>Increase (-)/Decrease (+) in Producer Inventory</b>	<b>+30</b>	<b>+10</b>	<b>-25</b>	<b>-67%</b>	<b>N/M</b>	<b>+5</b>	<b>+5</b>
<b>Total Mining Supply</b>	<b>6,155</b>	<b>6,125</b>	<b>6,405</b>	<b>0%</b>	<b>5%</b>	<b>1,520</b>	<b>1,615</b>
<b>Recycling</b>	<b>1,890</b>	<b>1,935</b>	<b>1,985</b>	<b>2%</b>	<b>3%</b>	<b>480</b>	<b>495</b>
Autocatalyst	1,325	1,420	1,495	7%	5%	355	365
Jewellery	560	510	485	-9%	-5%	125	130
Industrial	5	5	5	0%	0%	0	0
<b>Total Supply</b>	<b>8,045</b>	<b>8,060</b>	<b>8,390</b>	<b>0%</b>	<b>4%</b>	<b>2,000</b>	<b>2,110</b>
<b>DEMAND</b>							
<b>Automotive</b>	<b>3,330</b>	<b>3,125</b>	<b>3,015</b>	<b>-6%</b>	<b>-4%</b>	<b>775</b>	<b>765</b>
Autocatalyst	3,190	2,980	2,860	-7%	-4%	735	730
Non-road	140	145	150	4%	3%	40	40
<b>Jewellery</b>	<b>2,460</b>	<b>2,325</b>	<b>2,215</b>	<b>-5%</b>	<b>-5%</b>	<b>560</b>	<b>555</b>
<b>Industrial</b>	<b>1,680</b>	<b>1,920</b>	<b>1,910</b>	<b>14%</b>	<b>-1%</b>	<b>490</b>	<b>480</b>
Chemical	560	570	625	2%	10%	155	150
Petroleum	100	240	235	140%	-2%	55	55
Electrical	210	205	210	-2%	2%	55	50
Glass	180	245	215	36%	-12%	75	65
Medical	235	240	240	2%	0%	55	70
Other	395	420	385	6%	-8%	95	90
<b>Investment</b>	<b>275</b>	<b>15</b>	<b>905</b>	<b>-95%</b>	<b>N/M</b>	<b>765</b>	<b>90</b>
Change in Bars, Coins	215	280		30%		75	60
Change in ETF Holdings	105	-245		N/M		690	30
Change in Stocks Held by Exchanges	-45	-20		-56%		0	0
<b>Total Demand</b>	<b>7,745</b>	<b>7,385</b>	<b>8,045</b>	<b>-5%</b>	<b>9%</b>	<b>2,590</b>	<b>1,890</b>
<b>Balance</b>	<b>300</b>	<b>675</b>	<b>345</b>	<b>125%</b>	<b>-49%</b>	<b>-590</b>	<b>220</b>
<b>Above Ground Stocks</b>	<b>4,140*</b>	<b>2,315</b>	<b>2,990</b>	<b>29%</b>	<b>12%</b>		

Source: SFA (Oxford). \*As of 31st December 2012. NB: Numbers have been independently rounded. N/M means not meaningful.

Notes:

- All estimates are based on the latest available information. They are subject to revision in our subsequent quarterly reports in the event that additional information is identified.
- The WPIC did not publish quarterly estimates for 2013 or the first two quarters of 2014. However, quarterly estimates from Q3 2014, to Q4 2016 are contained in previously published PQs which are freely available on the WPIC website. Quarterly estimates from Q1 2017 and half-yearly estimates from H1 2017 are included in Tables 3 and 4 respectively, on pages 14-15 (supply, demand and above ground stocks).
- The 2019 forecasts are based on historical data and trends as well as modelling, with varying degrees of accuracy depending upon the supply or demand category. Investment demand is expected to be the least predictable segment. Some historical views are based on data and modelling that pre-date WPIC publication of PQ.

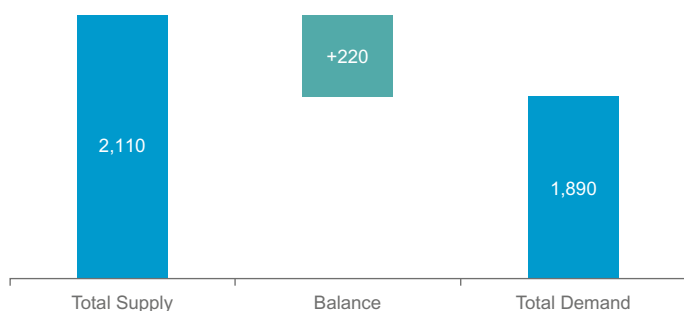
## 2019 SECOND QUARTER PLATINUM MARKET REVIEW

Global platinum demand was 1,890 koz in the second quarter, up 4% year-on-year (+70 koz) owing to improved investment demand (+145 koz) and slightly higher industrial demand (+5 koz) offsetting declines in automotive (-50 koz) and jewellery demand (-30 koz).

Total supply slipped by 1% year-on-year to 2,110 koz (-25 koz) as a 35 koz drop in total mining supply to 1,615 koz was partially offset by a 10 koz increase in recycling to 495 koz. Total mining supply was down marginally year-on-year (-2%) in Q2'19 as the recovery in South African refined production and an increase in North American output was offset by a decline in yield from Russia and lower stock sales from South African producers. Recycling increased as growing platinum recovery from spent autocatalysts (+20 koz) outweighed a decline in jewellery recycling (-10 koz).

With demand improving year-on-year in Q2'19 and supply edging lower the market surplus was 220 koz (Chart 1).

**Chart 1: Supply-demand balance, koz, Q2 2019**

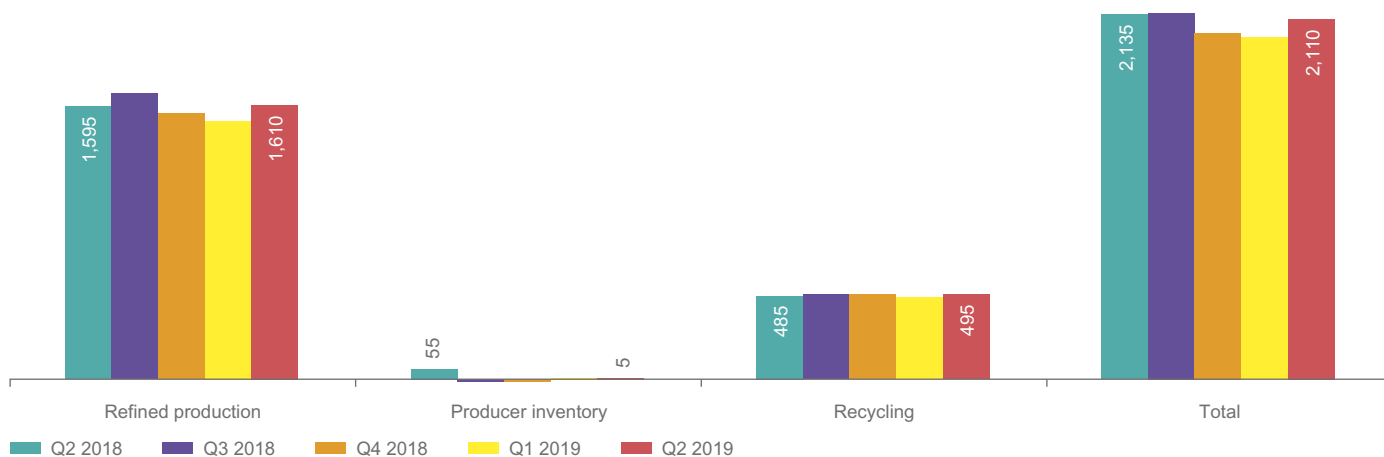


Source: SFA (Oxford)

## Supply

Global refined production increased marginally (+1%, +15 koz) year-on-year to 1,610 koz in Q2'19. South African supply increased by 10 koz (+1%) year-on-year in the second quarter to 1,160 koz as producers increased output following low production in Q1'19 caused by power disruptions and operational challenges. Russian output fell by 15 koz (-8%) year-on-year in Q2'19 to 185 koz owing to repair work carried out at refining facilities. Russian Q2'19 output accounted for mined production only, whereas Q1'19 output (205 koz) was inflated owing to the processing of work-in progress (WIP) concentrate built up during 2018. North American production increased year-on-year by 20 koz to 105 koz in Q2'19 as a result of project ramp-up. Elsewhere, production remained flat year-on-year in Q2'19 (Zimbabwe, 115 koz; Other, 45 koz). Total mining supply is estimated at 1,615 koz for Q2'19, a decrease of 35 koz (-2%) year-on-year.

**Chart 2: Platinum supply, koz**

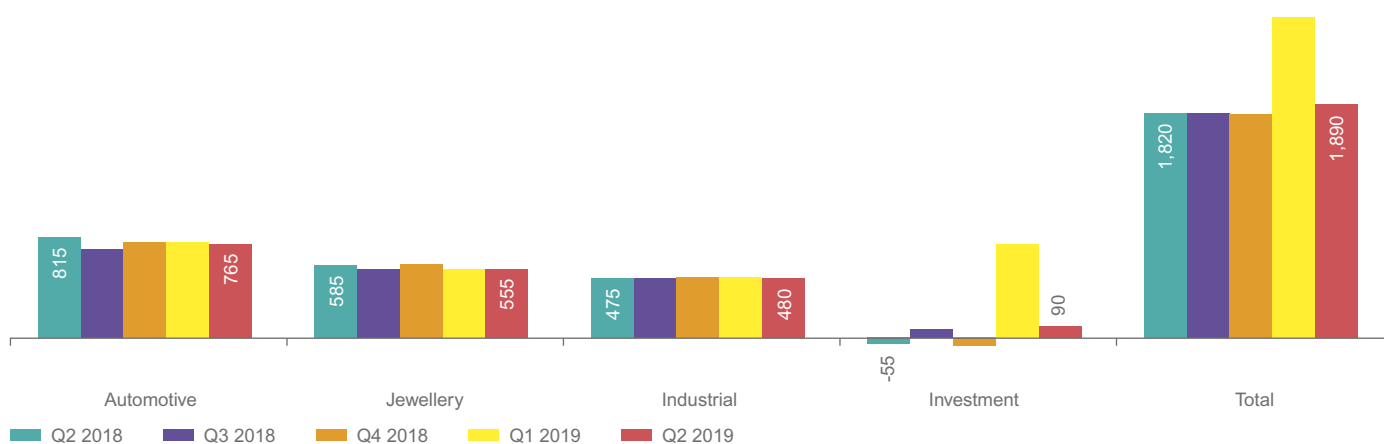


Source: SFA (Oxford)

The supply of secondary platinum was 495 koz in the second quarter. Autocatalyst recycling expanded by 6% year-on-year to 365 koz. With high prices for palladium and rhodium, good flows of all types of catalyst are being seen by recyclers. Scrap steel prices did come off in Q2'19, but this does not appear to have had an impact on scrappage rates. Jewellery recycling was 130 koz in the second quarter, up slightly compared to Q1'19 but down year-on-year owing to the weak platinum price.

## Demand

Chart 3: Platinum demand, koz



Source: SFA (Oxford)

### Automotive demand

Total automotive demand in Q2'19 was 765 koz, down just 1% from 775 koz in the previous quarter, though down 6% from 815 koz in Q1'18.

Demand for new passenger cars in the EU, where diesel still makes up just over 30% of the market, was 3% lower in the first half of 2019; of the major markets, only Germany was higher and by just 0.5% (source: ACEA).

By contrast, sales of commercial vehicles in the EU, which are dominated by diesel powertrains with platinum-loaded aftertreatment, have performed well so far in 2019. Total commercial vehicle registrations were up by 2.8% in June and by 5.8% in the first six months of the year. The heaviest vehicle sectors, where the diesel share is highest, performed better than the light commercial sector, where diesel shares are lower. Registrations of heavy commercial vehicles (>16 tonnes) rose by 47% year-on-year in June and by 16% year-on-year for H1'19. Buses and coaches also saw strong growth, up by 32% year-on-year in June and by 9% year-on-year for H1'19, with demand in Central European countries particularly strong (source: ACEA).

### Jewellery demand

The second quarter was generally a difficult quarter for jewellery, with platinum demand from jewellery fabricators dropping by 5% year-on-year to 555 koz, a similar rate of decline compared to Q1'19.

In China, excessive platinum stocks that built up in 2018 continue to be drawn down through 2019, while a sharp fall in jewellery retail sales in Hong Kong has further impacted the requirements for new metal. There has been some improvement in overall jewellery retail sales in China, but largely to the benefit of gold rather than platinum. This is being reflected in the ongoing decline in purchases of platinum by manufacturers, either via the SGE or through imports. One bright spot is Japan, where two quarters of negative growth have turned positive, with growth of 6% year-on-year in Q2'19. The arrival of the new era of Reiwa on 1 May, after the abdication of Emperor Akihito, was marked by extra holidays added to the Golden Week season at the end of April which led to additional jewellery sales.

There is a mixed picture from the US, where jewellery retail sales have been contracting and tourism spending on jewellery is down. Nonetheless, purchasing of platinum by manufacturers has held up. Similarly in Europe, jewellery retailer sales are down in all major markets, but hallmarking figures increased by 5% year-on-year in Q2'19.

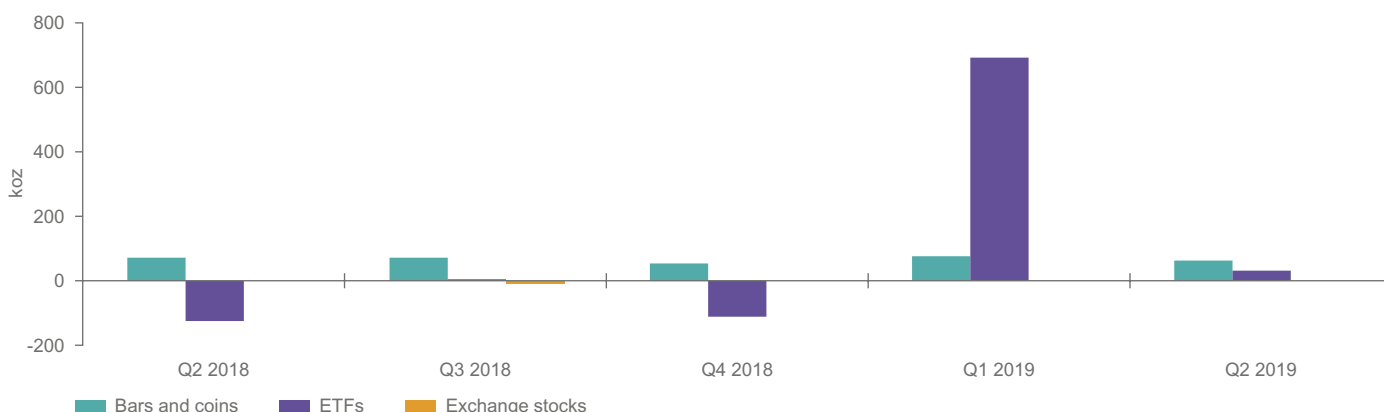
## Industrial demand

Second-quarter industrial demand for platinum increased by 1% year-on-year (+5 koz) to 480 koz and was primarily strengthened by growth in the chemical sector, predominately in China. Greater requirements for chemical catalysis, along with minor growth in the glass industry, marginally outweighed a decline in other industrial end-uses. In China, major new paraxylene capacity boosted new chemical catalyst requirements in the second quarter of this year, also supported by an increase in domestic demand for new propane dehydrogenation (PDH) units compared to Q2'18. There was limited expansion of platinum-catalysed chemical capacity in China last year, resulting in relatively soft new metal demand locally during the second quarter of 2018.

## Investment demand

Investment demand totalled 90 koz in Q2'19, as bar and coin purchases came to 60 koz and ETF holdings gained 30 koz (Chart 4).

**Chart 4: Platinum investment**



Source: SFA (Oxford)

After a record inflow of 692 koz into ETFs in the first quarter, the second quarter began with two months of declining ETF holdings. Nevertheless, ETF holdings jumped 110 koz in June, leaving the global total up 31 koz for the quarter as a whole. In April the sales were predominately from the US ETF and in May the sales came mainly from South African funds. However, the purchases in June were made across all the major regions as investors appear to have taken advantage of the platinum price falling to around \$800/oz. South African investors added a net 36 koz to their holdings, while US investors bought a net 28 koz, as did UK investors. There was a 12 koz hike in Japanese ETF holdings and Swiss funds gained 6 koz.

Bar and coin demand was 60 koz in Q2'19. The decline in the platinum price encouraged a pick-up in purchases in Japan, where investors are responsible for a large part of bar demand. Coin purchases were not as high in the second quarter as in the first because the US Mint sold most of its mintage of platinum American Eagle coins in Q1'19.

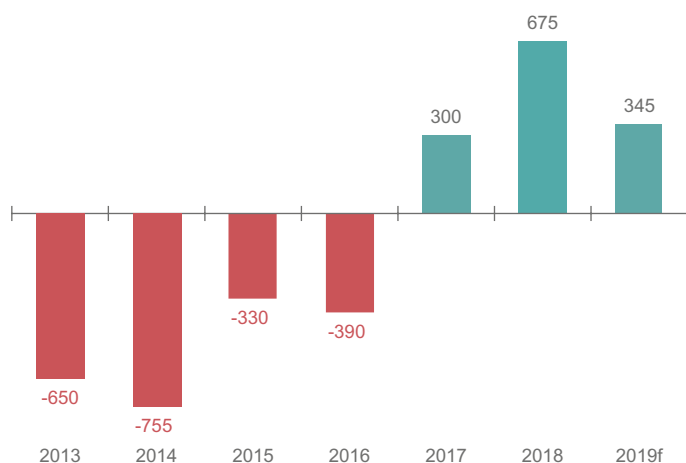
### 2019 FORECAST

In 2019, total platinum supply is forecast to increase by 4% to 8,390 koz. Refined production is projected to grow by 5% to 6,430 koz owing to the refining of material that built up in the processing pipeline in 2018 and expansion projects in North America. Producer inventories are below typical levels and so a small increase is anticipated, taking total mining supply to 6,405 koz. Recycling is projected to increase by 3% to 1,985 koz (+50 koz) owing to autocatalyst recycling expanding by 5% to 1,495 koz which outweighs a 5% decline in jewellery recycling to 485 koz.

Global platinum demand is predicted to rise by 9% to 8,045 koz following a large expansion in investment demand which more than offset declines in automotive (-110 koz), jewellery (-110 koz) and industrial demand (-10 koz). Investment demand is estimated to be 905 koz as significant inflows into ETFs are bolstered by bar and coin purchases. Automotive demand is being negatively impacted by the ongoing decline in diesel share in Western Europe, although the rate of decline appears to be moderating. Jewellery demand continues to be held back by the ongoing fall in sales in China, which is by far the largest market, and thus outweighs gains in other regions.

Global platinum demand is projected to grow by more than supply this year, mostly owing to much higher investment demand, which reduces the market balance to 345 koz (Chart 5).

**Chart 5: Supply-demand balance, koz, 2013-2019f**



Source: SFA (Oxford)

### Mine supply

Global refined production is forecast to increase by 315 koz (+5%) in 2019 accounting for 6,430 koz. This increase is mostly attributable to the processing of WIP material in both South Africa and Russia (Q1'19 release). South African supply is forecast to grow by 4% year-on-year in 2019 to 4,655 koz (+195 koz), almost all of which is attributable to the pipeline release of built-up 2018 WIP stock resulting from smelter outages and maintenance at processing operations. Refined output from South Africa excluding WIP stock is estimated to fall slightly in 2019 (-5 koz year-on-year), as the ramp-up in new projects is more than cancelled out by the expected reduction in yield from mature, high-cost operations. Zimbabwean output is forecast to increase marginally to 470 koz in 2019 (+5 koz year-on-year). A new PGM smelter was recently opened in the country in May 2019 but no major pipeline stock movements are expected in 2019.

Depletion in alluvial mine output will be negated by the impact of the pipeline release of WIP material in Q1'19 in Russia, meaning that total output from the country is expected to grow to 725 koz for 2019 (+60 koz year-on-year). Growth projects are underway in Russia with the construction of additional processing capacity to begin in 2019, allowing for mine expansion. North American supply is predicted to increase by 40 koz to 395 koz in 2019 (+11% year-on-year), due to expansion projects in the US and Canada. Total mining supply is forecast to increase by 5% year-on-year to 6,405 koz in 2019 (+280 koz); it is likely that producer restocking will account for an estimated 25 koz in producer inventory.



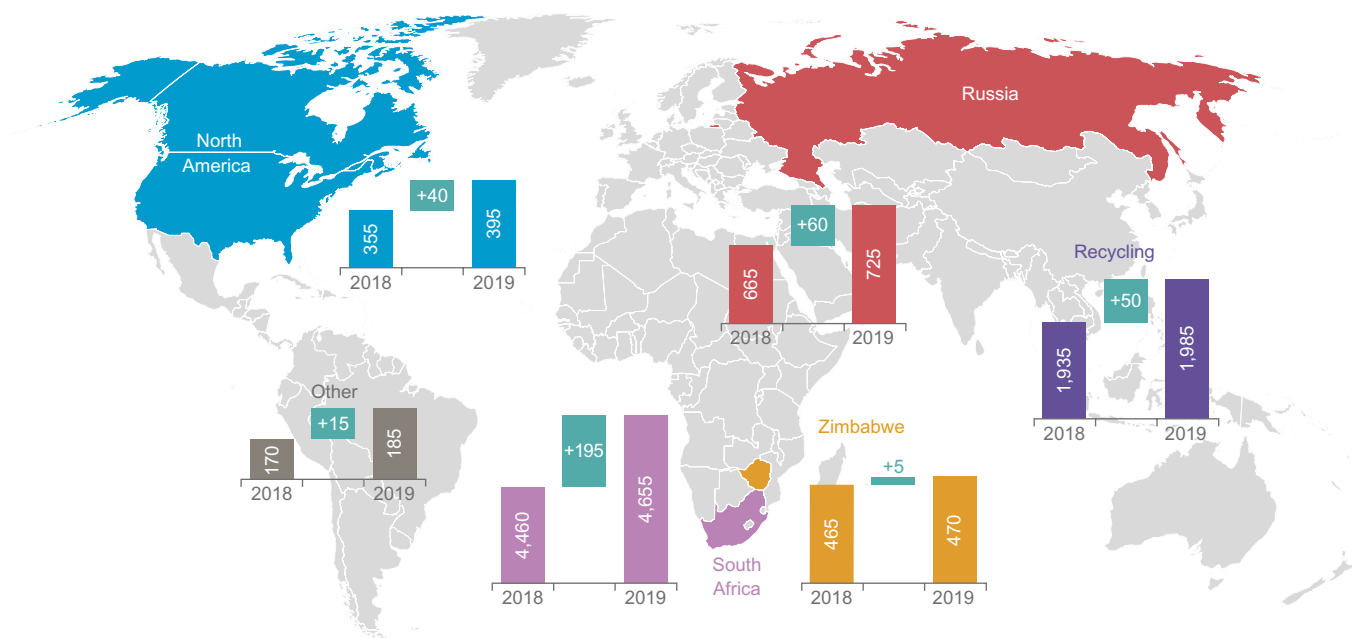
## Recycling

Globally, platinum recycling is forecast to rise by 3% to 1,985 koz this year, as the volume of platinum recovered from spent autocatalysts grows and more than offsets a decline in the amount of jewellery being recycled.

Platinum recycled from spent autocatalysts is forecast to rise by 5% to 1,495 koz this year. High palladium and rhodium prices are helping to incentivise the recovery of all types of catalyst. The number of vehicles reaching end-of-life is growing and rising numbers of diesel cars are being scrapped in Europe, which is boosting the amount of platinum being recovered. A growing proportion of scrapped diesel cars have diesel particulate filters which are more difficult to process. This is causing the smelters and refiners some problems, but has not impacted the amount of platinum being recycled.

Jewellery recycling is projected to decline by 5% this year to 485 koz, owing to the low platinum price.

**Chart 6: Changes in supply, koz, 2019f vs. 2018**



Source: SFA (Oxford)

## Automotive demand

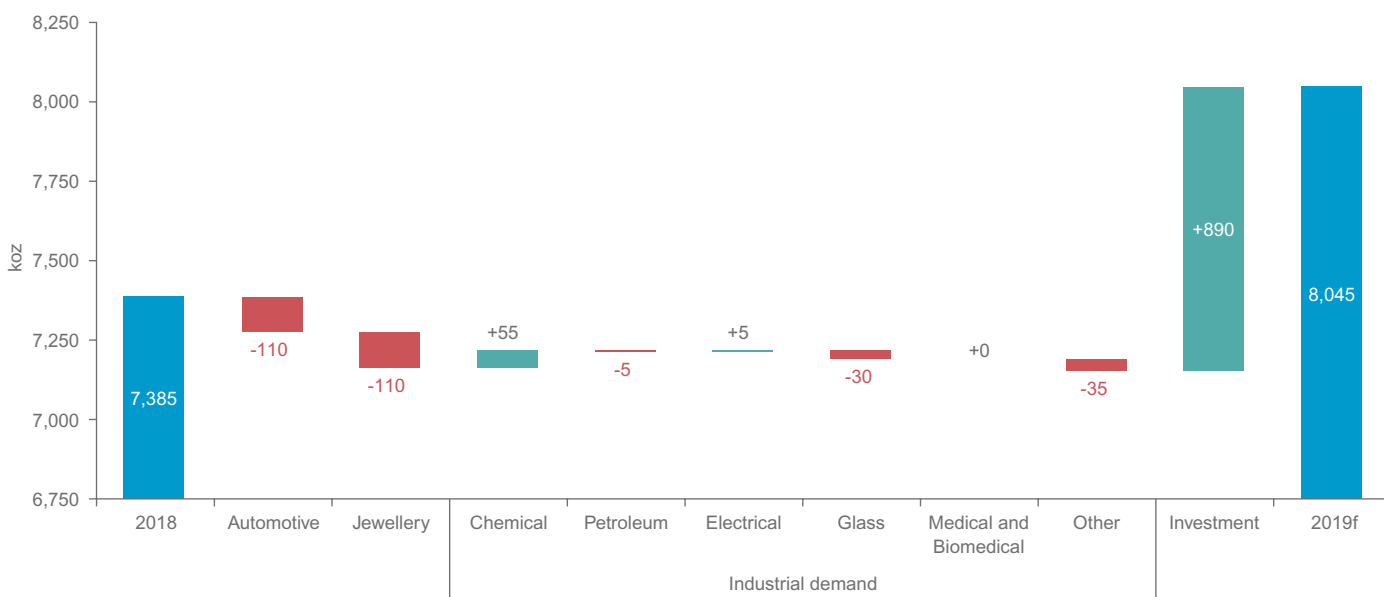
Total automotive demand is forecast to reach 3,015 koz in 2019, still a reduction of 4% from 2018 (3,125 koz) but a steady improvement on the 6% fall from 2017 (3,330 koz) to 2018, as the market appears to begin to stabilise.

In Europe, still the largest automotive market for platinum by a factor of more than two compared to North America and the Rest of the World, overall passenger car registration forecasts have been lowered into negative territory. A decline of 1% is now forecast, cut from a 1% gain earlier in the year, as overall growth slows and with business concerns over the UK's exit from the EU (source: ACEA). The European automotive industry makes clear that any additional barriers, costs or delays following from Brexit will pose a significant threat to employment and growth across the automotive industry supply chain, in the remaining EU states as well as in the UK. Euro 6d emissions standards apply from January 2020, to comply with the RDE2 test limit of 80 mg/km for NO<sub>x</sub> emissions. Diesel cars meeting this standard are now available extensively and their low emissions and company car tax savings in the UK are widely promoted, which should sustain sales and hence platinum use in the autocatalyst.

India remains a large market for light-duty diesel vehicles but sales are perturbed by weak overall consumer spending coupled with uncertainty over the costs of implementing tighter emissions legislation. Passenger vehicle sales fell 17% in June, but are nonetheless expected to grow by 3-5% in the financial year which began in April, as the economy strengthens with banks recapitalising and

liquidity improving in other financial companies (source: SIAM). Sales are likely to be inflated as stocks of old BS 4 vehicles are cleared ahead of the new BS 6 emissions standards which apply from April 2020. However, automakers are already producing compliant cars, with platinum-containing catalysts, and low-sulphur fuel is already available. Small, low-cost cars may lose diesel powertrains as the additional costs of aftertreatment render them unaffordable, but the fuel efficiency advantage of diesel is likely to secure its place in larger cars and increasingly popular SUVs.

**Chart 7: Changes in demand by category, 2019f vs. 2018**



Source: SFA (Oxford)

## Jewellery demand

Global jewellery demand for platinum is projected to fall by 5% to 2,215 koz in 2019. Another year of lower platinum demand in China is largely responsible. The platinum jewellery industry is still suffering from slower than expected sales in the second half of 2018 and excess stocks. SGE trading fell by 18% year-on-year in Q1'19 and by a further 7% in Q2'19. Mainland jewellery retail sales have improved as the year has progressed, rising by 3.5% year-on-year in H1'19, according to China's National Bureau of Statistics, but there has been a sharp fall-off in sales in Hong Kong.

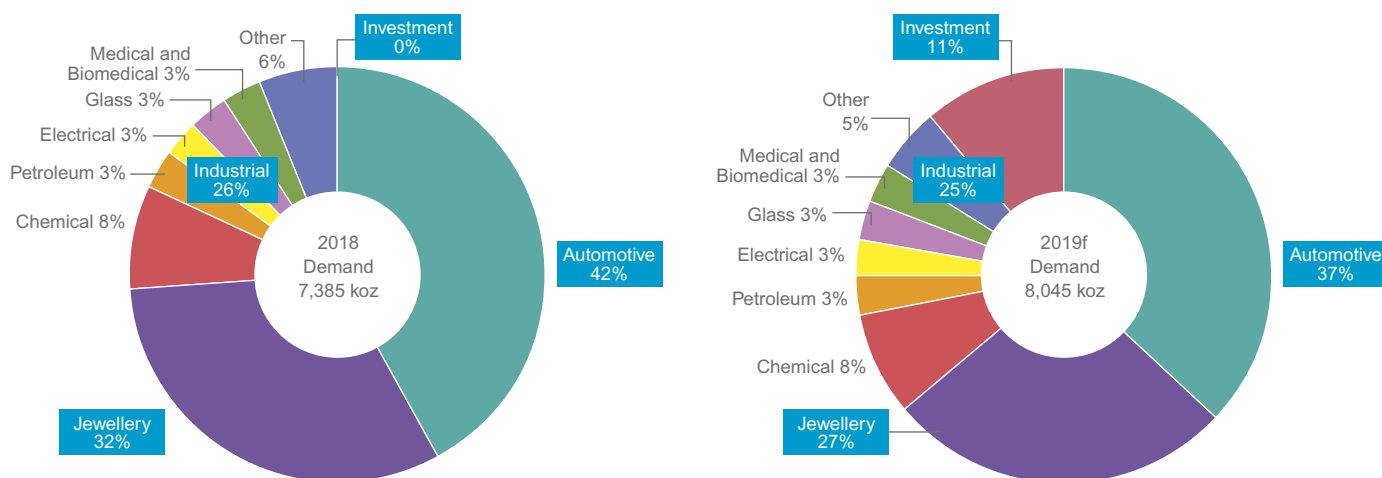
Japan's platinum jewellery demand is set to remain largely flat in 2019. Relatively strong demand is anticipated in Q3'19, but this is partly due to expected pre-buying ahead of the scheduled sales tax increase from 8% to 10% in October that is likely to impact jewellery purchasing in the final quarter. Similarly, European demand for platinum is set to remain largely static in 2019. Lower platinum prices are helping to boost platinum jewellery sales, as reflected in higher hallmarking statistics which were particularly strong at the beginning of the year, but this is against a backdrop of a difficult retail environment where sales have been falling.

Elsewhere, US demand is forecast to rise modestly in 2019, primarily due to lower platinum prices, more platinum products and continuing consumer confidence. However, as in other regions, jewellery retail sales as a whole are coming under pressure. In India, platinum jewellery demand faces several headwinds in 2019 as the jewellery retail sector experiences a number of challenges, including high gold prices affecting footfall in jewellery stores, weakening economic growth (Q1'19 saw the weakest growth in five years), an election year, cash restrictions and an erratic monsoon season. Platinum jewellery demand is still expected to see double-digit growth, but at a slower rate than over the last two years.

## Industrial demand

Industrial demand for platinum is predicted to drop by 1% (-10 koz) year-on-year to 1,910 koz in 2019, despite robust growth in the chemical sector (+55 koz), owing to lower requirements for glass fabrication (-30 koz) and other industrial end-uses (-35 koz). Platinum use in electrical devices (+5 koz) and petroleum processes (-5 koz) is expected to change only marginally, while medical demand is forecast to be flat year-on-year.

**Chart 8: Demand end-use shares, 2019f vs. 2018**



Source: SFA (Oxford)

## Chemical

Platinum requirements for chemical catalysis are forecast to rise by 10% to 625 koz this year, largely as a result of growth in China. Demand is also expected to increase slightly in North America and Western Europe, but decline marginally throughout the RoW. Significant expansion of paraxylene capacity over the next couple of years is set to boost China's platinum requirements in 2019, linked to the construction of large integrated refining and petrochemical complexes in the country, while new PDH plants and growing silicone production should also lift local demand this year.

## Petroleum

Net petroleum demand is projected to decrease by 2% to 235 koz in 2019, with growth in China and North America likely to be outweighed by a decline in platinum use in the RoW. Despite continued expansion of oil refining capacity throughout the RoW this year, the rate of catalytic reforming and isomerisation capacity growth is set to slow, reducing the region's petroleum catalyst requirements. This is mainly due to slower growth in India, following substantial upgrades in the country last year in preparation for the upcoming Bharat Stage 6/VI emissions standards. Conversely, net capacity expansion is forecast to accelerate in both China and the US in 2019, with growth in China supported by the impending China 6 emissions legislation.

## Electrical

Electrical sector requirements are expected to rise by 2% to 210 koz this year, owing to greater platinum usage in China and the RoW. Global shipments of hard disk drives (HDDs) are estimated to fall by 7% in 2019 but the total number of disks (platters) required is set to rise by 1% year-on-year, lifting platinum consumption in HDDs slightly in both China and the RoW. Robust growth in the high-capacity (multi-disk) enterprise segment is likely to increase the average number of disks per HDD, and thus boost platinum content per drive, which should offset the decline in overall HDD units.

### **Glass**

Platinum use in glass fabrication is predicted to decline by 12% to 215 koz in 2019, predominately owing to lower requirements in the RoW, despite capacity growth in India, Southeast Asia, Latin America and Eastern Europe. Although a similar number of new fabrication facilities and expansions are anticipated in the RoW this year compared to 2018, many of these were scheduled for completion early in 2019, meaning that some of the metal required was likely to have been purchased late last year. Therefore, the timing of some of the region's new facilities bolstered platinum demand last year at the expense of demand in 2019.

### **Other**

Platinum consumption in other industrial end-uses is estimated to fall by 8% to 385 koz this year, primarily owing to weaker demand for automotive sensors and fuel cells. Total ICE-based vehicle production in China is projected to decrease by 6% year-on-year in 2019, which should reduce domestic automotive sensor requirements, while global ICE vehicle production is predicted to decline by 3%. Similarly, platinum usage by the fuel cell industry is forecast to temporarily dip in Japan, South Korea and the US as thrifting more than negates overall growth in unit volumes this year.

### **Investment demand**

Global investment demand is forecast to be 905 koz this year. ETF purchases are expected to be substantial this year and to more than offset a modest decline in bar and coin purchases. Coin demand is estimated to be at a similar level to last year, whereas bar demand is anticipated to be somewhat lower as Japanese investors are not buying as much on price dips as they did in previous years.

### **ABOVE GROUND STOCKS**

The market has a surplus of 345 koz forecast for 2019, which will result in above ground stocks reaching 3,335 koz at the end of 2019.

The WPIC definition of above ground stocks is: the year-end estimate of the cumulative platinum holdings not associated with exchange-traded funds, metal held by exchanges or working inventories of mining producers, refiners, fabricators or end-users.

# PLATINUM QUARTERLY Q2 2019

**Table 2: Supply, demand and above ground stocks summary – annual comparison**

	2013	2014	2015	2016	2017	2018	2019f	2018/2017 Growth %	2019f/2018 Growth %
<b>Platinum Supply-demand Balance (koz)</b>									
<b>SUPPLY</b>									
<b>Refined Production</b>	<b>6,070</b>	<b>4,855</b>	<b>6,160</b>	<b>6,035</b>	<b>6,125</b>	<b>6,115</b>	<b>6,430</b>	<b>0%</b>	<b>5%</b>
South Africa	4,355	3,115	4,480	4,255	4,380	4,460	4,655	2%	4%
Zimbabwe	405	405	405	490	480	465	470	-3%	1%
North America	355	400	385	395	365	355	395	-3%	11%
Russia	740	740	710	715	720	665	725	-8%	9%
Other	215	195	180	180	180	170	185	-6%	9%
<b>Increase (-)/Decrease (+) in Producer Inventory</b>	<b>-215</b>	<b>+350</b>	<b>+30</b>	<b>+30</b>	<b>+30</b>	<b>+10</b>	<b>-25</b>	<b>-67%</b>	<b>N/M</b>
<b>Total Mining Supply</b>	<b>5,855</b>	<b>5,205</b>	<b>6,190</b>	<b>6,065</b>	<b>6,155</b>	<b>6,125</b>	<b>6,405</b>	<b>0%</b>	<b>5%</b>
<b>Recycling</b>	<b>1,980</b>	<b>2,035</b>	<b>1,705</b>	<b>1,840</b>	<b>1,890</b>	<b>1,935</b>	<b>1,985</b>	<b>2%</b>	<b>3%</b>
Autocatalyst	1,120	1,255	1,185	1,210	1,325	1,420	1,495	7%	5%
Jewellery	855	775	515	625	560	510	485	-9%	-5%
Industrial	5	5	5	5	5	5	5	0%	0%
<b>Total Supply</b>	<b>7,835</b>	<b>7,240</b>	<b>7,895</b>	<b>7,905</b>	<b>8,045</b>	<b>8,060</b>	<b>8,390</b>	<b>0%</b>	<b>4%</b>
<b>DEMAND</b>									
<b>Automotive</b>	<b>3,120</b>	<b>3,270</b>	<b>3,370</b>	<b>3,445</b>	<b>3,330</b>	<b>3,125</b>	<b>3,015</b>	<b>-6%</b>	<b>-4%</b>
Autocatalyst	2,980	3,130	3,235	3,305	3,190	2,980	2,860	-7%	-4%
Non-road	140	150	140	135	140	145	150	4%	3%
<b>Jewellery</b>	<b>2,945</b>	<b>3,000</b>	<b>2,840</b>	<b>2,505</b>	<b>2,460</b>	<b>2,325</b>	<b>2,215</b>	<b>-5%</b>	<b>-5%</b>
<b>Industrial</b>	<b>1,485</b>	<b>1,575</b>	<b>1,710</b>	<b>1,810</b>	<b>1,680</b>	<b>1,920</b>	<b>1,910</b>	<b>14%</b>	<b>-1%</b>
Chemical	535	540	530	580	560	570	625	2%	10%
Petroleum	50	65	205	215	100	240	235	140%	-2%
Electrical	195	215	205	195	210	205	210	-2%	2%
Glass	145	175	200	205	180	245	215	36%	-12%
Medical and Biomedical	220	220	225	230	235	240	240	2%	0%
Other	340	360	345	385	395	420	385	6%	-8%
<b>Investment</b>	<b>935</b>	<b>150</b>	<b>305</b>	<b>535</b>	<b>275</b>	<b>15</b>	<b>905</b>	<b>-95%</b>	<b>N/M</b>
Change in Bars, Coins	-5	50	525	460	215	280		30%	
Change in ETF Holdings	905	215	-240	-10	105	-245		N/M	
Change in Stocks Held by Exchanges	35	-115	20	85	-45	-20		-56%	
<b>Total Demand</b>	<b>8,485</b>	<b>7,995</b>	<b>8,225</b>	<b>8,295</b>	<b>7,745</b>	<b>7,385</b>	<b>8,045</b>	<b>-5%</b>	<b>9%</b>
<b>Balance</b>	<b>-650</b>	<b>-755</b>	<b>-330</b>	<b>-390</b>	<b>300</b>	<b>675</b>	<b>345</b>	<b>125%</b>	<b>-49%</b>
<b>Above Ground Stocks</b>	<b>4,140*</b>	<b>3,490</b>	<b>2,735</b>	<b>2,405</b>	<b>2,015</b>	<b>2,315</b>	<b>2,990</b>	<b>29%</b>	<b>12%</b>

Source: SFA (Oxford). \*As of 31st December 2012. NB: Numbers have been independently rounded. N/M means not meaningful.

# PLATINUM QUARTERLY Q2 2019

**Table 3: Supply and demand summary – quarterly comparison**

	Q2 2017	Q3 2017	Q4 2017	Q1 2018	Q2 2018	Q3 2018	Q4 2018	Q1 2019	Q2 2019	Q2'19/Q2'18 Growth %	Q2'19/Q1'19 Growth %
<b>Platinum Supply-demand Balance (koz)</b>											
<b>SUPPLY</b>											
<b>Refined Production</b>	<b>1,550</b>	<b>1,580</b>	<b>1,590</b>	<b>1,295</b>	<b>1,595</b>	<b>1,675</b>	<b>1,555</b>	<b>1,515</b>	<b>1,610</b>	<b>1%</b>	<b>6%</b>
South Africa	1,090	1,155	1,120	910	1,150	1,240	1,160	1,070	1,160	1%	8%
Zimbabwe	125	100	140	115	115	120	120	110	115	0%	5%
North America	85	95	95	90	85	90	90	85	105	24%	24%
Russia	205	185	190	140	200	180	145	205	185	-8%	-10%
Other	45	45	45	40	45	45	40	45	45	0%	0%
<b>Increase (-)/Decrease (+) in Producer Inventory</b>	<b>+75</b>	<b>-10</b>	<b>+25</b>	<b>-5</b>	<b>+55</b>	<b>-20</b>	<b>-20</b>	<b>+5</b>	<b>+5</b>	<b>-91%</b>	<b>0%</b>
<b>Total Mining Supply</b>	<b>1,625</b>	<b>1,570</b>	<b>1,615</b>	<b>1,290</b>	<b>1,650</b>	<b>1,655</b>	<b>1,535</b>	<b>1,520</b>	<b>1,615</b>	<b>-2%</b>	<b>6%</b>
<b>Recycling</b>	<b>480</b>	<b>480</b>	<b>505</b>	<b>460</b>	<b>485</b>	<b>490</b>	<b>495</b>	<b>480</b>	<b>495</b>	<b>2%</b>	<b>3%</b>
Autocatalyst	330	330	365	330	345	365	380	355	365	6%	3%
Jewellery	150	150	140	130	140	125	115	125	130	-7%	4%
Industrial	0	0	0	0	0	0	0	0	0	N/M	N/M
<b>Total Supply</b>	<b>2,105</b>	<b>2,050</b>	<b>2,120</b>	<b>1,750</b>	<b>2,135</b>	<b>2,145</b>	<b>2,030</b>	<b>2,000</b>	<b>2,110</b>	<b>-1%</b>	<b>6%</b>
<b>DEMAND</b>											
<b>Automotive</b>	<b>835</b>	<b>790</b>	<b>840</b>	<b>815</b>	<b>815</b>	<b>720</b>	<b>780</b>	<b>775</b>	<b>765</b>	<b>-6%</b>	<b>-1%</b>
Autocatalyst	805	755	810	770	780	685	740	735	730	-6%	-1%
Non-road	35	35	35	35	40	35	40	40	40	0%	0%
<b>Jewellery</b>	<b>590</b>	<b>580</b>	<b>680</b>	<b>595</b>	<b>585</b>	<b>565</b>	<b>600</b>	<b>560</b>	<b>555</b>	<b>-5%</b>	<b>-1%</b>
<b>Industrial</b>	<b>410</b>	<b>420</b>	<b>435</b>	<b>470</b>	<b>475</b>	<b>480</b>	<b>490</b>	<b>490</b>	<b>480</b>	<b>1%</b>	<b>-2%</b>
Chemical	130	160	135	145	135	160	135	155	150	11%	-3%
Petroleum	15	25	25	55	55	55	55	55	55	0%	0%
Electrical	50	50	65	55	50	50	55	55	50	0%	-9%
Glass	50	45	35	55	60	70	65	75	65	8%	-13%
Medical and Biomedical	70	45	70	55	70	45	70	55	70	0%	27%
Other	95	95	105	105	105	100	110	95	90	-14%	-5%
<b>Investment</b>	<b>105</b>	<b>-10</b>	<b>100</b>	<b>60</b>	<b>-55</b>	<b>65</b>	<b>-65</b>	<b>765</b>	<b>90</b>	<b>N/M</b>	<b>-88%</b>
Change in Bars, Coins	75	45	65	85	70	70	50	75	60	-14%	-20%
Change in ETF Holdings	30	-40	55	-15	-125	5	-115	690	30	N/M	-96%
Change in Stocks Held by Exchanges	0	-15	-20	-10	0	-10	0	0	0	N/M	N/M
<b>Total Demand</b>	<b>1,940</b>	<b>1,780</b>	<b>2,055</b>	<b>1,940</b>	<b>1,820</b>	<b>1,830</b>	<b>1,805</b>	<b>2,590</b>	<b>1,890</b>	<b>4%</b>	<b>-27%</b>
<b>Balance</b>	<b>165</b>	<b>270</b>	<b>65</b>	<b>-190</b>	<b>315</b>	<b>315</b>	<b>225</b>	<b>-590</b>	<b>220</b>		

Source: SFA (Oxford). NB: Numbers have been independently rounded. N/M means not meaningful.

# PLATINUM QUARTERLY Q2 2019

Table 4: Supply and demand summary – half-yearly comparison

	H1 2017	H2 2017	H1 2018	H2 2018	H1 2019	H1'19/H1'18 Growth %	H1'19/H2'18 Growth %
<b>Platinum Supply-demand Balance (koz)</b>							
<b>SUPPLY</b>							
<b>Refined Production</b>	<b>2,965</b>	<b>3,170</b>	<b>2,890</b>	<b>3,230</b>	<b>3,125</b>	<b>8%</b>	<b>-3%</b>
South Africa	2,110	2,275	2,060	2,400	2,230	8%	-7%
Zimbabwe	240	240	230	240	225	-2%	-6%
North America	180	190	175	180	190	9%	6%
Russia	345	375	340	325	390	15%	20%
Other	90	90	85	85	90	6%	6%
<b>Increase (-)/Decrease (+) in Producer Inventory</b>	<b>+15</b>	<b>+15</b>	<b>+50</b>	<b>-40</b>	<b>+10</b>	<b>-80%</b>	<b>N/M</b>
<b>Total Mining Supply</b>	<b>2,980</b>	<b>3,185</b>	<b>2,940</b>	<b>3,190</b>	<b>3,135</b>	<b>7%</b>	<b>-2%</b>
<b>Recycling</b>	<b>900</b>	<b>985</b>	<b>945</b>	<b>985</b>	<b>975</b>	<b>3%</b>	<b>-1%</b>
Autocatalyst	630	695	675	745	720	7%	-3%
Jewellery	270	290	270	240	255	-6%	6%
Industrial	0	0	0	0	0	N/M	N/M
<b>Total Supply</b>	<b>3,880</b>	<b>4,170</b>	<b>3,885</b>	<b>4,175</b>	<b>4,110</b>	<b>6%</b>	<b>-2%</b>
<b>DEMAND</b>							
<b>Automotive</b>	<b>1,695</b>	<b>1,630</b>	<b>1,630</b>	<b>1,500</b>	<b>1,540</b>	<b>-6%</b>	<b>3%</b>
Autocatalyst	1,625	1,565	1,550	1,425	1,465	-5%	3%
Non-road	70	70	75	75	80	7%	7%
<b>Jewellery</b>	<b>1,200</b>	<b>1,260</b>	<b>1,180</b>	<b>1,165</b>	<b>1,115</b>	<b>-6%</b>	<b>-4%</b>
<b>Industrial</b>	<b>835</b>	<b>855</b>	<b>945</b>	<b>970</b>	<b>970</b>	<b>3%</b>	<b>0%</b>
Chemical	270	295	280	295	305	9%	3%
Petroleum	50	50	110	110	110	0%	0%
Electrical	105	115	105	105	105	0%	0%
Glass	90	80	115	135	140	22%	4%
Medical and Biomedical	125	115	125	115	125	0%	9%
Other	195	200	210	210	185	-12%	-12%
<b>Investment</b>	<b>185</b>	<b>90</b>	<b>5</b>	<b>0</b>	<b>855</b>	<b>N/M</b>	<b>N/M</b>
Change in Bars, Coins	105	110	155	120	135	-13%	13%
Change in ETF Holdings	90	15	-140	-110	720	N/M	N/M
Change in Stocks Held by Exchanges	-10	-35	-10	-10	0	-100%	-100%
<b>Total Demand</b>	<b>3,915</b>	<b>3,835</b>	<b>3,760</b>	<b>3,635</b>	<b>4,480</b>	<b>19%</b>	<b>23%</b>
<b>Balance</b>	<b>-35</b>	<b>335</b>	<b>125</b>	<b>540</b>	<b>-370</b>		

Source: SFA (Oxford). NB: Numbers have been independently rounded. N/M means not meaningful.

# PLATINUM QUARTERLY Q2 2019

**Table 5: Regional demand – annual and quarterly comparison**

	2016	2017	2018	2019f	2018/2017 Growth %	2019f/2018 Growth %	Q2 2018	Q3 2018	Q4 2018	Q1 2019	Q2 2019
<b>Platinum gross demand (koz)</b>											
<b>Automotive</b>	<b>3,445</b>	<b>3,330</b>	<b>3,125</b>	<b>3,015</b>	<b>-6%</b>	<b>-4%</b>	<b>815</b>	<b>720</b>	<b>780</b>	<b>775</b>	<b>765</b>
North America	460	430	450		5%						
Western Europe	1,705	1,560	1,300		-17%						
Japan	455	440	420		-5%						
China	165	195	190		-3%						
India	165	170	190		12%						
Rest of the World	495	535	575		7%						
<b>Jewellery</b>	<b>2,505</b>	<b>2,460</b>	<b>2,325</b>	<b>2,215</b>	<b>-5%</b>	<b>-5%</b>	<b>585</b>	<b>565</b>	<b>600</b>	<b>560</b>	<b>555</b>
North America	265	280	295		5%						
Western Europe	240	250	255		2%						
Japan	335	340	345		1%						
China	1,450	1,340	1,155		-14%						
India	145	175	200		14%						
Rest of the World	70	75	75		0%						
<b>Chemical</b>	<b>580</b>	<b>560</b>	<b>570</b>	<b>625</b>	<b>2%</b>	<b>10%</b>	<b>135</b>	<b>160</b>	<b>135</b>	<b>155</b>	<b>150</b>
North America	55	50	50		0%						
Western Europe	115	110	110		0%						
Japan	15	15	15		0%						
China	230	215	215		0%						
Rest of the World	165	170	180		6%						
<b>Petroleum</b>	<b>215</b>	<b>100</b>	<b>240</b>	<b>235</b>	<b>140%</b>	<b>-2%</b>	<b>55</b>	<b>55</b>	<b>55</b>	<b>55</b>	<b>55</b>
North America	90	55	55		0%						
Western Europe	10	5	25		400%						
Japan	0	-40	5		-113%						
China	80	45	10		-78%						
Rest of the World	35	35	145		314%						
<b>Electrical</b>	<b>195</b>	<b>210</b>	<b>205</b>	<b>210</b>	<b>-2%</b>	<b>2%</b>	<b>50</b>	<b>50</b>	<b>55</b>	<b>55</b>	<b>50</b>
North America	10	15	15		0%						
Western Europe	10	10	10		0%						
Japan	15	15	15		0%						
China	80	90	85		-6%						
Rest of the World	80	80	80		0%						
<b>Glass</b>	<b>205</b>	<b>180</b>	<b>245</b>	<b>215</b>	<b>36%</b>	<b>-12%</b>	<b>60</b>	<b>70</b>	<b>65</b>	<b>75</b>	<b>65</b>
North America	20	5	5		0%						
Western Europe	5	5	35		600%						
Japan	-10	-10	0		-100%						
China	100	85	75		-12%						
Rest of the World	90	95	130		37%						
<b>Medical</b>	<b>230</b>	<b>235</b>	<b>240</b>	<b>240</b>	<b>2%</b>	<b>0%</b>	<b>70</b>	<b>45</b>	<b>70</b>	<b>55</b>	<b>70</b>
North America	90	95	95		0%						
Western Europe	80	80	80		0%						
Japan	20	20	20		0%						
China	20	20	20		0%						
Rest of the World	20	20	25		25%						
<b>Other industrial</b>	<b>385</b>	<b>395</b>	<b>420</b>	<b>385</b>	<b>6%</b>	<b>-8%</b>	<b>105</b>	<b>100</b>	<b>110</b>	<b>95</b>	<b>90</b>
<b>Investment</b>	<b>535</b>	<b>275</b>	<b>15</b>	<b>905</b>	<b>-95%</b>	<b>N/M</b>	<b>-55</b>	<b>65</b>	<b>-65</b>	<b>765</b>	<b>90</b>
<b>Total Demand</b>	<b>8,295</b>	<b>7,745</b>	<b>7,385</b>	<b>8,045</b>	<b>-5%</b>	<b>9%</b>	<b>1,820</b>	<b>1,830</b>	<b>1,805</b>	<b>2,590</b>	<b>1,890</b>

Source: SFA (Oxford). NB: Numbers have been independently rounded.



## GLOSSARY OF TERMS

### Above ground stocks

The year-end estimate of the cumulative platinum holdings not associated with: exchange-traded funds, metal held by exchanges or working inventories of: mining producers, refiners, fabricators or end-users. Typically, unpublished vaulted metal holdings from which a supply-demand shortfall can be readily supplied or to which a supply-demand surplus can readily flow.

### ADH

Alkane dehydrogenation: catalytic conversion of alkanes to alkenes. Broad term encompassing BDH and PDH.

### BDH

Butane dehydrogenation; catalytic conversion of isobutane to isobutylene.

### Bharat Stage V/VI standards (BS-V, BS-VI)

Early in 2016 the Indian government announced the intention to 'leapfrog' Bharat Stage V and move directly to Bharat Stage VI, equivalent to Euro 6, in 2020.

### Conformity factor (CF)

The EU is to allow automakers to exceed current Euro 6 NO<sub>x</sub> limits, giving time to adapt to new real-world driving emissions rules. From September 2017 for new models and from September 2019 for new vehicles, a CF of up to 2.1 (110%) will be allowed over the 80 mg/km NO<sub>x</sub> limit. This CF will be phased out at the latest in 2021, then from January 2020 (new models) and January 2021 (new vehicles) a lower CF of 1.5 will be allowed, reflecting statistical and technical uncertainty of the tests.

### Diesel oxidation catalyst (DOC)

A DOC oxidises harmful carbon monoxide and unburnt hydrocarbons, produced by incomplete combustion of diesel fuel, to harmless carbon dioxide and water.

### Diesel particulate filter (DPF) and catalysed diesel particulate filter (CDPF)

A DPF physically filters particulates (soot) from diesel exhaust. A CDPF adds a PGM catalyst coating to facilitate oxidation and removal of the soot. The terms are often used interchangeably.

### Emissions legislation

Tailpipe regulations covering emissions of particulate matter, hydrocarbons and oxides of nitrogen.

### ETF

Exchange-traded fund. A security that tracks an index, commodity or basket of assets. Platinum ETFs included in demand are backed by physical metal.

### Euro V/VI emission standards

EU emission standards for heavy-duty vehicles. Euro V legislation was introduced in 2009 and Euro VI in 2013/2014; will be widely adopted later in other regions.

### Euro 5/6 emission standards

EU emission standards for light-duty vehicles. Euro 5 legislation was introduced in 2009 and Euro 6 in 2014/2015; will be widely adopted later in other regions.

### Form factor

The size of a hard disk drive (e.g. 2.5-inch or 3.5-inch) which varies depending on the device the drive is used in.

### GTL

Gas-to-liquids is a refinery process that converts natural gas to liquid hydrocarbons such as gasoline or diesel fuel.

### HDD

Hard disk drive.

### HDV

Heavy-duty vehicle.

### ICE

Internal combustion engine.

### koz

Thousand ounces.

### LCD

Liquid-crystal display used for video display.

### LCV

Light commercial vehicle.

### Lean NO<sub>x</sub> traps (LNT)

Rhodium-based, catalyses the chemical reduction of NO<sub>x</sub> in diesel engine exhaust to harmless nitrogen.

### Metal-in-concentrate

PGMs contained in the concentrate produced after the crushing, milling and froth flotation processes in the concentrator. It is a measure of a mine's output before the smelting and refining stages.

### moz

Million ounces.

### NEDC

New European Driving Cycle vehicle emissions test.

### Net demand

A measure of the theoretical requirement for new metal, i.e. net of recycling.

### Non-road engines

Non-road engines are diesel engines used, for example, in construction, agricultural and mining equipment, using engine and emissions technology similar to on-road heavy-duty diesel vehicles.

### NO<sub>x</sub> storage catalyst (NSC)

Used in light duty diesel aftertreatment to convert harmful oxides of nitrogen to harmless nitrogen and carbon dioxide. The PGM content is mainly platinum, with some rhodium. NSCs may be used in conjunction with SCR technology to minimise NO<sub>x</sub> emissions.

### OECD

Organisation for Economic Co-operation and Development, consisting of 34 developed countries.

### oz

A unit of weight commonly used for precious metals.  
1 troy ounce = 1.1 ounces.

### Paraxylene

A chemical produced from petroleum naphtha extracted from crude oil using a platinum catalyst. This is used in the production of terephthalic acid which is used to manufacture polyester.

### PDH

Propane dehydrogenation, where propane is converted to propylene.

### PGMs

Platinum-group metals.

### PMR

Precious metals refinery.

### Producer inventory

As used in the supply-demand balance, the change in producer inventory is the difference between reported refined production and metal sales.

### RDE

Real Driving Emissions – the term used by the EU to define the testing protocol that will measure pollutants emitted from cars, including NO<sub>x</sub>, while driven on the road. It is in addition to laboratory tests. RDE testing was implemented in September 2017 for new types of cars and will apply to all registrations from September 2019.

### Refined production

Processed platinum output from refineries.

### Secondary supply

Recycling output.

### Selective catalytic reduction (SCR)

PGM-free, converts harmful NO<sub>x</sub> in diesel exhaust to harmless nitrogen, via a tank of urea solution. Used in heavy-duty diesel vehicles, increasingly competes with LNT in light-duty diesel vehicles. Contained within an aftertreatment system which normally requires a platinum-containing oxidation catalyst ahead of the SCR unit.

### SGE

Shanghai Gold Exchange.

### SSD

Solid-state drive.

### Stage 4 regulations

European emission standards implemented in 2014 for non-road diesel engines.

### Three-way catalyst

Used in gasoline cars to remove hydrocarbons, carbon monoxide and NO<sub>x</sub>. Largely palladium-based now, some rhodium.

### Tier 4 stage

Emissions standards phased in between 2008 and 2015 in the US for non-road vehicles.

### WIP

Work in progress.

### WLTP

Worldwide Harmonised Light Vehicle Test Procedure is a laboratory test to measure pollutant emissions and fuel consumption. WLTP replaces the New European Driving Cycle (NEDC).

### WPIC

The World Platinum Investment Council.

---

### Ounce conversion

1 million ounces = 31.1 tonnes.

**IMPORTANT NOTICE AND DISCLAIMER:** This publication is general and solely for educational purposes. The publisher, The World Platinum Investment Council, has been formed by the world's leading platinum producers to develop the market for platinum investment demand. Its mission is to stimulate investor demand for physical platinum through both actionable insights and targeted development, providing investors with the information to support informed decisions regarding platinum and working with financial institutions and market participants to develop products and channels that investors need. No part of this report may be reproduced or distributed in any manner without attribution to the authors. The research and commentary attributed to SFA in the publication is © SFA Copyright reserved. All copyright and other intellectual property rights in the data and commentary contained in this report remain the property of SFA, one of our third party content providers, and no person other than SFA shall be entitled to register any intellectual property rights in the information, or data herein. The analysis, data and other information attributed to SFA reflect SFA's judgment as of the date of the document and are subject to change without notice. No part of the data or commentary shall be used for the specific purpose of accessing capital markets (fundraising) without the written permission of SFA.

This publication is not, and should not be construed to be, an offer to sell or a solicitation of an offer to buy any security. With this publication, neither the publisher nor SFA intend to transmit any order for, arrange for, advise on, act as agent in relation to, or otherwise facilitate any transaction involving securities or commodities regardless of whether such are otherwise referenced in it. This publication is not intended to provide tax, legal, or investment advice and nothing in it should be construed as a recommendation to buy, sell, or hold any investment or security or to engage in any investment strategy or transaction. Neither the publisher nor SFA is, or purports to be, a broker-dealer, a registered investment advisor, or otherwise registered under the laws of the United States or the United Kingdom, including under the Financial Services and Markets Act 2000 or Senior Managers and Certifications Regime or by the Financial Conduct Authority.

This publication is not, and should not be construed to be, personalized investment advice directed to or appropriate for any particular investor. Any investment should be made only after consulting a professional investment advisor. You are solely responsible for determining whether any investment, investment strategy, security or related transaction is appropriate for you based on your investment objectives, financial circumstances and risk tolerance. You should consult your business, legal, tax or accounting advisors regarding your specific business, legal or tax situation or circumstances.

The information on which this publication is based is believed to be reliable. Nevertheless, neither the publisher nor SFA can guarantee the accuracy or completeness of the information. This publication contains forward-looking statements, including statements regarding expected continual growth of the industry. The publisher and SFA note that statements contained in the publication that look forward in time, which include everything other than historical information, involve risks and uncertainties that may affect actual results and neither the publisher nor SFA accepts any liability whatsoever for any loss or damage suffered by any person in reliance on the information in the publication.

The logos, services marks and trademarks of the World Platinum Investment Council are owned exclusively by it. All other trademarks used in this publication are the property of their respective trademark holders. The publisher is not affiliated, connected, or associated with, and is not sponsored, approved, or originated by, the trademark holders unless otherwise stated. No claim is made by the publisher to any rights in any third-party trademarks.

### **WPIC Research MiFID II Status**

The World Platinum Investment Council (WPIC) has undertaken an internal and external review of its content and services for MiFID II. As a result WPIC highlights the following to the recipients of its research services, and their Compliance/Legal departments:

WPIC research content falls clearly within the Minor Non-Monetary Benefit Category, and can continue to be consumed by all asset managers free of charge. WPIC research can be freely shared across investment organisations.

WPIC does not conduct any financial instrument execution business. WPIC does not have any market making, sales trading, trading or share dealing activity. (No possible inducement).

WPIC content is disseminated widely and made available to all interested parties through a range of different channels, therefore qualifying as a "Minor Non-Monetary Benefit" under MiFID II (ESMA/FCA/AMF). WPIC research is made freely available through the WPIC website. WPIC does not have any permissioning requirements on research aggregation platforms.

WPIC does not, and will not seek, any payment from consumers of our research services. WPIC makes it clear to institutional investors that it does not seek payment from them for our freely available content.

More detailed information is available on the WPIC website: <http://www.platinuminvestment.com/investment-research/mifid-ii>

