SFA Oxford

THE PLATINUM STANDARD

September 2015

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September 2015

Edition 04

CONTENTS

FOREWORD

Foreword

Stephen A. Forrest, Chairman, SFA (Oxford) Ltd

A blueprint for white metals in dark days

It's 30th August 2015 as I put pen to paper and develop my thinking for workable solutions in the global platinum-group metals sector. Put plainly, a good number of miners, investors and consultants, yes consultants, alike are losing money in this commodity segment as I write.

In 2015 we find ourselves in a world where economic growth is slowing despite six years of near-zero interest rates and quantitative easing. Governments have been desperate to promote economic growth because global debt levels have continued to climb, up by more than a third from 2007 to 2014, and slow growth with low inflation increases the debt load. China's phenomenal economic expansion has made it the largest consumer of many commodities, but growth has been slowing there as well.

High debt levels have historically been associated with slower growth and they increase the chance of financial crises that cause deep recessions. With the impact of central banks' unconventional monetary policies waning, continued slow growth could be the best case scenario over the next few years, which would keep commodity prices subdued.

In our Q4 2014 and Q1 2015 PGM price risk radar reports we signalled a much weaker PGM market ahead, and our latest extrapolations on PGM supply-demand balances point to a recurring diagnosis of reducing deficits. Significantly for all three metals, narrowing deficits/moving to surpluses mean the excess stock that has built up since 2008 is not going to be absorbed by the market anytime soon, unless there is a major event such as supply disruption or sizeable shaft closures in South Africa.

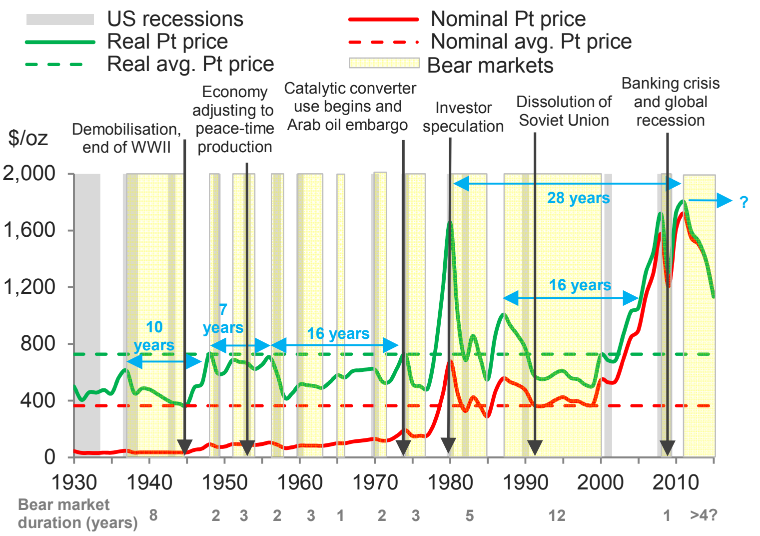
My blueprint for PGM recovery has three manifesto elements:

1) Know your enemy: a longer, deeper recession?
2) Promote the most important use: need a new 'autopilot'
3) Supply management: when in a hole, stop digging?

1) Know your enemy: a longer, deeper recession?

Since 2011 platinum prices have slumped and a number of factors suggest an imminent, sustainable upturn is unlikely.

Historical platinum price and bear markets



Source: SFA (Oxford). Note: The blue time spans represent an adjacent price peak.

Bigger, badder bear?

Industrial demand (price) spiked

Firstly, industrial demand pull for platinum has weakened considerably. Previous price spikes for platinum (and rhodium) changed end-users' purchasing behaviour; for example, automakers began to replace platinum with palladium in diesel autocatalysts. Annual platinum demand in global autocatalysts dropped from 46% in 2004 to 27% in 2014, whilst palladium use rose from 45% to 65%.

This lowered gearing of platinum usage in both gasoline and diesel catalyst systems could result in a delayed price recovery.

Jewellery unchained

Secondly, platinum demand is now more dependent on the jewellery market. This is significant because low prices in 2015 have failed to stimulate buying in China as they have done in the past. Jewellery demand as a share of the global total is up from 24% in 2007 to 38% in 2014.

Stocks unveiled

Thirdly, the platinum market is more transparent than it ever was; for example, before 1990 publication of the economics of mine supply data was non-existent. Furthermore, the introduction of ETFs means global stocks are more visible, with 2.9 moz of platinum accumulated, and these data are in the public domain.

The 'real' miners' power crisis

Lastly, with mining companies' finances tightening, it appears to me that metal producers have relatively weaker negotiating power with end-users. South African suppliers are particularly vulnerable, as consumers are fully stocked and continue to seek substitutes for, and reductions in, the amount of platinum (and other PGMs) required.

The bottom line is that platinum prices can be lower for longer this time. Investors and sector players should assume the worst but hope for the best – these may be abnormal times.

2) Promote the most important use: need a new 'autopilot'

Promote platinum's largest end-use

Mining companies have very successfully campaigned for the use of platinum in jewellery over the last 40 years through Platinum Guild International (PGI). Jewellery now consumes close to 3 moz p.a. Recently, the mining companies launched the World Platinum Investment Council to promote investment buying of platinum. What about the auto industry, the biggest consumer of PGMs?

Critical to investor behaviour is the underlying industrial demand pull of PGMs – this is the reason to invest for the long term. Now is the time to reignite the promotion of PGM use in the automotive industry, not only to protect what exists, but also to grow it. After all, it was the auto industry that provided the upfront finance to sink a number of the major shafts in South Africa in the first place.

Emerging market auto uncertainty

Of particular concern to me is the medium-term outlook for the emerging markets, expressly the palladium-dominated auto sector in China, and India with its high proportion of platinum-rich diesel vehicles.

Crucially, automakers' ability to sustain their rate of production and sales in the emerging markets, and thus maintain the projected growth in PGM autocatalyst demand, is, for me, the most significant factor keeping long-term investors and miners awake at night.

What is more, the potential demand boost from the introduction of Euro 6 equivalent legislation in these emerging economies is under threat of being postponed as the timetables for rollout are being extended.

Miners should steer South Africa into the emissions fast lane

The adoption of cleaner fuel and tighter tailpipe emissions standards in these territories would lead to a much larger parc of vehicles using the full suite of catalysts, and bring along with it the benefit of much higher PGM loadings and therefore demand. Producers should start by lobbying policy-makers in South Africa. Let South Africa lead the way in the emerging markets and let South Africa urge others to follow. Currently on Euro 2 emissions legislation, South Africa is expected to move straight to Euro 5 around 2017, while Europe first adopted Euro 5 standards in 2009 and moved on to Euro 6 in 2014.

If a firmer timetable for implementing tighter emissions standards were established, long lead-time players (miners, fabricators) and investors could sleep more easily.

Technological developments in the auto industry will also significantly shape future demand for PGMs. Production of commercially viable fuel cell vehicles, more accurate measurement of real-world driving emissions, along with growing acceptance that newer Euro 6 compliant diesel cars are legislated to the same emissions level as equivalent gasoline vehicles while delivering significantly better fuel economy, will all increase PGM requirements and stimulate PGM sector investment.

Again, such advances could be delayed or might never materialise unless a programme to promote increased PGM usage in the auto industry becomes a shared focus for governments, miners, users and investors.

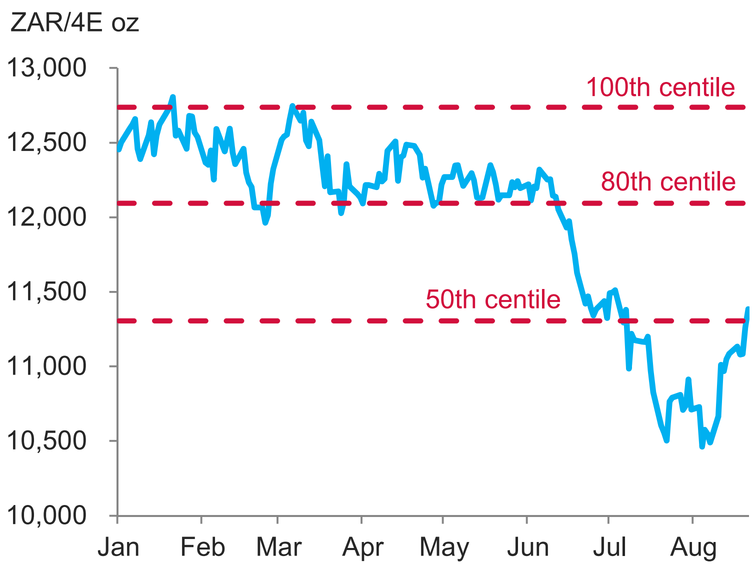
3) Supply management: when in a hole, stop digging?

The global PGM mining sector has been hit hard by the collapse of producer basket prices. A major slump in the rand producer basket price since June has profoundly impacted the South African mining industry and, as a consequence, is seriously threatening jobs as well as the investable future of the sector. PGM equity values have fallen by more than 40% in the last six months. This is likely to trigger M&A activity (consolidation).

Currently, we estimate some 1.1 moz of 4E PGM production is unprofitable and the balance of output (3.8 moz) has a gross margin of less than 10% at today's metal prices. (Our computations are based on a pre-CAPEX and total cash cost basis including by-product metal revenues.) A resumption of the downward trend in prices to the end of July 2015 would see 50% of the industry struggling to make a profit this year.

Half of South African mining at risk

Basket price vs. the cost of production, 2015

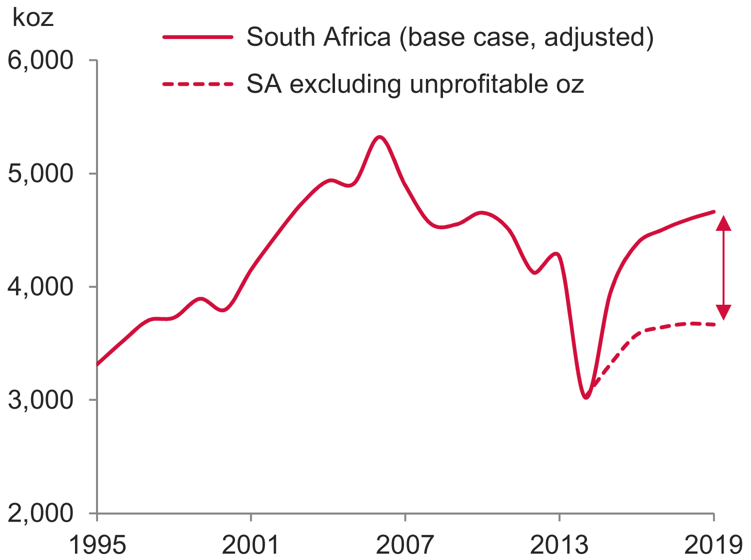


Source: SFA (Oxford). Note: Centiles represent the cost of mine production on a net total cash cost basis, excluding CAPEX.

Although South African producers' guidance suggests a base case platinum profile of 4.0 moz to 4.5 moz over the next three years, annual production could fall to between 3.3 moz and 3.6 moz if there is no platinum price uplift from today's level (around $1,000/oz). This assumption is based on the rand averaging in the ZAR11.5-12:$1 range (currently ZAR13.4:$1) and also assumes the closure of unprofitable mine shafts, equating to the loss of up to 660 koz Pt/year, and the cancellation of new shaft projects in construction, totalling 330 koz Pt/year, between 2015 and 2017.

South African platinum production could fall to 3.3 moz, lowest in 20 years

South African Pt production, 1995-2019

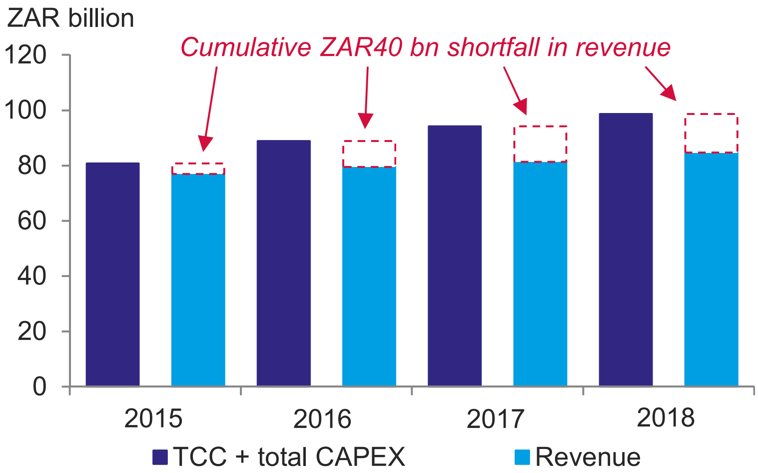


Source: SFA (Oxford)

The near-term risk to supply predominantly relates to the failure of new capacity to start up and premature shaft closures. Longer term (beyond five years), depletion is a key driver of declining mine supply. Sustained low prices could bring forward this South African depletion curve, as 74% of the country's producers would be unable to meet even pared-down capital requirements.

Failure to implement production cuts will put considerable pressure on mine finances. Unless South African miners dramatically tailor their output to market fundamentals, thereby cutting the impending overshoot in PGM supply and providing for more attractive equity investment credentials, a worst case scenario arising from low prices and no mine closures could potentially result in a funding shortfall in mine revenue of some ZAR58 billion by 2018. Certainly a regime of flat prices, even with the aforementioned closures, will still result in a significant revenue shortfall of some ZAR40 billion by 2018. Funding would have to be sourced through capital raising (rights issues) or via loan finance, or a combination thereof. Funding success will be very difficult in the current bear market.

Low prices, mine closures, 2015-2018



Source: SFA (Oxford)

Business 'as usual' will require funding of some ZAR40 bn

Summary: supply management and demand promotion

The platinum market is facing both macro challenges, owing to the cyclical movements in underlying commodity prices, and fundamental micro challenges, as I have outlined. All challenges stem from a number of factors including price volatility, varying regional economic growth rates, metal excesses and, after a sustained period of high prices, substitution.

In the short term, mining companies need to respond to external pressures by cutting output. This could be achieved by the deferral of supply from replacement shafts, mines in ramp-up and new projects, and the closure of high-cost mining areas.

Promotion potential by no means 'exhausted'

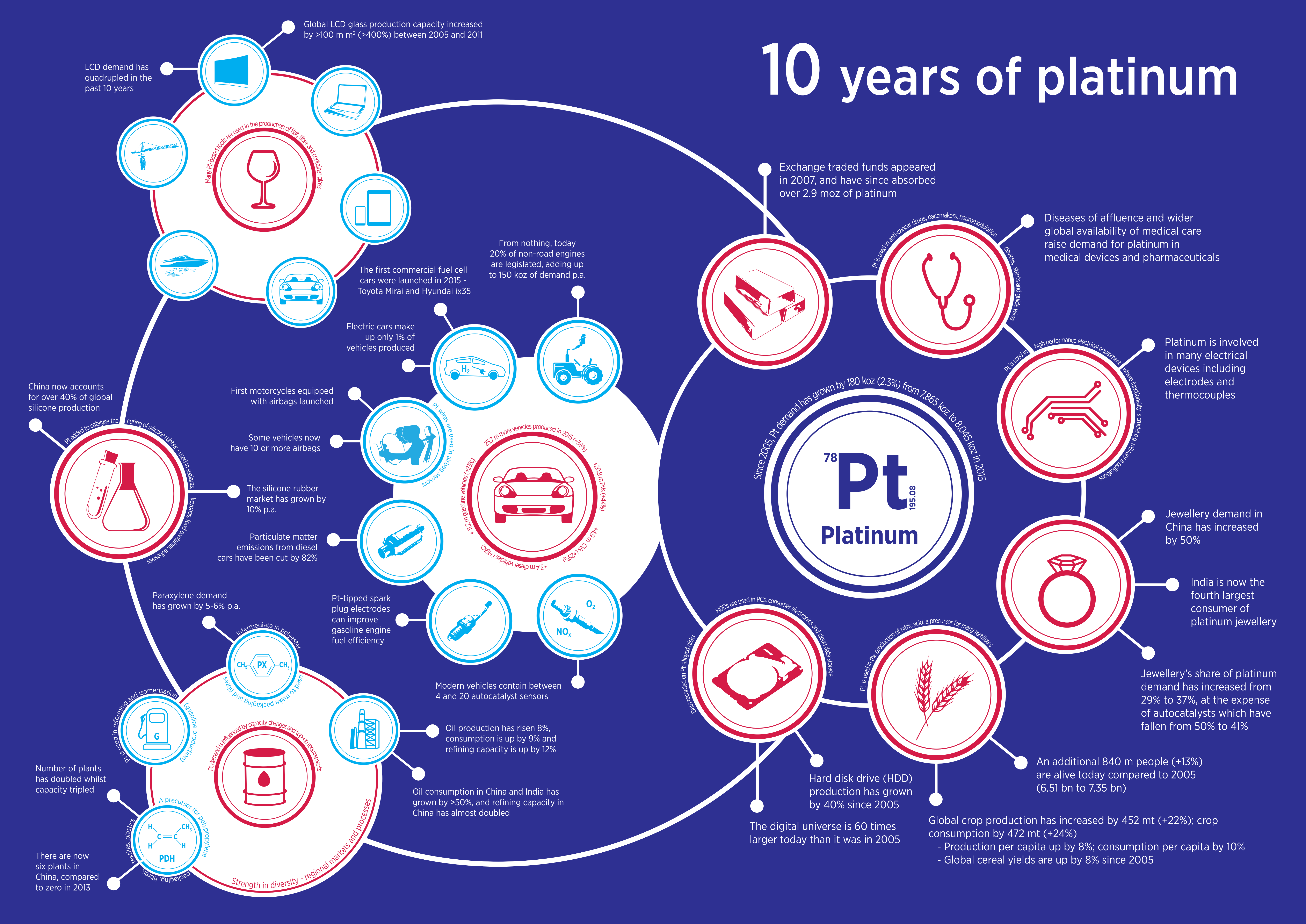
The key to motivating firmer, less volatile prices is held by automotive and jewellery demand pull. SFA estimates there is over 1 moz of potential platinum upside from the adoption of tighter tailpipe emissions in emerging markets, including China and India. Maintaining cooperation between miners, fabricators and end-users is essential to ensuring platinum's place in future emissions control technologies. All the while, funding campaigns aimed at governments and green lobby organisations for the accelerated adoption of cleaner fuel and tighter emissions legislation should be a priority to motivate demand pull from the automotive sector. South Africa should lead the way.

Polish up jewellery again

Key to jewellery's success has been PGI's campaigns in China, India, the US, Japan and Europe. Since PGI started out in 1975, platinum jewellery demand has doubled. However, funding for PGI had to be cut in recent years and consequently we have not seen the same demand response to falling prices as previously experienced. In fact, jewellery demand in China is forecast to fall 7% in 2015 and this goes some way to explain the recent price weakness. Critical to the demand pull for platinum is to increase jewellery funding.

In summary, cuts in loss-making supply, plus a new focus on auto-use promotion and a reinvigoration of jewellery demand marketing would provide the best fundamental case for investment, and so future profitable supply.

A REVIEW OF PLATINUM DEMAND OVER THE LAST 10 YEARS



10 years of platinum
Global LCD glass production capacity increased by >100 m m² (>400%) between 2005 and 2011
LCD demand has quadrupled in the past 10 years
Many Pt-based tools are used in the production of flat, fibre and container glass
The first commercial fuel cell cars were launched in 2015 - Toyota Mirai and Hyundai ix35
From nothing, today 20% of non-road engines are legislated, adding up to 150 koz of demand p.a.
Electric cars make up only 1% of vehicles produced
First motorcycles equipped with airbags launched
Some vehicles now have 10 or more airbags
Pt wires are used in airbag sensors
25.7 m more vehicles produced in 2015 (+38%)
+20.8 m PVs (+44%)
+4.9 m CVs (+25%)
+3.4 m diesel vehicles (+19%)
+11.2 m gasoline vehicles (+23%)
China now accounts for over 40% of global silicone production
Pt added to catalyse the curing of silicone rubber - used in sealants, keypads, food containers, adhesives
The silicone rubber market has grown by 10% p.a.
Particulate matter emissions from diesel cars have been cut by 82%
Pt-tipped spark plug electrodes can improve gasoline engine fuel efficiency
Modern vehicles contain between 4 and 20 autocatalyst sensors
Paraxylene demand has grown by 5-6% p.a.
Intermediate in polyester
Used to make packaging and fibres
Pt is used in reforming and isomerisation (gasoline production)
Pt demand is influenced by capacity changes and top-up requirements
Oil production has risen 8%, consumption is up by 9% and refining capacity is up by 12%
Oil consumption in China and India has grown by >50%, and refining capacity in China has almost doubled
Number of plants has doubled whilst capacity tripled
A precursor for polypropylene
textiles, plastics, packaging, fibres
There are now six plants in China, compared to zero in 2013
Strength in diversity - regional markets and processes
Exchange traded funds appeared in 2007, and have since absorbed over 2.9 moz of platinum
Pt is used in anti-cancer drugs, pacemakers, neuromodulation devices, stents and guide wires
Diseases of affluence and wider global availability of medical care raise demand for platinum in medical devices and pharmaceuticals
Pt is used in high performance electrical equipment where functionality is crucial e.g. military applications
Platinum is involved in many electrical devices including electrodes and thermocouples
Since 2005, Pt demand has grown by 180 koz (2.3%) from 7865 koz to 8045 koz in 2015
78
Pt
195.08
Platinum
Jewellery demand in China has increased by 50%
India is now the fourth largest consumer of platinum jewellery
Jewellery's share of platinum demand has increased from 29% to 37%, at the expense of autocatalysts which have fallen from 50% to 41%
HDDs are used in PCs, consumer electronics and cloud data storage
Data recorded on Pt-alloyed disks
Pt is used in the production of nitric acid, a precursor for many fertilisers
Hard disk drive (HDD) production has grown by 40% since 2005
The digital universe is 60 times larger today than it was in 2005
An additional 840 m people (+13%) are alive today compared to 2005 (6.51 bn to 7.35 bn)
Global crop production has increased by 452 mt (+22%); crop consumption by 472 mt (+24%)
- Production per capita up by 8%; consumption per capita by 10%
- Global cereal yields are up by 8% since 2005

OXFORD ECONOMICS' US OUTLOOK

Oxford Economics' US outlook

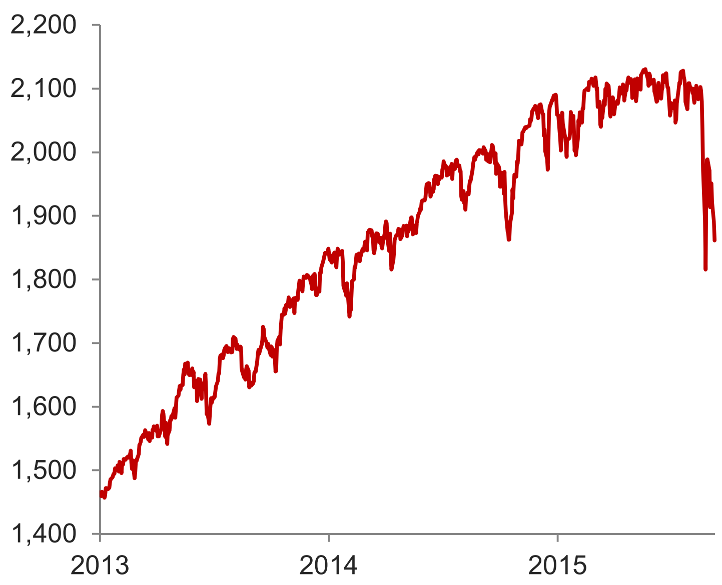
Oren Klachkin, Senior Economist, Oxford Economics

Slowing global growth, firming domestic environment – what is the Fed to do?

Exuberance exhausted?

Fears of a hard landing in China are grabbing headlines and spooking investors. Financial markets have become very anxious, with stock prices around the world near correction territory. This negative shock comes at a very inauspicious time, as the Federal Reserve prepares to lift rates for the first time in nearly a decade. This leaves the Fed in a difficult position: raise interest rates as the US economy strengthens, or hold off given the increasingly weak global backdrop. What are the potential outcomes of these options on PGM demand?

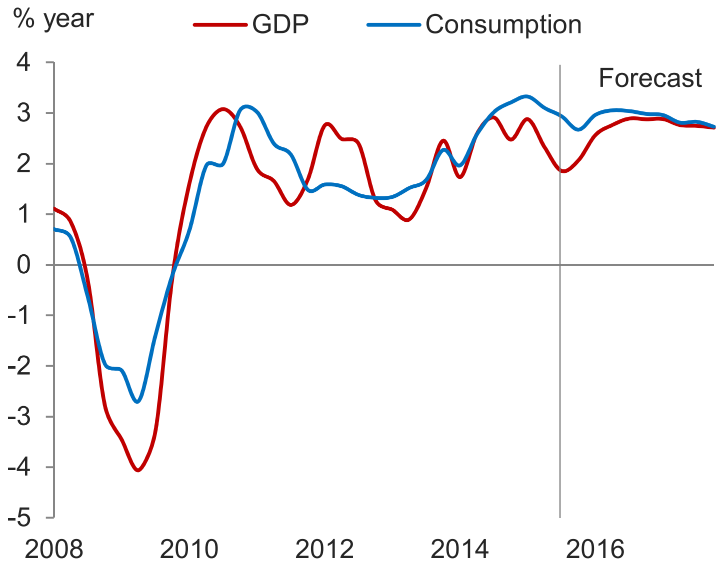
US: Stock market – S&P 500



Source: Oxford Economics, Haver Analytics. Note: 1941-1943=10.

The US economy appears to be the sole beacon of stability amidst increasingly rough global economic seas. Oxford Economics sees the US economy accelerating to about a 2.5% annual growth pace in the second half of the year and into 2016 an average of 3.0% as domestic fundamentals firm. Consumer spending is expected to accelerate as strong employment gains combine with firmer wage growth and a renewed drop in gasoline prices. The drag of sluggish global growth and a stronger dollar will impede exports and business investment. Indeed, oil prices have fallen further in recent weeks while the US dollar has appreciated quite strongly.

US: GDP and consumption

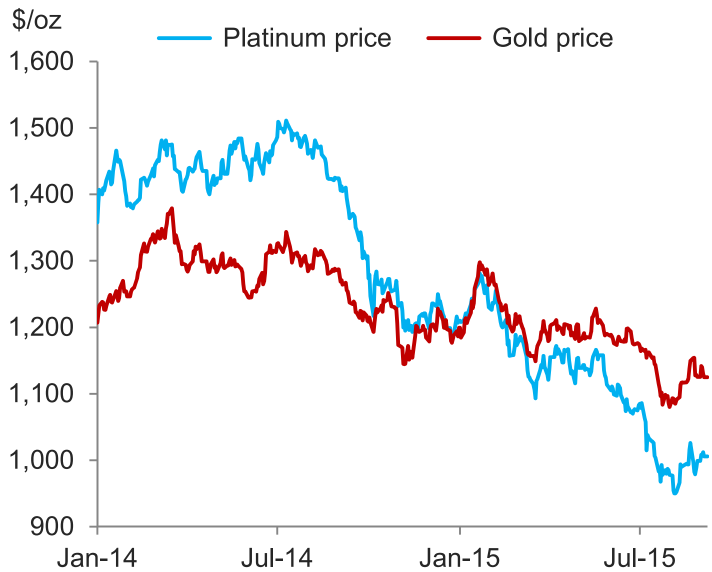


Source: Oxford Economics, Haver Analytics

The stark contrast between domestic and foreign economic conditions calls into question the Fed's ability to proceed with rate lift-off this year. While the Federal Open Market Committee (FOMC) statement released at the end of the July meeting signalled the FOMC is moving closer to interest rate lift-off as economic fundamentals strengthen, this conviction has likely receded given the recent downturn in emerging market growth, global market sell-off and volatility spike. Gold has assumed its traditional role during times of market crisis, with the price climbing higher alongside global economic fears.

US: Gold price

Safer haven in gold

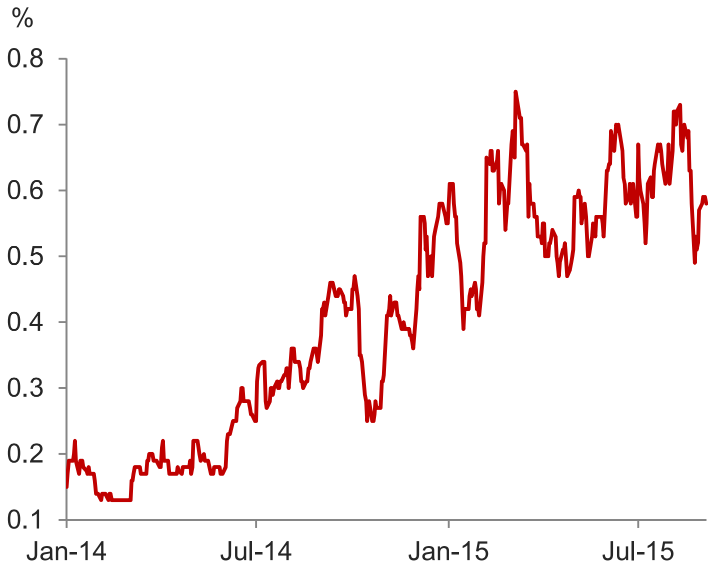


Source: Oxford Economics, Haver Analytics

Head winds to higher rates

The recent market panic makes it harder for the Fed to raise interest rates. The spike in volatility has sparked renewed declines in oil prices and led to a stronger US dollar, both of which will make it more difficult for the Fed to achieve its 2% inflation target over the medium term. Capital markets have pushed back their expectations of rate lift-off, which until a few weeks ago was largely expected to commence in September 2015. The Fed needs to pace itself carefully on the road to higher interest rates. The 'taper tantrum' of 2013 highlights the risk a poor Fed strategy can have on financial markets and the real economy.

US: Futures federal funds rate



Source: Oxford Economics, Haver Analytics

Fed rate lift-off is likely to put additional strain on foreign economies. Higher interest rates in the US will draw capital out of emerging markets, leaving those reliant on foreign capital exposed. An appreciating dollar will also make it relatively harder for foreign firms to service dollar-denominated debts, raising the possibility of default. Some of these dynamics have already begun to play out. On the plus side, however, weaker currencies relative to the US dollar will make the rest of the world's exports more competitive.

This market turmoil comes at a particularly sensitive time for US foreign relations. On foreign policy, the highly-touted US "pivot to Asia" has, in fact, invigorated some bilateral relationships in the region, particularly with Japan, India, Australia, Vietnam and the Philippines. This trend, along with the proposed US-Japanese led trans-Pacific trade pact that would exclude China, risks exacerbating tensions with China, particularly if Beijing becomes a prominent topic in the potentially raucous US presidential election. The administration's unsuccessful effort to prevent the establishment of a Chinese-led Asian Infrastructure Investment Bank also illustrates this trend.

The Obama administration's attempts to pivot US foreign policy away from the Middle East have been repeatedly frustrated by unrest in the region, much of it stemming from the Arab Spring that began in 2011. The emergence of IS and the escalation of the Saudi-Iranian rivalry over Syria, Yemen and other theatres have complicated Obama's goal of seeking a negotiated settlement to Iran's nuclear ambitions, though we believe such a deal will be signed in 2015. A lower oil price will make it difficult for traditional US allies in the Middle East to maintain their socioeconomic spending regimes in place, raising the risk of economic and political strain in the region. It has been a busy summer for policymakers and economies around the world, to say the least.

Risk scenarios and implications

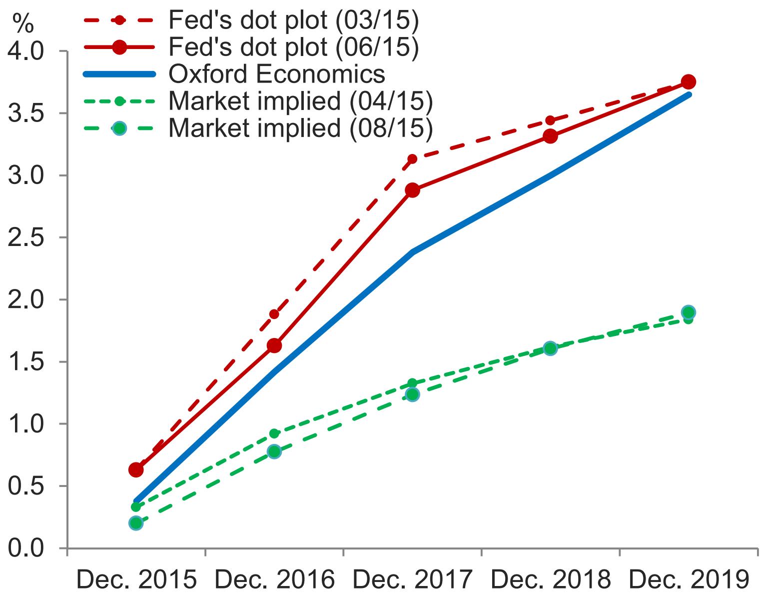
Faster than expected Fed rate hike

With the US economy on a fairly solid footing, financial markets are abuzz about when the Fed will raise rates. Federal Reserve officials have telegraphed their belief that the economy is approaching the point at which it will be ready for interest rates to rise off the zero lower bound.

However, in part due to the excessive forward guidance, market participants are pricing in an extremely shallow rise in interest rates, especially during the 2017-2019 time period. Indeed, as can be seen in the chart below, market expectations of the federal funds rate into the medium term are starkly below both the Fed's and our own forecasts.

Join the dots for future rates

US: Federal funds rate expectations



Source: CME, Federal Reserve, Oxford Economics

Using the Oxford Economics Global Economic Model, we can assess the implications of a scenario in which markets are caught off-guard by faster-than-expected hikes in the federal funds rate. The fundamental trigger for a faster pace of rate increases in this scenario is seen to be an intensifying and broadening of wage pressures which feeds into inflation, sparking concerns that the Fed is falling behind the proverbial inflation curve. Additionally, Fed officials in this scenario are increasingly concerned that the pockets of asset bubbles are deepening and expanding.

Higher rates hurt bonds…

Given the faster pace of monetary policy tightening, the Fed would jolt the bond market and ignite another 'taper tantrum', sending long-term interest rates sharply higher. We assume that the negative impact on long-term bond prices from surprisingly rapid policy tightening would more than offset the positive impact from foreign capital inflows stemming from geopolitical worries, divergent monetary policy outlooks for Europe and Japan, and a stronger dollar.

…and submerge emerging markets…

We also anticipate that an early announcement and subsequently larger-than-expected Fed rate hikes will place renewed pressure on emerging markets as long-term borrowing rates jump and lead to further macroeconomic weakness in the most vulnerable emerging market economies. Higher rates in the US relative to overseas would also draw capital into the US, leading to US dollar appreciation.

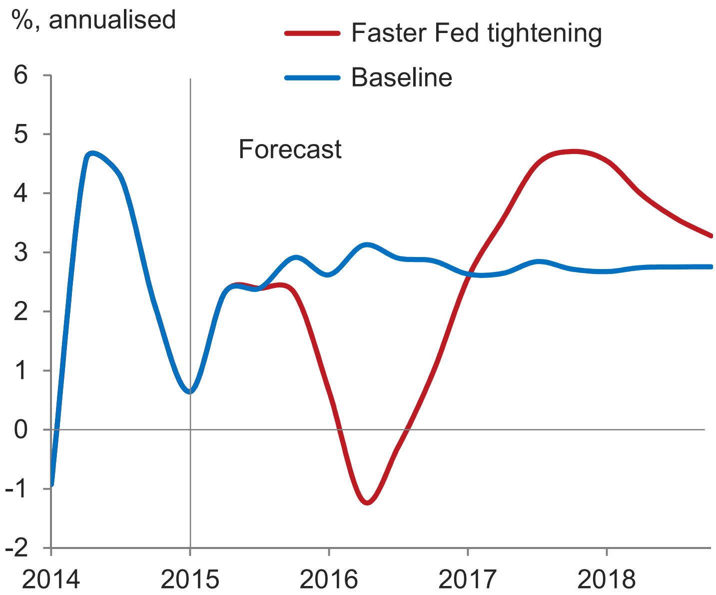
…and hammer stocks…

Equity prices would also slump given the unexpected shock of higher interest rates which raise market volatility and also lower the net present value of equity cash flows. Such a decline would be similar to the pullback recorded in 1994 following the jump in long-term rates triggered by the FOMC's surprisingly aggressive rate hikes.

…so hit the consumer

The rise in long-term rates would feed through to affect the real economy. Higher interest rates would slow the pace of residential housing activity and would deter some business fixed investment. In addition, higher borrowing costs would dampen consumer lending activity and reduce consumers' ability to spend. Consumers would also be negatively affected by the drop in equity prices and deterioration in consumer confidence that would result from this and a weakening in the labour market.

US: Real GDP growth



Source: Oxford Economics

Investment collapse in China

Private consumption growth is required as a counterbalance

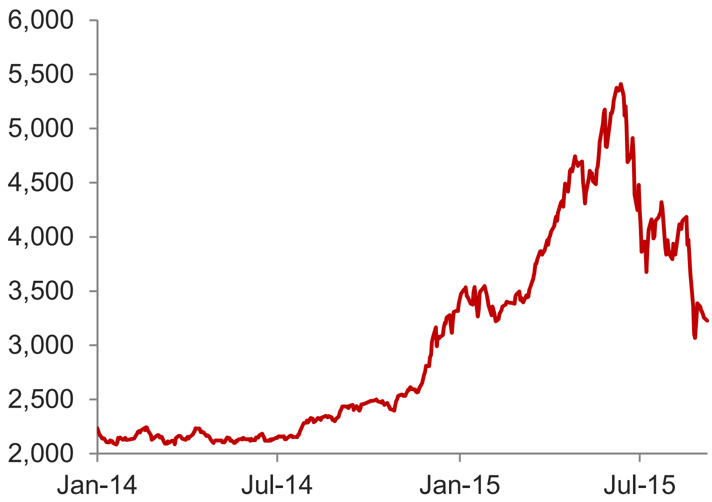
After a period of rapid investment-led growth, the Chinese authorities are engaged in a tricky balancing act as they try to manoeuvre the economy to a position where private consumption makes more of a contribution. Part of the plan is a more appropriate pricing of risk. However, this appears to be choking the economy; investment growth is already slowing noticeably in the face of tighter monetary conditions. Meanwhile, a correction in the housing market is underway in reaction to the twin problems of excess supply and rapid accumulation of debt in recent years. The increase in total debt – public and private – from 176% of GDP in 2007 to 264% of GDP by 2014 illustrates the challenge in managing the economy onto a more sustainable path.

For the first time, risks of a severe deceleration in Chinese growth are rising sharply as efforts to induce a gradual, manageable realignment of the economy have caused severe dislocations. Chinese financial markets have been roiled, with the benchmark Shanghai Stock Exchange Composite Index down nearly 40% from its recent highs, while Chinese officials have been forced to implement increasingly looser monetary policy and devalue the renminbi in recent months as they attempt to support economic activity. For the first time since the financial crisis, the People's Bank of China in late August cut the deposit, lending rates and reserve requirement ratio, highlighting the worries regarding the state of the real economy.

On the economic front, the pace of investment spending is falling significantly as the correction in the real estate sector continues. With new housing starts down around 18% y-o-y and excess supply significant in several industrial sectors, the impact on the wider economy is increasingly visible.

Bubble made and un-made in China

China: Shanghai Stock Exchange Composite Index



Source: Oxford Economics, Haver Analytics

In the wake of these rising concerns, we take a look at the implications of a Chinese investment collapse scenario. In this scenario, we assume that investment spending is hit through a variety of channels. Local governments scale back investment aggressively, as central government seeks to rein in excessive off-balance sheet debt accumulation. State-owned enterprises suffering from excess capacity cut investment, as do companies in sectors serving real estate and those burdened by excess supply. In addition, credit growth slows relatively sharply and worries over a loss of confidence in the economy's prospects see foreign direct investment inflows drop significantly.

With investment spending decelerating sharply from H2 2015, Chinese GDP growth would slow rapidly. Other countries with close trade and financial linkages are also affected, restricting world growth.

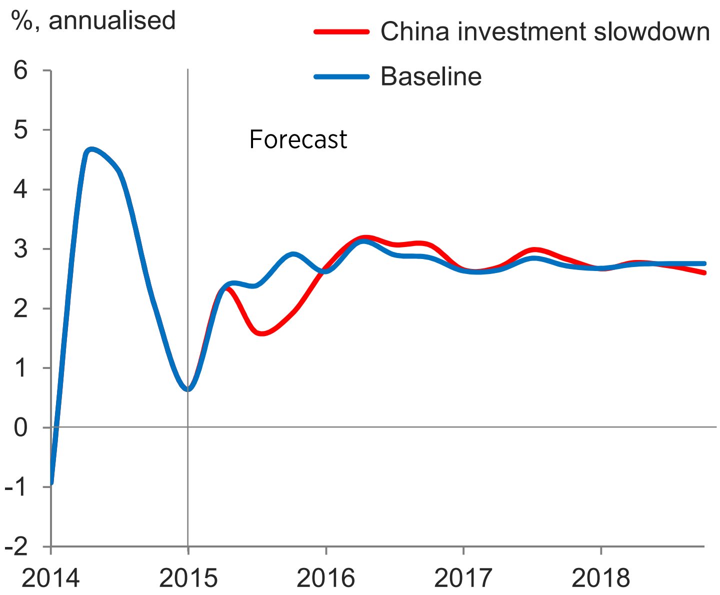
Dollar rises if Chinese investment collapses

Drastically weaker Chinese growth would spill over to affect the US economy through various economic and financial channels. Demand would rise for US Treasury securities as investors seek the safe haven of government bonds, while US stock prices would fall as concerns about the global economy mount. Greater demand for US assets reinforces the US dollar's appreciation relative to the renminbi, on top of the recent devaluation implemented by Chinese officials.

A distressed Chinese economy and subdued global growth would cause US exports to subtract from GDP growth this year and next. Investment and consumption growth would decelerate as confidence falters and the private sector scales back its spending plans. With inflation falling further below the Fed's 2% target, rate lift-off would be delayed until Q3 2018, more than three years later than in the baseline, as the Fed seeks to keep interest rates low to mitigate the effects of the Chinese banking crisis. The Fed would also re-engage in quantitative easing in this scenario, raising the size of its balance sheet as it attempts to put a leg under economic activity and stabilise financial markets.

QE to the rescue?

US: Real GDP growth



Source: Oxford Economics

PGMs – scenario-ed

The Fed's rapid tightening scenario would see higher interest rates in the US lead to lower consumer spending, which implies weaker jewellery and auto sales and reduced business investment, which imply lower industrial demand. Under this scenario the dollar also strengthens which would cause commodity prices to continue to decline. This could lead to further outflows from US ETFs, potentially of 100 koz each of platinum and palladium. Assuming a 10% decline in auto sales, and jewellery and industrial demand in the US in 2016, this would reduce PGM usage by 110 koz of platinum, 255 koz of palladium and 25 koz of rhodium. With knock-on effects from higher interest rates and a stronger dollar expected in vulnerable emerging markets, PGM demand elsewhere could easily fall by a similar amount.

The investment collapse in the China scenario impacts the US less than the Fed tightening scenario, so that might mean a 5% drop in PGM use in the US in 2016 (-55 koz Pt, -125 koz Pd, -10 koz Rh). Here, too, the US dollar is projected to strengthen so commodity prices can be expected to decline and ETFs could see net sales. This scenario impacts China more significantly than the first scenario so PGM demand there could fall by 20%, reducing demand by 470 koz, 440 koz and 25 koz for platinum, palladium and rhodium respectively. The impact of the slowdown in China would also be felt by China's trading partners' potentially slowing economic growth in Asia and Europe, resulting in reduced PGM demand in those regions too.

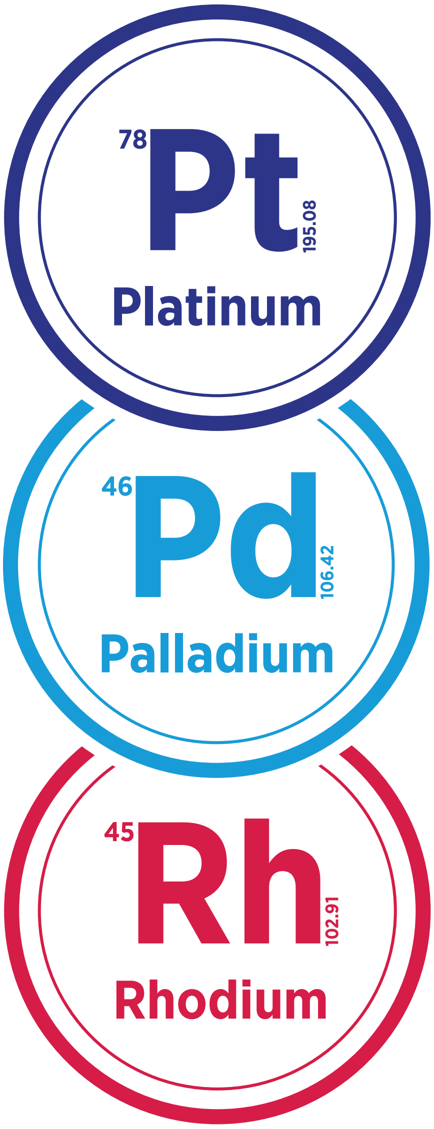
Impact on PGM demand in 2016

US: -180 3E koz

China: -935 3E koz

However, the potential downside from a slump in US equities could be more significant. Major declines in US equities are typically accompanied by a recession, the impact of which would be felt globally. This would see consumer spending and business investment fall significantly, negatively impacting auto sales, jewellery purchases and industrial demand.

A major decline in US equities could lead to a similar outcome to 2008-09. If equities were to slump in 2016 this could see global PGM demand fall by 10% in 2016 and further in 2017, reducing global PGM use in 2017 by 1.9 moz of platinum, 2.7 moz of palladium and 0.3 moz of rhodium compared to 2015 and pushing commodity prices significantly lower.



THE PGM MARKETS IN 2015

The PGM markets in 2015

Samantha Trickey, Principal Supply Analyst, SFA (Oxford) Ltd

The platinum market

Summary

The platinum (and basket) price has fallen to the unsustainable 50th centile of the cost curve, and thus is fundamentally oversold. Platinum prices have depreciated by 21% since the beginning of the year, versus -24% for palladium, -29% for rhodium and -11% for gold. As in 2009, the supply response to lower prices has been limited so far. Recovering mine supply following the 2014 strike in South Africa, some increase in recycling and a relatively buoyant auto sector have carved out a narrower fundamental market deficit for 2015. The cure for low prices is, as they say, low prices.

Price recovery will be largely dependent on the strength of demand pull. The market is forecast to be in deficit by 260 koz in 2015, excluding the net impact of ETF changes and producer sales. While SFA forecasts demand growth of 2.1% this year, the fragile state of the global economy could lead to further downgrades to demand.

Mine supply

Less than 4% of global primary platinum supply capacity has been closed or deferred in 2015; ZAR8.9 billion in capital expenditure has been postponed. As in 2009, producers are placing more emphasis on cash preservation and balance sheet health over production cuts, a stance reinforced by Zuma's administration in South Africa as it seeks to retain union support by taking a hard line over further retrenchments.

Proposed job losses in the PGM mining sector exceed 14,000 globally so far this year, with South Africa accounting for most. Between 2008 and 2010, PGM sector retrenchments affected 20,100 employees. The South African government is now pushing for the retraining and transfer of workers between companies, and may assist in the sale of distressed assets in order to keep them operating.

Producers will find it difficult to close shafts

The average PGM basket price for South African producers decreased below $1,000/oz in June 2015, and in August averaged just $119/oz higher than the previous lows of December 2008 ($730/oz in real terms). This time around producers are in a considerably tighter position, carrying an additional ZAR13.5 billion in debt on their balance sheets, absorbing higher operating costs across the board (wages, power and consumables) and experiencing reduced production flexibility in the wake of lengthy disruptions and previous shaft closures.

While there is some respite in rand movements, and further weakness is plausible, the basket price in local currency is still fluctuating around the 50th centile of the cost curve. Only the Northern Limb of the Bushveld is achieving positive free cash flow at today's prices. Operations on the Western and Eastern Limbs collectively may have a revenue shortfall exceeding ZAR14 billion this year if prices do not improve.

Guidance revisions mostly impact supply beyond 2015

Nonetheless, there has been no significant revision to the near-term supply forecast, with announced cuts and revised capital budgeting taking effect further out. A handful of operations are particularly vulnerable in the current price environment, potentially removing up to 190 koz in the second half of the year, but a lack of supply response so far indicates that only a basket price resolutely below the 50th centile may be sufficient to trigger closures. Recapitalisation, which should sustain the core of South African production through the downturn, is on the cards for at least one major producer.

In 2015, a 17% increase in primary supply is attributable to improved capacity utilisation post-strike. The global supply forecast totals 5,725 koz versus 4,875 koz in 2014 and 6,075 koz in 2013. This forecast continues the downward production trend that has been entrenched since 2006, and is more than 3,000 koz lower than producers were planning during the early 2000s.

Recycling

The low scrap metal price for steel has led to a reduction in end-of-life vehicles reaching scrapyards. In addition, the decline in PGM prices has prompted collectors to hold back some catalysts in the hope that prices improve. Indications are that platinum supply from autocatalyst recycling slowed by 8% in H1'15 compared to the previous six months.

However, cash flow and working capital considerations usually result in withheld material being processed within three months of a material price fall, and PGM price appreciation would see this material flow quickly through to refiners. Moreover, the metal ratio of scrap autocatalysts has a higher weighting to platinum compared to last year, thus autocatalyst recycling is forecast to increase by 10% y-o-y to 1,435 koz in 2015.

Despite downgrades to jewellery, total recycling increases

Jewellery recycling is expected to decrease by 8% y-o-y in 2015. In China, reduced demand for new jewellery pieces is resulting in fewer store returns. Overall, recycled platinum supply is forecast to increase by 3% y-o-y to 2,165 koz in 2015.

Demand

Gross demand is forecast to rise by 2% to 8,040 koz in 2015. Higher automotive (+145 koz) and industrial (+65 koz) demand is expected to offset a decline in the jewellery sector (-55 koz) this year. Further economic slowdown in China could undermine jewellery demand forecasts and reduce industrial consumption growth.

Automotive demand

Auto sales could slow in the second half

Autocatalyst demand is forecast to increase by 5% y-o-y to 3,445 koz in 2015, as vehicle production remains strong in platinum's main markets. However, demand in H2'15 is not expected to replicate H1 performance, as end users are well stocked and vehicles sales could slow.

Vehicle sales have been higher overall so far in 2015, up 1.2% y-o-y globally, with strong gains in the US and Western Europe. US auto sales are on track for 17 million units this year for the first time since 2001, bolstered by low gasoline prices, new production launches (+22% y-o-y) and cheap credit. Sales in Western Europe were stronger than expected in H1'15, with the fallout from a potential Greek exit postponed for now. However, the level of discounting and self-registrations by dealers in this region are limiting factors for the second half of the year.

Elsewhere, auto sales are slowing. Year-to-date sales in China have slackened to +1.5% y-o-y. Vehicle inventories are high, and purchase restrictions in Tier 1 and 2 cities plus slowing economic growth are having a negative impact on sales. Year-to-date figures are also lower for Japan (-10.8% y-o-y), Mercosur (-19.7% – high) and Eastern Europe (-13.3%) in response to high inflation and interest rates, weak job markets and falling currencies.

Jewellery

Jewellery demand is forecast to decline by 2% y-o-y in 2015, to 2,940 koz. Small to moderate growth in Western Europe, North America and India is offset by downgrades to the largest market, China.

Lower footfall in China's jewellery stores

Although platinum jewellery sales in China have outperformed those of gold this year, further downward revisions may be forthcoming as the economy cools. Marriage registrations in H1'15 are lower y-o-y, and if this trend continues then bridal jewellery, which represents *c.*30% of the Chinese market, could underperform expectations. Independent stores have seen more of a slowdown in sales than the leading retail chains which continue to open new outlets in Tier 2 and 3 cities, upgrade existing outlets and optimise their product mix (more platinum pieces) to drive sales.

Industrial

Industrial demand for platinum is forecast to increase by 5% to 1,660 koz in 2015. The petroleum sector is set to see strong growth, particularly in North America and China where refining capacity expansions are taking place. Increased use in the chemical sector should be supported by higher propane dehydrogenation (PDH) process capacity in North America and nitric acid production in the rest of the world.

Investment and above-ground stocks

South Africa ETF buying a rand or equity hedge

Investors in South Africa are speculating on ETFs to benefit from higher rand prices as a result of possible operational closures ahead. Year-to-date holdings are up 175 koz y-o-y as significant buying occurred in South Africa during July and August. However, platinum prices remain exposed to the speculative fallout of slowing global growth.

SFA's estimate of all-in platinum stocks is 10 moz by the end of this year. This includes metal allocated to investment (including ETFs) and working inventory in all end-uses, but excludes consumer stocks (jewellery) and catalysts in vehicles on the road. This stock level is down only a small fraction on last year's total.

The palladium market

Risk to automotive demand forecast in China and the US

Palladium remains heavily exposed to the vehicle production fortunes of China and the US. Vehicle growth projections for China are being downgraded, while US production is close to its peak. Negative news on growth from either country is likely to impact the market.

Automotive demand is currently forecast to grow to 7,725 koz in 2015 (+2.7% y-o-y). Increased Chinese and North American vehicle production rates plus stringent Californian emissions legislation (LEV III) are driving auto demand in these regions higher. A small offset in Western Europe and Japan is forecast.

Industrial demand for palladium is predicted to decline by 0.3% to 1,940 koz in 2015, primarily driven by the electrical sector. Lower consumer demand in some electronics markets (e.g. computers), plus thrifting and substitution, is expected to continue reducing requirements for palladium. Global jewellery demand is expected to remain static at the relatively low level of 290 koz this year.

Primary supply is forecast to increase by 5.6% to 6,745 koz in 2015. Post-strike recovery lifts South African production by 25% y-o-y to 2,340 koz. Output from Zimbabwe, Russia and North America is expected to decrease by 2.7% collectively to 4,405 koz following small producer guidance revisions earlier in the year.

Secondary supply from recycling is estimated to rise by 3.6% to 2,375 koz in 2015. This growth derives entirely from the automotive sector, with jewellery and other recycling forecasts flat y-o-y.

Deficit narrows to 865 koz as total supply increases

The fundamental deficit in the palladium market continues this year, narrowing to 865 koz. Gross demand is estimated to climb by 2.0% to 9,990 koz, but this is offset by an increase in both primary and secondary supply (+5.0% to 9,120 koz). By the end of 2015, total palladium stocks are estimated at just below 15 moz.

The rhodium market

Ample stocks

Rhodium remains a soft market unless siginficant revisions to production targets are announced and end-use adoption accelerates. A market deficit of 45 koz is forecast for 2015, following a wider deficit of 145 koz last year. Plenty of stock is available. With the risk of lower automotive forecasts, the rhodium market will require more substantive cuts to supply in order to give the price upward impetus.

Net demand is up by just 10 koz for the year, with demand growth in the automotive sector (Euro 6, lean NO_x traps) matched by an increase in recycling. Primary supply from South Africa grows by 100 koz (+17% y-o-y), with output from all other regions flat.

THE PRICE OUTLOOK FOR THE NEXT SIX MONTHS

Platinum: $1,060/oz

Limited upside in the next three months

Fundamentally, the platinum price is oversold. Prices have fallen below the 50th centile cost of production (total cash costs, including by-product credits, excluding CAPEX).

Nonetheless, demand pull is weak presently. Jewellery demand is forecast to decline this year owing to reduced requirements from China, and there is the possibility it could be even lower by year-end. Automakers are well stocked and industrial demand is growing, though this demand is largely dependent on the timing of capacity increases. Any negative developments in global economic growth can have an impact on the outlook.

Prices are therefore forecast to trade sideways with risks to the downside over the next three months. Any further weakening of the rand from current levels will be detrimental to dollar prices. Prices should recover some ground in Q1'16 as sustained low PGM basket prices further impact production and wage negotiations begin next year, which are generally disruptive.

Palladium: $655/oz

Price risks to the downside

As highlighted in the previous issue of *The Platinum Standard* in May, SFA had a platinum-to-palladium price ratio target of 1.5:1. Once our target was met, SFA saw limited further upside and predicted a reversal in the ratio owing to loss-making supply from South Africa.

Palladium is heavily exposed to the vehicle production fortunes of China and the US. Vehicle growth projections for China are being downgraded, while US production is close to its peak. Negative news on growth from either country is likely to further impact metal prices.

Rhodium: $830/oz

Fundamentals not price supportive yet

The rhodium price is trading well below its historical long-term average and is back to levels not seen since 2004. Limited mine production cutbacks from South Africa have been announced so far this year and the market remains well stocked. Net demand (after recycling) is forecast to increase by just 10 koz, so the demand pull to lift prices is not there. As with palladium, any negative economic sentiment from China or the US will continue to have a detrimental impact on rhodium prices.

APPENDIX

Platinum supply-demand balance

Market balance, koz

	2008	2009	2010	2011	2012	2013	2014	2015e
Primary supply								
Regional								
South Africa	4,555	4,550	4,725	4,595	4,205	4,355	3,115	4,040
Russia	805	775	790	800	780	740	740	705
Zimbabwe	180	230	280	340	365	405	405	390
North America	370	275	200	375	345	355	400	385
Other	0	0	120	145	180	215	220	210
Total	5,910	5,830	6,115	6,255	5,875	6,070	4,880	5,730
Demand & recycling								
Autocatalyst								
Gross demand	3,730	2,520	2,915	3,115	3,150	3,165	3,295	3,445
Recycling	1,055	835	955	1,210	1,175	1,120	1,255	1,380
Net demand	2,675	1,685	1,960	1,905	1,975	2,045	2,040	2,065
Jewellery								
Gross demand	1,935	2,680	2,170	2,450	2,760	2,945	2,990	2,940
Recycling	390	415	475	630	840	855	740	680
Net demand	1,545	2,265	1,695	1,820	1,920	2,090	2,250	2,260
Industrial demand	1,660	1,310	1,675	1,750	1,570	1,545	1,585	1,660
Other recycling	15	15	10	10	5	10	10	5
Gross demand	7,325	6,510	6,760	7,315	7,480	7,655	7,870	8,045
Recycling	1,460	1,265	1,440	1,850	2,020	1,985	2,005	2,065
Net demand	5,865	5,245	5,320	5,465	5,460	5,670	5,865	5,980
Market balance								
Balance (before ETFs)	45	585	795	790	415	400	-985	-250
ETFs (stock allocation)	100	365	570	175	200	905	215	
Balance after ETFs	-55	220	225	615	215	-505	-1,200	-250

Source: SFA (Oxford). Notes: Numbers have been rounded. Primary supply refers to refined metal production and excludes producer sales.

Demand & recycling summary, koz

	2008	2009	2010	2011	2012	2013	2014	2015e
Gross demand								
Autocatalyst								
North America	570	335	390	385	415	425	470	500
Western Europe	1,920	1,290	1,335	1,495	1,340	1,350	1,440	1,550
Japan	540	315	480	500	600	585	590	565
China	150	95	135	120	115	125	115	115
India	90	100	145	180	200	160	160	170
RoW	460	385	430	435	480	520	520	545
	3,730	2,520	2,915	3,115	3,150	3,165	3,295	3,445
Jewellery								
North America	195	140	160	160	185	200	230	245
Western Europe	200	185	180	175	175	220	220	240
Japan	450	430	370	315	325	335	335	335
China	1,020	1,860	1,370	1,670	1,915	1,990	1,965	1,825
India	40	40	50	80	105	140	175	225
RoW	30	25	40	50	55	60	65	70
	1,935	2,680	2,170	2,450	2,760	2,945	2,990	2,940
Industrial								
North America	330	240	295	280	340	345	335	375
Western Europe	305	230	200	185	205	135	200	200
Japan	165	135	245	240	120	75	100	110
China	200	135	300	255	335	475	385	400
RoW	660	570	635	790	570	515	565	575
	1,660	1,310	1,675	1,750	1,570	1,545	1,585	1,660
Total gross demand								
North America	1,095	715	845	825	940	970	1,035	1,120
Western Europe	2,425	1,705	1,715	1,855	1,720	1,705	1,860	1,990
Japan	1,155	880	1,095	1,055	1,045	995	1,025	1,010
China	1,370	2,090	1,805	2,045	2,365	2,590	2,465	2,340
RoW	1,280	1,120	1,300	1,535	1,410	1,395	1,485	1,585
	7,325	6,510	6,760	7,315	7,480	7,655	7,870	8,045
Recycling								
Autocatalyst								
North America	580	550	580	600	575	560	560	560
Western Europe	310	135	195	420	405	365	470	570
Japan	115	110	145	115	115	95	105	110
China	0	0	0	5	10	20	30	35
RoW	50	40	35	70	70	80	90	105
	1,055	835	955	1,210	1,175	1,120	1,255	1,380
Jewellery								
Japan	220	130	150	285	285	250	200	190
China	170	285	325	345	555	600	530	480
RoW	0	0	0	0	0	5	10	10
	390	415	475	630	840	855	740	680
WEEE	15	15	10	10	5	10	10	5
Total recycling								
North America	585	555	585	600	575	560	565	560
Western Europe	315	135	195	425	405	365	475	575
Japan	340	245	295	400	400	350	305	305
China	170	285	325	355	570	620	560	515
RoW	50	45	40	70	70	90	100	110
	1,460	1,265	1,440	1,850	2,020	1,985	2,005	2,065

Source: SFA (Oxford). Note: Numbers have been rounded.

Palladium supply-demand balance

Market balance, koz

	2008	2009	2010	2011	2012	2013	2014	2015e
Primary supply								
Regional								
South Africa	2,345	2,425	2,590	2,550	2,355	2,360	1,860	2,340
Russia	2,700	2,675	2,720	2,705	2,630	2,580	2,690	2,610
Zimbabwe	140	180	225	265	280	315	330	310
North America	880	610	580	865	895	975	1,055	1,045
Other	0	0	300	390	445	450	455	440
Total	6,065	5,890	6,415	6,775	6,605	6,680	6,390	6,745
Demand & recycling								
Autocatalyst								
Gross demand	4,790	4,090	5,625	6,210	6,715	7,170	7,555	7,760
Recycling	1,215	1,155	1,395	1,525	1,485	1,645	1,810	1,905
Net demand	3,575	2,935	4,230	4,685	5,230	5,525	5,745	5,855
Jewellery								
Gross demand	855	705	595	470	420	350	295	290
Recycling	0	0	100	135	130	145	120	115
Net demand	855	705	495	335	290	205	175	175
Industrial demand	2,405	2,400	2,465	2,445	2,330	2,020	1,940	1,940
Other recycling	315	340	400	350	345	365	370	360
Gross demand	8,050	7,195	8,685	9,125	9,465	9,540	9,790	9,990
Recycling	1,530	1,495	1,895	2,010	1,960	2,155	2,300	2,380
Net demand	6,520	5,700	6,790	7,115	7,505	7,385	7,490	7,610
Market balance								
Balance (before ETFs)	-455	190	-375	-340	-900	-705	-1,100	-865
ETFs (stock allocation)	380	480	1,110	-535	285	0	940	
Balance after ETFs	-835	-290	-1,485	195	-1,185	-705	-2,040	-865

Source: SFA (Oxford). Notes: Numbers have been rounded. Primary supply refers to refined metal production and excludes producer sales.

Demand & recycling summary, koz

	2008	2009	2010	2011	2012	2013	2014	2015e
Gross demand								
Autocatalyst								
North America	1,545	1,005	1,310	1,505	1,745	1,840	1,965	2,095
Western Europe	965	920	1,280	1,500	1,425	1,530	1,650	1,640
Japan	925	600	810	670	735	745	740	725
China	395	705	1,010	1,130	1,300	1,520	1,675	1,780
India	90	105	150	160	160	165	170	180
RoW	870	755	1,065	1,245	1,350	1,370	1,355	1,340
	4,790	4,090	5,625	6,210	6,715	7,170	7,555	7,760
Jewellery								
North America	60	60	65	45	45	40	35	40
Western Europe	45	50	65	65	80	75	60	55
Japan	90	65	65	70	75	65	55	50
China	635	505	370	260	190	145	120	120
RoW	25	25	30	30	30	25	25	25
	855	705	595	470	420	350	295	290
Industrial								
North America	515	495	495	485	470	460	445	445
Western Europe	375	360	405	365	360	265	330	335
Japan	605	590	580	550	555	405	375	375
China	325	425	435	425	400	405	315	315
RoW	585	530	550	620	545	485	475	470
	2,405	2,400	2,465	2,445	2,330	2,020	1,940	1,940
Total gross demand								
North America	2,120	1,560	1,870	2,035	2,260	2,340	2,445	2,580
Western Europe	1,385	1,330	1,750	1,930	1,865	1,870	2,040	2,030
Japan	1,620	1,255	1,455	1,290	1,365	1,215	1,170	1,150
China	1,355	1,635	1,815	1,815	1,890	2,070	2,110	2,215
RoW	1,570	1,415	1,795	2,055	2,085	2,045	2,025	2,015
	8,050	7,195	8,685	9,125	9,465	9,540	9,790	9,990
Recycling								
Autocatalyst								
North America	850	890	975	975	930	1,005	975	990
Western Europe	250	135	205	335	325	345	365	405
Japan	95	100	175	130	125	125	135	135
China	0	0	0	15	20	50	150	170
RoW	20	30	40	70	85	120	185	205
	1,215	1,155	1,395	1,525	1,485	1,645	1,810	1,905
Jewellery								
Japan	0	0	10	15	20	20	20	20
China	0	0	90	120	110	125	100	95
	0	0	100	135	130	145	120	115
WEEE								
North America	85	85	80	70	75	70	65	65
Western Europe	70	75	115	80	80	85	85	85
Japan	115	115	130	125	110	130	135	140
China	15	15	20	15	20	20	15	10
RoW	30	50	55	60	60	60	70	60
	315	340	400	350	345	365	370	360
Total recycling								
North America	935	975	1,055	1,045	1,005	1,075	1,040	1,055
Western Europe	320	210	320	415	405	430	450	490
Japan	210	215	315	270	255	275	290	295
China	15	15	110	150	150	195	265	275
RoW	50	80	95	130	145	180	255	265
	1,530	1,495	1,895	2,010	1,960	2,155	2,300	2,380

Source: SFA (Oxford). Note: Numbers have been rounded.

46 Pd 106.42
Palladium

Rhodium supply-demand balance

Market balance, koz

	2008	2009	2010	2011	2012	2013	2014	2015e
Primary supply								
Regional								
South Africa	610	660	650	645	600	590	425	525
Russia	80	75	75	75	75	70	75	70
Zimbabwe	15	20	25	30	30	35	35	35
North America	30	20	15	30	30	35	40	45
Other	0	0	10	10	10	10	10	10
Total	735	775	775	790	745	740	585	685
Demand & recycling								
Autocatalyst								
Gross demand	915	585	730	740	770	790	835	860
Recycling	190	170	220	235	235	260	275	295
Net demand	725	415	510	505	535	530	560	565
Industrial demand	140	110	170	170	150	160	160	160
Other recycling	3	2	1	1	1	1	2	2
Gross demand	1,055	695	900	910	920	950	995	1,020
Recycling	195	170	220	235	240	265	280	300
Net demand	860	525	680	675	680	685	715	720
Market balance								
Balance (before ETFs)	-125	250	95	115	65	55	-130	-35
ETFs (stock allocation)				15	35	50	5	
Balance after ETFs				100	30	5	-135	-35

Source: SFA (Oxford). Notes: Numbers have been rounded. Primary supply refers to refined metal production and excludes producer sales.

Demand & recycling summary, koz

	2008	2009	2010	2011	2012	2013	2014	2015e
Gross demand								
Autocatalyst								
North America	275	150	180	180	200	225	235	250
Western Europe	265	190	200	215	190	195	220	230
Japan	240	115	165	135	150	140	140	130
China	30	45	70	75	90	95	105	115
India	10	10	15	20	20	15	15	15
RoW	95	75	100	115	120	120	120	120
	915	585	730	740	770	790	835	860
Industrial								
North America	15	10	15	20	15	15	15	15
Western Europe	15	15	25	20	20	15	15	15
Japan	45	35	45	45	45	40	40	40
China + RoW	65	50	85	85	70	90	90	90
	140	110	170	170	150	160	160	160
Total gross demand								
North America	290	160	195	200	215	240	250	265
Western Europe	280	205	225	235	210	210	235	245
Japan	285	150	210	180	195	180	180	170
China + RoW	200	180	270	295	300	320	330	340
	1,055	695	900	910	920	950	995	1,020
Recycling								
Autocatalyst								
North America	115	125	160	140	145	165	160	160
Western Europe	50	20	30	60	60	55	60	70
Japan	20	20	25	25	25	25	30	35
China	0	0	0	0	0	5	5	5
RoW	5	5	5	10	5	10	20	25
	190	170	220	235	235	260	275	295

Source: SFA (Oxford). Note: Numbers have been rounded.

GLOSSARY OF TERMS

Base metals
Copper and nickel

Basket price
Collective revenue of metals divided by 4E oz

By-products
Copper, nickel, iridium and ruthenium

CAPEX
Capital expenditure

Emissions legislation
Tailpipe regulations affecting particulate matter, hydrocarbons and oxides of nitrogen (NO_x)

ETF
Exchange traded fund

Euro 5/6 emission standards
Euro 5 legislation introduced in 2009, Euro 6 in 2014, will be widely adopted later in other regions

Fuel cell
A device that converts the chemical energy from a fuel into electricity through a chemical reaction with oxygen or another oxidising agent

Gross demand
A measure of intensity of use

HDV
Heavy-duty vehicle

Head grade
Grams of 4E PGMs per tonne of ore milled

koz
A thousand ounces

LCV
Light commercial vehicle

Lean NO_x trap (LNT)
Platinum and rhodium-based, catalyses the chemical reduction of NO_x in diesel engine exhaust to harmless nitrogen

Merensky Reef
A layer of igneous rock situated in South Africa that contains most of the world's PGMs

moz
A million ounces

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

Net supply
Proxy supply of metal surplus to requirements

Net total cash costs
Total cash costs net of by-product credits (copper, nickel, iridium and ruthenium)

NYMEX
An exchange on which platinum futures and options contracts are traded

oz
Ounce

PDH
Propane dehydrogenation

PGMs
Platinum-group metals

Price elastic
Susceptible to changes in price

Primary supply
Mine production

Producer sales
Mine output plus inventory sold to market

Real-world driving emissions (RDE)
Real-world driving emissions from vehicles are often higher than those measured under laboratory conditions; it is proposed that Euro 6c legislation (expected around 2017) will begin to enforce these real-world limits

Secondary supply
Recycling output

S&P 500
Standard & Poor's 500 Index is an index of the largest 500 US companies by market capitalisation

Taper tantrum
A negative market reaction to a suggested change in the Federal Reserve's quantitative easing, or bond-buying programme

Tonnes milled
Concentrator throughput of ore

UG2 Reef
Also found in South Africa, this chromite-rich layer of rock contains fewer by-products than the Merensky Reef

4E
Platinum, palladium, rhodium and gold

Currency symbols

ZAR	South African rand
$	US dollar
£	UK pound

METHODOLOGY NOTES

Primary supply is calculated from actual mine production and excludes the sale of stock in order to provide pure production data. Stock sales are treated separately in SFA's database as movement of stocks. Therefore, state stock sales from Russia are excluded in tabulations.

Gross demand is a measure of intensity of use.

Net demand is a measure of the theoretical requirement for new metal, i.e. net of recycling.

Automotive demand is based on vehicle production data not sales.

ACKNOWLEDGEMENTS

SFA (Oxford) would like to thank all those whose hard work contributed to turning what began as an ambitious idea into the finished report you now see in front of you.

In particular, we would like to acknowledge our team:

Alex Biddle

Beresford Clarke

Dr. Jenny Watts

Dr. Ralph Grimble

Elaine Forrest

David Mobbs

Jamie Underwood

Oksan Atilan

Samantha Trickey

Stephen Forrest

Tom Chandler

Tracy Lindsay

Wenlin (Karen) He

We should also mention a team of Associate Consultants, without many of whom this publication would not have been possible.

A special mention should also be given to Jeremy Coombes whose knowledge of and expertise in compiling such an ambitious PGM industry review helped to fashion a report of which we could all be thoroughly proud.

Design and typeset by Jamie Underwood.

We thank Janice Hurst and Karen Darley for proofreading *The Platinum Standard* throughout its production.

Then there are our third-party data suppliers: LMC Automotive, Oxford Economics, Power Systems Research, and GTIS whose data form the basis of many of the charts in this report.

Finally, to our clients and all those who have supported us throughout our time in business, we would like to dedicate this report as a mark of our gratitude for your continuing support.

Printed by Holywell Press Ltd, Oxford.

Please note: Some tabulated data may not add up owing to rounding of individual numbers.

© Published in September 2015 by SFA (Oxford) Ltd.

SFA (Oxford) Ltd
The Magdalen Centre
Robert Robinson Avenue
The Oxford Science Park
Oxford
OX4 4GA
United Kingdom

Tel: +44 1865 784366
Fax: +44 1865 784368
info@sfa-oxford.com
www.sfa-oxford.com