

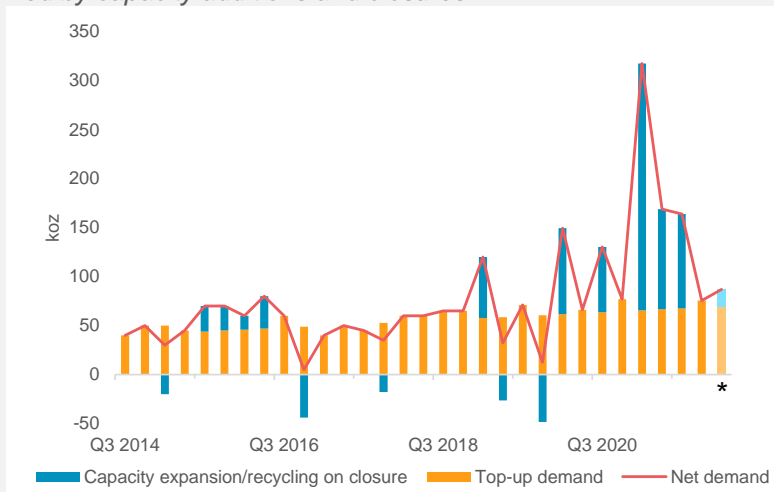
PLATINUM ESSENTIALS

Industrial demand for platinum can be highly variable on a short-term basis, due to steady top-up demand being intermittently boosted by capacity expansion demand

Industrial demand for platinum has grown at twice the pace of global GDP since 2013 and is the second largest demand segment after automotive.

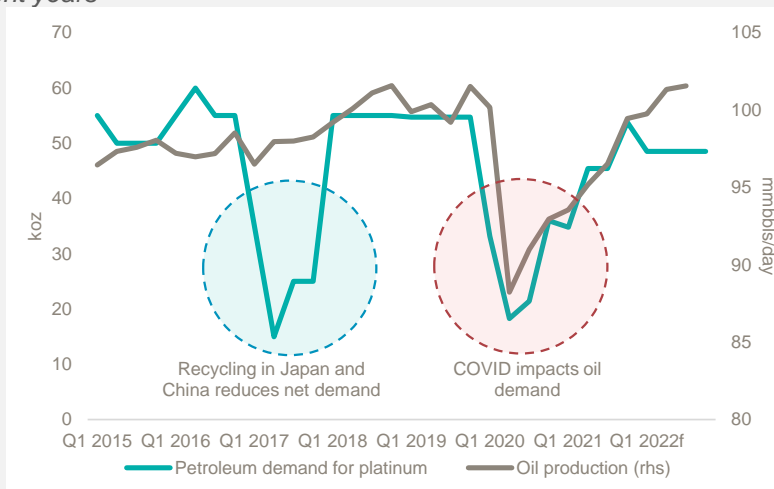
Despite its importance, industrial demand is often overlooked analytically due to fragmented end uses and the high quarterly variability in demand over the short term. This variability results because industrial demand is published 'net' of closed-loop or 'internal' recycling. Industrial facilities that use platinum typically require significant up-front loadings when the plant is built or expanded, after which only small top-ups are needed to off-set losses during plant operation. Consequently, most industrial demand comprises steady ongoing top-up demand, supplemented by staccato periods of extra demand due to capacity expansions, or, more rarely, recycling supply from plant closures. These effects are clearly illustrated in glass demand while platinum demand from some industrial sub-sectors can be more volume led, petroleum providing a good recent example.

Figure 1. WPIC illustration of how platinum glass demand has recently been led by capacity additions and closures



Source: Metals Focus, SFA (Oxford), WPIC Research, Note that the net demand figure is from official figures, but the detail of top-up demand versus capacity expansions and closures is entirely illustrative. * illustrative average quarterly demand for 2022.

Figure 2. Platinum petroleum demand has been far more volume led in recent years



Source: Metals Focus, SFA (Oxford), Bloomberg, WPIC Research

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Introduction

Background

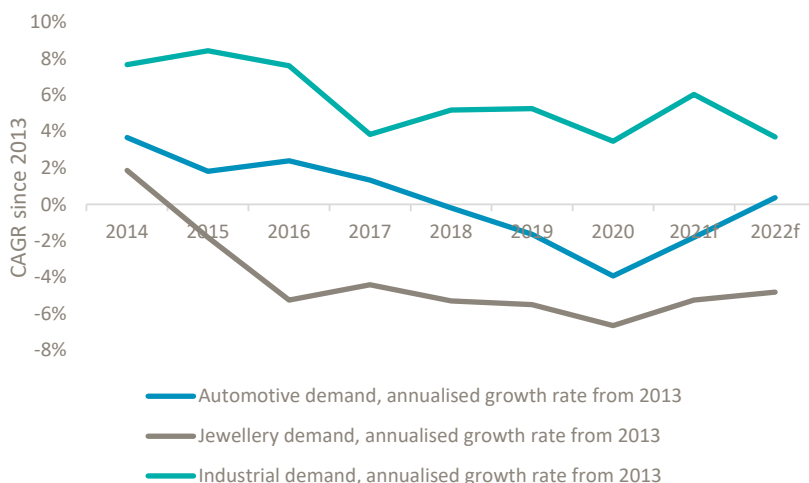
Analysis of platinum demand tends to focus on the automotive and jewellery sectors, with industrial demand often overlooked. This is likely due to a combination of the following factors:

- The multitude of sub-sectors and demand characteristics within industrial demand, which make modelling and interpretation of the sector relatively challenging
- Short-term demand variability driven by the 'closed-loop' nature of recycling in many of the industrial subsectors, with intermittent capacity additions supplementing the regular ongoing top-up of losses during plant operation
- The higher news flow related to the automotive, jewellery and investment demand segments, which make them generally more consistently topical

Expanding on the first point above, it is quite remarkable how many aspects of our everyday life are impacted by items and materials that require platinum for their fabrication. This can be illustrated when we consider that the high crop yields needed to supply the food we eat rely upon platinum for the production of nitric acid, a feedstock for crop fertiliser. While some of our food is prepared using silicone kitchen utensils it is not widely known that platinum is used to manufacture high quality silicones or that the glass fibre used in wind turbines or the LCD glass in one's computer monitor both need platinum to be manufactured.

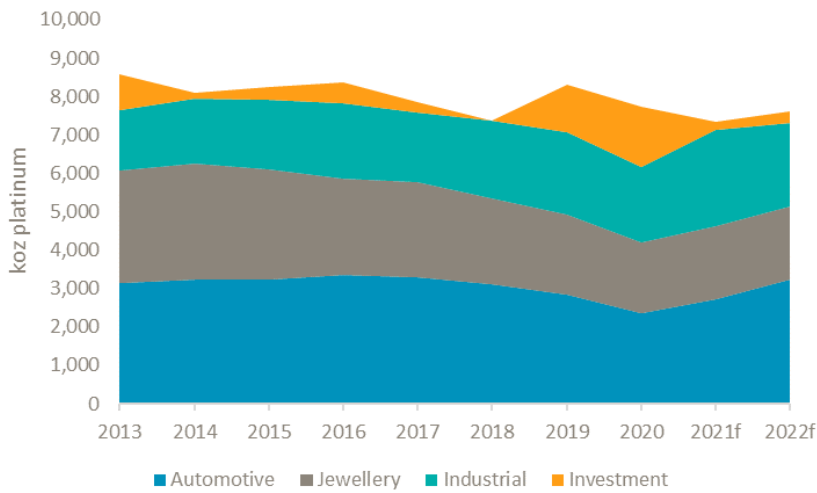
Despite being overlooked, industrial demand for platinum has been the most consistent demand growth segment, which from 2013 has averaged 6% per annum, in contrast to a broadly flat automotive demand growth profile and a contraction of -6% for jewellery. It is important to highlight that jewellery and automotive demand is measured gross (i.e. before considering recycling). Consequently, industrial demand, which is mostly expressed net of recycling, became the largest source of platinum demand in 2020 on a net of recycling basis, reaching 45% of net demand in 2021. When associated recycling is subtracted from gross demand in 2021, the jewellery share drops to 28% of total net demand and automotive to 21%.

Figure 3. Although variable on a year-to-year basis, industrial demand for platinum has maintained annual growth since 2013...



Source: Metals Focus, SFA (Oxford), WPIC Research

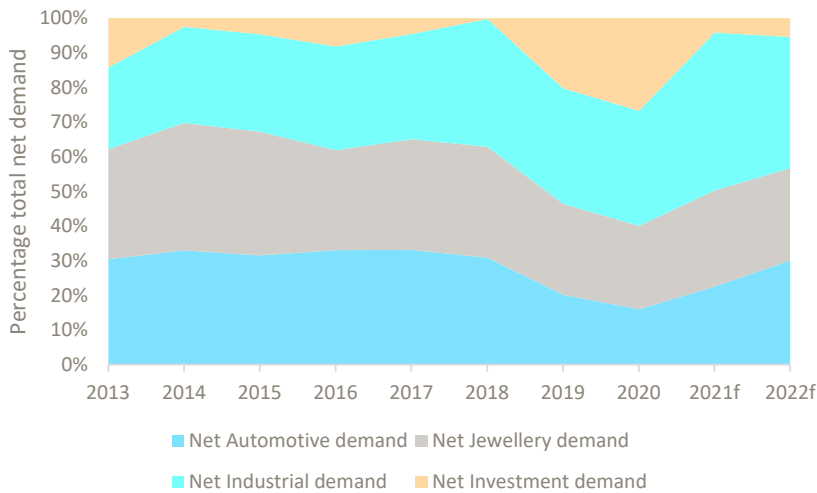
Figure 4. ...which has led to industrial demand overtaking jewellery as the second most significant source of gross annual demand,



Source: Metals Focus, SFA (Oxford), WPIC Research

Of course, the closed-loop nature of so much of industrial recycling has resulted in industrial demand always being reported on a net basis (except electronics), whereas recycling is split out for jewellery and automotive demand. Looking at the main sources of demand on a net of recycling basis, industrial demand became the largest segment of platinum demand in 2018.

Figure 5. Net of recycling, industrial demand for platinum has been the single largest segment of demand since 2018



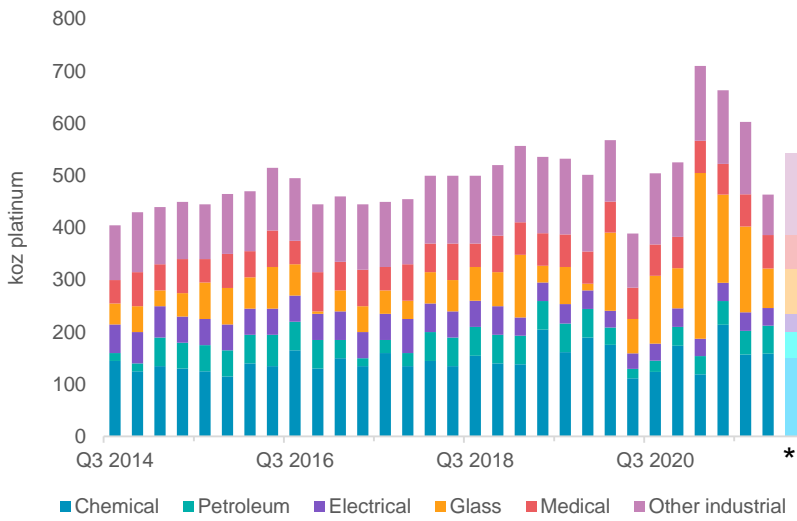
Source: Metals Focus, SFA (Oxford), WPIC Research

While the trend for industrial demand growth is a positive one, there is significant demand variability, with year-over-year changes ranging from -7% to +26%. This reflects the fact that platinum industrial demand is published net of recycling and annual demand comprising 1) incremental demand coming from top-up demand to replace losses, and 2) more episodic demand for capacity expansions and plant closures.

Industrial demand can be broken down into a number of subsectors, each of which has its own demand-pull characteristics. Whilst the industrial subsectors each often show significant variability, the timing of capacity additions seldom coincide with period of relative demand strength and weakness often cancelling each other out. But this is not always the case, and aggregate industrial demand can still demonstrate significant quarterly

volatility, but this tends to smooth out on annual basis, apart from the exceptional years of 2020 and 2021.

Figure 6. Industrial demand for platinum can be highly variable from period-to-period, due to the episodic nature of capacity changes



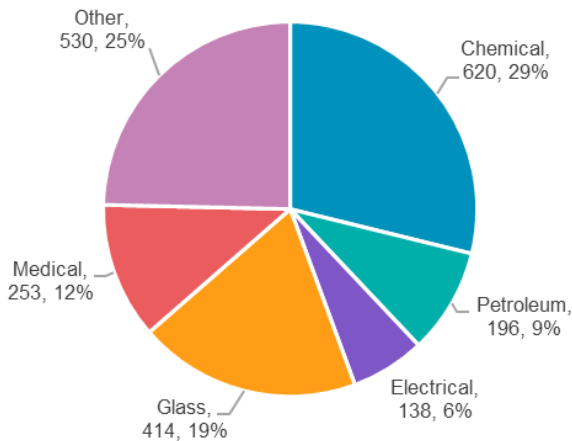
Source: Metals Focus, SFA (Oxford), WPIC Research, *Quarterly average for 2022

Given that industrial demand for platinum is now approximately a third of total demand expressed net of associated recycling, this means that quarterly variations can be significant enough to influence the global supply/demand balance. An example would be in Q1'21 when significant glass capacity additions in China more than offset weaker demand from the other industrial subsectors as well as automotive and jewellery demand. We should note that Q1'21 was a pretty unique quarter as it also included a number of capacity additions delayed from 2020 due to COVID.

Industrial demand subsectors and end-uses

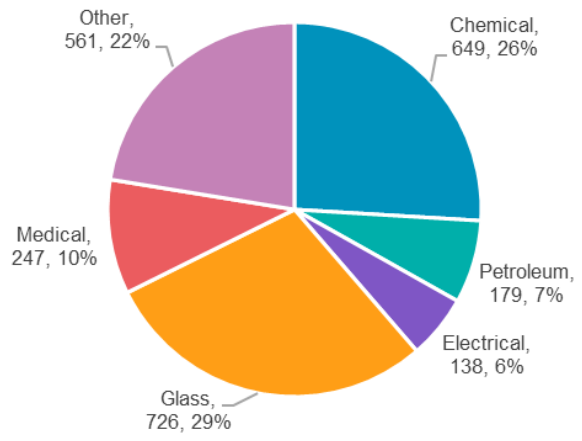
Within the industrial demand segment, the most consistent growth area has been from petroleum followed by chemical demand, with demand from the other sectors being highly variable due to the top-up/capacity expansion characteristics of Industrial demand.

Figure 7. Industrial demand was dominated by chemical demand in 2016...



Source: SFA (Oxford), WPIC Research. Units (koz,%)

Figure 8 ...but glass has grown to become the most significant source of demand in 2021



Source: Metals Focus, WPIC Research. Units (koz,%)

Platinum's attractiveness for industrial processes tends to be a result of its excellent catalytic abilities and/or its durability and resistance to erosion and oxidation in high-temperature and corrosive environments. Industrial demand for platinum consists of the following subsectors and end uses:

Chemical: 28-34% of industrial demand

Platinum's catalytic properties are the key useful attributes for the chemical industry, where the use of catalysts allows for higher yields and reduced energy requirements as processes typically can be conducted at lower temperatures and pressures than when catalysts are not used. Examples of platinum's use in the chemicals industry include the production of nitric acid for fertiliser manufacturing, making silicone rubbers, and hydrogen generation from steam methane reformation.

Petroleum: 3-11% of industrial demand

The petroleum industry employs platinum's catalytic abilities in reforming low octane petroleum naphtha into high quality products, as well as in the gas to liquids industry and the manufacturing of biofuels.

Electrical: 6-12% of industrial demand

Platinum is used in the recording substrates of hard discs for data recording, particularly in cloud-based servers, as well as for coating electrodes to protect against corrosion.

Glass: 9-29% of industrial demand

Glass demand for platinum is primarily for the bushings used in the manufacturing of glass fibre, and the casting surfaces for the manufacturing of LCD screens as, unlike base metals, platinum and platinum-rhodium alloys are unreactive and do not oxidise or scale at the high temperatures required.

Medical: 10-14% of industrial demand

Not strictly an industrial end-use but included within industrial applications for our supply/demand projections. Medical uses of platinum include pacemakers, implants and surgical equipment visible under x-ray due to platinum's radiopacity, but also its important application in platinum based antineoplastic anti-cancer drugs.

Other: 21-29% of industrial demand

Other industrial uses for platinum include sensors, such as used in engine management systems, and on spark plug electrodes, to reduce spark erosion and prolong operating life.

Glass demand for platinum is heavily influenced by the timing of capacity additions

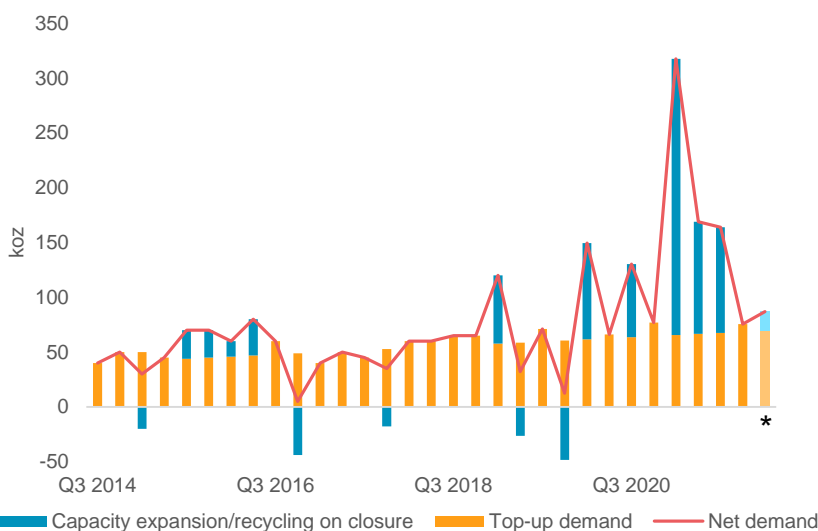
Glass demand is highly influenced by the effects of closed-loop recycling with platinum containing materials manufactured and installed in the glass making facilities comprising the bulk of demand from one plant site. The installed platinum suffers from gradual erosional losses during operation until out of parameter, and is then subsequently replaced and sent for recycling (usually back to the original supplier).

An example of this would be the platinum/rhodium bushings used for the drawing of glass fibre. The bushings are either manufactured in-house or come from a third-party supplier. There is a significant up front platinum requirement for new facilities or capacity additions (capacity expansion demand) but once up and running, the bushings are used until the internal aperture is off specification, at which point they are removed and returned to the source facility for recycling. Platinum losses due to erosion are minimal and so annual top up requirements are in the low single digit percent region.

WPIC's supply/demand estimates are prepared independently by Metals Focus, who only provides net glass demand. WPIC does not have visibility of the myriad of components that go into Metals Focus's forecast, so the following top-up demand versus capacity addition/recycling figures are presented by WPIC for illustrative purposes only.

There was a significant expansion of glass manufacturing capacity in China in the years leading into 2015, which then satisfied demand growth until 2019. Subsequently, capacity addition projects began to procure platinum for initial loadings, but COVID related delays pushed several start-ups from 2020 into the first quarter of 2021.

Figure 9. Illustrative breakdown of top-up vs. capacity addition demand in the glass industry



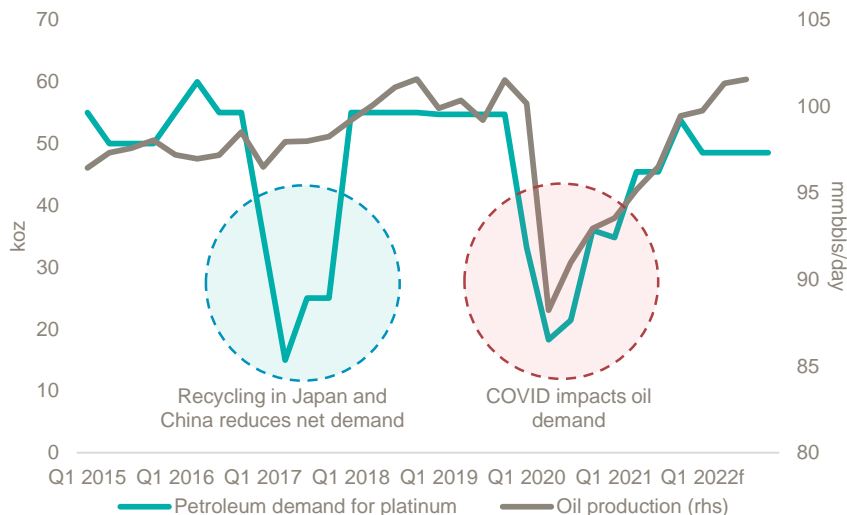
Source: Metals Focus, SFA (Oxford), WPIC Research, Note that the net demand figure is from official figures, but the detail of top-up demand versus capacity expansions and closures is entirely illustrative, * illustrative quarterly demand for 2022.

Petroleum demand for platinum has recently been led by volumes

Petroleum demand for platinum is also influenced by the effects of closed-loop recycling, but there is a greater influence on net platinum demand from changes in volume throughput of the petroleum refineries. Catalysts are replaced in a 'change-out' event typically every 5 to 7 years but in some cases every 2 years. This time will be longer if volume throughput reduces.

This can be seen in 2020 with the fall in output reflecting the COVID related drop in demand for petroleum products. Conversely, a fall in petroleum demand for platinum in 2017 was the result of industry consolidation in Japan and Europe leading to refinery closures, coinciding with slower growth in China and North American, with the resultant excess platinum returned to the market.

Figure 10. Platinum petroleum demand has been far more volume led in recent years



Source: Metals Focus, SFA (Oxford), Bloomberg, WPIC Research

Conclusion

Industrial demand has become an important driver of platinum demand growth and an increasingly important influence on the platinum supply/demand balance. But it is irregular and hard to forecast due to the episodic nature of capacity additions and occasional plant closures. This can distort market perceptions if only short timeframes are examined, but over a year or longer the key observation is that industrial demand is continuing to grow and will likely continue to do so.

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