

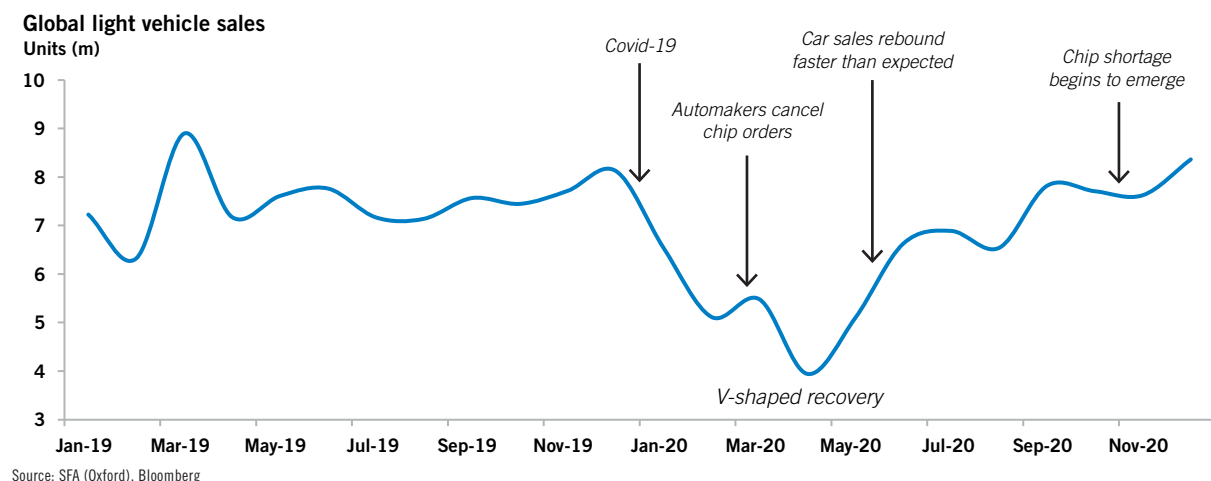


PGM MARKET ANALYSIS

Semiconductor chip shortage: the impact on the global automotive market and PGM demand

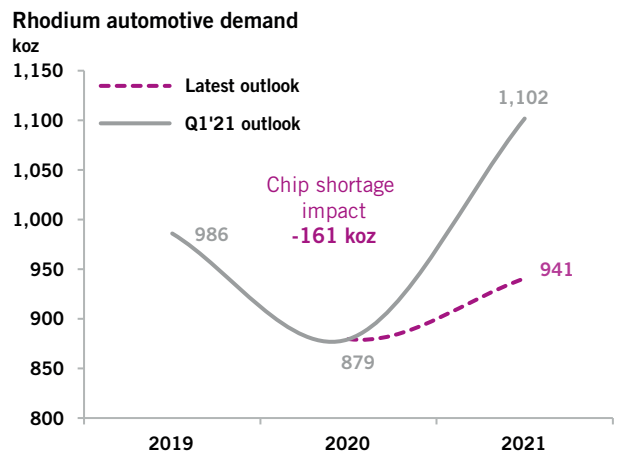
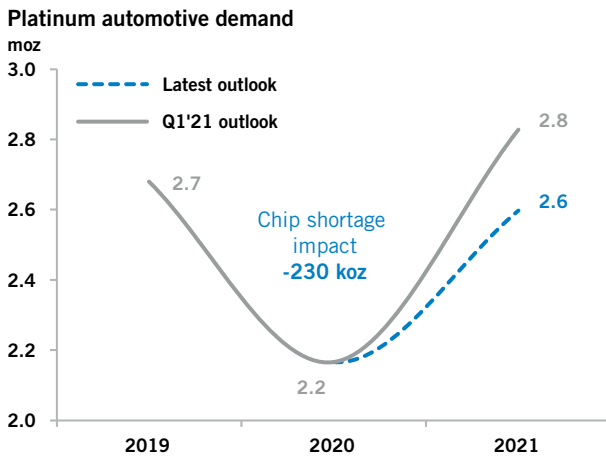
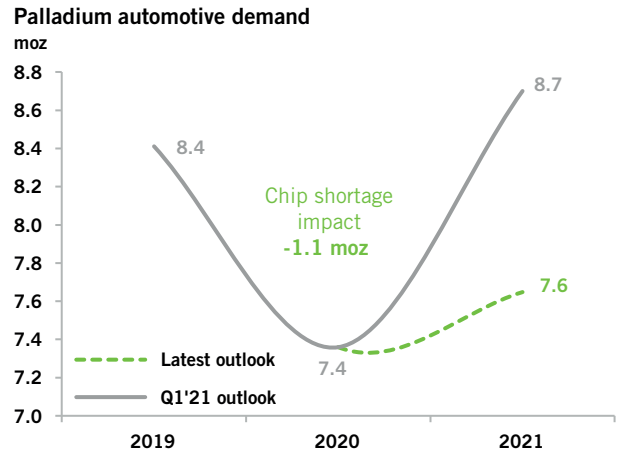
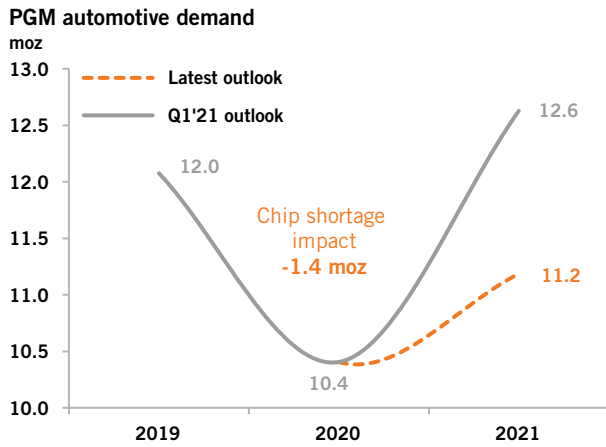
2021 was set to be the year when vehicle production and sales recovered from the pandemic disruptions to manufacturing, consuming and economic activity generally. However, the semiconductor chip shortage has introduced a whole host of supply disruptions, adding to some enduring pandemic problems, to further delay the recovery in vehicle sales and automotive PGM demand.

The chip shortage emerged at the end of 2020, when a perfect storm of strong demand and constraints in manufacturing capacity and logistics began to impact operational stability in the automotive industry. Automakers cut their semiconductor chip orders in Q2'20 in line with pandemic-weakened vehicle sales, and the spare capacity was quickly claimed by a boom in consumer electronics driven by the global shift to home working. However, global vehicle sales rebounded much faster than expected in Q3'20 from a 'V'-shaped recovery and automakers were 'caught short'. Meanwhile, chipmakers continued to focus production on their consumer electronics customers, where chips are more profitable, with higher volumes, and sales had been more consistent. Chip supplies were further reduced, albeit for a limited period, by power failures in Texas, where leading chipmakers Samsung, NXP and Infineon were forced to halt production, as well as a fire at one of Renesas Electronics' factories in Japan.



The semiconductor shortage is now estimated to impact global light-vehicle production by 9.6 m units in 2021 (source: LMC Automotive). While this is a slight improvement from earlier forecasts, the disruption is not expected to meaningfully improve much before H2'22 and closing the chip supply shortfall appears to be unlikely before 2023. The light-vehicle production forecast for 2021 (75.8 m) is just 1.2 m units higher than in 2020 (+2%) and 11.5 m units below the Q1'21 forecast (-13.1%), which excluded any impact from the chip problem. It is some 16.6 m units short of the Q4'19 forecast (-17.9%).

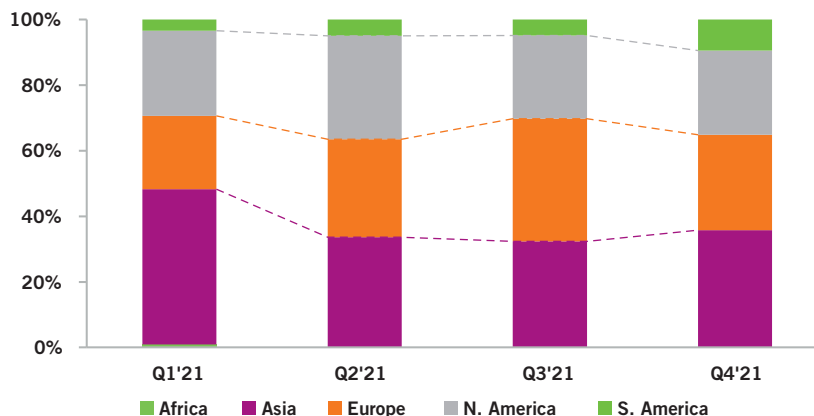
The estimate of 9.6 m units of lost vehicle production amounts to a reduction of around 1.4 moz of PGMs this year. This is led by palladium, reduced by close to 1.1 moz, followed by platinum down 230 koz and rhodium down 161 koz, derived from the average autocatalyst composition in each region. Platinum has been slightly less hard hit than the other metals, as some of the higher margin luxury cars, where diesel has a slightly larger share of the mix, have been prioritised by premium automakers for the available chips. The impact on PGM demand has been slightly amplified as a significant proportion of the lost vehicle demand has been in the regions with the most highly PGM-loaded autocatalysts to comply with their stringent emissions standards, such as Europe.



Source: SFA (Oxford)

Regional differences are emerging in the pace of the recovery. Asian automakers, closer to most chip production, appear to be returning to normal output levels more quickly than European automakers, who with very limited local chip fabrication, still report significant disruption to output. Light vehicle production in Asia was initially worst affected, with more reliance on just-in-time procurement, but then improved quickly from Q2'21, while Europe's position worsened through Q2 and Q3. North America's position has been relatively stable, after the recovery of its limited chip production capacity. Overall, of the 9.6m units of lost vehicle production included for 2021, Asia sees the most disruption (36%), closely followed by Europe (32%) then North America (27%).

Light vehicle production losses

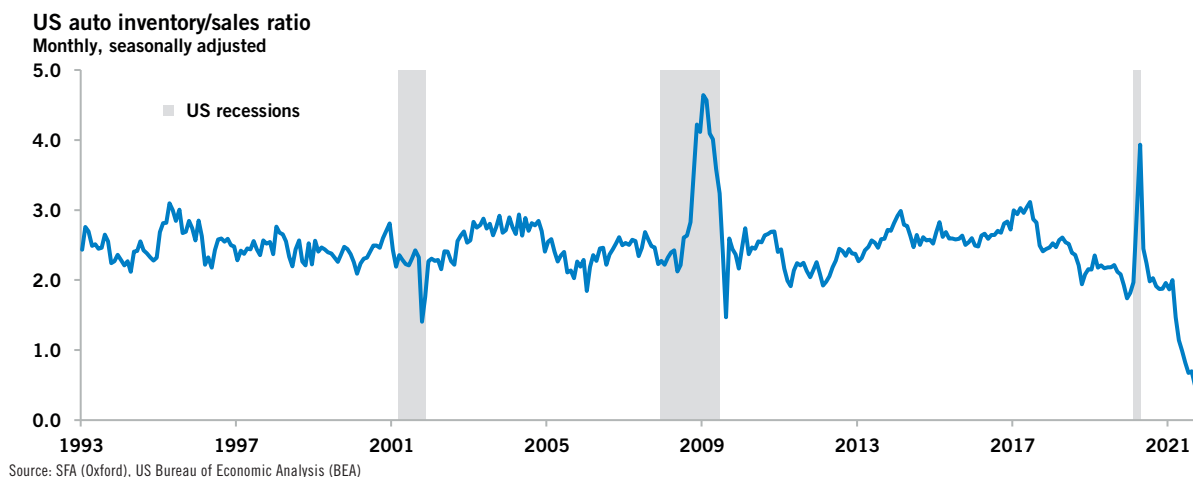


Disruption in the major auto markets of Europe and North America improved moving into Q4'21, suggesting a realistic chance of recovery in 2022

Source: SFA (Oxford), LMC Automotive

The situation is showing signs of stabilising, but it is increasingly likely that some of the previously anticipated demand recovery will be lost, at least for the next 2-3 years, as vehicle production is forecast to remain below pre-pandemic levels until 2024. Limited vehicle availability (numbers and choice) and the increase in pricing may have pushed some consumers in many countries out of the new vehicle market, either keeping an existing vehicle for longer, buying a used vehicle, or buying out a lease, instead of purchasing/leasing a new vehicle.

For now, new vehicle sales continue to be constrained by available inventory. In the US, retail inventory at dealerships is expected to have closed below 1 million vehicles for the fourth consecutive month in November, with sales each month being dictated by the number of vehicles delivered to dealerships rather than reflecting actual demand. Retailers continue to sell a large proportion of vehicles as soon as they arrive in inventory. In November, a record of nearly 55% of vehicles were sold within 10 days of arriving at a dealership, while the average number of days a new vehicle was held by dealers before being sold fell to 19 days, a record low and down from 48 days a year ago (source: JD Power). The US auto inventory to sales ratio fell to a record low of 0.3 in October (source: US Bureau of Economic Analysis).



There is no quick fix to the semiconductor chip shortage for the automotive sector. While the effects of the natural disasters that knocked out production earlier in 2021 have largely been recovered, there is a longer-term need for investment in capacity build. Plans are in place to build more European chip factories, especially in Germany and France. Intel has announced it will spend €80 bn to expand its semiconductor manufacturing capacity in Europe, but such new plants will take several years to be ready for production, leaving the region exposed in the meantime.

Some pent-up demand, for both vehicles and PGMs, is expected in 2024 and 2025, but this does assume that by this point chip production capacity is no longer constrained and automotive production has returned to normal levels. If so, this would allow inventory restocking and satisfy some of the pent-up demand, but still recoup only ~40% of the cumulative vehicle production lost over the course of the previous three years (2021-2023).

Vehicle production cuts have shifted all PGMs temporarily into surplus this year, the realisation of which led to a sharp contraction in the palladium and rhodium prices during Q3'21. However, auto demand is forecast to recover in 2022 (Pt +13%, Pd +4% and Rh +12% year-on-year) as vehicle production improves modestly on two consecutive weak years. Palladium is expected to benefit from higher loadings in China to meet stricter emissions standards, and platinum demand will be boosted by increasing use in heavy duty vehicles and some substitution of palladium in gasoline vehicles. All PGM markets are expected to tighten next year, but the unknown impacts of the Omicron variant of Covid-19 may dampen price upside if auto part supply-chain hold-ups slow the post-chip crisis recovery (excluded from the current outlook). That said, automakers and OEMs are far better equipped to deal with coronavirus outbreaks at production facilities than they were last year, and widespread vaccination should provide some degree of economic immunity.

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