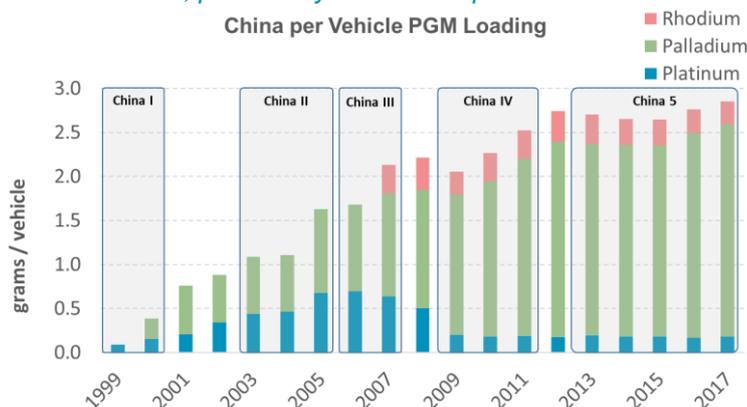


## China clean air, PGMs and platinum

**China's new auto emissions standards are likely to boost PGM demand.** China's 6a and 6b standards, to be fully implemented by 2020 and 2023, respectively, represent a significant tightening of emissions requirements (see Figure 1 next page). The new standards are more stringent than Euro 6 as they introduce elements of US regulation, e.g., enhanced on-board diagnostic provisions. Unlike European regulation, China 6 does not differentiate between diesel and gasoline vehicles, establishing a single standard for both. Real driving emissions (RDE) tests are also being introduced to ensure that cars on the road deliver similar emissions results to those in the lab. The step up in standards means that manufacturers will need to improve their emissions technology which should have a positive impact on platinum group metal (PGM) content, as we have seen in the past (left hand graph below).

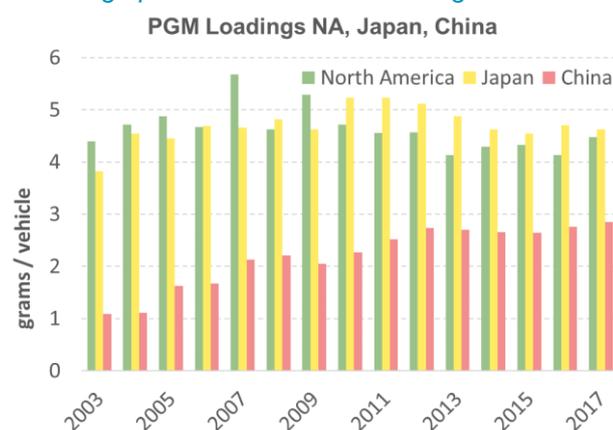
**6a implementation by July 2020, however, Beijing and other regions tend to adopt early.** While final implementation of 6a is not until mid-2020, several important municipalities tend to adopt more stringent emissions standards early. Beijing and other built-up regions have consistently adopted the more restrictive rules as much as several years early (see Figure 1 incl. footnote). In the left-hand graph below, we see PGM loadings often increase with a new regulation implementation, likely due to early implementation by Beijing and others, and then again later as all-China implementation is reached.

*China vehicle loadings have increased in step with new emissions rules, particularly as final adoption occurs*



Note: Shaded areas represent implementation periods starting with early adopters (e.g., Beijing) and final implementation for all of China.  
Source: OICA, Johnson Matthey, ICCT, WPIC Research

*China loadings lag NA and Japan by over 36%, indicating upside as emissions rules tighten*



Source: OICA, WPIC Research

**China has some way to catch up with PGM loadings in more mature markets.** The right-hand graph above shows PGM loadings per vehicle in North America, Japan and China. Several factors explain the differences including average engine size, fuel mix differences (thus excluding Europe), and, most importantly, emissions standards. Nonetheless, as emissions standards and wealth improve in China, PGM loadings should continue to approach those of more developed regions, thus providing a demand push for PGMs, including platinum, by potentially as much as a gram per vehicle.

**As palladium goes further into deficit, it should tighten the platinum market.** The Chinese demand trend is significant as it represents 26% of global PGM demand. Should Chinese automakers see supply risk and/or cost disadvantage in palladium, the platinum market offers ample capacity to satisfy increased PGM demand. For some additional views on potential platinum substitution for palladium, see our [October Platinum Perspectives](#).

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# Platinum charts – November 2018

Platinum's attraction as an investment asset arises from:

- Supply is relatively constrained, with limited investment going into new PGM mines
- Automotive demand shows promise with tighter emissions regulation and potential palladium substitution
- Platinum appears undervalued relative to palladium and gold
- Managed money positioning looks to be improving

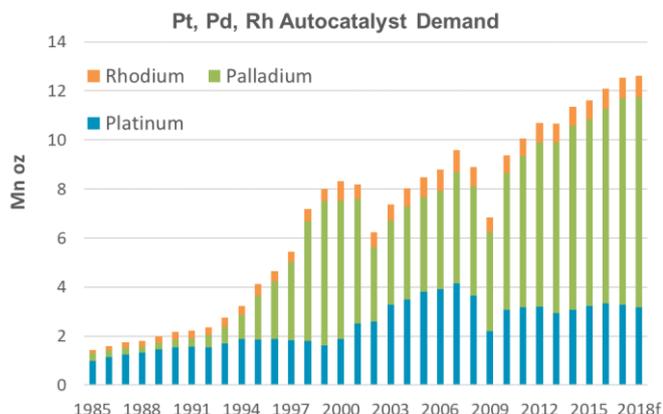
Figure 1: China 6 is a significant step-up in standards; Beijing and other provinces adopt early

China Emissions Regulation History			Type 1 Standards g/km				
	Adoption*		CO	HC	NMHC	NOx	PM
	Early Adopters	All China					
China 1	Jan-1999	Jul-2000	2.72	-	-	-	-
China 2	Jan-2003	Jul-2005	2.2	-	-	-	-
China 3	Dec-2005	Jul-2007	2.3	0.20	-	0.150	-
China 4	Dec-2008	Jul-2011	1.0	0.10	-	0.080	-
China 5 <sup>‡</sup>	Feb-2013**	Jan-2018	1.0	0.10	0.068	0.060	0.0045
China 6a <sup>‡</sup>	†	Jul-2020	0.7	0.10	0.068	0.06	0.0045
China 6b <sup>‡</sup>	†	Jul-2023	0.5	0.05	0.035	0.035	0.0030

\* adoption dates are for Type 1 LDVs below 2.5 t.  
 \*\* Beijing adopted "Beijing 5" as China 5 standards were not yet official.  
 † In 2016, Beijing proposed adopting an early version of China 6 by 2017, but did not go forward once China 6 was published.  
 ‡ China 6a and 6b include a N<sub>2</sub>O 0.02 g/km limit; China 5, 6a and 6b include a PN 6x10<sup>11</sup> limit.  
 CO = carbon monoxide; HC = hydrocarbons; NMHC = non-methane hydrocarbons;  
 NOx = nitrogen oxides; PM = particulate matter; PN = particulate number.

Source: ICCT, China MEP, WPIC Research

Figure 3: The auto market has become heavily reliant on palladium ...



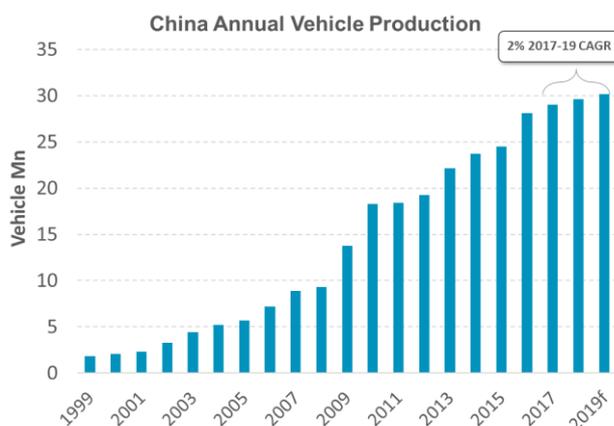
Source: Johnson Matthey, WPIC Research

Figure 5: Platinum's \$370/oz discount to gold is near an all-time high



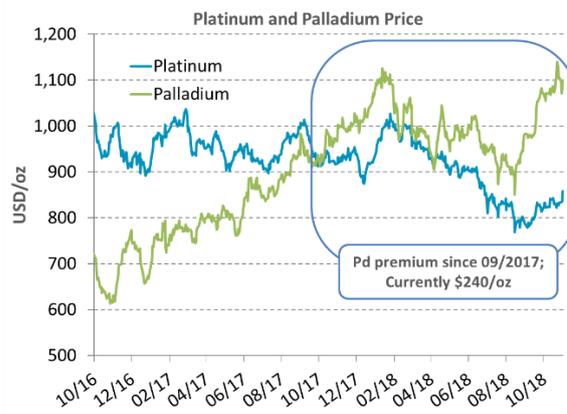
Source: Bloomberg, WPIC Research

Figure 2: China production growth continues despite a potentially challenging international environment



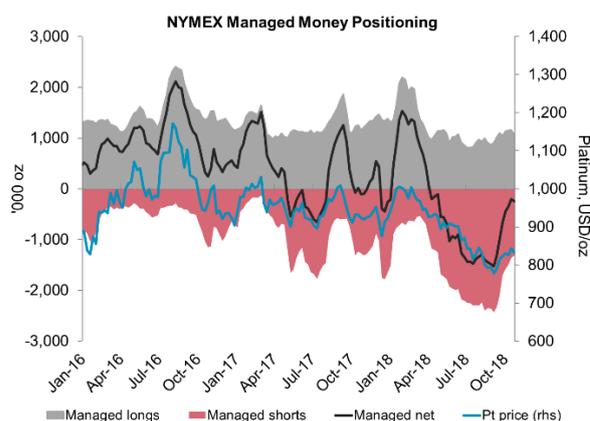
Source: OICA, WPIC Research

Figure 4: ... resulting in the significant palladium price premium over platinum seen today



Source: Bloomberg, WPIC Research

Figure 6: NYMEX net positioning has improved



Source: Bloomberg, WPIC Research

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