ABN·AMRO

The White Book

Investment Research / July 2010

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Introduction

This is the seventh edition of the ABN AMRO Bank White Book. The report presents historical data on all aspects of the international platinum and palladium markets between 2005-2009, together with our forecasts for 2010. In this edition we examine the changes in the global car market and implications for the PGM metals.

That the White Book is made available to the market on a complimentary basis is due to ABN AMRO Bank N.V., and VM Group thanks our colleagues at ABN AMRO for their continued support and recognition of the value of this research to the industry.

Our data is available electronically in Microsoft Excel format – email us with specific data requests at: info@virtualmetals.co.uk.

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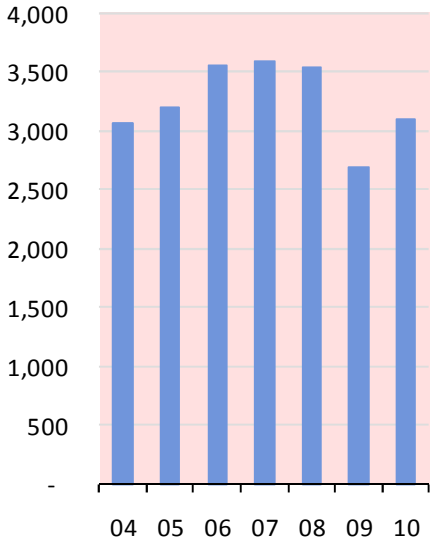
Analysis

On the road again - maybe

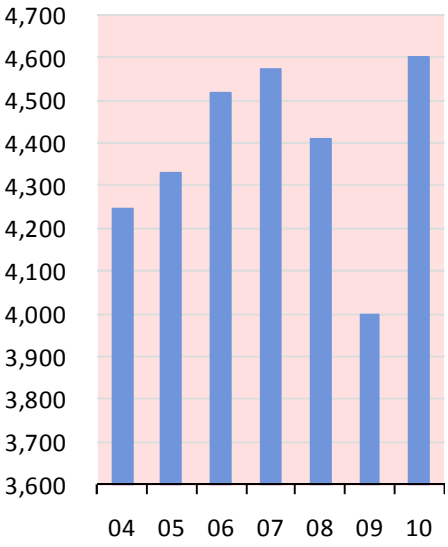
Without the road transport industry and the inextricably entwined environmental legislation that restricts the emission of toxic gases from the exhausts of motorcars and trucks, the platinum group metal markets would surely be done for.

Autocatalysts demand for platinum, 000 oz



Source: VM Group

Autocatalyst demand for palladium, 000 oz



Source: VM Group

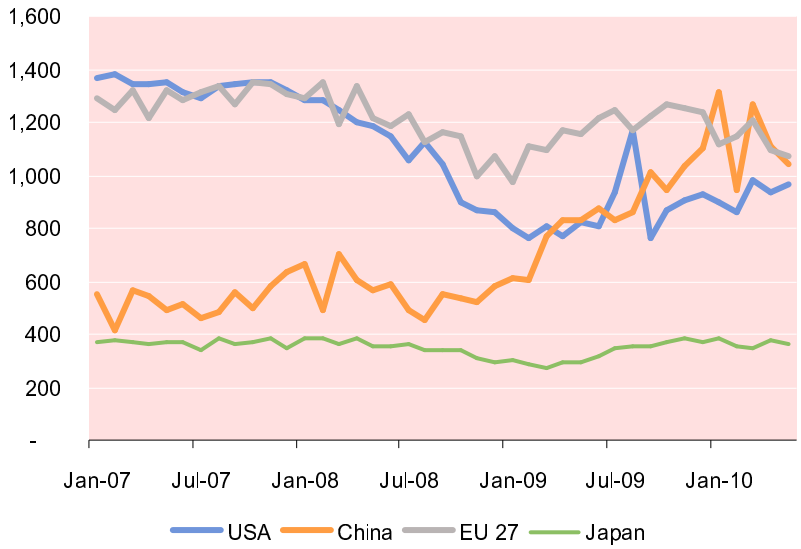
Last year, autocatalyst demand for platinum represented almost 54% of the metal's total offtake. The situation for palladium is even more extreme, as almost 57% of all demand came from the road transport industry. The position that rhodium finds itself in hardly bears thinking about, as almost all the demand for rhodium is destined for exhaust emissions' control. Delve into these markets without a sound understanding of where the autocatalysis market is headed is at your own peril.

Back in the 1980s, it was a relatively easy exercise to model the presence and evolution of autocatalysis. In the first case, there were essentially only three markets whose market share was big enough to warrant close attention. These were North America, Western Europe and Japan. In the second case, it was a relatively simple procedure to track how legislation was being phased-in, and apply the time lines to the car registrations of the relevant countries. And finally, back then autocatalyst design was comparatively primitive – the initial two-way and then the three-way catalyst was applied to petrol engines, and we had a fair idea as to the size of these engines and hence the pgm loading of each catalyst. The diesel engine in those days was considered a bit of a dinosaur, a technology for heavy-duty vehicles, and certainly not passenger cars. As for ethanol fuelled cars or hybrids – pardon? Electric vehicles were either milk floats or things you puttered about on the golf course.

The range of current and possible road vehicles today is enormously more complicated and much more dynamic, and the modelling of this industry has become concomitantly much more complex and almost endlessly mutating. The nature of the traditional markets has undergone radical change, thanks largely to the shock oil price spike of July 2008, when crude oil peaked at $147/barrel. This was unlike previous oil shocks partly because it went hand-in-hand with a game-changing circumstance that is bringing about profound shifts in all societies – climate change, global warming, and the increasingly frantic efforts to slow greenhouse gas emissions from human activity. The conventional passenger vehicle market is under pressure not just to become more fuel efficient, but also to switch from burning fossil fuels to other forms of fuel. These twin pressures are

bringing about a revolution – the speed of which is yet to clarify itself – in not just the type of cars the next generation will drive, but necessarily also the likely trajectory for future industrial demand for pgms.

New car sales in major markets, million units

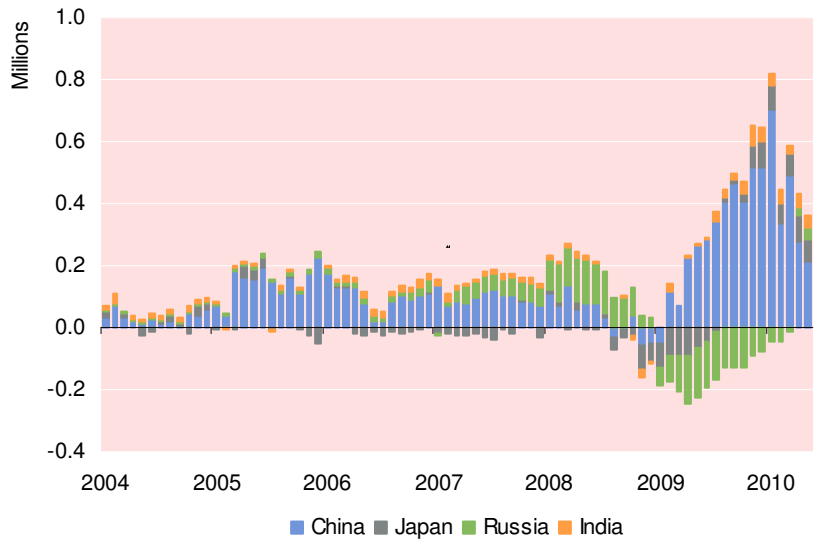


Source: VM Group

The GM announcement that the last of its gas-guzzling Hummers would be rolling off production lines in the US was therefore highly symbolic of the radical shift in consumer buyer patterns in America that will over time increasingly make itself felt. The 1990s' consumer clearly is gone and possibly forever; the hugely powerful SUVs that were synonymous with the American dream are just no longer desirable, they are possibly even regarded as unethical. In Europe the balance between diesel and petrol powered cars has see-sawed in response to the price differential between the two fuel types, but mostly because the past five years have witnessed an astonishing re-design of the diesel engine, greatly improving its fuel consumption and torque, rendering the latest generation of small diesel passenger cars sexy and sporty to drive. The diesel-dinosaur image is indeed extinct.

All this has meant that calculating pgm loadings in autocats has been rendered much more complex. There is now a multitude of different catalyst designs with a wide range of pgm loadings, and pgms' ratios within those loadings. On top of which, the location of where the dominant car markets are is shifting. The biggest traditional markets are becoming saturated, but there is vast – and as yet unsatisfied – pent-up demand in emerging markets. These markets hold the future and a model predicting autocatalyst demand for pgms now has to be global in every sense. Much of this growth is coming from the BRICs – Brazil, Russia, India and China.

BRIC new car sales, million units



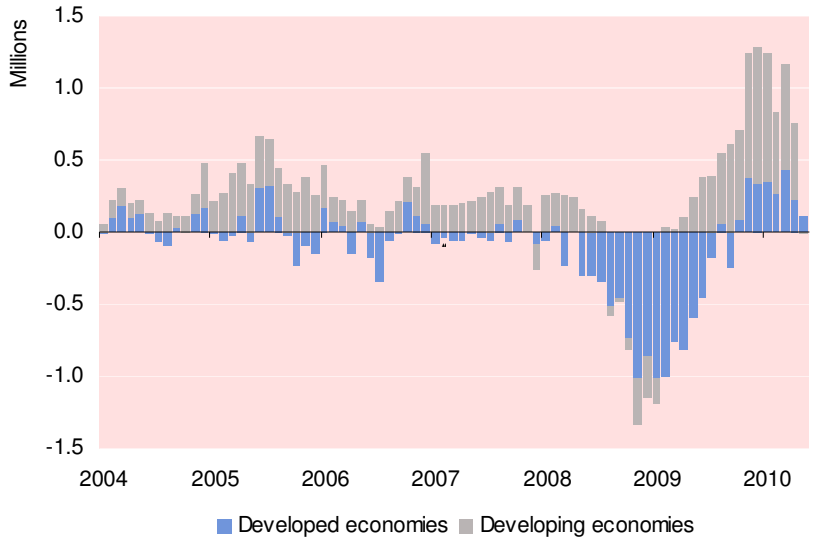
Source: VM Group

Around $5,000 a year is the earnings threshold at which car-ownership really takes off: as consumer purchasing power grows, so too will new car sales. It's estimated that the number of cars worldwide will rise from around 600m in 2005 to almost 3bn by 2050. India and China have insisted that the tough Euro IV standard for vehicle emissions will be introduced within the next few years. Barring some radical new autocatalyst technology – and so far there have been more promises than realities about substituting other, cheaper metals for pgms – these two facts alone will provide a huge and fairly captive demand base for pgms over the next four decades. It's also the case that the rapid expansion of the global car pool will provide pgm recyclers with vast new business possibilities – and the trickle of secondary supply will turn into a flood in the long-term. According to the IMF, China's car fleet will have overtaken that of the US by 2030 (even though the latter is expected to rise by 60% from 2005 levels) and by 2050 China is likely to have as many cars as the entire world has today. India will not be far behind, with an anticipated fleet of almost 370m cars by the same date, 45 times more than on its roads today. It's no accident that the greatest expected growth in the car market is happening precisely where the recent recession has barely registered. As the global car pool explodes, the pressure on legislators to tighten ever-further the control over emissions will rise proportionately – another underpinning for pgms' demand.

But within these rapidly expanding emerging markets' demand for cars there are huge variations. In China, medium to large but highly fuel efficient passenger cars are the order of the day. Car registrations in the country have risen 178% over the past five years, yielding an annual average growth rate of 58%/year. Yet it's not all cut-and-dried regarding future pgms' demand growth for these new markets. As is

so often the case, a technological leapfrog is underway. China is subsidising the purchases of cars deemed to be more fuel efficient – the buyer of a fully-electric vehicle stands to receive as much as yuan 60,000 (around $8,800), with lower subsidies of some $7,300 for hybrid gasoline-electric vehicles. These may not be sufficient subsidies to tempt a new buyer to opt for a hybrid – even with $7,300 of the price tag the hybrid still costs around $6,000 more than the conventional F3 sedan, one of China's most popular vehicles. But eventually the world will be driving all-electric vehicles – the noose of environmental legislation will hang the fossil-fuel-based car, and the eventually exorbitant price of crude oil will bury it.

New car sales, million units



Source: VM Group

Apart from the fact that a growing number of Chinese citizens are increasingly enjoying upward economic and financial mobility, a major reason why we are seeing these buoyant levels of car sales is because the authorities are addressing the need to provide the infrastructure to accommodate these motor car populations. Contrast this to India where capital investment in the much-needed infrastructure has been sporadic and subject to bureaucratic delays not least because of the planning difficulties associated with the historically haphazard way in which Indian cities have evolved over time. Unless this is resolved, the physical constraints of driving around Indian cities are likely to place a serious ceiling on future growth in car registrations.

This does not apply to Russia, a market showing all the signs of going the big gas-guzzling SUV route (tinted windows coming as standard rather than an optional extra). If any country could support a large SUV market, it surely must be Russia, where particularly harsh winter driving conditions are accepted as normal.

And so the modelling of pgms' demand will inevitably become increasingly complex. The industry is currently on the cusp of new technology, with much depending on getting electric vehicle battery technology right, and cheap enough for mass markets. That will happen. For the time being, our increasingly complicated model tells us that the pgms are safe with respect to their dominant end use, and the medium term future of the three biggest markets is assured. Longer term however there are some radical threats to pgms' demand. If ever there was a case for arguing that a commodity will have a steep parabola shape over the next few decades, pgms are it.

The data

The methodology

General comments: It has to be recognised that there are large swathes of the pgms market which are not open to public scrutiny, and therefore movements of metal within these sectors are largely beyond measurement and unverifiable. VM Group attempts to avoid spurious accuracy – measuring something visible to the last two decimal places is a waste of resources considering the global picture for this commodity. These supply/demand balances are designed therefore to give overall general flows of metal between regions and sectors. The data is accurate as of end December 2008 except where stated.

Derivation of the data series

- Mine supply derived on a mine-by-mine and company basis from annual reports
- Recycling of autocatalysts from Virtual Metals autocatalyst model and ongoing discussions with industry participants. Note: the figures presented represent scrap pgm material sourced from the country of collection; they do not identify the point at which the metal is refined
- Jewellery demand from trade data in the case of China and Johnson Matthey in other instances
- Autocatalyst demand from base line analysis of car registrations generated in the VM Group's autocatalyst model. Note: the difference between the VM Group's and Johnson Matthey autocatalyst figures imply inventory held by the motor car manufacturers
- Oil refining derived from the oil data in BP's Statistical Review
- Electronics – Data series derived by VM Group based on work relating to the electronics industry when studying the pgm industry and the recycling of electronic scrap
- Chemicals – Based on VM Group models and industry discussions
- Glass – Based on VM Group models and industry discussions. The "other category" of metal end-uses is an estimate of all other applications of platinum and palladium including industrial and decorative uses (excluding electronics), as well as medical and dental demand

The residual

The overall supply/demand balance does not balance. The difference between supply and demand (negative is demand exceeding supply), we term the residual – which is met by stock sales, which we have separated out. ETF movements are known, other movements are not, and as such the residual is an acknowledgement that a) omniscience about this market is impossible, and to pretend otherwise is misleading; b) there are pgm flows associated with the unofficial market, which cannot be verified and c) there are sectors which cannot be measured and therefore we do not pretend otherwise; these include any investment purchases.

Housekeeping

All volumes are in troy ounces unless stated.

All references to dollars are US dollars unless stated.

Numbers in the tables have been independently rounded and accordingly may not add exactly to indicated totals and subtotals.

Platinum world total and regional supply/demand imbalances (thousand ounces)

	World total					
	2005	2006	2007	2008	2009	2010f
Supply						
Mine Supply	6,402.0	6,702.3	6,368.7	5,964.0	6,020.0	6,160.0
Scrap Recycling	1,159.6	1,141.6	1,171.4	1,457.1	1,450.0	1,517.5
Total Supply	**7,561.7**	**7,843.9**	**7,540.1**	**7,421.1**	**7,470.0**	**7,677.5**
Demand						
Autocatalysts	3,197.7	3,553.8	3,597.4	3,538.0	2,700.0	3,100.0
Jewellery Fabrication	2,033.3	1,696.0	1,650.1	1,710.0	2,500.0	2,150.0
Petroleum Refining	111.7	153.1	191.7	200.3	176.0	165.0
Electronics	445.0	480.0	488.0	485.0	460.0	445.0
Chemicals	329.5	334.0	387.0	363.0	350.0	340.0
Glass	371.2	435.3	455.0	275.0	75.0	30.0
Other	480.0	490.0	475.0	490.0	510.0	525.0
Total Demand	**6,968.4**	**7,142.2**	**7,244.3**	**7,061.2**	**6,771.0**	**6,755.0**
Residual (Supply less demand)	**593.2**	**701.8**	**295.8**	**359.8**	**699.0**	**922.5**
Stock movements						
Exchange Traded Funds (in)			194.4	102.3	380.1	633.5
Unknown/Implied investment	**593.2**	**701.8**	**101.4**	**257.6**	**318.9**	**289.0**

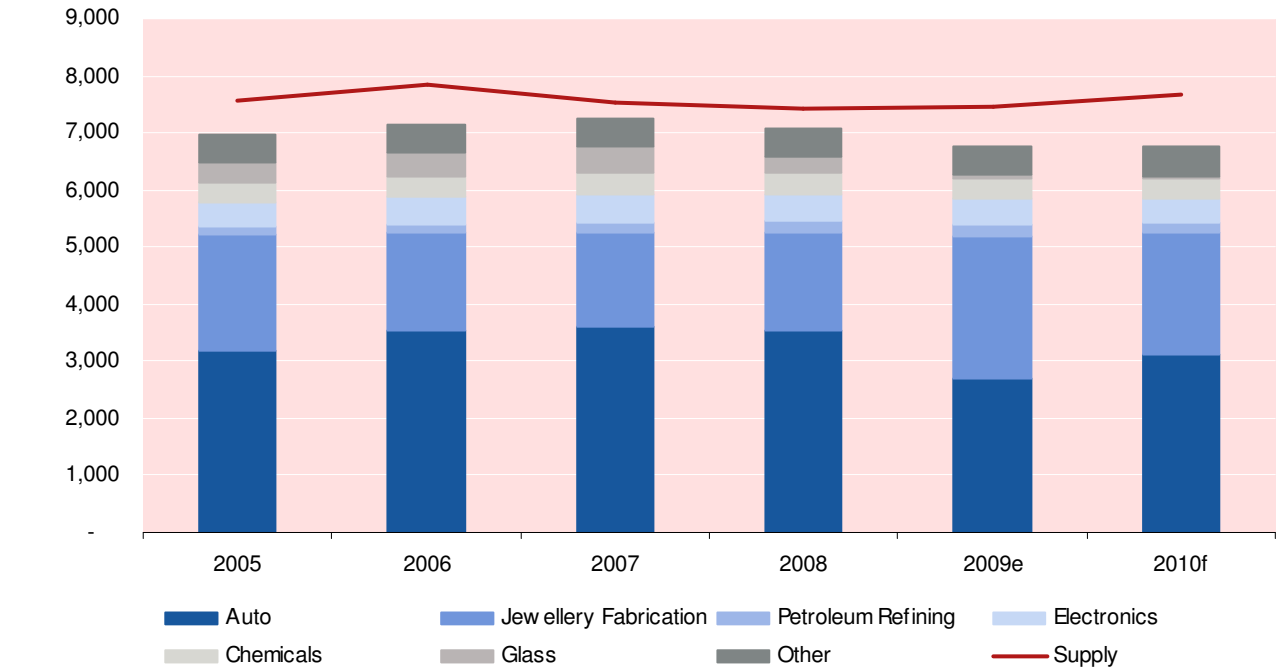
Source: VM Group
Note: Subtotals might not add to totals due to rounding
Note: 2010 mine data includes an adjustment for metal that is unlikely to come to market

Palladium world total and regional supply/demand imbalances (thousand ounces)

	World total					
	2005	2006	2007	2008	2009	2010f
Supply						
Mine Supply	6,714.0	6,991.2	6,749.6	6,345.0	6,390.0	6,480.0
Scrap Recycling	760.3	1,024.4	1,241.3	1,391.8	1,356.0	1,558.0
Total Supply	**7,474.3**	**8,015.6**	**7,990.9**	**7,736.8**	**7,746.0**	**8,038.0**
Demand						
Auto	4,329.3	4,515.9	4,570.9	4,410.8	4,000.0	4,600.0
Jewellery Fabrication	1,008.6	1,222.2	1,100.7	1,022.4	1,075.0	1,110.0
Electronics	991.4	995.9	1,020.7	1,165.0	1,190.0	1,230.0
Chemicals	270.2	292.8	300.4	282.9	273.0	251.0
Dental	815.0	730.0	625.0	600.0	500.0	500.0
Other	168.0	170.0	170.0	170.0	130.0	130.0
Total Demand	**7,582.4**	**7,926.8**	**7,787.8**	**7,651.1**	**7,168.0**	**7,821.0**
Residual (Supply less demand)	**(108.2)**	**88.8**	**203.2**	**85.7**	**578.0**	**217.0**
Stock movements						
Exchange Traded Funds (in)			280.2	381.0	502.1	1124.3
Russian Stock sales (out)	(715.0)	(1,400.0)	(1,200.0)	(1,000.0)	(1,000.0)	(850.0)
Unknown/Implied investment	**606.8**	**1,488.8**	**1,123.0**	**704.6**	**1,076.0**	**(57.3)**

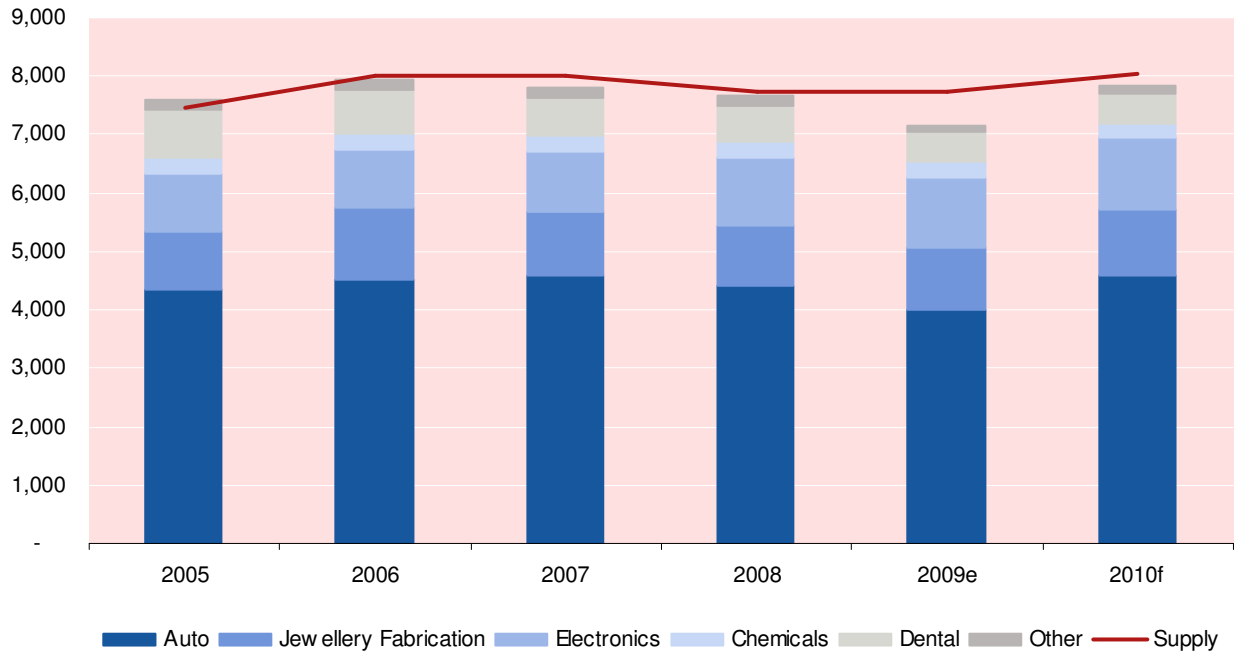
Source: VM Group
Note: Subtotals might not add to totals due to rounding
Note: 2010 mine data includes an adjustment for metal that is unlikely to come to market

Platinum demand by sector, thousand oz



Source: VM Group

Palladium demand by sector, thousand oz



Source: VM Group

Platinum primary mine supply, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
South Africa	4,967.1	5,289.7	4,956.6	4,669.0	4,851.5	4,940.0
Zimbabwe	154.9	168.6	172.8	143.0	123.0	125.0
Total Africa	5,122.0	5,458.2	5,129.4	4,812.0	4,974.5	5,065.0
Russia	901.1	880.5	892.0	825.0	730.0	755.0
Total Eastern Europe	901.1	880.5	892.0	825.0	730.0	755.0
Canada	253.0	225.2	223.3	218.0	209.5	225.0
USA	126.0	138.5	124.0	109.0	106.0	115.0
Total North America	379.0	363.6	347.3	327.0	315.5	340.0
World Total	6,402.0	6,702.3	6,368.7	5,964.0	6,020.0	6,160.0

Source: VM Group

Palladium primary mine supply, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
South Africa	2,528.8	2,691.3	2,565.2	2,544.0	2,645.0	2,698.0
Zimbabwe	128.3	137.0	140.1	148.0	173.0	185.0
Total Africa	2,657.1	2,828.4	2,705.3	2,692.0	2,818.0	2,883.0
Russia	3,133.2	3,170.7	3,073.0	2,749.0	2,831.0	2,845.0
Total Eastern Europe	3,133.2	3,170.7	3,073.0	2,749.0	2,831.0	2,845.0
Canada	495.7	529.1	558.3	520.0	356.0	382.0
USA	428.0	463.0	413.0	384.1	385.0	370.0
Total North America	923.7	992.1	971.4	904.0	741.0	752.0
World Total	6,714.0	6,991.2	6,749.6	6,345.0	6,390.0	6,480.0

Source: VM Group

Platinum auto and oil scrap recycled supply, 2005-2010f (thousand ounces)

Auto	2005	2006	2007	2008	2009e	2010f
South Africa	8.8	8.3	7.3	8.0	7.0	9.0
Total Africa	**8.8**	**8.3**	**7.3**	**8.0**	**7.0**	**9.0**
China	1.2	7.5	8.9	9.0	8.0	9.0
India	0.7	8.0	7.9	7.0	8.0	9.0
Japan	100.7	108.7	105.5	116.0	114.0	120.0
Malaysia	0.2	2.1	2.1	2.0	3.0	2.0
Philippines	0.0	0.6	0.5	1.0	0.8	1.0
South Korea	0.6	9.0	8.3	9.0	7.0	8.0
Taiwan	0.2	2.7	2.4	2.5	3.0	3.0
Thailand	0.1	1.3	0.9	0.5	1.0	1.0
Other Asia	0.2	1.4	1.5	1.6	2.0	2.0
Total Asia	103.9	141.3	137.9	148.6	146.8	155.0
Australia	12.1	11.2	11.7	12.0	10.0	10.0
Total Australasia	12.1	11.2	11.7	12.0	10.0	10.0
Bulgaria	0.0	0.1	0.1	0.1	0.1	0.1
Czech Republic	0.2	1.2	1.3	1.1	0.9	1.0
Hungary	0.2	0.7	0.7	0.8	0.8	1.0
Poland	0.4	2.9	3.5	3.6	3.0	3.2
Romania	0.1	1.2	1.1	1.2	0.9	1.0
Russia	1.1	8.8	9.7	10.0	6.4	8.0
Slovakia	0.1	1.0	0.7	1.0	0.5	0.5
Yugoslavia	0.2	1.6	1.8	2.0	1.5	1.5
Total Eastern Europe	2.2	17.5	19.0	19.9	14.1	16.3
Austria	5.3	6.0	7.5	9.0	7.0	9.0
Belgium	8.0	9.1	10.9	12.0	9.0	10.0
Denmark	2.9	2.7	2.7	4.0	5.0	7.0
Finland	1.8	1.9	2.1	3.0	4.0	6.0
France	38.9	41.9	44.3	47.0	45.7	52.0
Germany	54.2	52.0	54.2	62.0	58.0	66.0
Greece	2.3	2.4	2.4	4.0	5.0	6.0
Italy	35.1	33.3	43.9	45.0	30.6	14.0
Luxembourg	0.6	0.6	0.8	1.0	1.0	2.0
Netherlands	9.8	9.2	9.8	12.0	9.0	10.0
Norway	2.2	2.3	2.2	3.0	4.0	6.0
Portugal	5.2	5.1	5.6	7.5	8.0	10.0
Spain	20.7	21.6	28.9	38.0	31.0	33.0
Sweden	3.6	3.2	3.7	5.0	6.0	7.0
Switzerland	5.6	4.7	4.5	7.0	6.0	7.0
UK & Ireland	42.4	38.8	43.1	51.1	49.0	51.0
Total Western Europe	238.6	234.9	266.7	310.6	278.3	296.0
Argentina	0.2	2.8	2.3	5.0	3.0	3.1
Brazil	1.1	19.6	19.5	20.0	14.0	14.0
Mexico	0.6	5.1	6.4	9.0	6.0	8.0
Other Latin America	0.5	7.4	7.8	12.0	7.0	8.0
Total Latin America	2.4	34.9	36.0	46.0	30.0	33.1
Canada	31.4	28.7	31.9	35.0	28.8	33.0
USA	353.6	325.7	330.9	355.0	360.0	382.6
Total North America	385.0	354.4	362.8	390.0	388.8	415.6
World Total	752.9	802.4	841.3	935.0	875.0	935.0
Oil refining scrap recycling	8.8	8.3	7.3	8.0	7.0	9.0

Source: VM Group

Palladium auto scrap recycled supply, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
South Africa	8.4	10.2	11.2	12.7	13.6	15.0
Total Africa	8.4	10.2	11.2	12.7	13.6	15.0
China	4.4	12.5	17.6	21.6	22.2	34.0
India	2.5	10.6	12.9	14.0	15.4	18.0
Japan	107.9	142.3	155.0	156.0	157.0	175.0
Malaysia	0.6	2.6	3.2	2.5	4.8	6.0
Philippines	0.1	0.7	0.7	0.5	0.5	1.0
South Korea	1.6	10.0	10.3	8.1	15.0	16.0
Taiwan	0.6	3.3	3.7	5.1	5.7	8.0
Thailand	0.3	1.6	1.4	0.9	1.5	3.0
Other Asia	0.5	1.8	2.3	3.3	4.4	5.0
Total Asia	118.4	185.5	207.1	212.0	226.6	266.0
Australia	12.2	14.4	18.3	20.6	17.9	24.0
Total Australasia	12.2	14.4	18.3	20.6	17.9	24.0
Bulgaria	0.1	0.1	0.2	0.3	0.4	1.0
Czech Republic	0.6	2.1	3.0	3.4	4.0	4.0
Hungary	0.6	1.3	1.8	2.7	3.7	5.0
Poland	1.4	5.0	8.1	11.5	16.1	18.0
Romania	0.4	2.2	2.7	4.1	3.8	5.0
Russia	3.9	15.4	30.0	31.0	32.0	40.0
Slovakia	0.2	1.6	1.7	2.4	2.3	4.0
Yugoslavia	0.8	3.0	4.3	6.0	6.6	8.0
Total Eastern Europe	8.0	30.7	51.8	61.4	68.9	85.0
Austria	3.2	3.6	4.0	5.6	5.9	7.0
Belgium	4.6	5.9	6.3	8.1	9.4	12.0
Denmark	3.3	4.0	5.3	6.2	6.2	8.0
Finland	2.0	2.5	3.3	4.1	4.9	6.0
France	25.9	31.8	31.7	45.2	45.2	50.0
Germany	57.5	67.9	83.6	107.7	101.3	135.0
Greece	3.1	3.9	5.4	7.0	10.2	15.0
Italy	34.0	36.6	56.5	63.9	57.2	65.0
Luxembourg	0.5	0.5	0.7	0.8	0.9	3.0
Netherlands	9.8	11.1	12.2	16.5	20.4	25.0
Norway	2.5	3.3	3.7	4.3	4.1	6.0
Portugal	5.1	6.0	7.3	9.6	10.3	13.0
Spain	15.0	16.6	20.7	25.8	28.3	35.0
Sweden	4.3	4.9	6.8	8.6	10.8	15.0
Switzerland	6.1	6.7	8.1	10.2	11.5	15.0
UK & Ireland	41.3	47.6	62.5	77.2	79.7	85.0
Total Western Europe	218.1	252.9	318.1	400.8	406.3	495.0
Argentina	0.6	4.9	5.4	7.1	5.6	8.0
Brazil	4.0	33.2	44.8	33.7	25.0	35.0
Mexico	2.8	10.1	16.1	19.0	16.4	20.0
Other Latin America	1.7	12.5	18.0	15.2	10.5	15.0
Total Latin **America**	9.0	60.7	84.3	75.0	57.5	78.0
Canada	32.5	38.9	48.0	52.4	55.4	60.0
USA	353.5	431.1	502.3	557.0	509.9	535.0
Total North America	386.0	470.1	550.4	609.4	565.3	595.0
World Total	760.3	1,024.4	1,241.3	1,391.8	1,356.0	1,558.0

Source: VM Group

Platinum autocatalyst demand, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
South Africa	10.3	10.7	10.4	9.5	6.8	7.5
Total Africa	10.3	10.7	10.4	9.5	6.8	7.5
China	73.6	96.1	120.1	145.0	101.0	115.0
India	21.8	26.4	29.0	27.1	17.5	22.3
Japan	324.1	308.5	297.6	287.0	221.0	265.0
Malaysia	7.9	8.5	8.3	7.4	6.8	7.0
Philippines	1.0	1.0	1.0	0.9	0.7	1.0
South Korea	153.6	176.7	180.2	175.0	121.0	135.0
Taiwan	8.2	8.1	7.2	6.8	4.6	6.0
Thailand	3.3	3.5	3.4	3.0	2.0	2.7
Other Asia	7.1	7.7	7.5	7.1	4.2	5.0
Total Asia	600.6	636.6	654.4	659.3	478.9	559.0
Australia	20.6	20.8	20.8	17.8	13.2	17.5
Total Australasia	20.6	20.8	20.8	17.8	13.2	17.5
Bulgaria	0.8	1.0	1.2	1.0	0.9	1.0
Czech Republic	4.0	4.4	4.7	3.8	2.9	3.0
Hungary	6.0	5.2	4.6	3.6	2.7	3.0
Poland	7.7	7.5	8.8	7.7	6.7	7.0
Romania	6.4	7.0	8.2	7.0	4.5	6.0
Russia	30.2	31.3	41.8	36.0	28.6	37.0
Slovakia	1.8	2.0	2.0	1.7	1.2	2.0
Yugoslavia	5.4	4.5	4.5	3.6	2.5	4.0
Total Eastern Europe	62.2	62.8	75.8	64.4	50.0	63.0
Austria	44.7	48.9	42.0	38.0	28.7	32.0
Belgium	77.8	90.8	92.7	88.0	69.0	75.0
Denmark	13.6	15.2	19.6	17.0	12.0	16.0
Finland	9.2	9.4	10.5	8.0	7.0	8.0
France	342.4	371.9	385.0	390.0	346.0	379.5
Germany	349.9	394.8	374.3	385.4	365.0	387.0
Greece	9.7	8.9	15.1	13.0	12.0	13.0
Italy	299.0	341.6	328.5	327.0	288.0	314.0
Luxembourg	7.1	8.0	8.3	7.5	6.6	7.0
Netherlands	39.5	43.9	43.8	41.0	40.0	41.0
Norway	13.2	14.9	25.8	23.0	17.0	19.0
Portugal	36.3	37.1	41.0	38.0	28.0	33.0
Spain	251.4	277.9	272.9	269.0	218.0	245.0
Sweden	13.9	15.3	29.2	23.0	13.0	19.0
Switzerland	21.6	24.2	25.3	22.0	18.0	20.0
UK & Ireland	219.9	233.6	237.7	232.0	178.0	212.0
Total Western Europe (inc heavy duty)	1,749.2	1,936.5	1,951.8	1,921.9	1,646.3	1,820.5
Argentina	7.5	10.5	12.5	11.8	5.6	6.0
Brazil	28.1	36.1	38.5	36.0	21.0	26.0
Mexico	16.3	19.7	18.8	16.1	11.0	15.0
Other Latin America	11.0	13.5	13.1	12.0	8.5	10.0
Total Latin America	62.9	79.8	83.0	76.0	46.1	57.0
Canada	43.0	43.6	42.8	39.5	23.8	36.5
USA	648.7	763.0	758.6	740.0	435.0	523.0
Total North America	691.7	806.6	801.4	789.1	458.8	575.5
World Total	3,197.7	3,553.8	3,597.4	3,538.0	2,700.0	3,100.0

Source: VM Group

Palladium autocatalyst demand, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
South Africa	37.0	35.8	28.0	23.7	18.5	21.0
Total Africa	37.0	35.8	28.0	23.7	18.5	21.0
China	264.3	320.4	456.3	491.8	550.0	585
India	78.1	88.1	95.0	100.4	92.0	105
Japan	485.6	490.8	477.2	458.6	380.0	465
Malaysia	13.2	35.9	33.1	37.5	34.0	40
Philippines	3.4	3.4	3.2	3.4	3.2	4
South Korea	50.7	58.5	44.1	41.9	40.2	43
Taiwan	29.5	26.9	23.9	25.2	23.5	24
Thailand	15.7	15.3	12.6	16.9	15.7	17
Other Asia	25.7	25.6	25.0	26.5	24.6	25
Total Asia	966.2	1,065.0	1,170.6	1,202.2	1,163.2	1,307.5
Australia	74.1	69.4	69.0	65.7	61.0	67.0
Total Australasia	74.1	69.4	69.0	65.7	61.0	67.0
Bulgaria	2.8	4.5	5.3	5.7	4.6	5.0
Czech Republic	14.4	19.5	16.7	17.7	18.1	18.0
Hungary	21.7	23.2	20.7	18.8	13.4	19.0
Poland	28.0	33.3	39.2	41.1	38.0	39.0
Romania	23.2	31.3	36.2	33.8	28.9	32.0
Russia	107.3	128.1	167.4	173.0	140.1	160.0
Slovakia	6.4	8.9	9.0	9.8	9.2	9.0
Yugoslavia	19.4	20.3	19.9	18.7	15.6	18.0
Total Eastern Europe	223.0	269.1	314.5	318.6	268.0	295.0
Austria	13.1	14.2	17.0	20.9	18.0	15.0
Belgium	16.5	20.2	19.7	26.2	22.0	25.0
Denmark	16.7	18.3	15.2	12.9	10.7	15.0
Finland	14.8	15.0	11.7	10.0	8.3	13.0
France	84.0	90.9	92.2	114.3	127.0	135.0
Germany	225.6	238.4	213.9	244.6	278.0	300.0
Greece	31.2	31.9	32.5	30.8	25.6	30.0
Italy	111.8	124.9	148.8	161.9	170.0	185.0
Luxembourg	1.7	2.0	1.8	2.5	2.0	2.0
Netherlands	43.8	45.6	48.8	52.1	46.0	48.0
Norway	9.6	10.4	6.1	6.8	5.0	8.0
Portugal	11.4	12.6	11.5	14.3	12.7	13.0
Spain	66.3	74.1	73.8	71.4	61.0	75.0
Sweden	30.4	32.1	26.3	23.0	20.7	22.0
Switzerland	22.8	23.6	24.4	26.1	24.4	26.0
UK & Ireland	234.7	230.0	231.2	217.2	173.0	207.5
Total Western Europe	934.2	984.2	974.8	1,034.8	1,004.5	1,119.5
Argentina	27.0	37.9	46.7	51.8	40.0	45.0
Brazil	101.7	130.7	143.9	173.3	164.0	174.0
Mexico	83.9	99.4	92.8	89.8	69.0	80.0
Other Latin America	39.9	48.7	49.1	52.9	48.0	50.0
Total Latin America	252.5	316.7	332.4	367.8	321.0	349.0
Canada	160.8	163.4	161.3	153.9	138.0	165.0
USA	1,681.4	1,612.5	1,520.2	1,244.2	1,025.7	1,276.0
Total North America	1,842.2	1,775.9	1,681.5	1,398.1	1,163.7	1,441.0
World Total	4,329.3	4,515.9	4,570.9	4,410.8	4,000.0	4,600.0

Source: VM Group

Platinum jewellery demand, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
Japan	510.0	360.0	270.0	198.0	298.0	235.0
USA	275.0	245.0	220.0	207.0	165.0	125.0
Europe	195.0	195.0	210.0	223.0	230.0	175.0
China	941.0	775.8	821.5	967.0	1,712.0	1,555.0
Other	112.3	120.2	128.6	115.0	95.0	60.0
World Total	2,033.3	1,696.0	1,650.1	1,710.0	2,500.0	2,150.0

Source: VM Group, Johnson Matthey and industry sources

Palladium jewellery demand, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
Japan	145.0	150.0	153.0	149.9	145.0	150.0
USA	16.7	40.0	60.0	66.0	60.0	65.0
Europe	27.0	40.0	40.9	40.0	35.0	40.0
China	784.9	957.2	811.9	726.5	803.0	825.0
Other	35.0	35.0	35.0	40.0	32.0	30.0
World Total	1,008.6	1,222.2	1,100.7	1,022.4	1,075.0	1,110.0

Source: VM Group, Johnson Matthey and industry sources

Platinum petroleum refining demand, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
Reforming Process	44.9	81.4	114.7	117.4	88.0	82.0
Isomerisation Process	23.9	24.5	25.1	25.8	26.0	28.0
Other	42.9	47.2	51.9	57.1	62.0	55.0
World Total	111.7	153.1	191.7	200.3	176.0	165.0

Source: VM Group

Platinum electronics demand, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
World Total	445.0	480.0	488.0	485.0	460.0	445.0

Source: VM Group and Paumanok

Palladium electronics demand, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
MLCCs	826.2	829.9	850.6	975.0	980.0	1,000.0
Other	165.2	166.0	170.1	190.0	210.0	230.0
World Total	991.4	995.9	1,020.7	1,165.0	1,190.0	1,230.0

Source: VM Group and Paumanok

Platinum chemicals demand, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
Nitric Acid	59.5	34.0	43.0	39.0	32.0	23.0
Other	270.0	300.0	344.0	324.0	318.0	317.0
World Total	329.5	334.0	387.0	363.0	350.0	340.0

Source: VM Group and Johnson Matthey

Platinum glass demand, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
Japan	116.9	152.8	154.0	66.0	12.0	5.0
USA	49.1	52.6	61.5	32.0	8.0	3.0
Europe	24.2	36.6	32.0	12.0	4.0	2.0
China	155.3	169.2	181.0	153.0	48.0	18.0
ROW	25.7	24.1	26.5	12.0	3.0	2.0
World Total	371.2	435.3	455.0	275.0	75.0	30.0

Source: VM Group

Platinum ETF demand, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
World Total			194.4	102.3	380.1	633.5

Source: VM Group from company data and own estimates

Palladium ETF demand, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
World Total			280.2	381.0	502.1	1124.3

Source: VM Group from company data and own estimates

Platinum other demand, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
World Total	480.0	490.0	475.0	490.0	510.0	525.0

Source: VM Group and industry sources

Palladium other demand, 2005-2010f (thousand ounces)

	2005	2006	2007	2008	2009e	2010f
Dental	815.0	730.0	625.0	600.0	500.0	500.0
Other	168.0	170.0	170.0	170.0	130.0	130.0
World Total	983.0	900.0	795.0	770.0	630.0	630.0

Source: VM Group and industry sources

Platinum NYMEX futures positions, 2005-2010e, end-period

	2005	2006	2007	2008	2009	2010e
Open Interest	10,032	8,961	13,428	15,016	24,882	34,568
Non-Commercial Positions Long	6,597	4,499	8,387	8,978	14,772	22,805
Non-Commercial Positions Short	1,147	1,433	2,358	2,358	2,373	2,632
Commercial Positions Long	1,162	1,890	2,090	2,975	5,759	6,201
Commercial Positions Short	8,169	6,484	10,898	11,202	21,127	30,108
Net non-reportable long	1,408	1,666	2,737	1,374	4,176	3,552
Non-Commercial Net Position (ozs)	295,731	168,349	358,860	341,645	639,890	1,040,994

Source: Commodity Futures Trading Commission

Palladium NYMEX futures positions, 2005-2010e, end-period

	2005	2006	2007	2008	2009	2010e
Open Interest	13,865	14,534	16,819	16,564	17,567	22,847
Non-Commercial Positions Long	8,365	7,476	10,536	10,307	11,803	16,291
Non-Commercial Positions Short	2,277	2,366	3,030	3,030	2,761	2,999
Commercial Positions Long	2,378	3,600	3,733	3,757	3,282	3,361
Commercial Positions Short	9,623	11,065	13,878	12,678	14,064	18,816
Net non-reportable long	2,938	2,022	1,604	827	2,142	2,032
Non-Commercial Net Position (ozs)	515,108	519,908	817,006	727,680	912,088	1,329,223

Source: Commodity Futures Trading Commission
Notes: 2008 as of end November. 2007 data in previous edition had slight error.

Platinum TOCOM futures, 2005-2010e, trading volumes

	2005	2006	2007	2008	2009	2010e
500g contracts/month	625,794	918,172	764,157	578,362	301,499	212,741
Tonnes	312.9	459.1	382.1	289.2	150.7	106.4
Ounces	10,059,878	14,759,965	12,284,118	9,297,391	4,846,709	3,419,899

Source: The Tokyo Commodity Exchange

Palladium TOCOM futures, 2005-2010e, trading volumes

	2005	2006	2007	2008	2009	2010e
500g contracts/month	24,343	30,123	17,322	57,057	8,986	13,501
Tonnes	12.2	15.1	8.7	28.5	4.5	6.8
Ounces	391,314	484,240	278,461	917,209	144,449	217,036

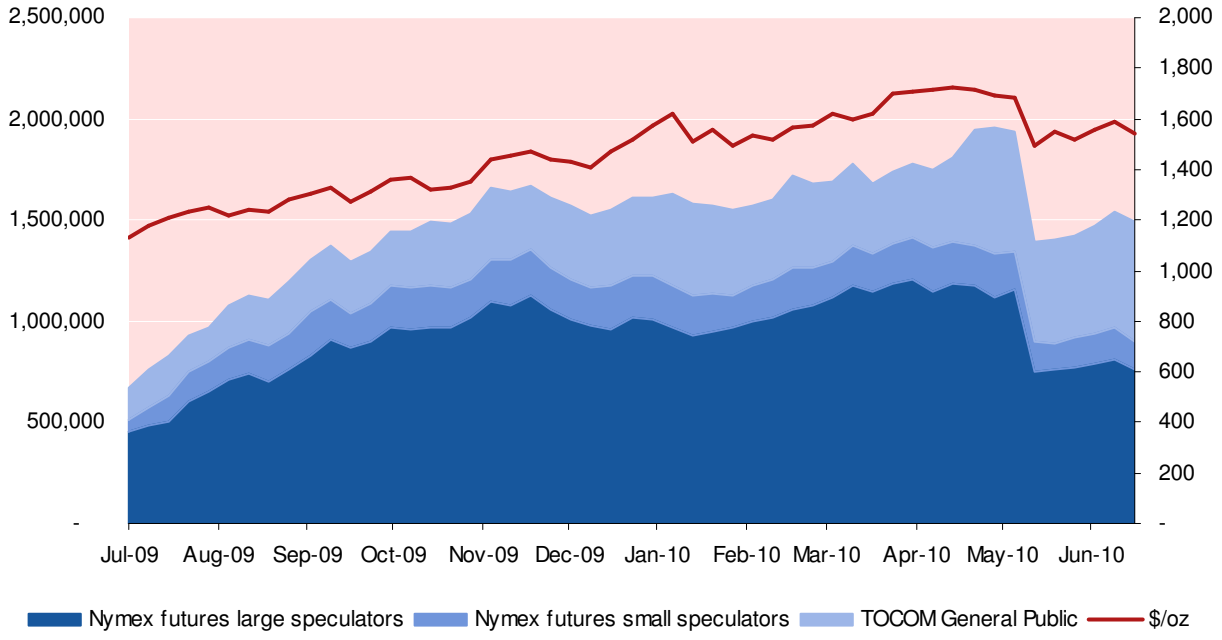
Source: The Tokyo Commodity Exchange

Platinum Shanghai Gold Exchange (SGE) turnover, 2005-2010e

	2005	2006	2007	2008	2009	2010e
Kg a day	84.2	66.0	78.4	88.1	114.7	116.8
Ounces	2,706	2,121	2,521	2,833	3,689	3,755

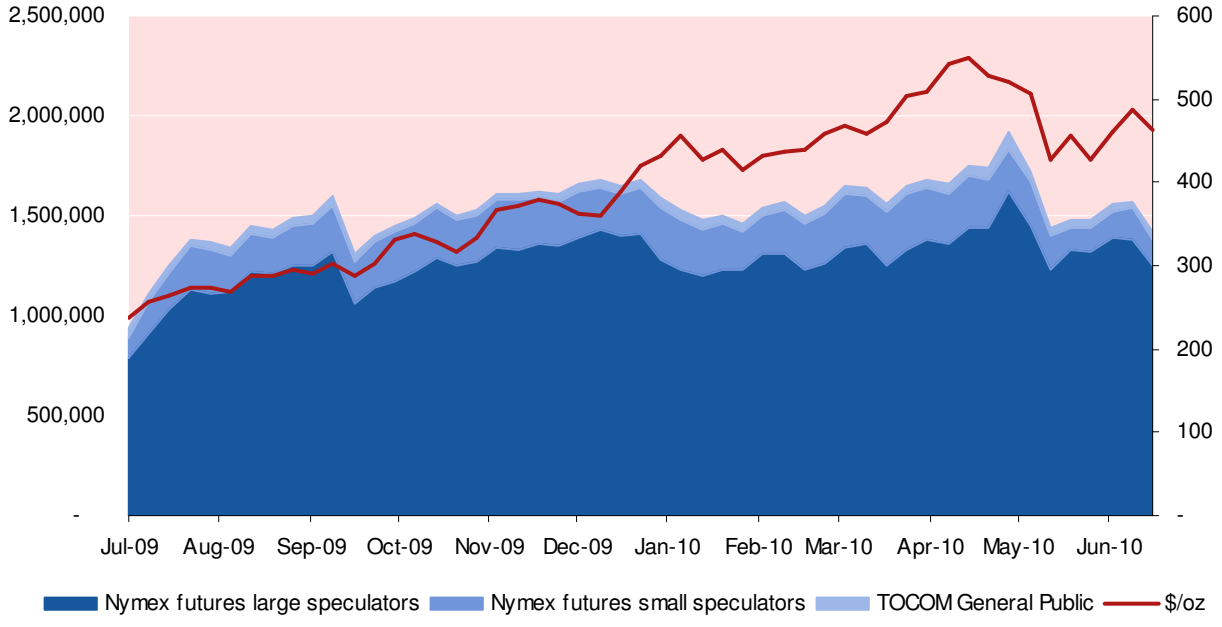
Source: Shanghai Gold Exchange *Note: Up to July 8thr*

Futures speculation in platinum, Nymex positions LHS (ounces), price RHS



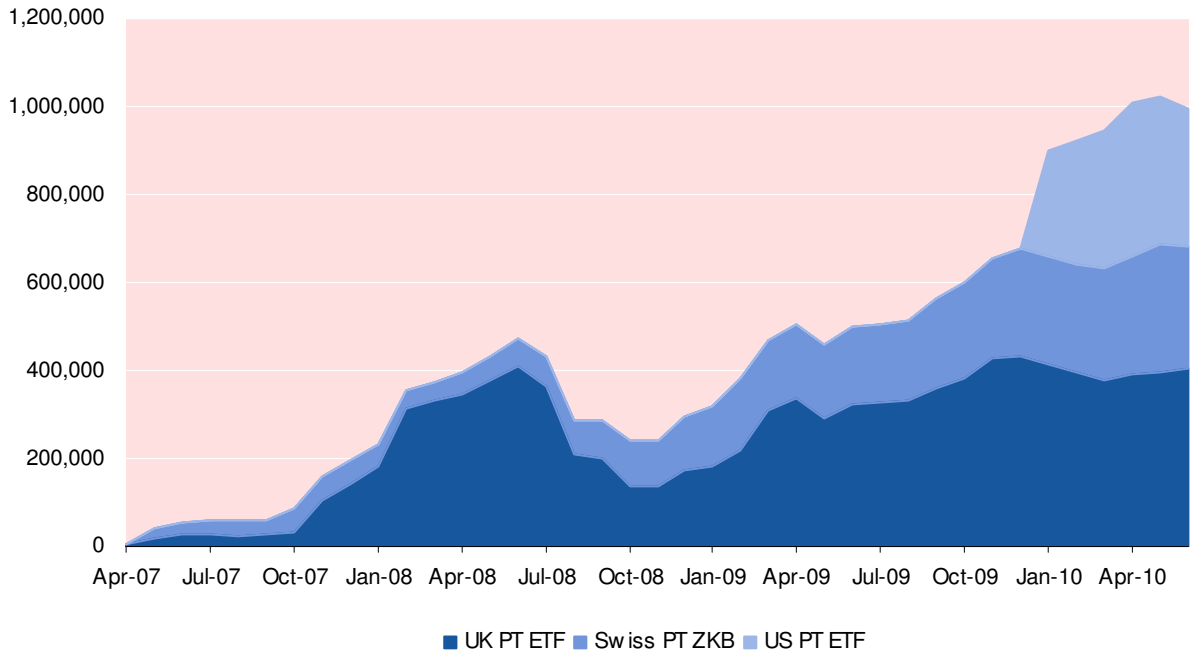
Source: VM Group from CFTC, TOCOM

Futures speculation in palladium, Nymex positions LHS (ounces), price RHS



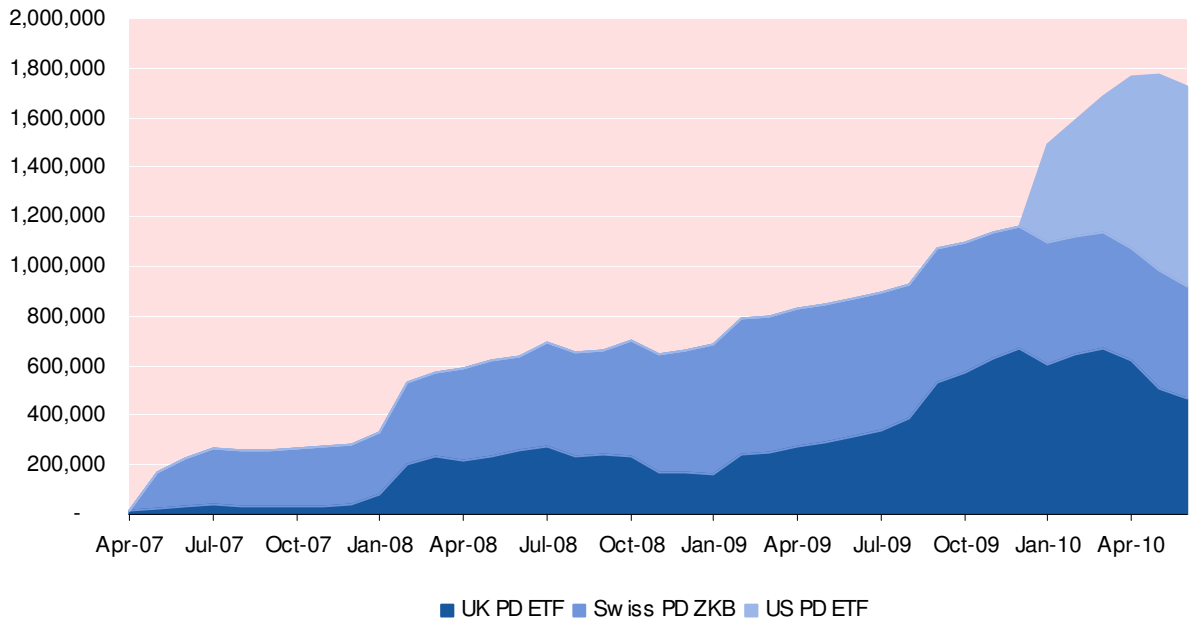
Source: VM Group from CFTC, TOCOM

Platinum ETFs holdings (oz)



Source: VM Group from company data

Palladium ETFs holdings (oz)



Source: VM Group from company data

Platinum price volatility, 2005-2010e

	2005	2006	2007	2008	2009	2010e
Daily Avg	8.8	19.8	11.1	31.8	20.8	16.1
Daily High	23.9	62.1	33.7	90.6	59.0	44.6
Daily Low	0.6	1.0	0.9	0.9	1.4	1.7
1 Month	11.7	25.7	13.7	40.1	26.9	23.5
3 Month	12.2	23.5	18.7	38.3	29.5	23.9
6 Month	13.4	21.2	22.3	34.7	34.0	23.3
12 Month	16.9	17.8	27.0	28.9	38.8	24.4

Source: VM Group

Palladium price volatility, 2005-2010e

	2005	2006	2007	2008	2009	2010e
Daily Avg	19.6	28.6	12.9	34.0	25.4	31.5
Daily High	57.6	82.2	34.9	106.4	75.8	91.0
Daily Low	0.8	1.5	0.5	1.3	0.0	4.4
1 Month	25.6	37.8	16.8	45.2	32.6	44.9
3 Month	24.9	40.1	17.7	42.8	36.3	42.9
6 Month	24.8	40.1	19.5	39.1	41.6	38.6
12 Month	29.2	36.4	26.3	32.9	46.5	35.3

Source: VM Group

Palladium lease rates, 2005-2010e

	2005	2006	2007	2008	2009	2010e
1 Month Avg	0.1	0.1	0.1	0.1	2.6	3.0
1 Month High	0.3	0.6	0.3	0.4	3.6	3.6
1 Month Low	-0.1	0	0	-0.4	2.0	2.6
3 Month Avg	0.2	0.2	0.2	0.3	3.0	3.4
3 Month High	0.4	0.7	0.3	0.7	5.0	4.3
3 Month Low	0	0.1	0.1	-0.2	2.3	2.6
6 Month Avg	0.2	0.4	0.3	0.5	3.0	3.9
6 Month High	0.4	0.9	0.5	0.9	5.0	4.7
6 Month Low	0	0.1	0.2	0	2.3	3.2
12 Month Avg	0.3	0.5	0.3	0.6	3.6	4.4
12 Month High	0.5	1.1	0.5	1	5.2	5.5
12 Month Low	0	0.2	0	0	2.8	3.5

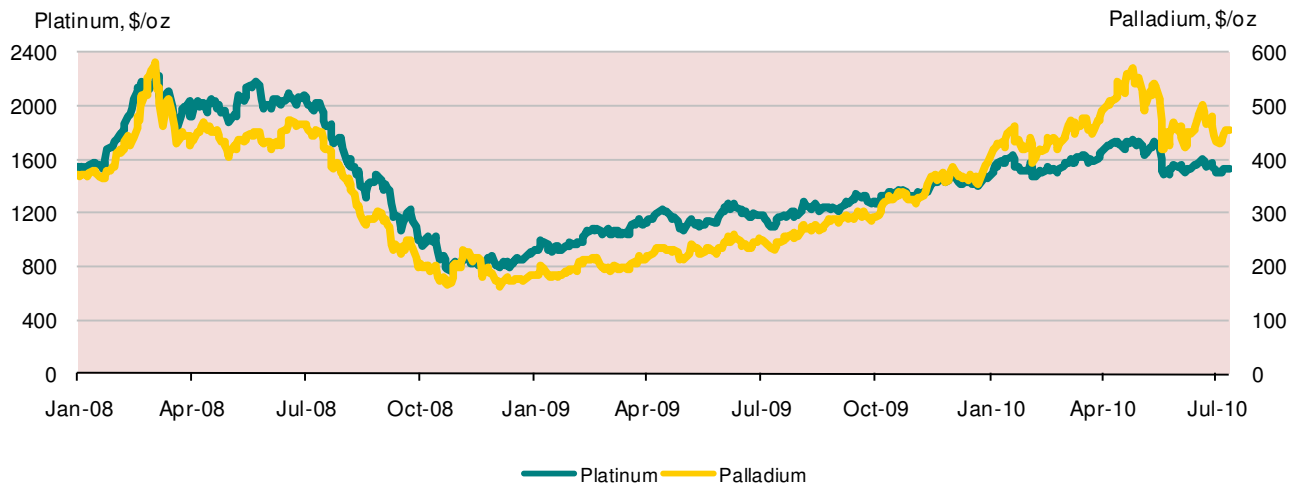
Source: VM Group

Platinum lease rates, 2005-2010e

	2005	2006	2007	2008	2009	2010e
1 Month Avg	2.9	1.5	2.4	1.8	3.0	3.2
1 Month High	3.2	10	3.2	2.8	3.8	3.7
1 Month Low	2.7	1.7	1.7	1	2.3	2.8
3 Month Avg	3	2.9	3.2	2.6	3.4	3.5
3 Month High	3.3	8.6	3.8	3.5	5.1	4.5
3 Month Low	2.7	2	2.8	1.8	2.7	2.8
6 Month Avg	3	3.3	3.6	3.2	3.6	4.0
6 Month High	3.3	7.2	4.2	4.2	5.2	4.9
6 Month Low	2.8	2.5	3.2	2.4	3.1	3.4
12 Month Avg	3.1	3.5	3.9	3.9	4.0	4.6
12 Month High	3.5	5.8	4.5	4.8	5.5	5.5
12 Month Low	2.8	2.8	3.4	3.1	3.4	3.7

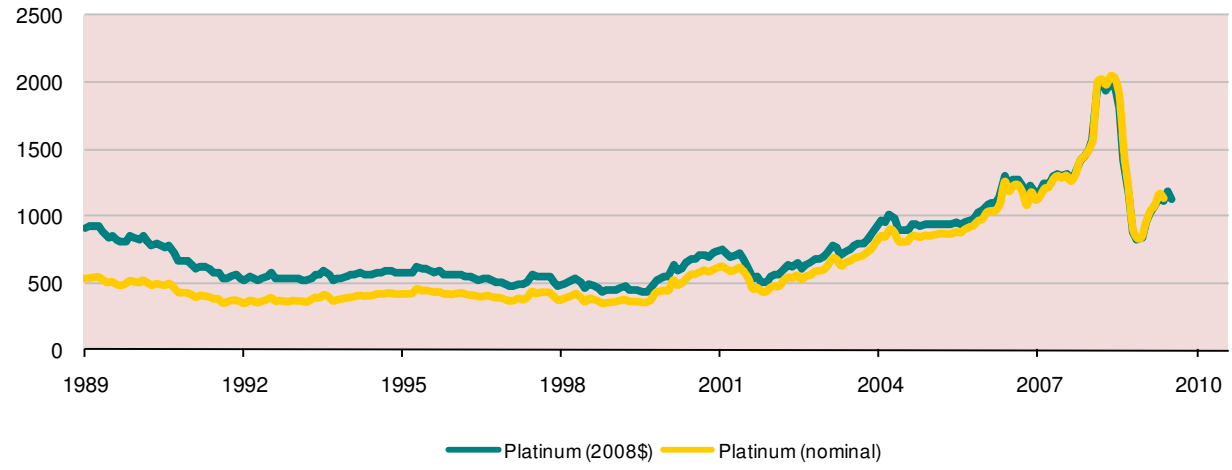
Source: VM Group

Platinum and palladium price, 2008 ($/oz)



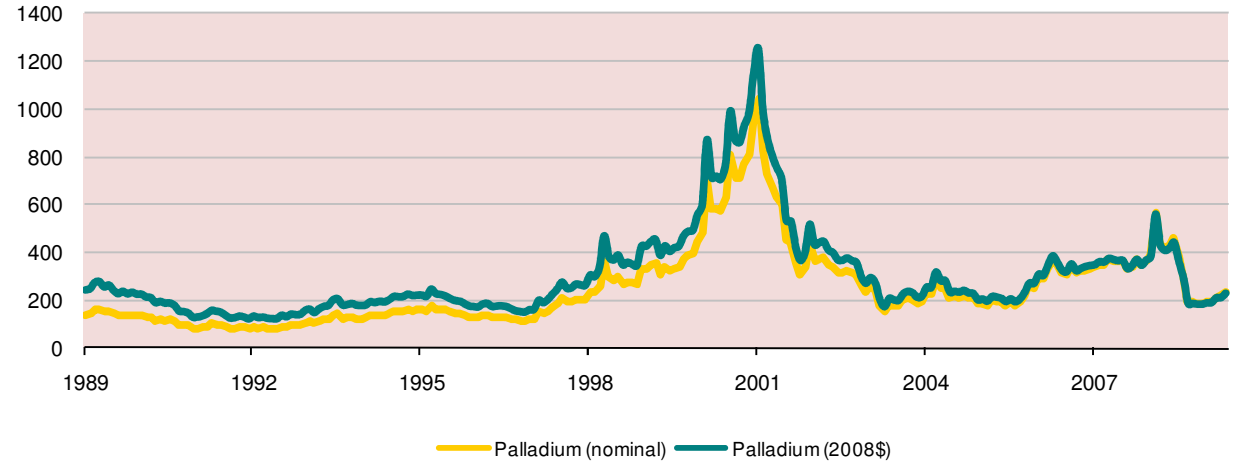
Source: VM Group

Platinum price, real (2008 $/oz) and nominal ($/oz), since 1989



Source: VM Group

Palladium price, real (2008 $/oz) and nominal ($/oz), since 1989



Source: VM Group

Weights and measures

Platinum chemical properties

Atomic mass	195.08
Atomic number	78
Chemical symbol	Pt
Melting point deg C	1,772
Hardness (mohs)	3.5
Boiling point deg C	3,827
Density gr/cubic cm	21.45
Hardness (Vickers MN m-2)	549
Tensile strength Mpa	123

Source: VM Group

Palladium chemical properties

Atomic mass	106.42
Atomic number	46
Chemical symbol	Pd
Melting point deg C	1,552
Hardness (mohs)	4.75
Boiling point deg C	2,964
Density gr/cubic cm	12.02
Hardness (Vickers MN m-2)	461
Tensile strength Mpa	170

Source: VM Group

Measures

1 troy ounce	= 31.103 grammes
	= 408.6 grains
	= 1.097 oz avoirdupois
	= 20 pennyweights
1 metric tonne	= 32,151 troy ounces
	= 1.102 short tons
1 short ton	= 0.893 long tonnes
	= 2,000 Pounds
1 pound	= 14.58 troy ounces
1 grain	= 0.0648 grammes
	= 0.002083 troy ounces
1 gramme	= 14.43 grains
1 pennyweight	= 24 grains
1 kilogramme	= 32.1507 troy ounces
1 oz avoirdupois	= 0.9115 troy ounces

Source: VM Group

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