

Precious Metals Perspective

The Equation Is Not as Simple as It Looks

We caution that the market should not extrapolate recent supply cuts directly to the S/D balance for platinum. This is as higher prices may weigh on elastic demand (c.30-40% of total platinum demand) and result in draw-down of stock piles (excl. ETFs). These may largely offset the effect of recently mothballed production. We remain bullish on outlook for palladium.

- **Revisions to macro outlook** — We update our macroeconomic scenarios to reflect the subdued global economic outlook and test the impact of each on the supply-demand fundamentals of platinum and palladium. The Citi house view of “modest global growth” forms our base case. We also test the impact of “austerity hits hard” and “quick fix to developed market concerns” scenarios.

- **Price changes** — We upgrade our 2013-16 dollar platinum price assumptions by up to 1.5%. We upgrade our 2013-16 assumptions for palladium by 4-9%. We upgrade our long-term real basket price assumption by 6.7% to R13,542/ounce (USD1,354/ounce) by applying our newly developed incentive pricing model (pages 22-24).

- **Platinum outlook muted** — We forecast a 94k ounce deficit in 2013, but expect it to be short-lived. This is as higher prices are likely to 1) weigh on price-elastic Chinese jewellery demand, 2) increase auto catalyst recycling, and 3) incentivize end-product manufacturers to draw down stock piles. As a result, we forecast a balanced market from 2014-17; even without assuming a return of recently mothballed production. Remain cautious on platinum.

- **Continued bullish view for palladium** — We continue to forecast a rising deficit market for palladium, due mainly to growth in light vehicle (LV) production in gasoline-based markets (in particular, China and the US). The sheer size of these two markets combined (40% of global vehicle production) implies significant uplift in demand for palladium, even in a muted growth environment.

■ Commodities

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Figure 1. Summary of changes to Citi's precious metal price expectations

	2011a	2012e	2013e	2014e	2015e	2016e	LT real
CIRA ZAR/USD - New	7.23	8.20	8.81	8.92	9.27	9.64	10.00
CIRA ZAR/USD - Old	7.23	8.27	8.81	8.92	9.27	9.64	10.00
% change	0%	-1%	0%	0%	0%	0%	0%
Platinum price - New (USD/ounce)	1,722	1,544	1,700	1,775	1,825	1,800	1,531
Platinum price - Old (USD/ounce)	1,722	1,557	1,675	1,775	1,825	1,800	1,500
% change	0%	-1%	1%	0%	0%	0%	2%
Palladium price - New (USD/ounce)	734	642	775	925	925	900	680
Palladium price - Old (USD/ounce)	734	649	744	925	925	825	600
% change	0%	-1%	4%	0%	0%	9%	13%

Source: INET, Citi Research estimates

See Appendix A-1 for Analyst Certification, Important Disclosures and non-US research analyst disclosures.

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Summary

Cautious platinum, bullish palladium

Base case points to a medium-term balance for platinum...

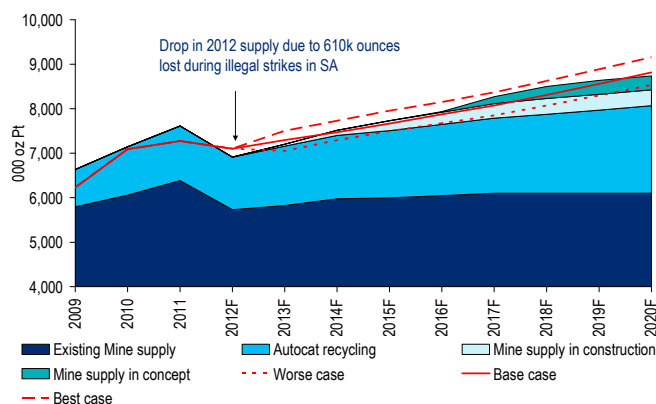
Investors should be careful not to over-estimate the impact of supply cuts on the platinum market (details pages 11-15)

Our base case scenario points to a 94k ounce deficit market in 2013. This is due mainly to spill-over effects of labor unrest in SA during 2012, and mothballing of supply by AMS and AQP.

We caution that the market should not extrapolate the 350-450k oz supply cuts from AMS and AQP directly to the S/D balance for platinum. This is as we expect an already higher platinum price to result in 1) lower Chinese jewellery demand, 2) the drawdown of end-product manufacturer stock piles, and 3) higher auto catalyst recycling (refer "[Back In Balance, But Hold Your Horses](#)" and "[New Strategy Unlikely To Change The Game For AMS – Sell](#)"). Higher prices may also result in recently mothballed shafts being brought back into production.

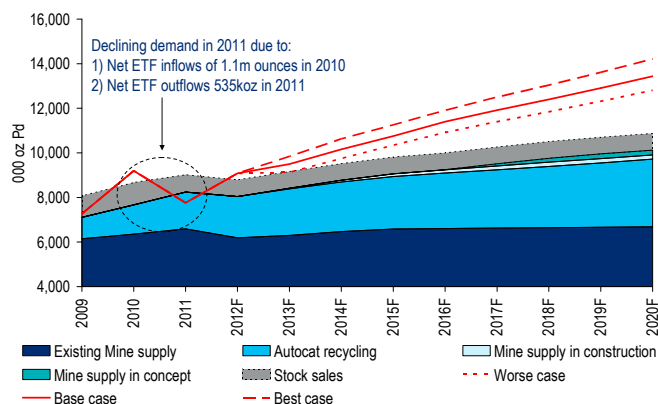
As a result of these factors, we expect the platinum market to return to balance (and even surplus) from FY14 onwards. We believe the platinum market will remain constrained until price-inelastic demand (i.e. auto catalyst and industrial demand) grows to such a point where SA's 5.2-5.4m ounce mining capacity is exceeded. This is unlikely to happen before 2017, according to our estimates (*Figure 2*).

Figure 2. CitiE platinum supply-demand profile



Source: Johnson Matthey, Citi Research estimates

Figure 3. CitiE palladium supply-demand profile



Source: Johnson Matthey, Citi Research estimates

...and a growing deficit market in palladium

Growth in inelastic demand to drive growing deficit, higher prices for palladium (details page 16-21)

In contrast, we continue to view a growing deficit market in palladium as likely from 2012 onwards. This is as we expect strong growth in LV production in gasoline-based markets (China and US). The sheer size of these two markets combined (40% of global vehicle production) implies significant uplift in demand for palladium, even in a muted growth environment.

Contrary to the platinum market, the palladium market does not have a price-elastic 'counter weight' such as Chinese jewellery demand. Rather, 85-90% of palladium demand is industrially linked and price-inelastic. All these points make us bullish on the outlook for the price of palladium.

There is further upside to our forecasts if Russian stockpiles are depleted over the next 12-24 months (a plausible outcome, but not included in our already bullish outlook for palladium), or if supply issues persist in South Africa.

Price changes

Near- to medium-term price changes (*Figure 4*) reflect the effect of our updated S/D outlooks for platinum and palladium. The upgrades to our long-term price assumptions are due to the development of a new incentive pricing model (refer pages 22-24), which we now use, together with our cost curve and margin models, to inform our long-term perspective on prices.

Figure 4. Citi precious metals price expectations

	2011a	2012e	2013e	2014e	2015e	2016e	LT real	Long-term nominal
R/USD								
CIRA ZAR/USD - New	7.23	8.20	8.81	8.92	9.27	9.64	10.00	10.00
CIRA ZAR/USD - Old	7.23	8.27	8.81	8.92	9.27	9.64	10.00	10.00
% change	0.0%	-0.8%	0.0%	0.0%	0.0%	0.0%	0%	0%
Gold								
Gold price - New (USD/ounce)	1,585	1,670	1,675	1,655	1,540	1,350	1,050	1,205
Gold price - Old (USD/ounce)	1,585	1,671	1,749	1,655	1,540	1,350	1,050	1,205
% change	0%	0%	-4%	0%	0%	0%	0%	0%
Gold price - New (R/ounce)	11,460	13,694	14,757	14,763	14,276	13,014	10,500	12,050
Gold price - Old (R/ounce)	11,460	13,819	15,409	14,763	14,276	13,014	10,500	12,050
% change	0.0%	-0.9%	-4.2%	0.0%	0.0%	0.0%	0.0%	0.0%
Platinum								
Platinum price - New (USD/ounce)	1,722	1,544	1,700	1,775	1,825	1,800	1,531	1,757
Platinum price - Old (USD/ounce)	1,722	1,557	1,675	1,775	1,825	1,800	1,500	1,722
% change	0.0%	-0.8%	1.5%	0.0%	0.0%	0.0%	2%	2%
Platinum price - New (R/ounce)	12,450	12,661	14,977	15,833	16,918	17,352	15,310	17,569
Platinum price - Old (R/ounce)	12,450	12,876	14,757	15,833	16,918	17,352	15,000	17,220
% change	0.0%	-1.7%	1.5%	0.0%	0.0%	0.0%	2.1%	2.0%
Palladium								
Palladium price - New (USD/ounce)	734	642	775	925	925	900	680	780
Palladium price - Old (USD/ounce)	734	649	744	925	925	825	600	689
% change	0.0%	-1.1%	4.2%	0.0%	0.0%	9.1%	13%	13%
Palladium price - New (R/ounce)	5,307	5,264	6,828	8,251	8,575	8,676	6,800	7,803
Palladium price - Old (R/ounce)	5,307	5,367	6,555	8,251	8,575	7,953	6,000	6,890
% change	0.0%	-1.9%	4.2%	0.0%	0.0%	9.1%	13.3%	13.3%
Rhodium								
Rhodium price - New (USD/ounce)	2,000	1,262	1,175	1,250	1,500	2,000	2,859	3,281
Rhodium price - Old (USD/ounce)	2,000	1,336	1,175	1,250	1,500	1,800	2,250	2,582
% change	0.0%	-5.5%	0.0%	0.0%	0.0%	11.1%	27%	27%
Rhodium price - New (R/ounce)	14,460	10,348	10,352	11,150	13,905	19,280	28,590	32,808
Rhodium price - Old (R/ounce)	14,460	11,049	10,352	11,150	13,905	17,352	22,500	25,820
% change	0.0%	-6.3%	0.0%	0.0%	0.0%	11.1%	27.1%	27.1%
3PGE +Au basket price*								
3PGM price - New (USD/ounce)	1,441	1,257	1,385	1,480	1,524	1,531	1,354	1,554
3PGM price - Old (USD/ounce)	1,441	1,273	1,363	1,480	1,524	1,494	1,269	1,457
% change	0.0%	-1.2%	1.6%	0.0%	0.0%	2.4%	6.7%	6.7%
3PGM price - New (R/ounce)	10,418	10,311	12,202	13,198	14,125	14,754	13,542	15,540
3PGM price - Old (R/ounce)	10,418	10,524	12,007	13,198	14,125	14,402	12,690	14,568
% change	0.0%	-2.0%	1.6%	0.0%	0.0%	2.4%	6.7%	6.7%

* Using a 60% Platinum, 30% Palladium, 7% Rhodium and 3% Gold split.

Source: I-NET, Citi Research estimates

Platinum supply-demand outlook

Figure 5. Citi Platinum supply-demand outlook (000 ounces)

	2007	2008	2009	2010	2011	2012F	2013F	2014F	2015F
Demand									
Auto catalysts									
Europe	2055	1970	970	1495	1465	1321	1245	1270	1269
North America	850	505	370	405	380	440	448	491	509
China	175	145	85	100	110	120	128	139	143
Japan	610	610	395	550	500	650	612	607	604
Rest of the world	455	420	365	525	650	696	726	756	780
Total	4145	3650	2185	3075	3105	3227	3160	3263	3305
Jewellery									
Europe	200	205	185	175	175	184	193	197	200
North America	225	200	135	175	185	194	204	210	216
China	1070	1060	2080	1650	1680	1764	1676	1726	1778
Japan	540	530	335	325	315	302	293	293	311
Rest of the world	75	65	75	90	125	123	120	120	123
Jewellery recycled	655	695	565	735	820	850	668	659	659
Net jewellery demand	1455	1365	2245	1680	1660	1717	1818	1887	1969
Investment									
Europe	195	105	385	140	155	60	79	63	63
North America	30	60	105	465	10	21	23	18	18
Japan	-60	385	160	45	250	100	140	87	87
Rest of the world	5	5	10	5	45	29	32	34	34
Total	170	555	660	655	460	210	274	202	202
Industrial									
Europe	350	335	290	326	398	378	397	411	425
North America	420	380	250	370	452	429	450	467	483
China	295	205	0	200	244	231	243	252	260
Japan	225	210	160	205	250	237	249	258	267
Rest of the world	555	595	440	580	707	672	705	731	756
Total	1845	1725	1140	1681	2050	1948	2045	2118	2191
Total platinum demand	7615	7295	6230	7091	7275	7101	7297	7471	7666
Supply									
Mine supply									
Southern Africa	5240	4695	4865	4915	5195	4485	4569	4827	4992
Russia	915	805	785	825	835	790	798	767	752
North America	325	325	260	210	350	340	381	376	371
Rest of world	120	115	115	110	100	120	120	120	120
Total	6600	5940	6025	6060	6480	5735	5868	6090	6235
Auto catalyst recycling									
Europe	215	385	299	375	445	344	385	408	433
North America	605	630	421	580	640	646	723	767	805
China	10	15	23	10	10	43	52	63	72
Japan	35	60	54	65	60	75	90	97	105
Rest of the world	70	45	44	55	70	70	84	91	99
Total	935	1135	840	1085	1225	1179	1335	1426	1513
Total platinum supply	7535	7075	6865	7145	7705	6914	7203	7516	7748
Supply-demand surplus/(deficit)	-80	-220	635	54	430	-187	-94	46	82

Source: Johnson Matthey, Citi Research estimates

Palladium supply-demand outlook

Figure 6. Citi palladium supply-demand outlook (000 ounces)

	2007	2008	2009	2010	2011	2012F	2013F	2014F	2015F
Demand									
Auto catalysts									
Europe	920	1005	995	1330	1440	1426	1436	1499	1638
North America	1695	1290	1020	1355	1475	1711	1756	2036	2185
China	325	390	685	1005	1115	1347	1493	1646	1779
Japan	820	885	590	820	665	801	774	766	765
Rest of the world	785	895	760	1070	1335	1498	1611	1723	1821
Total	4545	4465	4050	5580	6030	6783	7070	7671	8187
Jewellery									
Europe	40	45	50	65	60	55	58	59	60
North America	55	60	60	65	45	43	45	46	48
China	705	740	560	360	305	275	261	269	277
Japan	125	115	80	75	70	64	62	62	66
Rest of the world	25	25	25	30	25	25	24	24	25
Jewellery recycled	235	130	70	100	210	250	236	223	210
Net jewellery demand	715	855	705	495	295	211	214	237	265
Investment									
Europe	280	370	525	-5	-35	65	78	62	56
North America	-20	50	95	1090	-535	112	135	115	103
Japan	0	0	0	10	5	8	6	6	6
Rest of the world	0	0	5	0	0	0	0	0	0
Total	260	420	625	1095	-565	185	219	183	165
Industrial									
Europe	465	375	345	366	361	343	361	374	386
North America	565	515	480	503	496	472	495	513	530
China	435	320	320	312	308	293	308	319	330
Japan	635	625	610	610	602	572	601	623	644
Rest of the world	540	585	525	571	564	536	562	583	603
Total	2325	2075	1885	2025	2000	1900	1995	2067	2137
Total palladium demand	7845	7815	7265	9195	7760	9080	9497	10158	10754
Supply									
Mine supply									
Southern Africa	2900	2570	2550	2860	2825	2523	2625	2733	2822
Russia	3050	2700	2675	2720	2705	2600	2650	2650	2650
North America	990	910	755	590	900	890	870	980	1050
Rest of world	150	170	160	185	155	180	180	180	180
Total	7090	6350	6140	6355	6585	6193	6325	6543	6702
Stock sales									
Russia	1490	960	960	1000	775	750	750	750	750
Total stock sales	1490	960	960	1000	775	750	750	750	750
Auto catalyst recycling									
Europe	300	310	330	335	385	373	418	443	470
North America	35	75	55	80	70	84	101	109	118
China	590	660	480	790	1050	1208	1352	1434	1505
Japan	20	30	35	30	35	53	63	76	87
Rest of the world	70	65	65	75	115	127	152	164	177
Total	1015	1140	965	1310	1655	1844	2086	2225	2357
Total palladium supply	9595	8450	8065	8665	9015	8787	9162	9519	9809
Supply-demand surplus/(deficit)	1750	635	800	-530	1255	-292	-336	-639	-946

Source: Johnson Matthey, Citi Research estimates

Macroeconomic Scenarios

We update our three macro economic scenarios...

We have updated our three macro economic scenarios. While we still expect a subdued outlook in 2013, the risks to the downside have increased. A description of each of the three scenarios is summarized below:

- **Worst case – US fiscal woes and European austerity hit hard:** If the US economy fails to address its debt ceiling, it could possibly lead to a further ratings downgrade. At the same time, European austerity measures (particularly out of Germany) may hit economic growth worse-than-expected and economic weakness may be compounded as revenues fall and government debt/GDP ratios overshoot official forecasts in many periphery countries. A toxic cocktail of weak economic growth, banks lacking capital and fiscal woes would be worsened by political uncertainty in the euro area and political disappointment in the US. Together, weaker-than-expected developed economies would weigh heavily on emerging markets, diminishing growth prospects and as a result, global commodity prices.
- **Citi house view and base case – Another year of modest global growth:** 2013 is expected to be another year of modest global growth, with sizeable divergences between regions. From 2.5% in 2012, our base case is for global growth of 2.6% in 2013 and 3.1% in 2014. This is slightly below the IMF forecasts. Major central banks are likely to retain loose policy in the near term, with tightening not expected until 2015 in the US (and rather later in Europe and Japan). China growth is transitioning to a slower path of 7% per year. Still, we expect China to remain the global powerhouse, accounting for one-third of global growth over the next five years. Though we expect more emphasis on China consumer spending, investment in the economy is also expected to remain robust, exceeding investment in the US and euro area combined. US fiscal stability remains key to its outlook, however; provided the US fiscal situation does not deteriorate rapidly, US growth is likely to rise to 3%+ from late-2013 as constraints from weak balance sheets and poor credit availability ease. The euro area and UK economies will remain weak in 2013E and beyond. We still expect a Greek exit from the EU over the next 12-18 months. In addition, we expect Greece, Ireland, Portugal, Italy and Spain to be downgraded to sub-investment grade over coming years.
- **Best case – Quick fix to US fiscal problems and euro area uniformity:** Addressing the US fiscal cliff in early 2013 was a major plus and if the US comes up with a better-than-expected (and quick) political agreement for its debt ceiling, this would no doubt minimize the risk of a US slowdown this year. In addition, should Greece continue to implement its far-reaching structural reforms in a consistent manner, while applying only moderate austerity measures, this would go some way in easing the risk of a 'Grexit', leading to increased market optimism. Firm German growth would, of course, be a key prerequisite to a view that the euro area is performing better-than-expected. If the US and euro area prove stronger in 2013, this would facilitate robust emerging market growth, particularly out of Asia. As a result, commodity prices would find more vigour, as would the outlook for global economic growth (to around 3%+ in 2013).

Figure 7 summarises our regional GDP growth assumptions for each scenario. The modest growth scenario is the Citi house view and forms the base case scenario for our analysis.

Figure 7. GDP growth rates at difference macroeconomic scenarios (%)
















	US and euro area fiscal woes					Another year of modest global growth (Citi house view)					Quick fix to US fiscus and euro area uniformity				
	2010	2011	2012e	2013e	2014e	2010	2011	2012e	2013e	2014e	2010	2011	2012e	2013e	2014e
Regional															
Global growth	4.0%	3.0%	2.5%	2.3%	2.8%	4.0%	3.0%	2.5%	2.6%	3.1%	4.0%	3.2%	2.5%	2.8%	3.0%
Industrialised growth	2.5%	1.3%	1.8%	1.9%	3.1%	2.5%	1.3%	1.8%	2.1%	3.7%	2.5%	1.6%	1.8%	2.4%	3.5%
Emerging market growth	7.2%	6.0%	4.7%	5.0%	5.3%	7.2%	6.0%	4.7%	5.3%	5.5%	7.2%	6.2%	4.7%	5.7%	5.9%
Country specific															
USA	2.9%	1.7%	2.2%	1.3%	2.5%	2.9%	1.7%	2.2%	1.6%	3.0%	2.9%	1.9%	2.2%	1.9%	3.2%
Europe	1.6%	1.5%	-0.4%	-1.1%	-0.7%	1.6%	1.5%	-0.4%	-0.7%	-0.4%	1.6%	1.7%	-0.4%	-0.1%	-0.2%
Japan	3.9%	-0.7%	1.6%	0.4%	0.5%	3.9%	-0.7%	1.6%	0.7%	0.7%	3.9%	-0.2%	1.6%	0.9%	1.7%
China	10.3%	9.2%	7.7%	7.0%	7.1%	10.3%	9.2%	7.7%	7.8%	7.3%	10.3%	9.3%	7.7%	8.2%	8.5%

Source: Citi Research

... and test their likely impacts on PGM demand

We have tested the likely impact of each of these scenarios on platinum and palladium demand, by application. Our perspective is summarised in *Figure 8* below:

Figure 8. Likely impact of different macroeconomic scenarios on platinum and palladium demand (relative to 2012 demand)

Demand driver	Worse case scenario		Base case scenario		Best case scenario	
	Impact	Description	Impact	Description	Impact	Description
Autocatalysts		Global LV production remains flat in 2013E, driven mainly by a sharp fall in demand from industrialised economies, which is offset by re-stocking in Japan post the recent earthquake.		Global LV production increases only marginally into 2013E, driven mainly by continued growth in China and a recovery in demand in the US.		Growth in LV production remains strong into 2013. Growth in demand is driven by industrialised economies and China. Europe grows at mid single digit levels.
Jewellery		A likely decrease in PGM prices stimulates an increase in jewellery demand, especially in China		A retracement in PGM prices stimulates an increase in jewellery demand, especially in China.		With PGM prices remaining range-bound at current buoyant levels, jewellery demand is likely to remain stagnant to slightly lower.
Industrial		In line with a slowdown in global growth, industrial demand for PGMs is likely to decrease as consumer spending falters.		Given the strong recovery in industrial demand in 2011 and 2012 demand in this sector is likely to remain stagnant in 2013 in a Euro-zone drag scenario as fixed investment and consumer spending remains low.		Rising capital expenditure and consumer spending results in a gradual increase in industrial demand for platinum.
Investment		Falling equity markets and rising levels of volatility and risk are reduces sentiment for the industrial properties of platinum and palladium, resulting in net outflows from ETFs		Given the current infancy stage of the PGM ETF market, current PGM ETF holdings are unlikely to be liquidated in a Euro zone drag scenario, especially following net outflows (for Pd) in 2011. Slow net inflows.		Growth in LV production improves investment sentiment for platinum and palladium, resulting in net inflows into ETFs
Autocat recycling		Autocatalyst recycling falls from 1H10 levels closer to 2009 levels as falling consumer confidence and spending leads to consumers hanging onto existing cars. Low PGM prices de-incentivise refineries to recover and recycle		Marginally higher LV sales and a continuing trend of increased recycling results in gradually higher PGM supplies from auto catalyst recycling.		Improved consumer confidence and spending result in a continuation in growth in vehicle sales. More old vehicles are traded in and scrapped. Rising PGM prices also incentivise refineries to recover and recycle more.

Source: Citi Research

The net result from our analysis is a likely 0.7% decrease in **platinum** demand in our worst case scenario in 2013, 2.8% growth in demand in our base case scenario and 5.7% growth in demand in our best case scenario (all relative to 2012F levels).

In terms of **palladium**, our analysis indicates a likely 0.5% increase in demand in our worse scenario in 2013, 4.6% growth in demand in our base case scenario and 8.4% growth in demand in our best case scenario (all relative to 2012F levels).

Platinum Outlook

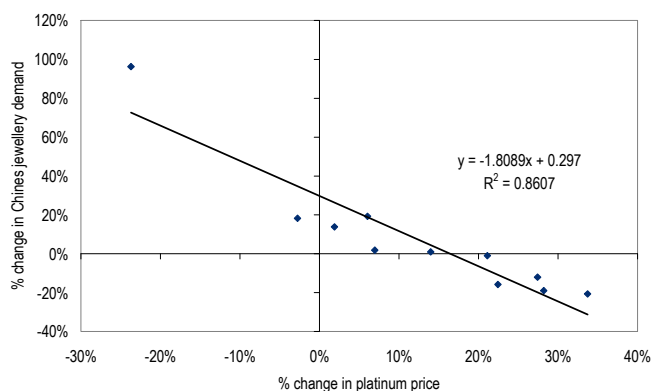
Short-term deficit followed by medium-term balance

2013E deficit, followed by medium-term balance/surplus

We expect a 94k ounce deficit market for platinum in 2013. This is due mainly to spill-over effects of labor unrest in SA during 2012, and mothballing of supply by AMS and AQP.

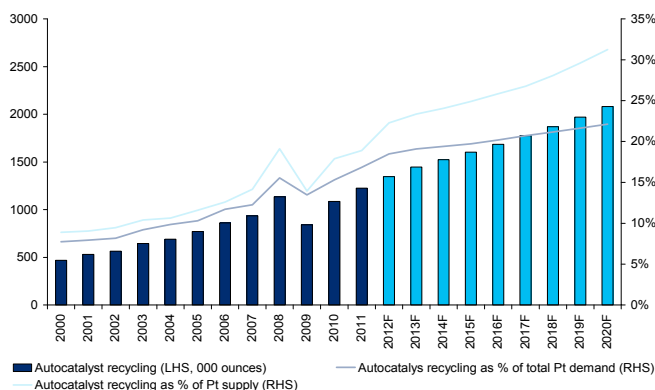
We caution that the market should not extrapolate the 350-450k oz supply cuts from AMS and AQP directly to the S/D balance for platinum. This is as we expect an already higher platinum price to result in 1) lower Chinese jewellery demand, 2) the drawdown of consumer stock piles, and 3) higher auto catalyst recycling (*Figures 9-11*). Higher prices may also result in recently mothballed shafts being brought back into production (*Figure 12*). As a result of these factors, we expect the platinum market to return to balance (and even surplus) from FY14 onwards. We believe the platinum market will remain constrained until price-inelastic demand (i.e. auto catalyst and industrial demand) grows to such a point where SA's 5.2-5.4m ounce mining capacity is exceeded. This is unlikely to happen before 2017, according to our estimates.

Figure 9. Chinese jewellery demand is elastic to the platinum price



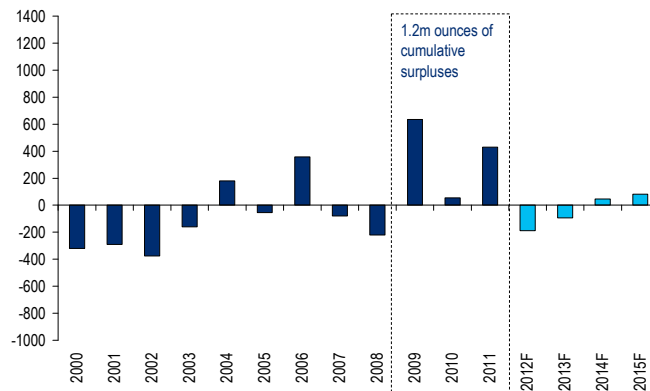
Source: Johnson Matthey, Bloomberg, Citi Research

Figure 11. Auto catalyst recycling continues to grow, and is responsive to sharp change in the platinum price ('000 ounces)



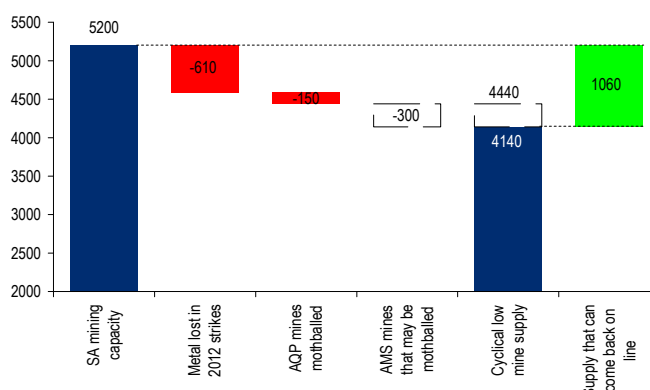
Source: Johnson Matthey, Citi Research estimates

Figure 10. Surpluses since 2008 imply 1.2m ounces of platinum may sit in consumer stock piles ('000 ounces)



Source: Johnson Matthey, Citi Research estimates

Figure 12. SA mine supply at cyclical (not structural) low and can respond if prices rise ('000 ounces)

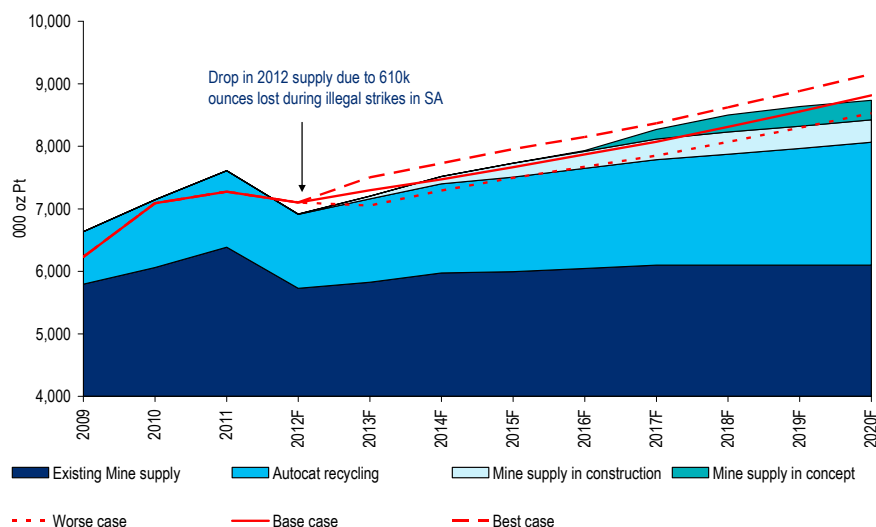


Source: Citi Research estimates

Both our worst case and base case scenarios (*Figure 13*) indicate a balanced/surplus market up to 2017. This is unless production from existing mines can be trimmed, or mines currently in construction can be delayed. Our best case predicts a deficit market outlook.

Base case points to medium-term
balance/surplus

Figure 13. Citi platinum supply-demand outlook (000 oz)



Source: Johnson Matthey, Citi Research estimates

Figure 14. CitiE platinum changes to supply-demand outlook (000 ounces)

	2011	2012F	2013F	2014F	2015F
Demand (000 ounces)					
Gross Autocatalysts - New	3,105	3,227	3,160	3,263	3,305
Gross Autocatalysts - Old	3,105	3,229	3,249	3,391	3,491
% change	0.0%	-0.1%	-2.7%	-3.8%	-5.3%
Net Jewellery - New	1,660	1,717	1,818	1,887	1,969
Net Jewellery - Old	1,660	1,841	1,995	2,069	2,156
% change	0.0%	-6.7%	-8.9%	-8.8%	-8.7%
Investment - New	460	210	274	202	202
Investment - Old	460	89	141	120	120
% change	0.0%	136.2%	94.3%	68.3%	68.3%
Net Industrial - New	2,050	1,948	2,045	2,118	2,191
Net Industrial - Old	2,050	2,103	2,160	2,238	2,321
% change	0.0%	-7.4%	-5.3%	-5.3%	-5.6%
Total demand - New	7,275	7,101	7,297	7,470	7,666
Total demand - Old	7,275	7,262	7,545	7,818	8,088
% change	0.0%	-2.2%	-3.3%	-4.4%	-5.2%
Supply (000 ounces)					
Southern Africa - New	5,195	4,485	4,569	4,827	4,992
Southern Africa - Old	5,195	4,719	4,896	5,067	5,192
% change	0.0%	-5.0%	-6.7%	-4.7%	-3.9%
Russia - New	835	790	798	767	752
Russia - Old	835	815	798	767	752
% change	0.0%	-3.1%	0.0%	0.0%	0.0%
North America - New	350	340	381	376	371
North America - Old	350	325	381	376	371
% change	0.0%	4.6%	0.0%	0.0%	-0.1%
Total mine supply - New	6,480	5,735	5,868	6,090	6,234
Total mine supply - Old	6,480	5,979	6,195	6,330	6,435
% change	0.0%	-4.1%	-5.3%	-3.8%	-3.1%
Autocatalyst Recycling - New	1,225	1,179	1,335	1,426	1,513
Autocatalyst Recycling - Old	1,225	1,346	1,447	1,524	1,602
% change	0.0%	-12.4%	-7.7%	-6.4%	-5.5%
Surplus/(Deficit) balance - New	430	-187	-94	46	82
Surplus/(Deficit) balance - Old	430	63	97	36	-51
% change	0.0%	n/a	n/a	26.7%	n/a

Source: Johnson Matthey, Citi Research estimates

Worst case scenario

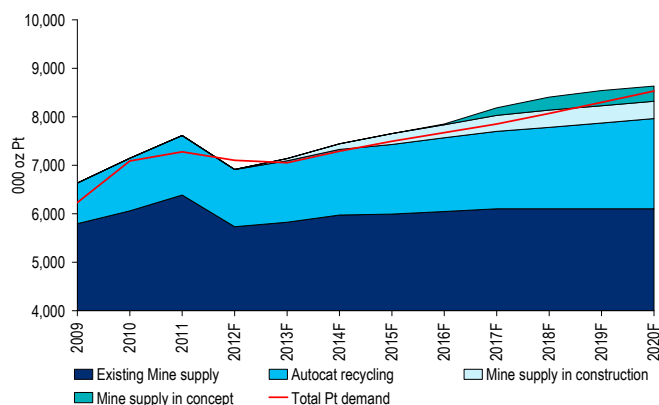
Chinese jewellery sales likely to soften the fall

Under our worst case scenario, we see the market being in surplus of 84k ounces in 2013 and 151k ounces by 2014. This is as global growth contracts, resulting in global LV production remaining flat into 2013E. We see European and US LV production decreasing by 6% and 2%, respectively, and the Chinese market growing by only 3%.

The effect of falling European LV production should be somewhat offset by 1) a rise in Chinese jewellery sales as prices decline sharply, and 2) stricter emission standards for heavy duty and off-road vehicles.

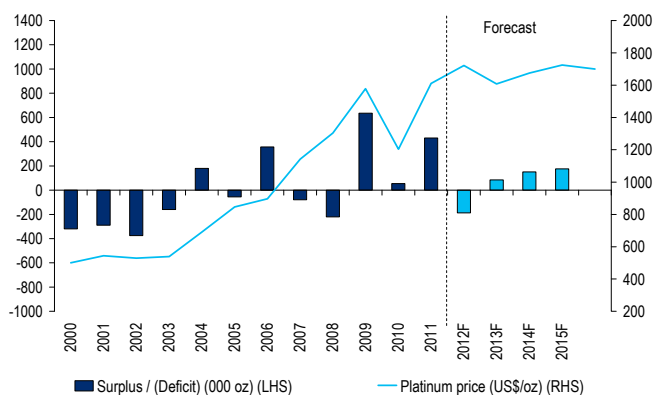
In the absence of additional auto stimulus packages, auto catalyst recycling stalls at 1.27m ounces in 2013E from 1.18m ounces (low base) in 2012E.

Figure 15. Citi platinum supply-demand outlook under a worst case scenario (000 oz)



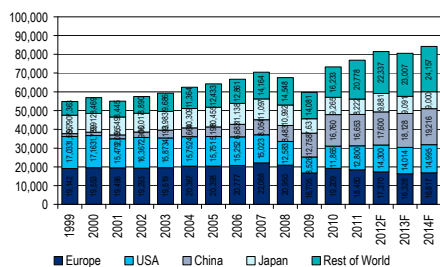
Source: Johnson Matthey, Citi Research estimates

Figure 16. Citi platinum supply-demand balance under a worst case scenario (000 oz)



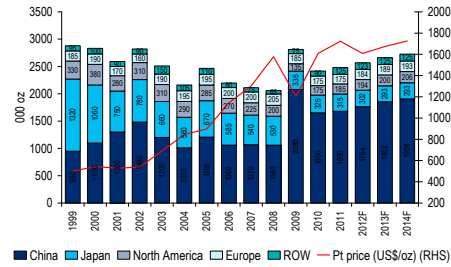
Source: Johnson Matthey, Citi Research estimates

Figure 17. Global LV production (000 units)



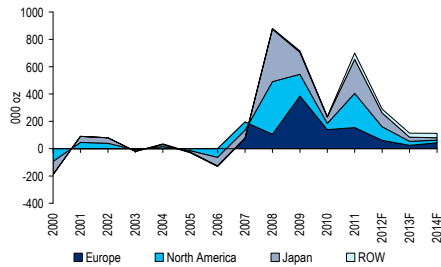
Source: JD Power, Citi Research estimates

Figure 18. Net platinum jewellery demand (000 oz)



Source: Johnson Matthey, Citi Research estimates

Figure 19. Net platinum ETF flows (000 oz)



Source: Johnson Matthey, Citi Research estimates

Base case scenario

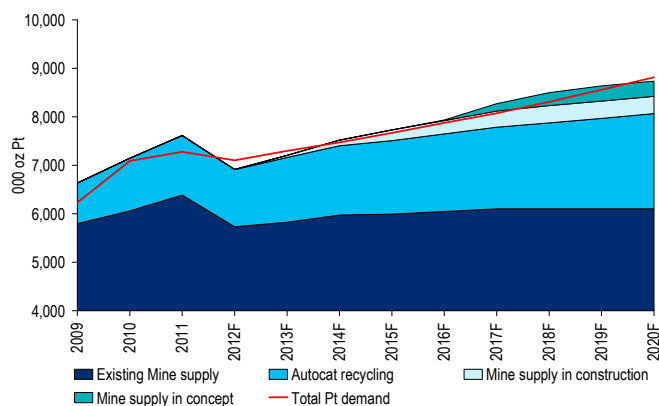
94k ounce deficit in 2013

Under our base case scenario, we expect the market to be in deficit of 94k ounces in 2013 and a surplus of 46k in 2014. This is as global growth remains modest, resulting in only marginal increases in global LV production in 2013. This growth is mainly driven by continued growth in China and a recovery in the US (9% and 2% respectively), while the recessionary environment in Western Europe results in a 3% contraction in LV production in this region.

The marginal increase in LV production is, however, somewhat offset by a slowdown in jewellery demand, especially price sensitive regions like China.

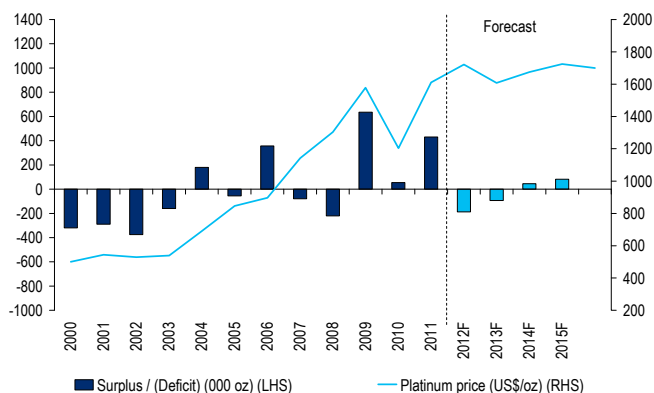
Auto catalyst recycling increases 13% to 1.34m ounces in 2013. This is as improved consumer confidence and increasing LV sales result in more old vehicles being traded-in and scrapped.

Figure 20. Citi platinum supply-demand outlook under our base case scenario (000 oz)



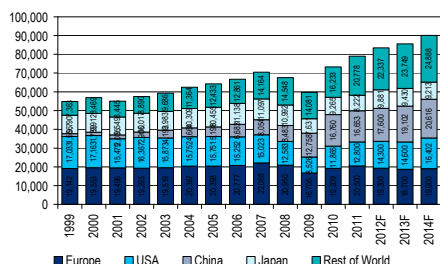
Source: Citi Research, Johnson Matthey

Figure 21. Citi platinum supply-demand balance under our base case scenario (000 oz)



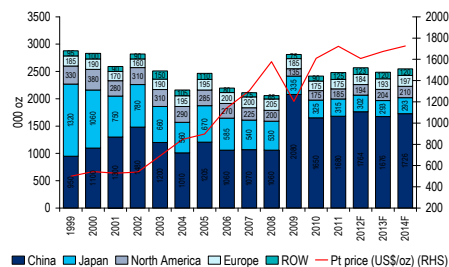
Source: Johnson Matthey, Citi Research

Figure 22. Global LV production (000 units)



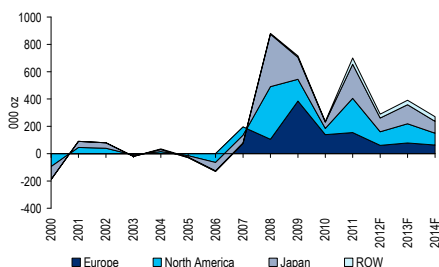
Source: JD Power, Citi Research

Figure 23. Net platinum jewellery demand (000 oz)



Source: Johnson Matthey, Citi Research

Figure 24. Net platinum ETF flows (000 oz)



Source: Johnson Matthey, Citi Research

Best case scenario

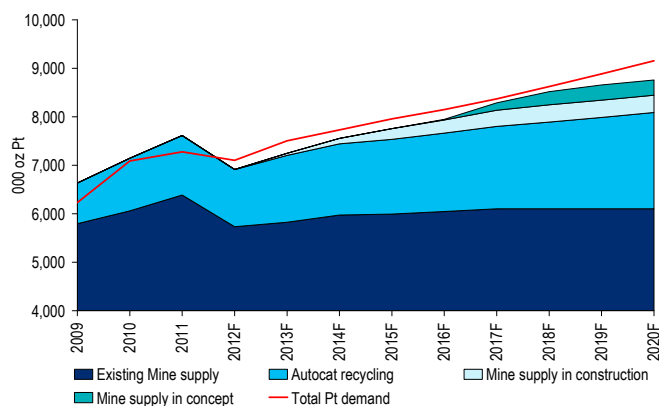
Deficit market outlook

Under our best-case scenario, we see the market being in deficit of 254k ounces in 2013, and 174K ounces in 2014, respectively. This is due mainly to average medium-term growth of 4.4% in global industrial demand, which outstrips an average 3.3% growth in platinum supply over this period.

The recovery in global LV production and a likely rise in PGM prices will likely weigh on jewellery demand. Buoyant equity markets, decreasing levels of risk and rising PGM prices are likely to result in an increase in ETF inflows.

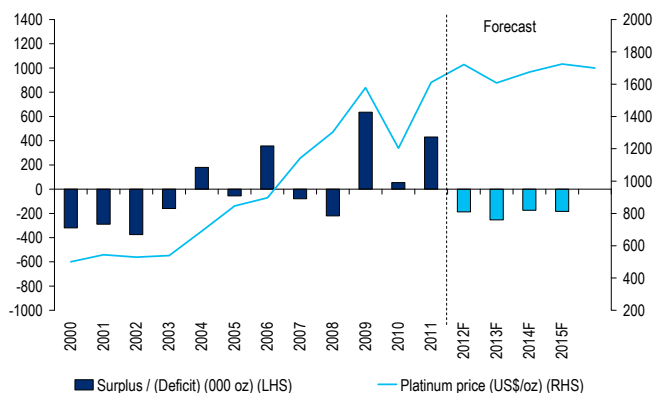
Auto catalyst recycling increases 17% to 1.38m ounces in 2013E. This is as improved consumer confidence and increasing LV sales result in more old vehicles being traded-in and scrapped. Rising PGM prices also incentivise refineries to recover and recycle more PGMs.

Figure 25. Citi platinum supply-demand outlook under a best case scenario (000 oz)



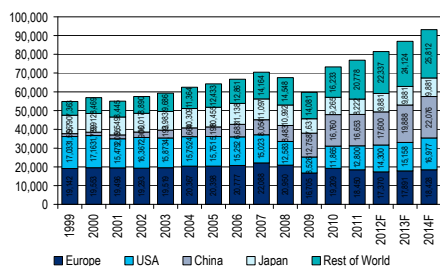
Source: Johnson Matthey, Citi Research estimates

Figure 26. Citi platinum supply-demand balance under a best case scenario (000 oz)



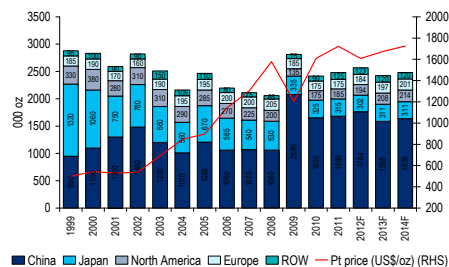
Source: Johnson Matthey, Citi Research estimates

Figure 27. Global LV production (000 units)



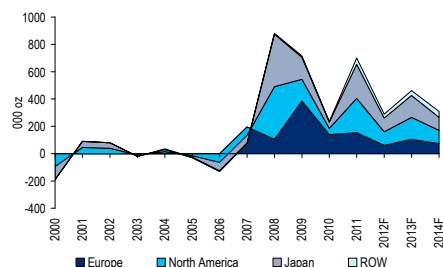
Source: JD Power, Citi Research estimates

Figure 28. Net platinum jewellery demand (000 oz)



Source: Johnson Matthey, Citi Research estimates

Figure 29. Net platinum ETF flows (000 oz)



Source: Johnson Matthey, Citi Research estimates

Palladium Outlook

Maintain bullish outlook

We forecast a 336k ounce deficit in 2013 and rising thereafter

Assuming a further 750k ounce of stock sales from Russia in 2013, we forecast a 336k ounce deficit market for palladium in 2013 under our base case scenario. Any decrease in Russian stock sales would push the market further into deficit.

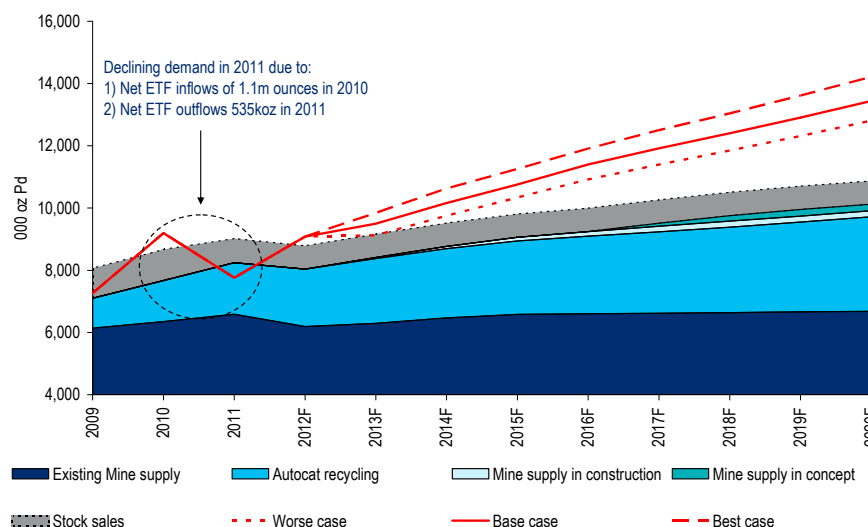
Note: Given the lack of transparency over Russian stock sales, we continue to include 750k ounces of stock sales pa in our supply outlook (see Figure 30). The consensus view is that Russian stock piles are at – or near – depletion. Should the consensus view be realised, we caution that there could be further upside to our already bullish view on the supply-demand fundamentals for palladium.

Figure 30. CitiE palladium changes to supply-demand outlook (000 ounces)

	2011	2012F	2013F	2014F	2015F
Demand (000 ounces)					
Gross Autocatalysts - New	6,030	6,783	7,070	7,671	8,187
Gross Autocatalysts - Old	6,030	6,809	7,233	7,858	8,528
% change	0.0%	-0.4%	-2.3%	-2.4%	-4.0%
Net Jewellery - New	295	211	214	237	265
Net Jewellery - Old	295	277	305	331	362
% change	0.0%	-23.7%	-29.8%	-28.4%	-26.8%
Investment - New	-565	185	219	183	165
Investment - Old	-565	299	167	140	126
% change	0.0%	-38.0%	30.9%	30.5%	30.9%
Net Industrial - New	2,000	1,900	1,995	2,067	2,137
Net Industrial - Old	2,000	2,052	2,107	2,183	2,264
% change	0.0%	-7.4%	-5.3%	-5.3%	-5.6%
Total demand - New	7,760	9,080	9,497	10,157	10,754
Total demand - Old	7,760	9,437	9,812	10,512	11,280
% change	0.0%	-3.8%	-3.2%	-3.4%	-4.7%
Supply (000 ounces)					
Southern Africa - New	2,825	2,523	2,625	2,733	2,822
Southern Africa - Old	2,825	2,675	2,785	2,853	2,922
% change	0.0%	-5.7%	-5.7%	-4.2%	-3.4%
Russia - New	2,705	2,600	2,650	2,650	2,650
Russia - Old	2,705	2,700	2,650	2,650	2,650
% change	0.0%	-3.7%	0.0%	0.0%	0.0%
North America - New	900	890	870	980	1,050
North America - Old	900	795	870	980	1,050
% change	0.0%	11.9%	0.0%	0.0%	0.0%
Rest of world - New	155	180	180	180	180
Rest of world - Old	155	180	180	180	180
% change	0.0%	0.0%	0.0%	0.0%	0.0%
Total mine supply - New	6,585	6,193	6,325	6,543	6,702
Total mine supply - Old	6,585	6,350	6,485	6,663	6,802
% change	0.0%	-2.5%	-2.5%	-1.8%	-1.5%
Russian stock piles - New	775	750	750	750	750
Russian stock piles - Old	775	775	775	775	775
% change	0.0%	-3.2%	-3.2%	-3.2%	-3.2%
Autocatalyst Recycling - New	1,655	1,844	2,086	2,225	2,357
Autocatalyst Recycling - Old	1,655	1,844	1,974	2,072	2,173
% change	0.0%	0.0%	5.7%	7.4%	8.5%
Surplus/(Deficit) balance - New	1,255	-292	-336	-639	-946
Surplus/(Deficit) balance - Old	1,255	-468	-578	-1,002	-1,530
% change	0.0%	-37.4%	-41.9%	-36.2%	-38.2%

Source: Johnson Matthey, Citi Research estimates

Figure 31. CitiE palladium supply-demand outlook (000 oz)



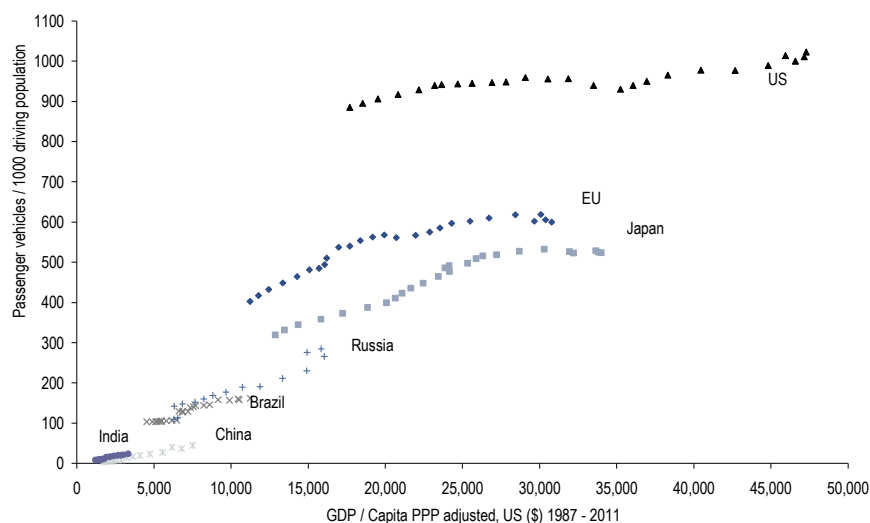
Source: Johnson Matthey, Citi Research estimates

Strong growth in gasoline-powered LV production to drive rising medium-term deficit

We expect the palladium market to move into a rising deficit in the medium term. Our bullish stance is based on our view of 1) sustained growth in auto demand from China, 2) a medium-term recovery in US auto production from cyclical lows, and 3) further potential upside should Russian stock sales decrease (a consensus view, but not included in our forecasts).

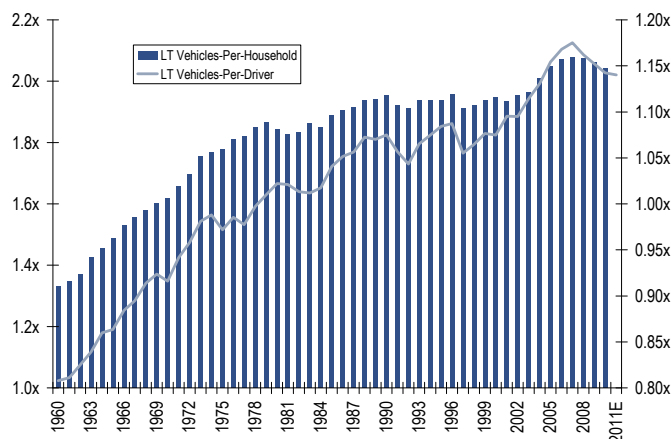
- **Sustained growth in auto demand from China:** We believe growth in Chinese auto demand over the next decade will be driven by 1) sustained growth in GDP/capita, and 2) increasing light-vehicle density. Given the relative preference for smaller gasoline engines, we believe this growth will be a strong demand driver for palladium (*Figure 32*).
- **US recovery from a low base:** Even though US vehicle density shows noticeable weakness, we believe this to be predominantly cyclical rather than structural. As a result, US auto production may be highly leveraged to any macro-economic upside. (*Figures 33 and 34*).
- **Depletion of Russian stockpiles:** General consensus suggests that Russian stockpiles are likely to be depleted over the next 12-24 months. We see this as plausible but, given the lack of transparency, we do not include a “depletion scenario” in our forecasts. Also, even by assuming 750k ounces p.a. will be sold from Russian stocks going forward, our outlook is still bullish. As a result, a depletion of Russian stocks would only add to our already bullish outlook.

Figure 32. Global passenger car intensity curve



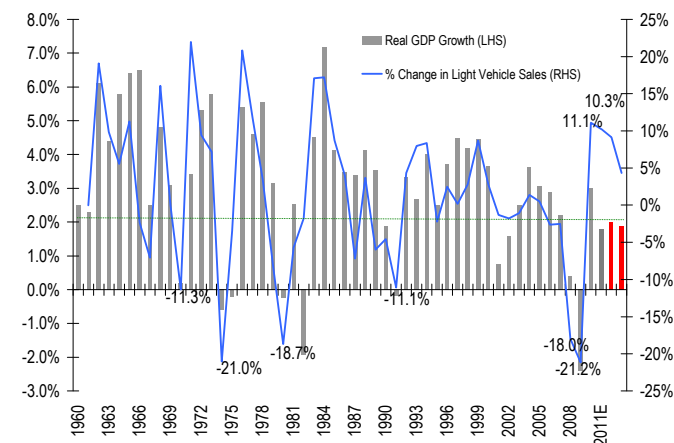
Source: JD Power, Ward's, FHWA, CSM, company reports, Citi Research

Figure 33. US vehicle saturation



Source: JD Power, Ward's, FHWA, CSM, company reports, Citi Research estimates

Figure 34. Correlation between change in LV sales and US real GDP growth



Source: JD Power, Ward's, FHWA, CSM, company reports, Citi Research estimates

Worst case scenario

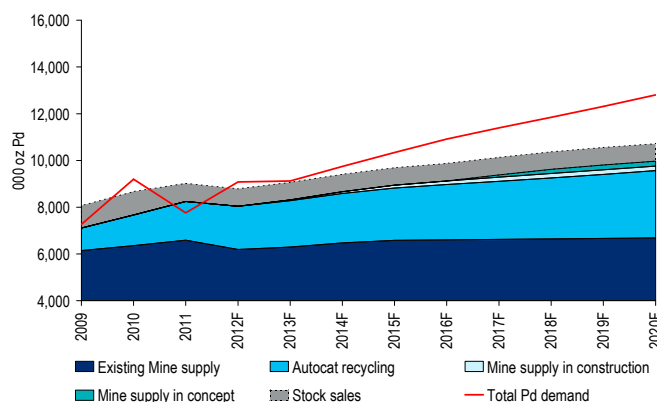
62k ounce deficit market in 2013

Under our worst case scenario, we see a 62k ounce deficit market in 2013 and rising thereafter (assuming a continuation of 750koz ounce pa. supply from Russian stock sales). This is despite consumers remaining hesitant to spend as the impact of earlier fiscal stimulus fades and global light vehicle production grows at only a slow pace y-o-y. However, importantly for palladium demand, most of the growth in global LV production looks set to come from gasoline-based economies (China and US), while LV production in Europe likely declines. Even under this scenario, we view a rising deficit market going forward as likely.

Net jewellery demand is likely to increase marginally y-o-y due to low current spot levels (USD705/ounce). Net ETF inflows slow y-o-y as sentiment for industrial metals remain weak.

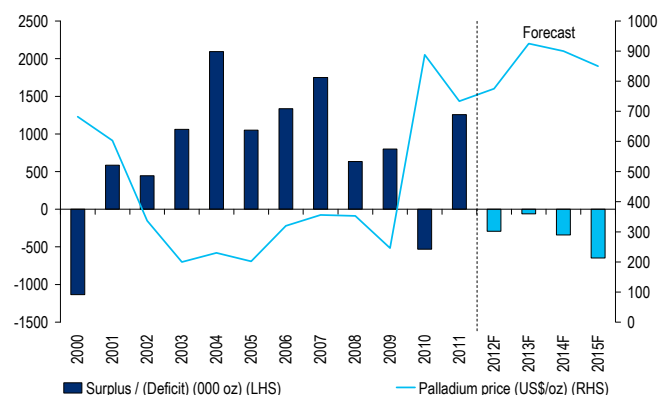
In the absence of additional auto stimulus packages, autocatalyst recycling increase only 7.7% to 1.98m ounces in 2013 from 1.84m ounces in 2012.

Figure 35. Citi palladium supply-demand outlook under a worst case scenario (000 oz)



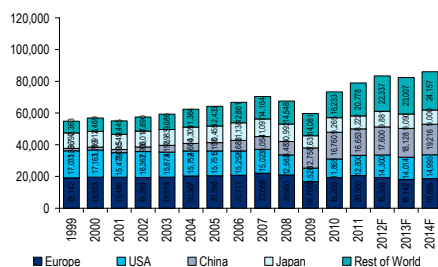
Source: Johnson Matthey, Citi Research estimates

Figure 36. Citi palladium supply-demand balance under a worst case scenario (000 oz)



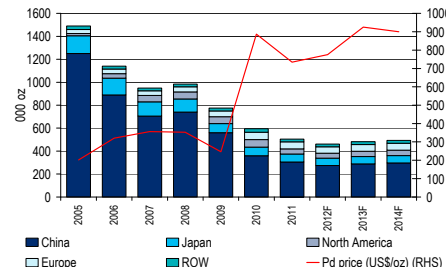
Source: Johnson Matthey, Citi Research estimates

Figure 37. Global LV production (000 units)



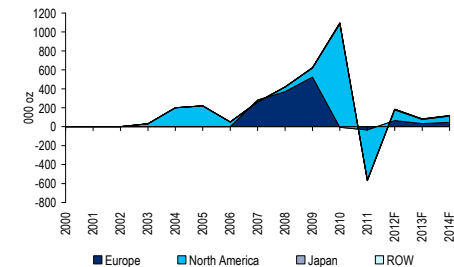
Source: JD Power, Citi Research estimates

Figure 38. Net palladium jewellery demand (000 oz)



Source: Johnson Matthey, Citi Research estimates

Figure 39. Net palladium ETF flows (000 oz)



Source: Johnson Matthey, Citi Research estimates

Base case scenario

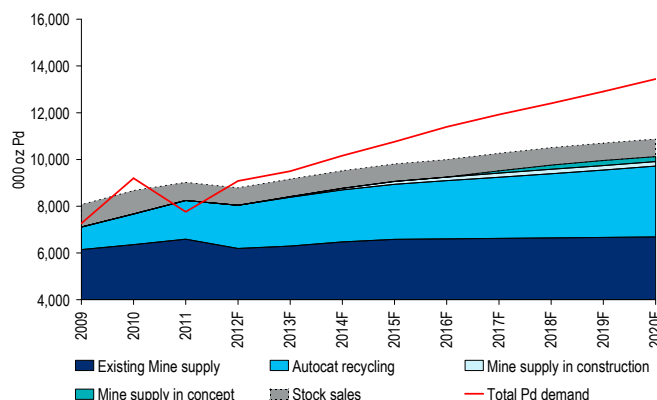
Growing deficit

Under our base case scenario, we expect a 336k ounce deficit in 2013 and growing thereafter. This is due mainly to our view of a continued recovery in US auto production and sustained 5-9% medium-term growth in Chinese LV demand.

The recovery in global LV production and a likely rise in PGM prices should result in slowing jewellery demand.

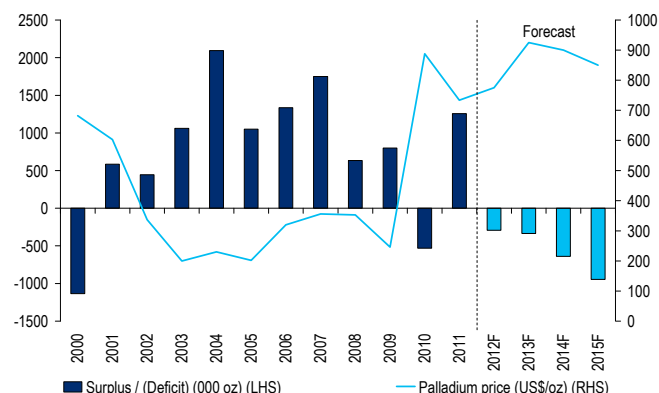
We estimate auto catalyst recycling increases 13% to 2.09m ounces in 2013. This is as improved consumer confidence and increasing LV sales result in more old vehicles being traded-in and scrapped. Rising PGM prices also incentivise refineries to recover and recycle more PGMs.

Figure 40. Citi palladium supply-demand outlook under our base case scenario (000 oz)



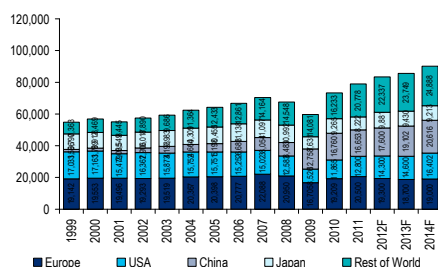
Source: Johnson Matthey, Citi Research estimates

Figure 41. Citi palladium supply-demand balance under our base case scenario (000 oz)



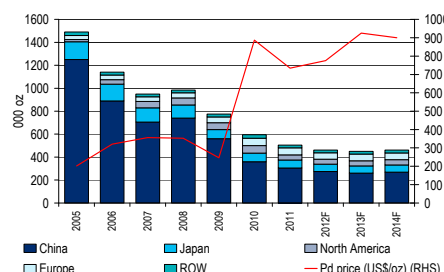
Source: Johnson Matthey, Citi Research estimates

Figure 42. Global LV production (000 units)



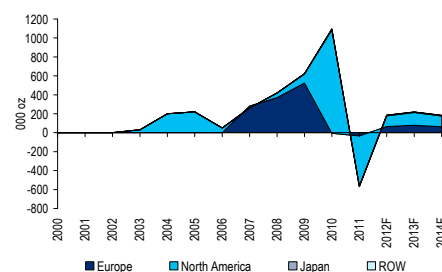
Source: JD Power, Citi Research estimates

Figure 43. Net palladium jewellery demand (000 oz)



Source: Johnson Matthey, Citi Research estimates

Figure 44. Net palladium ETF flows (000 oz)



Source: Johnson Matthey, Citi Research estimates

Best case scenario

Remain very bullish

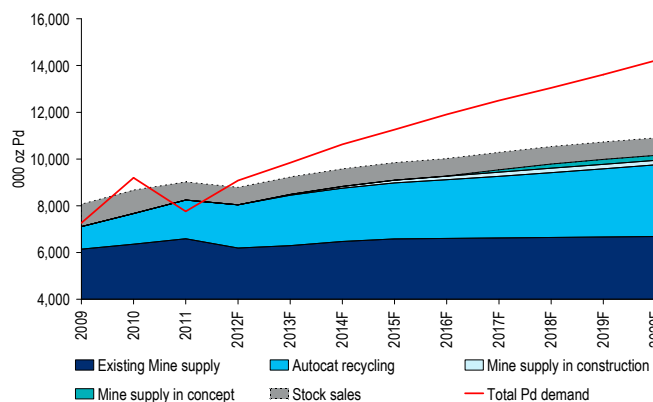
Under our best case scenario, we expect the market to be in a 608k ounce deficit during 2013, and growing thereafter. This is due mainly to our view of a strong recovery in US auto production and sustained strong (5-13%) medium-term growth in Chinese LV demand.

The recovery in global LV production and a likely rise in PGM prices would likely result in a decrease in net jewellery demand.

An improved global economic environment and outlook should result in strong net inflows into palladium ETFs, given that +80% of palladium demand is industrially linked.

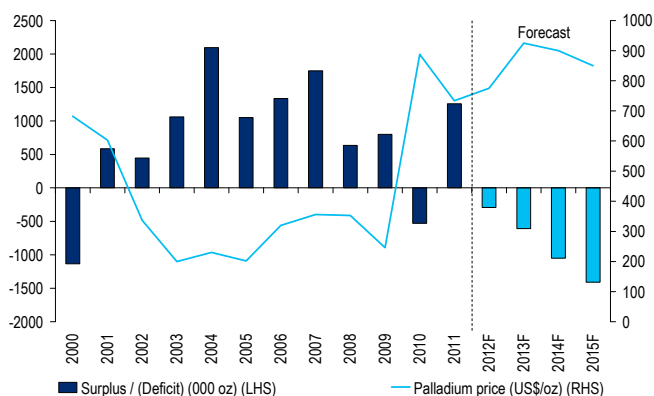
Auto catalyst recycling increases 17% to 2.16m ounces in 2013E. This is as improved consumer confidence and increasing LV sales result in more old vehicles being traded in and scrapped. Rising PGM prices also incentivise refineries to recover and recycle more PGMs.

Figure 45. Citi palladium supply-demand outlook under a best case scenario (000 oz)



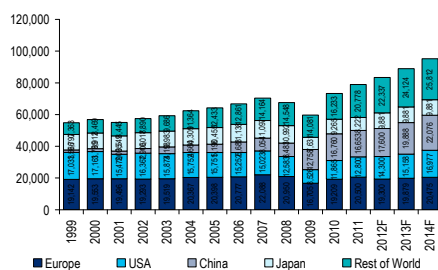
Source: Johnson Matthey, Citi Research estimates

Figure 46. Citi palladium supply-demand balance under a best case scenario (000 oz)



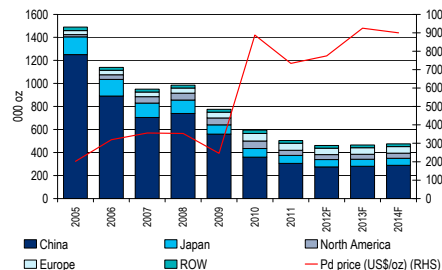
Source: Johnson Matthey, Citi Research estimates

Figure 47. Global LV production (000 units)



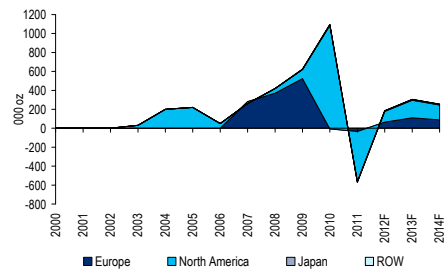
Source: JD Power, Citi Research estimates

Figure 48. Net palladium jewellery demand (000 oz)



Source: Johnson Matthey, Citi Research estimates

Figure 49. Net palladium ETF flows (000 oz)



Source: Johnson Matthey, Citi Research estimates

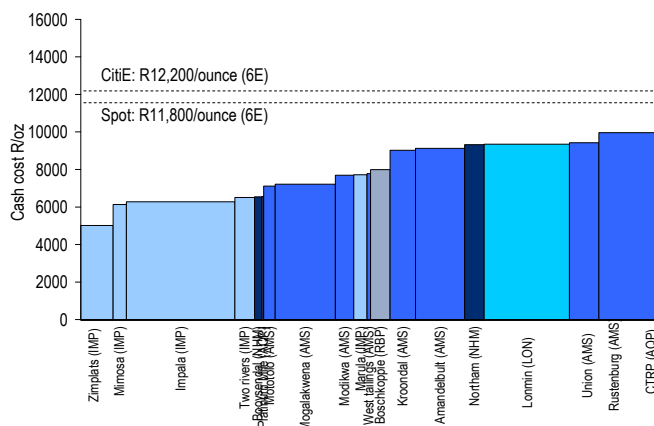
Price Outlook

Minor upgrades to medium-term price assumptions

6E basket to average R11,800-12,200/ounce (real) in the medium term

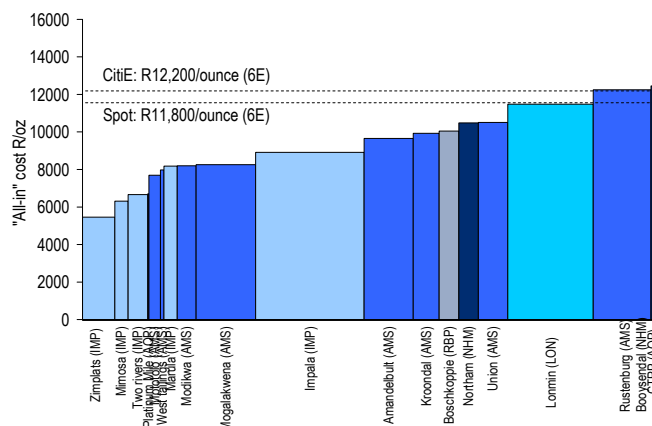
We expect the 90th percentile to remain incentivized (in rand terms and on a 6E basis) over the medium term, given our balanced market outlook. As a result, we expect the 6E basket price to average R11,800-12,200/ounce (real) in the medium term.

Figure 50. 2H13 5PGE+Au cash cost curve (R/ounce)



Source: Citi Research, INET

Figure 51. 2H13 5PGE+Au "All-in" cost curve (R/ounce)



Source: Citi Research, INET

We have marked-to-market our 2012 price assumptions. We expect platinum to average USD1,700/ounce in 2013 (1.5% upgrade), USD1,775/ounce (unchanged) in 2014 and USD1,825/ounce in 2015 (unchanged), falling to USD1,800/ounce in 2016 (unchanged) before further declining to our long-term average assumptions of USD1,531/ounce real (2% upgrade) (USD1,757/ounce nominal).

We expect palladium to average USD775/ounce in 2013 (4.2% upgrade), USD925/ounce (unchanged) in 2014 and USD925/ounce in 2015 (unchanged), falling to USD900/ounce in 2016 (9.1% upgrade) before declining further to our long-term average assumptions of USD680/ounce real (13% upgrade) (USD780/ounce nominal).

Upgrade to long-term prices

We upgrade our long-term real basket price assumption 6.7% to R13,542/ounce (USD1,354/ounce). We upgrade our long-term real platinum, palladium and rhodium price assumptions by 2%, 13%, and 27% to USD1,531/ounce, USD680/ounce and USD2,859/ounce, respectively. These upgrades are due to our new incentive pricing model, which we describe below.

Incentive pricing

We have developed a new incentive pricing model that calculates what rand basket price (6E) is required to provide a 15% hurdle rate for constructing an average size underground mine in the Western Bushveld PGM complex. Specific assumptions for such a mine are shown in *Figure 52*.

Figure 52. Incentive pricing model input assumptions

Input assumptions	Units	
Annual 4E production	koz	350
Grade (4E)	g/t	3.5
Recovery	%	80%
LOM	years	30
Ni price	\$/ton	15,000
Cu price	\$/ton	7,000
R/\$ exchange		8.20
Cash costs	R/t	650
Project capex (real)	R/4E ounce	35,000
Project capex (real)	Rm	12,250
Sustaining capex	% of opex	15%
SA mining inflation	%	6%
US mining inflation	%	3%

Source: Citi Research estimates

Based on these assumptions, we calculate that a rand basket price (2013 real) of R13,542/ounce is needed to yield a 15% hurdle rate. Grade, cash cost and capex sensitivities are provided in *Figure 53 to 55*.

Figure 53. Grade vs hurdle rate sensitivity (R/4E basket price)*

Grade (g/t)	Hurdle rate			
	10%	12%	CitiE (15%)	17%
2.5	13740	14750	16550	18000
3	12000	13000	14800	16200
CitiE (3.5)	10750	11750	13542	15000
4	9800	10800	12625	14000

*Based on 350koz production, 80% recovery, R650/t cash costs, 30 year LOM, R35,000/4E capex per new ounce
Source: Citi Research estimates

Figure 54. Cash costs vs hurdle rate sensitivity (R/4E basket price)*

Cash costs (R/t)	Hurdle rate			
	10%	12%	CitiE (15%)	17%
600	10000	11000	12800	14250
CitiE (650)	10750	11750	13542	15000
700	11475	12475	14300	15700
750	12200	13200	15000	16450

*Based on 350koz production, 80% recovery, R650/t cash costs, 30 year LOM, R35,000/4E capex per new ounce
Source: Citi Research estimates

Figure 55. Capex vs hurdle rate sensitivity (R/4E basket price)*

Capex (R/oz)	Hurdle rate			
	10%	12%	CitiE (15%)	17%
20000	9350	9920	10950	11750
30000	10270	11150	12625	13900
CitiE (35000)	10740	11750	13542	15000
40000	11200	12350	14400	16050

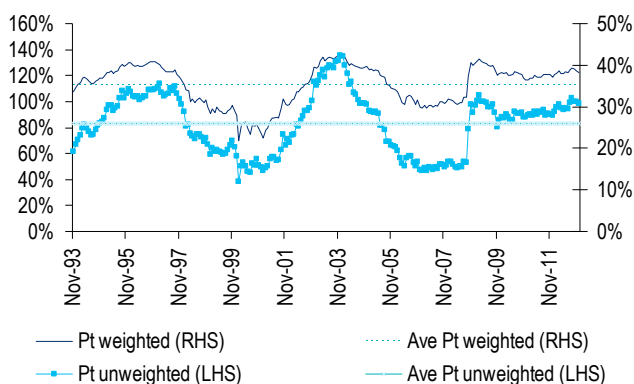
*Based on 350koz production, 80% recovery, R650/t cash costs, 30 year LOM, R35,000/4E capex per new ounce
Source: Citi Research estimates

We then apply the following methodology to “back calculate” individual dollar PGM prices, as described below:

- Apply our long-term exchange rate of R10/\$ to yield a dollar basket price of \$1,354/ounce
- Calculate platinum, palladium, rhodium and gold's 20-year average weighted and unweighted ratios of the PGM basket price.
- Apply these ratios to our long-term basket price to calculate individual long-term prices for platinum, palladium, rhodium and gold.

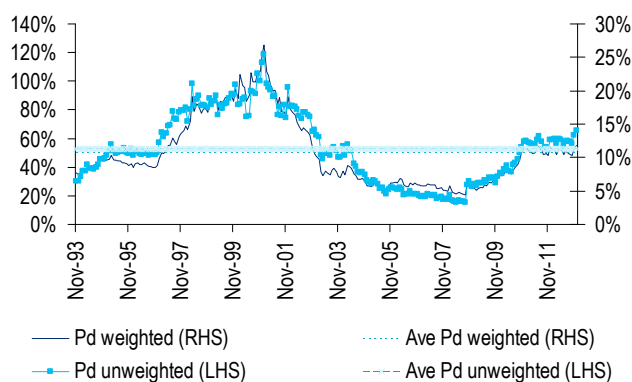
Figures 56-59 show the 20-year contribution of platinum, palladium, rhodium and gold to the PGM basket price.

Figure 56. Platinum's 20-year weighted and unweighted contribution to the 4E basket price



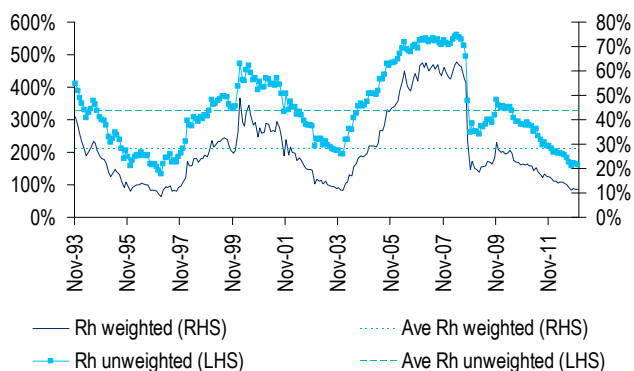
Source: Citi Research, I-Net

Figure 57. Palladium's 20-year weighted and unweighted contribution to the 4E basket price



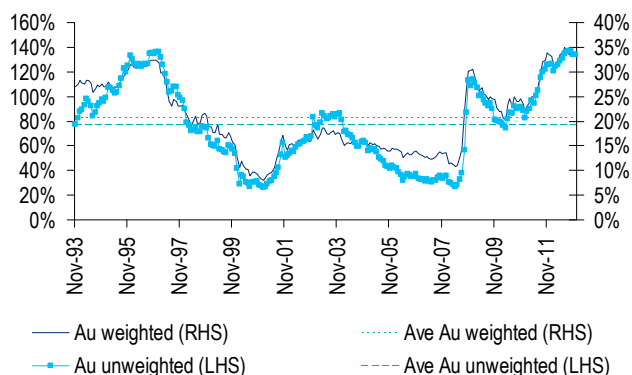
Source: Citi Research, I-Net

Figure 58. Rhodium's 20-year weighted and unweighted contribution to the 4E basket price



Source: Citi Research, I-Net

Figure 59. Gold's 20-year weighted and unweighted contribution to the 4E basket price



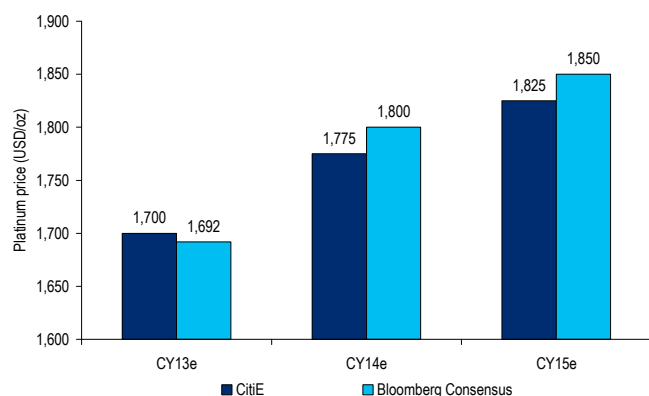
Source: Citi Research, I-Net

Figure 60. Citi precious metals price expectations

	2011a	2012e	2013e	2014e	2015e	2016e	LT real	Long-term nominal
R/USD								
CIRA ZAR/USD - New	7.23	8.20	8.81	8.92	9.27	9.64	10.00	10.00
CIRA ZAR/USD - Old	7.23	8.27	8.81	8.92	9.27	9.64	10.00	10.00
% change	0.0%	-0.8%	0.0%	0.0%	0.0%	0.0%	0%	0%
Gold								
Gold price - New (USD/ounce)	1,585	1,670	1,675	1,655	1,540	1,350	1,050	1,205
Gold price - Old (USD/ounce)	1,585	1,671	1,749	1,655	1,540	1,350	1,050	1,205
% change	0%	0%	-4%	0%	0%	0%	0%	0%
Gold price - New (R/ounce)	11,460	13,694	14,757	14,763	14,276	13,014	10,500	12,050
Gold price - Old (R/ounce)	11,460	13,819	15,409	14,763	14,276	13,014	10,500	12,050
% change	0.0%	-0.9%	-4.2%	0.0%	0.0%	0.0%	0.0%	0.0%
Platinum								
Platinum price - New (USD/ounce)	1,722	1,544	1,700	1,775	1,825	1,800	1,531	1,757
Platinum price - Old (USD/ounce)	1,722	1,557	1,675	1,775	1,825	1,800	1,500	1,722
% change	0.0%	-0.8%	1.5%	0.0%	0.0%	0.0%	2%	2%
Platinum price - New (R/ounce)	12,450	12,661	14,977	15,833	16,918	17,352	15,310	17,569
Platinum price - Old (R/ounce)	12,450	12,876	14,757	15,833	16,918	17,352	15,000	17,220
% change	0.0%	-1.7%	1.5%	0.0%	0.0%	0.0%	2.1%	2.0%
Palladium								
Palladium price - New (USD/ounce)	734	642	775	925	925	900	680	780
Palladium price - Old (USD/ounce)	734	649	744	925	925	825	600	689
% change	0.0%	-1.1%	4.2%	0.0%	0.0%	9.1%	13%	13%
Palladium price - New (R/ounce)	5,307	5,264	6,828	8,251	8,575	8,676	6,800	7,803
Palladium price - Old (R/ounce)	5,307	5,367	6,555	8,251	8,575	7,953	6,000	6,890
% change	0.0%	-1.9%	4.2%	0.0%	0.0%	9.1%	13.3%	13.3%
Rhodium								
Rhodium price - New (USD/ounce)	2,000	1,262	1,175	1,250	1,500	2,000	2,859	3,281
Rhodium price - Old (USD/ounce)	2,000	1,336	1,175	1,250	1,500	1,800	2,250	2,582
% change	0.0%	-5.5%	0.0%	0.0%	0.0%	11.1%	27%	27%
Rhodium price - New (R/ounce)	14,460	10,348	10,352	11,150	13,905	19,280	28,590	32,808
Rhodium price - Old (R/ounce)	14,460	11,049	10,352	11,150	13,905	17,352	22,500	25,820
% change	0.0%	-6.3%	0.0%	0.0%	0.0%	11.1%	27.1%	27.1%
3PGE +Au basket price*								
3PGM price - New (USD/ounce)	1,441	1,257	1,385	1,480	1,524	1,531	1,354	1,554
3PGM price - Old (USD/ounce)	1,441	1,273	1,363	1,480	1,524	1,494	1,269	1,457
% change	0.0%	-1.2%	1.6%	0.0%	0.0%	2.4%	6.7%	6.7%
3PGM price - New (R/ounce)	10,418	10,311	12,202	13,198	14,125	14,754	13,542	15,540
3PGM price - Old (R/ounce)	10,418	10,524	12,007	13,198	14,125	14,402	12,690	14,568
% change	0.0%	-2.0%	1.6%	0.0%	0.0%	2.4%	6.7%	6.7%

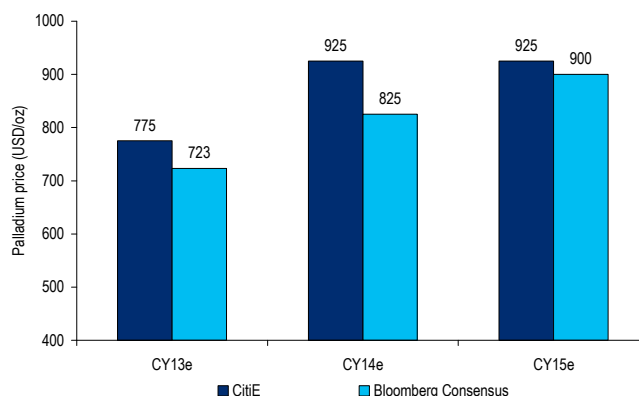
Source: Citi Research, I-NET, * use a 60% Platinum, 30% Palladium, 7% Rhodium and 3% Gold split.

61. Platinum price - Citi forecasts vs. consensus



Source: Bloomberg, Citi Research

62. Palladium price - Citi forecasts vs. consensus



Source: Bloomberg, Citi Research

Appendix 1 – PGM supply-demand tables

Platinum: Worst case

Figure 63. Citi platinum supply-demand outlook under a worst case scenario (000 ounces)

	2007	2008	2009	2010	2011	2012F	2013F	2014F	2015F
Demand									
Auto catalysts									
Europe	2055	1970	970	1495	1465	1321	1208	1249	1248
North America	850	505	370	405	380	440	431	453	466
China	175	145	85	100	110	120	121	128	133
Japan	610	610	395	550	500	650	592	589	600
Rest of the world	455	420	365	525	650	696	703	729	751
Total	4145	3650	2185	3075	3105	3226	3054	3148	3197
Jewellery									
Europe	200	205	185	175	175	184	189	193	196
North America	225	200	135	175	185	194	200	206	212
China	1070	1060	2080	1650	1680	1764	1852	1908	1965
Japan	540	530	335	325	315	302	293	293	311
Rest of the world	75	65	75	90	125	123	125	125	128
Jewellery recycled	655	695	565	735	820	850	668	659	659
Net jewellery demand	1455	1365	2245	1680	1660	1717	1992	2066	2153
Investment									
Europe	195	105	385	140	155	60	24	44	44
North America	30	60	105	465	10	21	15	37	37
Japan	-60	385	160	45	250	100	30	18	18
Rest of the world	5	5	10	5	45	29	29	33	33
Total	170	555	660	655	460	210	98	131	131
Industrial									
Europe	350	335	290	326	398	378	371	378	391
North America	420	380	250	370	452	429	420	429	443
China	295	205	0	200	244	231	227	231	239
Japan	225	210	160	205	250	237	232	237	245
Rest of the world	555	595	440	580	707	672	658	671	694
Total	1845	1725	1140	1681	2050	1948	1909	1947	2013
Total platinum demand	7615	7295	6230	7091	7275	7101	7052	7292	7495
Supply									
Mine supply									
Southern Africa	5240	4695	4865	4915	5195	4485	4569	4827	4992
Russia	915	805	785	825	835	790	798	767	752
North America	325	325	260	210	350	340	381	376	371
Rest of world	120	115	115	110	100	120	120	120	120
Total	6600	5940	6025	6060	6480	5735	5868	6090	6235
Auto catalyst recycling									
Europe	215	385	299	375	445	344	365	387	410
North America	605	630	421	580	640	646	691	732	769
China	10	15	23	10	10	43	50	57	66
Japan	35	60	54	65	60	75	83	89	96
Rest of the world	70	45	44	55	70	70	81	87	94
Total	935	1135	840	1085	1225	1179	1269	1353	1435
Total platinum supply	7535	7075	6865	7145	7705	6914	7137	7443	7670
Supply-demand surplus/(deficit)	-80	-220	635	54	430	-187	84	151	176

Source: Johnson Matthey, Citi Research estimates

Platinum: Base case

Figure 64. Citi platinum supply-demand outlook under base case scenario (000 ounces)

	2007	2008	2009	2010	2011	2012F	2013F	2014F	2015F
Demand									
Auto catalysts									
Europe	2055	1970	970	1495	1465	1321	1245	1270	1269
North America	850	505	370	405	380	440	448	491	509
China	175	145	85	100	110	120	128	139	143
Japan	610	610	395	550	500	650	612	607	604
Rest of the world	455	420	365	525	650	696	726	756	780
Total	4145	3650	2185	3075	3105	3227	3160	3263	3305
Jewellery									
Europe	200	205	185	175	175	184	193	197	200
North America	225	200	135	175	185	194	204	210	216
China	1070	1060	2080	1650	1680	1764	1676	1726	1778
Japan	540	530	335	325	315	302	293	293	311
Rest of the world	75	65	75	90	125	123	120	120	123
Jewellery recycled	655	695	565	735	820	850	668	659	659
Net jewellery demand	1455	1365	2245	1680	1660	1717	1818	1887	1969
Investment									
Europe	195	105	385	140	155	60	79	63	63
North America	30	60	105	465	10	21	23	18	18
Japan	-60	385	160	45	250	100	140	87	87
Rest of the world	5	5	10	5	45	29	32	34	34
Total	170	555	660	655	460	210	274	202	202
Industrial									
Europe	350	335	290	326	398	378	397	411	425
North America	420	380	250	370	452	429	450	467	483
China	295	205	0	200	244	231	243	252	260
Japan	225	210	160	205	250	237	249	258	267
Rest of the world	555	595	440	580	707	672	705	731	756
Total	1845	1725	1140	1681	2050	1948	2045	2118	2191
Total platinum demand	7615	7295	6230	7091	7275	7101	7297	7471	7666
Supply									
Mine supply									
Southern Africa	5240	4695	4865	4915	5195	4485	4569	4827	4992
Russia	915	805	785	825	835	790	798	767	752
North America	325	325	260	210	350	340	381	376	371
Rest of world	120	115	115	110	100	120	120	120	120
Total	6600	5940	6025	6060	6480	5735	5868	6090	6235
Auto catalyst recycling									
Europe	215	385	299	375	445	344	385	408	433
North America	605	630	421	580	640	646	723	767	805
China	10	15	23	10	10	43	52	63	72
Japan	35	60	54	65	60	75	90	97	105
Rest of the world	70	45	44	55	70	70	84	91	99
Total	935	1135	840	1085	1225	1179	1335	1426	1513
Total platinum supply	7535	7075	6865	7145	7705	6914	7203	7516	7748
Supply-demand surplus/(deficit)	-80	-220	635	54	430	-187	-94	46	82

Source: Johnson Matthey, Citi Research estimates

Platinum: Best case

Figure 65. Citi platinum supply-demand outlook under best case scenario (000 ounces)

	2007	2008	2009	2010	2011	2012F	2013F	2014F	2015F
Demand									
Auto catalysts									
Europe	2055	1970	970	1495	1465	1321	1324	1368	1367
North America	850	505	370	405	380	440	466	512	537
China	175	145	85	100	110	120	134	148	155
Japan	610	610	395	550	500	650	641	650	668
Rest of the world	455	420	365	525	650	696	739	785	806
Total	4145	3650	2185	3075	3105	3226	3303	3464	3533
Jewellery									
Europe	200	205	185	175	175	184	197	201	204
North America	225	200	135	175	185	194	208	214	221
China	1070	1060	2080	1650	1680	1764	1588	1635	1684
Japan	540	530	335	325	315	302	311	311	330
Rest of the world	75	65	75	90	125	123	120	120	123
Jewellery recycled	655	695	565	735	820	850	668	659	659
Net jewellery demand	1455	1365	2245	1680	1660	1717	1756	1822	1903
Investment									
Europe	195	105	385	140	155	60	106	74	74
North America	30	60	105	465	10	21	59	41	41
Japan	-60	385	160	45	250	100	160	96	96
Rest of the world	5	5	10	5	45	29	36	43	48
Total	170	555	660	655	460	210	361	254	259
Industrial									
Europe	350	335	290	326	398	378	405	425	439
North America	420	380	250	370	452	429	459	482	498
China	295	205	0	200	244	231	248	260	269
Japan	225	210	160	205	250	237	254	266	275
Rest of the world	555	595	440	580	707	672	719	755	780
Total	1845	1725	1140	1681	2050	1948	2084	2188	2262
Total platinum demand	7615	7295	6230	7091	7275	7101	7503	7729	7956
Supply									
Mine supply									
Southern Africa	5240	4695	4865	4915	5195	4485	4569	4827	4992
Russia	915	805	785	825	835	790	798	767	752
North America	325	325	260	210	350	340	381	376	371
Rest of world	120	115	115	110	100	120	120	120	120
Total	6600	5940	6025	6060	6480	5735	5868	6090	6235
Auto catalyst recycling									
Europe	215	385	299	375	445	344	396	415	432
North America	605	630	421	580	640	646	743	780	811
China	10	15	23	10	10	43	54	65	75
Japan	35	60	54	65	60	75	98	105	114
Rest of the world	70	45	44	55	70	70	92	99	107
Total	935	1135	840	1085	1225	1179	1382	1464	1538
Total platinum supply	7535	7075	6865	7145	7705	6914	7249	7555	7773
Supply-demand surplus/(deficit)	-80	-220	635	54	430	-187	-254	-174	-183

Source: Johnson Matthey, Citi Research estimates

Palladium: Worst case

Figure 66. Citi palladium supply-demand outlook under worst case scenario (000 ounces)

	2007	2008	2009	2010	2011	2012F	2013F	2014F	2015F
Demand									
Auto catalysts									
Europe	920	1005	995	1330	1440	1426	1393	1473	1609
North America	1695	1290	1020	1355	1475	1711	1685	1855	1973
China	325	390	685	1005	1115	1347	1416	1538	1662
Japan	820	885	590	820	665	801	745	751	769
Rest of the world	785	895	760	1070	1335	1498	1561	1678	1772
Total	4545	4465	4050	5580	6030	6783	6801	7295	7786
Jewellery									
Europe	40	45	50	65	60	55	59	60	61
North America	55	60	60	65	45	43	46	47	49
China	705	740	560	360	305	275	288	297	306
Japan	125	115	80	75	70	64	64	64	68
Rest of the world	25	25	25	30	25	25	25	25	25
Jewellery recycled	235	130	70	100	210	250	236	223	210
Net jewellery demand	715	855	705	495	295	211	246	270	299
Investment									
Europe	280	370	525	-5	-35	65	33	46	46
North America	-20	50	95	1090	-535	112	45	67	67
Japan	0	0	0	10	5	8	4	5	5
Rest of the world	0	0	5	0	0	0	0	0	0
Total	260	420	625	1095	-565	185	81	118	118
Industrial									
Europe	465	375	345	366	361	343	361	374	386
North America	565	515	480	503	496	472	495	513	530
China	435	320	320	312	308	293	308	319	330
Japan	635	625	610	610	602	572	601	623	644
Rest of the world	540	585	525	571	564	536	562	583	603
Total	2325	2075	1885	2025	2000	1900	1995	2067	2137
Total palladium demand	7845	7815	7265	9195	7760	9080	9123	9749	10340
Supply									
Mine supply									
Southern Africa	2900	2570	2550	2860	2825	2523	2625	2733	2822
Russia	3050	2700	2675	2720	2705	2600	2650	2650	2650
North America	990	910	755	590	900	890	870	980	1050
Rest of world	150	170	160	185	155	180	180	180	180
Total	7090	6350	6140	6355	6585	6193	6325	6543	6702
Stock sales									
Russia	1490	960	960	1000	775	750	750	750	750
Total stock sales	1490	960	960	1000	775	750	750	750	750
Auto catalyst recycling									
Europe	300	310	330	335	385	373	396	420	445
North America	35	75	55	80	70	84	92	100	108
China	590	660	480	790	1050	1208	1292	1370	1438
Japan	20	30	35	30	35	53	60	69	80
Rest of the world	70	65	65	75	115	127	145	157	170
Total	1015	1140	965	1310	1655	1844	1986	2115	2240
Total palladium supply	9595	8450	8065	8665	9015	8787	9062	9409	9692
Supply-demand surplus/(deficit)	1750	635	800	-530	1255	-292	-62	-341	-648

Source: Johnson Matthey, Citi Research estimates

Palladium: Base case

Figure 67. Citi palladium supply-demand outlook under base case scenario (000 ounces)

	2007	2008	2009	2010	2011	2012F	2013F	2014F	2015F
Demand									
Auto catalysts									
Europe	920	1005	995	1330	1440	1426	1436	1499	1638
North America	1695	1290	1020	1355	1475	1711	1756	2036	2185
China	325	390	685	1005	1115	1347	1493	1646	1779
Japan	820	885	590	820	665	801	774	766	765
Rest of the world	785	895	760	1070	1335	1498	1611	1723	1821
Total	4545	4465	4050	5580	6030	6783	7070	7671	8187
Jewellery									
Europe	40	45	50	65	60	55	58	59	60
North America	55	60	60	65	45	43	45	46	48
China	705	740	560	360	305	275	261	269	277
Japan	125	115	80	75	70	64	62	62	66
Rest of the world	25	25	25	30	25	25	24	24	25
Jewellery recycled	235	130	70	100	210	250	236	223	210
Net jewellery demand	715	855	705	495	295	211	214	237	265
Investment									
Europe	280	370	525	-5	-35	65	78	62	56
North America	-20	50	95	1090	-535	112	135	115	103
Japan	0	0	0	10	5	8	6	6	6
Rest of the world	0	0	5	0	0	0	0	0	0
Total	260	420	625	1095	-565	185	219	183	165
Industrial									
Europe	465	375	345	366	361	343	361	374	386
North America	565	515	480	503	496	472	495	513	530
China	435	320	320	312	308	293	308	319	330
Japan	635	625	610	610	602	572	601	623	644
Rest of the world	540	585	525	571	564	536	562	583	603
Total	2325	2075	1885	2025	2000	1900	1995	2067	2137
Total palladium demand	7845	7815	7265	9195	7760	9080	9497	10158	10754
Supply									
Mine supply									
Southern Africa	2900	2570	2550	2860	2825	2523	2625	2733	2822
Russia	3050	2700	2675	2720	2705	2600	2650	2650	2650
North America	990	910	755	590	900	890	870	980	1050
Rest of world	150	170	160	185	155	180	180	180	180
Total	7090	6350	6140	6355	6585	6193	6325	6543	6702
Stock sales									
Russia	1490	960	960	1000	775	750	750	750	750
Total stock sales	1490	960	960	1000	775	750	750	750	750
Auto catalyst recycling									
Europe	300	310	330	335	385	373	418	443	470
North America	35	75	55	80	70	84	101	109	118
China	590	660	480	790	1050	1208	1352	1434	1505
Japan	20	30	35	30	35	53	63	76	87
Rest of the world	70	65	65	75	115	127	152	164	177
Total	1015	1140	965	1310	1655	1844	2086	2225	2357
Total palladium supply	9595	8450	8065	8665	9015	8787	9162	9519	9809
Supply-demand surplus/(deficit)	1750	635	800	-530	1255	-292	-336	-639	-946

Source: Johnson Matthey, Citi Research estimates

Palladium: Best case

Figure 68. Citi palladium supply-demand outlook under best case scenario (000 ounces)

	2007	2008	2009	2010	2011	2012F	2013F	2014F	2015F
Demand									
Auto catalysts									
Europe	920	1005	995	1330	1440	1426	1526	1614	1765
North America	1695	1290	1020	1355	1475	1711	1823	2100	2248
China	325	390	685	1005	1115	1347	1551	1764	1900
Japan	820	885	590	820	665	801	811	822	854
Rest of the world	785	895	760	1070	1335	1498	1635	1787	1878
Total	4545	4465	4050	5580	6030	6783	7346	8088	8645
Jewellery									
Europe	40	45	50	65	60	55	56	57	58
North America	55	60	60	65	45	43	44	45	46
China	705	740	560	360	305	275	247	254	262
Japan	125	115	80	75	70	64	61	61	65
Rest of the world	25	25	25	30	25	25	24	24	24
Jewellery recycled	235	130	70	100	210	250	236	223	210
Net jewellery demand	715	855	705	495	295	211	196	219	246
Investment									
Europe	280	370	525	-5	-35	65	111	89	80
North America	-20	50	95	1090	-535	112	185	158	142
Japan	0	0	0	10	5	8	8	8	8
Rest of the world	0	0	5	0	0	0	0	0	0
Total	260	420	625	1095	-565	185	304	254	229
Industrial									
Europe	465	375	345	366	361	343	361	374	386
North America	565	515	480	503	496	472	495	513	530
China	435	320	320	312	308	293	308	319	330
Japan	635	625	610	610	602	572	601	623	644
Rest of the world	540	585	525	571	564	536	562	583	603
Total	2325	2075	1885	2025	2000	1900	1995	2067	2137
Total palladium demand	7845	7815	7265	9195	7760	9080	9840	10627	11257
Supply									
Mine supply									
Southern Africa	2900	2570	2550	2860	2825	2523	2625	2733	2822
Russia	3050	2700	2675	2720	2705	2600	2650	2650	2650
North America	990	910	755	590	900	890	870	980	1050
Rest of world	150	170	160	185	155	180	180	180	180
Total	7090	6350	6140	6355	6585	6193	6325	6543	6702
Stock sales									
Russia	1490	960	960	1000	775	750	750	750	750
Total stock sales	1490	960	960	1000	775	750	750	750	750
Auto catalyst recycling									
Europe	300	310	330	335	385	373	429	451	469
North America	35	75	55	80	70	84	109	118	127
China	590	660	480	790	1050	1208	1389	1458	1516
Japan	20	30	35	30	35	53	66	79	91
Rest of the world	70	65	65	75	115	127	164	178	192
Total	1015	1140	965	1310	1655	1844	2157	2283	2395
Total palladium supply	9595	8450	8065	8665	9015	8787	9233	9577	9847
Supply-demand surplus/(deficit)	1750	635	800	-530	1255	-292	-608	-1051	-1410

Source: Johnson Matthey, Citi Research estimates

Platinum: Citi Supply Assumptions

Figure 69. Citi platinum supply assumptions (000 ounces)

	2011	2012F	2013F	2014F	2015F	2016F	2017F	2018F	2019F	2020F
Current mine supply										
Anglo Platinum	2500	2097	2150	2200	2200	2200	2200	2200	2200	2200
Implats	1299	1107	1172	1244	1221	1293	1348	1348	1348	1348
Lonmin	714	690	680	710	750	750	750	750	750	750
Aquarius	96	51	18	18	18	18	18	18	18	18
Northam	152	175	178	185	185	185	185	185	185	185
Russia	835	790	798	767	752	737	737	737	737	737
USA	350	340	381	376	371	366	366	366	366	366
Other	440	480	448	475	498	498	498	498	498	498
Total current mine supply	6386	5730	5824	5975	5994	6046	6101	6101	6101	6101
Additional mine supply in construction										
Anglo Platinum	0	0	0	0	0	0	0	0	0	0
Implats	0	5	43	71	75	93	93	93	93	93
Lonmin	0	0	0	0	0	0	0	0	0	0
Aquarius	0	0	0	0	0	0	0	0	0	0
Northam	0	0	0	45	98	98	98	98	98	98
Russia	0	0	0	0	0	0	0	0	0	0
USA	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0
Total additional supply in construction	0	5	43	116	173	191	191	191	191	191
Additional mine supply in feasibility										
Anglo Platinum	0	0	0	0	0	0	0	0	0	0
Implats	0	0	0	0	0	0	100	200	245	245
Lonmin	0	0	0	0	0	0	0	0	0	0
Aquarius	0	0	0	0	0	0	0	0	0	0
Northam	0	0	0	0	0	14	55	69	69	69
Russia	0	0	0	0	0	0	0	0	0	0
USA	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0
Total additional supply in feasibility	0	0	0	0	0	14	155	269	314	314
Autocat recycling	1225	1179	1335	1426	1513	1602	1684	1772	1865	1964
Total platinum supply	7705	6914	7203	7516	7748	7853	8131	8332	8471	8570

Source: Company data, Citi Research estimates

Palladium: Citi Supply Assumptions

Figure 70. Citi palladium supply assumptions (000 ounces)

	2011	2012F	2013F	2014F	2015F	2016F	2017F	2018F	2019F	2020F
Current mine supply										
Anglo Platinum	1179	1049	1075	1100	1100	1100	1100	1100	1100	1100
Implats	1071	921	939	958	977	997	1017	1037	1058	1079
Lonmin	338	345	340	355	375	375	375	375	375	375
Aquarius	39	6	9	9	9	9	9	9	9	9
Northam	147	147	174	185	185	185	185	185	185	185
Nkomati	55	55	55	55	55	55	55	55	55	55
Russia	2705	2600	2650	2650	2650	2650	2650	2650	2650	2650
USA	900	890	870	980	1050	1050	1050	1050	1050	1050
Other	155	180	180	180	180	180	180	180	180	180
Total current mine supply	6589	6192	6293	6472	6582	6601	6621	6641	6662	6683
Additional mine supply in construction										
Anglo Platinum	0	0	0	0	0	0	0	0	0	0
Implats	0	2	33	53	56	70	70	70	70	70
Lonmin	0	0	0	0	0	0	0	0	0	0
Aquarius	0	0	0	0	0	0	0	0	0	0
Northam	0	0	0	18	39	39	39	39	39	39
Russia	0	0	0	0	0	0	0	0	0	0
USA	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0
Total additional supply in construction	0	2	33	71	95	109	109	109	109	109
Additional mine supply in feasibility										
Anglo Platinum	0	0	0	0	0	0	0	0	0	0
Implats	0	0	0	0	0	0	75	150	184	184
Lonmin	0	0	0	0	0	0	0	0	0	0
Aquarius	0	0	0	0	0	0	0	0	0	0
Northam	0	0	0	0	0	6	22	28	28	28
Russia	0	0	0	0	0	0	0	0	0	0
USA	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0
Total additional supply in feasibility	0	0	0	0	0	6	97	178	211	211
Stock sales										
Russia	775	750	750	750	750	750	750	750	750	750
Total stock sales	775	750	750	750	750	750	750	750	750	750
Autocat recycling	1655	1844	2086	2225	2357	2492	2616	2747	2886	3034
Total palladium supply	9015	8787	9162	9519	9809	9958	10192	10424	10618	10787

Source: Company data, Citi Research estimates

Notes

Notes

Appendix A-1

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