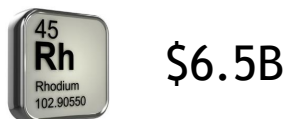
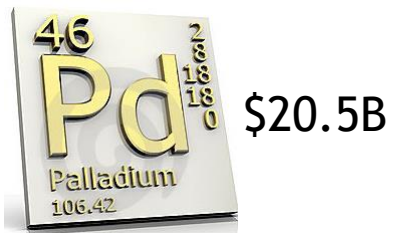
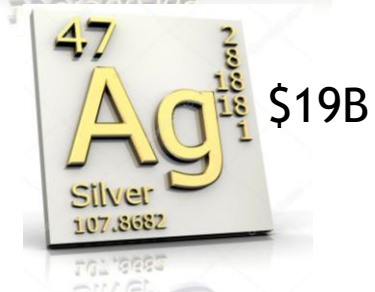


## Platinum Group Metals \$36B



# Precious Metals 101

44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.9055	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.8682
76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.222	78 <b>Pt</b> Platinum 195.084	79 <b>Au</b> Gold 196.9666

January 3, 2020

By: Precious Metals Commodity Management LLC

# \$300B Precious Metals Markets

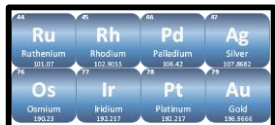
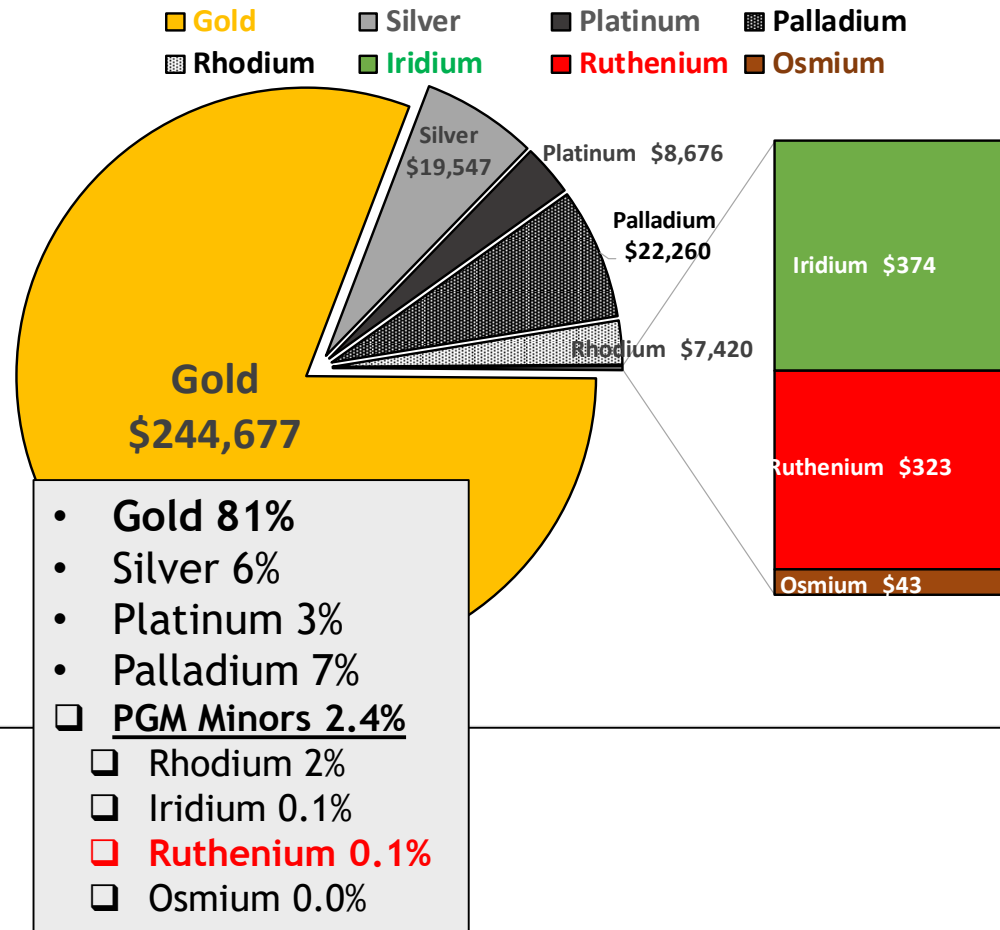
Minor PGM's only 2.4% (\$7.3B market)



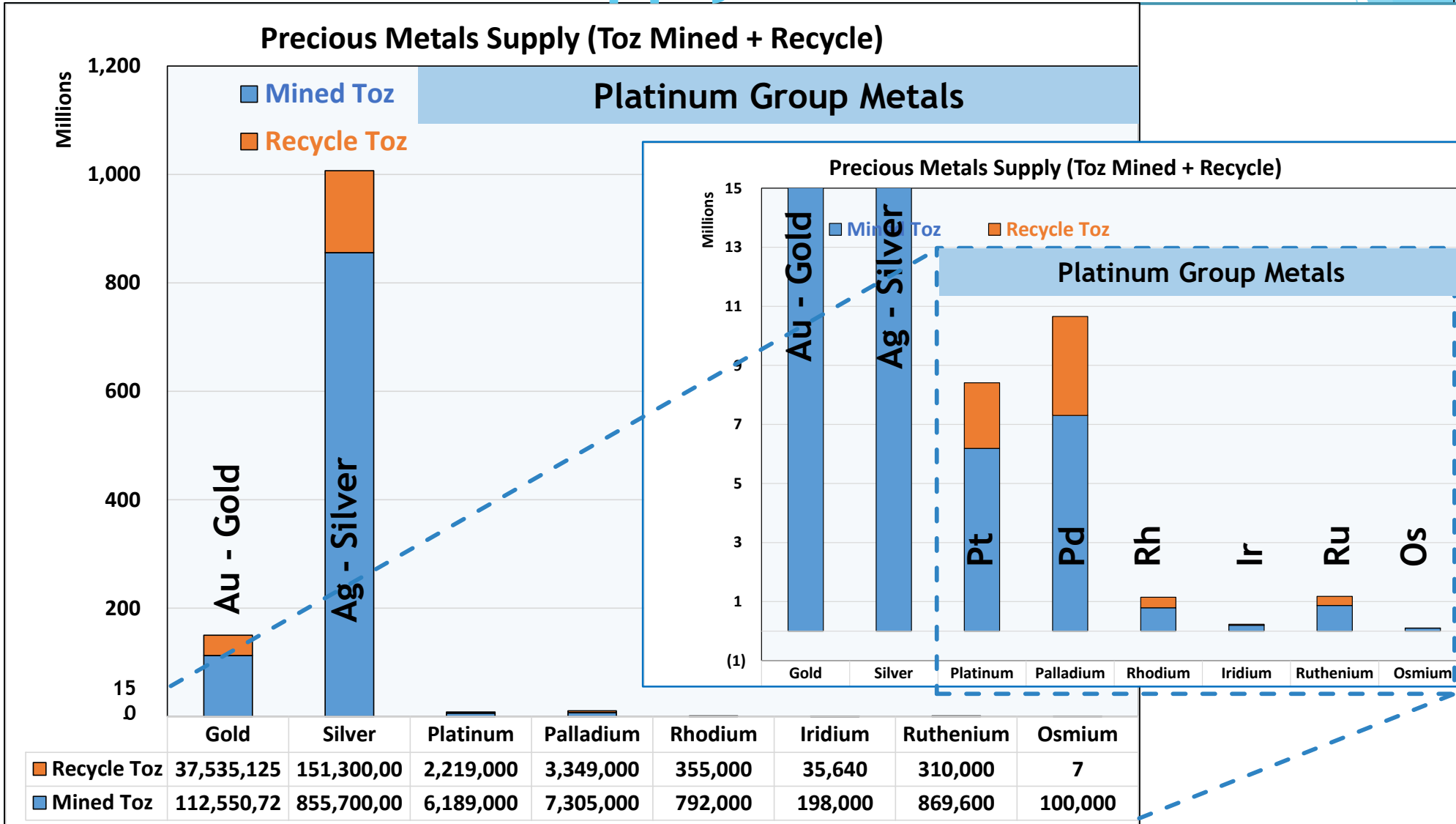
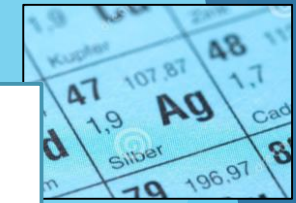
## Precious Metals Market Overview

	In Millions USD\$		TAM - Precious Metals Total Avail.	
	Mined Toz	Recycle Toz		
Gold	112,550,720	37,535,125	\$ 244,677	\$264,224
Silver	855,700,000	151,300,000	\$ 19,547	
Platinum	6,189,000	2,219,000	\$ 8,676	\$ 30,937
Palladium	7,305,000	3,349,000	\$ 22,260	
Rhodium	792,000	355,000	\$ 7,420	\$ 8,160
Iridium	198,000	35,640	\$ 374	
Ruthenium	869,600	310,000	\$ 323	
Osmium	100,000	7	\$ 43	
			\$ 39,097	
			\$ 303,320	
<b>TOTAL</b>			<b>\$ 303,320</b>	

## 2019 Precious Metals TAM



# Precious Metals Supply

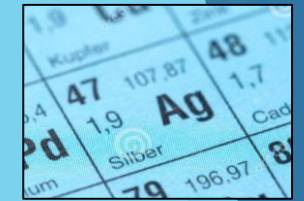


Ru Ruthenium 44 101.07	Rh Rhodium 45 102.9053	Pd Palladium 46 106.42	Ag Silver 47 107.87
Os Osmium 76 190.23	Ir Iridium 77 192.222	Pt Platinum 78 195.084	Au Gold 79 196.967

Prepared by Precious Metals Commodity Management

Jan. 3, 2020

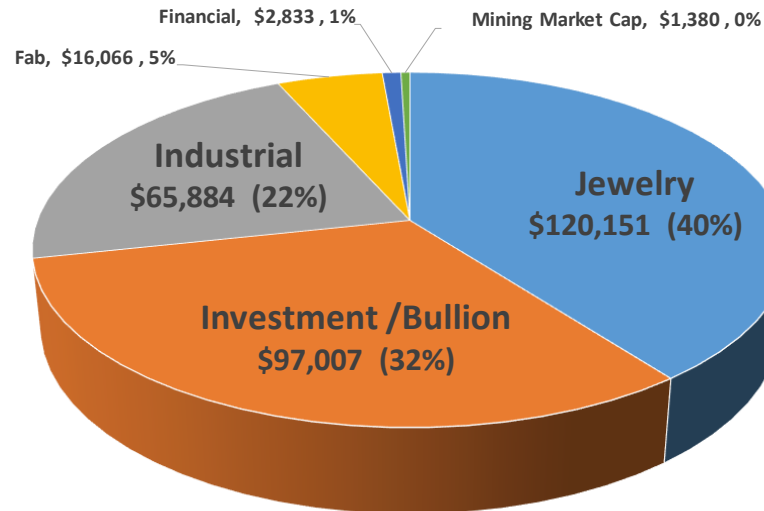
# \$303B Precious Metals Markets



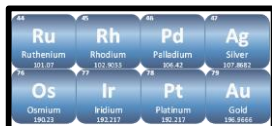
## Precious Metals Market Overview

	In Millions USD\$									TAM - Precious Metals Total Avail.
	Mined Toz	Recycle Toz	Jewelry	Investment /Bullion	Industrial	Fab	Financial	Mining Market Cap		
<b>Gold</b>	112,550,720	37,535,125	\$ 109,744	\$ 89,135	\$ 29,702	\$ 12,699	\$ 2,286	\$ 1,111	\$ 244,677	\$264,224
<b>Silver</b>	855,700,000	151,300,000	\$ 3,836	\$ 4,139	\$ 10,202	\$ 1,050	\$ 182	\$ 139	\$ 19,547	
<b>Platinum</b>	6,189,000	2,219,000	\$ 2,182	1,820	\$ 4,014	\$ 475	\$ 83	\$ 102	\$ 8,676	\$ 30,937
<b>Palladium</b>	7,305,000	3,349,000	\$ 4,320	\$ 1,665	\$ 14,684	\$ 1,360	\$ 207	\$ 25	\$ 22,260	
<b>Rhodium</b>	792,000	355,000	\$ 69	\$ 241	\$ 6,601	\$ 438	\$ 69	\$ 2	\$ 7,420	\$ 8,160
<b>Iridium</b>	198,000	35,640	-	\$ 3	\$ 345	\$ 22	\$ 3	\$ 0	\$ 374	
<b>Ruthenium</b>	869,600	310,000	-	\$ 3	\$ 298	\$ 19	\$ 3	\$ 0	\$ 323	
<b>Osmium</b>	100,000	7	-	\$ 0	\$ 40	\$ 3	\$ 0	\$ 0	\$ 43	
									PGM's	
									Precious Metals	\$ 303,320
			\$ 120,151	\$ 97,007	\$ 65,884	\$ 16,066	\$ 2,833	\$ 1,380	<b>TOTAL</b>	<b>\$ 303,320</b>
			39.6%	32.0%	21.7%	5.3%	0.9%	0.5%		

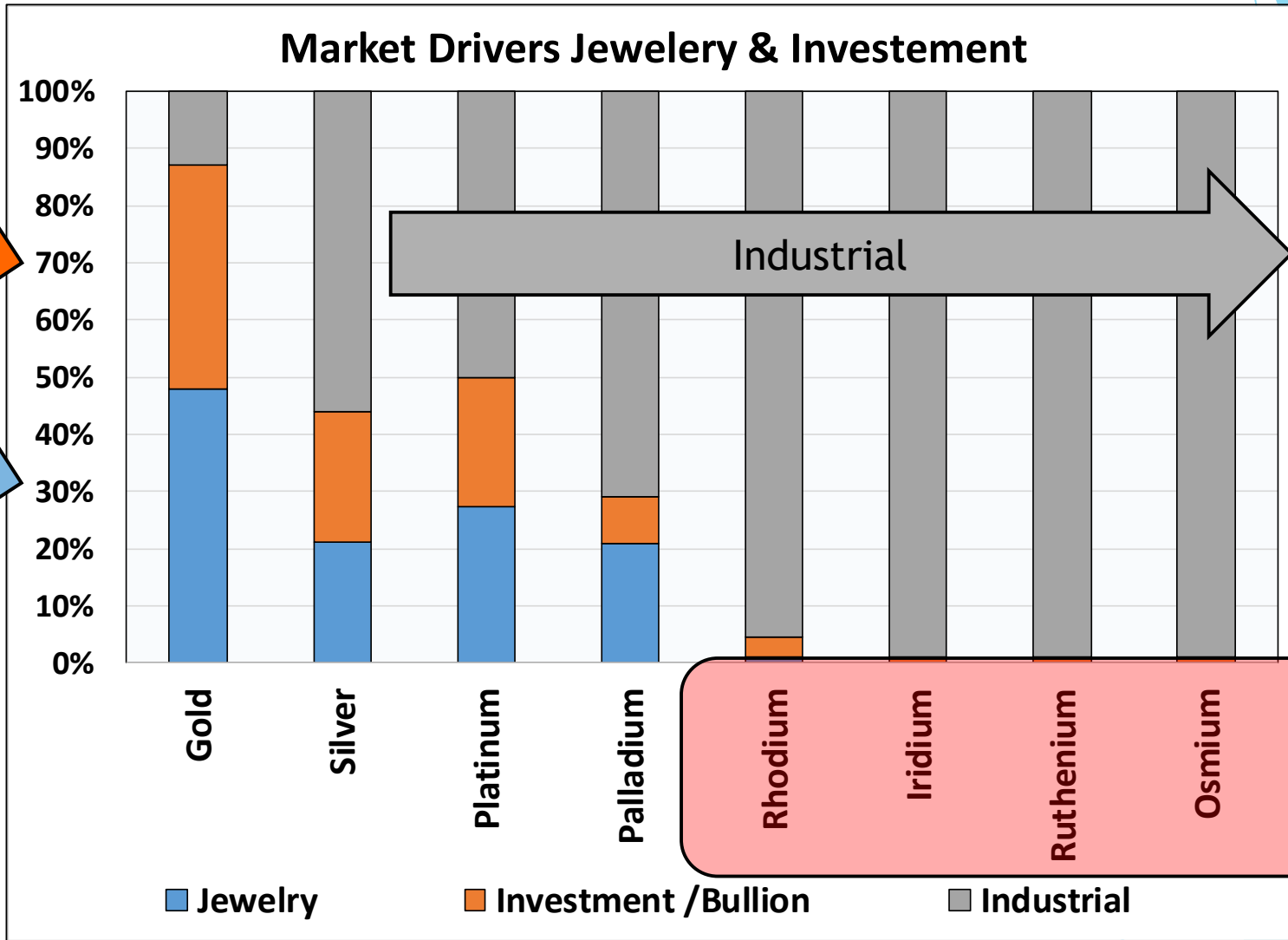
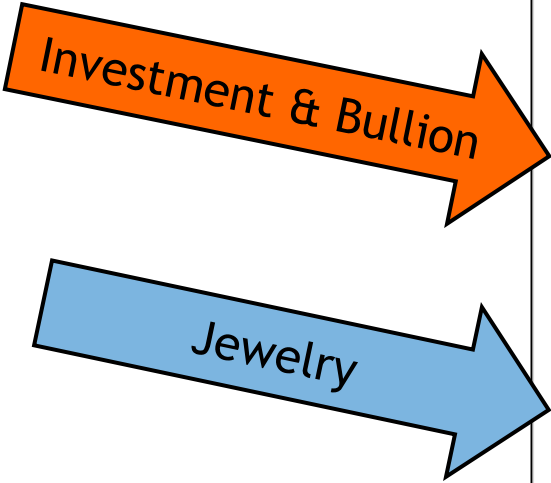
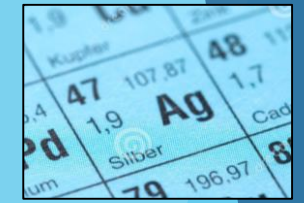
### 2019 Precious Metals TAM



- Jewelry 39%
- Investment/Bullion 32%
- ▣ **Industrial Prod. 23%**
- Fab 5%
- Financial Serv. 1%
- Mining Mkt Cap 0.5%

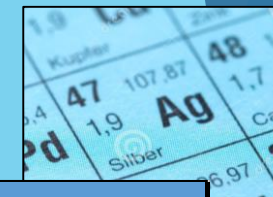


# Precious Metals Market Drivers 2019



Ru Ruthenium 44 101.07	Rh Rhodium 45 102.9055	Pd Palladium 46 106.42	Ag Silver 47 107.8642
Os Osmium 76 190.23	Ir Iridium 77 192.222	Pt Platinum 78 195.084	Au Gold 79 196.9665

# Precious Metals Key Facts

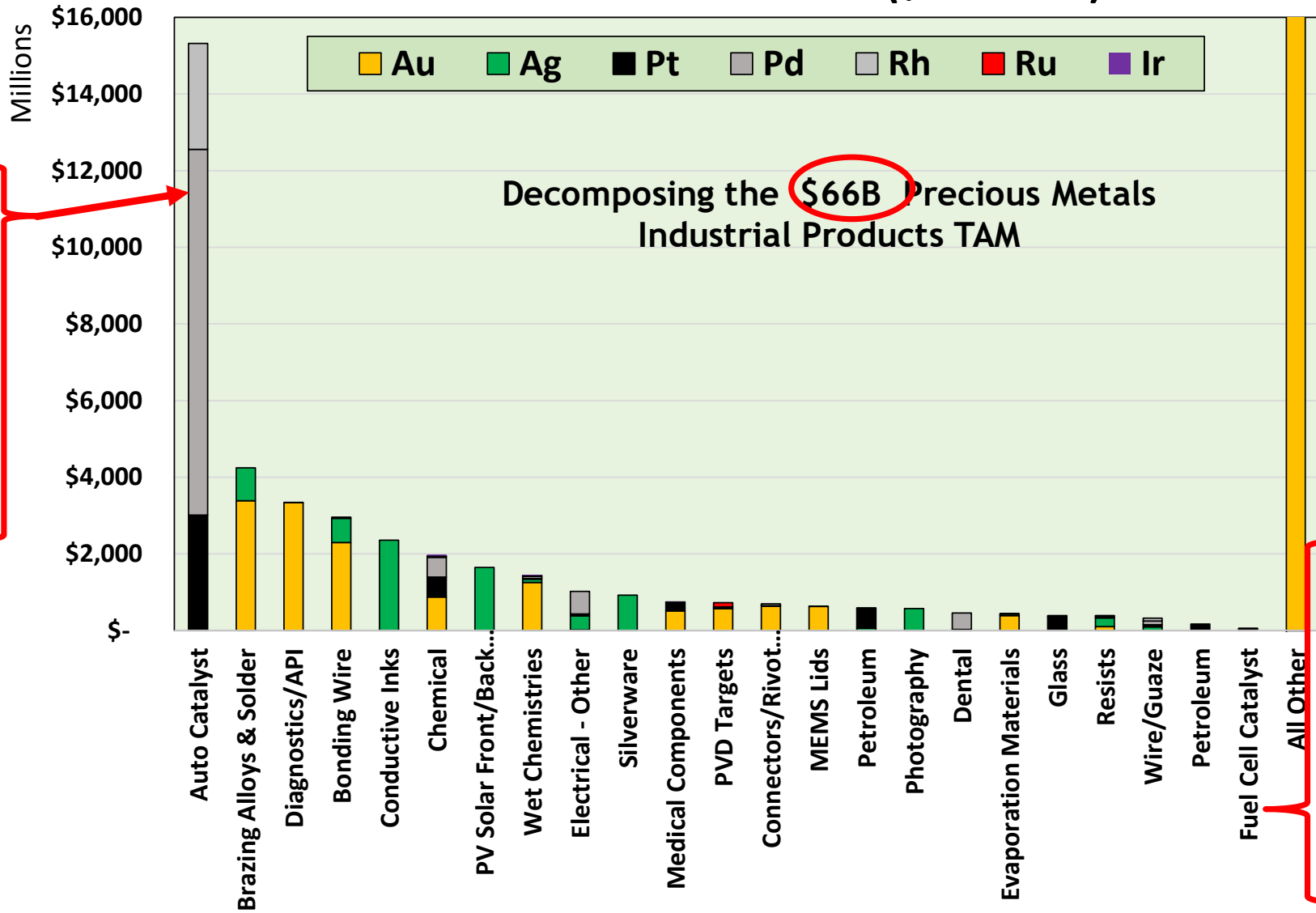


	PGM's - Platinum Group Metals							
	Gold Au	Silver Ag	Platinum Pt	Palladium Pd	Minor PGM's			
					Rhodium Rh	Iridium Ir	Ruthenium Ru	Osmium Os
Fix Dec 31 (\$/Toz)	1,513 \$/Toz	17.90 \$/Toz	955 \$/Toz	1,911 \$/Toz	6,025 \$/Toz	1,490 \$/Toz	255 \$/Toz	400 \$/Toz
Market TAM (M's \$)	\$ 245 B	\$ 20 B	\$ 9 B	\$ 22 B	\$ 7 B	\$ 374 M	\$ 323 M	\$ 43 M
Supply Outlook	Modest decline	Declining -3%	Increasing	Increasing	+ Recycle - Mining	Declining	Declining	Declining
			Lower Cost Russian + N.American coming		Oldest, Deepest, Most Expensive S.A. mines go EOL next 15 years			
Top Mining	China (13%) Australia (10%) Russia (9%) USA (7%) <b>All Others (64%)</b>	Mexico (23%) Peru (16%) China (13%) Poland (5%) <b>All Others (43%)</b>	<b>S. Africa (73% -)</b> <b>Russia (11% ++)</b> Zimbabwe (7% +) N. America (6% +) All Others (3%)	<b>Russia (38% ++)</b> <b>S. Africa (36% -)</b> <b>N. America (15% +)</b> Zimbabwe (5% +) All Others (6%)	<b>S. Africa (81% -)</b> Russia (9% ++) Zimbabwe (5% +) N. America (3% +) All Others (1%)	S. Africa (96% -) Zimbabwe (3% +) All Others (1%)	S. Africa (96% -) Zimbabwe (3% +) All Others (1%)	S. Africa (96% -) Zimbabwe (3% +) All Others (1%)
Top 3 Demand	<b>51% Jewelry</b> <b>41% Investment</b> <b>8% Industrial</b>	<b>58% Industrial</b> <b>23% Investment</b> <b>21% Jewelry</b>	<b>60% Industrial</b> <b>30% Jewelry</b> <b>10% Investment</b>	<b>84% Industrial</b> <b>2% Jewelry</b> <b>Investment</b>	<b>100% Industrial</b>	<b>100% Industrial</b>	<b>100% Industrial</b>	<b>100% Industrial</b>
	Electronics Medical Various	Electronics Solar PV Ethelyne Oxide	AutoCat (37%) Electronics Catalyst	Auto Catalyst (82%) (especially gas) Other Catalyst	Auto Catalyst (90%+) Glass Prod. (4%) Catalyst	Crucibals Chlor-Alkali Electronics	Electronics Chlor-Alkali Chemical	Corrosion Resistance Ir/Os alloys Various
Demand Outlook	Investment Driven Demand Cycles	Growing use in Elect. Auto, and Solar PV	LT Demand from PEM Fuel Cells	Potential Li-O <sub>2</sub> Battery Material	Growing AutoCat	Growing Steady Demand	Growing Steady Demand	Unique Small App's





# 2018 Industrial Demand Pareto (\$M's USD)



90+% TWC Slurry Production

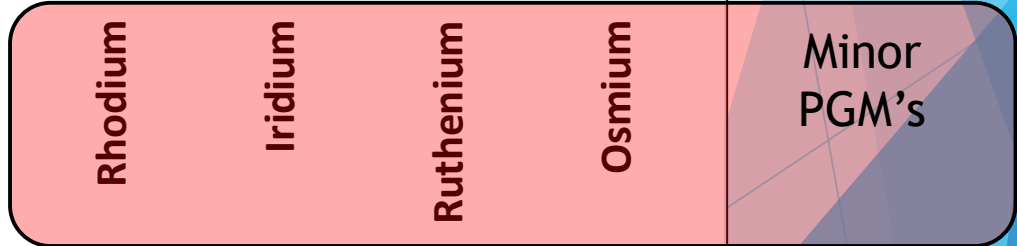
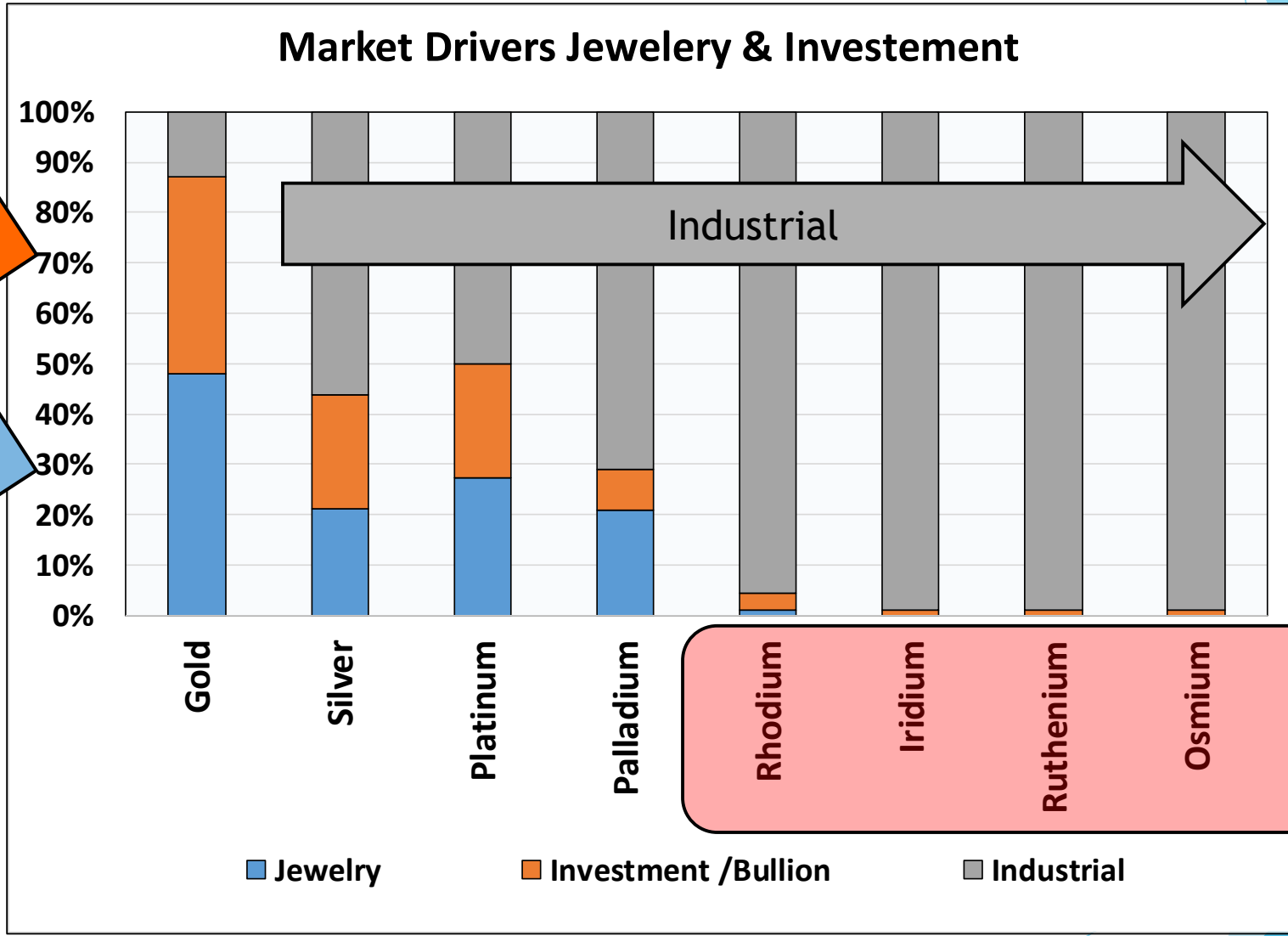
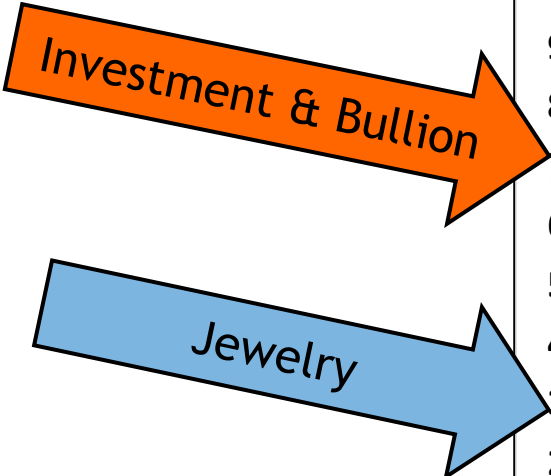
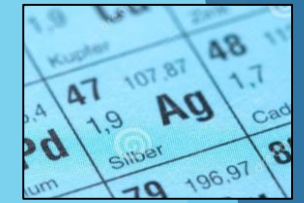


4 Big Industrial FC Catalyst Producers



Ru Ruthenium 44 101.07	Rh Rhodium 45 102.9053	Pd Palladium 46 106.42	Ag Silver 47 107.8642
Os Osmium 76 192.22	Ir Iridium 77 192.222	Pt Platinum 78 195.084	Au Gold 79 196.9665

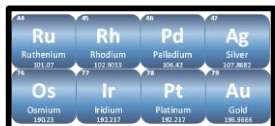
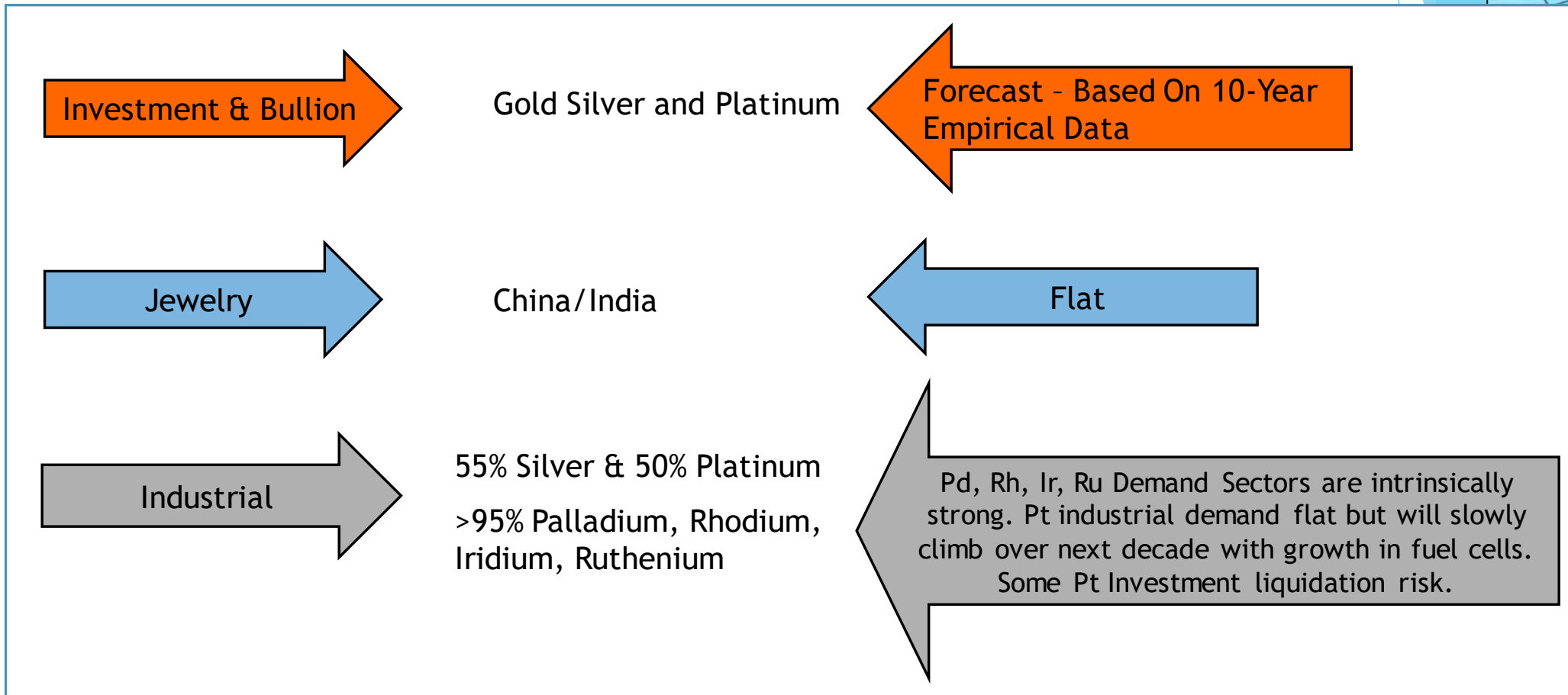
# Precious Metals Market Drivers 2019



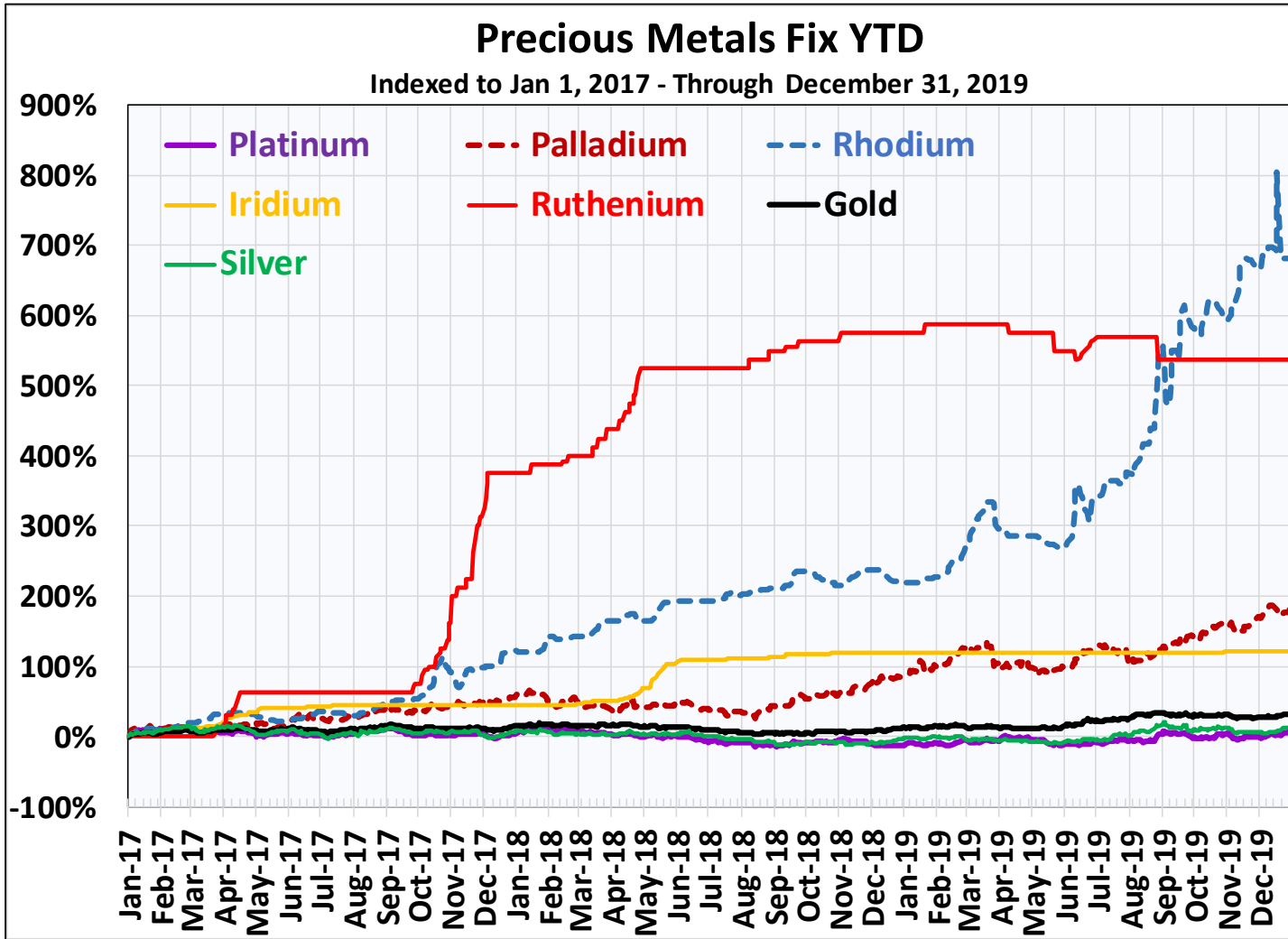
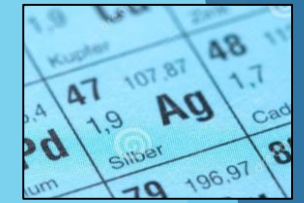
Ru Ruthenium 101.07	Rh Rhodium 102.9053	Pd Palladium 106.42	Ag Silver 107.8642
Os Osmium 190.23	Ir Iridium 192.222	Pt Platinum 195.084	Au Gold 196.9665



# Precious Metals Market Forecast



# Precious Metals 2017-19



Rhodium +682%

Ruthenium 538%

Palladium 182%

Iridium 121%

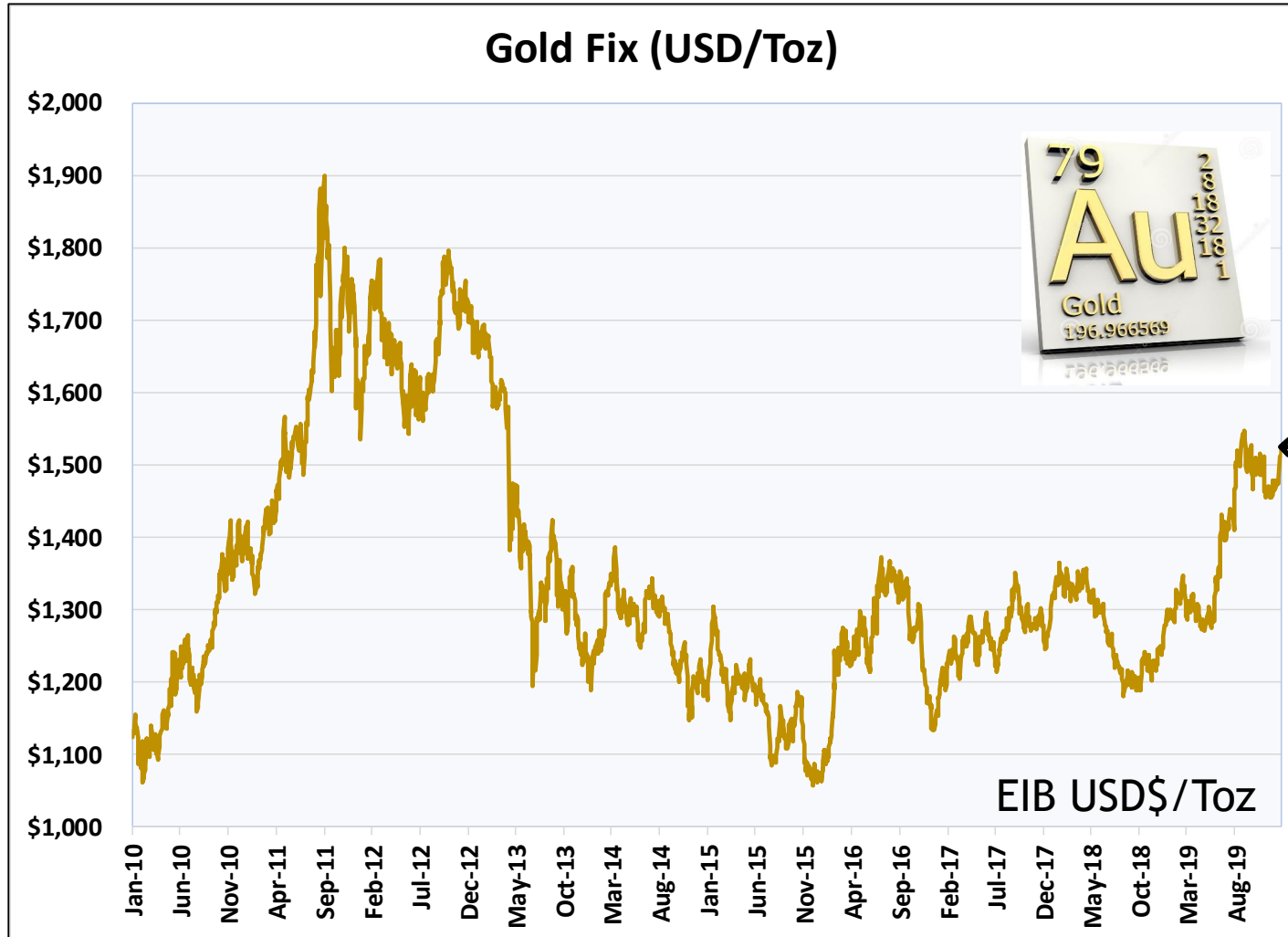
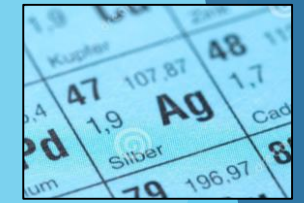
Gold +32%

Silver +13%

Platinum +8%

Ru Ruthenium 44 101.07	Rh Rhodium 45 102.9053	Pd Palladium 46 106.42	Ag Silver 47 107.8672
Os Osmium 76 192.22	Ir Iridium 77 192.222	Pt Platinum 78 195.084	Au Gold 79 196.9665

# 10-year Gold

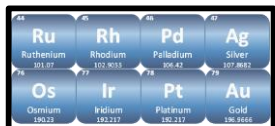


**Dec'20 Frcst**

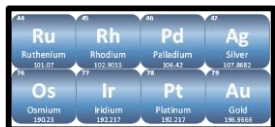
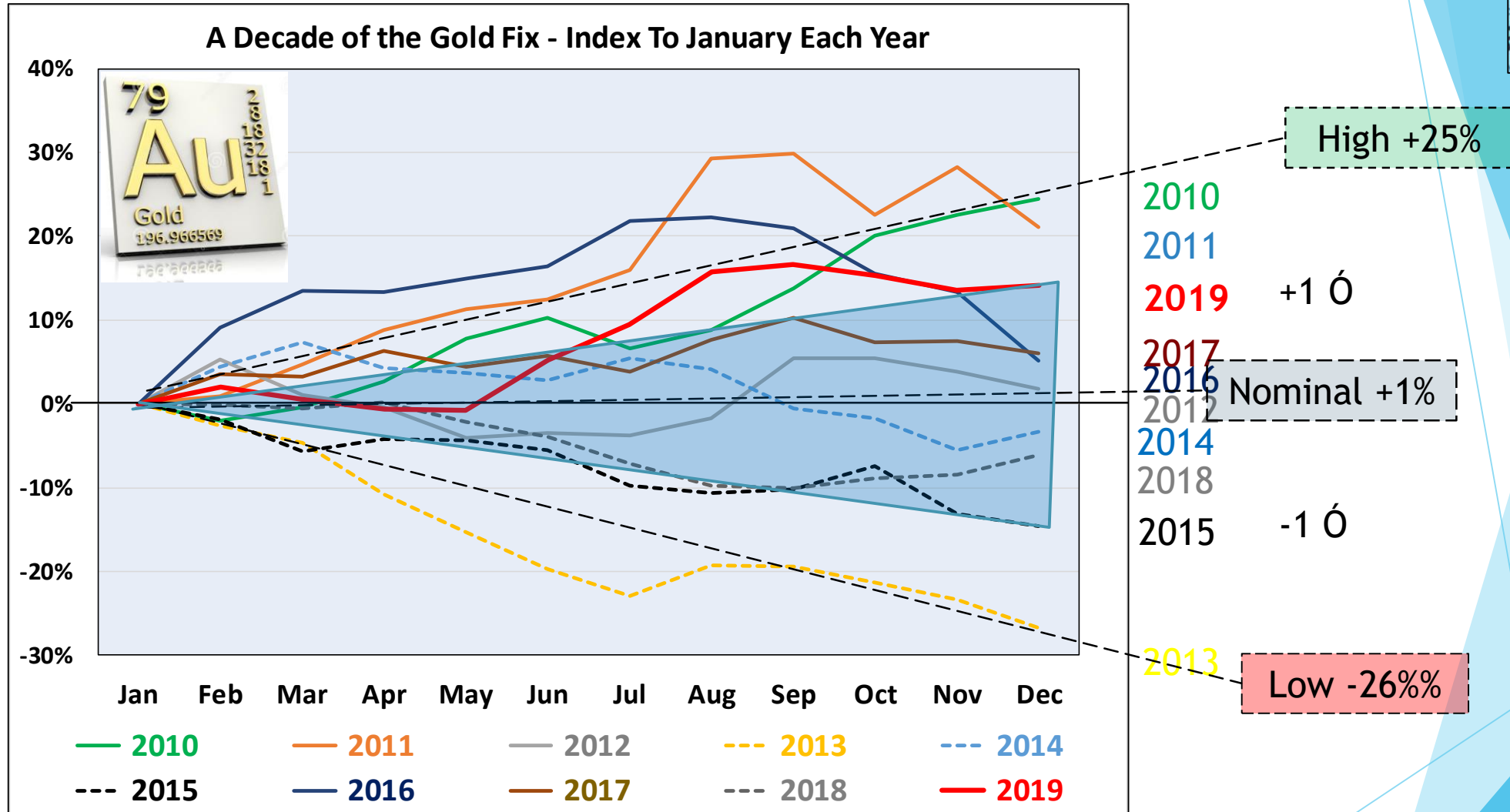
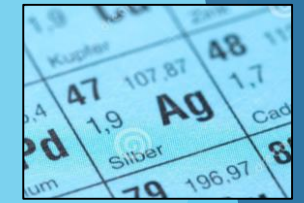
High \$1,774

Base \$1,533

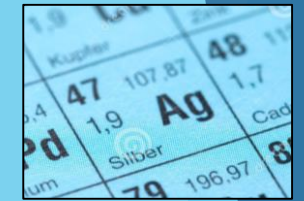
Low \$1,293



# Gold 2010-2019 Annual Growth



# 10-year Silver



47	107.87	48
Ag	1.7	
Silber		
79	196.97	8

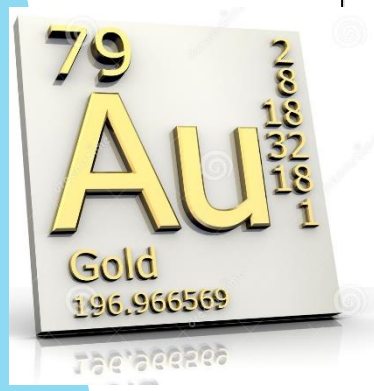


## Dec'20 Frcst

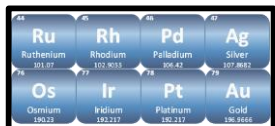
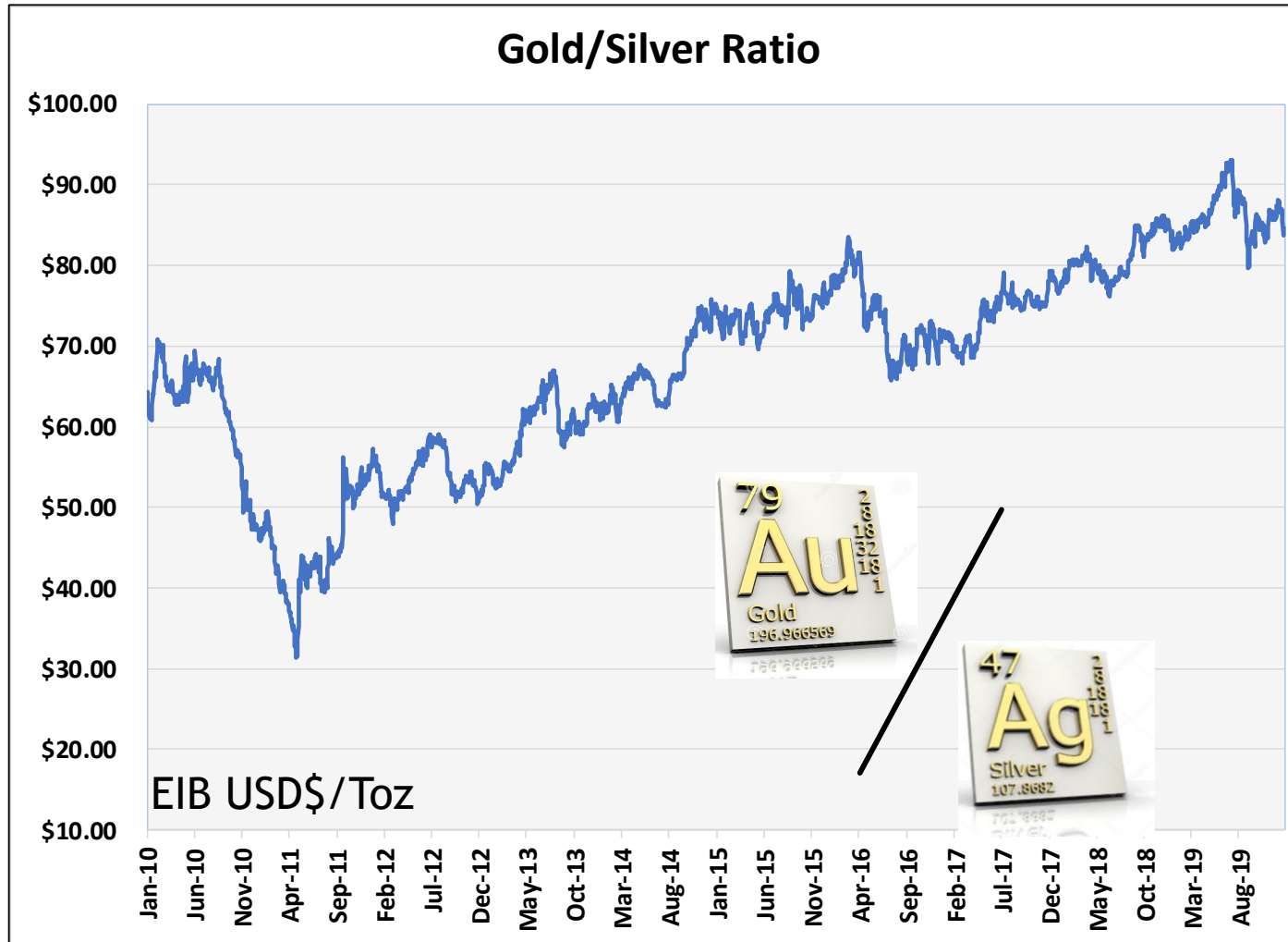
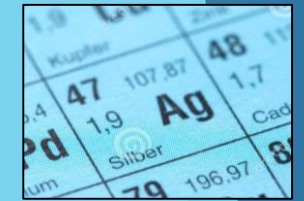
High \$22.60

Base \$17.73

Low \$12.75



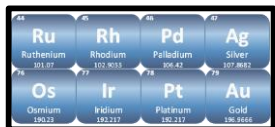
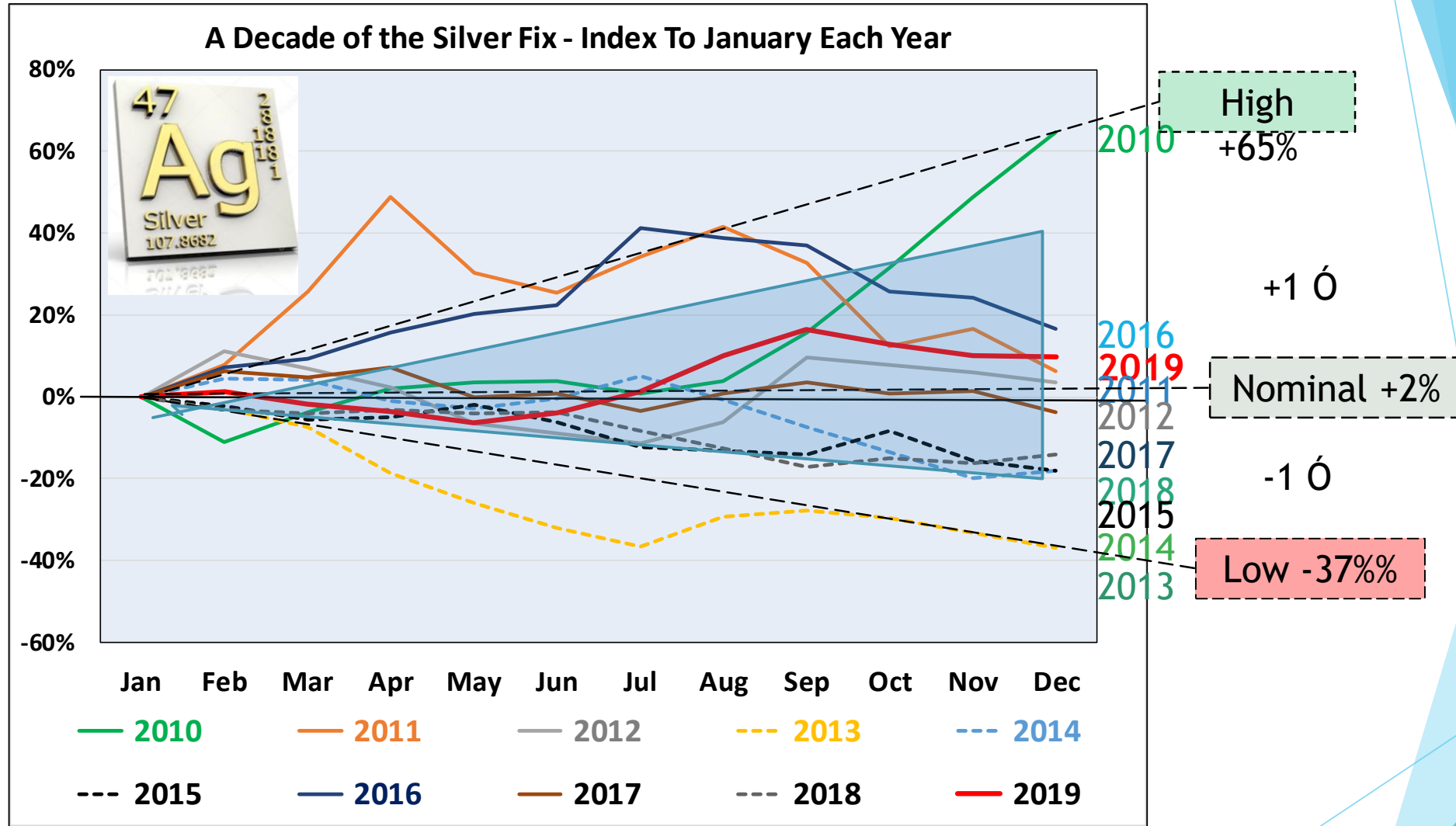
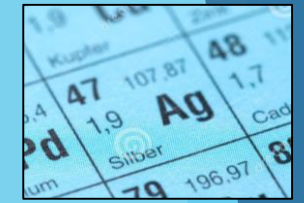
# 10-Year Gold/Silver Ratio



Prepared by Precious Metals Commodity Management

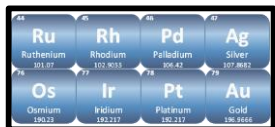
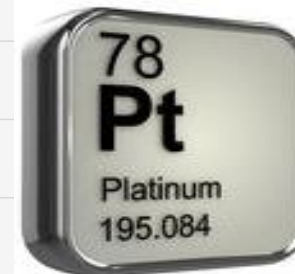
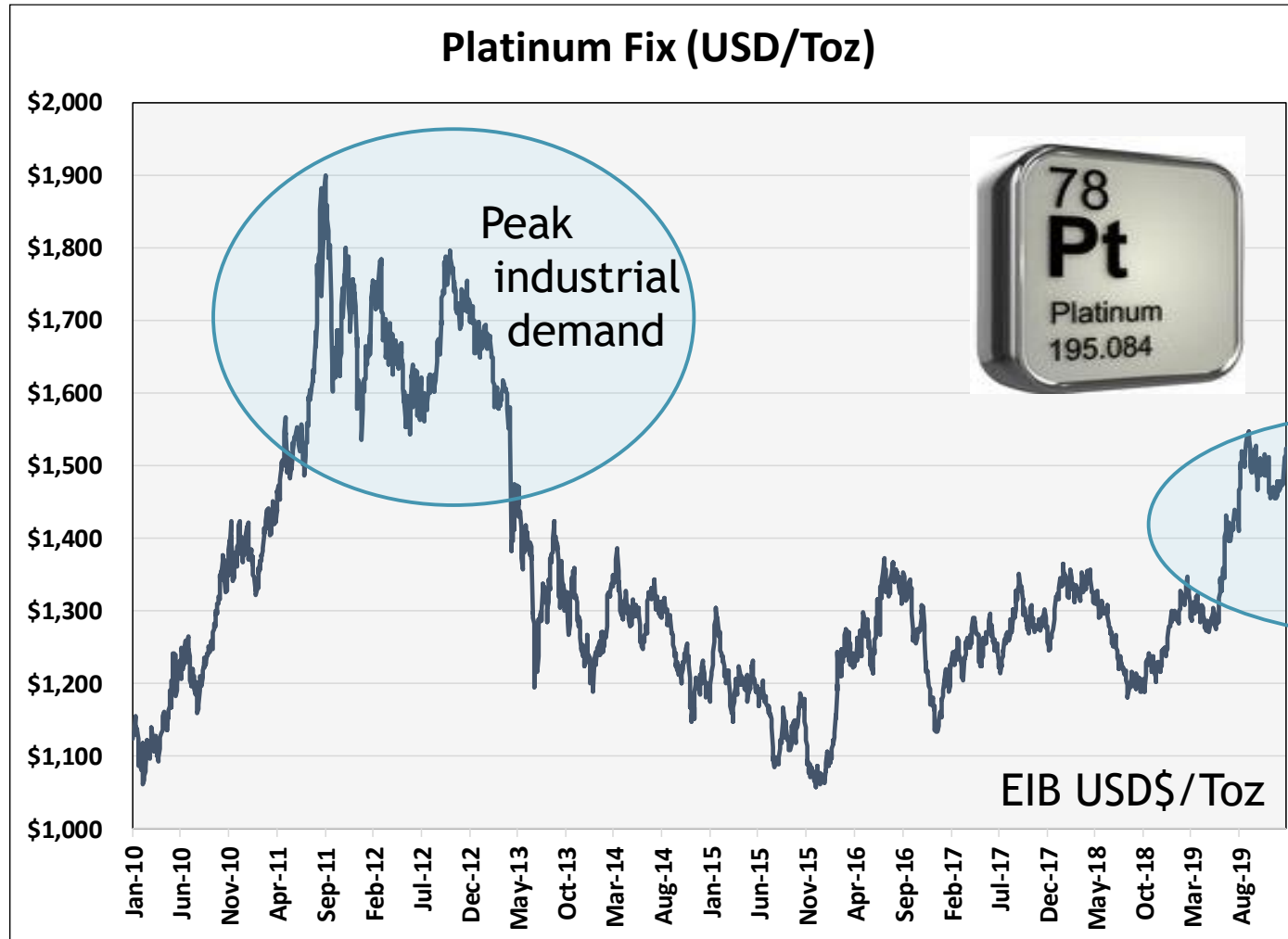
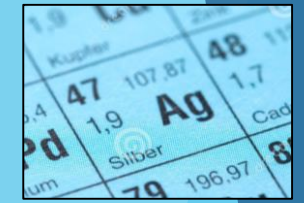
Jan. 3, 2020

# Silver 2010-2019 Annual Growth

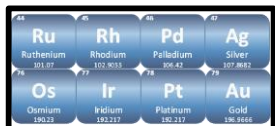
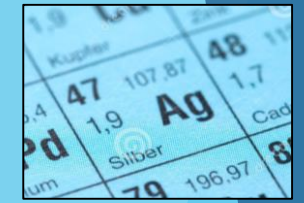
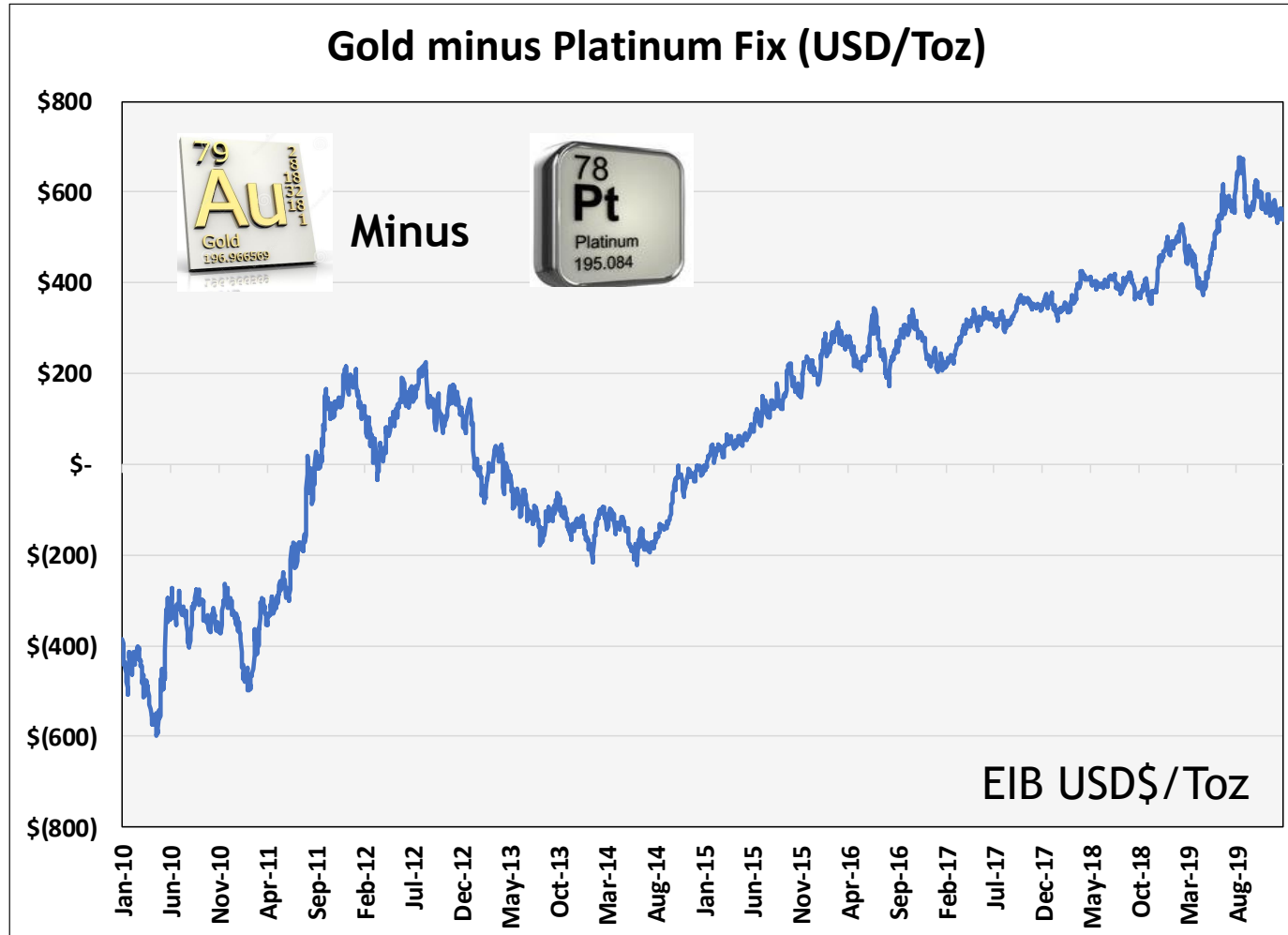




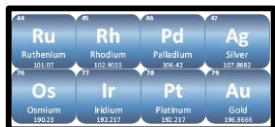
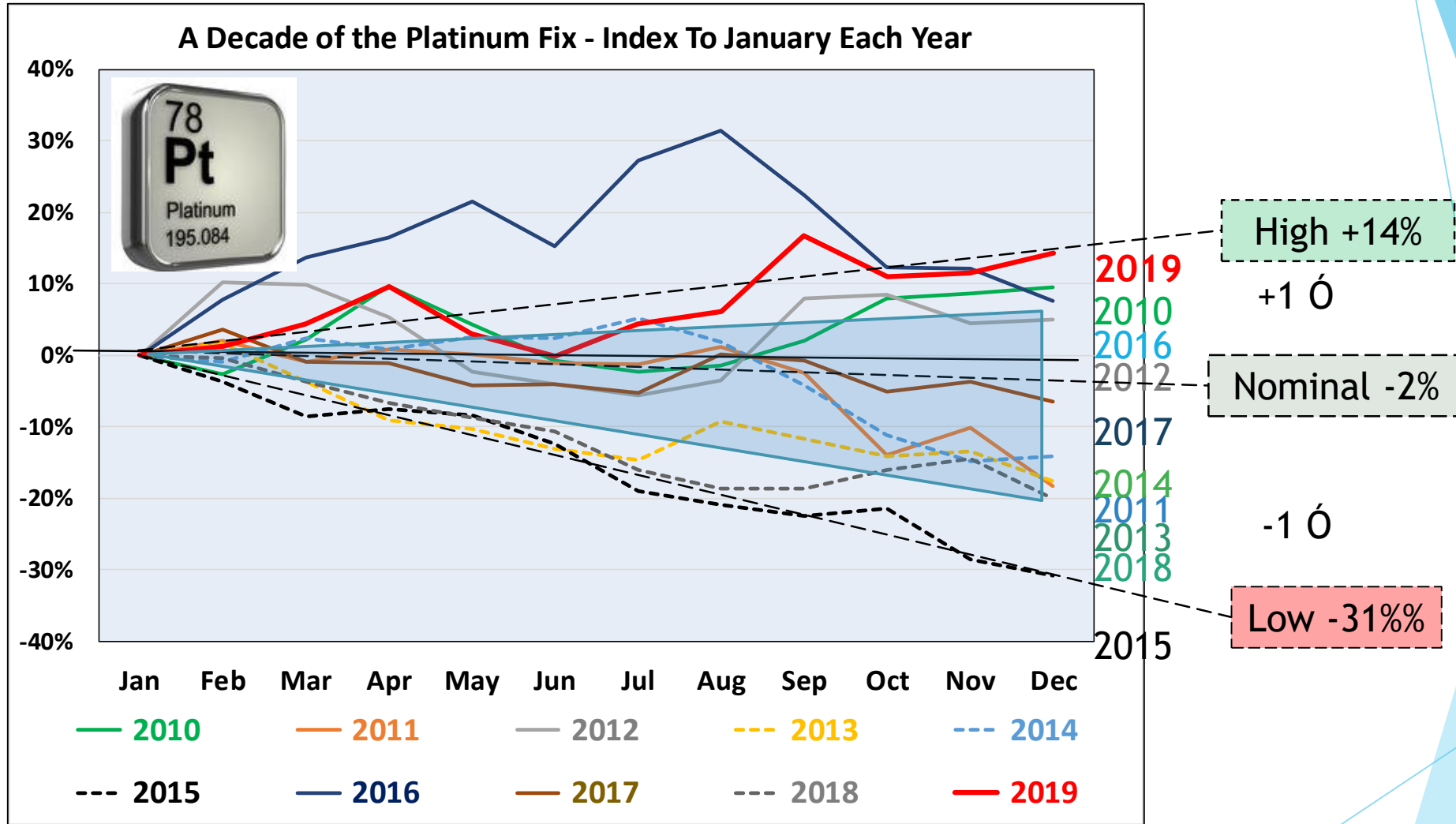
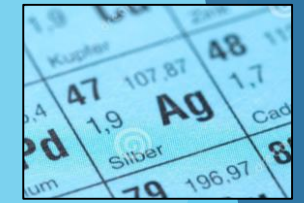
# 10-year Platinum



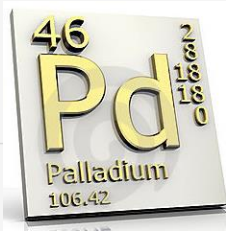
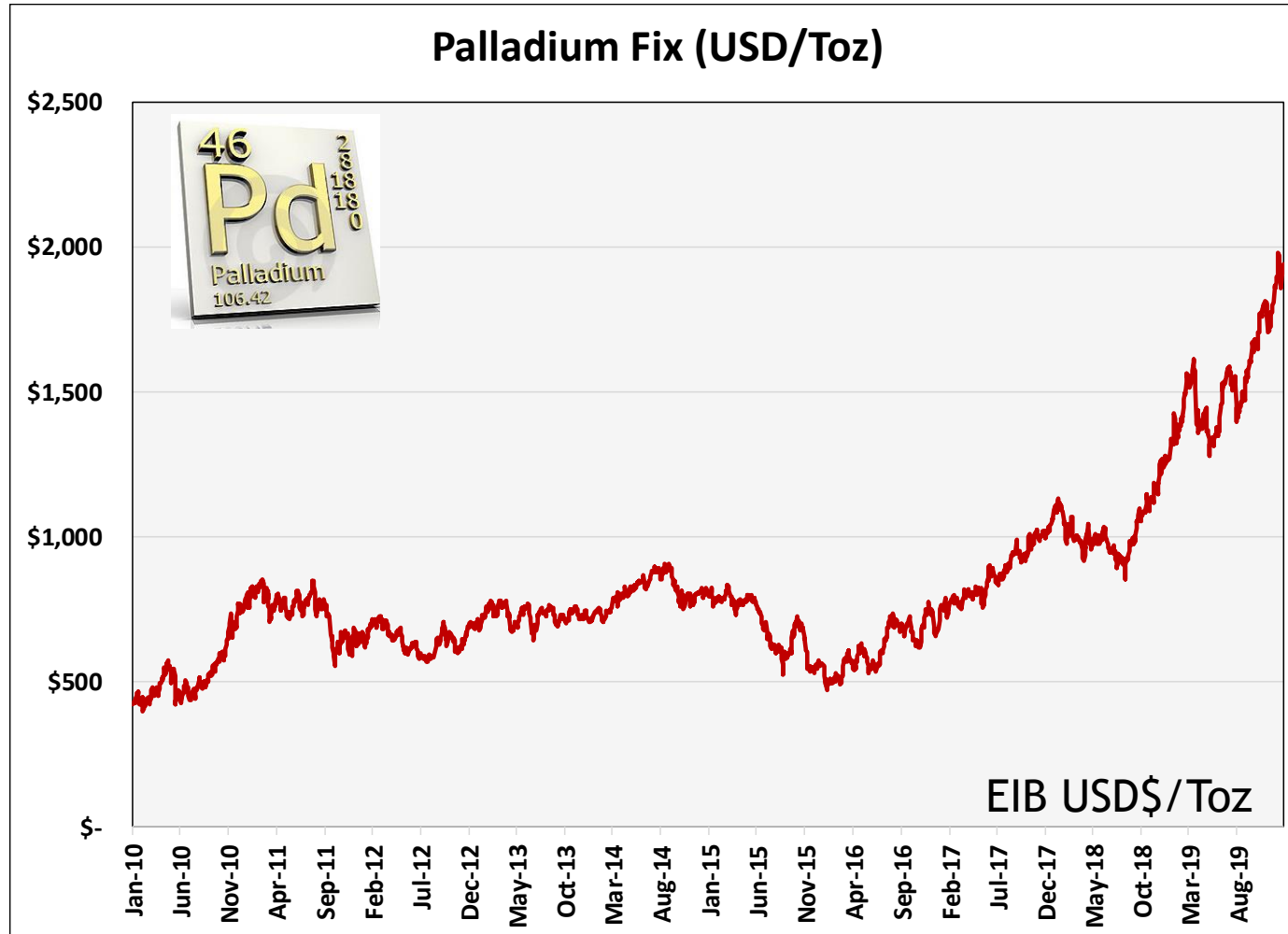
# 10-year Gold minus Platinum (Pt Discount)



# Platinum 2010-2019 Annual Growth



# 10-year Palladium

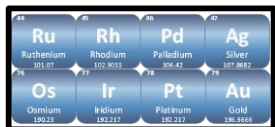
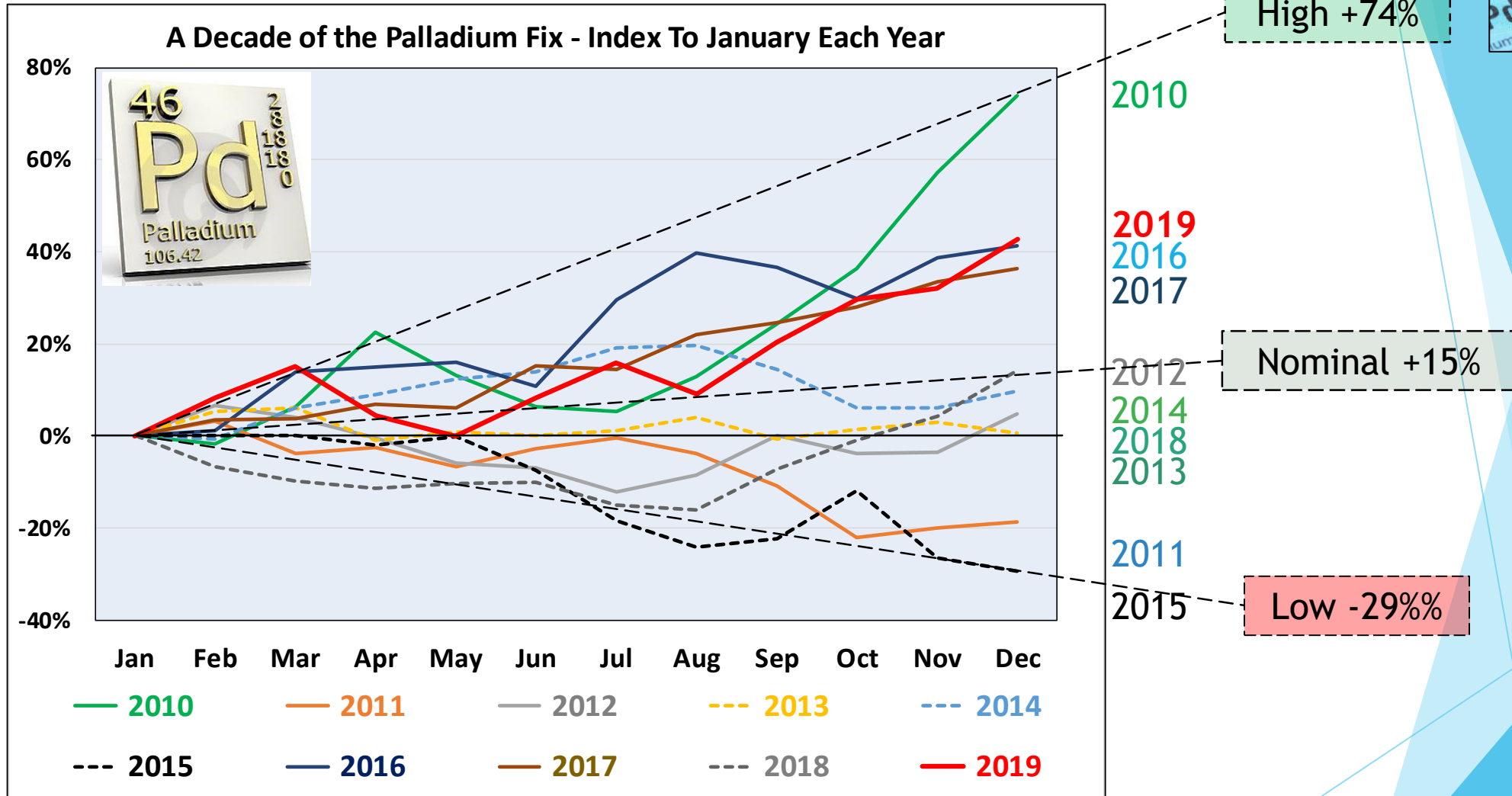
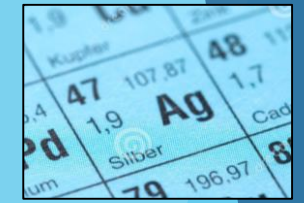


Ru Ruthenium 44 101.07	Rh Rhodium 45 102.9033	Pd Palladium 46 106.42	Ag Silver 47 107.8672
Os Osmium 76 192.22	Ir Iridium 77 192.222	Pt Platinum 78 195.084	Au Gold 79 196.9665

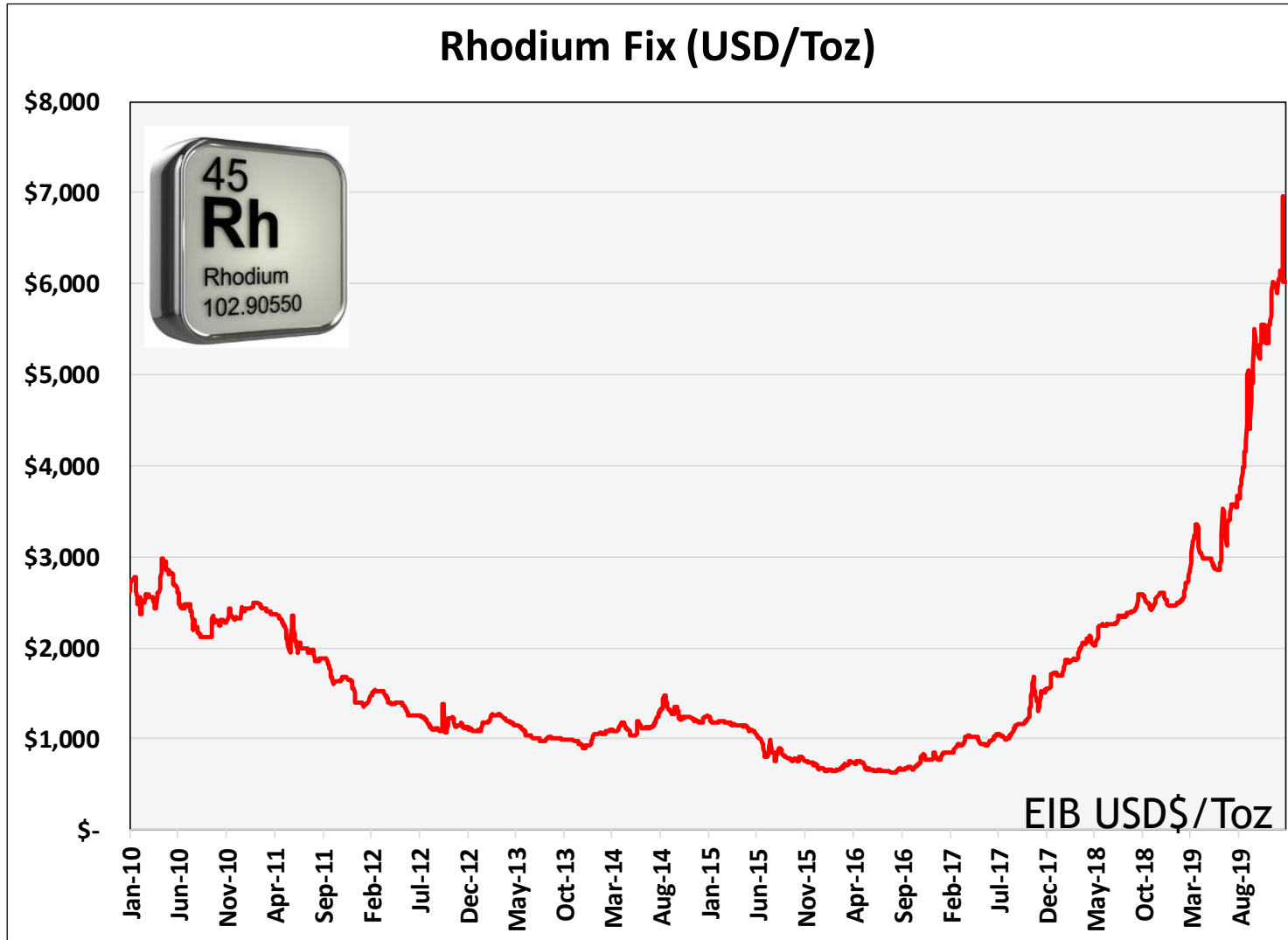
Prepared by Precious Metals Commodity Management

Jan. 3, 2020

# Palladium 2010-2019 Annual Growth



# 10-year Rhodium

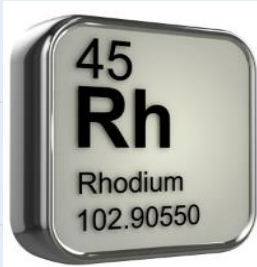
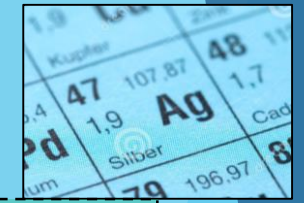


Ru Ruthenium 44 101.07	Rh Rhodium 45 102.90550	Pd Palladium 46 106.42	Ag Silver 47 107.87
Os Osmium 76 190.23	Ir Iridium 77 223.07	Pt Platinum 78 195.08	Au Gold 79 196.97

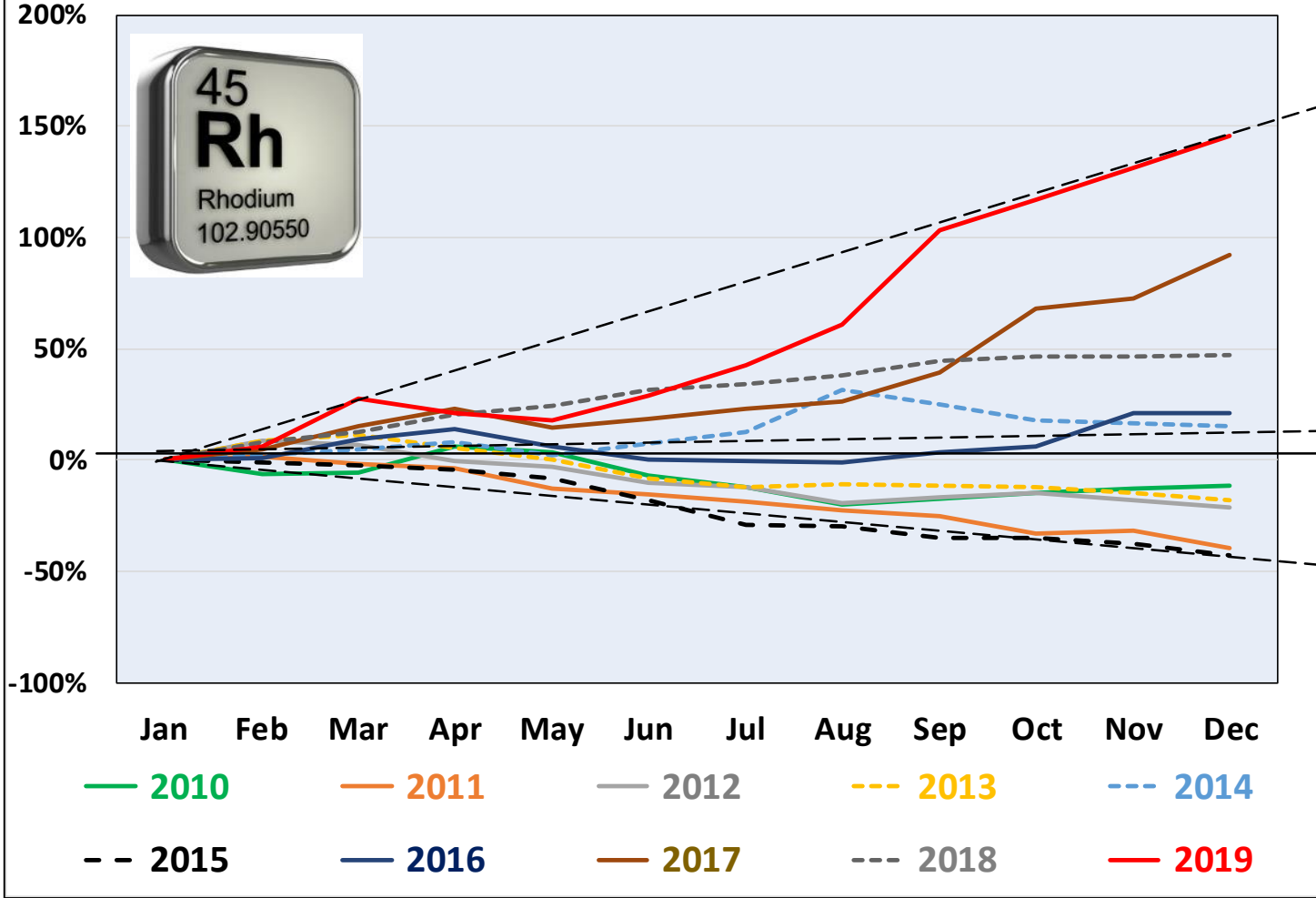
Prepared by Precious Metals Commodity Management

Jan. 3, 2020

# Rhodium 2010-2019 Annual Growth



A Decade of the Rhodium Fix - Index To January Each Year



High +146%

2019

2017

2018

2016

2014

Nominal +20%

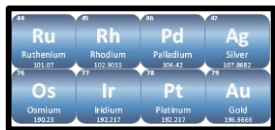
2013

2012

2011

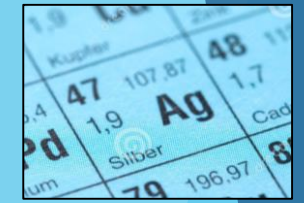
2015

Low -42%

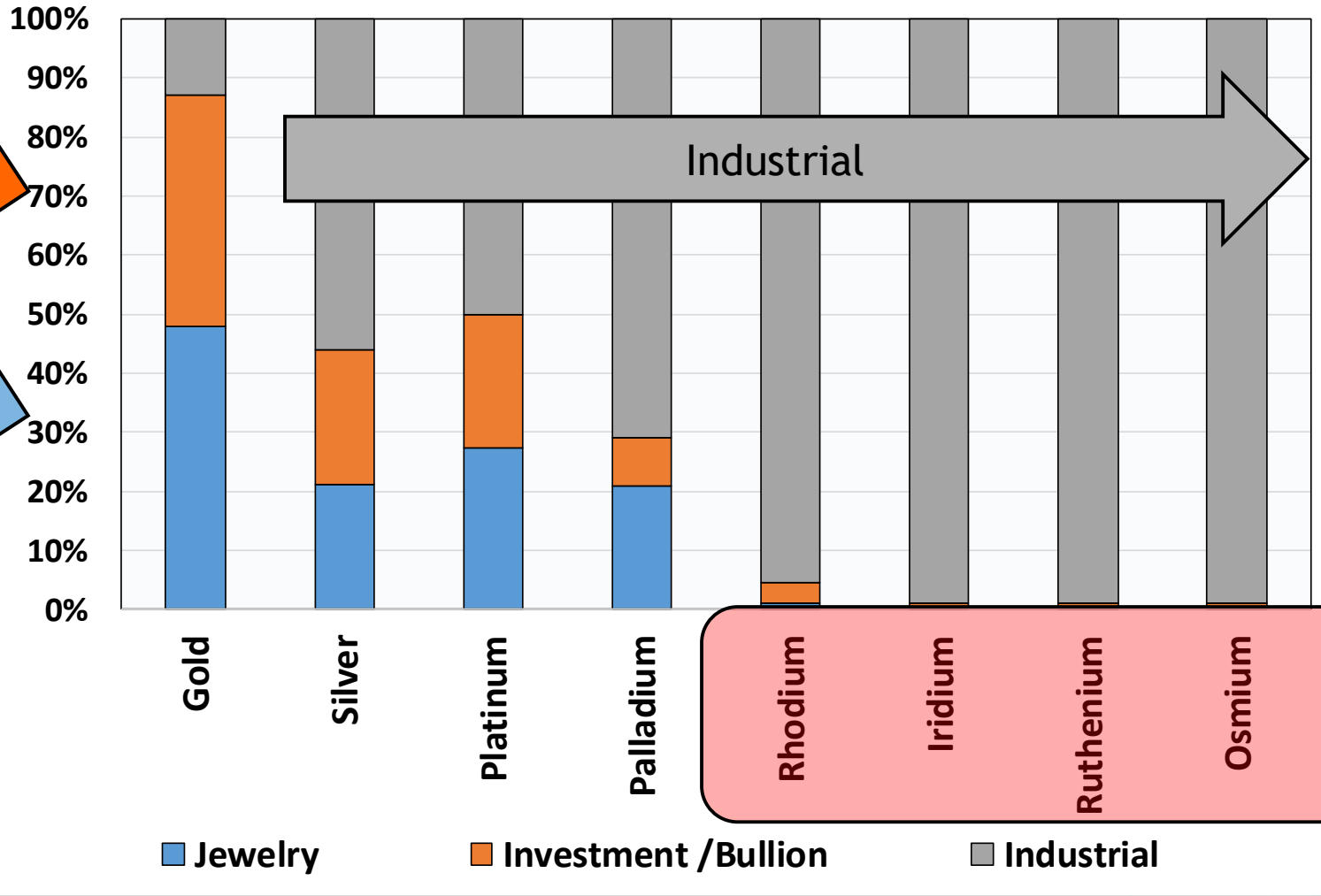




# Precious Metals Market Drivers 2019



Market Drivers Jewellery, Investment, & Industrial Demand



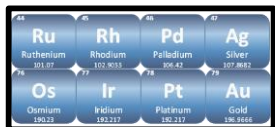
Investment & Bullion

Jewelry

Industrial

Rhodium Iridium Ruthenium Osmium Minor PGM's

Jewelry Investment/Bullion Industrial



# Precious Metals Market Forecast



Investment & Bullion

Gold Silver and Platinum

Forecast - Based On 10-Year Empirical Data

Jewelry

China/India

Jewelry - Flat

Industrial

55% Silver & 50% Platinum  
>95% Palladium, Iridium, Osmium, Iridium, Ruthenium

**Industrial Demand small downside risk**  
Pd, Rh, Ir, Ru Demand Sectors are intrinsically strong. Pt industrial demand flat but will slowly climb over next decade with growth in fuel cells. Some Pt Investment liquidation risk.

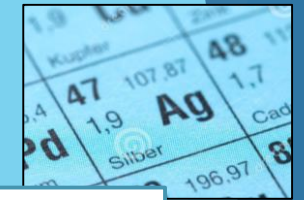
Critical Supply/Demand shortage of Rhodium

- 90% Rh towards auto catalyst
- Rh is key to NO<sub>x</sub> Suppression.
- Tightening NO<sub>x</sub> standards.
- Real world test conditions.
- Next best design alternative 9x more expensive

Rh +40%

Ru Ruthenium 44 101.07	Rh Rhodium 45 102.9055	Pd Palladium 46 106.42	Ag Silver 47 107.8682
Os Osmium 76 192.22	Ir Iridium 77 192.222	Pt Platinum 78 195.084	Au Gold 79 196.9665

# Precious Metals Dec'20 Forecast



## Precious Metals Forecast

Based On 2010 through 2019 Metals Price History

	December 2019 Ending	Dec 31, 2020 Forecast	Ave. Dec. Change % (2010-2019)	Nonnominal +1 Sigma	Dec 31, 2020 Forecast	Nominal -1 Sigma
<b>Gold</b>	\$ 1,523	\$ <b>1,533</b>	0.7%	\$ 1,762	\$ <b>1,523</b>	\$ 1,285
<b>Silver</b>	\$ 18.05	\$ <b>17.73</b>	-1.8%	\$ 22.51	\$ <b>17.58</b>	\$ 12.65
<b>Platinum</b>	\$ 985	\$ <b>965</b>	-2.0%	\$ 1,082	\$ <b>878</b>	\$ 790
<b>Palladium</b>	\$ 1,940	\$ <b>2,223</b>	14.6%	\$ 2,786	\$ <b>3,113</b>	\$ 1,594
<b>Rhodium</b>	\$ 6,025	\$ <b>7,254</b>	20.4%	\$ 10,928	\$ <b>8,400</b>	\$ 6,025
<b>Iridium</b>	\$ 1,490	\$ <b>1,644</b>	10.4%	\$ 2,224	\$ <b>1,650</b>	\$ 1,065
<b>Ruthenium</b>	\$ 255	\$ <b>267</b>	4.8%	\$ 568	\$ <b>270</b>	\$ 240
<b>Osmium</b>	\$ 400	\$ <b>400</b>	0.0%	\$ 400	\$ <b>400</b>	\$ 400

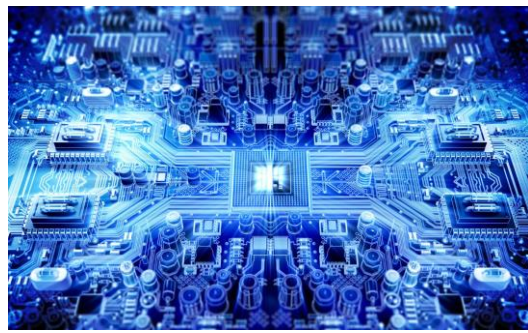
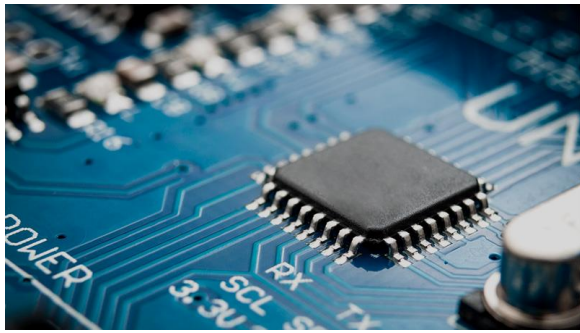
Forecast - Based On 10-Year Empirical Data

Pd & Rh +40%

Industrial Demand small downside risk

- Pd, Rh, Ir, Ru Demand Sectors are intrinsically strong.
- Pt industrial demand flat but will slowly climb over next decade with growth in fuel cells.

Ru Ruthenium 101.07	Rh Rhodium 102.9053	Pd Palladium 106.42	Ag Silver 107.8642
Os Osmium 190.23	Ir Iridium 192.222	Pt Platinum 195.084	Au Gold 196.9665



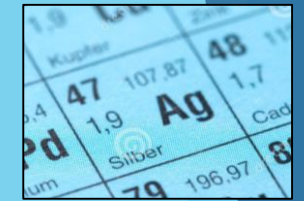
# Thank You

## Jan. 3, 3030

44 Ru Ruthenium 101.07	45 Rh Rhodium 102.9055	46 Pd Palladium 106.42	47 Ag Silver 107.8682
76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 192.217	79 Au Gold 196.9666

By: Precious Metals Commodity Management LLC

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