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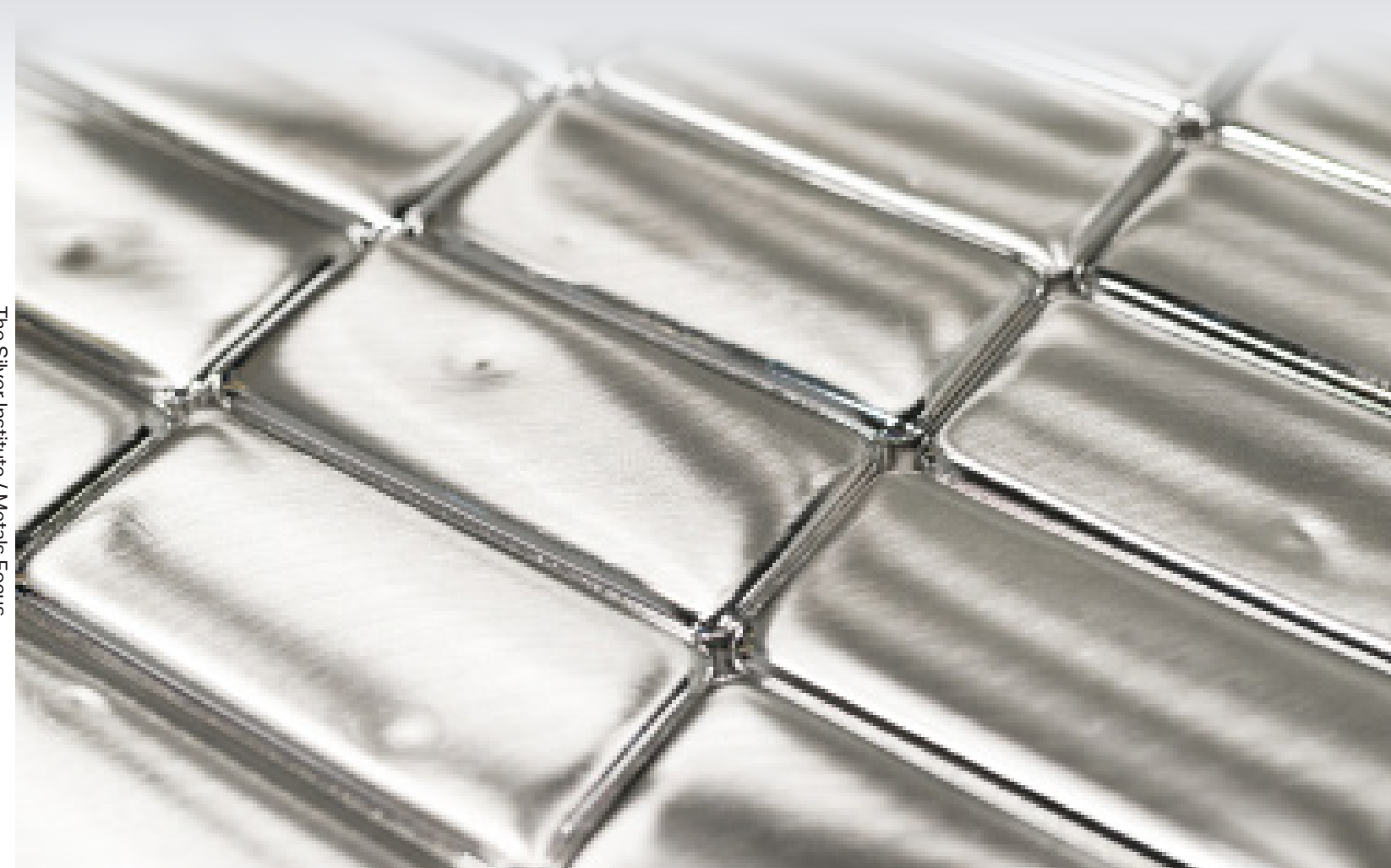
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World Silver Survey 2020

WORLD SILVER SURVEY 2020

The Silver Institute / Metals Focus



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30th Edition of the World Silver Survey

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World Silver Survey 2020

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This is the thirtieth annual edition of the World Silver Survey produced for The Silver Institute. The World Silver Survey 2020 was produced by the Metals Focus team. The information contained herein is based in part on the analysis of publicly available data such as hallmarking series, trade statistics, company reports and other public-domain information. More importantly, it is also based on a large series of interviews with the industry's main players, carried out over the year by the team. This work generates the essential data to allow the compilation of reliable estimates for world supply and demand and inform the analysis of market structures, and the degree of significance of any changes and developments.

Metals Focus is grateful to the many miners, refiners, bullion dealers, bankers and fabricators throughout the world who have contributed their time and information to ensuring that the picture of the industry described in the World Silver Survey is as complete and accurate as possible.

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Fresnillo plc has seven operating mines, all of them in Mexico – Fresnillo, Saucito, Ciénega (including the San Ramón satellite mine Las Casas Rosario & Cluster Cebollitas), Herradura, Soledad-Dipolos¹, Noche Buena and San Julián (Veins and Disseminated Ore Body), three development projects – the Pyrites Plant at Fresnillo, the optimisation of the beneficiation plant also at Fresnillo and Juanicipio, and six advanced exploration projects – Orisyvo, Centauro great potential and Centauro Deep, Guanajuato, Rodeo and Tajitos as well as a number of other long term exploration prospects.

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¹Operations at Soledad-Dipolos are currently suspended.

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Peñoles is a mining group with integrated operations in smelting and refining non-ferrous metals, and producing chemicals. Peñoles is the world's top producer of refined silver, metallic bismuth and sodium sulfate, and the leading Latin American producer of refined gold and lead. The Company was founded in 1887 and it is part of "Grupo BAL", a privately held diversified group of independent Mexican companies. Peñoles' shares have traded on the Mexican Stock Exchange since 1968 under the ticker PE&OLES. Peñoles highlights:

- Began operations in 1887 as a mining company.
- Has integrated operations in the areas of exploration, mining, metallurgy and chemicals.
- Listed on the Mexican Stock Exchange since 1968; the stock is included in the IPC index.
- One of the largest net exporters in Mexico's private sector.

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In 2019, Pan American produced 25.9 million ounces of silver and 559,200 ounces of gold. As at June 30, 2019, proven and probable silver mineral reserves were approximately 557.2 million ounces and gold mineral reserves were approximately 5.1 million ounces.

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Chapter 1

- Silver prices in 2019 saw a robust 15% intra-year rise as the macro-economic background turned pro-investment in the second half.
- Supply rose 1%, mainly due to lower mine production, while demand was flat, as higher investment offset jewelry losses while industrial offtake was stable.
- The COVID-19 crisis has already had a profound impact on silver supply, demand and prices, something we expect will continue for some months to come.

Summary

Introduction

Over the few weeks running up to the time of writing (in early April), the COVID-19 crisis has had a profound impact on normal ways of life, economies and financial markets around the world. What had originally been seen as a China/Asia problem quickly evolved into a global pandemic, resulting in large swathes of the world population being forced to operate under some form of restrictive activities. The impact of such disruptions on the world economy is already stark. Unsurprisingly, the crisis has triggered some of the most aggressive liquidations seen in history. Equities, high yield debt and industrial commodities were particularly hard hit, with the S&P 500, for instance, falling by 35% from peak to trough over February-March.

Against this backdrop, one might have expected silver to do well. The metal's traditional correlation with gold (as well as its own safe haven attributes) would suggest that the silver price ought to, at the very least, only suffer modest losses, if not in fact rally, as investors rotate into precious metals.

Silver Supply and Demand

Million ounces												Year on Year		
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020F	2019	2020		
Supply														
Mine Production	760.1	792.7	840.3	877.5	892.9	892.3	863.4	847.8	836.5	797.8	-1%	-5%		
Recycling	232.9	216.0	192.7	174.9	166.5	164.4	167.7	167.7	169.9	169.4	1%	-0.3%		
Net Hedging Supply	11.9	-	-	10.7	2.2	-	-	-	15.7	10.0	na	-36%		
Net Official Sector Sales	4.8	3.6	1.7	1.2	1.1	1.1	1.0	1.2	1.0	1.0	-15%	0%		
Total Supply	1,009.7	1,012.4	1,034.7	1,064.2	1,062.6	1,057.8	1,032.2	1,016.8	1,023.1	978.1	1%	-4%		
Demand														
Industrial	508.1	450.5	460.8	449.6	456.2	490.3	517.2	511.5	510.9	475.4	-0.1%	-7%		
...of which photovoltaics	68.4	55.0	50.5	48.4	54.1	93.7	101.8	92.5	98.7	96.1	7%	-3%		
Photography	61.6	52.5	45.8	43.6	41.2	37.8	35.1	34.2	33.7	30.5	-1%	-10%		
Jewelry	162.2	159.2	187.1	193.5	202.6	189.2	196.3	203.1	201.3	187.5	-1%	-7%		
Silverware	41.5	40.1	45.7	52.4	56.6	52.3	57.7	65.4	59.8	54.3	-9%	-9%		
Net Physical Investment	272.0	240.8	300.1	282.6	310.4	213.9	156.2	165.7	186.1	215.8	12%	16%		
Net Hedging Demand	-	40.4	29.3	-	-	12.0	2.1	8.4	-	-	na	na		
Total Demand	1,045.4	983.5	1,068.9	1,021.6	1,067.0	995.5	964.7	988.3	991.8	963.4	0%	-3%		
Market Balance	-35.7	28.9	-34.2	42.6	-4.4	62.3	67.5	28.5	31.3	14.7	10%	-53%		
Net Investment in ETPs	-18.9	53.6	4.6	-0.5	-17.2	50.9	6.8	-22.3	81.7	120.0	na	47%		
Market Balance less ETPs	-16.9	-24.7	-38.8	43.1	12.8	11.3	60.7	50.8	-50.4	-105.3	na	109%		
Silver Price (US\$/oz, London price)	35.12	31.15	23.79	19.08	15.68	17.14	17.05	15.71	16.21	15.70	3%	-3%		

Source: Metals Focus

Silver Prices & Gold:Silver Ratio*



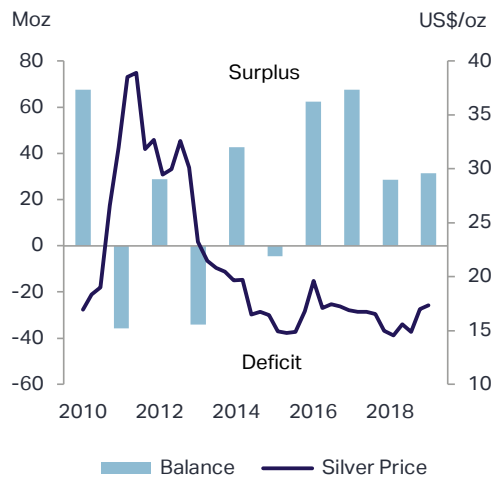
* Monthly averages
Source: Bloomberg

Instead, silver (and indeed also gold) suffered selling pressure similar to other pro-cyclical assets. Its price fell to its lowest level in more than a decade, at the peak of the panic in global markets around mid-March. Silver also performed poorly relative to gold, with the gold:silver ratio briefly touching an all-time high of 127. A number of factors contributed to this, including professional investors’ need to raise cash, the drag from its link to base metals and silver’s own underlying fundamentals.

Looking at the latter in some detail, silver saw a market surplus in 2019 of 31.3Moz (973t). The fourth surplus in a row, this only added to earlier gains in global above-ground stocks, giving a total of 254.2Moz (7,905t) for the decade to 2019. Mine production actually fell at the margin last year, while scrap was also little changed. However, the year saw producers shift from net de-hedging to hedging, resulting in overall supply rising at the margin. Meanwhile, global silver demand of 991.8Moz (30,848t) barely rose last year. We recorded healthy gains in physical investment and demand from the photovoltaic industry, as well as smaller increases seen in our other industrial category. However, these were largely offset by losses elsewhere in electrical and electronics applications, silverware and jewelry.

Institutional investment fared even better than physical demand in 2019. Exchange-traded product (ETP) holdings for instance rose notably last year, while money-managers’ net positions in Comex futures went from being short over much of 2018 to consistently positive in the second half of last year. This sea-change in investor attitudes towards silver was mainly due to improving sentiment towards gold, in turn owing to a handful of macroeconomic drivers. Among these, the most important was the Fed cutting policy rates three times in the second half of the year. This saw precious metal prices rally, even as US equities also rose. The ongoing US:China trade war was another factor helping the case for precious metals investment.

Market Balance

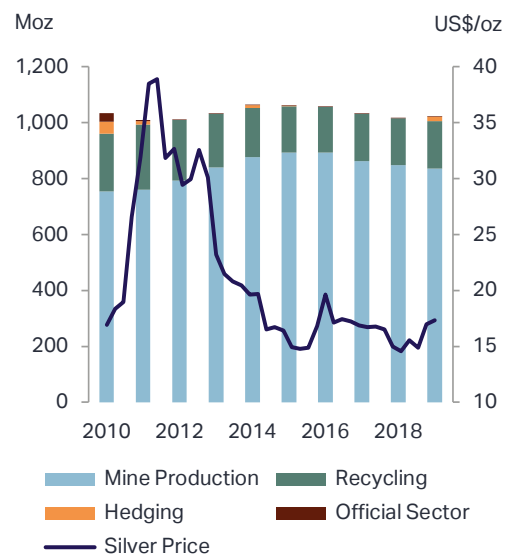


Source: Metals Focus, Bloomberg

Looking ahead, roughly 80% of silver’s demand comes from areas likely to suffer as a result of the COVID-19 crisis. As detailed in Chapter 2, while we expect physical investment to grow (and indeed accelerate), all other demand areas are forecast to suffer losses this year. However, we also envisage sizable declines for supply, as restrictive measures affect a large number of mines. This generates a still notable market surplus of 14.7Moz (457t), although this is considerably smaller than those recorded in 2016-19.

In spite of this and the recently negative stance of institutional investors, Metals Focus is constructive towards silver prices over the rest of 2020. As noted above, we expect physical investment to enjoy strong growth. Importantly, we also believe that professional investor interest in silver will also improve considerably in the months to come, as confidence that gold is once again in a sustainable bull market grows and silver’s historical undervaluation makes it look yet more attractive.

Global Supply



Source: Metals Focus, Bloomberg

Silver Supply in 2019

Global **mine production** fell for the fourth consecutive year in 2019, dropping by 1.3% y/y to 836.5Moz (26,019t). This was a result of declining grades at several large primary silver mines, lower silver production from copper mines and notable disruption losses at some major silver producers. Lead-zinc mines continued to contribute the biggest proportion of output, producing 268.7Moz (8,359t) or 32.1% of the total. Production from primary silver mines, classified as a mine where silver is the main revenue source over the life-of-mine, dipped by 3.8% y/y to 240.0Moz (7,464t). Silver produced as a by-product of copper mining also fell, by 3.1% to 190.6Moz (5,928t), while output from primary gold mines remained flat year-on-year at 132.1Moz (4,108t).

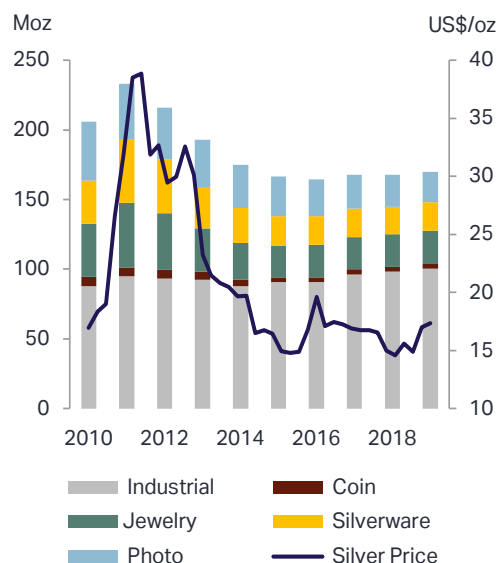
At the country level, the largest declines came from Peru where output fell by 11.1Moz (345t) y/y. This was chiefly a result of lower head grades at major silver producing mines alongside some mine closures during the year. Other notable year-on-year falls were seen in Mexico (-4.2Moz, 131t), Indonesia (-2.9Moz, 90t) and Kazakhstan (-2.8Moz, 87t). These losses were partially offset by year-on-year increases in silver output from Argentina (+3.9Moz, 123t), Australia (+2.6Moz, 80t) and the US (+1.8Moz, 55t).

An uptick in **hedging** activity in the second half of 2019 saw the global hedge book increase for the first time since 2014. Forward positions continued to decline, falling by 11.5Moz (357t) to their lowest level since 2010, at 3.7Moz (114t). Producers preferred to enter into options contracts, with outstanding positions increasing by 27.2Moz (845t) to reach 27.6Moz (858t) at year-end.

Global **recycling** edged higher last year, up 1.3% to 169.9Moz (5,284t). Volumes from industrial end-uses, the biggest source of scrap, rose 2% to the highest level this decade. This, in part, reflected growth in ethylene oxide change-outs as a result of a rise in globally installed capacity and the trend towards higher silver usage in modern plants. Jewelry recycling also increased in many emerging markets owing to higher dollar prices, although volumes in China remained subdued. Similarly, silverware scrap rose modestly, with higher prices a contributory factor, with most of the gains coming from western countries. Lastly, recycling from photography continued its secular decline, sliding a notable 6% to 21.6Moz (671t) in 2019.

Net supply from the **official sector** fell last year, but remained trivial in absolute terms at just 1.0Moz (32t).

Global Recycling, by Source

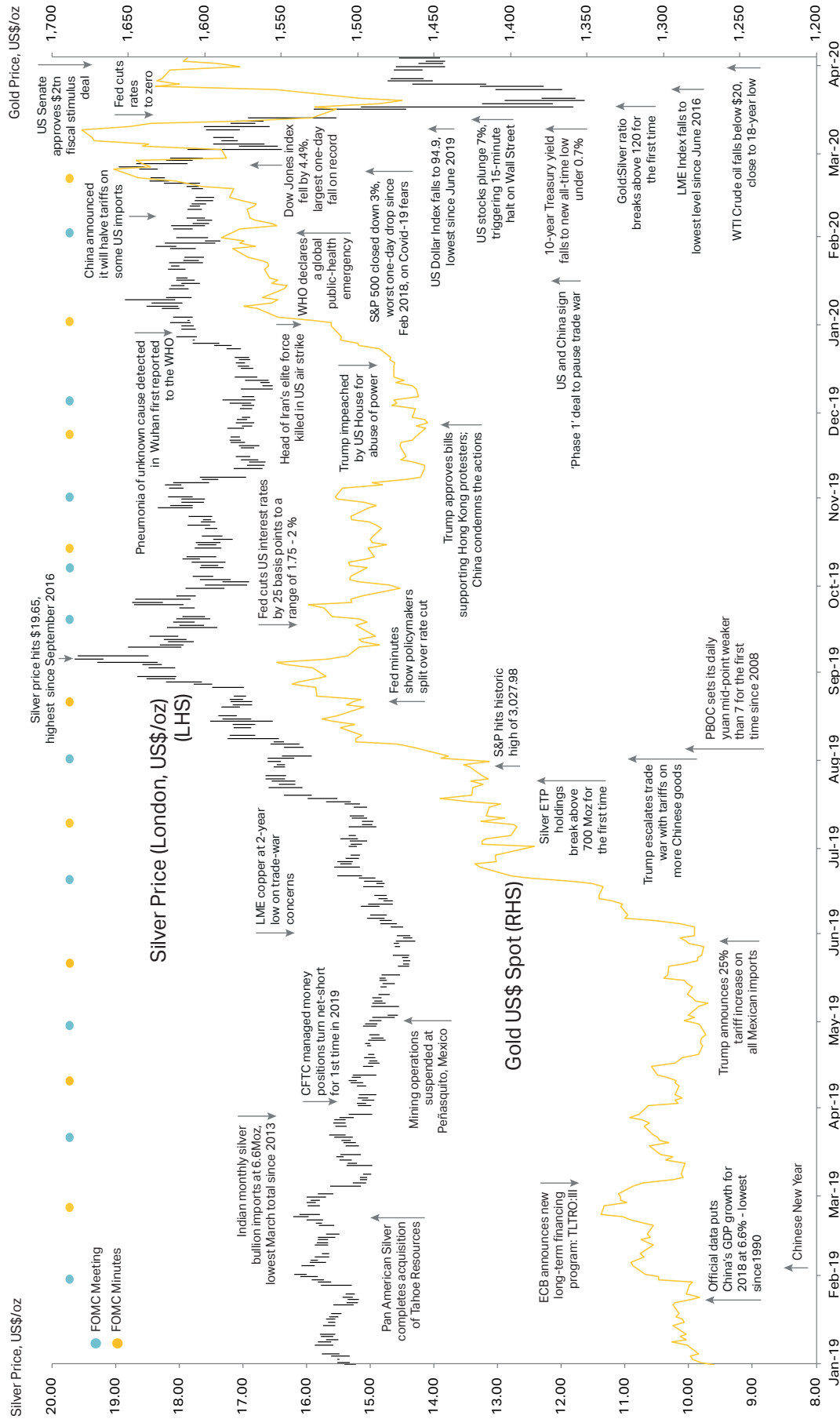


Source: Metals Focus, Bloomberg

Silver Demand in 2019

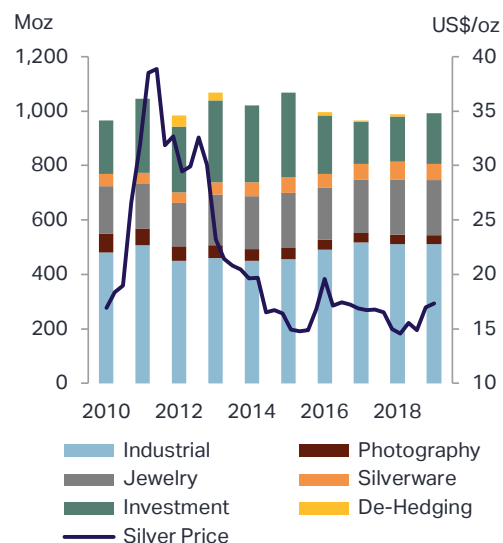
World silver demand rose 0.4% in 2019 to 991.8Moz (30,848t) as higher retail investment was offset by lower jewelry and silverware demand. **Industrial** fabrication was nearly unchanged y/y in 2019 at 510.9Moz (15,891t) and was just 1% shy of the 2017 record. There was limited pressure from substitution and thrifting, one chief exception being in the all-important photovoltaics

Silver vs Gold Price (London, \$/oz) and Key Events in 2019 - 2020



NB: Black line indicates daily trading range
Source: Metals Focus, Bloomberg

Global Demand



Source: Metals Focus, Bloomberg

(PV) sector, part of a long-standing emphasis towards lower silver loadings. At the country-level, sizable gains were noted in Japan, while notable losses were seen in the US, due mainly to lower powder offtake and India, due to the slowdown in its GDP growth. At the sectoral level, offtake from the electric and electronics segment fell by 2%, mainly as a result of the downturn in some key industrialized nations such as Germany in late 2019, due to the trade war. This occurred despite a 7% rise in PV offtake, to the second highest level ever and growing end-use in the automotive sector. Brazing alloy demand also rose globally, as did end-use in ethylene oxide (EO) catalysts, whose installed capacity continued to rise, most notably in the US.

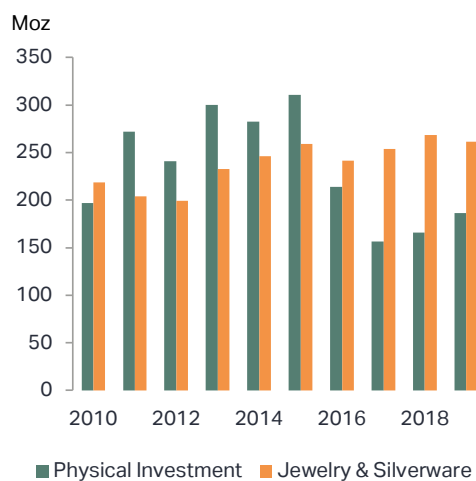
The secular decline in **photography** continued, as demand fell by 1% to 33.7Moz (1,047t) or 48% of levels in 2010. Last year's drop reflected further falls in silver-bearing consumer and professional film rolls and paper.

After its high for the decade in 2018, **jewelry** fabrication posted a modest decline of 1% to 201.3Moz (6,262t) last year. This was chiefly as demand in the largest market, India, fell 5% from a record high in 2018. This reflected a slowing economy and an erratic monsoon which hit the all-important rural sector. China also saw a notable fall (its sixth straight year of losses) as the trade war and economic slowdown resulted in deteriorating consumer sentiment. Another factor was the ongoing structural change, notably the shift away from heavy plain jewelry to smaller pieces. Western jewelry consumption also fell, but only modestly. In the US, this reflected the ongoing (although now slowing) trend for large-scale retailers to shift assortment space from silver to gold. Trade feedback on weak sales in Europe tended to focus on key retailers' unhelpful strategies, such as stale designs and a point-of-sale shift from third party to in-house. However, that still left room for Italian fabrication to enjoy a small export-led rise of 3%. Thailand also saw an export-led recovery, but this was a more buoyant +13%.

From a high for the decade in 2018, global **silverware** fabrication fell by a notable 9% last year to 59.8Moz (1,860t). This was almost all due to India, where an economic slowdown led to demand falling 11% to 41.2Moz (1,282t). In fact, if we exclude all of South Asia, offtake was flat y/y, although that residual was still at its second lowest level this decade.

Net **physical investment** jumped 12% y/y to 186.1Moz (5,788t), the biggest rise since 2015. That said, this growth was from a relatively low base following 2017's losses. At a country level, growth was largely the result of notable gains in Europe (+25%), the US (+9%) and India (+5%). In Europe, gains were primarily led by Germany, owing to positive price expectation. In the US, gains last year can also be attributed to supportive second half price expectations, despite strong competition from buoyant US equities. Indian demand rose for a third year in 2019, due to such drivers as silver's under performance versus gold and a gold-centered crackdown on unaccounted incomes.

Global Physical Investment vs Jewelry & Silverware



Source: Metals Focus

Chapter 2

- Total supply is forecast to fall 4% to 978.1Moz (30,424t), chiefly through COVID-19 related disruptions to mining activities.
- Demand is projected to dip by 3% to 963.4Moz (29,967t), as most sectors suffer losses from the COVID-19 crisis, offset by a 16% rise in bars and coins.
- Silver prices are forecast to rally strongly towards the \$19 mark before year-end as institutional investment builds.

Market and Price Outlook

Introduction

The uncertainties presented by the COVID-19 crisis make the job of forecasting silver market conditions over the rest of the year incredibly challenging. The extreme markets volatility that we have seen in recent weeks is in some ways reminiscent of the 2008 global financial crisis (GFC) and the recession that followed.

The current woes that economies and financial markets are facing are of course different. Unlike the GFC's delayed impact on the real economy, through a collapse in liquidity, the COVID-19 crisis is hurting consumption and economies in a far more direct and immediate way. This is evident in the rising unemployment figures and growing evidence of businesses struggling over the past few weeks. On the other hand, with the hindsight of the GFC, authorities around the world have been quicker to make drastic interventions and structure these in a way to ensure they reach consumers and businesses in a more direct manner.

Looking ahead, as of early April, there are some promising signs that the curve of new infections may already be starting to turn down in some of the hardest hit European nations. This follows weeks of unprecedented restrictions on movement and economic activity. Positive as these signs may be, it is far too early to call when the crisis may end.

Having said this, it was essential to make some assumptions about the timeline of the crisis, in order to adjust many of the individual elements of our supply and demand forecasts. To do this, we took into account the experience of China and other East Asian countries, as well as some of the limited research on the properties of the virus, such as typical duration of the incubation and illness periods. The broad assumption we have taken is that some sort of lockdown will be in place across most major markets for a period of 6-8 weeks and that this will be followed by a month of a gradual return to normality. Moreover, we have assumed that even beyond these two and a half to three month-periods, lighter social distancing programs will remain in place across a number of countries.

There are a few important caveats to the above hypothesis. First, cultural and structural factors may result in a different trajectory in Western markets to that experienced in East Asia. Second, the restrictions seen across much of the US at the moment are less aggressive than those in Europe and parts of Asia. Thirdly, the virus has yet to take hold in less developed countries and the as yet unknown impact on South Asia and Sub-Saharan Africa could prove devastating. Finally, one cannot rule out the re-emergence of new waves of infections flaring up later in the year, resulting in restrictive

Gold, Silver & Copper Prices

Index, 2nd January 2019 =100



Source: Bloomberg, Metals Focus

Gold:Silver Ratio



Source: Bloomberg

measures being brought back in. All this suggests that our base case may well prove optimistic.

Based on the above, we have made adjustments to silver supply and demand from what we might have otherwise expected to see this year. For mine supply, we looked at which countries have implemented policies resulting in mine closures and the expected duration of these closures. We combined this with company announcements to estimate a disruption percentage and applied this to our original estimates for 2020. As a result, we expect mine production will decline by 5% to 797.8Moz (24,813t). We believe the impact on recycling will be small. Finally, our projections see a more than one-third decline in producer hedging. Overall, global supply is forecast to fall by 4% to 978.1Moz (30,424t) in 2020, its lowest since 2009.

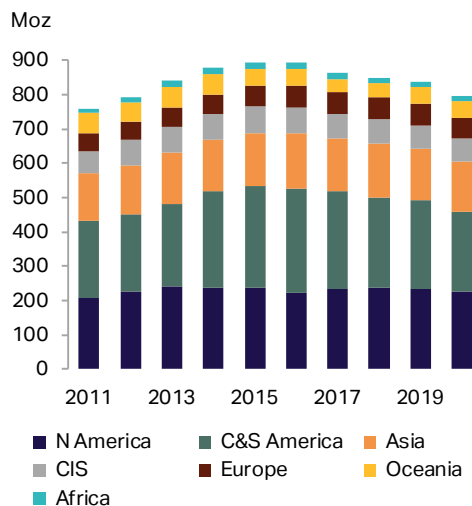
For demand, we took a view on the impact of restrictions on fabrication capacity as well as the impact of the economic slowdown on related end-use sectors. Unsurprisingly, our projections for 2020 see sizable declines across most areas of demand. Total industrial fabrication is expected to fall by 7%, with losses seen across all individual components. Jewelry and silverware are also expected to suffer losses, as a result of lower visitors to retail stores and the appetite for discretionary spending taking a hit.

Metals Focus expects these declines will be partly offset by a 16% increase in bar and coin demand. As discussed elsewhere in this report, we have seen evidence of strong interest in silver from retail investors and we expect this will continue for much of this year. As a result of this offset, our projections see global demand fall by a modest 3% to 963.4Moz (29,967t), which also represents the lowest total since 2009.

Combining the above-mentioned supply and demand figures, we expect the market will see another surplus this year. At 14.7Moz (457t), this will be 53% smaller than in 2019. Meanwhile, we expect to see another year of very strong inflows into silver exchange-traded products (ETPs), as well as net buying by institutional investors on both the futures and OTC markets. Driving this behavior will be renewed interest in silver (and gold) on the back of macroeconomic drivers such as ultra-low interest rates, other stimulus measures and concerns about the outlook for the global economy. Meanwhile, silver should also benefit from bargain hunting, on the back of its historically low relative value compared to gold.

All this should ultimately drive silver prices upwards. During this move, we would expect silver to outperform gold. By year-end, we would not be surprised to see the white metal's price testing the \$19 mark. Having said this, as a result of its recent weakness, the full year average is still expected to fall a modest 3% y/y to \$15.70.

Mine Production Forecast



Source: Metals Focus

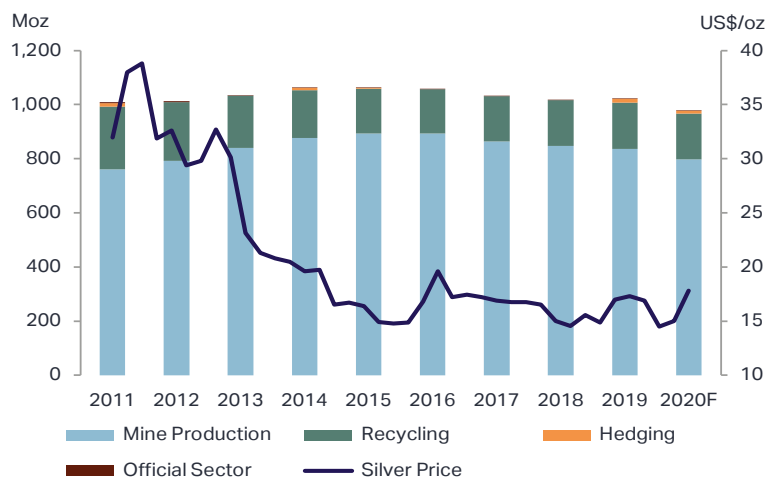
Supply Outlook

We expect global silver **mine production** to fall by 4.6%, or 38.8Moz (1,206t), y/y in 2020 to 797.8Moz (24,813t). This is entirely the result of expected disruptions to operations from the COVID-19 pandemic and represents a 6.4%, or 54.5Moz (1,694t), reduction compared to our forecast at the start of the year. Estimating the precise impact on production is challenging, but mining operations have already been temporarily suspended in major silver producers, notably Mexico, Peru, Bolivia and the province of Quebec in Canada. Mine supply in China will also have been impacted by measures enacted by the government to control the virus, although the exact impact on their silver production is currently unknown. Partially offsetting these losses will be growth from individual mining operations such as Imiter (+2.6Moz, 80t), Dukat (+1.3Moz, 39t) and Lucky Friday (+0.7Moz, 23t). Specific assets that will contribute to year-on-year declines in silver production include Cannington (-2.2Moz, 69t), alongside mines which closed in 2019 such as Silvertip (-1.2Moz, 37t) and El Cubo (-1.1Moz, 34t).

We anticipate moderate levels of **hedging** in 2020 with the global hedge book growing by 10.0Moz (311t). It is quite possible however that more producers will move to lock-in longer term price stability in the face of elevated volatility.

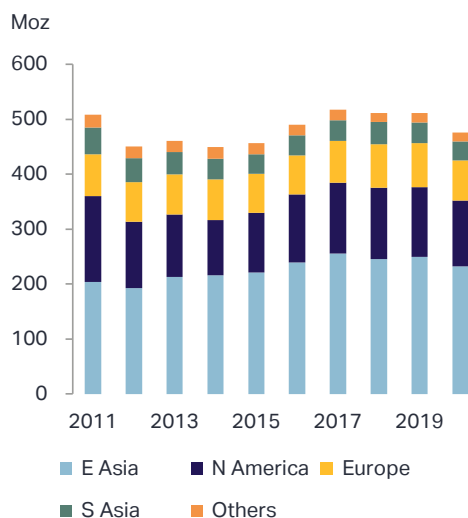
Recycling is expected to post a drop of just 0.3% in 2020. Jewelry and silverware recycling is forecast to fall by 4% and 2% respectively, with much of this due to the dip in the annual average price. However, should the COVID crisis grow yet worse, we could see heavy inventory melt and, in emerging markets, distress selling. Photographic recycling should continue its secular decline, falling 7% this year. Industrial recycling in contrast could rise due to gains EO plant change-outs. Net supply from the **official sector** is forecast to stay flat y/y at 1.0Moz (32t).

Global Supply Forecast



Source: Metals Focus, Bloomberg

Industrial Fabrication Forecast



Source: Metals Focus

Demand Outlook

Industrial silver offtake is likely to see a sizable 7% drop in 2020 to a five-year low of 475.4Moz (14,786t). These losses reflect the negative impact of COVID-19 on supply chains and product sales by many of the largest end-users. Silver use in the PV sector, for example, is expected to fall. However, some segments, such as EO catalysts, may in fact see gains this year.

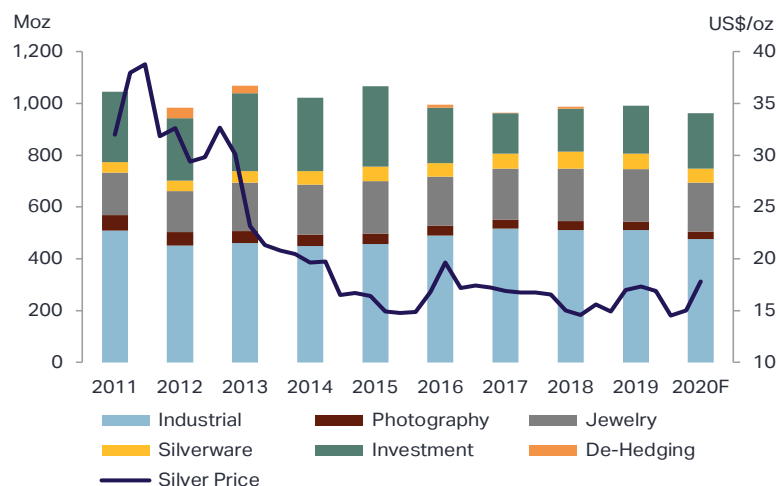
Furthermore, restrained prices and R&D budgets mean the pressure from thrifting and substitution should be weak. That said, this outlook is based on a model of most economies seeing heavy losses for a month or two followed by a gradual recovery, but even this dispiriting view could prove optimistic.

Photographic demand should also see losses, but these will be more down to the ongoing secular decline than sales damage from COVID-19.

Jewelry fabrication is also forecast to decrease in 2020, by 7%, its biggest drop since 2016. That said, at 187.5Moz (5,832t), this would still be only 8% below the high for the decade. India and China should account for most of this decline as their demand is forecast to suffer due to the slowdown in their economies and lockdowns related to the COVID-19 pandemic. Western markets should also see COVID-led losses, but silver jewelry's affordability may mean it performs better than other jewelry sectors, as it gains market share for example from gold jewelry. Global **silverware** demand is forecast to fall again this year (by 9%), with the retreat once more due largely to India.

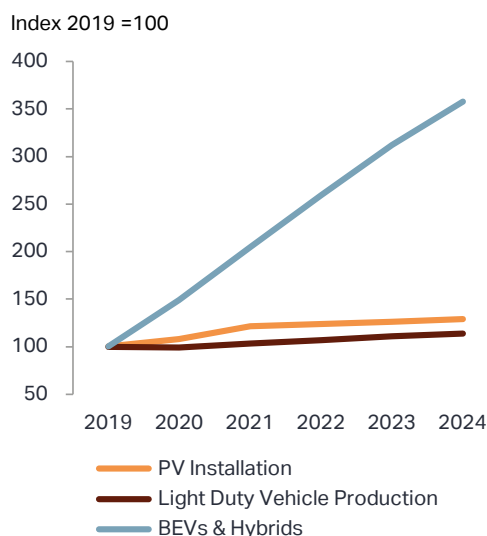
Net **physical investment** in 2020 is forecast to see a third year of notable growth, with a 16% rise to 215.8Moz (6,711t). The largest gain is expected in western markets, mainly the US and Germany, as a result of bargain hunting and investors' response to rising macroeconomic uncertainty. In India, we expect to see modest growth, as investors respond to the sharp price drop. That said, some of these gains should be offset by the forecast drop in China.

Global Demand Forecast



Source: Metals Focus, Bloomberg

Longer Term Industrial Demand Indicators



Source: Metals Focus, LMC Automotive (total vehicles data from April update, BEV and hybrid detail from January 2020).

The Longer Term Outlook for Silver

The main theme for **mine output** in the medium term is growth. This is partly due to a slight rise for mines already producing as operational improvements and expansions outweigh losses from grade decline and reserve depletion. We can also expect larger gains from new projects, both new primary silver projects (mainly in Mexico) and as a by-product. To avoid losses in the longer term (four to five years out), investment will be required to bring earlier stage projects into production as these are needed to replace lost output from reserve depletion, in both primary silver projects and assets where silver is a by-product. In addition, disruption from industrial action will likely continue, as a major share of silver production comes from jurisdictions recently prone to disruption and there is little to suggest this trend will cease.

The outlook for **recycling** is mixed. Ever tighter waste legislation points to ongoing small gains in industrial scrap, but this will be offset by further losses in photographic scrap as the pool of old X-rays diminishes. There is little to suggest either structural gains or losses for jewelry or silverware scrap.

Looking beyond the COVID-19 crisis, there are underlying themes for demand that could emerge in the next few years. On the **industrial** side, a good example will be the eventual dominance for hybrid (including mild-hybrids) and battery electric vehicles. This matters as both have higher silver loadings than vehicles with an internal combustion engine. PV demand however may soften as thrifting continues and the growth in installations slows. However, it is becoming more resilient as falling costs makes it less dependent on government subsidies (which can change rapidly) and as the geographical spread of installations widens. Other areas, such as 5G, are promising and many of silver's established demand areas look solid. As such, industrial demand should offer enduring gains.

The future for **jewelry** looks mixed. There are positives, such as western consumption benefiting from continued growth in self-purchases in an ever more online and branded market place. Indian demand could also benefit from growing sales of 925 fashion jewelry. However, the country's rural demand, dominated by simple heavy pieces, could fade as India modernizes. The outlook for **silverware** is also mixed. All-important Indian demand could suffer due to pressure on the informal economy, but it would gain from a recovery in GDP growth and clear consumer interest in sterling silverware. At least the major losses in western demand are over. Similarly, **photographic** demand may fall further, but the bulk of the secular decline is now behind us.

Lastly, **coin and bar** purchases again face divergent forces. In India, the crackdown on the informal economy is not going away and a younger generation is often more interested in equities and, if they still want silver, ETPs. This generational change could also become more apparent in the US. Despite that, the strength of industrial demand and the mixed picture for other fields point to total demand trending higher in the longer run.

Chapter 3

- Sentiment among institutional investors towards silver improved notably last year.
- Physical investment rose by 12% in 2019, with widespread gains in most key countries.
- In spite of near-term headwinds, institutional investment will eventually benefit from growing demand for safe haven assets later this year.

Investment

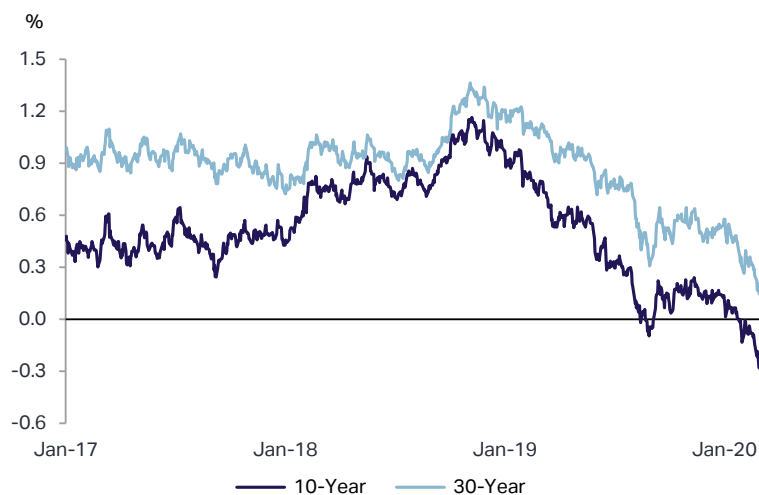
Introduction

Unlike the contrast that occurred between retail and institutional investment in 2018, the silver investment market saw widespread gains last year.

Retail demand, for instance, jumped by 12% y/y to 186.1Moz (5,788t), the biggest increase since 2015. That said, this growth comes from a relatively low base following the collapse in 2017. As a result, total sales of bars and coins were still 40% lower than 2015's record levels; they also remained below 200Moz (6,200t) for the third year in succession. Meanwhile, net institutional investment saw a bigger rise, considering the outflows seen in 2018. Exchange-traded product (ETP) holdings saw a sharp rise in H2.19 from already elevated volumes and reached historically high levels last year. Meanwhile, after being net short for much of 2018, managed money positions on the Comex have been consistently positive since June 2019. This was the key driver for the 15% intra-year rise in the silver price and the strong rally from a three-year low of \$13.90 in November 2018 to a three-year high of \$19.65 last September.

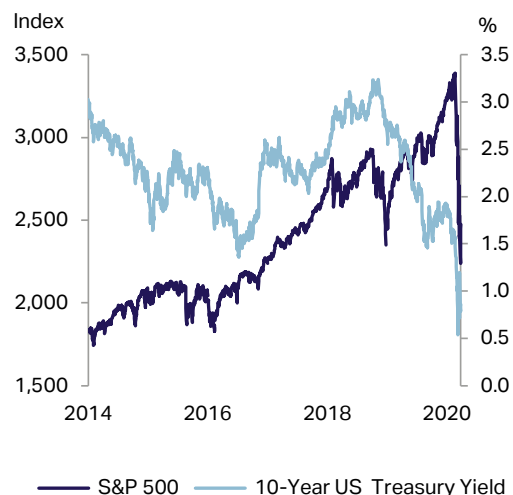
The improvement in investor appetite for silver chiefly reflected healthier sentiment towards gold and to a lesser extent, some respite from the downward trajectory of industrial metals in place since 2018. Underpinning safe haven demand for precious metals were uncertainties arising from the US:China trade dispute and the manufacturing slowdown across much of the industrialized world, which raised concerns about an emerging economic slowdown. These challenges also prompted major central banks to adopt an

US Treasury Inflation Protected Securities Yield



Source: Bloomberg

S&P 500 & 10-Year US Treasury Yield



Source: Bloomberg

Gold, Silver and the LME Index



Source: Bloomberg

increasingly dovish stance towards their respective monetary policies. For instance, the US Federal Reserve nearly reversed all of its 2018 rate hikes by cutting rates three times in 2019.

While macroeconomic uncertainties bolstered its safe haven appeal, silver also faced headwinds from the slowdown in global industrial activity. The slump in manufacturing, especially among some of the larger economies such as China, Germany and the US, that started in 2018, deepened in 2019. Manufacturing PMIs (Purchasing Managers' Index) slipped into contraction for several months. This prevented any meaningful gains in the base metals complex and, in turn, undermined silver. As a result, the gold:silver ratio rose over much of last year, averaging 86:1 in 2019, the highest level since 1993. In the face of the COVID-19 pandemic, this under performance has continued in 2020-to-date, with the ratio exceeding 127:1 in mid-March, an all-time record.

Silver's struggling supply/demand fundamentals also played an important role in this relative under performance. The global silver market saw its fourth consecutive surplus in 2019, reaching 31.3Moz (973t). The silver market has now accumulated surpluses of around 250Moz (7,800t) over 2010-19. All this, at times even during 2019, made silver particularly vulnerable to investors' tactical shorts, when the broader commodity sector came under pressure.

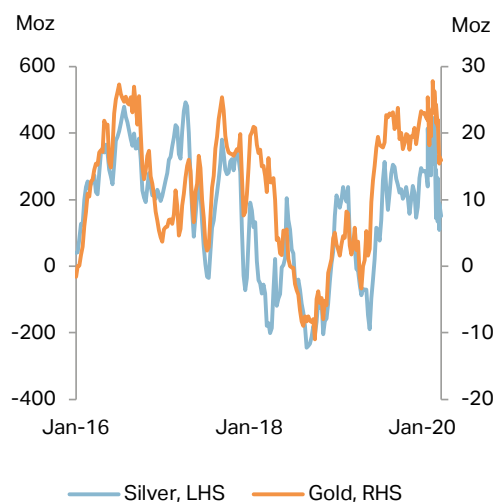
Outlook

With an inevitable sharp contraction in global economic output in H1.20, investor sentiment is likely to remain cautious toward silver in the short term. Even though silver seems to have been oversold during the retreat that it saw in March, the metal's exceptional volatility and liquidity strains in the financial market are still limiting professional investor interest in the metal. The performance of retail investment demand has varied across different markets, although even in countries where appetite is strong, limited product availability due to supply chain disruptions has capped net demand volumes.

Assuming the spread of COVID-19 slows during Q2.20, investor sentiment towards silver is likely to recover as we progress into H2.20. Key to this will be exceptionally low policy rates cuts and unprecedented liquidity injections by central banks, which will ensure a minimal opportunity cost of carrying gold and silver. A slowing global economy should also ultimately encourage a rotation from stocks and bonds to defensive assets. With the recent flows into cash now looking overdone, silver should eventually benefit from this.

Even though gold will be the main beneficiary of these fresh investment inflows, silver should also enjoy healthy spillovers. Meanwhile, silver's low price level and the high gold:silver ratio will also make the white metal increasingly appear undervalued, prompting additional investor inflows. Once there are convincing signs that a sustained gold rally is underway, we would expect a more noticeable rise in investment into silver to occur.

Investors' Net Long Positions on Comex*



*Managed money positions; Source: CFTC

Annual Turnover on Major Commodity Exchanges

Million ounces	2018	2019	Y/Y
Comex	119,935	120,746	0.7%
SHFE ¹	20,428	68,878	237%
SGE T+D ¹	12,596	27,824	121%
MCX	3,999	5,295	32%
LME	743	354	-52%
Tocom	6	7	12%
SGE Spot ¹	6	4	-39%

1) Both the SGE and SHFE record each transaction twice, from the point of view of the buyer and also the seller. However, to compare these volumes with other exchanges, such as the Comex, the reported figures have been halved (as shown above).

Source: Bloomberg, respective exchanges

Institutional Investor Activity

2019 witnessed a dramatic turnaround in investor sentiment towards silver across all key areas of institutional investment. Initially, the market through to early June was characterized by subdued investor interest. Thereafter, however, silver investment posted a sharp rebound, which subsequently drove the price to a three-year high. Much of this improvement can be attributed to positive spillovers from a macro-fueled gold rally. Inflows driven by silver's underlying fundamentals or its industrial commodity attributes, by contrast, remained subdued throughout the year.

Commodity Exchanges

2019 saw higher silver turnover on most commodity exchanges. As illustrated in the table, Comex remained the largest exchange for silver trading on an annual basis. That said, a sharp rebound on the **Shanghai Futures Exchange (SHFE)** saw its volumes exceed Comex briefly in September and December.

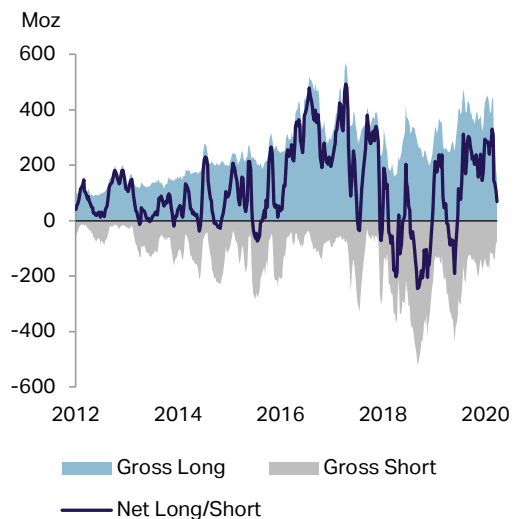
On **Comex**, aggregate volumes strengthened for the fourth consecutive year, up by 0.7% to a new record annual total in 2019. The marginal increase was mainly led by a dramatic rebound in activity from late June onwards, which mitigated a double-digit decline in turnover over January-May.

The turnaround in sentiment was also highlighted by a sharp swing in managed money positions during 2019. From a net long of 213.8Moz (4,673t) in early January, these positions switched to the short side in April hitting a net short of 190.0Moz (5,911t) by late May, a level last seen in October 2018. On top of an unfavorable macroeconomic backdrop for precious metals investment, silver's lackluster fundamentals and concerns over industrial output weighed on investors' interest. Over the same period, bearish price expectations also encouraged some tactical investors to increase their short positions. This in turn helps to explain a sharp rise in the gold:silver ratio at the time.

Thereafter, as sentiment turned positive towards gold, silver followed suit. As key price thresholds were broken, some investors became more comfortable holding long positions in the metal. As a result, net long positions quickly returned in mid-June and then climbed to a high of 312.8Moz (9,729t) on July 30th. Despite modest liquidation thereafter, net positions remained long and relatively high through to end-2019.

Looking at 2020-to-date, the spread of COVID-19 has boosted fears of a global recession. As associated panic selling accelerated from late February, silver was aggressively sold amid investors' rush to raise cash. The situation was further exacerbated by silver's high volatility at a time when many investors were reluctant to hold the metal when faced with an equity and bond market rout. By end-March, net longs had fallen below 90Moz (2,800t), down by over 70% from their February high.

Investors' Positions on Comex*



*Managed money positions

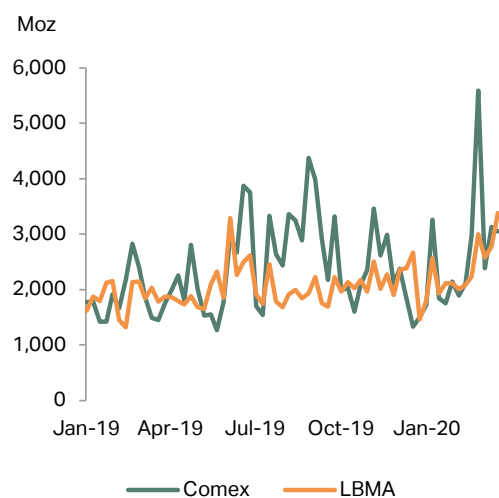
Source: CFTC

Turnover on the SHFE more than tripled in 2019, albeit against a low base in 2018. As trading on the exchange is dominated by short-term investors, it is not surprising that trading volumes started to improve in July, when the silver price eventually broke out to the upside. Investor sentiment was also helped by the weakening yuan over the summer, as growth in the local silver price posted steeper gains. Weak base metal prices also helped, as this encouraged investors to rotate their investments into silver.

The **Shanghai Gold Exchange** (SGE) also reported sharp gains in silver trading, as volumes of its T+D contracts more than doubled in 2019. In addition to improving price sentiment, silver trading also benefited at the margin from several favorable factors during 2019, including an extension in trading hours from June onwards, lower transaction fees and promotion by local banks and other financial institutions.

Turnover on the **Multi Commodity Exchange of India** (MCX) and on the **Tokyo Commodity Exchange** (Tocom) rose by 32% and 12% respectively last year. For both exchanges, September witnessed the highest monthly turnover in 2019, thanks to improving price expectations. In contrast, silver trading on the **London Metal Exchange** (LME) more than halved in 2019. After an initial ramp-up following the introduction of silver (and gold) futures in July 2017, trading on the LME tapered off during 2018. To boost liquidity, the LME launched a one-year program in 2019 which offered new trading participants a rebate of trading and clearing fees across all contracts.

Comex & LBMA: Weekly Turnover



Source: CME Group, LBMA, Nasdaq

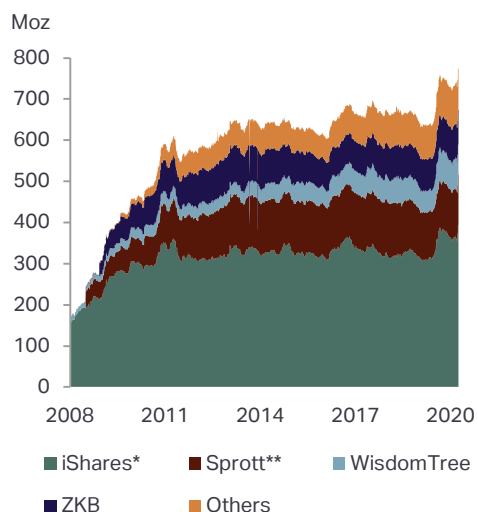
Over-the-Counter Market (OTC)

In November 2018, the LBMA started to publish trading data that covers the LBMA members' share of OTC activity. For the first time ever, there has been publicly available, reliable numbers for the size and liquidity of the global OTC market for gold, silver, platinum and palladium. In 2019, LBMA members traded 104,631Moz (3,254,398t) of silver in the London OTC market, 13% below turnover on Comex (5,000oz silver futures). Similar to other areas of investment, silver OTC trading posted a sharp jump in June. Feedback from our contacts suggests this growth was largely driven by speculators who were using silver as a leveraged play on gold. Even though interest eased after the silver (and gold) rally ran lost momentum in September, trading volumes thereafter remained decent and notably above the levels seen in late 2018. Finally, with a 62% market share, spot trading dominates the London OTC trading in 2019. This was followed by swaps and forwards (with a 33% share), with the rest accounted for by options, leases, loans and deposits.

Exchange-Traded Products (ETPs)

Combined silver ETP holdings stood at 728.9Moz (22,672t) at end-2019, up by 13% from the previous year, the largest annual increase since 2010. The majority of inflows were recorded over June-August. Prior to that, a lack of clear price trend led to stagnant holdings, within a 630-640Moz (15,600-

Silver ETP Holdings



*iShares Silver Trust; **Combined holdings of Sprott Gold & Silver and Sprott Silver

Source: Bloomberg, respective issuers

15,900t) range. Following the major gold price recovery in early June, investors' confidence in silver improved materially. Bargain hunting also picked up, as the elevated gold:silver ratio made silver seem increasingly undervalued. As a result, ETPs holdings jumped by 15% over June-August to reach a fresh all-time high of 758.3Moz (23,587t) on August 29th. After the silver rally faltered in early September, profit-taking ensued over the rest of 2019, which continued initially in 2020. That said, the scale of redemptions remained limited, as sentiment among some towards precious metals has remained positive amid economic and geopolitical uncertainties.

From late January this year, inflows once again resumed, as investors viewed falling prices as an opportunity to accumulate, particularly in the light of rising coronavirus fears. By late March, global holdings have surpassed 2019's peak level to hit a fresh all-time high of 773.3Moz (24,054t). Looking ahead, we expect inflows to continue over the rest of 2020, as demand for safe haven assets also favors silver.

Physical Investment

Global investment in 2019 grew for the second consecutive year, rising by 12% to 186.1Moz (5,788t). As positive as that may appear, the 2019 increase was from a relatively low base and the total was still some 40% below 2015's record high. Germany contributed the largest gain last year, as investors rushed to physical silver ahead of the reduction in the limit for anonymous precious metal purchases at the start of 2020. The US and India also posted modest gains on the back of improving price expectations. Turning to 2020, demand for silver bars and coins has picked up notably so far, following the price pull-back in March, although coronavirus containment measures and supply disruptions have capped sales in some localities.

Physical Investment Forecast

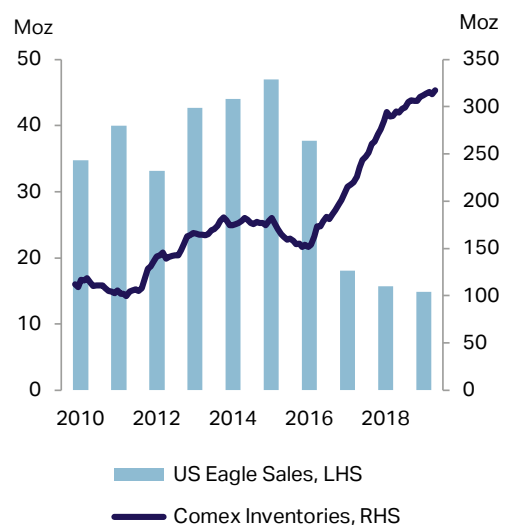
Million ounces	2019	2020F	Y/Y
Bars	88.2	99.9	13%
Coins	97.9	115.9	18%
Global Total	186.1	215.8	16%

Source: Metals Focus

Looking first at the **US**, retail demand is estimated to have risen last year by 9% y/y to 48.2Moz (1,500t). That said, this performance was flattered by the modest total in 2018 of 44.3Moz (1,379t). To put that into perspective, US retail investment in 2015 had achieved a record high of 128.0Moz (3,981t). In part, that year's strength reflected heightened price volatility. This was in sharp contrast to much of 2019, when the silver price was often confined to a relatively tight trading range. At the same time, US equities were setting new highs and so for many retail investors there appeared little reason to buy coins and bars.

Even though retail investment improved last year from a low base, the supply chain still had to contend with shortages, especially of coin blanks. This helps explain why bars and 1oz rounds gained market share at the expense of a number of official bullion coins. As challenging as this was at times, our understanding is that retail premiums rarely jumped. There was rarely a time last year when US retail investors could not secure investment products.

US Silver Eagle Sales vs Comex Inventories



Source: US Mint, Comex

The lack of retail investor excitement for physical silver was reinforced by the relatively subdued response during the third quarter when precious metals prices strengthened. This contrasted sharply with gold, when an initial wave of selling back soon gave way to a jump in demand.

As for this year, the trend in retail demand could not be more different. After a quiet start, retail demand has recently burst into life. One key catalyst for this was a sharp drop in the silver price. This saw dealer stocks for several investment products quickly become depleted, resulting in extended delivery lead times. Taking note of this change in appetite, we expect US demand to post a sharp increase in 2020, achieving a four-year high.

Indian physical investment rose for the third year in 2019, by 5% to 56.5Moz (1,757t). This was due to two factors. The first concerned the government's ongoing crackdown on unaccounted wealth, with a particular focus on gold. This contributed to a shift in favor of silver. Secondly, silver's under performance relative to gold fueled positive price expectations, encouraging many investors to rotate out of gold and into silver.

As for 2019's intra-year trends, investment demand during the first half was helped by a drop in the rupee silver price, which fell by some 10% from Rs.40,000/kg in February to Rs.36,000 in July. However, the sharp rally during July to September, when silver recovered to Rs.40,000, saw net purchases fall noticeably, as investors booked profits.

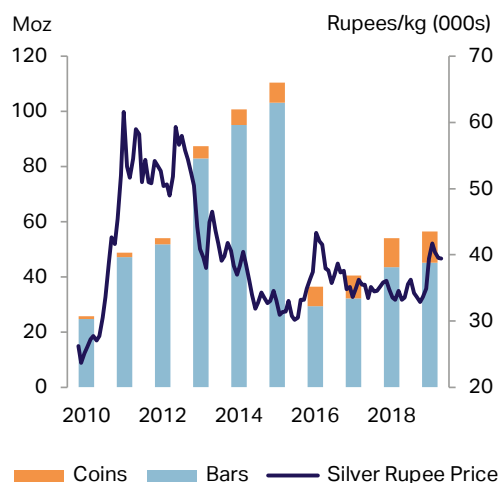
Turning to the Indian silver coin market, 2019 was another strong year, with demand increasing by 7% to 11.3Moz (351t), the third year of record sales. In contrast to the bar market, coins tend to be gifted during religious occasions. One reason for the strong performance is that betel nut and mouth freshener manufacturers have continued to buy coins in bulk, which they then use in promotional activities, with average orders ranging between 150,000-300,000 pieces.

Physical Investment

Million ounces	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
India	25.7	48.8	54.1	87.4	100.8	110.4	36.5	40.5	54.0	56.5	5%
United States	95.0	121.0	104.6	121.1	113.1	128.0	98.8	54.6	44.3	48.2	9%
Germany	34.1	36.0	23.7	27.6	19.9	21.6	24.0	22.0	24.0	32.0	34%
China	9.9	20.9	22.9	21.2	11.7	11.5	11.1	7.7	6.8	6.2	-8%
Canada	3.6	4.8	4.8	6.6	7.4	7.6	7.2	4.7	4.6	5.0	10%
Other Europe	8.5	11.0	7.2	7.9	7.3	9.9	10.8	9.1	10.9	11.6	6%
Others	20.3	29.5	23.4	28.3	22.4	21.4	25.4	17.7	21.1	26.5	26%
Global Total	197.2	272.0	240.8	300.1	282.6	310.4	213.9	156.2	165.7	186.1	12%

Source: Metals Focus

Indian Coin & Bar Demand



Source: Metals Focus, Bloomberg

Looking to this year, we expect to see a modest increase in bar and coin demand, following a rise in investor appetite spurred by the sharp price drop. Our discussions with refineries and bullion dealers revealed strong buying by investors in March. At that time, physical silver was sold by retailers with a 3-7% premium, which compares to typical levels of 1-2%.

European physical investment surged by 25% to an eight-year high in 2019. Almost all of last year's gains were accounted for by Germany, where volumes jumped by over a third. Similar to other key markets, this increase was initially driven by improving price expectations, while the gold:silver ratio's rise to multi-decade highs also prompted bargain hunting. Investment then accelerated later in the year, after the German government decided to reduce the limit for anonymous cash purchases from €10,000 to €2,000, effective from January 1st 2020. The change coincided with a further cut in policy rates by the ECB, which saw an increasing number of banks impose negative interest rates for retail customers in Germany. Worries about fiat currencies and an increasing preference for hard assets saw demand for physical precious metals surge in the final weeks of 2019. Even though much of this centered on gold, silver also benefited, helped also by its appeal to small retail investors resulting from its lower price entry level.

The downtrend in **Chinese** physical investment continued in 2019 for the tenth straight year. Due to the VAT treatment of silver (13% is levied on the full value of silver products, whereas gold and platinum are exempt from VAT), the bar and coin markets are driven by gifting and collector purchases. In the face of an economic slowdown and weaker consumer sentiment, demand fell by 8% in 2019 to 6.2Moz (193t). With regards to this year, in spite of the lower silver price, we do not expect to see much bargaining hunting. Instead, purchases will be undermined as the economy continues to struggle.

Coins & Medals Fabrication

Million ounces	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Canada	19.0	24.0	19.8	30.6	32.4	37.6	36.2	21.0	21.0	25.8	23%
United States	38.5	45.4	36.1	45.8	46.4	49.1	39.4	19.3	17.1	19.5	14%
Australia	7.6	11.1	10.5	8.6	8.5	12.7	13.2	10.7	10.4	12.7	21%
India	1.0	1.6	2.3	4.5	5.7	7.2	7.1	8.3	10.5	11.3	7%
China	4.8	11.7	12.0	12.0	11.7	11.5	11.4	8.0	7.5	7.0	-7%
Germany	5.8	4.0	1.3	1.3	1.3	1.9	4.3	4.0	4.0	3.9	-4%
South Africa	0.0	0.0	0.0	0.8	0.0	0.6	0.0	1.2	3.7	3.6	-3%
United Kingdom	0.4	0.9	0.7	2.5	2.2	3.5	3.5	3.1	3.5	3.2	-9%
Austria	11.4	17.9	8.8	14.5	4.6	7.3	3.4	2.1	2.1	2.9	38%
Mexico	1.0	1.7	1.3	0.7	0.7	1.1	1.2	1.2	0.6	0.4	-35%
Others	6.5	6.7	6.7	7.4	6.7	6.8	5.8	5.5	6.4	7.6	19%
Global Total	95.9	125.0	99.5	128.8	120.1	139.3	125.5	84.4	86.9	97.9	13%

Source: Metals Focus

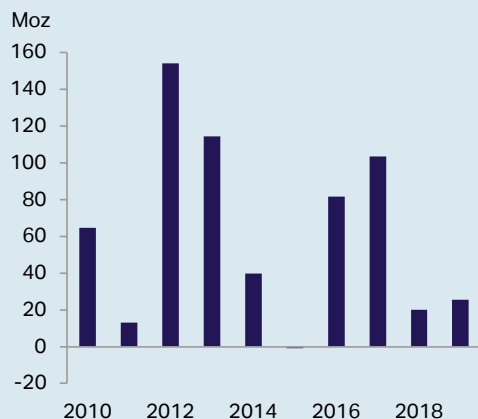
Above-Ground Silver Stocks

The structural surplus, that has been in place in recent years for silver, continued in 2019. Supply exceeded demand by 31.3Moz (973t) over the year, a little higher than the surplus in 2018. The decade that ended last year saw silver market surpluses in seven out of its ten years, resulting in a cumulative increase in global above-ground bullion stocks of 254.2Moz (7,905t). This excludes the official sector, as well as retail investors' coin and bar holdings, which together rose by 186.1Moz (5,788t) last year and by 2.3 billion ounces (72,312t) over the whole decade.

Further to the above-mentioned increases in global above-ground stocks, the past few years have seen a growing share of these inventories being captured by publicly available data. It would thus seem that previously unidentified inventories have shifted to vaults that report holdings. As a result, in recent years we have seen reported silver inventories increase that are considerably higher than the corresponding surpluses. 2019 was no exception. As illustrated in the accompanying table, identifiable bullion inventories rose by approximately 114.9Moz (3,573t), an increase that was more than 3.5 times the size of the global market surplus last year.

Looking at the detail behind this figure, bullion stocks held at London vaults, as reported by the LBMA, rose by 24.5Moz (761t) in 2019. Most months saw increases, and these were partly offset by the declines seen in the middle of the year, when UK exports to India rose considerably.

UK Net Silver Bullion Imports



Source: HM Customs & Excise

Identifiable Silver Bullion Inventories*

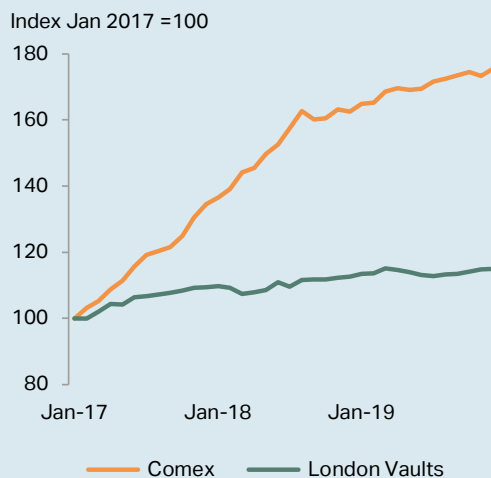
Million ounces	2017	2018	2019	Y/Y
London Vaults	1,106.5	1,137.7	1,162.2	2%
Comex	243.4	293.9	317.2	21%
SGE	40.4	68.5	108.2	69%
SHFE	43.1	35.8	63.2	-17%
Total	1,433.4	1,535.9	1,650.8	7%

*Year-end; Source: Metals Focus, LBMA, Comex, SGE, SHFE

Inventories held at Comex-registered depositories rose by 23.3Moz (724t), as still subdued (albeit higher than 2018) retail investment demand in the country perpetuated over-supply. It is worth noting that the rise in Comex stocks was far smaller than the one we had seen in 2018, reflecting higher local demand.

Chinese reported stocks were also higher last year, with SGE inventories rising by 39.7Moz (1,235t) and SHFE stocks increasing by 27.4Moz (853t). One driver of this was the rise seen in copper, lead and zinc concentrate imports into the country, that would have resulted in higher local output of silver from the processing of imported raw materials. As far as we understand, smelters/refiners would deliver the metal into exchanges to offload the price risk as well as to quickly generate cashflow.

Comex vs London* Vault Inventories



*Includes silver stored at LBMA-member custodian vaults and the Bank of England; Source: Metals Focus, LBMA, Comex

Chapter 4

- Mine production fell by 1.3% y/y to 836.5Moz (26,019t) due to lower primary silver and copper by-product output.
- Primary silver mines' total cash costs increased by 55% y/y to \$5.16/oz, the result of lower base metal prices and higher treatment costs.
- We have reduced our mine production forecast for 2020 by 6.4%, or 54.5Moz (1,694t), since January as a result of the COVID-19 pandemic.

Mine Supply

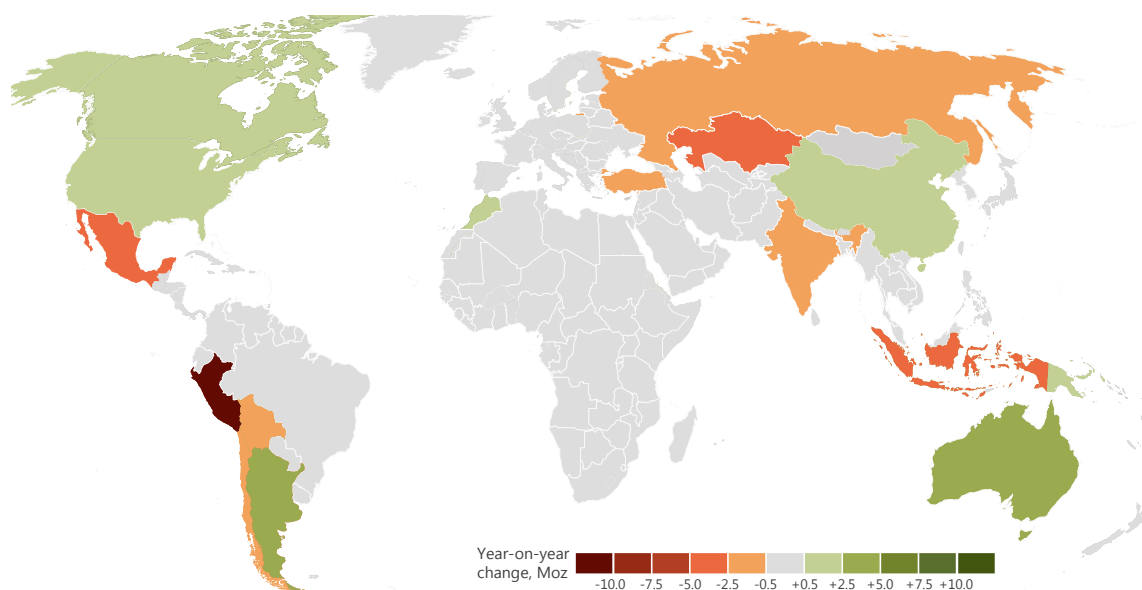
Mine Production

Global mined silver production fell for the fourth consecutive year in 2019, dropping by 1.3% y/y to 836.5Moz (26,019t). This was the result of declining grades at large silver mines, lower silver output from copper mines and disruption-related losses at some major producers. Lead-zinc mines once more contributed the most to the global total, with their silver output rising by 2.3% y/y. Silver production from gold mines was flat y/y, while output from copper and silver mines dropped by 3.1% and 3.8% respectively.

On a country level, the largest year-on-year drop emerged in Peru, where output fell 11.1Moz (345t), a drop of close to 8%. This was largely a result of lower head grades at major silver producing mines alongside mine closures. Other notable year-on-year declines came in Mexico (-4.2Moz, 131t), Indonesia (-2.9Moz, 90t) and Kazakhstan (-2.8Moz, 87t). These losses were partially offset by increases in Argentina (+3.9Moz, 123t), Australia (+2.6Moz, 80t) and the US (+1.8Moz, 55t).

We are expecting global mine production to decline by 4.6% y/y in 2020, a reduction of 38.8Moz (1,206t). This is a result of expected disruption from the COVID-19 pandemic and represents a 6.4%, or 54.5Moz (1,694t), decrease compared to our forecast at the start of this year. Estimating the impact is challenging at this stage, but we have already seen temporary closures at silver producing mines across the globe, and so it seems likely this will have major implications for silver production in 2020.

Major Changes to Global Mine Production, 2019 versus 2018



Source: Metals Focus

Top 20 Producing Countries

Million ounces	2018	2019	Y/Y
Mexico	194.5	190.3	-2%
Peru	146.5	135.4	-8%
China	110.0	110.7	1%
Australia	40.3	42.9	6%
Russia	43.1	42.4	-2%
Poland	40.9	40.4	-1%
Chile	40.0	38.2	-4%
Bolivia	38.3	37.2	-3%
Argentina	30.9	34.8	13%
United States	29.8	31.5	6%
India	21.2	20.4	-4%
Kazakhstan	19.5	16.7	-14%
Sweden	15.0	14.4	-4%
Canada	11.8	13.5	14%
Morocco	7.4	8.1	9%
Indonesia	10.6	7.7	-27%
Uzbekistan	6.0	6.1	2%
Papua New Guinea	3.0	4.7	58%
Dominican Republic	5.1	4.5	-12%
Turkey	4.7	3.2	-33%
Others	29.3	33.4	14%
Global Total	847.8	836.5	-1%

Source: Metals Focus

North America

North American silver mine production was almost flat year-on-year in 2019 at 235.3Moz (7,319t), a drop of 0.3%. Production from Mexico was down by 4.2Moz (131t), although this was offset by a combined increase of 3.4Moz (106t) in the US and Canada.

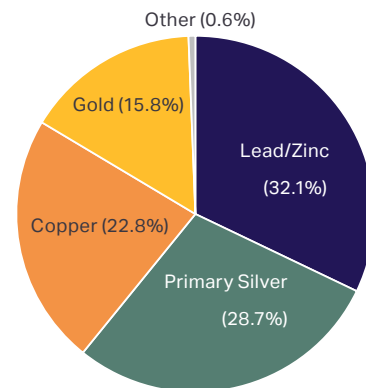
The 2.2% y/y decline in **Mexico's** silver production was largely a result of lower grades at several major silver mines in the country. Fresnillo, the biggest silver mining company in the world, saw its attributable silver production drop by 11% y/y to 51.8Moz (1,610t) as a result of lower grades at its Fresnillo, Saucito and San Julian mines. Other significant declines came from operations being put into care and maintenance during the year, such as First Majestic's San Martin and Endeavour Silver's El Cubo mines. These decreases were partially offset by increases at mines such as La Encantada (+1.5Moz, 47t), Peñasquito (+1.2Moz, 37t) and Dolores (+1.0Moz, 31t). At the start of 2019 it was anticipated that Peñasquito would produce more than 40Moz (1,244t) during the year, as mining moved into higher grade zones and the completion of the pyrite leach plant allowed for higher recoveries. However, mining was suspended for almost 90 days over the year due to blockades. This resulted in significantly lower production from Peñasquito than anticipated despite the year-on-year increase.

Production in the **US**, which increased by 1.8Moz (55t) or 5.9% y/y, was heavily influenced by higher production at Hecla's Greens Creek. Average silver grades increased from 417g/t in 2018 to 502g/t in 2019 resulting in a year-on-year increase of 1.9Moz (59t). The strike by unionized workers at Lucky Friday, which started in March 2017, came to an end in January 2020. Hecla is aiming to bring the mine up to full production rates by the end of 2020 which will add significant production in the US moving forward.

Silver Mine Production, by Source Metal in 2019

Million ounces	Primary				
	Lead/Zinc	Silver	Copper	Gold	Other
North America	36.1	131.6	16.0	50.9	0.7
Central & South America	76.8	58.3	71.3	50.0	0.0
Europe	14.7	1.0	45.7	1.0	0.0
Africa	3.7	5.2	2.9	2.8	0.0
CIS	12.6	21.0	22.3	10.7	2.9
Asia	102.9	8.3	27.3	10.5	1.5
Oceania	21.9	14.6	5.2	6.2	0.0
Total	268.7	240.0	190.6	132.1	5.1

Source: Metals Focus



Top 20 Producing Companies

Million ounces	2018	2019	Y/Y
Fresnillo ¹	58.1	51.8	-11%
KGHM Polska Miedź ²	38.7	45.6	18%
Glencore	34.9	32.0	-8%
Pan American Silver Corp.	24.8	25.9	4%
Polymetal Intl. plc	25.3	21.6	-15%
Hindustan Zinc Ltd. ^{3,4}	21.2	20.4	-4%
Southern Copper Corp.	17.3	20.3	17%
Buenaventura ⁵	26.3	20.1	-24%
CODELCO	18.9	17.9	-5%
Hochschild Mining plc ⁶	19.7	16.8	-15%
Newmont ⁷	2.8	15.9	466%
Volcan Cia. Minera S.A.A.	17.0	15.6	-8%
First Majestic Silver Corp.	11.7	13.2	13%
BHP ⁸	15.4	13.2	-14%
Hecla Mining Company	10.4	12.6	22%
South32 Ltd	13.4	12.3	-8%
Boliden A.B. ⁹	12.9	12.0	-7%
Coeur Mining, Inc.	12.9	11.7	-9%
Yamana Gold Inc.	8.0	10.6	33%
Industrias Peñoles ¹⁰	11.7	10.6	-10%

NB: 1: Excludes Silverstream contract, 2: Payable silver production, 3: Hindustan Zinc is a Vedanta Group company, 4: Production from integrated operations only, 5: Includes production from associated companies 6: Attributable production (whole group production 20.2Moz), 7: Newmont acquired Goldcorp in 2019, 8: Payable silver in concentrate, includes 57.5% share in Escondida, 9: Silver in concentrate, 10: Excludes 100% Fresnillo plc.
Source: Company Reports, Metals Focus

Mine Production Forecast, by Region

Million ounces	2019	2020F	Y/Y
C&S America	256.4	234.0	-9%
N America	235.3	225.6	-4%
Asia	150.4	145.3	-3%
CIS	69.5	67.5	-3%
Europe	62.4	60.6	-3%
Oceania	47.9	47.7	-0.4%
Africa	14.7	17.1	17%
Global Total	836.5	797.8	-5%

Source: Metals Focus

In **Canada** silver production increased by 1.6Moz (51t) or 14%. The ramp-up of Coeur's Silvertip mine was the most significant reason for this increase, with output up 0.8Moz (25t) y/y. However, Coeur made the decision to place the mine into care and maintenance in February 2020 due to poor market conditions, with a re-start not anticipated until late 2021 at the earliest.

Central & South America

Silver production in Central and South America fell for the third consecutive year, by 8.9Moz (276t) or 3.3% y/y. Production was lower from most major silver producing countries in the region, notably in Peru (-8%), Chile (-4%) and Bolivia (-3%), while output increased significantly in Argentina (+13%).

Peruvian output fell by 11.1Moz (345t) y/y to 135.4Moz (4,210t). The biggest contributor to this decline was Uchucchacua, owned by Buenaventura, where silver output dropped by 4.8Moz (149t) y/y as a result of a 27% y/y drop in silver head grade and a 21-day strike at the start of the year. Hochschild's Arcata was placed into care and maintenance in February 2019 as a result of market conditions leading to a 3.1Moz (96t) y/y fall in silver production. Declining grades also resulted in lower silver production at primary copper mines such as Antamina (-1.4Moz, 44t) and Las Bambas (-1.1Moz, 34t).

In **Bolivia**, silver production dropped by 1.0Moz (33t) y/y largely due to strike action at Sumitomo Corporation's San Cristobal mine where output fell by 1.8Moz (56t) y/y. In **Chile**, silver production dropped by 1.7Moz (54t) y/y as a result of reduced silver production at the country's major copper mines. Silver production from **Argentina** rose by 3.9Moz (123t) y/y as output increased from new projects, such as SSR Mining's Chinchillas mine, part of their Puna operations, and Yamana Gold's Cerro Moro.

In **Guatemala** there was no silver production for the second successive year. Escobal, owned by Pan American Silver, remained closed throughout the year having had its mining license suspended in 2017.

Asia

Silver production in Asia declined by 3.0% y/y to 150.4Moz (4,678t). A marginal increase in **China's** production of 0.7Moz (21t) was overshadowed by losses across most of the region.

In **Indonesia** production fell by 2.9Moz (90t), primarily due to reduced production at Grasberg. During 2019, the final ore was extracted from the open pit as the mine transitioned to a solely underground operation. This led to lower ore throughput and grades which significantly reduced silver production. Elsewhere in Indonesia, production at Martabe was negatively affected by lower grades and recovery rates due to higher copper content in the ore. In **Thailand**, the Chatree mine remained on care and maintenance for the third year as legal proceedings were pushed back to 2020.

Mine Production

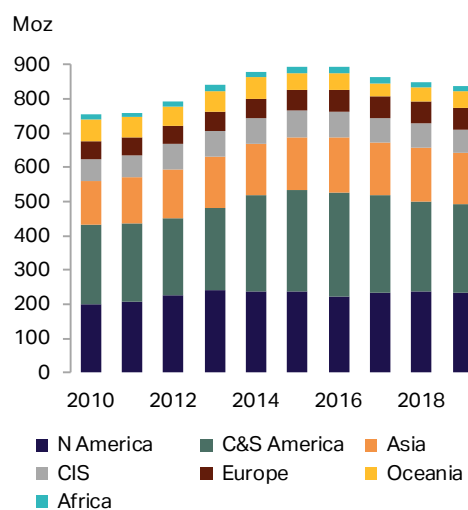
Million ounces	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
North America											
Mexico	141.8	153.6	172.3	187.1	185.4	192.1	174.3	187.0	194.5	190.3	-2%
United States	40.9	36.0	34.1	33.6	37.9	35.0	37.0	33.2	29.8	31.5	6%
Canada	18.3	17.1	21.4	19.9	15.2	11.9	11.6	12.7	11.8	13.5	14%
Sub-total	201.1	206.7	227.8	240.7	238.5	239.0	222.8	232.8	236.1	235.3	0%
Central & South America											
Peru	117.2	110.6	110.6	118.4	121.7	132.4	146.0	156.0	146.5	135.4	-8%
Chile	41.4	41.5	38.3	37.6	50.2	48.1	46.6	40.4	40.0	38.2	-4%
Bolivia	40.5	39.0	38.8	41.4	43.2	42.0	43.5	38.5	38.3	37.2	-3%
Argentina	23.5	23.6	24.7	26.6	29.6	36.4	32.0	29.3	30.9	34.8	13%
Dominican Republic	0.0	0.6	0.9	2.6	4.4	3.1	3.9	4.9	5.1	4.5	-12%
Brazil	0.4	0.5	0.5	0.9	1.1	1.6	2.5	2.8	2.3	2.3	2%
Honduras	1.9	1.6	1.7	1.7	1.9	1.1	0.6	0.7	1.0	1.4	39%
Guatemala	6.3	8.8	6.6	9.1	27.6	27.7	27.0	10.8	0.0	0.0	na
Others	1.3	1.7	1.5	1.4	1.2	1.2	1.1	1.1	1.2	2.4	99%
Sub-total	232.4	227.8	223.6	239.6	280.8	293.6	303.2	284.5	265.3	256.4	-3%
Europe											
Poland	38.3	37.9	37.3	38.8	38.4	39.2	40.9	41.7	40.9	40.4	-1%
Sweden	9.1	9.1	9.8	10.8	12.7	15.8	16.4	15.5	15.0	14.4	-4%
Spain	0.7	1.0	1.1	1.2	1.1	1.4	1.5	1.9	2.1	2.1	0%
Portugal	0.7	1.0	1.1	1.4	1.5	1.5	1.4	1.3	1.8	1.7	-5%
Greece	0.9	0.9	0.8	1.2	1.1	0.8	0.8	0.9	0.9	1.4	43%
Others	1.2	1.1	1.4	1.5	1.5	1.6	1.6	1.5	1.5	2.4	67%
Sub-total	50.9	51.0	51.5	55.0	56.4	60.3	62.6	62.9	62.2	62.4	0%
Africa											
Morocco	9.9	7.8	7.1	7.4	7.7	8.7	9.5	9.8	7.4	8.1	9%
Eritrea	0.0	0.1	1.0	0.5	1.7	3.2	3.2	2.5	1.7	2.2	25%
South Africa	2.7	3.1	2.8	2.4	1.8	1.9	2.0	2.2	1.6	2.0	21%
DR Congo	0.5	0.7	0.9	2.6	1.0	0.9	0.1	0.1	0.1	0.1	-2%
Others	1.6	1.9	2.5	3.0	3.2	2.9	2.4	2.4	2.3	2.4	4%
Sub-total	14.7	13.7	14.2	15.9	15.4	17.5	17.1	17.0	13.2	14.7	12%
Commonwealth of Independent States											
Russia	36.8	39.3	45.4	44.4	46.1	51.1	46.6	42.0	43.1	42.4	-2%
Kazakhstan	22.0	19.8	20.6	21.2	18.3	16.3	17.7	18.6	19.5	16.7	-14%
Uzbekistan	4.8	4.7	4.8	5.9	5.9	5.9	5.9	5.9	6.0	6.1	2%
Armenia	1.7	1.8	2.1	2.3	2.4	2.5	2.4	2.6	2.0	2.4	19%
Tajikistan	0.1	0.1	0.6	0.6	1.0	1.2	1.1	1.4	1.2	1.2	0%
Others	0.3	0.4	0.2	0.2	0.2	0.3	0.5	0.5	0.6	0.6	14%
Sub-total	65.8	66.2	73.6	74.7	73.9	77.2	74.2	70.9	72.4	69.5	-4%

Mine Production

Million ounces	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Asia											
China	93.6	105.9	112.6	118.1	118.4	118.5	120.7	115.8	110.0	110.7	1%
India	5.8	6.5	9.3	10.7	8.4	12.0	14.0	16.9	21.2	20.4	-4%
Indonesia	8.5	6.9	6.3	7.9	7.3	10.0	10.9	10.4	10.6	7.7	-27%
Turkey	11.5	8.9	7.1	6.5	6.4	6.6	6.7	4.9	4.7	3.2	-33%
Iran	1.7	2.1	2.3	2.2	2.3	2.2	2.5	2.5	2.5	2.6	3%
Mongolia	0.8	0.8	0.8	1.3	1.7	2.0	2.2	1.8	1.7	1.6	-3%
Laos	0.6	0.5	0.6	1.1	1.3	1.7	1.7	1.4	1.2	1.1	-8%
Philippines	1.3	1.5	1.6	1.3	0.7	1.0	1.1	1.0	1.0	1.0	0%
Thailand	0.7	0.7	1.1	1.2	1.1	0.8	1.3	0.1	0.1	0.1	0%
Others	1.5	1.5	1.6	1.8	1.8	1.6	2.1	1.9	2.1	2.0	-4%
Sub-total	125.9	135.4	143.4	151.9	149.3	156.3	163.2	156.7	155.1	150.4	-3%
Oceania											
Australia	60.4	55.5	55.5	59.2	59.4	46.0	45.6	36.0	40.3	42.9	6%
Papua New Guinea	2.8	2.9	2.7	3.0	3.1	2.3	3.2	2.1	3.0	4.7	58%
Others	0.7	0.9	0.4	0.5	0.6	0.6	0.4	0.4	0.3	0.2	-18%
Sub-total	63.9	59.3	58.6	62.6	63.1	48.9	49.2	38.6	43.6	47.9	10%
Global Total	754.6	760.1	792.7	840.3	877.5	892.9	892.3	863.4	847.8	836.5	-1%

Source: Metals Focus

Global Mine Production



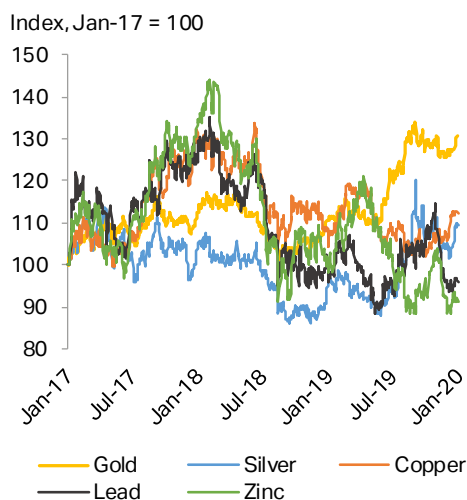
Source: Metals Focus

Other Regions

In Oceania, silver production increased by 4.2Moz (132t) y/y or nearly 10%. Production in **Australia** grew 6% y/y to 42.9Moz (1,334t). This was driven by higher output from lead-zinc mines, such as Mount Isa and the Century Tailings Project. Silver production in Europe was flat year-on-year at 62.4Moz (1,940t) despite silver in concentrate production declining by 1.2% at KGHM's operations in **Poland**, which is the biggest silver producing mine in the world.

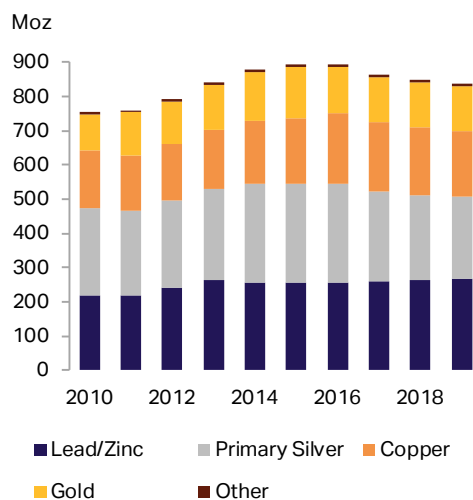
Production in the CIS decreased 4.0% y/y to 69.5Moz (2,162t), mainly due to a 14% decline in production from **Kazakhstan** as a result of lower silver output from Kazzinc (-1.9Moz, 58t). **Russian** silver production fell by 0.7Moz y/y to 42.4Moz (1,320t). An increase in production at Mangazeisky (+1.0Moz, 32t), as it continued to ramp up to commercial production, was offset by reduced output at Dukat (-1.5Moz, 47t) caused by a 7.7% y/y drop in silver grade. Silver production in Africa increased by 12% to 14.7Moz (457t). This was largely driven by a 9% y/y increase in output from **Morocco** as production from Imiter rose by 0.7Moz (24t) y/y.

Indexed Metal Prices



Source: Bloomberg, Metals Focus

Mine Production by Source Metal



Source: Metals Focus

By-Product Analysis

The majority of silver is produced as a by-product, with 71% of mined silver production in 2019 coming from lead-zinc, copper and gold mines. In 2019, lead and zinc production increased year-on-year by 0.7% and 0.9% respectively, while copper production fell by 0.7% and gold by 1.2%.

Lead-zinc mines are the biggest contributor to global mined silver supply, producing 268.7Moz (8,359t) of silver in 2019, 32% of the global total. The largest producer of both these commodities is China, which accounted for 44% and 34% of global lead and zinc production respectively in 2019. Chinese zinc output rose by 1.0% y/y to 4,371kt, while lead production fell by 1.7% to 2,058kt, resulting in little overall growth in silver supply from China. Despite this, global silver production from lead-zinc mines increased by 2.3% y/y. This was largely due to growth in Australia where lead production was up 9.8% y/y and zinc up 15.4% y/y, contributing an additional 2.8Moz (86t) of silver. This was the result of higher output at existing operations, such as Glencore's Mount Isa and McArthur River, alongside ramp-ups at new projects, including Dugald River and the Century Tailings Project.

Copper output from the biggest producing country in the world, Chile, dropped by 0.8% to 5,787kt in 2019. This underpinned the global year-on-year drop in copper production and was a result of falling grades at some of the countries largest operations and water scarcity, as a result of drought and operational issues. Copper output did increase at other major producers, such as China (+2%), the US (+3%) and Peru (+1%), although these were not enough to offset the reductions in Chile. This resulted in silver production from copper mines falling by 3.1% y/y.

The 1.2% y/y drop in **gold** production was significantly influenced by declining output at Grasberg in Indonesia. Reduced grade and ore throughput, as the mine ended its open pit operation and transitioned to a solely underground mine, resulted in a 1.9Moz (59t) y/y reduction in gold output. This, alongside lower gold output from major producers such as the US (-7%) and China (-5%), was enough to offset increases elsewhere, including Russia (+8%) and Australia (+3%). Excluding the impact of Grasberg, a primary copper mine, global gold production was almost flat year-on-year, which resulted in little change to silver production from primary gold mines.

The 2020 outlook for production of lead, zinc, copper and gold, alongside the silver produced as a by-product from these mines, will be heavily influenced by the COVID-19 pandemic. It is likely we will see lower than expected production of all of these metals as the pandemic causes miners and governments to take preventative action to halt the spread of the virus. We have already seen mining operations temporarily suspended in several countries, including Peru, Argentina and South Africa, which has impacted all commodities produced in these jurisdictions.

Disruption to Silver Mine Supply in 2019 and 2020

In 2019, we estimate that 35Moz (1,091t) of silver production was “lost” relative to expected output at the start of the year. The biggest losses came as a result of disruption from industrial and community action.

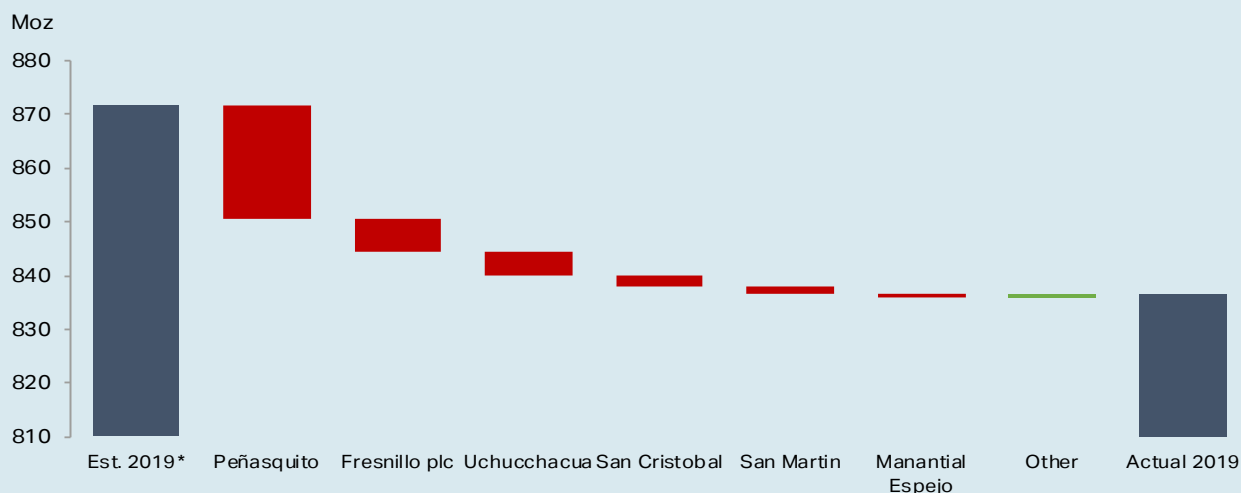
The most prominent disruption-related loss came at Peñasquito in Mexico. The mine was expected to produce over 40Moz (1,244t) in 2019, but achieved 21Moz (653t). This was due to operations being suspended twice during the year, for a combined period of almost 90 days, due to blockades led by local truck drivers, landowners and residents. Notable strike action was also seen at Buenaventura’s Uchucchacua mine, in Peru, and Sumitomo Corporation’s San Cristobal mine in Bolivia.

Fresnillo’s production was 6Moz (187t) lower than anticipated at the start of the year due to unexpected grade declines at its major operations in Mexico. Pan American Silver’s Manantial Espejo, in Argentina, saw guidance missed for similar reasons. Elsewhere, disruption losses at First Majestic Silver’s San Martin were due to operations being suspended because of growing insecurity in the area. While in Guatemala, Escobal remained closed throughout 2019 as expected at the start of the year.

Despite these losses in 2019 we expect to see greater challenges for silver mine production this year as a result of the COVID-19 pandemic. The situation as it relates to mining operations is evolving on a daily basis so accurate predictions are challenging. At the time of writing, we are estimating that mined silver production will drop by 6.4% or 54.5Moz (1,694t) compared to our prediction at the start of the year as a result of temporary mine closures caused by the outbreak.

China, where the outbreak began, will undoubtedly have had mining operations impacted by the country’s efforts to control the spread of the virus. That said, the impact on silver production, the majority of which comes from its lead-zinc mines, is currently unknown. Other major silver producers, including Mexico, Peru, and Bolivia have implemented nationwide lockdowns, resulting in the temporary closure of silver mining operations. In Canada, operations in Quebec have been suspended, while most in other provinces remain open. Meanwhile, mines in other key silver producing nations, such as the US, Australia and Russia are currently operating as normal. However, we may also see mines in some of these countries impacted as measures to control the outbreak are introduced.

Disruptions to Mine Supply in 2019



* as of December 2018

Source: Metals Focus Silver Mine Cost Service

Primary Silver Production Costs

US\$/oz (by-product*)	2018	2019	Y/Y
North America			
Total Cash	2.44	4.05	66%
All-In Sustaining	10.61	12.18	15%
Central & South America			
Total Cash	5.54	7.04	27%
All-In Sustaining	11.03	11.57	5%
CIS			
Total Cash	7.21	10.42	45%
All-In Sustaining	8.96	12.64	41%
Asia			
Total Cash	-3.51	-1.66	na
All-In Sustaining	2.12	4.36	106%
Oceania			
Total Cash	-0.47	2.02	na
All-In Sustaining	5.54	7.77	40%
Global Total			
Total Cash	3.33	5.16	55%
All-In Sustaining	9.85	11.47	16%

* Costs shown on a by-product accounting basis.

Source: Metals Focus Silver Mine Cost Service

Primary Silver Production Costs

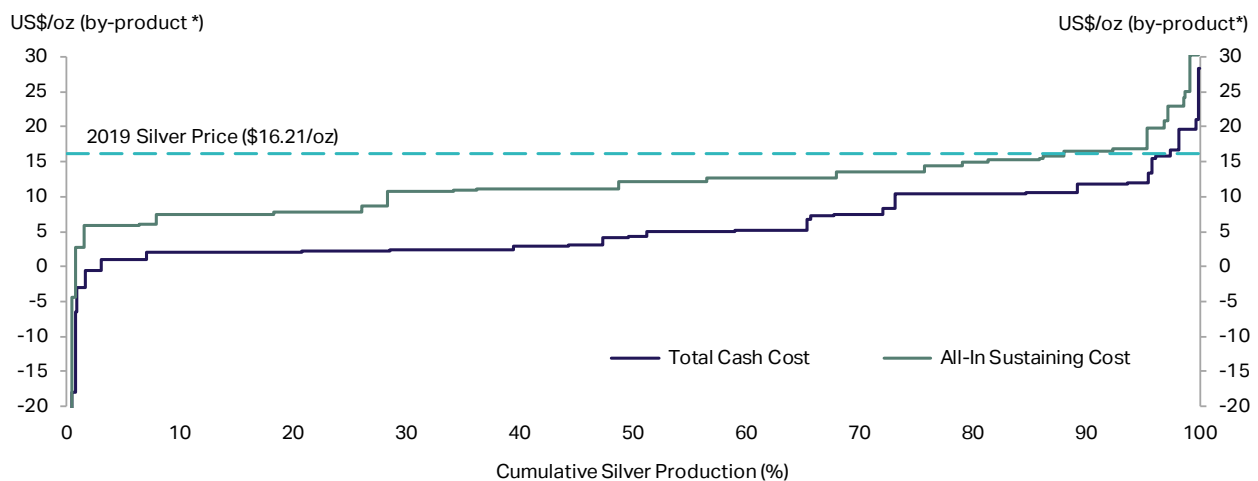
The cost analysis in this section covers roughly 80% of primary silver mine supply – in other words, those mines that derive most of their revenue from silver over the life-of-mine. Primary silver mining total cash costs (TCC) increased by 55% y/y to \$5.16/oz in 2019, while all-in sustaining costs (AISC) rose by 16% y/y to \$11.47/oz.

The currencies of key silver producing nations weakened year-on-year against the US dollar in 2019, including the Australian dollar (-7.4%), Russian ruble (-3.0%) and the Peruvian nuevo sol (-1.5%). Meanwhile, economic problems in Argentina resulted in the peso falling by 71.7% y/y against the US dollar. Although weaker local currencies would normally result in falling costs on a US dollar basis, this effect was negated by rising local inflation, lower head grades at some major operations and a drop in by-product revenues.

Most silver mines are polymetallic in nature and often produce appreciable amounts of lead, zinc, gold and/or other metals. Revenue generated from these metals lower cash costs as by-product credits. Zinc, lead and copper prices decreased by 13%, 11% and 8% respectively year-on-year. In addition, zinc treatment charges were at a four-year high of \$245/t. This additional cost further reduced net revenue available from zinc production at silver mines. As a result, cost reductions from by-product credits were lower year-on-year and this was the biggest factor behind rising TCC and AISC at silver mines.

Looking ahead to this year, the COVID-19 pandemic is sure to have a significant impact on silver production costs. Metal prices have already

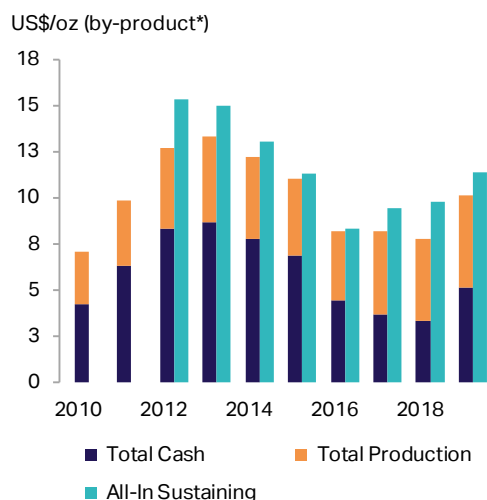
Global Primary Silver Mine Production Costs in 2019



* Cost shown on a by-product accounting basis.

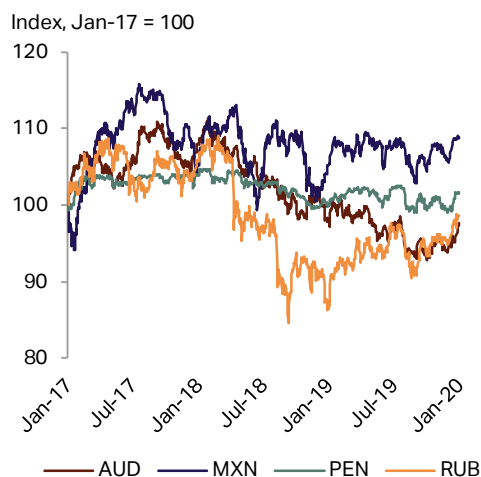
Source: Metals Focus Silver Mine Cost Service

Global Production Costs



*Cost shown on a by-product accounting basis
Source: Metals Focus Silver Mine Cost Service

Exchange rates to US dollar



AUD - Australian dollar, MXN - Mexican peso, PEN - Peruvian nuevo sol, RUB - Russian ruble
Source: Bloomberg, Metals Focus

fallen significantly as the outbreak weighs on demand for key commodities. This will feed through to lower by-product credits for silver producers, increasing costs. Mining operations are also being put into temporary care and maintenance as a preventative measure to control the outbreak and to comply with government regulations in several key silver producers, such as Mexico and Peru. The cost of closing and then re-opening mining operations will feed through into higher costs for impacted assets. There will be some relief from lower oil prices, which will feed through to diesel costs, alongside a strong US dollar. However, it seems likely that TCC and AISC will increase year-on-year. This development, together with the drop in metal prices, may put some higher cost silver operations under pressure.

Regional Performances

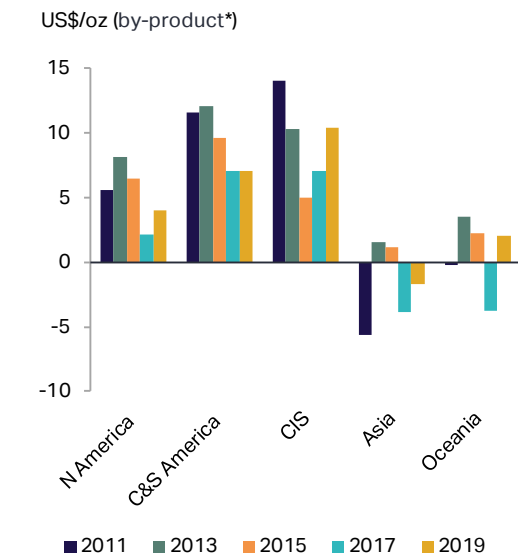
In North America, which accounts for 55% of global primary silver production, average TCC and AISC increased to \$4.05/oz (+66%) and \$12.18/oz (+15%) respectively. This was the highest TCC and AISC for the region since 2015. The increase was primarily from lower base metal prices, higher treatment charges and lower grades at several major operations in the region.

In Mexico, the world's biggest silver producer, TCC averaged \$3.74/oz (+64%), while AISC averaged \$11.96/oz (+17%). Currency movements had very little impact on operating costs in the country, with the year-on-year change between the US dollar and the Mexican peso only -0.1%. Local cost inflation of 3.6%, low base metal prices, high treatment charges and lower ore grades drove costs up. Fresnillo reported higher costs on a unit of ore milled basis across all of its mines. This was the result of higher wages, increased development work and higher consumption and prices of consumables. Alongside these factors, lower than expected grades at several of the company's large operations, reduced base metal prices, higher treatment costs and increased capitalized development resulted in higher TCC and AISC year-on-year for all of Fresnillo's silver mines. AISC at Fresnillo, Saucito and San Julian were up \$4.62/oz, \$2.33/oz and \$4.23/oz respectively.

Meanwhile in the US, Hecla's Greens Creek saw TCC increase \$3.10/oz y/y on the back of a 37% rise in treatment costs, 12% increase in mining costs and a 10% lift in milling costs. However, AISC only rose by \$0.41/oz y/y as a result of a 24% drop in sustaining capital expenditure. In Canada, Coeur's Silvertip was put into care and maintenance in February 2020. Lower base metal prices and higher treatment costs resulted in reduced by-product credits and higher costs. For example, for Q4.19 we estimated that Silvertip's AISC was \$19.47/oz compared to quarterly average silver price of \$17.32/oz.

In Central & South America, average TCC and AISC rose to \$7.04/oz (+27%) and \$11.57/oz (+5%), respectively. Cost increases in the region were less pronounced than in North America partly as a result of weaker local currencies against the US dollar.

Regional Total Cash Costs



* Cost shown on a by-product accounting basis.

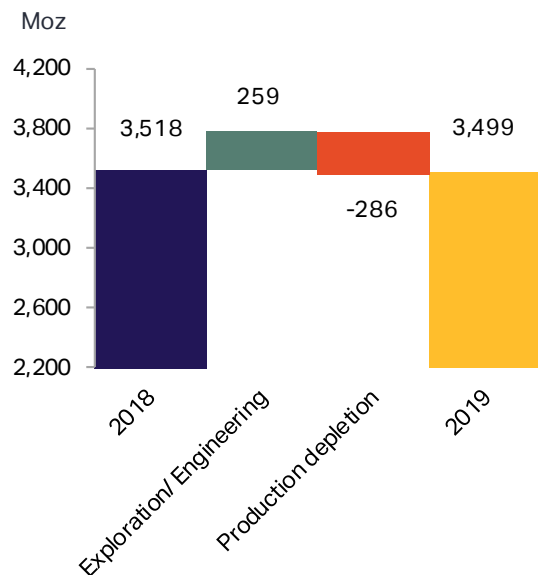
Source: Metals Focus Silver Mine Cost Service

Costs increased at two major silver mines in the region, due to reduced production alongside macro factors such as inflation, lower base metal prices and higher treatment costs. TCC and AISC of Pan American Silver's Manantial Espejo increased by \$4.76/oz and \$1.60/oz respectively. The mine suffered a production shortfall from the temporary suspension of operations following an accident in June 2019. This resulted in lower sales of silver and gold, alongside additional costs from the export tax introduced in Argentina in September 2018. Meanwhile, Uchucchacua experienced a 27% y/y drop in silver grade and 21 days of strike action early in the year. This resulted in a 31% drop in silver production and 17% increase in unit costs.

In the CIS, TCC and AISC increased at Polymetal's Dukat by \$3.22/oz and \$3.68/oz respectively. This occurred as the mine processed larger volumes of low-grade ores leading to higher unit costs and lower gold credits. Contributing to higher AISC, capital expenditure increased from the purchase of mining equipment, upgrade of the tailings storage facilities and underground development of the Perevalnoye satellite mine.

At South32's Cannington in Australia, TCC and AISC increased by \$2.49/oz and \$2.23/oz respectively. During Q1.19, the site incurred additional haulage costs as a result of flooding in North Queensland. In addition, silver grades fell 28g/t y/y, resulting in a 6% y/y drop in silver output. This combined with lower base metal prices and higher treatment charges to push costs up.

Reserve Replacement – Primary Silver



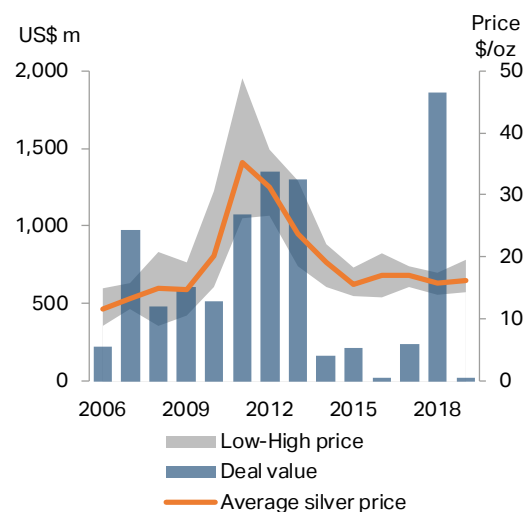
Source: Metals Focus

Reserves & Resources

Mineral ore reserves at primary silver mines fell 19Moz (591t), or 0.5%, y/y to 3,499Moz (108,831t) as new initial reserve estimates and resource conversion kept pace with mining depletion. Total identified resources excluding reserves totaled 7,611Moz (236,729t), a rise of just 1.5% as near mine exploration and the delineation of new undeveloped resources exceeded conversions to reserves.

Reserves at Fresnillo's producing assets continued to decline as the company looked to improve geological model accuracy through infill drilling. Silver production grades at its eponymous mine were 56g/t lower than reserve grades in 2019, compared to 26g/t lower in the previous year. However, in 2019 the recognition of new reserves at the Juanicipio project offset losses and total reserves increased by 8Moz (249t) y/y. Other significant increases came from Hecla's Greens Creek (+24Moz, 746t), Coeur's Rochester (+11Moz, 342t) and Americas Gold and Silver's Cosalá operations (+13Moz, 404t). These increases offset mining depletion across the industry, such as at Endeavour Silver's El Cubo operations, where reserves were exhausted and operations placed on care and maintenance. Other significant declines came at South32's Cannington (-19Moz, 591t) and Americas Gold and Silver's Galena Complex (-8Moz, 249t).

Value of Completed Deals



Source: Bloomberg

Corporate Activity

The value of merger and acquisition activity in the primary silver sector fell sharply in 2019, to just US\$25m from three deals. This was down from US\$1.9Bn in 2018, which was the highest level on record. The primary silver sector is considerably smaller than the gold sector; the value of primary silver M&A deals since 2005 has totaled US\$9.1Bn. By contrast, just two deals in the gold sector in 2019 involving Goldcorp and Randgold totaled US\$17.7Bn.

The largest deal in 2019, which accounted for 86% of transactions by value, was from SSR Mining acquiring Golden Arrow Resources' remaining 25% interest in the Puna Operations. This asset is in the Jujuy Province of Argentina and includes the new Chinchillas mine which commenced operations in December 2018. Following the completion of the deal in July 2019, for a value of US\$22m, SSR Mining became the sole owner of the Puna Operations. SSR Mining also owns the Marigold gold mine in Nevada and the Seabee Gold Operation in Saskatchewan.

The other two deals in the year were far more modest. In May 2019, Outcrop Gold Corporation announced that it had entered into an agreement with Cedar Capital Corporation to acquire the Santa Ana Silver Project in consideration for common shares valued at c. US\$1.8m. Meanwhile, Santacruz Silver Mining acquired PCG Mining in a two-stage deal involving common shares, debt and assets, with an estimated value of US\$1.7m.

Not included in our graph but still noteworthy, the Peñasquito mine in Mexico was part of the merger between Newmont and Goldcorp that was announced at the beginning of 2019. In 2019, Peñasquito produced 21Moz of silver although it is primarily a gold mine. Meanwhile, Pan American Silver completed their US1.0Bn acquisition of Tahoe Resources in February 2019. This deal was announced in November 2018 and included in our graph in the same year.

Hedge Book Composition*

Million ounces	2018	2019	Y/Y
Forwards	15.2	3.7	-76%
Options	0.4	27.6	6536%
Total	15.6	31.2	101%

* Delta-adjusted positions at end-period

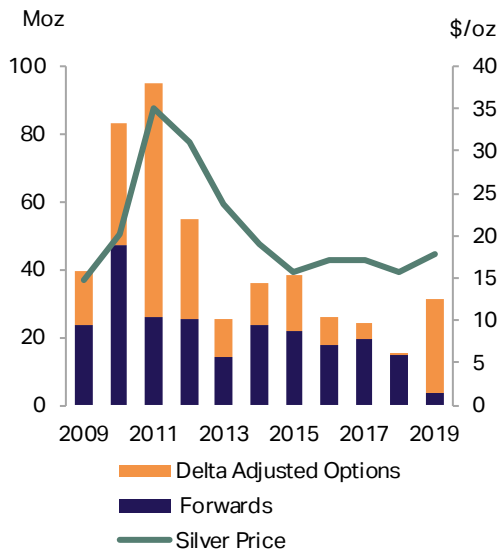
Source: Metals Focus

Producer Hedging

The global hedge book increased during 2019, reversing the declining trend observed since 2014. On a delta-adjusted basis, we estimate that the global hedge book increased by 15.7Moz (487t) during 2019, primarily due to a significant rise in new options positions. These rose by 27.2Moz (845t) to 27.6Moz (858t) over the year. In contrast, forward positions fell by 11.5Moz (357t) to 3.7Moz (114t).

Peñoles dominated hedging activity during 2019, taking out put and call options to cover some of their production out to December 2021. At the end of 2019, the company had 29.0Moz (901t) of outstanding positions, with strike prices at \$16.2/oz and \$19.0/oz respectively. Hecla increased its option positions by 4.9Moz (151t) to 5.7Moz (177t) at an average price of \$15.73/oz.

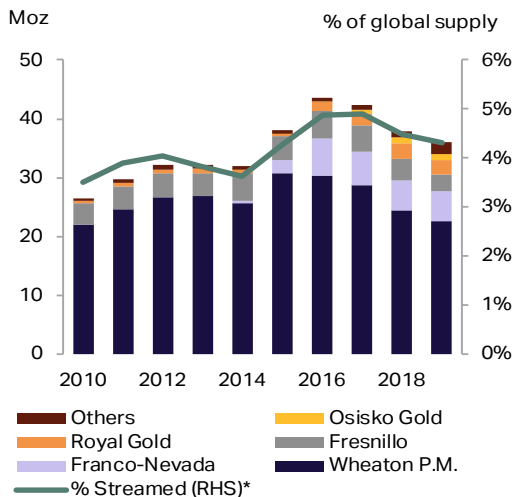
Hedge Book Evolution*



* Delta adjusted position at end-period

Source: Metals Focus

Silver Royalty and Streaming



Percentage of global mine supply covered by royalty and streaming agreements.

Source: Metals Focus

Minera Frisco settled their swap positions during the first half of 2019, but took out further positions in the latter half of the year. At the end of 2019, their outstanding positions had been reduced by 1.0Moz (31t) from 2018 to 3.0Moz (93t) at \$17.56/oz.

Harmony also took advantage of the improved silver price, increasing their zero cost collars by 1.7Moz (53t) to 2.0Moz (62t) in 2019. These options had an average floor price of \$17.74/oz and an average ceiling price of \$19.18/oz. KGHM Polska Miedź bought put options for 3.6Moz (112t) at \$17.00/oz.

There was minimal activity in forwards in 2019. The forwards hedge book decreased from 4.9Moz (154t) at end-2018 to 2.9Moz (90t) at the end of 2019. Peñoles was the only producer with outstanding forward contracts at the end of the year, with 2.8Moz (90t) of forward sales at \$16.85/oz and 0.07Moz (2t) of forward buys at \$18/oz.

Silver Streaming

Silver held under streaming and royalty contracts fell for the third consecutive year, down 5% or 1.9Moz (57.9t) y/y in 2019 to 36.1Moz (1,122t). New acquisitions and project ramp-ups failed to replace ounces lost through lower production from existing arrangements and the termination of key deals. Royal Gold acquired a stream of 80% of the future silver produced from the Khoemacau Copper Project, in Botswana. The deal is expected to deliver 1.5Moz (47t) p.a. from 2021 and will in part fund the project's construction. Ascendant Resources agreed a deal with Maverix Metals for 22.5% of payable silver from the El Mochito mine. The transaction aims to provide working capital stability while the company seeks finance for a mine expansion.

Wheaton Precious Metals, which did not add to its portfolio in 2019, continued to dominate the space, accounting for 63% of the silver streaming and royalty market, albeit down from 81% in 2018. The company's attributable production fell 1.9Moz (59t) y/y due to the termination of the San Dimas silver stream, the cessation of deliveries associated with the Pascua-Lama purchase agreement and lower volumes from Antamina. There was, however, some offset due to increased volumes from Peñasquito.

Franco-Nevada's production was little changed in 2019, at 5.1Moz (159t), as organic growth from the ramp-up of Cobre Panama and higher grades at Candelaria were offset by lower output from Antamina. Fresnillo's silver stream delivered 0.9Moz (28t) less y/y on lower grades at Sabinas. Maverix production rose by 0.4Moz (12t) as the Moss mine ramped-up and additional ounces from El Mochito were realized. Sandstorm Gold posted the largest growth with a 0.7Moz (22t) increase due to the ramp-up of Cerro Moro.

Chapter 5

- Silver recycling rose by 1.3% to 169.9Moz (5,284t) in 2019, but this compared poorly to the decade high in 2011 of 232.9Moz (7,245t).
- Most significant was the rise in industrial recycling, followed by jewelry and silverware.
- For 2020, industrial scrap is expected to rise, despite the impact of COVID-19, but this will be offset elsewhere by weak silver prices.

Recycling

Introduction

Global silver recycling edged higher last year, by 1.3% to 169.9Moz (5,284t). Every key segment of scrap supply rose aside from photography, which suffered further structural losses. Industrial scrap benefited from growth in ethylene oxide (EO) change-outs and electrical supplies. Elsewhere, higher silver prices contributed to a rise in jewelry and silverware scrap supply, while coin recycling rose due largely to the continued melting of unsold commemorative coins.

Looking ahead, a slight drop this year is expected for the global total. Weak silver prices will discourage price sensitive jewelry and silverware recycling, while the widespread impact of COVID-19 will result in a much smaller rise in the number of EO plant change-outs.

Industrial

Among industrial materials, the volume of silver recovered increased for the fifth year in succession, by 2% to 100.5Moz (3,125t). This may surprise, given that the precious metals content of electronic scrap maintained its structural decline. However, the impact of this was effectively offset by the effects of a higher gold price, which improved the economics of processing end-of-life products, where gold is typically the principal value. We also understand that silver recovered from old electrical equipment rose last year. Importantly, the volume of silver this generates will exceed that recovered from consumer electronics. Within this segment there were varying trends. For example, our research suggests that recycling of spent components rose (including from chip protection and passive components), which offset a weaker contribution from the touch panel sector.

A more important issue last year was a further rise in the recovery of silver from spent ethylene oxide (EO) catalysts. This reflects the increase in global installed capacity and also the trend towards higher silver usage in modern plants, some of which contain around 3Moz (30t), compared with around 250koz (7t) for those built in the 1970s.

Jewelry

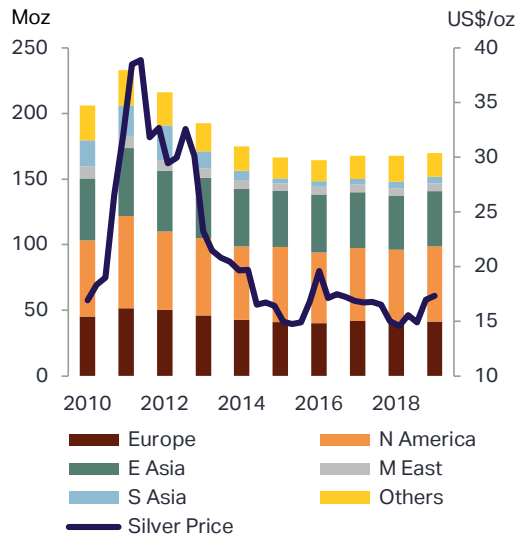
Jewelry recycling in 2019 rose by 3% to a five-year high of 23.9Moz (743t). For most emerging markets, the modest gains achieved were largely due to firmer prices. One exception was China, where volumes stayed subdued because consumers cannot recover the 13% VAT upon resale. Indian volumes were also restrained as most jewelry is still traditionally sold back by farmers looking to raise cash to buy agricultural inputs. Western volumes edged higher, driven by the price-led rise in gold jewelry scrap. This occurs when consumers add pieces of silver jewelry (which alone would be barely

Global Recycling Forecast, by Region

Million ounces	2019	2020F	Y/Y
Europe	41.5	40.5	-2%
North America	57.4	60.5	5%
Middle East	5.8	5.3	-9%
South Asia	5.0	4.5	-10%
East Asia	41.8	40.8	-2%
CIS	10.0	9.8	-2%
Other	8.4	7.9	-5%
Global Total	169.9	169.4	-0.3%

Source: Metals Focus

Global Recycling



Source: Metals Focus, Bloomberg

worth selling) when visiting a collector to sell more valuable gold items. In contrast, the remelt of unsold inventory was stable. Looking ahead, global volumes are forecast to fall by 4% this year, again largely due to the dip in the annual average silver price and provided that inventory melt and, in emerging markets, distress selling do not soar.

Silverware

Global volumes of silverware recycling grew by 3% last year to 20.5Moz (639t). Despite that rise, volumes represented just 46% of their peak in 2011. Much of last year's slight growth was driven by Western countries, which together continued to account for two-thirds of the total. Many recyclers saw no change in receipts, but a handful saw notable increases, typically during the mid-year price rally. The price levels achieved in 2019, however, were never sufficient to trigger much collection and processing of silver-plated/clad items. Other regions' volumes were essentially flat year-on-year as domestic prices were rarely high enough to encourage recycling. Our expectations of a fall in the annual average silver price this year also mean that we are forecasting a 2% drop in silverware recycling, much of which is driven by lower East Asian volumes. Western scrap may hold up somewhat better, given the potential for some distress selling.

Photography

Photographic recycling fell 6% last year to 21.6Moz (671t). This represented a clear continuation of the structural slide, which left last year's level at just 51% of 2010's. With lower volumes of silver bearing paper, liquids and old x-rays each year, those involved in processing this material are understandably facing tough times. In addition, deliveries to recyclers are becoming more sporadic and often triggered by non-price events, such as the closure of a hospital. Secular forces largely explain our forecast of yet another drop this year (over 7%). Importantly, while some niches (such as the recovery of silver from non-destructive testing) may hold steady, losses should continue beyond that, unless emerging markets change their common policy of giving x-rays to patients (which slashes recycling rates).

Recycling, by Source

Million ounces											Year on Year	
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020F	2019	2020
Industrial	95.1	93.1	92.5	87.8	90.7	91.0	96.0	98.4	100.5	103.3	2.1%	2.8%
Photographic	40.2	37.3	33.8	30.9	28.4	26.2	24.4	23.0	21.6	20.0	-6.0%	-7.5%
Jewelry	46.4	40.5	30.9	26.2	22.5	23.3	23.1	23.1	23.9	22.9	3.2%	-4.2%
Silverware	45.1	38.6	29.7	25.2	21.5	20.6	20.5	19.9	20.5	20.2	3.4%	-1.8%
Coin	6.2	6.4	5.8	4.8	3.5	3.3	3.8	3.3	3.4	3.1	2.6%	-10.3%
Global Total	232.9	216.0	192.7	174.9	166.5	164.4	167.7	167.7	169.9	169.4	1.3%	-0.3%

Source: Metals Focus

Recycling

Million ounces	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Europe											
Germany	17.7	17.7	15.9	14.8	14.5	14.3	14.3	14.2	14.8	15.1	2%
UK	7.3	7.5	6.9	6.9	6.7	7.0	7.1	7.9	7.6	7.9	4%
Italy	6.2	8.9	10.1	8.1	6.6	5.8	5.5	5.2	5.0	5.1	1%
France	4.6	4.9	5.7	5.0	4.3	3.8	3.4	3.2	3.1	3.1	-1%
Others	9.3	12.3	11.7	11.3	10.7	10.0	10.0	11.1	10.1	10.3	2%
Sub-total	45.1	51.4	50.4	46.1	42.8	40.9	40.3	41.7	40.7	41.5	2%
CIS											
Russia	11.9	11.7	11.5	9.9	8.0	6.7	6.5	7.9	10.0	8.5	-15%
Others	3.2	3.1	3.1	2.3	1.8	1.4	1.4	1.4	1.5	1.5	2%
Sub-total	15.1	14.8	14.6	12.2	9.8	8.1	8.0	9.3	11.4	10.0	-13%
North America											
United States	51.7	62.5	53.0	53.3	51.4	53.2	49.9	51.5	51.4	53.4	4%
Others	6.6	8.0	6.6	5.6	4.7	4.1	4.1	4.0	4.0	4.0	0%
Sub-total	58.3	70.5	59.7	59.0	56.1	57.3	53.9	55.5	55.4	57.4	4%
Middle East											
Turkey	4.9	4.5	4.1	3.7	3.4	2.5	2.5	2.5	2.7	2.7	1%
Others	4.0	4.8	3.9	3.8	3.6	3.0	3.5	3.4	3.0	3.2	5%
Sub-total	8.9	9.3	8.0	7.4	7.0	5.5	6.0	5.9	5.7	5.8	3%
South Asia											
India	16.4	18.9	21.7	10.8	6.0	3.1	3.4	3.6	4.0	4.2	4%
Others	3.6	4.1	4.7	2.3	1.3	0.7	0.7	0.8	0.8	0.9	4%
Sub-total	20.0	23.0	26.4	13.1	7.2	3.8	4.1	4.4	4.8	5.0	4%
East Asia											
China	25.9	28.5	25.0	24.4	24.0	25.0	24.3	23.6	23.2	23.6	2%
Japan	11.7	12.0	11.2	11.4	11.0	11.0	11.4	11.4	10.9	10.5	-4%
Taiwan	3.5	4.8	4.1	3.5	3.3	2.6	3.0	2.8	2.6	2.9	11%
Others	6.1	6.6	6.2	6.4	5.2	4.6	5.3	4.7	4.7	4.9	4%
Sub-total	47.3	52.0	46.5	45.7	43.5	43.3	43.9	42.5	41.4	41.8	1%
Other Regions											
C&S America	6.0	5.9	4.8	4.0	3.5	3.1	3.4	3.5	3.6	3.6	2%
Africa	3.0	3.6	3.3	3.0	3.0	2.8	2.8	2.9	2.8	2.9	1%
Oceania	2.4	2.5	2.4	2.3	2.1	2.0	2.0	1.9	1.9	1.9	-2%
Sub-total	11.4	12.0	10.4	9.2	8.5	7.8	8.2	8.3	8.3	8.4	0%
Global Total	206.1	232.9	216.0	192.7	174.9	166.5	164.4	167.7	167.7	169.9	1%

Source: Metals Focus

Chapter 6

- The two main swings in 2019 silver bullion flows was a 20% drop in Indian imports and a 11% rise in Chinese exports.
- The COVID-19 outbreak is having a significant impact on bullion flows, as markets go into lockdown.
- The longer-term impact is very unclear at this stage. Much will depend on how long companies are closed and their ability to resume normal operations.

Bullion Trade

Introduction

The global bullion trade is at the heart of the silver supply chain, bringing together the mining industry, the financial community, refiners and fabricators, to name but a few. This chapter reviews the key flows noted in 2019 and attempts to investigate how they relate to changing conditions in silver supply and demand around the globe.

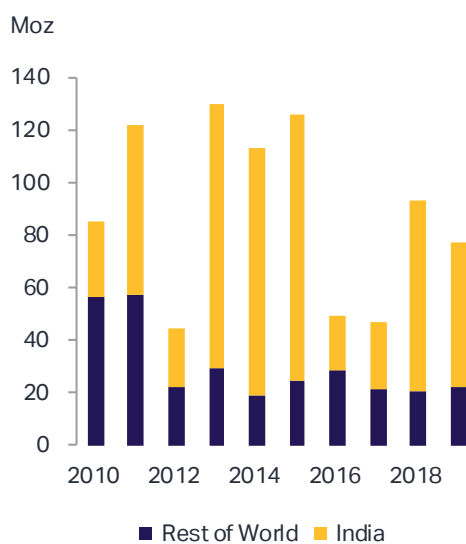
This year, the industry is facing considerable uncertainty, in the midst of the COVID-19 pandemic. This is having a profound effect on the silver bullion supply chain. Although much of this is moved by sea-freight, which for now continues to operate, the breakdown of air-freight routes does restrict the industry's ability to quickly respond to market conditions. It also impacts silver flows from gold mines, which tend to use air-freight to ship doré bars. Capacity closures will also undoubtedly change the landscape for bullion flows in 2020. At the time of writing, several refiners and fabricators in Europe, North America and South Africa have closed (albeit temporarily), while mining has also been disrupted, notably in Peru, Argentina, Quebec and South Africa. At this stage, the longer-term impact on the bullion trade is unclear. Much will depend on how long logistics, routes and industries stay closed and the speed with which they can eventually return to full operation.

Europe

Within Europe, the UK and Switzerland play a pivotal role in terms of global bullion movements. The UK's position reflects its role as the world's largest terminal market for silver (and more notably gold) and includes vaulting services provided by seven custodians. At end-November 2019, these vaults held a combined 1.16bn oz (36,096t) of silver. In addition, the UK fabricated 17.7Moz (552t) of silver industrial products last year, much of which was made using imported bullion. As for imports, these totaled 92.5Moz (2,877t) in 2019, down 13% y/y. The receipt of refined mine production often dominates inbound UK shipments, notably from Poland and Kazakhstan, which sent a combined 49.6Moz (1,543t) into London last year. Swiss exports to the UK can also be significant, but in 2019 these dropped to just 2.0Moz (63t); this was a key reason for the fall in total UK imports. UK exports also fell in 2019, down a sharp 23% y/y, to 67.1Moz (2,081t). This was mainly driven by a 26% drop to 51.9Moz (1,614t) in deliveries to India.

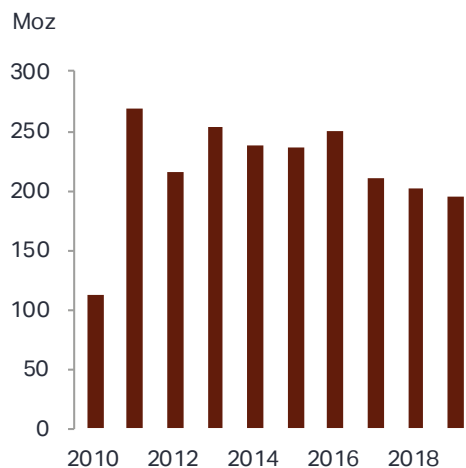
With regard to Switzerland, the country is home to four prominent LBMA refineries. These will import and process mine doré and high-grade recycled material, which will then be delivered to manufacturing centers. Reported Swiss bullion imports of 19.7Moz (610t) therefore undercounts the volume of silver-bearing material that is treated there. This is because of the considerable amount of gold doré that is imported, with a high silver

UK Bullion Exports*



Source: Metals Focus, IHS Markit. *Gross weight

North American Bullion Imports*



Source: Metals Focus, IHS Markit. *Gross weight

content (notably from South America). A clearer picture emerges from the Swiss bullion export data. This shows that in 2019 the country exported 46.1Moz (1,430t) of silver bullion, a drop of 10% y/y. The two most important destinations were Germany (16.1Moz, 498t) and India (7.5Moz, 230t).

North America

The region is home to eight LBMA-accredited silver refineries. These will principally treat the region's internally generated mine production as well as some imported material from South America and a modest amount of scrap. However, as the following analysis reveals, silver bullion and doré imports from South America barely register. This is because much of the silver mined there is contained in base metal concentrates. This aside, much of the silver refined in the Americas will be consumed in the US (a reflection of its sizable industrial and retail investment demand) or, in the interim, delivered onto Comex. At the margin, refined 9999 London Good Delivery bullion is also imported, typically for industrial fabricators.

Some of these flows are reflected in the composition of US bullion imports, which, in 2019, were barely changed year-on-year at 167.8Moz (5,220t). Over half the total consisted of shipments of refined metal from Mexico (93.1Moz, 2,897t), with Canada a distant, but still sizable, second (at 42.7Moz, 1,329t). Turning to Canada itself, although its bullion imports were relatively modest (24.5Moz, 761t), exports were a far more noteworthy 47.4Moz (1,473t); the vast majority (over 90%) was shipped to the US last year.

Middle East

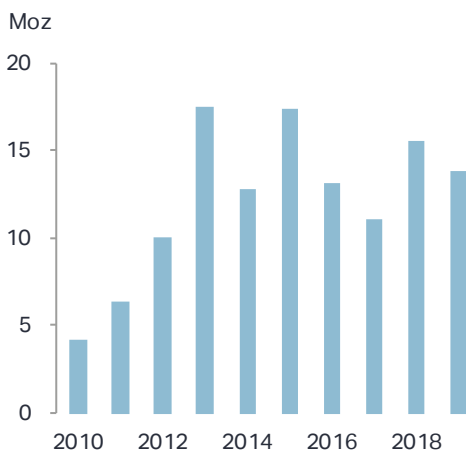
Bullion imports fell by 11% in 2019 as the rise in Turkish imports was more than offset by falling United Arab Emirates (UAE) imports. The drop in bullion exports was far more notable. These almost halved following a rise of around one-third in 2018. This was almost entirely due to a near two-thirds drop in UAE exports as shipments to India fell sharply, both directly and via Nepal.

South Asia

After rising for two years, Indian silver bullion imports fell by 20% to 178.5Moz (5,566t) in 2019. Importantly, this is only the third time since 2010 that shipments have declined on an annual basis. Furthermore, there was another (albeit trivial) 1.9-2.3Moz (60-70t) of metal recovered from gold doré imports.

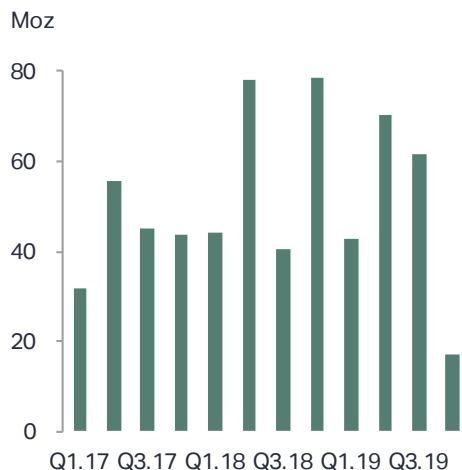
Looking at intra-year trends, first half imports fell by a more modest 8% y/y, which reflected a healthier demand backdrop. Our discussion with importers even revealed that there was a shortage of metal in the bonded warehouses between March and May due to strong demand (both from fabricators and investors) that had been triggered by a fall in the rupee silver price. In contrast, the drop in imports was steepest in the second half (-33% y/y) as demand suffered from a weak economy and the reluctance of fabricators to stock the metal in an uncertain demand environment. Looking at imports

Middle Eastern Bullion Imports



Source: Metals Focus, IHS Markit

Indian Bullion Imports*



Source: Metals Focus, IHS Markit. *Gross weight

in more detail, 83% of the metal was delivered into bonded warehouse in Sri City (near Chennai) followed by 11% in Kandla, both of which are Free Trade Warehouse Zones (FTWZ). It is worth noting that the Kandla FTWZ only opened in 2019. Prior to this, 90% of Indian imports landed in Sri City.

As for the origins of this bullion, one-third of the metal was imported from Hong Kong, followed by the UK (21%) and the US (9%). Despite that, the share of imports from Hong Kong and the UK fell in 2019. In comparison, there was a sizable increase in imports from Switzerland, Thailand and Poland, which together achieved a 14% market share in 2019.

East Asia

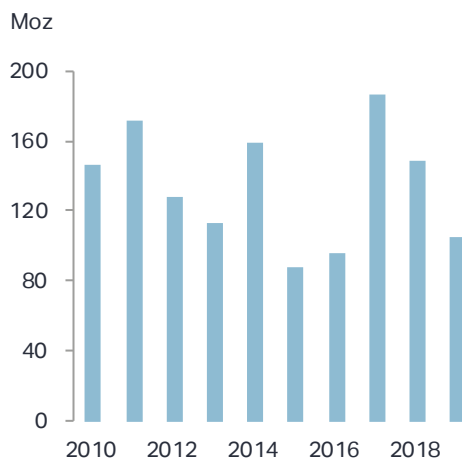
China has traditionally been a net exporter of silver, which is due to the structural oversupply of silver in the Chinese market. In part, this is fueled by the large volumes of refined silver produced both from the processing of imported base metal concentrates and also from its own mines, whose silver output ranks third globally.

Mainland China’s silver bullion imports were flat y/y in 2019 at 7.0Moz (219t). Meanwhile, imports of copper, lead and zinc metal concentrates containing silver all rose notably in 2019. As far as zinc concentrate imports are concerned, it is worth noting that a few smaller-scaled zinc mines stopped operations last year as a lower zinc price rendered them loss-making. This, together with increasing availability from overseas, encouraged smelters to source from these markets.

Turning to mainland China’s silver bullion exports, these rose by 11% y/y in 2019 to 83.3Moz (2,590t). Small increases in local mine production and recycling, lower demand and, perhaps most importantly, the rise in base metal concentrate imports enabled this rise in exports. Some of this increased supply also found its way into reported local silver inventories. The vast majority of shipments went to Hong Kong, exports to which rose by 15% y/y to 82.4Moz (2,563t). There were no direct flows to India for the second year running. Having said that, there were once again sizable flows from Hong Kong to India. This, along with the fact that mainland China is the dominant source of metal arriving in Hong Kong and the lack of sufficiently large production capacity in the SAR, does suggest that much of China’s silver exports ultimately found their way to India.

Hong Kong’s reported bullion imports rose by 13% y/y to 54.7Moz (1,702t) in 2019. Imports from mainland China rose by 16% y/y to 37.7Moz (1,172t). The massive discrepancy between that figure and what China reported as exports into Hong Kong suggests that some metal is probably recorded coming into Hong Kong under a different trade code. Silver bullion exports fell by 29% y/y to 92.3Moz (2,871t) in 2019. The decline was mostly due to the 33% drop in shipments to India, the largest destination for silver bullion from Hong Kong.

Hong Kong Bullion Exports*



Source: Metals Focus, IHS Markit. *Gross weight

Chapter 7

- Industrial silver demand was stable y/y in 2019 at 510.9Moz (15,891t) as healthy photovoltaic demand and limited thrifting / substitution were offset by trade war damage.
- Industrial demand this year is forecast to fall by 7% due to losses related to COVID-19.
- Photographic demand fell by just 1% in 2019, but a 10% drop is forecast for this year.

Industrial & Photography

Industrial Demand

Introduction

Global industrial silver demand in 2019 was effectively flat year-on-year at 510.9Moz (15,891t), and therefore only 1% down on the decade's record high in 2017. Last year also marked the third year in a row of over 500Moz (15,500t) of demand. There was some minor damage in the closing months from the US:China trade war, but the total was helped by limited pressure from substitution and thrifting. The annual average price may have risen by 3%, but the absolute level was never high enough to trigger aggressive attempts to minimize silver usage. There was also ongoing support from structural changes in demand, such as vehicle electrification and, importantly, the key field of photovoltaics bounced back, with its offtake up 7% to the second highest level ever. At the country-level, sizable gains were recorded in Japan, while notable losses were seen in both the US and India.

In sharp contrast, the impact this year of COVID-19, on supply chains, end-user demand and a whole host of other market segments, explains our current forecast of a drop of 7% (-36Moz/1,100t) to a five-year low. This is premised on the rest of the world mirroring China and so emerging from the shutdown in the next few months. This, however, could prove overly optimistic, should, for example, other countries take far longer to emerge from their lockdowns or repeated outbreaks of the virus emerge.

Europe

Industrial silver demand in Europe grew by 2% in 2019 to a high for the decade of 79.9Moz (2,484t). Any growth might surprise, given the downturn in the region's economy (especially in Germany) in the last months of the year due to the trade war. The latter certainly inflicted harm, but this was mainly limited to electrical & electronics offtake; this dipped by 1%, with the losses greatest in Germany. Some industry sources also reported clear weakness in automotive end-use, reflecting the 4% drop in last year's light vehicle output in Europe. Another factor that also hit the second half was the rising silver price (this rallied by over €100/kg during the summer to highs of over €550/kg in early September). However, such levels were reportedly only high enough to at worst trigger order postponement, not cancellation. Nor were they high enough to lead to major moves to thrift on silver use or switch to alternatives.

Even if electrical & electronics overall was down, some countries and segments within this field (for example power distribution) had another good year. There was also decent growth in other areas of demand. Brazing alloys & solders for example were up 3% due to such factors as improving demand

Global Industrial Demand Forecast

Million ounces	2019	2020F	Y/Y
Europe	79.9	73.5	-8%
North America	126.7	119.2	-6%
South Asia	37.8	34.0	-10%
East Asia	249.5	232.7	-7%
Others	17.0	16.0	-6%
Global Total	510.9	475.4	-7%

Source: Metals Focus

Industrial Demand

Million ounces	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Europe											
Germany	32.9	32.0	28.6	28.9	29.4	28.9	29.1	30.1	31.2	31.0	-1%
United Kingdom	11.3	12.8	13.8	13.9	14.5	12.7	13.2	16.6	16.6	17.7	7%
France	11.2	10.4	9.5	9.5	9.1	8.6	8.4	8.7	9.1	9.3	2%
Italy	9.2	8.8	8.4	8.3	8.5	8.5	8.4	8.7	9.1	9.2	1%
Others	13.6	13.0	11.8	12.8	12.2	11.9	12.0	12.4	12.7	12.6	-1%
Sub-total	78.3	77.0	72.3	73.3	73.7	70.7	71.2	76.5	78.6	79.9	2%
North America											
United States	121.3	150.3	114.5	107.7	95.8	102.3	118.4	122.7	124.9	120.8	-3%
Others	5.6	5.7	5.7	5.8	4.6	5.7	6.0	5.6	5.7	5.9	4%
Sub-total	126.9	156.0	120.1	113.4	100.3	108.0	124.4	128.4	130.6	126.7	-3%
South Asia											
India	45.5	48.3	44.0	40.3	37.9	35.7	35.9	37.3	40.2	37.8	-6%
Sub-total	45.5	48.3	44.0	40.3	37.9	35.7	35.9	37.3	40.2	37.8	-6%
East Asia											
China	80.7	85.4	85.6	92.3	97.3	100.2	105.0	117.4	121.3	121.3	0%
Japan	88.9	84.6	73.4	86.7	87.0	90.5	104.6	108.7	93.6	99.1	6%
South Korea	20.5	20.6	21.9	22.2	20.2	19.0	18.0	19.1	19.1	18.4	-4%
Taiwan	11.8	12.2	11.1	10.5	10.5	10.2	10.0	9.4	9.7	8.8	-9%
Others	2.3	1.0	1.0	1.3	1.0	1.8	1.4	1.3	1.5	2.0	34%
Sub-total	204.1	203.7	193.1	213.0	216.1	221.6	239.0	255.8	245.2	249.5	2%
Other Regions											
C&S America	10.1	7.7	6.6	6.7	7.0	6.9	7.2	6.5	3.9	4.1	5%
Middle East	5.9	6.1	5.6	6.0	6.9	6.4	5.8	6.0	6.0	5.7	-5%
Oceania	4.4	4.5	4.6	4.4	4.4	4.3	4.4	4.2	4.4	4.5	2%
CIS	4.6	3.7	3.0	2.4	1.9	1.5	1.6	1.6	1.7	1.8	7%
Africa	1.0	1.1	1.2	1.4	1.3	1.0	0.9	0.9	1.0	1.0	6%
Sub-total	26.0	23.1	21.0	20.8	21.5	20.1	19.9	19.3	16.9	17.0	1%
Global Total	480.8	508.1	450.5	460.8	449.6	456.2	490.3	517.2	511.5	510.9	-0.1%

Source: Metals Focus

Silver Demand in Photovoltaics

Over the past decade, photovoltaic (PV) cells have become a leading option in the field of renewable energy due to both significant cost reductions and supportive policy measures. By the end of 2019, global cumulative installed capacity exceeded 600GW, including record additions of 116GW last year. Those installations in 2019 saw silver offtake in PV applications reach 98.7Moz (3,069t).

While Chinese installations are discussed in the main chapter text, it is worth taking a quick look at other key markets. Provided COVID-19 damage does not drag on, the outlook in Europe is bright and total installed capacity of 255GW by 2023 seems needed to achieve renewable energy targets. The US staged a solid performance last year and, with that same caveat, growth should continue on the back of robust demand in utility and residential sectors. India took a hit in 2019, impacted by the safeguard duty on solar cell and module imports. However, with the decreased duty, installations could soon be on track to reach a near-term target of 100GW by 2022. Other regions, such as the Middle East, South America, south-east Asia and Africa, are also still looking at long term gains.

Silver is an essential material and accounts for a relatively high share of costs within solar cells. As a result, there is a perennial effort by the industry to thrift silver use. The reduction of metal loadings is conducted through increasing the number

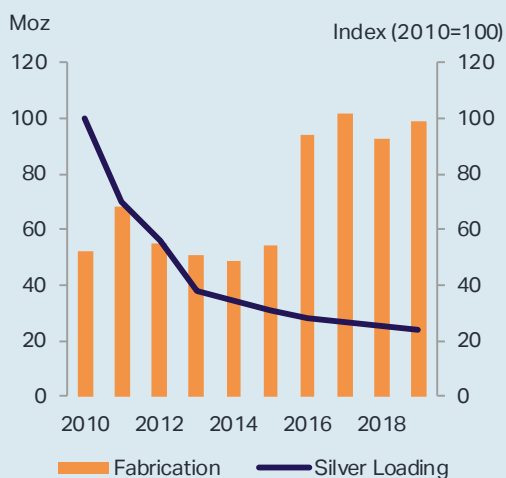
of busbars (BB) and printing thinner conductive lines. In 2019, 5BB dominated while 4BB was phased out entirely. Meanwhile, 9BB designs started gaining market share quickly due to their cost advantage of 25% less silver usage compared with 5BB. For now, the majority of cells will remain 5BB but 9BB will likely account for one-third of total shipments this year. As for the shrinkage of conductive lines, the average width is about 40µm currently. With printing technology improvements the line width is expected to further drop 35% to 25µm within 5 years.

On the technological front, innovative module designs such as half-cuts and shingles are capturing market share due to better durability and an instant power boost of 6 watts. The introduction of new cell structures also helps to achieve higher efficiency levels. These included Passivated Emitter and Rear Contacts (PERC), bifacial cells, Interdigitated Back Contact (IBC) and Heterojunction. As far as substrates are concerned, mono-crystal has replaced multi-crystal to become the dominant type. All these improvement efforts will drive higher cell performance and ultimately reduce the cost of electricity generation.

It's worth noting that the development of Concentrated Solar Power (CSP) tower systems is accelerating. These reflect sunlight by parabolic mirrors onto a receiver at the top of a tower. The concentrated thermal energy is then used to vaporize water to drive an electric generator. Currently, the existing capacity of CSP is trivial and installations remain modest, with only 382MW deployed globally last year. However, it seems to have decent potential going forward, due to competitive cost and high compatibility with traditional thermal power plants. This means it can be easily integrated into existing coal, natural gas and geothermal plants. Moreover, the thermal energy can be stored using reusable molten salts to generate power in the absence of sunlight. This gives CSP an advantage over solar panels. The success of CSP will be positive for silver offtake, due to higher metal loadings.

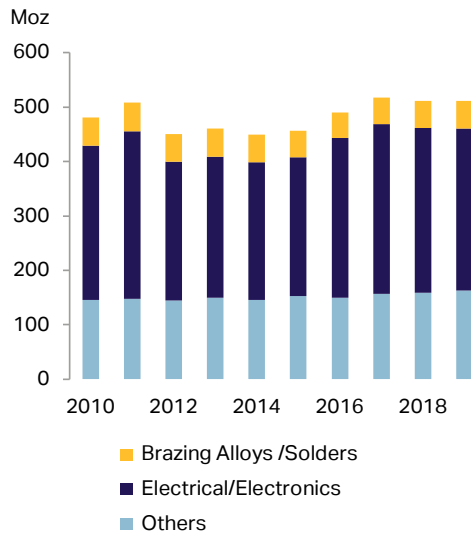
Continued growth of electricity demand, renewable energy aspirations and falling costs all point to rising penetration of solar power in the foreseeable future. Although this will be partly offset by ongoing thrift and substitution efforts, we remain optimistic towards silver PV demand over the next few years.

PV Silver Demand & Cell Loadings*



*denotes silver loadings per photovoltaic cell; Source: Metals Focus

Global Industrial Demand



Source: Metals Focus

from overseas heating/ventilation/air conditioning producers. The ethylene oxide sector also had a good year, as did the broad category of anodes and targets. The latter have a myriad of applications, with one end-use last year that enjoyed modest gains being glass coatings.

It had been hoped that a run down in stocks in late 2019 due to the trade war would generate restocking this year and thus decent demand gains. Unsurprisingly since then, the eruption of the COVID-19 virus means we are now forecasting losses, which for Europe we put at 8%. This is based on a resumption in economic activity in a few months and clearly, if that were delayed, double-digit losses would almost be guaranteed.

North America

In 2019, North American industrial silver fabrication fell by 3% to a three-year low of 126.7Moz (3,940t). This was driven by the 3% drop for the US, which was largely due to the fall in offtake for photovoltaic (PV) applications. If we exclude this, US industrial demand would have risen by 4%, which better fits the country's then still buoyant economy. PV offtake in the US is estimated to have fallen by 25% to a three-year low. This may surprise as global PV demand rose by 7%. However, the US:China trade war saw US silver powder fabricators subject to import tariffs imposed by China. As a result, US manufacturers lost market share to competitors, either in China or elsewhere in East Asia.

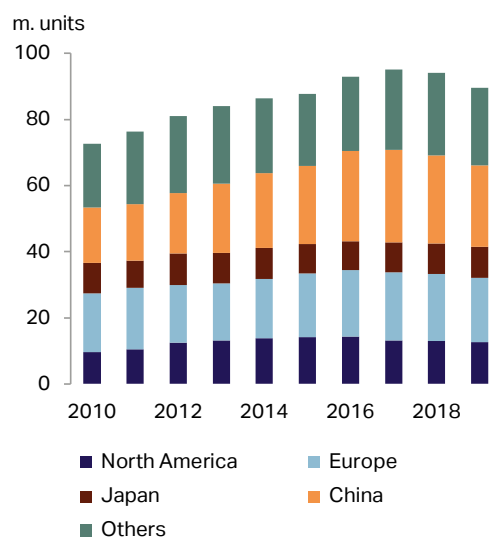
In contrast, the use of silver in ethylene oxide (EO) catalysts recorded solid gains last year. This was driven by growth in US EO capacity which increased markedly last year, its growth outstripping the global average. Feedback on silver's end-use in the automotive industry was quite varied, although it does appear that demand rose slightly. Offtake was certainly not helped by last year's 2.2% decline in North American vehicle output, but the increasing sophistication of those cars looks to have offset that. This was the product

Electrical & Electronics Demand

Million ounces	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Japan	74.8	71.1	59.8	72.2	73.6	75.8	91.0	94.6	79.3	84.7	7%
China/Hong Kong	38.4	41.5	40.6	44.7	48.3	49.7	55.3	67.1	70.4	69.2	-2%
United States	71.1	99.3	65.6	56.0	44.2	46.9	65.0	66.9	68.7	62.4	-9%
Germany	21.8	20.7	17.7	17.7	18.2	17.3	17.7	18.3	19.0	18.5	-3%
South Korea	9.3	8.5	8.4	8.7	9.3	8.5	8.3	8.6	8.4	7.9	-6%
Taiwan	8.6	9.1	8.1	7.7	7.8	7.5	7.3	6.6	6.8	6.0	-11%
Others	60.2	57.9	54.4	52.0	51.5	48.9	49.4	50.0	50.5	49.0	-3%
Global Total	284.3	308.1	254.5	259.0	253.0	254.7	293.9	312.0	303.1	297.6	-2%

Source: Metals Focus

Global Light Duty Vehicle Production



Source: LMC Automotive

of mass market cars containing yet more infotainment systems, warning sensors and so forth, plus more novel areas such as a virtual dashboard, which can contain notable levels of silver. Other areas of electrical & electronics offtake also had a good year, with little sign of any damage from the US:China trade war. End-use in defense / aerospace was, for example, reportedly strong. Brazing alloys also saw modest growth last year, in part helped by an uptick from end-use in the extractive industries.

Brazing alloys are under potential pressure from substitution in the HVAC sector (heating, ventilation and air-conditioning) switches from copper based systems (which use brazing) to aluminum (brazing-free). The pace of this change had slowed greatly if not stopped, but industry sources are now looking at a resumption in the move. Generally, the pressure from thrifting / substitution was slight as prices were never viewed as too high or too volatile. This limited pressure was also reflected in there being less apparent interest to develop silver-mix powders, such as silver-copper or silver-graphite.

For this year, the COVID-19 pandemic underpins our forecast of a 6% decline in US industrial demand. That is more modest than some countries because of a partial recovery in PV-related demand in the US and as some factories (having seen the supply chain disruption elsewhere), opted to raise inventories in order to keep producing for longer. We could of course see yet greater losses than that, should the virus restrictions persist for longer. This may also postpone the material future demand gains that could arise from promising areas such as investment in renewables, the substitution of indium tin oxide with silver nanowires and the broadening of the wearables category.

South Asia

Indian industrial silver offtake fell by 6% last year to 37.8Moz (1,175t) due to broader economic weakness and specifically the related slowdown in the country's manufacturing sector.

Brazing Alloys & Solder Demand

Million ounces	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
China	18.9	20.8	21.8	24.0	25.0	25.5	24.1	24.5	24.8	25.1	1%
United States	7.1	6.7	6.4	6.1	6.0	5.7	5.9	6.2	6.4	6.5	2%
South Korea	3.3	3.4	3.2	3.0	2.7	2.6	2.3	2.4	2.4	2.3	-4%
India	2.7	2.9	2.6	2.4	2.3	2.1	2.2	2.2	2.3	2.2	-4%
Japan	3.6	2.4	2.0	2.0	1.9	1.8	1.8	2.0	2.1	2.1	-2%
Germany	2.9	2.7	2.6	2.5	2.4	2.3	2.2	2.2	2.2	2.1	-3%
Others	12.8	13.2	12.5	12.5	10.8	8.9	8.6	9.2	9.7	10.0	4%
Global Total	51.3	52.2	51.0	52.4	51.0	48.8	46.9	48.7	49.8	50.3	1%

Source: Metals Focus

Silver's Pivotal Role in Green Energy

Introduction: Silver's unique properties mean that it will have a vital role in enabling the entire spectrum of the clean energy network, spanning generation, storage and consumption. Critically, this is a role that it can play for the indefinite future.

Generation: Silver's role here is not restricted to the major area of photovoltaics (see page 45) as the efficient generation of other forms of renewable energy depends greatly on accurate information. If a single rotor blade in a wind turbine fails, for example, it can cause catastrophic damage to both that turbine and its neighbors. A continuous monitoring system is thus essential. A single turbine can house up to 150 sensors checking inputs including wind speed, weather and vibration.

Silver-bearing sensors can also improve grid management. Access to real-time data will enable energy companies to control voltage and network configuration, among other functions. Smart switches, containing silver, can automatically isolate problems and reroute power. These technologies also apply to legacy fuels, which will remain a notable contributor to global supply over the foreseeable future; even modest gains in efficiency will lead to significantly fewer CO₂ emissions. The emergence of the Smart Grid, an electricity network that integrates the generation and consumption of energy, will further reduce its overall environmental impact.

Storage: Energy storage using batteries further improves the efficiency of renewable energy. Batteries cut waste, and supply can be released on demand, which is particularly useful as renewables such as wind, solar and hydro, have variable output levels. Silver oxide batteries, which can handle high voltages, are very stable and have a long life, could therefore have an important role in providing renewable energy storage.

Consumption: Silver-bearing controls, computers and new technologies work together to boost reliability and efficiency. Consumers monitor and control usage through smart meters, while distribution panels containing PCBs feed electricity into homes. Excess supply can then be fed back to the grid, whether from micro-generation (domestic solar panels) or larger scale (such as wind turbines).

Perhaps the most exciting avenue for silver in this field is in the automotive sector, principally in the rapidly growing area of battery electric vehicles (BEVs). Obviously, their total emissions are

not zero, as the energy used for their production, powering and disposal should be taken into account. That said, the rising share of electricity generated from renewables means that their overall emissions are on a rapidly declining trajectory. Those renewables include PV which will benefit as BEV growth continues to develop.

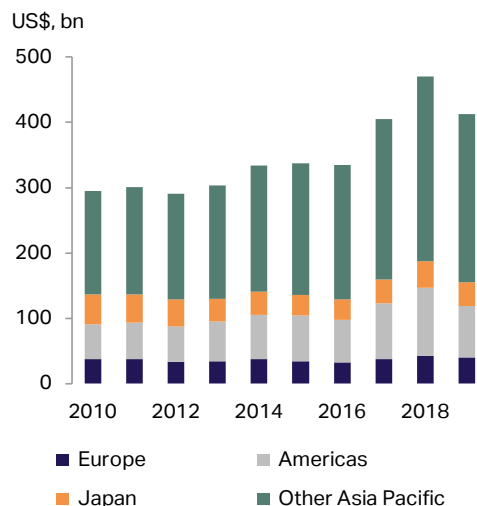
BEVs rely upon silver across a host of applications, ranging from semiconductors, sensors, harnesses, controls, fuses, switches and displays. Sensors, for instance, play a significant role in enabling the technological requirements of BEVs, through their continuous battery monitoring. In order to process information from these sensors, BEVs require a greater number of electronic control units or ECU (an ECU oversees the operation of a car's electronic systems, processing, storing and analyzing the data). Recent developments in lithium metal solid-state batteries, with a silver-carbon coating on the anode, offer further potential for silver use. Inevitably, some areas within this field will face pressure from thriftiness and substitution. However, as reliability and safety are a higher priority here than in, say, consumer electronics, this pressure will tend to be less intense.

There are also additional, if smaller, gains for silver demand via BEVs through the proliferation of their chargers. Here the white metal is primarily used in contacts and tips. Private homes could be increasingly equipped with wall chargers, while larger capacity roadside chargers (with a greater silver content) will also need to be installed in ever growing numbers.

The above all explains why the amount of silver in a BEV is greater than that in an internal combustion (IC) vehicle. That said, it is worth noting that some of the recent gains in IC fuel economy have been due to improved engine management, which has been achieved through a greater number of increasingly sophisticated sensors and enhanced ECUs, many of which contain silver.

Looking further ahead, silver has an integral role in the growing autonomous vehicle (AV) sector. This ties into environmental issues through expectations that AV equipment will save energy by allowing these vehicles to reduce excessive acceleration and braking, restrict speed and manage traffic flow. To achieve this level of location awareness, AVs require a great number of silver-bearing components, including infrared radars, laser radar (LIDAR), cameras and motion sensors.

Global Semiconductor Billings



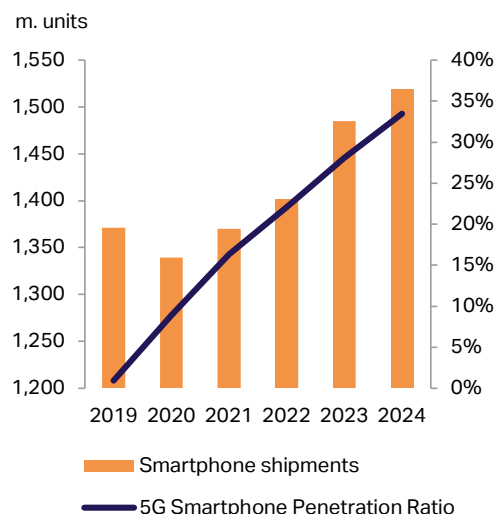
Source: Semiconductor Industry Association

Looking first at the electrical market, demand for switchgear remained robust, particularly for low voltage applications. However, that was offset by a reduction in the high voltage category due to a slowdown in transmission and generation utilities. Importantly, thrifting in electric contacts continued in 2019, such that the low voltage household switch industry is now increasingly using silver plated contacts instead of pure silver. Consumer electronics demand was boosted by increased cell phone manufacturing in India, as companies such as Apple and Samsung ramped up local production. India is now the second largest fabricator globally behind China. From just a handful of cell phone manufacturing units in 2014, the country now has 268 handset and related accessories manufacturing units.

Brazing alloys demand fell by 4% in 2019 due to the slowing economy and thrifting. While consumer goods sales (such as refrigerators and air-conditioning units) rose in 2019, slower industrial activity led to reduced demand for HVAC units. In addition, ongoing efforts to cut the number of contact points in these applications has impacted demand and so some cost-sensitive industrial users have shifted to lower silver containing alloys.

Silver demand in the "other industrial" category also fell last year, but the extent of the decline was lower compared to other categories as certain sub-sectors outperformed. In particular, usage in the food industry continued to grow at a steady pace, chiefly due to higher sales of silver-coated cardamom and betel nuts. Interestingly, demand from the food industry and indelible ink makers (silver nitrate) also saw a boost due to a flurry of elections in India last year (indelible ink is used to mark voters), while traditional Indian sweets are distributed widely by political parties, which increased sales of varakh (silver foil). This was offset by weaker offtake from the glass industry due to a slowdown of both vehicle sales and in the construction sector.

5G Smartphone Ratio



Source: IDC, Metals Focus

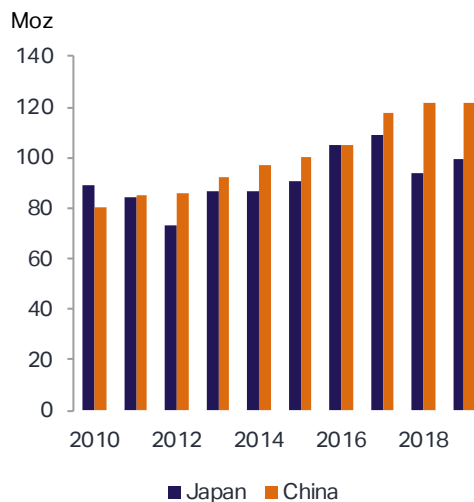
Turning to 2020, the economic slowdown in India will be exacerbated by coronavirus induced shutdowns and disruptions. As a result, industrial silver demand is likely to suffer a meaningful drop, at least in H1.20 before a slow recovery emerges in the latter half of the year.

East Asia

East Asian industrial fabrication rose by 2% last year to 249.5Moz (7,761t). This was mainly due to a rebound in Japanese demand that was partly offset by declines in South Korean and Taiwanese offtake.

Chinese industrial silver demand was virtually flat at 121.3Moz (3,773t) last year, as gains in the PV sector were offset by a slowdown in other electrical and electronics applications. Looking first at PV, local installations fell by 32% to 30GW. This was largely due to policy delays in the transition toward a subsidy-free target. Silver offtake nevertheless rose, as falling solar module prices boosted overseas installations. Chinese panel production surpassed

Industrial Fabrication: Japan and China



Source: Metals Focus

100GW, two-thirds of which was exported to emerging markets. Meanwhile, local powder fabricators gained further market share, due to improved quality and partnerships with paste and panel makers.

Looking ahead, local installations are expected to stagnate at around 30GW, as China phases out Feed-in Tariffs (FiTs) for the utility-scale grid by 2021 to ease fiscal burdens. Panel and module output growth will thus continue to rely on increasing installations elsewhere. Separately, the COVID-19 pandemic has hit local supply chains hard. As a result, the share of China-made silver powders may fall for the first time since localization began.

In contrast, silver demand from electrical contacts fell by 9% last year, reflecting the slowdown in power grid developments. Auto-related demand remained healthy, in spite of weaker car sales, due to increasing vehicle sophistication and electrification. However, this segment has now been hard hit due to preventive measures to contain the virus, including shutting down plants and lockdowns, which unsurprisingly have led to a collapse in consumer spending.

The deployment of 5G networks continued to roll-out last year, but related consumer electronics was slow to catch up due to limited service coverage. Nonetheless, the spread of the virus has boosted demand for internet access due to an explosion of remote working and on-line learning. We expect this will stimulate the network upgrade and accelerate upcoming intelligent applications. This should boost silver offtake over the next few years.

Brazing alloys & solders demand remained healthy, rising marginally to 25.1Moz (781t). This was driven by railway investments, including 3,200km of high-speed rail network. Silver offtake in other major end-uses, such as HVAC, was dragged down by a weak real estate market, where the government has introduced a series of tighter measures to rein in the housing bubble. With the economic damage this year, silver usage will inevitably be impacted, even if China is expected to increase infrastructure spending to hedge against dwindling economic growth.

Japanese industrial fabrication rebounded last year, rising by 6% to 99.1Moz (3,081t). This was driven by a 7% rise in electrical and electronics fabrication to 84.7Moz (2,634t). Within that, most gains were due to a recovery in PV powder output, related to the aforementioned strength of Chinese panel production. Japanese powder makers were also helped by the US:China trade war, which created challenges in direct shipments of powders from the former to the latter. The trade war had the opposite effect on other electrical and electronics applications, as challenges faced by end-users (many of which were either located in China or had links there) put some pressure on silver demand. Looking ahead, we expect demand will be hit hard by the COVID-19 pandemic and, as a result, lose all of last year's gains.

Technological Progress & Future Silver Demand

Introduction: This focus box analyzes the outlook for silver demand through the lens of technological history. As we show, silver is in a great position in this regard, and one quite different to where it stood two decades ago.

Background: A brief explanation is useful to explain this approach. Technological history sorts progress into four distinct stages: invention, innovation, diffusion and obsolescence. Invention covers areas that have come into existence but are not yet viable. One example here is nuclear fusion - on paper great, but useless today as more power goes in than comes out. Innovation covers those technologies that have become viable and are enjoying rapid growth, such as the internal combustion (IC) engine at the beginning of the Twentieth Century (C. 20th). As end-use spreads, we then enter the diffusion space, or the established and dominant forms (the IC engine in the late C.20th). Obsolescence is the final phase as one technology is displaced by another, for example steam power in the early C.20th.

Invention: Sitting on the border with innovation, it is worth noting the potential being offered by the internet-of-things (with their myriad of silver-bearing sensors) and the replacement of indium tin oxide in touchscreens by silver nano-wires (as electronics OEMs shed their apparent reluctance to switch). Looking further ahead, there are several other promising fields, such as artificial intelligence and in-road automotive induction chargers.

Innovation: The more exciting segment though is innovation - those areas that are rapidly growing, having just become economically practical. The current "star" is photovoltaic demand, but waiting in the wings is the extra demand created by shifting from IC vehicles to hybrids and BEVs. Promisingly, there are many other end-uses in this category, most obviously 5G infrastructure and hand-held devices, but we could also mention concentrated solar power, wind turbines, new forms of batteries and wearables.

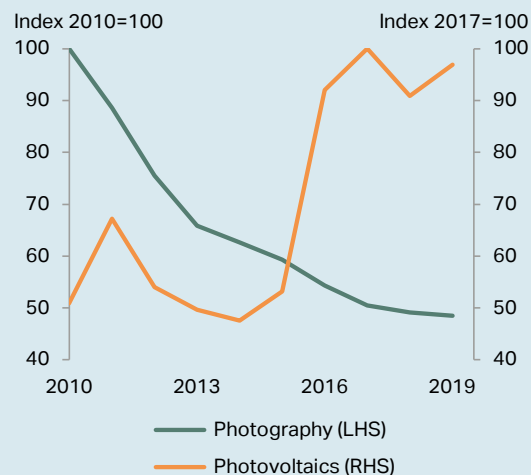
Diffusion: The flipside of there being so little in the obsolescence silo is that demand is dominated by the diffusion category. Some key areas here include: pastes, targets and so forth going into consumer electronics, defense and aerospace; wires, profiles, contacts and related products found in power distribution, switchgear and the like; ethylene oxide catalysts, and lastly brazing alloys in fields such as

industrial tools. Importantly, the above may experience some thrifting and substitution in the decade to come, but it will typically be at the margin - if the silver could have been removed, this would have happened a while back.

Obsolescence: As noted in previous editions of the World Silver Survey, photographic demand reached as much as 228Moz (7,100t and 26% of total demand) in 1999. It then succumbed to technological change as the emergence of digital photography led to the offtake for conventional silver halide film falling to 33.7Moz (1,047t or 3% of the total) last year. Critically for silver, there are only a few areas of demand that we might now place in this silo, but these are almost all small, often having already been displaced by other technologies (like solders in plumbing). We could extend this field to include areas outside of industrial like flatware; this too in the West has been hit by technology in the form of stainless steel and dishwashers, but this again is no longer substantial. One area worth highlighting is the use of brazing alloys in air-conditioning units, which could fade away as aluminum-based units (using no brazing) take over.

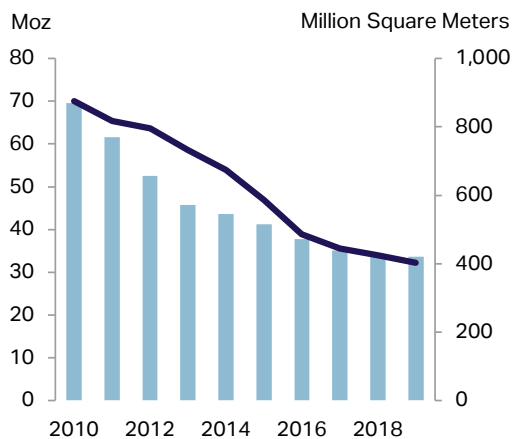
Conclusion: Even if the invention silo yields little, the solid nature of the diffusion category and the tremendous promise of the innovation field mean that we do not need breakthroughs for the structure of silver demand from a technological perspective to become intrinsically supportive looking ahead.

Innovation & Obsolescence in Action



Source: Metals Focus fabrication series.

Photographic Demand & Paper Production



Source: Metals Focus, Photofinishing Newsletter

South Korean industrial offtake fell by 4% last year, largely reflecting weaker consumer electronics shipments as the emerging demand from 5G infrastructure was unable to make up for losses elsewhere. **Taiwan’s** industrial demand dropped by 9%, mainly due to market share losses in the PV sector. The negative outlook for the global economy is expected to weigh noticeably on industrial demand for both countries this year.

Photographic Demand

Last year, silver photographic demand slipped by 1% to 33.7Moz (1,047t). However, at the start of the previous decade in 2010 silver offtake stood at 69.5Moz (2,162t), meaning that photographic demand more than halved over the past ten years. Driving the fall in 2019 were further contractions in consumer and professional film and paper production, which fell by 20% and 5% respectively. The decline in total film rolls occurred despite a strong rise in demand from young consumers. This in turn was partly driven by the increased visibility of film and film cameras on social media platforms, such as Instagram. Demand for instant films, for example, continued to grow, climbing by over 10% as the nostalgia trend showed no sign of abating.

In contrast to the decline for film and paper, offtake for 35mm film in motion pictures saw another strong year. Aside from its artistic merits, such as the depth of field, some directors argue that 35mm film is in fact more cost-effective than digital. This is achieved due to the tighter discipline required, which reduces overtime and costly post-production editing.

Demand from non-destructive testing equipment also proved robust, thanks mainly to the growing rate of industrialization and urbanization, which increased demand from the construction industry. The medical sector faced conflicting forces. On the one hand, further conversions were made from analog silver halide X-ray film to digital radiography, something that continued to weigh on demand. This was, however, offset by growing access to healthcare across a number of countries where halide use is still prevalent, for instance in China and south-east Asia, whether due to a lack of resources to make the switch or local resistance to change. On balance, we believe that medical demand was flat or may have even been up at the margin.

Photographic Demand

Million ounces	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Europe & N America	47.3	41.9	38.0	34.8	32.5	30.3	27.3	25.1	24.2	23.5	-3%
East Asia	19.5	18.0	12.8	9.8	9.8	9.6	9.0	8.7	8.4	8.3	-1%
Others	2.8	1.8	1.7	1.2	1.3	1.3	1.4	1.4	1.6	1.8	14%
Global Total	69.5	61.6	52.5	45.8	43.6	41.2	37.8	35.1	34.2	33.7	-1%

Source: Metals Focus

Chapter 8

- World jewelry demand slipped by 1% in 2019, as India's heavy losses were nearly matched by Thailand's gains. Consumption in key Western markets eased slightly too.
- Jewelry fabrication in 2020 is forecast to fall by a greater 7%, largely due to COVID-19 losses.
- Silverware offtake fell 9% last year and is forecast to slide by another 9% in 2020.

Jewelry & Silverware

Jewelry

Introduction

Global jewelry fabrication in 2019 slipped by 1% to 201.3Moz (6,262t). Much of the decline was down to India, where a slowing economy and an erratic monsoon hit the all-important rural sector. A sizable drop was also recorded in China, thanks to the trade war and poor consumer sentiment. Lastly, western consumption was soft, reflecting such factors as competition from gold and stale product designs. Much of these losses, however, were countered by an export-led rebound in Thailand, and Italy also saw a modest export-led rise. Unsurprisingly, we are forecasting a larger decline of 7% for the world total this year. On top of damage to global GDP, the jewelry trade will have to contend with retailers being closed and shipping problems meaning product is unavailable when consumers finally venture out.

Europe

European jewelry **fabrication** rose by 2% in 2019 to a four-year high of 29.9Moz (930t). Most of this growth came from Italy, whose offtake rose by 3%, itself due to the 4% rise in its jewelry exports (excluding re-exports). The US remained the largest single destination, with a 3% rise. That growth runs counter to the softness in US consumption, but most of the US losses look to have been borne by Thai shipments. The second largest destination, Hong Kong, actually saw double-digit gains last year, despite the territory's political unrest. These gains were due to greater re-exports of finished jewelry to south-east Asia plus generally higher sales of semi-manufactured jewelry items. It might also surprise that the third largest destination, the United Arab Emirates (UAE), saw double-digit gains. This was possible as silver seems less affected than gold by the Emirates' fiscal changes and also thanks to still strong re-exports of basic product, mostly chains, to east Africa.

Another explanation for the strength of Hong Kong and UAE flows is a change in the origin classification. An apparent slump of 7% in shipments to the EU contradicts trade sources' view that these countries' take from Italy was stable. What may have instead happened is more Italian product was shipped directly to outside the EU rather than via a third (EU) country.

Italian fabrication ended 2019 on a strong note and strength in very early 2020 was also reported. It is highly unlikely however that this can continue in virus-hit times, and so we forecast a 5% drop in Europe's demand this year. That may sound small, but silver's lower price points could enable it to take market share from gold. If that fails to happen in a material way and logistics problems persist, the estimated decline could prove too restrained.

Global Silver Jewelry Fabrication Forecast

Million ounces	2019	2020F	Y/Y
Europe	29.9	28.4	-5%
North America	20.6	20.4	-1%
Middle East	9.0	8.6	-4%
South Asia	71.6	67.5	-6%
East Asia	62.8	55.5	-12%
CIS	3.5	3.4	-5%
Others	3.9	3.8	-3%
Global Total	201.3	187.5	-7%

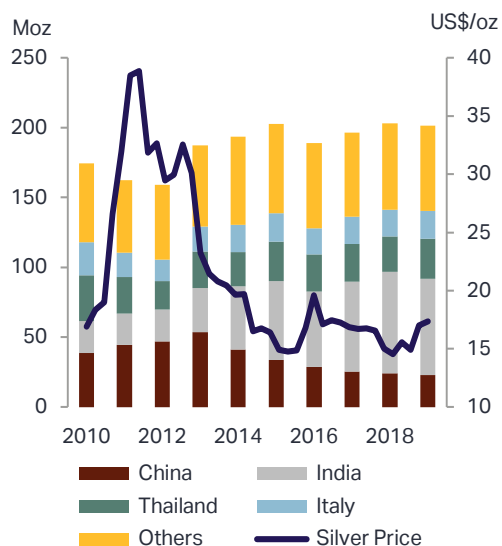
Source: Metals Focus

Jewelry Fabrication

Million ounces	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Europe											
Italy	23.4	17.2	15.4	17.9	19.5	20.0	18.8	19.5	19.3	19.9	3%
Germany	3.6	3.4	3.4	3.5	3.4	3.5	3.4	3.4	3.5	3.5	1%
France	2.0	2.1	2.0	2.0	1.9	2.0	2.0	1.9	1.8	1.8	-2%
Others	4.9	4.3	4.2	4.6	4.7	4.7	4.6	4.7	4.6	4.7	1%
Sub-total	33.9	26.9	24.9	27.9	29.6	30.2	28.7	29.5	29.3	29.9	2%
North America											
United States	10.0	11.1	11.7	12.3	13.0	13.6	12.9	13.2	13.0	12.9	-1%
Mexico	5.4	4.7	5.0	4.5	5.4	5.7	5.8	4.9	5.0	4.5	-10%
Canada	4.1	3.7	3.5	3.7	3.9	3.5	3.6	3.4	3.2	3.2	0%
Sub-total	19.5	19.6	20.2	20.6	22.3	22.9	22.3	21.5	21.2	20.6	-3%
Middle East											
Turkey	4.5	3.6	4.0	4.9	6.3	6.7	4.9	4.9	5.9	6.0	1%
Others	3.3	2.2	2.5	2.6	2.7	3.2	3.0	2.8	3.5	3.0	-14%
Sub-total	7.8	5.8	6.5	7.4	9.0	9.8	7.9	7.7	9.4	9.0	-4%
South Asia											
India	22.5	22.3	22.8	31.8	45.1	56.6	53.9	64.2	72.5	69.0	-5%
Others	0.8	0.8	0.8	1.2	1.7	2.1	2.0	2.4	2.7	2.5	-5%
Sub-total	23.3	23.1	23.6	33.0	46.8	58.7	55.9	66.5	75.2	71.6	-5%
East Asia											
Thailand	33.1	26.3	20.3	26.1	24.7	28.2	26.6	26.9	25.2	28.5	13%
China	38.8	44.6	46.9	53.4	41.1	33.8	28.7	25.5	24.3	22.8	-6%
Indonesia	3.7	2.6	3.0	4.1	6.1	4.9	5.2	5.1	5.3	5.6	7%
South Korea	2.5	2.6	2.7	3.3	2.9	3.1	2.7	2.7	2.5	2.5	-2%
Japan	1.1	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.6	1.7	5%
Others	1.4	1.6	1.7	1.7	1.6	1.5	1.5	1.6	1.7	1.8	6%
Sub-total	80.6	78.9	75.7	89.9	77.8	72.9	66.2	63.3	60.5	62.8	4%
Other Regions											
CIS	5.4	4.3	4.5	4.4	4.0	4.5	4.3	4.1	3.7	3.5	-3%
C&S America	1.8	1.9	2.0	2.1	2.2	2.0	2.0	1.9	2.0	2.1	5%
Africa	1.5	1.0	1.1	1.2	1.2	1.1	1.0	1.0	1.1	1.1	-2%
Oceania	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	-2%
Sub-total	9.4	7.9	8.2	8.3	8.1	8.1	8.1	7.8	7.5	7.5	-1%
Global Total	162.2	162.2	159.2	187.1	193.5	202.6	189.2	196.3	203.1	201.3	-1%

Source: Metals Focus

Global Jewelry Fabrication



Source: Metals Focus, Bloomberg

Europe's silver jewelry **consumption** fell slightly in 2019. As evidence, French sales (basis Société 5 data in unit terms) fell by 3%, while UK hallmarking slipped 5%. In addition, Pandora's reported EMEA sales (Europe, the Middle East and Africa) fell 7% last year and this matters due to their leading position. However, their figures can also hide better results elsewhere. In Italy for instance, research contacts believe that many segments of the silver market saw gains, but the drop for Pandora within Italy was sufficient to trim the national total. Pandora's reported use of Germany as its distribution hub in Europe also masks results for that market - the 17% drop in total German imports bears no relation to German consumption, which we believe was stable. Points of growth last year across Europe included innovative independents, a strong showing from the top-end, further organic growth in the men's jewelry niche and a faltering challenge from base metal jewelry.

North America

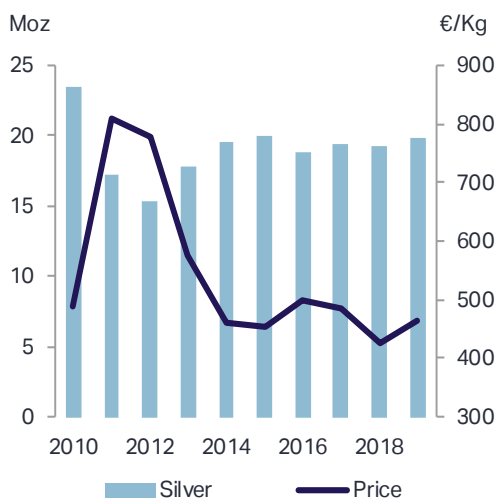
US jewelry fabrication last year fell by just 1% to 12.9Moz (402t). As in Europe, this result was better than the slightly greater dip for jewelry consumption. That still left the US as easily the world's second largest market after India.

It may seem brave stating that consumption only fell a few percent, given that silver jewelry imports according to US Customs fell by 11% in 2019 in dollar terms. As ever, trade data can be misleading and so we reviewed the figures as reported by those countries exporting to the US. Our analysis puts the decline in imports at a more modest 3% in fine weight terms. There was also uniformity in trade feedback that US sales last year were between flat to a few percent down y/y. That certainly better matches the Department of Commerce's monthly sales figures for all jewelry and watches, which indicate a rise of 2% in value. It would also seem peculiar if silver in the US were to perform worse than Pandora (down 5% in 2019), given widespread feedback from research contacts that they underperformed the market.

This weakness for Pandora is one reason that the total market fell though. As a leading player, the overall market can suffer if their designs come to be seen as stale, their promotional budgets are cut and the reconfiguration of their points-of-sale unintentionally reduce product accessibility to buyers. Another factor behind the overall slip was the ongoing if now slowing trend for large scale retailers to shift assortment space from silver to gold (our figures show a 4% rise in US gold jewelry consumption last year). While not helping, we do not see the rise in the silver price as causing any real damage to sales. It would also be wrong to put any blame on the launch of the potential rival to silver, one karat gold jewelry, chiefly as it is currently only offered by a handful of retailers and consumers seem skeptical of its quality.

There were also some factors actively boosting silver jewelry sales. Firstly, its price points mean it is well suited to the booming area of online sales.

Italian Silver Jewelry Fabrication



Source: Metals Focus

Global Silverware Fabrication Forecast

Million ounces	2019	2020F	Y/Y
Europe	3.9	3.6	-8%
North America	1.9	1.8	-4%
Middle East	2.4	2.2	-8%
South Asia	44.9	41.1	-9%
East Asia	5.0	4.0	-19%
CIS	1.0	1.0	-5%
Others	0.6	0.6	-6%
Global Total	59.8	54.3	-9%

Source: Metals Focus

Secondly, it is well placed to exploit the ongoing structural growth in the self-purchase of jewelry by women. Thirdly, pieces at a mid-level price point (typically \$100-\$200) with the right design and right “message” are enjoying strong sales to increasingly affluent millennial consumers. This feedback from our industry sources is mirrored by the research done by the Silver Promotion Service (SPS), which centers on the independent sector. One highlight from the SPS was signs of silver starting to regain market share from gold; basis the SPS responses, silver’s share of all jewelry sales in dollar terms was up from 18% in 2018 to 21% in 2019, although that was still down on the 25-30% range enjoyed for much of the rest of the decade. We see this as compatible with our above figure on gold consumption as margins have tended to rise on silver jewelry, as it shifts to higher design pieces, and much of the growth for gold has come from plain basics, including heavy chain.

We could even see a shift in the total market in favor of silver this year as its lower price point suits challenging times. However, with consumers under lockdown, unemployment rising and imported jewelry struggling to reach stores, it seems unlikely that consumption can avoid another decline.

Middle East

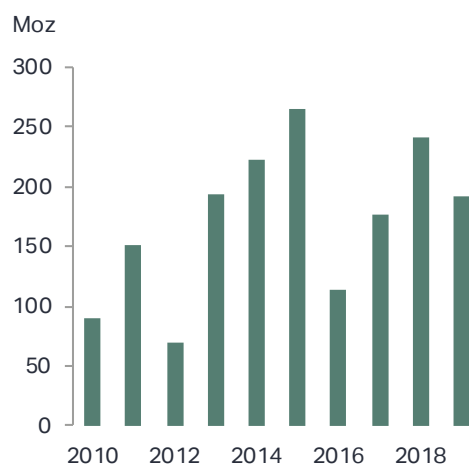
Jewelry fabrication in the Middle East fell by 4% in 2019 to 9.0Moz (279t), chiefly as offtake in Iran returned to more normal levels after its one-off boom in 2018. In contrast, demand in Turkey, the dominant regional player, saw an increase last year, albeit of just 1%, thanks to exports, which grew for the fourth year straight and posted a new high. Demand in the Middle East is currently forecast to fall by another 4% this year.

South Asia

Following a record high in 2018, **Indian** silver jewelry fabrication fell by 5% to 69.0Moz (2,148t) last year. However, the recent economic slowdown, erratic monsoons and the deepening liquidity crunch all hurt demand. This was most pronounced in the rural sector, which had been the bedrock of the rapid growth that the market had experienced over the last decade. In that regard, it is worth noting that offtake last year was the second highest for that decade and more than three times volumes in 2010.

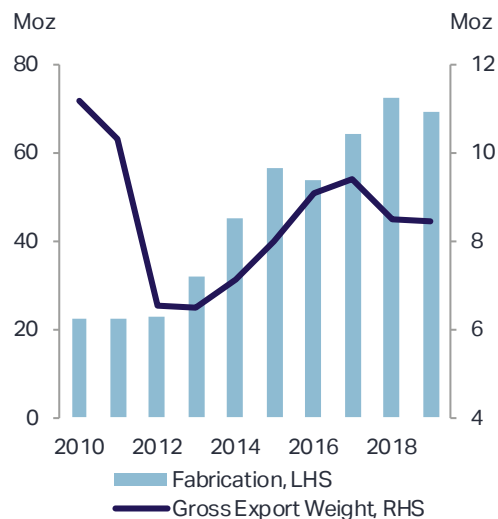
For the record, the Indian economy in the 2019/20 financial year (April 2019-March 2020) is projected to grow at its slowest pace in the last six years. Linked to this, there was a rise in non-performing assets (NPAs), which saw banks curtail their lending across much of the jewelry supply chain. The reduction in liquidity for small and medium-sized businesses was particularly acute and this, together with the downturn in the broader economy, hit consumer expenditure. Lastly, although India saw above normal monsoons last year, the rainfall was still erratic, with many parts of the country experiencing either flooding or drought. Further to this, an extended southwest monsoon caused damage to many standing crops.

Indian Silver Bullion Imports



Source: Metals Focus, IHS Markit

Indian Jewelry Fabrication



Source: Metals Focus, IHS Markit

From a product standpoint, demand for traditional jewelry items, such as payals (leg chains) and toe rings, (which together account for more than 60% of the total) saw a sharp drop. By contrast, so called fashion jewelry saw double-digit growth. This segment is benefiting from young consumers shifting from gold to silver, which goes well both traditional and western-style clothing. However, the silver content is often as low as 30%. Another growing segment is gold-plated silver jewelry, which is now popular among the upper middle class due to its finish (as it resembles gold jewelry) and attractive price points of Rs.10,000-Rs.30,000 (\$130-\$400). Lastly, sterling silver jewelry continues to resonate as new manufacturers enter this market and an increasing number of gold jewelry retailers showcase these products.

In contrast to weak domestic consumption, exports grew modestly in 2019 in volume terms. However, the value of these shipments jumped by 40% to \$1.2bn. This reflected a concerted shift by many exporters towards higher margin merchandise. Much of this product was initially delivered to Hong Kong, for re-export to Europe and the Americas.

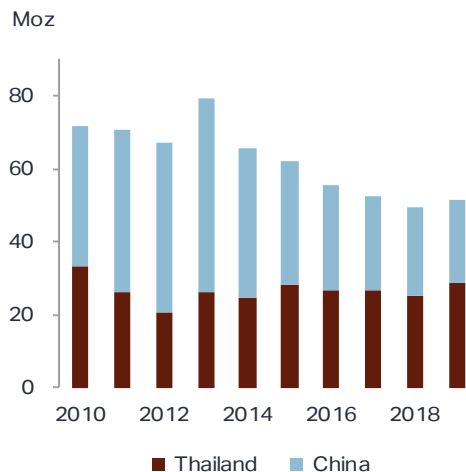
For 2020, demand is forecast to fall by 6% to 65.0Moz (2,021t) due to the continued slowdown in the economy and lockdowns related to the COVID-19 pandemic. Within the year, we expect the first half to see a sizable drop as most manufacturing units remain shut. Even if the lockdown is relaxed in May, units may not return to full capacity until June or July as many artisans should take longer to resume work. That said, we expect a recovery to emerge in the second half, as festive and wedding related demand emerges.

East Asia

Chinese fabrication fell for the sixth consecutive year in 2019 to 22.8Moz (709t). This represented a sizable 6% y/y drop. The most important factor behind the decline was a marked deterioration in consumer sentiment, itself a response to the trade war and economic slowdown in China. A secondary factor was structural changes, notably the shift away from heavy plain jewelry to smaller pieces. However, the impact of this in 2019 was not as acute as in previous years as much of this shift had already run its course. Lastly, the US:China trade war also did not help China's exports, as flows to the US fell by 22%. On a more positive note, the supply chain's ongoing efforts concerning new product development and marketing activities lent some support to demand. Last year, driven by the increasing popularity of antique-crafted gold, silver jewelry manufacturers launched "antique-crafted silver" collections. Moreover, the adoption of popular licensed designs and TV series themes also encouraged some purchases. Additionally, online sales enjoyed a robust increase, fueled by successful marketing campaigns through social media and e-commerce mobile apps.

As for 2020, the direct impact of COVID-19 and equity market volatility has already weighed heavily on China's jewelry demand. China's Statistics Bureau

Chinese & Thai Jewelry Fabrication



Source: Metals Focus

announced that gold and silver jewelry retail sales during the first two months fell by 41% y/y. We think there is limited scope for a swift recovery in Q2.20, as store visitors remain low and may stay so until virus fears ease considerably. The full year total therefore is expected to see a notable decline of 15%.

Thai jewelry fabrication recovered last year, rising 13% to 28.4Moz (886t). This is only the third time since 2010 that its offtake has surpassed 27Moz/850t. The improvement reflected healthy demand, both domestically and overseas. In the local market, high gold prices encouraged both Thai consumers and tourists to shift in favor of silver. From an export standpoint, Thai companies benefited from the US:China trade war as the North American trade reduced its exposure to mainland China. Turning to this year, we expect fabrication to weaken due to the spread of COVID-19, principally in the US and Europe. Thai manufacturers revealed that buyers in these locations, who had placed orders in January and February, have now refused to take delivery resulting in a build-up of unsold inventory in Thailand.

Indonesian jewelry fabrication rose for the second straight year, by 7% to 5.6Moz (175t). The domestic market benefited from positive economic expectations and healthy consumer sentiment. This offset a weaker export sector, with orders from the US and Singapore in particular down on 2018.

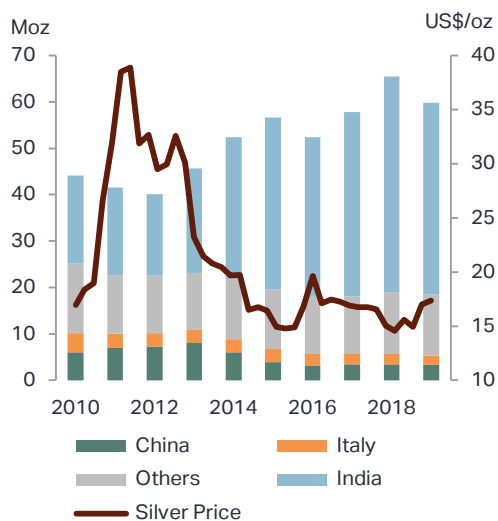
Silverware

Introduction

Global silverware demand fell by a notable 9% last year to 59.8Moz (1,860t), but that was still the second highest total this decade. The drop was almost entirely down to India's 11% decline. Increases were rare, with the only notable example being Turkey's export-led 36% jump. Widespread losses remain the order of the day for this year, with the total currently forecast to fall another 9% and again largely down to the decline India faces.

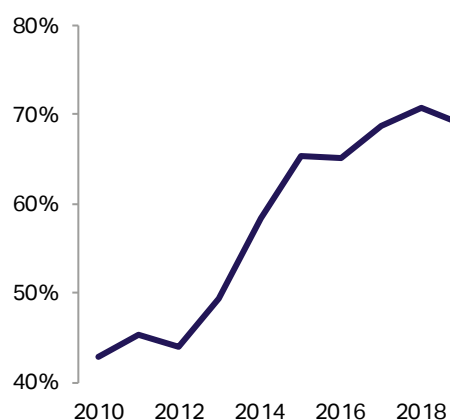
After rising for two consecutive years **Indian** silverware fabrication dropped by 11% to 41.2Moz (1,282t) in 2019, its largest annual decline over the past decade. This reflected two key factors, the economic slowdown and the growing liquidity crunch. Taking each in turn, the Indian economy grew by just 4.7% in Q4.19, its slowest pace in nearly six years, while unemployment rose to a 45-year high of 6.1%. The slowdown was one of three factors that helped to further reduce the amount of liquidity in the wider economy and therefore also the silver supply chain. A second issue that reduced the availability of cash was the delay in Goods and Service Tax (GST) credits being refunded. Finally, the increase in corporate debt meant that banks were increasingly reluctant to lend to the trade. Together, this negatively impacted both consumer demand and also purchases by companies (who use silverware to gift employees, clients and distributors).

Global Silverware Fabrication



Source: Metals Focus, Bloomberg

Indian Share of Global Silverware Fabrication



Source: Metals Focus

As for key trends within the market, sterling silverware continued to take market share last year. As a result, the average purity of silverware sold in India now stands at 80-85% compared to 60-65% just a few years ago. Another key development has been the increasing popularity of silver as a piece of furniture, with much of this channeled through interest from architects in cities such as Mumbai, Delhi and Bangalore.

Turning to 2020, we forecast silverware demand to fall by 9%, largely due to the negative impact of COVID-19, which will weigh on an already slowing economy. While the first half of the year is likely to witness a sharp fall in demand, we forecast a marginal recovery in the second half driven by festive and wedding related buying.

After two years of modest growth, **Chinese** silverware fabrication saw a small drop of 4% in 2019 to 3.3Moz (103t). This reflected market saturation, weaker consumer sentiment and fierce competition, which weighed on profits. Looking ahead, we expect demand to suffer more acutely in 2020 in light of reported sales losses to-date, the broader economic slowdown and faltering consumer sentiment throughout the rest of this year.

Europe's silverware demand in 2019 fell once more, slipping 5% to 3.9Moz (123t) or 45% less than volumes in 2010. Last year's drop was again driven by further losses in mass market items, with industry contacts typically seeing declines of 10-20% as the structural slide in this area continues. In contrast, output for the top-end brands and religious bodies, orders for custom made items and artisans' production were stable if not up. For many producers, these "niches" are now bigger than the "mass" market. **US** demand also fell last year, if only by 1%, partly due to still solid religious offtake.

In the **Middle East**, silverware fabrication rose by 9% in 2019 to 2.4Moz (76t). This was driven by Turkey and in particular its export sector. The region's demand is forecast to drop by 8% in 2020 as the broader economic slowdown and weak consumer sentiment hit Turkish exports.

Silverware Fabrication

Million ounces	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
India	19.0	18.8	17.7	22.6	30.6	37.0	34.1	39.7	46.4	41.2	-11%
China	5.9	6.9	7.2	8.0	6.0	3.9	3.1	3.4	3.5	3.3	-4%
Italy	4.2	3.1	3.0	2.8	2.8	2.7	2.5	2.3	2.2	2.0	-7%
United States	1.4	1.4	1.3	1.2	1.3	1.3	1.3	1.3	1.3	1.3	-1%
Others	13.5	11.3	11.0	11.0	11.6	11.6	11.3	11.1	12.2	12.0	-1%
Global Total	44.1	41.5	40.1	45.7	52.4	56.6	52.3	57.7	65.4	59.8	-9%

Source: Metals Focus

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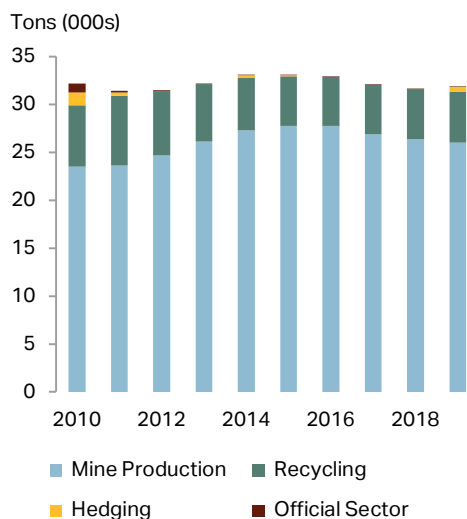
Appendix 1 - Silver Supply and Demand

Tons											Year on Year	
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020F	2019	2020
Supply												
Mine Production	23,640	24,656	26,136	27,292	27,771	27,754	26,855	26,371	26,019	24,813	-1%	-5%
Recycling	7,245	6,719	5,994	5,440	5,178	5,114	5,216	5,217	5,284	5,268	1.3%	-0.3%
Net Hedging Supply	369	-	-	332	67	-	-	-	487	311	na	-36%
Net Official Sector Sales	150	114	52	36	33	33	33	37	32	32	-15%	0%
Total Supply	31,405	31,488	32,183	33,099	33,049	32,901	32,104	31,625	31,821	30,424	1%	-4%
Demand												
Industrial	15,803	14,012	14,334	13,983	14,189	15,251	16,088	15,911	15,891	14,786	-0.1%	-7%
...of which photovoltaics	2,127	1,711	1,571	1,507	1,684	2,915	3,166	2,877	3,069	2,988	7%	-3%
Photography	1,917	1,634	1,424	1,355	1,282	1,174	1,092	1,062	1,047	947	-1%	-10%
Jewelry	5,046	4,952	5,820	6,019	6,301	5,884	6,104	6,316	6,262	5,832	-1%	-7%
Silverware	1,290	1,248	1,420	1,630	1,760	1,627	1,796	2,034	1,860	1,690	-9%	-9%
Net Physical Investment	8,460	7,489	9,334	8,789	9,655	6,653	4,858	5,153	5,788	6,711	12%	16%
Net Hedging Demand	-	1,255	913	-	-	374	66	261	-	-	na	na
Total Demand	32,516	30,590	33,245	31,774	33,186	30,964	30,004	30,738	30,848	29,967	0.4%	-3%
Market Balance	-1,111	898	-1,062	1,325	-137	1,936	2,099	886	973	457	10%	-53%
Change in ETP Holdings	-587	1,667	143	-17	-534	1,584	211	-694	2,540	3,732	na	47%
Market Balance less ETPs	-524	-769	-1,206	1,342	397	352	1,889	1,580	-1,567	-3,276	na	109%
Silver Price (US\$/oz)*	35.12	31.15	23.79	19.08	15.68	17.14	17.05	15.71	16.21	15.70	3%	-3%

*London Price

Source: Metals Focus

Global Supply



Source: Metals Focus

Global Demand



Source: Metals Focus

Appendix 2 - Mine Production

Tons	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
North America											
Mexico	570	4,778	5,358	5,821	5,767	5,975	5,421	5,815	6,049	5,919	-2%
United States	4,411	1,120	1,060	1,046	1,180	1,090	1,150	1,031	926	981	6%
Canada	1,273	533	666	618	472	369	361	393	368	419	14%
Sub-total	6,253	6,431	7,084	7,485	7,419	7,433	6,931	7,240	7,344	7,319	-0.3%
Central & South America											
Peru	3,646	3,442	3,439	3,682	3,784	4,119	4,542	4,854	4,555	4,210	-8%
Chile	1,287	1,290	1,191	1,169	1,562	1,496	1,448	1,257	1,243	1,189	-4%
Bolivia	1,259	1,214	1,207	1,287	1,345	1,306	1,353	1,196	1,191	1,158	-3%
Argentina	731	733	768	827	920	1,133	994	910	961	1,084	13%
Dominican Republic	-	18	27	82	136	95	122	152	159	141	0%
Brazil	11	14	17	27	35	49	77	86	71	72	2%
Honduras	58	48	52	52	58	35	19	23	32	45	39%
Guatemala	195	273	205	283	858	863	840	337	-	-	na
Others	40	52	48	43	38	36	36	33	38	75	99%
Sub-total	7,227	7,085	6,955	7,452	8,735	9,133	9,430	8,849	8,251	7,975	-3%
Europe											
Poland	1,192	1,178	1,159	1,208	1,195	1,218	1,272	1,297	1,272	1,257	-1%
Sweden	284	283	306	337	396	492	511	484	467	446	-4%
Spain	20	31	34	36	35	44	46	59	66	66	0%
Portugal	23	31	34	45	47	46	43	40	56	53	-5%
Greece	29	28	26	37	34	26	25	29	30	42	43%
Others	36	34	43	47	47	50	49	47	45	76	67%
Sub-total	1,584	1,585	1,602	1,711	1,755	1,876	1,946	1,957	1,935	1,940	0.3%
Africa											
Morocco	309	243	220	230	240	272	295	306	230	251	9%
Eritrea	-	4	30	16	53	98	98	79	54	67	25%
South Africa	84	97	88	75	55	59	61	69	51	62	21%
DR Congo	16	22	28	81	32	27	2	2	2	2	-2%
Others	49	60	78	93	98	89	74	73	72	75	4%
Sub-total	458	426	443	494	478	544	530	529	409	457	12%
Commonwealth of Independent States											
Russia	1,145	1,221	1,411	1,381	1,434	1,588	1,450	1,305	1,341	1,320	-2%
Kazakhstan	685	617	642	661	570	506	550	578	606	519	-14%
Uzbekistan	148	147	149	183	183	184	184	184	185	189	2%
Armenia	54	57	64	72	75	77	74	82	63	75	19%
Tajikistan	3	4	19	18	31	38	35	43	39	39	0%
Others	11	13	5	7	7	11	15	15	17	20	14%
Sub-total	2,046	2,059	2,290	2,322	2,300	2,402	2,308	2,206	2,251	2,162	-4%

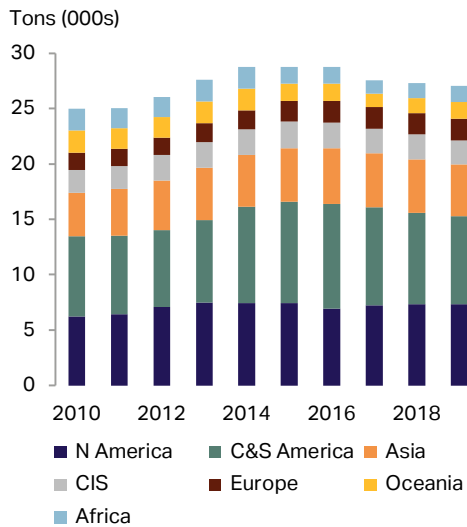
Source: Metals Focus

Appendix 2 - Mine Production (continued)

Tons	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Asia											
China	2,910	3,293	3,503	3,674	3,684	3,685	3,754	3,601	3,422	3,443	1%
India	181	204	289	333	261	374	436	526	658	633	-4%
Indonesia	263	215	197	245	226	311	340	325	330	241	-27%
Turkey	357	278	221	201	199	205	209	152	147	99	-33%
Iran	52	65	71	67	70	67	77	79	79	82	3%
Mongolia	25	24	24	39	52	62	68	54	53	51	-3%
Laos	17	16	19	33	40	52	51	44	38	35	-8%
Philippines	41	46	49	40	23	30	35	30	30	30	0%
Thailand	21	23	35	36	34	24	39	4	4	4	0%
Others	47	47	51	55	55	51	67	61	64	61	-4%
Sub-total	3,915	4,212	4,460	4,724	4,644	4,862	5,077	4,875	4,824	4,678	-3%
Oceania											
Australia	1,879	1,725	1,727	1,840	1,847	1,430	1,418	1,120	1,254	1,334	6%
Papua New Guinea	86	90	84	92	95	72	100	66	93	147	58%
Others	22	27	11	16	20	17	13	13	9	8	-18%
Sub-total	1,988	1,843	1,822	1,948	1,962	1,520	1,531	1,199	1,356	1,488	10%
Global Total	23,471	23,640	24,656	26,136	27,292	27,771	27,754	26,855	26,371	26,019	-1%

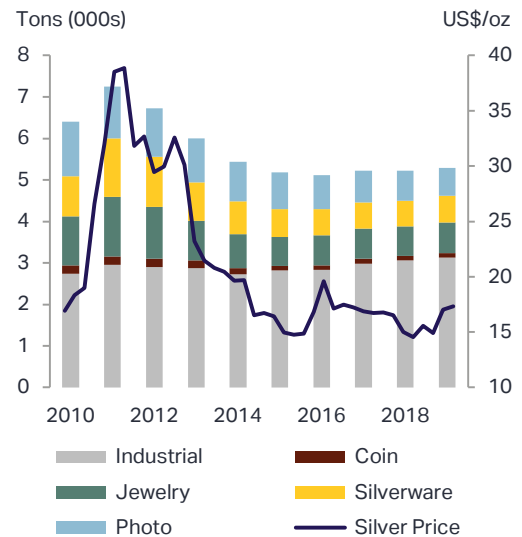
Source: Metals Focus

Mine Supply by Region



Source: Metals Focus

Recycling by Sector



Source: Metals Focus, Bloomberg

Appendix 3 - Recycling

Tons	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Europe											
Germany	552	552	493	462	452	446	446	443	461	470	2%
UK	227	234	215	215	207	216	220	246	236	245	4%
Italy	192	278	315	252	206	182	171	163	156	158	1%
France	144	152	179	156	134	118	106	101	98	97	-1%
Others	288	381	365	350	332	311	311	344	314	320	2%
Sub-total	1,402	1,598	1,567	1,435	1,332	1,272	1,252	1,297	1,265	1,290	2%
CIS											
Russia	371	364	358	307	249	208	203	246	310	264	-15%
Others	99	97	95	71	55	43	45	44	45	46	2%
Sub-total	470	461	453	378	304	251	247	291	355	310	-13%
North America											
United States	1,609	1,944	1,650	1,658	1,599	1,654	1,551	1,602	1,600	1,661	4%
Others	204	248	206	176	146	127	127	126	125	125	0%
Sub-total	1,814	2,191	1,856	1,834	1,744	1,781	1,678	1,728	1,725	1,786	4%
Middle East											
Turkey	152	141	128	114	104	77	78	78	83	83	1%
Others	125	148	121	118	113	93	108	106	93	98	5%
Sub-total	277	289	249	231	217	170	186	184	176	182	3%
South Asia											
India	510	587	674	337	185	97	106	112	124	129	4%
Others	112	128	148	72	39	20	22	24	26	27	4%
Sub-total	622	715	822	408	224	117	128	136	150	157	4%
East Asia											
China	807	887	777	759	747	778	756	735	721	734	2%
Japan	364	374	349	354	342	343	354	354	340	326	-4%
Taiwan	110	150	128	110	101	81	93	88	81	89	11%
Others	190	207	193	198	163	143	163	146	146	152	4%
Sub-total	1,471	1,618	1,447	1,421	1,354	1,345	1,367	1,323	1,286	1,300	1%
Other Regions											
C&S America	187	184	149	123	108	95	105	109	110	112	2%
Africa	93	112	102	94	92	86	89	90	89	89	1%
Oceania	73	77	73	70	64	61	61	60	60	58	-2%
Sub-total	353	373	324	287	265	242	255	258	259	260	0%
Global Total	6,410	7,245	6,719	5,994	5,440	5,178	5,114	5,216	5,217	5,284	1%

Source: Metals Focus

Appendix 4 - Industrial Demand

Tons	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Europe											
Germany	1,025	994	891	900	915	900	906	935	969	963	-1%
United Kingdom	353	397	430	431	451	395	412	515	516	552	7%
France	348	323	296	294	283	269	262	270	283	290	2%
Italy	287	274	262	259	264	264	261	271	282	286	1%
Others	424	405	368	397	381	372	373	387	395	392	-1%
Sub-total	2,436	2,394	2,247	2,281	2,294	2,200	2,214	2,378	2,446	2,484	2%
North America											
United States	3,773	4,675	3,561	3,349	2,978	3,180	3,682	3,818	3,885	3,756	-3%
Others	175	177	176	179	142	178	187	175	177	184	4%
Sub-total	3,948	4,852	3,736	3,528	3,121	3,359	3,869	3,993	4,062	3,940	-3%
East Asia											
China	2,510	2,657	2,663	2,872	3,027	3,117	3,265	3,650	3,774	3,773	0%
Japan	2,764	2,632	2,284	2,696	2,707	2,814	3,255	3,381	2,911	3,081	6%
South Korea	636	640	682	689	629	590	561	593	595	571	-4%
Taiwan	366	379	346	327	328	318	310	292	302	275	-9%
Others	72	30	30	40	31	55	42	39	45	61	34%
Sub-total	6,348	6,337	6,005	6,624	6,722	6,893	7,433	7,955	7,628	7,761	2%
Other Regions											
South Asia	1,415	1,501	1,369	1,254	1,178	1,110	1,116	1,162	1,250	1,175	-6%
C&S America	315	241	207	208	219	215	223	201	121	127	5%
Oceania	137	139	143	136	137	133	136	132	136	139	2%
Middle East	182	190	173	187	214	199	182	187	186	177	-5%
CIS	144	115	92	74	59	47	50	51	53	56	7%
Africa	30	34	39	42	40	31	29	29	30	32	6%
Sub-total	2,223	2,220	2,023	1,900	1,846	1,737	1,735	1,761	1,775	1,706	-4%
Global Total	14,956	15,803	14,012	14,334	13,983	14,189	15,251	16,088	15,911	15,891	-0.1%

Appendix 5 - Electrical & Electronics Demand

Tons	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Japan	2,327	2,212	1,859	2,245	2,290	2,358	2,830	2,941	2,465	2,634	7%
China/Hong Kong	1,194	1,289	1,264	1,390	1,501	1,545	1,720	2,086	2,190	2,152	-2%
United States	2,213	3,090	2,040	1,742	1,373	1,460	2,021	2,080	2,136	1,939	-9%
Germany	677	645	552	551	568	539	550	569	592	574	-3%
South Korea	290	263	260	270	290	265	259	268	262	246	-6%
Taiwan	268	282	251	238	243	234	226	204	212	188	-11%
Others	1,874	1,801	1,692	1,619	1,603	1,522	1,537	1,555	1,570	1,523	-3%
Global Total	8,842	9,583	7,917	8,055	7,868	7,924	9,142	9,704	9,427	9,257	-2%

Source: Metals Focus

Appendix 6 - Brazing Alloys & Solder Demand

Tons	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
China	587	646	679	746	776	792	749	761	772	781	1%
United States	220	210	200	190	187	177	182	192	198	202	2%
South Korea	102	106	99	93	84	80	70	75	74	71	-4%
India	85	89	80	73	70	66	67	69	71	68	-4%
Japan	111	76	61	61	58	56	56	64	67	65	-2%
Germany	90	85	80	78	74	70	68	68	67	65	-3%
Others	399	411	389	389	337	278	266	288	301	312	4%
Global Total	1,595	1,623	1,588	1,631	1,586	1,519	1,460	1,515	1,550	1,565	1%

Appendix 7 - Photographic Demand

Tons	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Europe & N. America	1,470	1,303	1,183	1,082	1,009	942	850	780	752	732	-3%
East Asia	606	559	399	304	304	299	280	270	262	259	-1%
Others	86	55	52	39	41	41	45	42	49	56	14%
Global Total	2,162	1,917	1,634	1,424	1,355	1,282	1,174	1,092	1,062	1,047	-1%

Appendix 8a - Physical Investment

Tons	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
India	800	1,517	1,682	2,719	3,136	3,435	1,136	1,259	1,680	1,757	5%
United States	2,954	3,764	3,254	3,767	3,518	3,981	3,073	1,699	1,379	1,500	9%
Germany	1,060	1,118	736	858	618	672	747	683	745	996	34%
China	309	651	713	660	364	357	346	238	210	193	-8%
Canada	112	149	150	206	230	237	225	147	142	156	10%
Other Europe	264	342	225	246	226	307	337	282	340	362	6%
Others	633	918	728	879	697	666	790	550	655	824	26%
Global Total	6,132	8,460	7,489	9,334	8,789	9,655	6,653	4,858	5,153	5,788	12%

Appendix 8b - Coins & Medals Fabrication

Tons	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Canada	592	748	615	953	1,007	1,171	1,125	655	653	803	23%
United States	1,196	1,412	1,123	1,425	1,444	1,527	1,225	601	532	608	14%
Australia	235	346	328	267	266	394	409	333	325	394	21%
India	30	50	70	140	176	224	220	257	328	351	7%
China	149	364	373	373	362	359	355	248	233	217	-7%
Germany	180	125	40	40	40	60	135	125	125	120	-4%
South Africa	0	0	0	26	0	18	0	36	116	112	-3%
United Kingdom	11	26	23	78	67	109	109	96	109	99	-9%
Austria	355	557	274	451	144	227	107	64	65	90	38%
Mexico	30	52	40	21	22	33	36	38	19	12	-35%
Others	202	208	209	229	208	213	181	171	200	238	19%
Global Total	2,982	3,888	3,095	4,005	3,737	4,334	3,902	2,624	2,704	3,044	13%

Source: Metals Focus

Appendix 9 - Jewelry Demand

Tons	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
Europe											
Italy	729	534	479	556	606	622	586	605	601	619	3%
Germany	111	107	105	109	105	108	104	107	108	109	1%
Others	213	197	192	204	208	209	204	205	202	202	0%
Sub-total	1,053	838	775	869	919	938	894	917	911	930	2%
North America											
United States	312	347	365	384	404	425	403	410	404	402	-1%
Mexico	167	146	155	141	168	177	180	153	155	139	-10%
Canada	127	116	110	115	121	110	112	105	101	101	0%
Sub-total	606	608	629	640	693	711	695	668	659	642	-3%
Middle East											
Turkey	140	112	125	151	195	208	152	153	184	186	1%
Others	104	69	77	80	84	98	93	88	108	93	-14%
Sub-total	244	182	202	231	279	306	245	241	292	279	-4%
South Asia											
India	700	693	708	990	1,404	1,760	1,677	1,995	2,256	2,148	-5%
Others	26	26	26	36	52	65	62	73	83	79	-5%
Sub-total	726	719	734	1,027	1,455	1,825	1,739	2,069	2,339	2,227	-5%
East Asia											
Thailand	1,029	818	632	812	769	877	828	837	785	886	13%
China	1,207	1,389	1,458	1,662	1,280	1,050	893	794	755	709	-6%
Indonesia	116	82	92	128	191	152	163	157	163	175	7%
Others	154	166	173	194	182	187	177	179	179	183	2%
Sub-total	2,507	2,455	2,355	2,797	2,421	2,267	2,060	1,967	1,881	1,953	4%
Other Regions											
Sub-total	293	245	256	257	251	253	251	243	234	232	-1%
Global Total	5,429	5,046	4,952	5,820	6,019	6,301	5,884	6,104	6,316	6,262	-1%

Appendix 10 - Silverware Demand

Tons	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Y/Y
India	590	584	549	702	952	1,151	1,061	1,236	1,442	1,282	-11%
China	185	215	223	250	188	122	98	105	107	103	-4%
Italy	132	97	92	87	88	86	78	71	68	63	-7%
United States	45	43	41	39	40	40	40	40	39	39	-1%
Others	421	351	343	343	362	361	351	345	378	372	-1%
Global Total	1,373	1,290	1,248	1,420	1,630	1,760	1,627	1,796	2,034	1,860	-9%

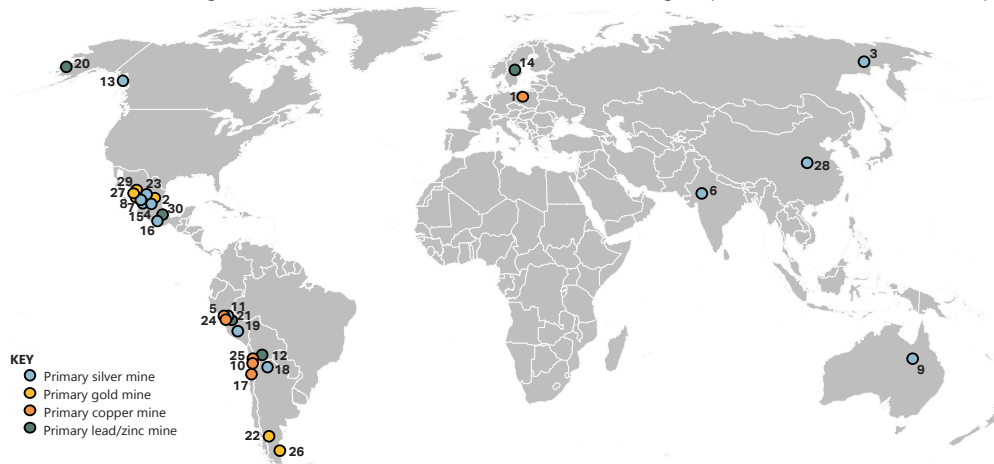
Source: Metals Focus

Appendix 11 - Top 30 Silver Producing Mines

Million ounces

Rank	Mine	Country	Ownership	2018	2019	Y/Y
1	KGHM Polska Miedź	Poland	KGHM Polska Miedź (100%)	40.6	40.2	-1%
2	Peñasquito	Mexico	Newmont (100%)	21.5	22.7	6%
3	Dukat	Russia	Polymetal International (100%)	20.9	19.3	-7%
4	Saucito	Mexico	Fresnillo (100%)	20.8	18.3	-12%
5	Antamina ¹	Peru	Glencore (33.75%) / BHP Billiton (33.75%)	16.4	15.0	-9%
6	Sindesar Khurd ²	India	Hindustan Zinc (100%)	14.7	14.0	-5%
7	San Julian	Mexico	Fresnillo (100%)	14.6	13.0	-11%
8	Fresnillo	Mexico	Fresnillo (100%)	15.1	13.0	-14%
9	Cannington ³	Australia	South32 (100%)	13.4	12.3	-8%
10	Chuquibambilla ³	Chile	Codelco (100%)	8.4	10.9	30%
11	Uchucchacua	Peru	Buenaventura (100%)	15.4	10.6	-31%
12	San Cristobal	Bolivia	Sumitomo Corporation (100%)	11.7	9.9	-15%
13	Greens Creek	United States	Hecla Mining Company (100%)	8.0	9.9	24%
14	Garpenberg	Sweden	Boliden (100%)	8.8	8.3	-6%
15	La Colorada	Mexico	Pan American Silver (100%)	7.6	8.2	8%
16	San Jose	Mexico	Fortuna Silver Mines (100%)	8.0	7.9	-1%
17	Escondida ³	Chile	BHP Billiton (57.5%) / Rio Tinto (30%) / JECO (12.5%)	9.4	7.7	-19%
18	Pirquitas	Argentina	SSR Mining Inc. (100%)	3.7	7.7	105%
19	Pallancata	Peru	Hochschild Mining (100%)	7.5	7.3	-3%
20	Red Dog ²	United States	Teck Resources (100%)	7.2	7.1	-2%
21	Yauli	Peru	Volcan Compañía Minera S.A.A (100%)	7.8	7.0	-10%
22	San Jose	Argentina	Hochschild Mining (51%) / McEwen Mining (49%)	6.2	6.8	11%
23	Palmarejo	Mexico	Coeur Mining (100%)	7.5	6.8	-10%
24	Toromocho	Peru	Chinalco (100%)	4.9	6.6	35%
25	Collahuasi ⁴	Chile	Glencore (44%) / Anglo American (44%)	7.4	6.5	-11%
26	Cerro Moro	Argentina	Yamana Gold (100%)	4.1	6.3	54%
27	San Dimas	Mexico	First Majestic Silver (100%)	5.6	6.3	12%
28	Ying ⁵	China	Silvercorp Metals (77.5%)	5.9	6.1	3%
29	Cienega	Mexico	Fresnillo (100%)	6.0	5.8	-3%
30	Tizapa ⁶	Mexico	Industrias Peñoles (51%)	5.9	5.8	-3%

NB: All numbers are silver contained in concentrate or dore unless stated otherwise, 1: Teck Resources (22.5%), 2: Estimate, 3: Payable metals produced, 4: Mitsui & Co (12%), 5: Henan Non-Ferrous Geological & Mineral Resources Co (22.5%), 6: Dowa Mining Corporation (39%) / Sumitomo Corporation (10%)



Source: Metals Focus

Appendix 12a - Top 20 Producing Companies

Tons	2018	2019	Y/Y
Fresnillo ¹	1,806	1,610	-11%
KGHM Polska Miedź ²	1,205	1,417	18%
Glencore	1,085	996	-8%
Pan American Silver Corp.	771	805	4%
Polymetal Intl. plc	786	671	-15%
Hindustan Zinc Ltd. ^{3,4}	658	633	-4%
Southern Copper Corp.	538	631	17%
Buenaventura. ⁵	819	625	-24%
CODELCO	587	556	-5%
Hochschild Mining plc ⁶	613	523	-15%
Newmont ⁷	87	493	466%
Volcan Cia. Minera S.A.A.	529	485	-8%
First Majestic Silver Corp.	363	412	13%
BHP ⁸	478	410	-14%
Hecla Mining Company	323	392	22%
South32 Ltd	416	383	-8%
Boliden A.B. ⁹	402	372	-7%
Coeur Mining, Inc.	403	365	-9%
Yamana Gold Inc.	250	331	33%
Industrias Peñoles ¹⁰	364	328	-10%

NB: 1: Excludes Silverstream contract, 2: Payable silver production, 3: Hindustan Zinc is a Vedanta Group company, 4: Production from integrated operations only, 5: Includes production from associated companies 6: Attributable production (whole group production 20.2Moz), 7: Newmont acquired Goldcorp in 2019, 8: Payable silver in concentrate, includes 57.5% share in Escondida, 9: Silver in concentrate, 10: Excludes 100% Fresnillo plc,

Source: Company Reports, Metals Focus

Appendix 12b - Top 20 Producing Countries

Tons	2018	2019	Y/Y
Mexico	6,049	5,919	-2%
Peru	4,555	4,210	-8%
China	3,422	3,443	1%
Australia	1,254	1,334	6%
Russia	1,341	1,320	-2%
Poland	1,272	1,257	-1%
Chile	1,243	1,189	-4%
Bolivia	1,191	1,158	-3%
Argentina	961	1,084	13%
United States	926	981	6%
India	658	633	-4%
Kazakhstan	606	519	-14%
Sweden	467	446	-4%
Canada	368	419	14%
Morocco	230	251	9%
Indonesia	330	241	-27%
Uzbekistan	185	189	2%
Papua New Guinea	93	147	58%
Dominican Republic	159	141	-12%
Turkey	147	99	-33%
Others	912	1,039	14%
Global Total	26,371	26,019	-1%

Source: Metals Focus

Appendix 12c - Mine Production Forecast by Region

Tons	2019	2020F	Y/Y
C&S America	7,975	7,278	-9%
N America	7,319	7,015	-4%
Asia	4,678	4,518	-3%
CIS	2,162	2,100	-3%
Europe	1,940	1,886	-3%
Oceania	1,488	1,482	-0.4%
Africa	457	533	17%
Global Total	26,019	24,813	-5%

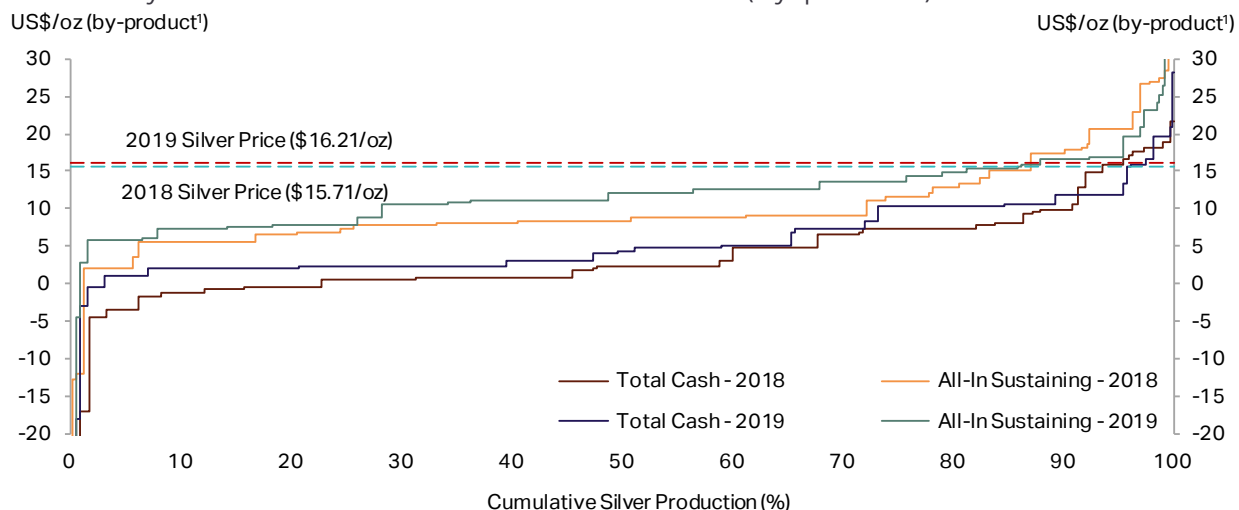
Source: Metals Focus

Appendix 13 - Primary Silver Production Costs (by-product¹)

US\$/oz (by-product)											Year on Year	
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2018	2019
North America												
Total Cash Cost	3.90	5.55	5.88	8.17	7.63	6.50	3.39	2.18	2.44	4.05	12%	66%
Total Production Cost	7.53	10.19	11.88	13.93	13.53	11.66	8.55	8.21	7.98	10.68	-3%	34%
All-In Sustaining Cost ²	n/a	n/a	14.44	15.49	14.36	12.30	8.54	9.67	10.61	12.18	10%	15%
Central & South America												
Total Cash Cost	9.71	11.55	13.50	12.05	10.45	9.66	7.54	7.05	5.54	7.04	-21%	27%
Total Production Cost	13.45	15.59	18.39	17.58	14.55	14.06	10.57	10.07	8.86	10.65	-12%	20%
All-In Sustaining Cost ²	n/a	n/a	20.63	18.81	15.36	13.55	10.75	11.56	11.03	11.57	-5%	5%
CIS												
Total Cash Cost	9.90	14.00	10.18	10.27	7.21	4.99	4.35	7.04	7.21	10.42	2%	45%
Total Production Cost	11.41	15.33	11.83	13.02	9.43	6.39	5.81	9.26	9.88	11.42	7%	16%
All-In Sustaining Cost ²	n/a	n/a	13.43	13.90	9.42	6.41	5.85	9.25	8.96	12.64	-3%	41%
Asia												
Total Cash Cost	-6.35	-5.66	-1.94	1.52	1.01	1.11	-1.60	-3.90	-3.51	-1.66	na	na
Total Production Cost	-5.24	-3.96	-0.43	4.00	4.64	4.92	1.05	-1.40	-0.58	1.50	na	na
All-In Sustaining Cost ²	n/a	n/a	18.63	17.73	9.58	9.44	4.03	1.88	2.12	4.36	13%	106%
Oceania												
Total Cash Cost	-0.50	-0.24	5.86	3.55	2.10	2.25	-1.79	-3.72	-0.47	2.02	na	na
Total Production Cost	1.03	1.35	7.34	5.15	4.40	4.85	1.32	0.60	3.21	7.22	435%	125%
All-In Sustaining Cost ²	n/a	n/a	9.24	7.14	5.34	5.57	1.33	1.24	5.54	7.77	347%	40%
Global Total												
Total Cash Cost	4.22	6.38	8.37	8.70	7.81	6.91	4.44	3.69	3.33	5.16	-10%	55%
Total Production Cost	7.14	9.92	12.79	13.41	12.26	11.10	8.22	8.21	7.81	10.17	-5%	30%
All-In Sustaining Cost ²	n/a	n/a	15.46	15.11	13.11	11.36	8.35	9.52	9.85	11.47	3%	16%

Source: Metals Focus

Global Primary Silver Mine Production Costs in 2019 (by-product)



1: Costs shown on a by-product accounting basis 2: All-In Sustaining Cost figures not reported prior to 2012

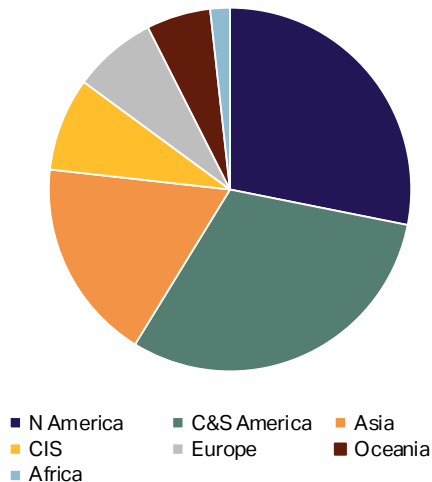
Source: Metals Focus Silver Mine Cost Service

Appendix 14 - Mine Production by Region & Primary Metal

Million ounces											Year on Year	
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2018	2019
Regional Breakdown												
C&S America	201.1	206.7	227.8	240.7	238.5	239.0	222.8	232.8	236.1	235.3	1%	-0.3%
North America	232.4	227.8	223.6	239.6	280.8	293.6	303.2	284.5	265.3	256.4	-7%	-3%
Asia	125.9	135.4	143.4	151.9	149.3	156.3	163.2	156.7	155.1	150.4	-1%	-3%
CIS	65.8	66.2	73.6	74.7	73.9	77.2	74.2	70.9	72.4	69.5	2%	-4%
Europe	50.9	51.0	51.5	55.0	56.4	60.3	62.6	62.9	62.2	62.4	-1%	0.3%
Oceania	63.9	59.3	58.6	62.6	63.1	48.9	49.2	38.6	43.6	47.9	13%	9.7%
Africa	14.7	13.7	14.2	15.9	15.4	17.5	17.1	17.0	13.2	14.7	-23%	12%
Global Total	754.6	760.1	792.7	840.3	877.5	892.9	892.3	863.4	847.8	836.5	-2%	-1%
Global Breakdown												
Primary Silver	252.8	248.6	254.7	266.9	287.5	292.2	290.1	265.4	249.4	240.0	-6%	-4%
Gold	108.0	125.2	126.8	133.8	144.2	151.4	135.4	131.9	132.1	132.1	0.2%	0.0%
Copper	168.7	160.5	165.7	170.4	183.0	189.1	204.9	200.5	196.6	190.6	-2%	-3%
Lead/Zinc	219.8	219.3	239.9	263.6	257.4	254.8	255.4	258.9	262.7	268.7	1%	2%
Other	5.4	6.4	5.7	5.7	5.5	5.3	6.5	6.7	7.0	5.1	4%	-27%
Global Total	754.6	760.1	792.7	840.3	877.5	892.9	892.3	863.4	847.8	836.5	-2%	-1%
Global Breakdown (Percentage)												
Primary Silver	33.5%	32.7%	32.1%	31.8%	32.8%	32.7%	32.5%	30.7%	29.4%	28.7%		
Gold	14.3%	16.5%	16.0%	15.9%	16.4%	17.0%	15.2%	15.3%	15.6%	15.8%		
Copper	22.4%	21.1%	20.9%	20.3%	20.9%	21.2%	23.0%	23.2%	23.2%	22.8%		
Lead/Zinc	29.1%	28.9%	30.3%	31.4%	29.3%	28.5%	28.6%	30.0%	31.0%	32.1%		
Other	0.7%	0.8%	0.7%	0.7%	0.6%	0.6%	0.7%	0.8%	0.8%	0.6%		

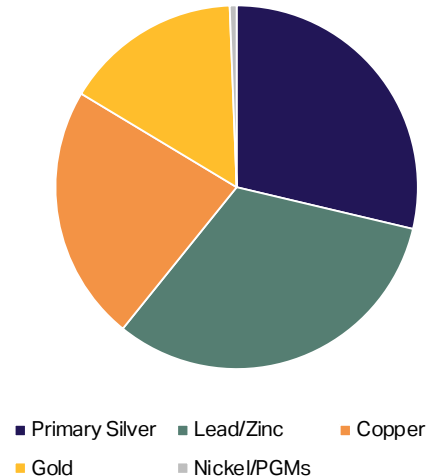
Source: Metals Focus

Mine Production by Region in 2019



Source: Metals Focus

Mine Production by Source Metal in 2019



Source: Metals Focus

Appendix 15 - Nominal Silver Prices

Year	Average ¹ US\$/oz	Low ² US\$/oz	High ² US\$/oz	€/kg ³	CNY/kg ⁴	INR/kg	JPY/g	A\$/oz	MXN/oz	PEN/oz
1986	5.46	4.85	6.31	177.64	608.27	2,212	29.66	8.15	3.23	n/a
1987	7.02	5.36	9.08	193.59	841.64	2,919	32.55	10.01	9.31	n/a
1988	6.53	6.05	7.82	177.21	783.68	2,918	26.95	8.33	14.83	n/a
1989	5.50	5.05	6.21	158.50	665.43	2,861	24.36	6.94	13.74	n/a
1990	4.83	3.95	5.35	120.24	742.93	2,713	22.57	6.18	13.69	n/a
1991	4.06	3.61	4.57	103.83	696.01	2,970	17.55	5.20	12.24	n/a
1992	3.95	3.65	4.34	96.01	701.10	3,563	16.08	5.37	12.21	5.95
1993	4.31	3.56	5.50	116.86	801.22	4,334	15.33	6.34	13.43	8.60
1994	5.28	4.54	5.95	141.23	1,462.51	5,335	17.36	7.22	17.90	11.61
1995	5.20	4.32	6.15	125.98	1,394.85	5,419	15.71	7.01	33.34	11.71
1996	5.20	4.68	5.88	129.41	1,389.91	5,917	18.16	6.64	39.48	12.69
1997	4.90	4.18	6.40	139.28	1,305.19	5,726	19.09	6.59	38.78	13.01
1998	5.54	4.60	7.93	160.42	1,473.76	7,322	23.31	8.80	50.66	16.21
1999	5.22	4.84	5.81	157.47	1,388.99	7,227	19.08	8.09	49.85	17.65
2000	4.95	4.56	5.56	172.64	1,318.16	7,152	17.16	8.51	46.85	17.28
2001	4.37	4.04	4.86	156.90	1,162.98	6,628	17.06	8.44	40.79	15.33
2002	4.60	4.23	5.15	156.79	1,223.84	7,185	18.50	8.45	44.46	16.17
2003	4.88	4.34	6.01	138.66	1,297.84	7,294	18.14	7.47	52.65	16.96
2004	6.66	5.46	8.45	172.08	1,771.68	9,693	23.12	9.03	75.16	22.71
2005	7.31	6.33	9.27	189.58	1,924.82	10,378	25.97	9.59	79.63	24.10
2006	11.55	8.69	15.22	295.04	3,091.08	16,831	43.17	15.33	125.96	37.81
2007	13.38	11.06	16.22	314.15	3,029.76	17,779	50.64	15.95	146.26	41.87
2008	14.99	8.46	21.36	324.36	3,014.45	20,648	50.16	17.59	167.31	43.81
2009	14.67	10.35	19.46	336.95	2,810.23	22,768	44.01	18.50	198.11	44.16
2010	20.19	14.64	30.94	489.62	3,920.91	29,632	56.54	21.93	255.04	57.03
2011	35.12	26.07	49.79	809.49	6,496.25	52,523	89.92	34.00	437.00	96.70
2012	31.15	26.16	37.48	778.30	5,532.74	53,380	79.93	30.07	409.80	82.17
2013	23.79	18.23	32.48	576.50	4,132.84	44,480	74.25	24.58	303.63	64.32
2014	19.08	14.29	22.18	460.87	3,421.89	37,405	64.64	21.14	254.00	54.17
2015	15.68	13.65	18.49	454.23	2,918.65	32,289	61.00	20.84	249.01	49.95
2016	17.14	13.75	21.14	497.60	3,262.84	37,004	59.56	23.03	320.28	57.83
2017	17.05	15.19	18.66	486.59	3,356.49	35,700	61.46	22.23	322.44	55.59
2018	15.71	13.90	17.70	427.23	3,094.63	34,462	55.73	21.01	302.06	51.63
2019	16.21	14.29	19.65	465.80	3,416.90	36,719	56.77	23.31	311.99	54.08

1: Average US\$ prices are based on the daily London Silver Fixing and (since 08/15/2014) the daily LBMA Silver Price. Unless otherwise specified, these US\$ prices in conjunction with Bloomberg Closing exchange rates have been used to illustrate annual average prices in other currencies.

2: High and low derived from intra-day spot prices

3: Euro price based on euro-quoted LBMA PM Fix from 1999 onwards and the dollar price converted into euros using Bloomberg synthetic exchange rates prior to that time

4: CNY price is the SGE AG (T+D) from 2006 onwards and based on London Silver Fixing converted into renminbi using Bloomberg exchange rates prior to that time. VAT has been subtracted from the quoted price.

Currency key: € - Euro, CNY - Chinese Yuan, INR - Indian Rupee, JPY - Japanese Yen, AUD - Australian dollar, MXN - Mexican peso, PEN - Peruvian nuevo sol

Source: Metals Focus, Bloomberg

Appendix 16 - Real Silver Prices (Inflation Adjusted)

Year	Average ¹ US\$/oz	Low ² US\$/oz	High ² US\$/oz	€/kg ³	CNY/kg ⁴	INR/kg	JPY/g	A\$/oz	MXN/oz	PEN/oz
1986	12.71	11.29	14.67	379.98	2,901.42	24,155	35.53	21.32	217.13	n/a
1987	15.62	11.94	20.22	400.37	3,741.27	29,295	38.67	24.42	241.34	n/a
1988	13.93	12.90	16.68	352.65	2,933.35	26,769	31.69	18.90	253.55	n/a
1989	11.21	10.28	12.66	300.55	2,111.02	24,509	27.91	14.60	196.19	n/a
1990	9.28	7.59	10.28	216.88	2,286.10	21,332	24.94	12.17	150.52	n/a
1991	7.56	6.73	8.52	177.68	2,070.91	20,504	18.88	10.10	113.28	n/a
1992	7.15	6.61	7.85	157.99	1,960.75	22,010	17.10	10.38	100.96	n/a
1993	7.60	6.27	9.69	184.74	1,953.58	25,178	16.14	12.04	102.80	n/a
1994	9.07	7.79	10.21	216.51	2,872.78	28,112	18.16	13.36	127.97	28.25
1995	8.70	7.23	10.30	187.47	2,340.18	25,906	16.50	12.34	156.83	25.85
1996	8.42	7.58	9.53	189.00	2,152.90	25,956	18.96	11.52	145.42	25.06
1997	7.80	6.66	10.20	200.44	1,966.77	23,440	19.56	11.46	123.43	24.12
1998	8.68	7.21	12.43	229.14	2,238.51	26,469	23.75	15.08	135.95	28.36
1999	7.97	7.38	8.87	221.10	2,140.01	24,959	19.65	13.60	119.11	29.77
2000	7.31	6.73	8.20	236.51	2,022.47	23,748	17.75	13.53	102.74	28.08
2001	6.36	5.88	7.06	210.62	1,772.12	21,206	17.86	13.00	85.68	24.95
2002	6.53	6.01	7.31	205.70	1,879.92	22,044	19.43	12.66	88.35	25.93
2003	6.80	6.05	8.38	178.39	1,969.96	21,557	19.13	10.92	100.62	26.54
2004	8.99	7.37	11.41	216.37	2,588.29	27,608	24.34	12.88	136.55	34.34
2005	9.55	8.26	12.10	233.11	2,762.32	28,353	27.45	13.30	140.01	35.90
2006	14.71	11.07	19.38	356.03	4,370.10	43,464	45.48	20.56	212.85	55.69
2007	16.37	13.51	19.83	367.81	4,087.29	43,160	52.97	20.80	238.19	59.34
2008	18.32	10.34	26.08	373.86	3,840.24	46,263	52.26	22.12	255.78	58.21
2009	17.46	12.30	23.16	384.80	3,605.60	46,008	46.65	22.79	292.41	58.54
2010	23.67	17.19	36.28	547.06	4,870.16	53,466	60.12	26.30	360.56	74.07
2011	39.99	29.70	56.71	880.20	7,656.26	87,058	95.82	39.58	595.08	119.89
2012	34.86	29.27	41.95	827.93	6,355.35	80,941	85.36	34.26	538.82	99.26
2013	26.24	20.09	35.79	608.10	4,626.79	60,813	77.99	27.26	383.97	75.53
2014	20.88	15.78	24.27	486.97	3,755.73	48,085	66.33	23.05	308.61	61.62
2015	17.04	14.83	20.08	478.75	3,159.14	39,206	62.53	22.34	296.24	54.43
2016	18.24	14.63	22.50	518.76	3,462.46	42,816	60.87	24.33	368.63	61.05
2017	17.77	15.83	19.44	500.55	3,505.97	40,302	62.13	23.05	347.57	57.89
2018	16.06	14.21	18.11	432.90	3,165.96	37,101	56.17	21.39	310.60	52.60
2019	16.21	14.29	19.65	465.80	3,416.90	36,719	56.77	23.31	311.99	54.08

Based on respective countries' CPI. €/kg based on Eurozone CPI Index (Values until 1996 calculated using the Harmonised Index of Consumer Prices).

1: Average US\$ prices are based on the daily London Silver Fixing and (since 08/15/2014) the daily LBMA Silver Price. Unless otherwise specified, these US\$ prices in conjunction with Bloomberg Closing exchange rates have been used to illustrate annual average prices in other currencies.

2: High and low derived from intra-day spot prices

3: Euro price based on euro-quoted LBMA PM Fix from 1999 onwards and the dollar price converted into euros using Bloomberg synthetic exchange rates prior to that time.

4: CNY price is the SGE AG (T+D) from 2006 onwards and based on London Silver Fixing converted into renminbi using Bloomberg exchange rates prior to that time. VAT has been subtracted from the quoted price.

Currency key: € - Euro, CNY - Chinese Yuan, INR - Indian Rupee, JPY - Japanese Yen, AUD - Australian dollar, MXN - Mexican peso, PEN - Peruvian nuevo sol

Source: Metals Focus, Bloomberg

Appendix 17 - LBMA & Comex Silver Prices

US\$/oz	LBMA ¹			Comex ²		
	Year/Month	Low	High	Average	Low	High
2000	4.57	5.45	4.95	4.56	5.57	4.98
2001	4.07	4.82	4.37	4.03	4.83	4.37
2002	4.24	5.10	4.60	4.22	5.13	4.60
2003	4.37	5.97	4.88	4.35	5.99	4.89
2004	5.50	8.29	6.66	5.51	8.22	6.69
2005	6.39	9.23	7.31	6.45	9.00	7.33
2006	8.83	14.94	11.55	8.87	14.85	11.57
2007	11.67	15.82	13.38	11.50	15.55	13.41
2008	8.88	20.92	14.99	8.79	20.69	14.97
2009	10.51	19.18	14.67	10.44	19.30	14.70
2010	15.14	30.70	20.19	14.83	30.94	20.24
2011	26.16	48.70	35.12	26.81	48.58	35.25
2012	26.67	37.23	31.15	26.25	37.14	31.16
2013	18.61	32.23	23.79	18.53	32.44	23.76
2014	15.28	22.05	19.08	15.41	22.05	19.04
2015	13.71	18.23	15.68	13.67	18.36	15.66
2016	13.58	20.71	17.14	13.75	20.70	17.15
2017	15.22	18.56	17.05	15.37	18.51	17.04
2018	13.97	17.52	15.71	13.98	17.62	15.68
2019	14.38	19.31	16.21	14.28	19.39	16.19
Jan-19	15.26	16.08	15.59	15.30	16.07	15.66
Feb-19	15.58	16.04	15.81	15.53	16.18	15.79
Mar-19	15.08	15.56	15.32	14.96	15.51	15.21
Apr-19	14.81	15.26	15.04	14.79	15.24	15.00
May-19	14.38	14.93	14.63	14.28	14.91	14.60
Jun-19	14.70	15.40	15.00	14.64	15.49	15.00
Jul-19	15.03	16.54	15.75	14.92	16.56	15.74
Aug-19	16.01	18.48	17.14	16.18	18.32	17.19
Sep-19	17.26	19.31	18.17	17.00	19.39	18.07
Oct-19	17.11	18.13	17.62	17.30	18.07	17.66
Nov-19	16.74	18.19	17.18	16.69	18.07	17.13
Dec-19	16.62	18.05	17.11	16.48	18.00	17.13
Jan-20	17.47	18.44	17.97	17.46	18.39	17.97
Feb-20	17.19	18.78	17.92	16.39	18.88	17.83

1: Prices are based on the daily London Silver Fixing and (since 08/15/2014) the daily LBMA Silver Price.

2: Prices are based on the generic 1st futures contract.

Source: LBMA, CME Group, Bloomberg

Appendix 18 - Comex Activity & Inventories

Moz	Futures		Managed Money Positions in Comex Futures				Comex Inventories ²
Year/Month	Volume ¹	Open Interest ²	Long ²	Short ²	Net ²	Net Change ³	
2011	98,043	528	85	61	24	-112	117
2012	66,563	707	138	23	115	91	148
2013	72,378	662	159	120	39	-76	174
2014	68,485	756	201	105	97	58	176
2015	67,263	841	246	211	36	-61	161
2016	91,094	824	291	95	196	160	183
2017	115,175	966	242	278	-36	-232	243
2018	119,935	881	267	223	44	80	294
2019	120,746	1,149	429	135	294	250	317
Jan-18	10,933	990	250	118	132	168	247
Feb-18	10,778	960	183	265	-82	-214	251
Mar-18	9,212	1,146	160	331	-171	-89	261
Apr-18	13,129	967	232	211	21	192	263
May-18	8,511	1,052	300	296	4	-17	271
Jun-18	12,432	1,046	371	261	110	106	276
Jul-18	7,912	1,133	341	381	-40	-150	285
Aug-18	11,821	1,059	302	481	-179	-139	294
Sep-18	8,242	1,019	263	477	-213	-35	290
Oct-18	8,968	1,059	252	378	-126	88	290
Nov-18	11,496	923	200	358	-158	-32	295
Dec-18	6,503	881	267	223	44	202	294
Jan-19	7,631	1,017	330	131	200	156	298
Feb-19	8,918	983	363	125	239	39	299
Mar-19	7,093	979	263	201	62	-177	305
Apr-19	9,602	983	261	330	-69	-130	307
May-19	7,381	1,050	250	440	-190	-121	306
Jun-19	13,256	1,092	400	283	116	306	306
Jul-19	10,435	1,181	474	162	313	197	310
Aug-19	15,093	1,094	423	144	279	-34	312
Sep-19	12,899	1,066	384	139	245	-34	314
Oct-19	9,053	1,125	390	152	238	-7	316
Nov-19	11,671	1,023	380	139	241	3	313
Dec-19	7,714	1,149	429	135	294	54	317
Jan-20	10,063	1,147	414	174	240	-55	321
Feb-20	12,577	1,004	434	126	308	69	324

1: Aggregate volume over the period, 2: Position at end-period, 3: Net change versus previous end-period

Source: Comex - CME Group, CFTC, Bloomberg

Appendix 19 - Chinese Silver Exchanges' Activity

Moz	Shanghai Gold Exchange		Shanghai Futures Exchange		
Year/Month	Ag (T +D) Volume ¹	Ag99.99 Volume ¹	Futures Volume ¹	Futures Open Interest ²	SHFE Inventories ²
2011	3,971	0.1	n/a	n/a	n/a
2012	3,358	0.0	10,255	118	31
2013	6,912	8.1	83,538	323	14
2014	8,024	14.0	93,758	196	4
2015	12,935	17.8	69,825	251	17
2016	17,954	10.9	41,765	357	60
2017	18,564	7.5	25,670	291	43
2018	12,596	6.1	20,428	348	36
2019	27,824	3.7	68,878	740	63
Jan-18	1,193	0.7	1,777	355	42
Feb-18	822	0.2	1,493	432	43
Mar-18	1,119	0.1	2,224	460	42
Apr-18	1,100	0.0	1,788	392	43
May-18	1,109	0.1	1,687	386	43
Jun-18	1,154	0.0	1,935	313	45
Jul-18	833	0.1	1,440	354	44
Aug-18	1,124	0.1	1,863	415	44
Sep-18	1,160	0.1	1,556	373	41
Oct-18	992	1.8	1,301	353	41
Nov-18	1,118	2.4	1,686	309	34
Dec-18	872	0.4	1,677	348	36
Jan-19	1,467	0.4	2,792	379	39
Feb-19	764	0.1	1,441	395	41
Mar-19	1,330	0.1	2,193	411	39
Apr-19	868	0.4	1,570	407	35
May-19	751	0.1	1,629	360	36
Jun-19	1,312	0.0	2,433	411	41
Jul-19	2,517	0.1	5,727	630	44
Aug-19	4,955	0.0	11,900	836	46
Sep-19	5,109	0.2	13,627	589	46
Oct-19	2,861	0.7	8,007	718	46
Nov-19	3,095	1.1	8,971	581	55
Dec-19	2,795	0.5	8,588	740	63
Jan-20	2,470	0.3	3,202	346	73
Feb-20	2,535	0.0	1,740	322	77

1: Aggregate volume over the period, 2: Position at end-period;

N.B. Both the SGE and SHFE record each transaction twice, from the point of view of the buyer and also the seller. However, to compare these volumes with other exchanges, such as the Comex, the figures in the table have been halved (as shown above).

Source: SGE, SHFE, Bloomberg

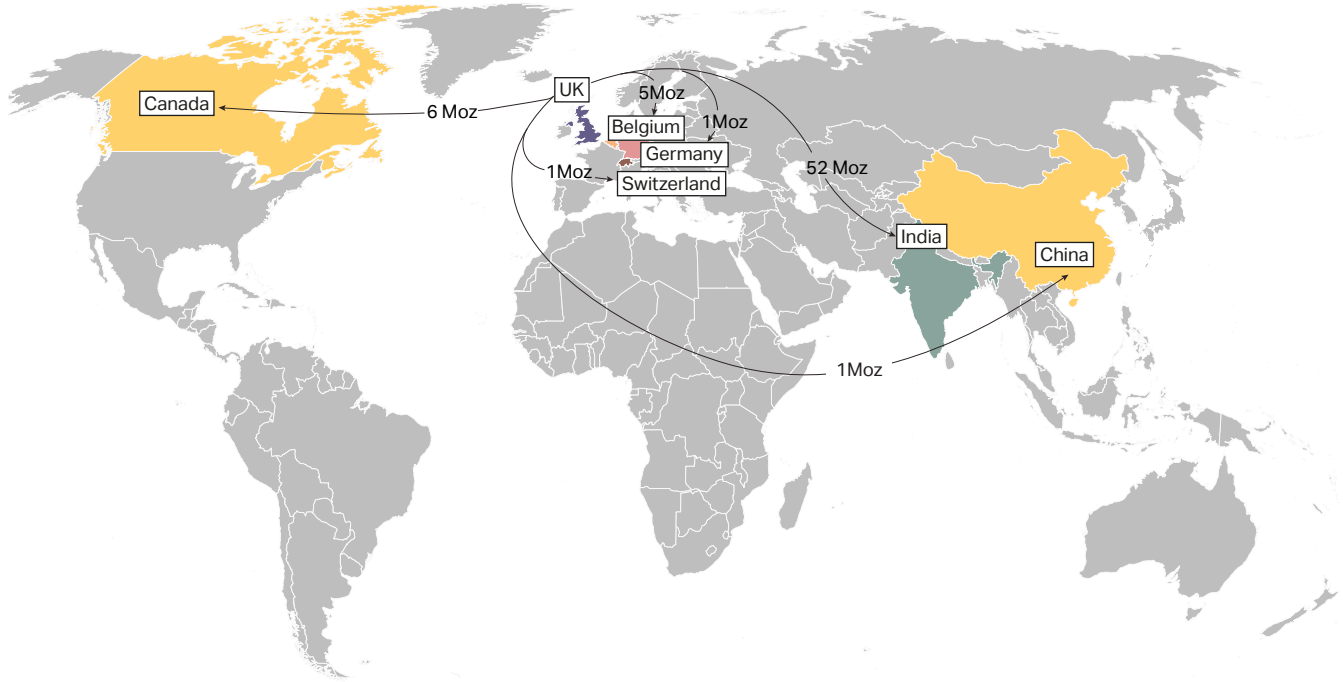
Appendix 20 - Physically Backed Silver Exchange-Traded Product Holdings*

Moz	iShares Silver Trust	ZKB	WisdomTree	Sprott Silver	Sprott Gold & Silver	Others	Total Holdings (Moz)	Total Value (\$M)
Year/Month								
2011	309	81	29	22	76	54	571	16,101
2012	324	90	29	49	76	57	625	18,718
2013	320	85	35	49	77	63	630	12,276
2014	330	77	37	49	77	59	629	10,045
2015	318	69	41	49	77	58	612	8,456
2016	341	72	53	56	76	65	663	10,763
2017	321	80	60	56	75	78	670	11,292
2018	317	79	52	56	64	78	647	10,009
2019	363	83	69	60	58	96	729	13,153
Jan-18	313	80	55	56	75	80	659	11,358
Feb-18	317	80	56	56	75	80	665	10,930
Mar-18	319	79	60	57	73	81	669	10,886
Apr-18	317	79	63	56	73	82	670	10,972
May-18	322	79	63	56	71	83	673	11,144
Jun-18	322	78	56	56	69	80	663	10,623
Jul-18	329	78	56	56	69	79	667	10,293
Aug-18	330	78	56	56	68	79	668	9,787
Sep-18	333	78	57	56	67	78	670	9,586
Oct-18	328	79	54	56	64	80	662	9,491
Nov-18	322	79	60	56	64	79	660	9,398
Dec-18	317	79	52	56	64	78	647	10,009
Jan-19	311	78	52	56	61	79	637	10,238
Feb-19	309	78	52	56	60	83	638	10,086
Mar-19	309	78	52	56	59	82	636	9,607
Apr-19	312	78	51	56	59	81	637	9,538
May-19	312	78	51	56	58	81	636	9,214
Jun-19	323	78	56	56	58	82	653	9,934
Jul-19	357	80	75	56	57	92	717	11,813
Aug-19	388	81	79	57	57	94	758	13,933
Sep-19	384	82	75	59	57	93	751	12,952
Oct-19	377	82	75	60	57	95	746	13,467
Nov-19	370	82	69	60	58	96	735	12,471
Dec-19	363	83	69	60	58	96	729	13,153
Jan-20	362	84	70	61	57	96	729	13,042
Feb-20	368	84	74	61	57	98	742	12,749

*Holdings at end-period; value calculated basis end-period price.

Source: Respective ETP providers, Bloomberg

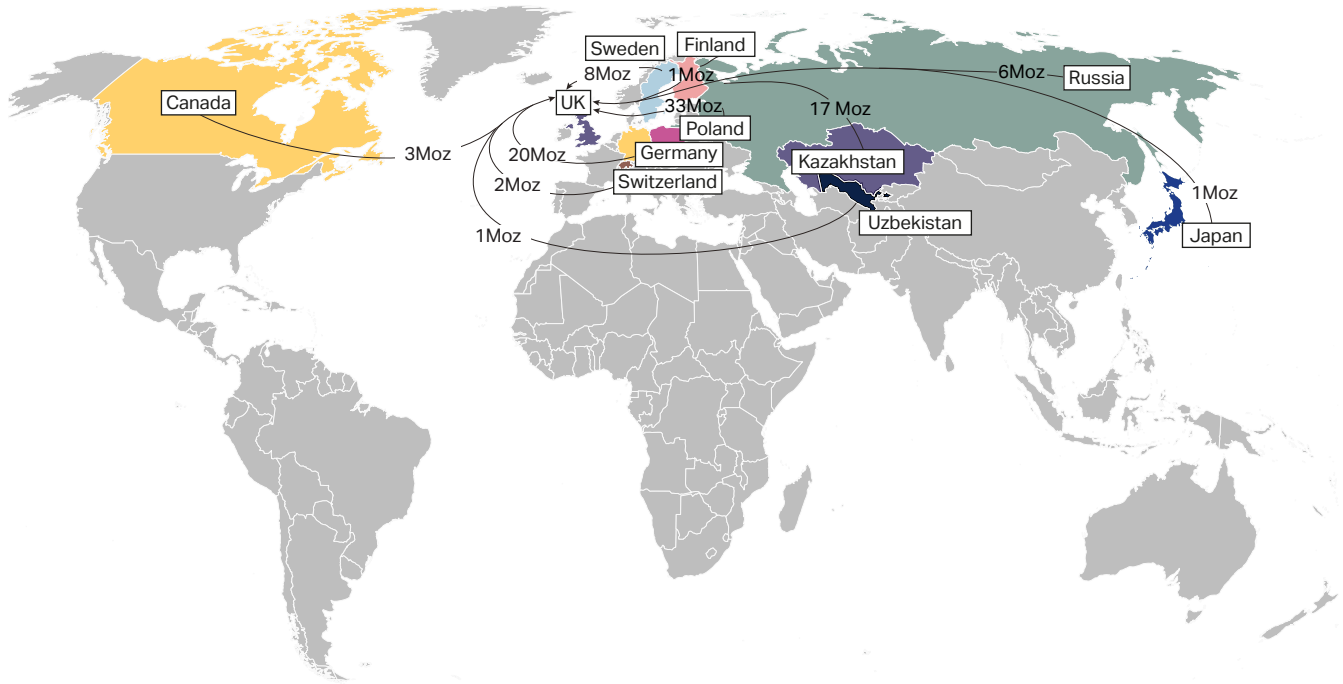
Appendix 21a - Selected United Kingdom Silver Bullion Exports in 2019



NB: In gross weight terms, exports shown account for 99% of total UK silver bullion exports in 2019

Source: HM Customs & Excise, Metals Focus

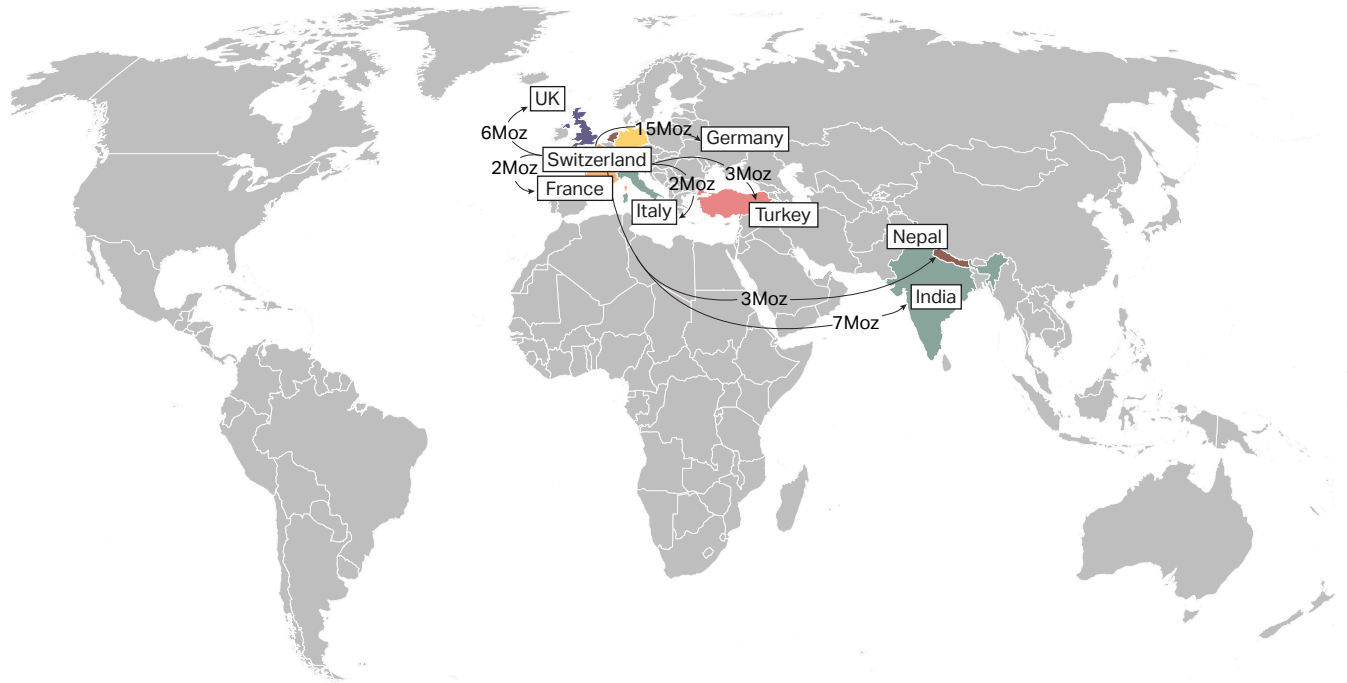
Appendix 21b - Selected United Kingdom Silver Bullion Imports in 2019



NB: In gross weight terms, imports shown account for 99% of total UK silver bullion imports in 2019

Source: HM Customs & Excise, Metals Focus

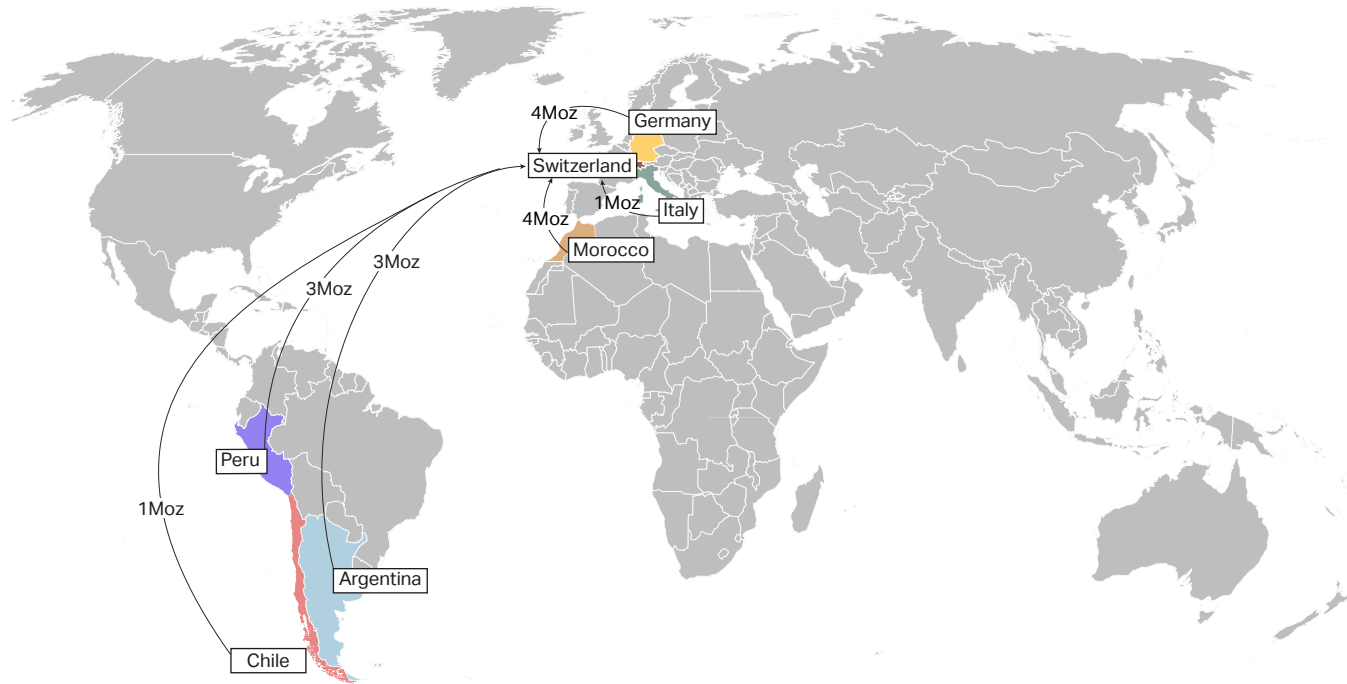
Appendix 22a - Selected Swiss Silver Bullion Exports in 2019



NB: In gross weight terms, exports shown account for 91% of total Swiss silver bullion exports in 2019

Source: Swiss Customs Administration, Metals Focus

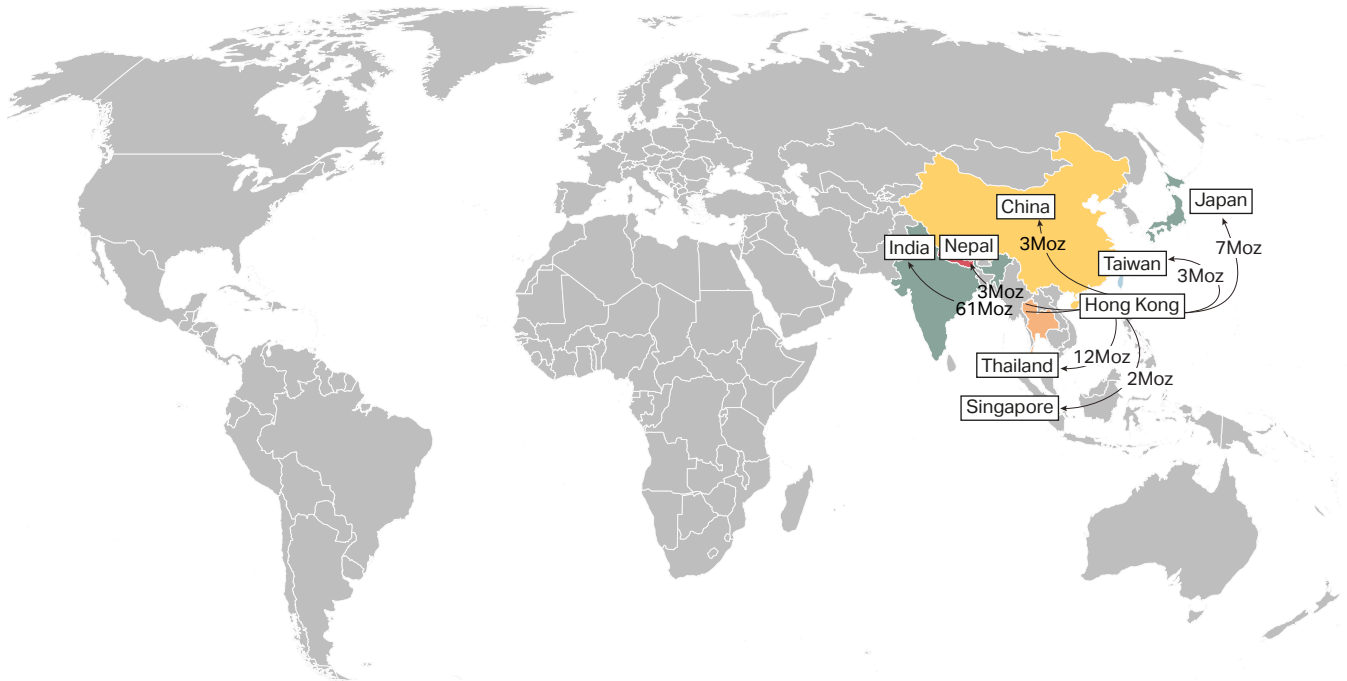
Appendix 22b - Selected Swiss Silver Bullion Imports in 2019



NB: In gross weight terms, imports shown account for 81% of total Swiss silver bullion imports in 2019

Source: Swiss Customs Administration, Metals Focus

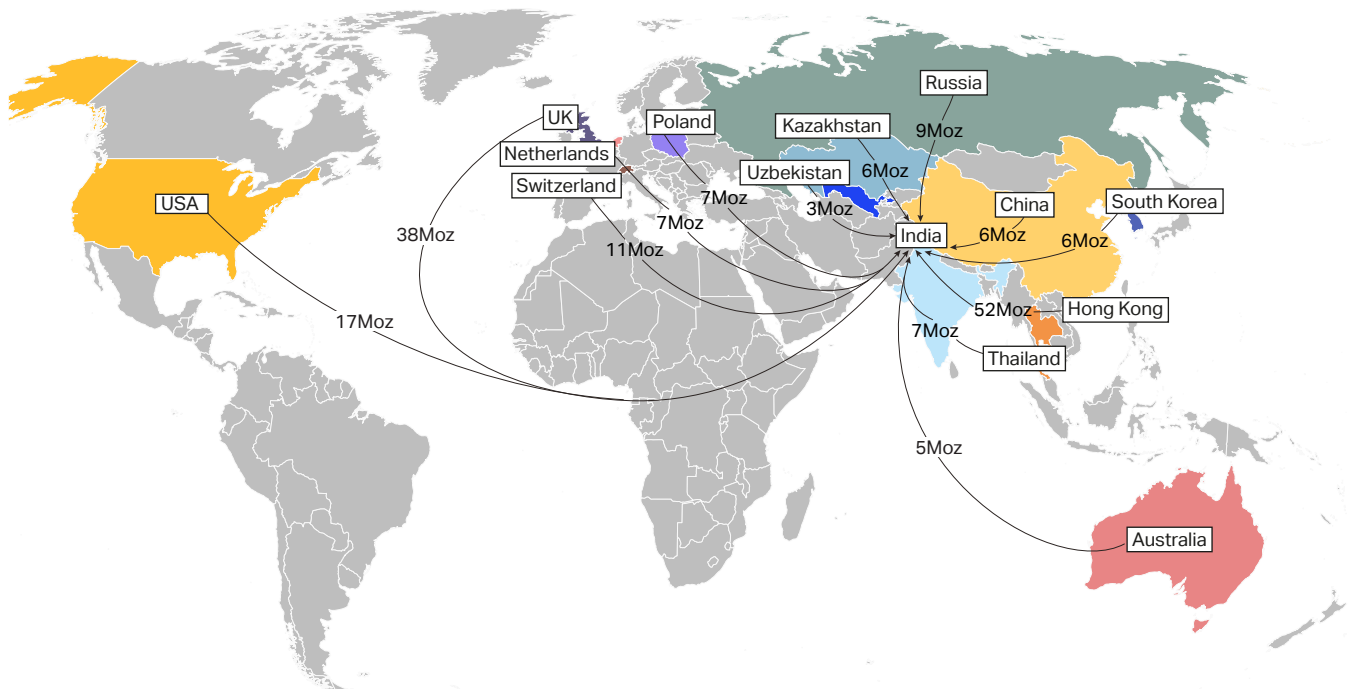
Appendix 23 - Selected Hong Kong Silver Bullion Exports in 2019



NB: In gross weight terms, exports shown account for 98% of total Hong Kong silver bullion exports in 2019

Source: Hong Kong Census & Statistics Department, Metals Focus

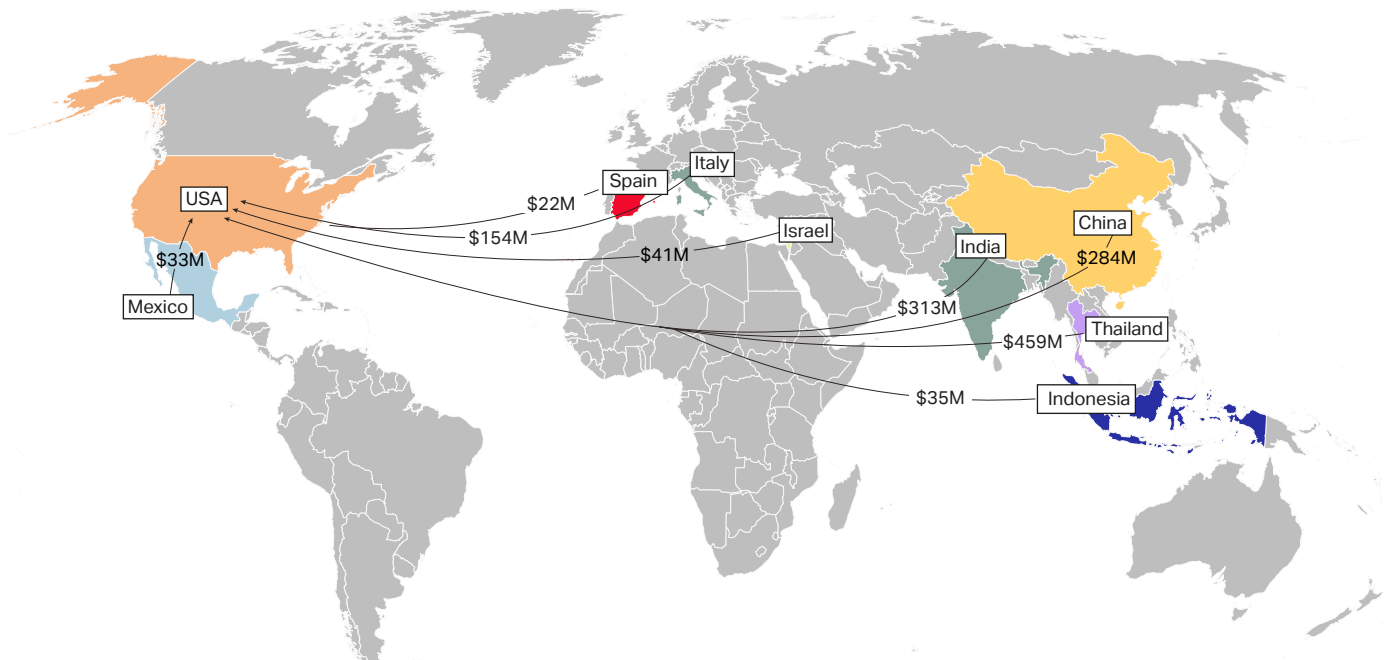
Appendix 24 - Selected Indian Silver Bullion Imports in 2019



NB: In gross weight terms, imports shown account for 98% of total Indian silver bullion imports in 2019

Source: Ministry of Commerce, Metals Focus

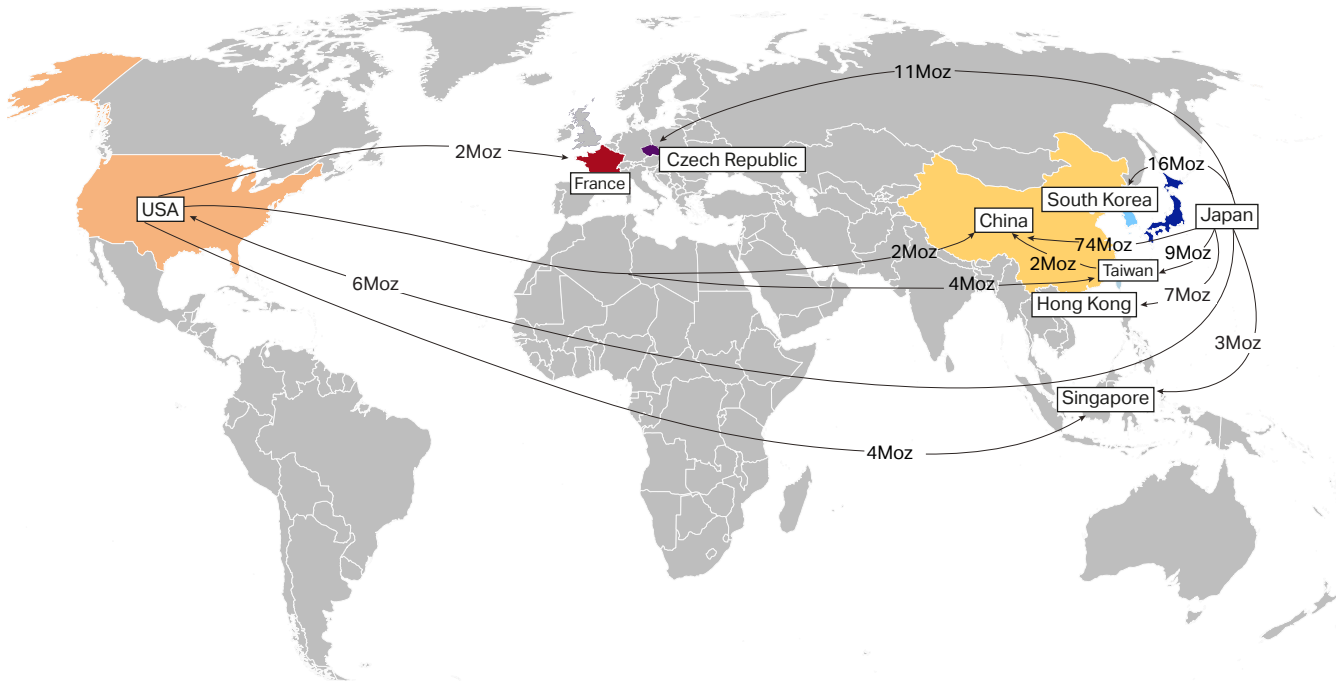
Appendix 25 - Value of Selected US Silver Jewelry Imports in 2019



NB: Imports shown represent around 90% of the total value of US silver jewelry imports in 2019

Source: Various

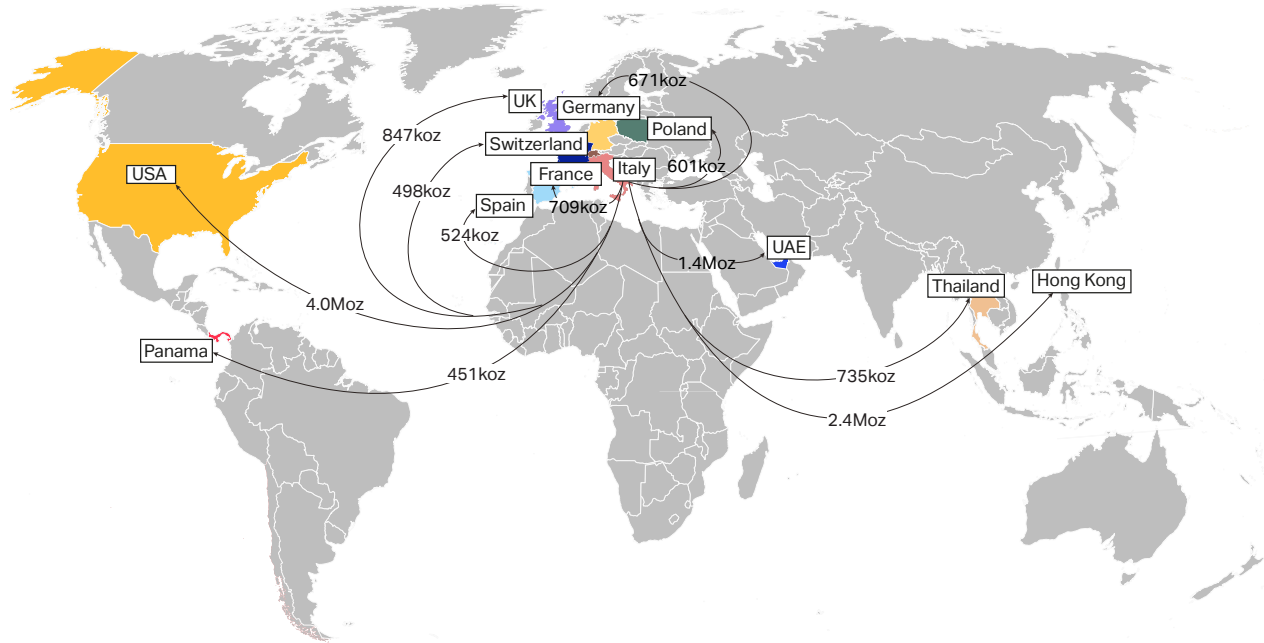
Appendix 26 - Selected Silver Powder Trade Flows in 2019



NB: Figures stated represent reported gross volumes of material shipped

Source: Various, Metals Focus

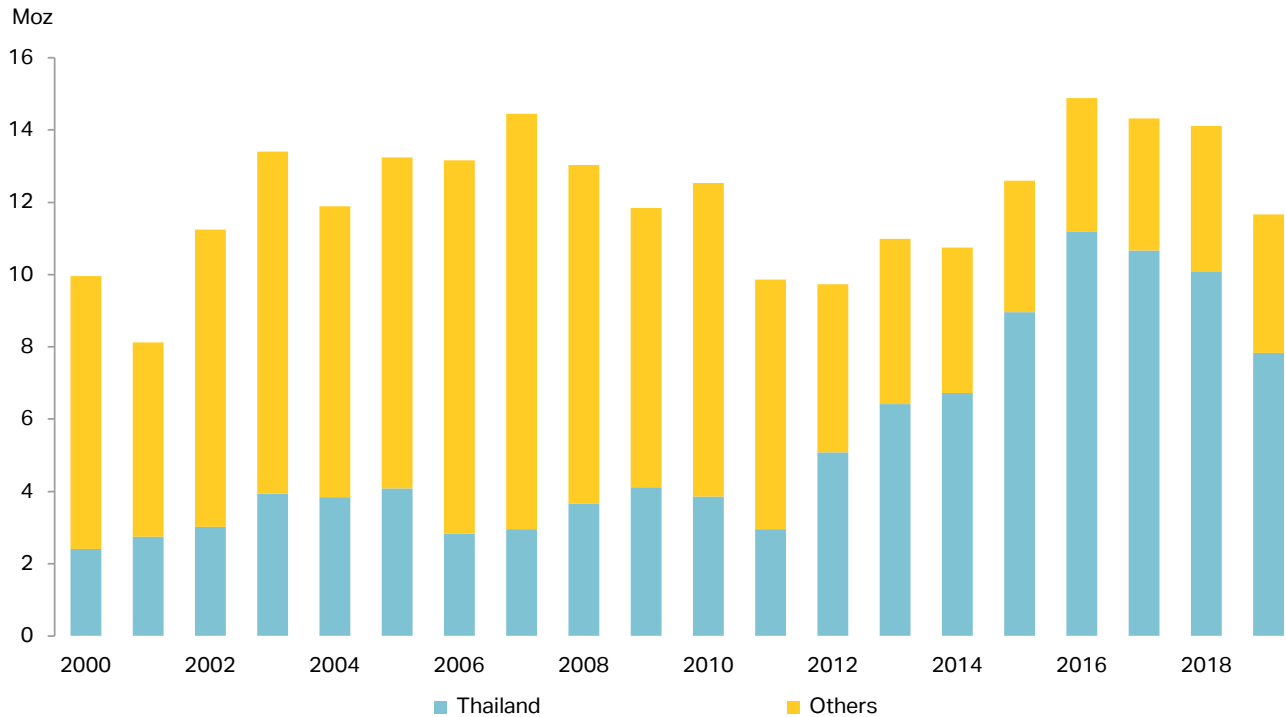
Appendix 27 - Selected Italian Silver Jewelry Exports in 2019



NB: In gross weight terms, exports shown account for 58% of total Italian silver jewelry exports in 2019

Source: Istat, Metals Focus

Appendix 28 - German Silver Jewelry Imports



NB: In gross weight terms

Source: Eurostat, Metals Focus

Notes & Definitions

Notes

Throughout the tables, totals may not add up due to independent rounding.

What one country reports as an export to another may be different to the imports reported by the receiving country for a variety of reasons, including conflicting rules of origin, classifications and timing. As a result, similar flows on different maps and/or tables may not be reciprocal due to reporting variations. The tonnage figures shown are fine weights calculated by Metals Focus from the data provided by each origin for exports and by each destination for imports.

Units

Troy ounce (oz)	One troy ounce - 31.103 grams
Ton (t)	One metric ton - 1,000 kilograms (kg) or 32,151 troy ounces
Grade (g/t)	Grams per metric ton of rock
Dollar (\$)	US dollar unless otherwise stated

Definitions

Fabrication	Captured in the country where the first transformation of silver bullion or grain into semi-finished and/or finished products takes place (such as silver nitrate or silver oxide).
Consumption	The sum of domestic jewelry fabrication plus imports, less exports, adjusted for changes in trade stocks.
Recycling	Covers the recovery of silver from fabricated products, including unused trade stocks. Excludes scrap generated during manufacturing (known as production or process scrap). The recycling is captured in the country where the scrap is generated, which may differ from where it is refined. The one exception to this is ethylene oxide, where the recycling of silver is measured at the point where it is recovered.
Mineral Resources	A concentration of material in, or on, the earth's crust of such grade or quantity where there is a reasonable prospect for economic extraction.
Mineral Reserves	The economically mineable part of a measured or indicated mineral resource demonstrated by at least a preliminary feasibility study.
By-Product Costs	Revenue generated from additional metals produced at a mine alongside the primary metal. This revenue is subtracted from costs as a by-product credit.
Total Cash Cost	Includes all direct and indirect mine site cash costs related directly to the physical activities of producing metals, including mining, ore processing on-site general and administrative costs, third-party refining expenses, royalties and production taxes, net of by-product revenues.
Total Production Cost	Total cash costs, plus depreciation, amortization and reclamation and closure cost obligations relating to each operating unit.
All-In Sustaining Cost	The sum of total cash costs plus community costs, sustaining capital expenses, corporate, general and administrative expenses (net of stock option expenses) and exploration expenses.

